



Arkansas Analytical, Inc.

Toxicity Test Results

MAGCOBAR MINE SITE
NPDES PERMIT NUMBER: AR0049794
Second quarter 2003

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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Magcobar Mine Site
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Malvern, AR 72104

Prepared by: Arkansas Analytical, Inc.
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Lab Number K306582

Monday, July 14, 2003

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 quarter for both *Ceriodaphnia dubia* and *Pimephales promelas*. The test results in this report represent the testing for the second quarter of 2003.

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:	6-18-03, 1400	6-19-03, 1400
Sample #2:	6-19-03, 1400	6-20-03, 1400
Sample #3:	6-23-03, 1000	6-24-03, 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:	6-20-03, 0825	4
Sample #2:	6-20-03, 1635	4
Sample #3:	6-26-03, 1615	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	16.8	X	
At least 60% of surviving females should have produced 3 broods	60%	X	
The percent coefficient of variation between replicates must be 40% or less for the young of surviving females	35.9%	X	

TEST ACCEPTANCE CRITERIA for *Pimephales promelas*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	94%	X	
The percent coefficient of variation between replicates must be 40% or less for survival	5.83%	X	
Minimum of 0.25 mg average dry weight of surviving controls	0.550	X	
The percent coefficient of variation between replicates must be 40% or less for growth	7.21%	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:	500 ppm KCl	NOEC Survival:	500 ppm KCl
LOEC Survival:	1000 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)	15.2	%CV survival (critical dilution)	0%
%CV Reproduction (critical dilution)	22.7%	Mean dry weight (critical dilution) in milligrams	0.721
		%CV growth (critical dilution)	7.18%

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.

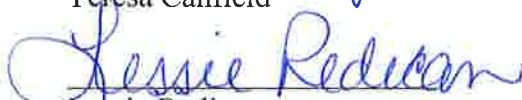
Biomonitoring Analysts:


Melissa Green


Andrea Fox


Teresa Canfield


Mark Wilson


Lessie Redican

**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:	6-18-03, 1400	6-19-03, 1400
Sample #2:	6-19-03, 1400	6-20-03, 1400
Sample #3:	6-23-03, 1000	6-24-03, 1000

Test initiated (date, time): 6-20-03, 1500 Test terminated (date, time): 6-27-03, 1330

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%	90	100	100	90	90	98	98	94	5.83	
32%	100	100	100	90	100	100	100	98		
42%	100	100	100	100	100	100	100	100		
56%	100	90	100	100	100	100	100	98		
75%	100	100	100	100	100	100	100	100		
100%	100	100	100	100	100	100	100	100	0.00	

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%	0.490	0.555	0.600	0.545	0.562	0.550	7.21
32%	0.693	0.603	0.609	0.551	0.654	0.622	
42%	0.666	0.675	0.606	0.590	0.567	0.621	
56%	0.718	0.602	0.698	0.816	0.801	0.727	
75%	0.737	0.751	0.653	0.719	0.647	0.701	
100%	0.661	0.687	0.791	0.753	0.714	0.721	6.89

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)= 0 %

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:	6-18-03, 1400	6-19-03, 1400
Sample #2:	6-19-03, 1400	6-20-03, 1400
Sample #3:	6-23-03, 1000	6-24-03, 1000

Test initiated (date, time): 6-20-03, 1145 Test terminated (date, time): 6-28-03, 0900

Dilution water used: Soft Synthetic

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

Replicate	0%	32%	42%	52%	75%	100%
A	13	16	22	X6	10	10
B	25	24	22	7	20	10
C	X1	X0	15	13	12	16
D	7	6	7	7	18	18
E	24	25	24	16	13	14
F	X7	X16	11	27	5	12
G	19	11	12	21	10	17
H	13	13	14	7	6	18
I	15	19	15	12	20	18
J	18	14	21	17	8	19
Mean	14.2	14.4	16.3	13.5	12.2	15.2
Mean/surviving female	16.8	16.0	16.3	14.1	12.2	15.2
CV%*	35.9					22.7

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	80	80	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)= 0 %



APPENDIX A

Chain of Custody Forms

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION			Project Description		Turnaround Time		Preservation Codes:	
Weston			Reporting Information		(CIRCLE ONE)		1. Cool, 4 degrees Centigrade 2. Sulfuric Acid, pH <2 3. Nitric Acid, pH <2	
Telephone:			24 hour		48 hour		4. Thiosulfate for dechlorination	
FAX:			routine		Preservative Code:		5. Hydrochloric Acid for VOA	
Bill to/P.O.:			Sample Identification/Description		Bottle Type		6. Sodium Hydroxide, pH >12	
Attn: James P. Taylor			Sample Matrix		G=glass; P=HDPE		V=sseptum; A=amber	
Samplers: (Printed)			water outfall		Bottle type code			
James P. Taylor			Sample # of Containers		Arkansas Analytical		Lab #	
6/18-19/03			15		16306582A			
Sample Collection Date/s			Grab		Matrix			
1400-1400			✓		water			
Date/Time			1. Received by: (Signature)		Condition of samples:		REMARKS	
6/19/03 1740			James P. Taylor		A. Containers Correct?			
Date/Time			2. Received by: (Signature)		B. Preservation Correct?			
6/20/03 0825			Penny Ambrosecki		C. Seals Intact?			
1. Relinquished by: (Signature)			1. Relinquished by: (Signature)					
James P. Taylor			James P. Taylor					
2. Relinquished by: (Signature)			2. Relinquished by: (Signature)					
Penny Ambrosecki			Penny Ambrosecki					

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION			Project Description		Turnaround Time (CIRCLE ONE)		Preservation Codes:			
Weston Solutions, Inc. P.O. Box 699 2000 Derby Lane Malvern, AR 72104 Attn: David Passmore			MAGCOBAR Mine Site Reporting Information Telephone: 501/467-8365 FAX: 501/467-8687 Bill to/P.O.		24 hour 48 hour routine		1. Cool, 4 degrees Centigrade 2. Sulfuric Acid, pH <2 3. Nitric Acid, pH <2 4. Thiocysulfate for dechlorination 5. Hydrochloric Acid for VOA 6. Sodium Hydroxide, pH >12			
Alan B. Brown Daniel Scott			Alan B. Brown Daniel Scott		Preservative Code: Bottle Type		Bottle type code G=glass; P=HDPE V=septum; A=amber			
Field		Sample Collection		Sample		TEST PARAMETERS				
Number	Date/s	Date/s	Time/s	Grab	Comp	# of Containers	IDENTIFICATION/ DESCRIPTION	Chronic Bio	Arkansas Analytical Lab #	REMARKS
	6/23-6/24	6/23-6/24	10:00	X		4	Facility Discharge	X	K306582	
1. Relinquished by: (Signature)		Date/Time		1. Received by: (Signature)		For completion by laboratory		Condition of samples:		
Daniel Scott		6-24-03 4:15 PM		[Signature]				YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>		
2. Relinquished by: (Signature)		Date/Time		2. Received by laboratory: (Signature)				A. Containers Correct? <input checked="" type="checkbox"/> B. Preservation Correct? <input checked="" type="checkbox"/> C. Seals Intact? <input checked="" type="checkbox"/>		
[Signature]		6/24/03 1615		[Signature]						



APPENDIX B

Effluent and Dilution Water Data

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING

Fathead Minnow

Lab # / Sample ID		K306582							Test Start (Date/Time)	6-20-03/1500
Client		Weston							Test End (Date/Time)	6-27-03/1330
		Day of Test								
		1	2	3	4	5	6	7	notes/remarks	
Control		10/20	10/21	10/22	10/23	10/24	10/25	10/26	SS #52	
D.O (mg/L)	INITIAL	7.8	7.3	9.3	8.8	6.5	6.6	7.2		
	FINAL	7.8	10.4	8.0	10.6	4.3	6.6	5.2		
pH(mg/L)	INITIAL	6.7	7.2	7.1	7.3	6.8	7.0	6.8		
	FINAL	7.0	6.8	6.8	6.8	7.3	6.4	6.6		
temp(C)	INITIAL	22.3	21.7	21.9	21.4	22.0	22.2	22.1		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
ALKALINITY(mg/L)		210								
HARDNESS(mg/L)		50								
CONDUCTIVITY(umhos/cm)		1660								
CHLORINE(mg/L)		40.05								
CONC:		32%	32%	32%	32%	32%	32%	32%		
D.O (mg/L)	INITIAL	8.0	7.6	9.6	8.9	6.9	6.5	7.1		
	FINAL	7.6	11.4	8.0	10.6	6.4	6.4	5.4		
pH(mg/L)	INITIAL	6.7	7.2	7.1	7.1	7.0	7.1	6.7		
	FINAL	7.0	7.0	6.6	6.9	7.0	6.1	6.5		
temp(C)	INITIAL	22.9	21.6	21.8	21.9	22.3	23.7	22.8		
	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	8.0	7.7	9.9	9.0	7.0	6.4	7.0		
	FINAL	7.8	10.4	8.0	10.5	6.2	6.4	5.4		
pH(mg/L)	INITIAL	6.8	7.2	7.0	7.1	7.0	7.1	6.8		
	FINAL	7.1	6.8	6.6	6.9	7.0	6.2	6.6		
temp(C)	INITIAL	23.3	21.9	21.7	22.1	22.6	24.5	23.2		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
CONC:		51%	51%	51%	51%	51%	51%	51%		
D.O (mg/L)	INITIAL	8.1	7.8	10.0	9.1/3	7.1	6.4	7.0		
	FINAL	7.7	10.4	8.1	6.5	6.3	6.6	5.4		
pH(mg/L)	INITIAL	6.9	7.2	7.0	7.0	7.0	7.1	6.8		
	FINAL	7.1	6.8	6.6	6.9	6.9	6.2	6.6		
temp(C)	INITIAL	23.6	21.4	21.6	22.3	23.1	25.2	23.5		
	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	8.1	8.1	10.0	9.3	7.1	6.3	7.0		
	FINAL	7.6	10.4	8.0	6.5	6.4	6.6	5.3		
pH(mg/L)	INITIAL	6.8	7.1	7.0	7.0	7.0	7.1	6.8		
	FINAL	7.0	6.8	6.6	6.8	6.9	6.2	6.5		
temp(C)	INITIAL	24.0	21.4	21.6	22.7	24.1	26.3	23.9		
	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	8.2	8.1	10.6	9.4	7.4	6.5	7.3		
	FINAL	7.7	10.3	8.1	6.7	6.4	6.5	5.2		
pH(mg/L)	INITIAL	6.8	7.0	6.9	7.0	6.9	7.0	6.8		
	FINAL	7.0	6.7	6.6	6.8	6.8	6.2	6.4		
temp(C)	INITIAL	24.4	26.8	21.1	23.0	26.0	27.7	24.1		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
CONC:		100%	A	B	B	A	A	C	C	
ALKALINITY(mg/L)		9	8		9		8			
HARDNESS(mg/L)		1210	1216		1210		1250			
CONDUCTIVITY(umhos/cm)		2120	2200		2120		2200			
CHLORINE(mg/L)		0.05	40.05		0.05		40.05			

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING

Ceriodaphnia dubia

Lab # / Sample ID		K306582								Test Start (Date/Time)	10-20-03/1145	
Client		Weston								Test End (Date/Time)	6-28-03/0900	
		Day of Test										
		1	2	3	4	5	6	7	8	notes/remarks		
Control		10-20	10-21	10-22	10-23	10-24	10-25	10-26	10-27	SS #52		
D.O (mg/L)	INITIAL	7.8	7.3	9.3	8.8	10.5	10.6	7.2	7.0			
	FINAL	8.1	10.8	10.9	6.5	6.4	10.1	7.0	10.6			
pH(mg/L)	INITIAL	6.7	7.2	7.1	7.3	10.8	7.0	10.8	10.9			
	FINAL	7.3	7.4	7.4	6.3	7.0	6.9	6.9	6.8			
temp(C)	INITIAL	22.3	21.7	21.9	21.4	22.0	22.2	22.1	22.0			
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0			
ALKALINITY(mg/L)		26										
HARDNESS(mg/L)		50										
CONDUCTIVITY(umhos/cm)		166										
CHLORINE(mg/L)		<0.05										
CONC:		32%	32%	32%	32%	32%	32%	32%	32%			
D.O (mg/L)	INITIAL	8.0	7.6	9.6	8.9	6.9	6.5	7.1	7.1			
	FINAL	8.1	10.8	7.0	6.6	6.6	10.1	7.0	6.7			
pH(mg/L)	INITIAL	10.7	7.2	7.1	7.1	7.0	7.1	6.7	6.8			
	FINAL	7.3	7.4	7.1	6.4	6.7	6.8	10.9	6.8			
temp(C)	INITIAL	22.9	21.6	21.8	21.9	22.3	23.7	22.8	22.2			
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0			
CONC:		42%	42%	42%	42%	42%	42%	42%	42%			
D.O (mg/L)	INITIAL	8.0	7.7	9.7	9.0	7.0	10.4	7.0	7.1			
	FINAL	8.1	10.8	6.9	6.6	6.6	10.0	6.9	6.7			
pH(mg/L)	INITIAL	10.8	7.2	7.1	7.1	7.0	7.1	6.8	6.8			
	FINAL	7.2	7.3	7.1	6.5	6.7	10.9	6.8	6.8			
temp(C)	INITIAL	23.3	21.5	21.8	22.1	22.10	24.5	23.2	22.7			
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0			
CONC:		56%	56%	56%	56%	56%	56%	56%	56%			
D.O (mg/L)	INITIAL	8.1	7.8	9.9	9.1	7.1	10.4	7.0	7.0			
	FINAL	8.2	10.7	6.8	6.4	6.7	6.1	6.8	6.6			
pH(mg/L)	INITIAL	10.9	7.2	7.0	7.0	7.0	7.1	6.8	6.8			
	FINAL	7.3	7.4	7.2	10.5	10.8	7.0	6.9	6.8			
temp(C)	INITIAL	23.6	21.4	21.7	22.3	23.1	25.2	23.5	23.0			
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0			
CONC:		75%	75%	75%	75%	75%	75%	75%	75%			
D.O (mg/L)	INITIAL	8.1	8.1	10.0	9.3	7.1	6.3	7.0	7.0			
	FINAL	8.2	10.8	10.9	6.5	6.8	6.0	10.8	10.6			
pH(mg/L)	INITIAL	10.8	7.1	7.0	7.0	7.0	7.1	6.8	6.8			
	FINAL	7.3	7.3	7.1	10.5	10.7	7.0	7.0	6.8			
temp(C)	INITIAL	24.0	21.4	21.6	22.7	24.1	26.3	23.9	23.1			
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0			
CONC:		100%	100%	100%	100%	100%	100%	100%	100%			
D.O (mg/L)	INITIAL	8.2	8.1	10.5	9.4	7.4	10.5	7.3	7.0			
	FINAL	8.2	10.8	7.0	6.6	6.8	10.1	10.7	10.5			
pH(mg/L)	INITIAL	6.8	7.0	6.9	7.0	10.9	7.0	6.8	6.7			
	FINAL	7.2	7.2	7.1	6.3	6.7	7.0	7.0	6.9			
temp(C)	INITIAL	24.4	28.8	21.1	23.0	26.0	27.7	24.1	23.3			
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0			
CONC: 100%		A	B	B	A	A	B	C	C			
ALKALINITY((mg/L)		9	8	→	9	→	8	→	→			
HARDNESS(mg/L)		1210	1216	→	1210	→	1250	→	→			
CONDUCTIVITY(umhos/cm)		2120	2200	→	2120	→	2200	→	→			
CHLORINE(mg/L)		0.05	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

		TEST START		DATE 6-20		TIME 1500							
Lab #/s: K306582		TEST END		DATE 6-27		TIME 1330							
		AGE AND SOURCE OF MINNOWS 24 hrs Aquatox											
		DAY (NUMBER SURVIVING)								SURVIVAL			
CONC:	REP #	start	1	2	3	4	5	6	7	%	MEAN %		
control	A	10	9	9	9	9	9	9	9	90	94%	9.83	
	B	↓	10	10	10	10	10	10	10	100			
	C	↓	10	10	10	10	10	10	10	100			
	D	↓	10	10	10	10	9	9	9	90			
	E	↓	10	10	9	9	9	9	9	90			
32%	A	10	10	10	10	10	10	10	10	100	98%		
	B	↓	10	10	10	10	10	10	10	100			
	C	↓	10	10	10	10	10	10	10	100			
	D	↓	10	10	9	9	9	9	9	90			
	E	↓	10	10	10	10	10	10	10	100			
42%	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			
56%	A	10	10	10	10	10	10	10	10	100	98%		
	B	↓	10	10	10	9	9	9	9	90			
	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			
75%	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			
100%	A	10	10	10	10	10	10	10	10	100	100%	01	
	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			
ANALYST:		AF	LR	SR	ma	TC	TC,mg	TC	AF				
DATE:		6-20	6-21-03	6-22	6-23	6-24	6-25	6-26	6-27				
TIME:		1500	1555	1455	1330	1400	1420	1415	1330				

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

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB #/S: <u>K306582</u>		TEST DATES (BEGIN/END): <u>6-20-03/6-27-03</u>
CLIENT: <u>WESTON</u>		WEIGHING DATE/TIME:
ANALYST/S: <u>AE, MG, JC</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	A31	0.98000	0.97510	0.00490	10	0.490	AVG DRY WEIGHT (mg) 0.550 CV 7.21%
	B32	0.97855	0.97300	0.00555	10	0.555	
	C33	0.98037	0.97437	0.00600	10	0.600	
	D34	0.98062	0.97517	0.00545	10	0.545	
	E35	0.98436	0.97874	0.00562	10	0.562	
32%	A36	0.98610	0.97917	0.00693	10	0.693	AVG DRY WEIGHT(MG) 0.627 CV 8.44%
	B37	0.97975	0.97372	0.00603	10	0.603	
	C38	0.98166	0.97557	0.00609	10	0.609	
	D39	0.97631	0.97080	0.00551	10	0.551	
	E40	0.97364	0.96710	0.00654	10	0.654	
42%	A41	0.97889	0.97223	0.00666	10	0.666	AVG DRY WEIGHT(MG) 0.621 CV 7.66%
	B42	0.97998	0.97323	0.00675	10	0.675	
	C43	0.97450	0.96844	0.00606	10	0.606	
	D44	0.97773	0.97183	0.00590	10	0.590	
	E45	0.97639	0.97072	0.00567	10	0.567	
56%	A46	0.97801	0.97083	0.00718	10	0.718	AVG DRY WEIGHT(MG) 0.727 CV 11.9%
	B47	0.98184	0.97582	0.00602	10	0.602	
	C48	0.98207	0.97509	0.00698	10	0.698	
	D49	0.98198	0.97382	0.00816	10	0.816	
	E50	0.98257	0.97456	0.00801	10	0.801	
75%	A51	0.98154	0.97417	0.00737	10	0.737	AVG DRY WEIGHT(MG) 0.701 CV 6.89%
	B52	0.98020	0.97269	0.00751	10	0.751	
	C53	0.98056	0.97403	0.00653	10	0.653	
	D54	0.98027	0.97308	0.00719	10	0.719	
	E55	0.97622	0.96975	0.00647	10	0.647	
106%	A56	0.97731	0.97070	0.00661	10	0.661	AVG DRY WEIGHT(MG) 0.721 CV 7.18%
	B57	0.97401	0.96714	0.00687	10	0.687	
	C58	0.97797	0.97006	0.00791	10	0.791	
	D59	0.98035	0.97282	0.00753	10	0.753	
	E60	0.98013	0.97299	0.00714	10	0.714	

CV = (STANDARD DEVIATION/MEAN)*100

AA# K306582 FATHEAD MINNOW SURVIVAL, 6-20-03
File: westons Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.074

W = 0.827

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# K306582 FATHEAD MINNOW SURVIVAL, 6-20-03
File: westons 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# K306582 FATHEAD MINNOW SURVIVAL, 6-20-03
FILE: westons
TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.9000	1.2490
1	CONTROL	2	1.0000	1.4120
1	CONTROL	3	1.0000	1.4120
1	CONTROL	4	0.9000	1.2490
1	CONTROL	5	0.9000	1.2490
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	1.0000	1.4120
3	42 % EFFLUENT	5	1.0000	1.4120
4	56 % EFFLUENT	1	1.0000	1.4120
4	56 % EFFLUENT	2	0.9000	1.2490
4	56 % EFFLUENT	3	1.0000	1.4120
4	56 % EFFLUENT	4	1.0000	1.4120
4	56 % EFFLUENT	5	1.0000	1.4120
5	75 % EFFLUENT	1	1.0000	1.4120
5	75 % EFFLUENT	2	1.0000	1.4120
5	75 % EFFLUENT	3	1.0000	1.4120
5	75 % EFFLUENT	4	1.0000	1.4120
5	75 % EFFLUENT	5	1.0000	1.4120
6	100 % EFFLUENT	1	1.0000	1.4120
6	100 % EFFLUENT	2	1.0000	1.4120
6	100 % EFFLUENT	3	1.0000	1.4120
6	100 % EFFLUENT	4	1.0000	1.4120
6	100 % EFFLUENT	5	1.0000	1.4120

AA# K306582 FATHEAD MINNOW SURVIVAL, 6-20-03

File: westons 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	1.314				
2	32 % EFFLUENT	1.379	32.50	16.00	5.00	
3	42 % EFLLUENT	1.412	35.00	16.00	5.00	
4	56 % EFFLUENT	1.379	32.50	16.00	5.00	
5	75 % EFFLUENT	1.412	35.00	16.00	5.00	
6	100 % EFFLUENT	1.412	35.00	16.00	5.00	

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

AA # K306582, FATHEAD MINNOW GROWTH, 6-20-03
File: westonG Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.077

W = 0.973

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 # K306582, FATHEAD MINNOW GROWTH, 6-20-03
File: westonG Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 2.95

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 # K306582, FATHEAD MINNOW GROWTH, 6-20-03

FILE: westonG

TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.4900	0.4900
1	CONTROL	2	0.5550	0.5550
1	CONTROL	3	0.6000	0.6000
1	CONTROL	4	0.5450	0.5450
1	CONTROL	5	0.5620	0.5620
2	32 % EFFLUENT	1	0.6930	0.6930
2	32 % EFFLUENT	2	0.6030	0.6030
2	32 % EFFLUENT	3	0.6090	0.6090
2	32 % EFFLUENT	4	0.5510	0.5510
2	32 % EFFLUENT	5	0.6540	0.6540
3	42 % EFFLUENT	1	0.6660	0.6660
3	42 % EFFLUENT	2	0.6750	0.6750
3	42 % EFFLUENT	3	0.6060	0.6060
3	42 % EFFLUENT	4	0.5900	0.5900
3	42 % EFFLUENT	5	0.5670	0.5670
4	56 % EFFLUENT	1	0.7180	0.7180
4	56 % EFFLUENT	2	0.6020	0.6020
4	56 % EFFLUENT	3	0.6980	0.6980
4	56 % EFFLUENT	4	0.8160	0.8160
4	56 % EFFLUENT	5	0.8010	0.8010
5	75 % EFFLUENT	1	0.7370	0.7370
5	75 % EFFLUENT	2	0.7510	0.7510
5	75 % EFFLUENT	3	0.6530	0.6530
5	75 % EFFLUENT	4	0.7190	0.7190
5	75 % EFFLUENT	5	0.6470	0.6470
6	100 % EFFLUENT	1	0.6610	0.6610
6	100 % EFFLUENT	2	0.6870	0.6870
6	100 % EFFLUENT	3	0.7910	0.7910
6	100 % EFFLUENT	4	0.7530	0.7530
6	100 % EFFLUENT	5	0.7140	0.7140

AA # K306582, FATHEAD MINNOW GROWTH, 6-20-03
File: westonG Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.124	0.025	7.760
Within (Error)	24	0.077	0.003	
Total	29	0.201		

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

AA # K306582, FATHEAD MINNOW GROWTH, 6-20-03
 File: westonG 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	0.550	0.550		
2	32 % EFFLUENT	0.622	0.622	-1.999	
3	42 % EFFLUENT	0.621	0.621	-1.965	
4	56 % EFFLUENT	0.727	0.727	-4.930	
5	75 % EFFLUENT	0.701	0.701	-4.216	
6	100 % EFFLUENT	0.721	0.721	-4.768	

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

AA # K306582, FATHEAD MINNOW GROWTH, 6-20-03
 File: westonG 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	0.085	15.4	-0.072
3	42 % EFFLUENT	5	0.085	15.4	-0.070
4	56 % EFFLUENT	5	0.085	15.4	-0.177
5	75 % EFFLUENT	5	0.085	15.4	-0.151
6	100 % EFFLUENT	5	0.085	15.4	-0.171

APPENDIX D

Ceriodaphnia dubia Raw Data and Statistics

Ceriodaphnia dubia

SURVIVAL AND REPRODUCTION TEST

Discharger: Weston

Lab Number/s

Analyst: MW, MG, TC

Location:

K306582

Test Start-Date/Time: 6-20-03/1145

Date Sample Collected: see COC

Test Stop-Date/Time: 6-28-03/0900

Conc 1	Day	Replicate												No. of Young/Adults	Analyst		
		A	B	C	D	E	F	G	H	I	J						
%	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	MW
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	MG
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	MG
	4	3	4	0	0	5	6	4	0	0	7	2	3	23	10	2.3	TC
	5	1	0	0	3	6	0	6	3	5	2	2	6	26	10	2.6	MG
	6	5	3	0	4	0	0	3	6	4	6	2	6	25	10	2.5	MG
	7	4	9	X	1	0	3	7	0	4	6	5	3	38	9	4.2	MG
	8	0	9	-	0	10	X	0	6	0	4	2	9	29	8	3.2	MG
	Total	13	25	X	7	24	X	19	13	15	18	14	2	142	X=16.8	CV=35.1	

Conc 2	Day	Replicate												No. of Young/Adults	Analyst		
		A	B	C	D	E	F	G	H	I	J						
%	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	MW
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	MG
	3	0	0	0	0	4	0	0	0	0	0	0	0	4	10	0.4	MG
	4	3	6	X	0	6	0	1	5	6	7	4	3	38	9	4.2	TC
	5	7	7	-	0	7	10	0	6	7	6	6	9	50	9	5.6	MG
	6	1	1	-	0	6	6	2	0	6	1	1	9	11	9	1.2	MG
	7	5	2	-	0	8	X	5	4	0	2	0	8	20	8	3.3	MG
	8	0	8	-	0	0	0	1	3	3	3	1	8	15	8	1.9	MG
	Total	16	24	X	6	25	X	16	11	13	19	14	2	144			

Conc 3	Day	Replicate												No. of Young/Adults	Analyst		
		A	B	C	D	E	F	G	H	I	J						
%	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	MW
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	MG
	3	0	0	0	0	6	0	0	0	0	0	0	6	6	10	0.6	MG
	4	6	6	6	3	0	0	0	0	6	5	3	2	32	10	3.2	TC
	5	9	7	4	4	7	6	7	3	6	7	6	6	60	10	6.0	MG
	6	0	0	0	0	11	0	2	2	0	0	0	15	15	10	1.5	MG
	7	4	0	3	0	0	5	3	3	0	2	0	20	20	10	2.0	MG
	8	3	9	2	6	0	0	0	6	3	7	3	30	30	10	3.0	MG
	Total	22	22	15	7	24	11	12	14	15	21	16	2	163			

X=DEAD; Y=MALE

Total X=19.2 CV=22.7

FISHER'S EXACT TEST

=====			
NUMBER OF			
IDENTIFICATION	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	9	1	10
32% effluent	8	2	10
TOTAL	17	3	20

CRITICAL FISHER'S VALUE (10,10,9) (p=0.05) IS 4. b VALUE IS 8.
 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
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

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

IDENTIFICATION	NUMBER OF		
	DEAD	ALIVE	TOTAL ANIMALS
CONTROL	1	9	10
75% 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
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	2
2	42% effluent	10	0
3	56% effluent	10	1
4	75% effluent	10	0
5	100% effluent	10	0

AA # K306582, CERIODAPHNIA DUBIA REPRODUCTION, 6-20-03
File: westonC 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 # K306582, CERIODAPHNIA DUBIA REPRODUCTION, 6-20-03
File: westonC Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 6.49

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 # K306582, CERIODAPHNIA DUBIA REPRODUCTION, 6-20-03
 FILE: westonC
 TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	13.0000	13.0000
1	CONTROL	2	25.0000	25.0000
1	CONTROL	3	1.0000	1.0000
1	CONTROL	4	7.0000	7.0000
1	CONTROL	5	24.0000	24.0000
1	CONTROL	6	7.0000	7.0000
1	CONTROL	7	19.0000	19.0000
1	CONTROL	8	13.0000	13.0000
1	CONTROL	9	15.0000	15.0000
1	CONTROL	10	18.0000	18.0000
2	32 % EFFLUENT	1	16.0000	16.0000
2	32 % EFFLUENT	2	24.0000	24.0000
2	32 % EFFLUENT	3	0.0000	0.0000
2	32 % EFFLUENT	4	6.0000	6.0000
2	32 % EFFLUENT	5	25.0000	25.0000
2	32 % EFFLUENT	6	16.0000	16.0000
2	32 % EFFLUENT	7	11.0000	11.0000
2	32 % EFFLUENT	8	13.0000	13.0000
2	32 % EFFLUENT	9	19.0000	19.0000
2	32 % EFFLUENT	10	14.0000	14.0000
3	42 % EFFLUENT	1	22.0000	22.0000
3	42 % EFFLUENT	2	22.0000	22.0000
3	42 % EFFLUENT	3	15.0000	15.0000
3	42 % EFFLUENT	4	7.0000	7.0000
3	42 % EFFLUENT	5	24.0000	24.0000
3	42 % EFFLUENT	6	11.0000	11.0000
3	42 % EFFLUENT	7	12.0000	12.0000
3	42 % EFFLUENT	8	14.0000	14.0000
3	42 % EFFLUENT	9	15.0000	15.0000
3	42 % EFFLUENT	10	21.0000	21.0000
4	56 % EFFLUENT	1	6.0000	6.0000
4	56 % EFFLUENT	2	7.0000	7.0000
4	56 % EFFLUENT	3	13.0000	13.0000
4	56 % EFFLUENT	4	7.0000	7.0000
4	56 % EFFLUENT	5	16.0000	16.0000
4	56 % EFFLUENT	6	27.0000	27.0000
4	56 % EFFLUENT	7	21.0000	21.0000
4	56 % EFFLUENT	8	7.0000	7.0000
4	56 % EFFLUENT	9	12.0000	12.0000
4	56 % EFFLUENT	10	17.0000	17.0000
5	75 % EFFLUENT	1	10.0000	10.0000
5	75 % EFFLUENT	2	20.0000	20.0000
5	75 % EFFLUENT	3	12.0000	12.0000
5	75 % EFFLUENT	4	18.0000	18.0000
5	75 % EFFLUENT	5	13.0000	13.0000
5	75 % EFFLUENT	6	5.0000	5.0000
5	75 % EFFLUENT	7	10.0000	10.0000
5	75 % EFFLUENT	8	6.0000	6.0000
5	75 % EFFLUENT	9	20.0000	20.0000
5	75 % EFFLUENT	10	8.0000	8.0000

6	100 %	EFFLUENT	1	10.0000	10.0000
6	100 %	EFFLUENT	2	10.0000	10.0000
6	100 %	EFFLUENT	3	16.0000	16.0000
6	100 %	EFFLUENT	4	18.0000	18.0000
6	100 %	EFFLUENT	5	14.0000	14.0000
6	100 %	EFFLUENT	6	12.0000	12.0000
6	100 %	EFFLUENT	7	17.0000	17.0000
6	100 %	EFFLUENT	8	18.0000	18.0000
6	100 %	EFFLUENT	9	18.0000	18.0000
6	100 %	EFFLUENT	10	19.0000	19.0000

AA # K306582, CERIODAPHNIA DUBIA REPRODUCTION, 6-20-03
File: westonC Transform: NO TRANSFORMATION

STEEL'S MANY-ONE RANK TEST

Ho: Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	14.200				
2	32 % EFFLUENT	14.400	105.50	75.00	10.00	
3	42 % EFFLUENT	16.300	111.50	75.00	10.00	
4	56 % EFFLUENT	13.300	99.00	75.00	10.00	
5	75 % EFFLUENT	12.200	95.50	75.00	10.00	
6	100 % EFFLUENT	15.200	108.00	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 6-20-03 Arkansas Analytical

SPECIES Pimephales promelas

QUANTITY SHIPPED 500

AGE/LIFE STAGE 24 hrs 6/30 1500LST

BROODSTOCK SOURCE Anderson Farms, AR

CULTURE WATER groundwater

ALKALINITY (Mg/l as CaCO₃) = 180

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

FEEDING Artemia

COMMENTS _____

PACKAGED BY CM

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: 4/15/02

SPECIES: Ceriodaphnia dubia

AGE: Variable

LIFE STAGE: Adult

HATCH DATE: Variable

BEGAN FEEDING: Immediately

FOOD: YTC, Selenastrum

Water Chemistry Record:

	Mean	Range
TEMPERATURE:	<u>23 °C</u>	<u>21-24°C</u>
SALINITY/CONDUCTIVITY:	<u>--</u>	<u>--</u>
TOTAL HARDNESS (as CaCO ₃):	<u>116 mg/l</u>	<u>70-156 mg/l</u>
TOTAL ALKALINITY (as CaCO ₃):	<u>60 mg/l</u>	<u>50-115 mg/l</u>
pH:	<u>7.58</u>	<u>7.56-8.32</u>

Comments:

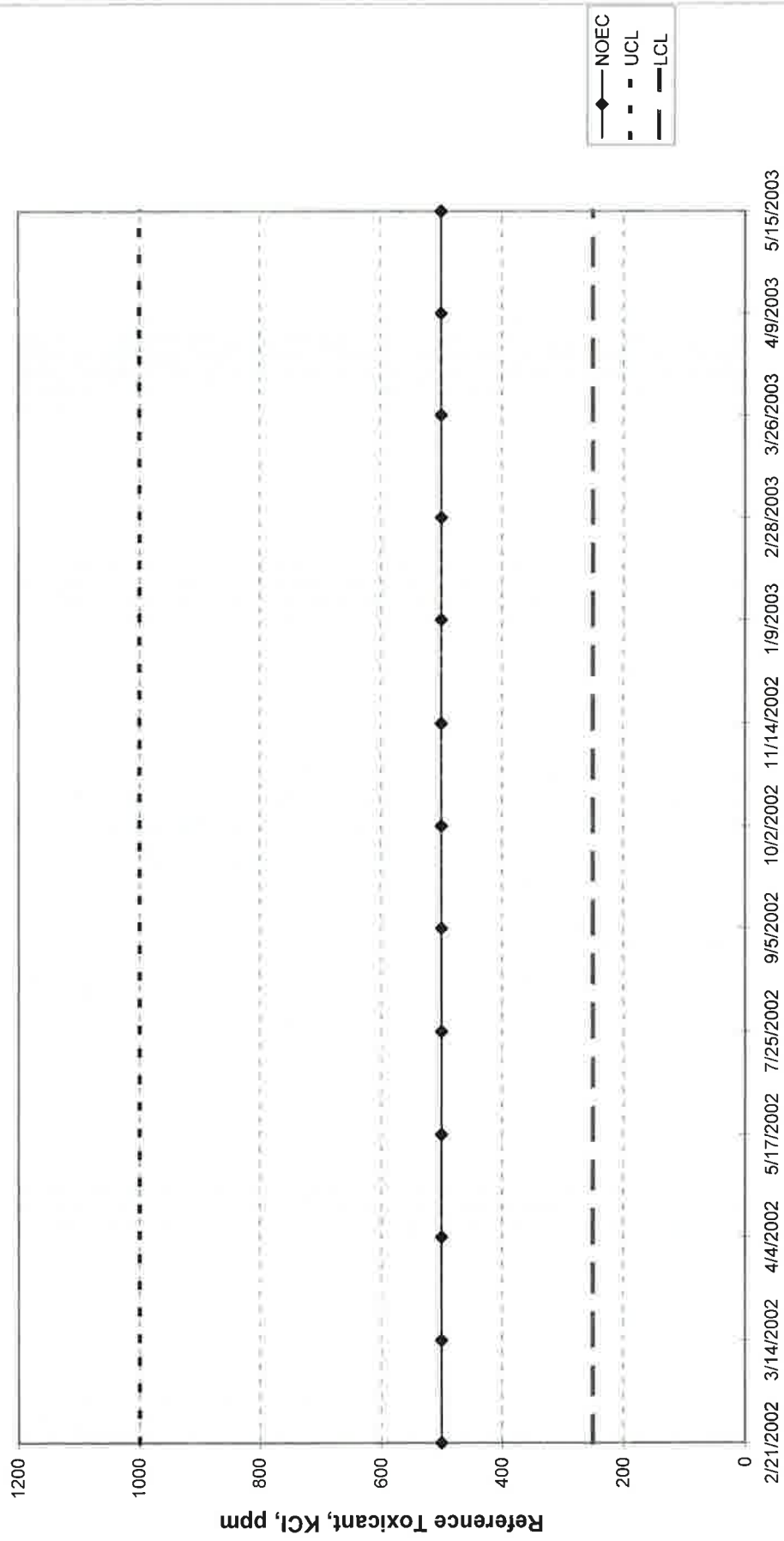
Facility Supervisor



APPENDIX F

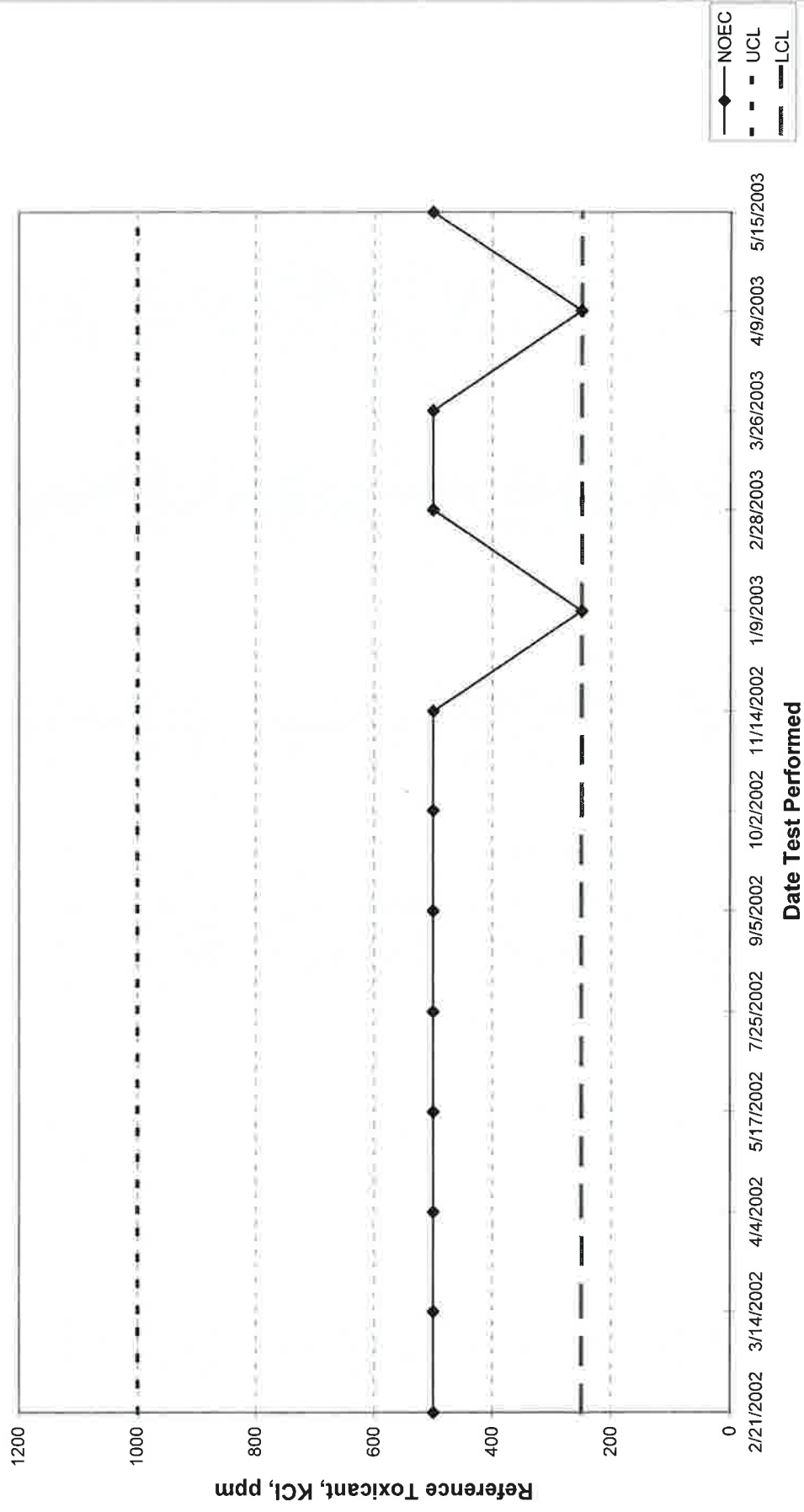
Quality Assurance Charts

ARKANSAS ANALYTICAL, INC.
FATHEAD MINNOW SURVIVAL
QUALITY ASSURANCE

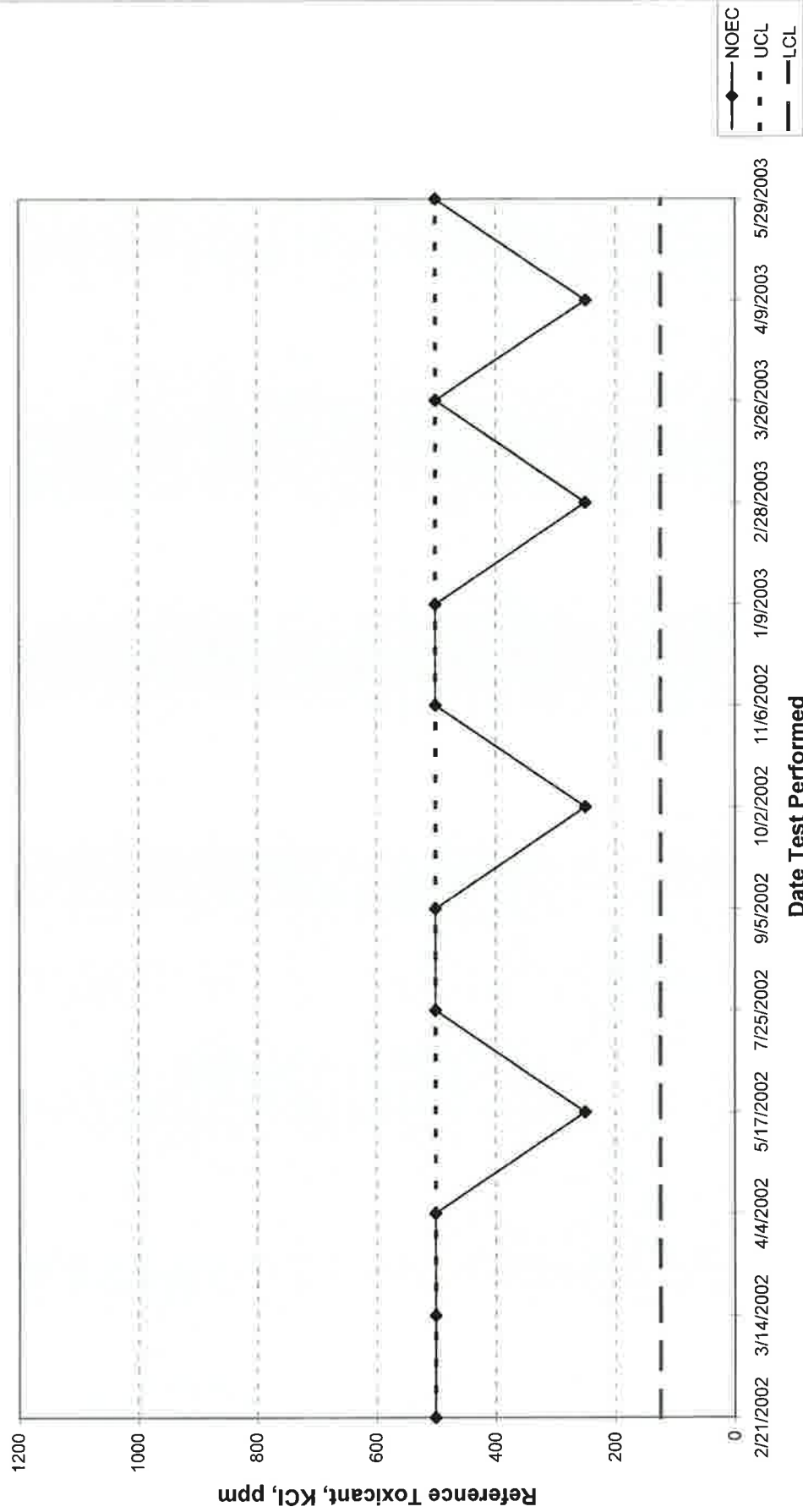


◆ NOEC
- - - UCL
- - - LCL

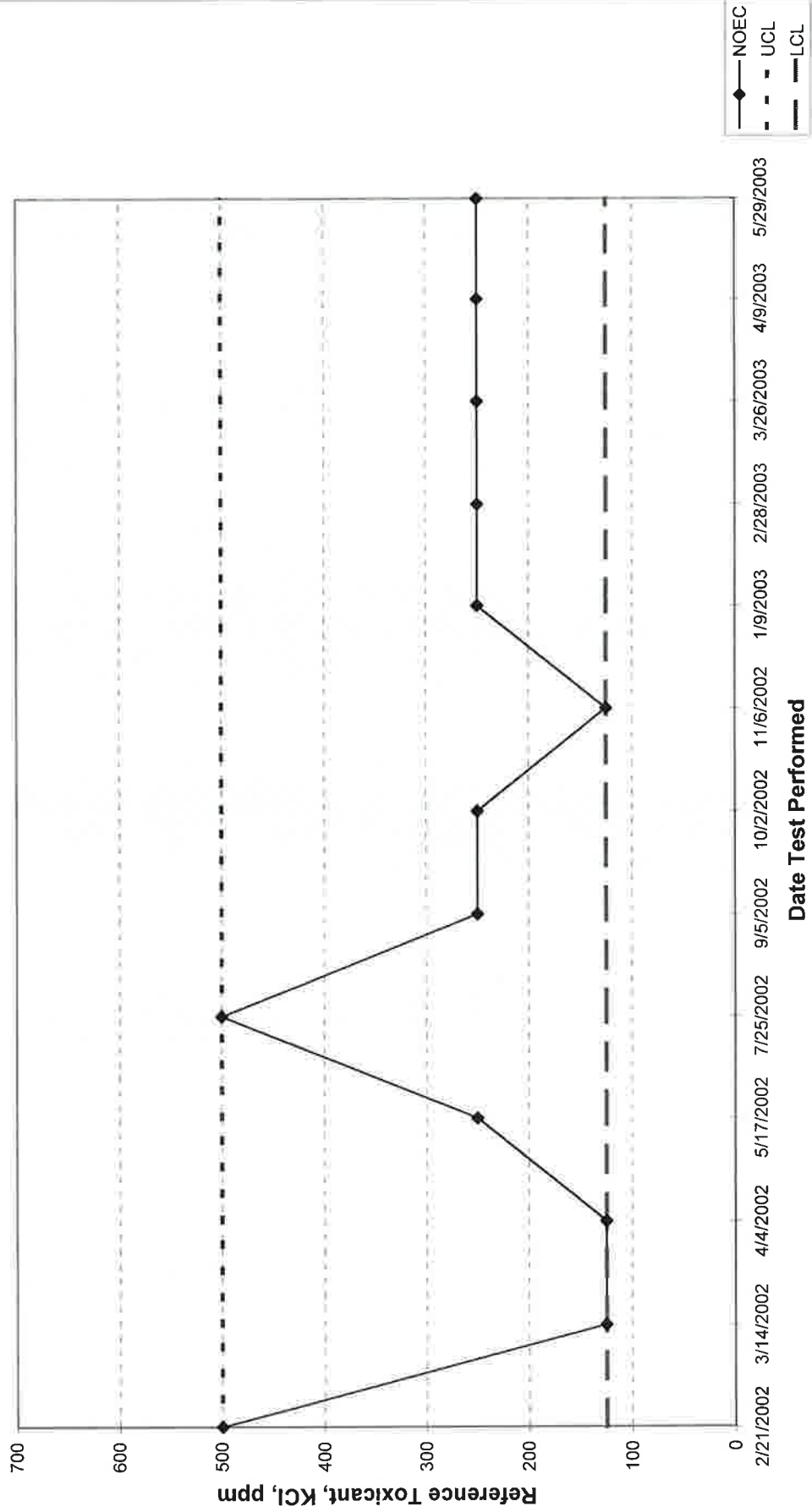
ARKANSAS ANALYTICAL, INC.
FATHEAD MINNOW GROWTH
QUALITY ASSURANCE



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

May 14, 2003 to October 30, 2003

Laboratory ID # 60-1754

Certificate # 03-031-1

The following parameters are certified:

Alkalinity
Ammonia
BOD
Bromide
CBOD
Chloride
Chlorine
COD
Conductivity
Cyanide
Fluoride
Hardness
Nitrate
Nitrite

Oil & Grease
Orthophosphate
Perchlorate
pH
Phenol
Sulfate
Sulfide
Surfactants
TDS
TKN
TOC
Total Phosphorus
Total Solids
TSS
Iron

Turbidity
Aluminum
Antimony
Arsenic
Barium
Beryllium
Boron
Cadmium
Calcium
Chromium
Cobalt
Copper
Hex. Chromium
Iron

Lead
Magnesium
Manganese
Mercury
Molybdenum
Nickel
Potassium
Selenium
Silver
Sodium
Strontium
Thallium

Tin
Titanium
Vanadium
Zinc
Herbicides
Pesticides & PCBs
Semi-volatiles
TPHC
Volatile Organics
Fecal Coliform
Acute Toxicity
Chronic Toxicity

May 15, 2003 Date

J.A. Semberaki
Quality Assurance Officer

ARKANSAS ANALYTICAL, INCORPORATED

11701 I-30, BUILDING 1, SUITE 115
LITTLE ROCK, AR 72209

Laboratory Control Number: K306582 Date: 7-14-03

Client: Mageobar Mine Site Sample ID: outfall

	<u>Pass</u>	<u>Fail</u>
Fathead Minnow Survival Test	<u>✓</u>	<u>_____</u>
Fathead Minnow Growth Test	<u>✓</u>	<u>_____</u>
<i>Ceriodaphnia dubia</i> Survival Test	<u>✓</u>	<u>_____</u>
<i>Ceriodaphnia dubia</i> Reproduction Test	<u>✓</u>	<u>_____</u>

Analyst Initials MLJ