Arkansas Analytical, Inc.

Toxicity Test Results

MAGCOBAR MINE SITE
NPDES PERMIT NUMBER: AR0049794
August 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
Malvern, AR 72104

Prepared by: Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, Arkansas 72209
Lab Number K408524

Wednesday, September 1, 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 bi-monthly for both *Ceriodaphnia dubia* and *Pimephales promelas.* The test results in this report represent the testing for August 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:	8-18-04, 1000	8-19-04, 1000
Sample #2:	8-19-04, 1000	8-20-04, 1000
Sample #3:	8-23-04, 0930	8-24-04, 0930

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:	8-19-04, 1459	4
Sample #2:	8-20-04, 1500	4
Sample #3:	8-24-04, 1504	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 < 48 hour old Fathead Minnows, *Pimephales promelas*, which were purchased from Aquatox; a copy of the organism history is provided in Appendix E.

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

Quality Assurance

Test Acceptability

TEST ACCEPTANCE CRITERIA for *Ceriodaphnia dubia*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	100%	X	
Average of 15 or more young per surviving female	16.3	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	24.9%	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	0.389	X	
The percent coefficient of variation between replicates must be 40% or less for growth	16.8%	X	

Reference Toxicant

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

REFERENCE TOXICANT

Ceriodaphnia dubia		*Pimephales promelas*	
NOEC Survival:	250 ppm KCl	NOEC Survival:	500 ppm KCl
LOEC Survival:	500 ppm KCl	LOEC Survival:	1000 ppm KCl
NOEC Reproduction:	250 ppm KCl	NOEC Growth:	500 ppm KCl
LOEC Reproduction:	500 ppm KCl	LOEC Growth:	1000 ppm KCl

Quality Assurance charts are provided in Appendix F.

Summary of Results
Magcobar Mine Site

Ceriodaphnia dubia		*Pimephales promelas*	
NOEC / LOEC Survival	100% / NA	NOEC / LOEC survival	100% / NA
NOEC / LOEC Reproduction	100% / NA	NOEC / LOEC growth	100% / NA
Mean number of neonates (critical dilution)	20.3	%CV survival (critical dilution)	4.56%
%CV Reproduction (critical dilution)	33.4%	Mean dry weight (critical dilution) in milligrams	0.693
		%CV growth (critical dilution)	13.3%

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

Wendy Harston

Arkansas Analytical Inc.

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:	8-18-04, 1000	8-19-04, 1000
Sample #2:	8-19-04, 1000	8-20-04, 1000
Sample #3:	8-23-04, 0930	8-24-04, 0930

Test initiated (date, time): 8-20-04, 1000 Test terminated (date, time): 8-27-04, 1320

Dilution water used: Soft Synthetic

DATA TABLE FOR FATHEAD MINNOW SURVIVAL

	Percent Survival in Replicate Chambers						Mean Percent Survival			
Effluent Conc %	A	B	C	D	E		24 hours	48 hours	7 days	CV %
0%	100	100	100	100	100		100	100	100	0.00
32%	100	100	100	100	100		100	100	100	
42%	100	100	100	100	100		100	100	100	
56%	100	100	100	100	100		100	100	100	
75%	100	100	100	100	100		100	100	100	
100%	100	90	100	100	100		100	100	98	4.56

DATA TABLE FOR GROWTH OF FATHEAD MINNOWS

Average Dry Weight in milligrams in replicate chambers

Effluent Conc %	A	B	C	D	E		Mean Dry Weight	CV%
0%	0.475	0.332	0.332	0.366	0.440		0.389	16.8
32%	0.613	0.522	0.463	0.534	0.664		0.559	
42%	0.543	0.678	0.614	0.514	0.706		0.611	
56%	0.457	0.673	0.542	0.661	0.662		0.599	
75%	0.773	0.686	0.208	0.598	0.743		0.602	
100%	0.639	0.601	0.818	0.762	0.645		0.693	13.3

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)= _____**4.56**_____%

Arkansas Analytical Inc.

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:	8-18-04, 1000	8-19-04, 1000
Sample #2:	8-19-04, 1000	8-20-04, 1000
Sample #3:	8-23-04, 0930	8-24-04, 0930

Test initiated (date, time): 8-20-04, 0950 Test terminated (date, time): 8-27-04, 0920

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	17	19	25	27	27	22
B	17	19	24	27	17	28
C	9	13	25	24	25	27
D	20	22	27	20	18	17
E	12	21	22	18	21	21
F	16	25	22	29	23	15
G	21	16	28	25	25	23
H	22	24	26	25	23	17
I	15	19	21	24	32	27
J	14	14	20	33	22	6
Mean	16.3	19.2	24.0	25.2	23.3	20.3
Mean/surviving female	16.3	19.2	24.0	25.2	23.3	20.3
CV%*	24.9					33.4

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	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)= _____**33.4**_____%

APPENDIX A

Chain of Custody Forms

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION	Project Description	Turnaround Time
Weston Solutions, Inc.	MAGCOBAR Mine Site	(CIRCLE ONE)
P.O. Box 699	Reporting Information	24 hour
2000 Darby Lane	Telephone: 501/467-8355	48 hour
Malvern, AR 72104	FAX: 501/467-8687	routine
Attn: Alan Brown	Bill to/P.O	Preservative Code
		Bottle Type: P

Preservation Codes:

1. Cool, 4 degrees Centigrade
2. Sulfuric Acid, pH <2
3. Nitric Acid, pH <2
4. Thiosulfate for dechlorination
5. Hydrochloric Acid for VOA
6. Sodium Hydroxide, pH >12

Samplers:(Signature/s): Darrel Scott

Samplers:(Printed): DARREL SCOTT

Field Number	Sample Collection Date/s	Sample Collection Time/s	Grab	Comp	# of Containers	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	Chronic Bio	TEST PARAMETERS	Arkansas Analytical Lab #
FD0819COMP	8/19/2004	10:00		X	4		Facilty Discharge	X		140852 4A

Bottle type code: G=glass;P=HDPE V=septum;A=amber

1. Relinquished by:(Signature)	Date/Time	1.Received by:(Signature)
Darrel Scott	8/19/04 14:59	
2.Relinquished by:(Signature)	Date/Time	2.Received by laboratory :(Signature)
	8/19/04 1459	

For completion by laboratory

Condition of samples:	yes	no
A. Containers Correct:?	✓	
B. Preservation Correct:?	✓	
C. Seals Intact:?	✓	

Rec 20C

REMARKS

ARKANSAS ANALYTICAL, INC. ** 11701 I-30, Bldg 1, Suite 115**Little Rock, Arkansas 72209**phone(501)455-3233**Fax(501)455-6118

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION	Project Description	Turnaround Time
Weston Solutions, Inc.	MAGCOBAR Mine Site	(CIRCLE ONE)
P.O. Box 699	Reporting Information	24 hour
2000 Darby Lane	Telephone: 501/467-8355	48 hour
Malvern, AR 72104	FAX: 501/467-8687	routine
Attn: Alan Brown	Bill to/P.O	Preservative Code
		Bottle Type

Preservation Codes:

1. Cool, 4 degrees Centigrade
2. Sulfuric Acid, pH <2
3. Nitric Acid, pH <2
4. Thiosulfate for dechlorination
5. Hydrochloric Acid for VOA
6. Sodium Hydroxide, pH >12

Samplers:(Signature/s): Darrel Scott

Samplers:(Printed): DARREL SCOTT

Field Number	Sample Collection Date/s	Sample Collection Time/s	Grab	Comp	# of Containers	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	TEST PARAMETERS: Chronic Bio	Arkansas Analytical Lab #
FD0820COMP	8/20/2004	11:00		X	3		Facilty Discharge	X	K40852 4B

Bottle type code: G=glass;P=HDPE V=septum;A=amber

P

1.Relinquished by:(Signature)	Date/Time	1.Received by:(Signature)
Darrel Scott	1500 8-20-04	
2.Relinquished by:(Signature)	Date/Time	2.Received by laboratory :(Signature)
	8-20-04, 1500	Sydney Farmer

For completion by laboratory

Condition of samples:	yes	no
A. Containers Correct:?	✓	
B. Preservation Correct:?	✓	
C. Seals Intact:?	✓	

REMARKS

ARKANSAS ANALYTICAL, INC. ** 11701 I-30, Bldg 1, Suite 115**Little Rock, Arkansas 72209**phone(501)455-3233**Fax(501)455-6118

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION	Project Description	Turnaround Time
Weston Solutions, Inc.	MAGCOBAR Mine Site	(CIRCLE ONE)
P.O. Box 699	Reporting Information	24 hour
2000 Darby Lane	Telephone: 501/467-8355	48 hour
Malvern, AR 72104	FAX: 501/467-8687	~~Routine~~
Attn: Alan Brown	Bill to/P.O	Preservative Code:
		Bottle Type

Preservation Codes:

1. Cool, 4 degrees Centigrade
2. Sulfuric Acid, pH <2
3. Nitric Acid, pH <2
4. Thiosulfate for dechlorination
5. Hydrochloric Acid for VOA
6. Sodium Hydroxide, pH >12

Samplers:(Signature/s): Darrel Scott

Samplers:(Printed): DARREL SCOTT

Field Number	Sample Collection Date/s	Sample Collection Time/s	Grab	Comp	# of Containers	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	Chronic Bio	TEST PARAMETERS	Arkansas Analytical Lab #
								P		
FD0824COMP	8/24/2004	9:30		X	3		Facilty Discharge	X		K408~~1107~~A 524C

Bottle type code: G=glass;P=HDPE V=septum;A=amber

1 Relinquished by:(Signature)	Date/Time	1.Received by:(Signature)
Darrel Scott	8-24-04 15:04	
2.Relinquished by:(Signature)	Date/Time	2.Received by laboratory :(Signature)
	8-24-04 15:04	Wendy Houston

For completion by laboratory

Condition of samples:	yes	no
A. Containers Correct:?		
B. Preservation Correct:?		
C. Seals Intact:?		

REMARKS

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APPENDIX B

Effluent and Dilution Water Data

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING — Fathead Minnow

Lab # / Sample ID: 6408524 — Test Start (Date/Time): 8-20-04/1000

Client: Dester — Test End (Date/Time): 8-27-04/1320

		Day of Test							
		1	2	3	4	5	6	7	notes/remarks
Control		8/20	8/21	8/22	8/23	8/24	8/25	8/26	SS #110
D.O (mg/L)	INITIAL	7.6	7.7	6.9	6.3	6.4	6.8	6.7	
	FINAL	7.3	7.4	7.1	6.3	6.3	6.3	6.2	
pH(mg/L)	INITIAL	7.8	7.7	8.0	7.3	7.9	7.6	7.9	
	FINAL	8.0	7.8	7.6	7.7	7.6	7.3	8.0	
temp(C)	INITIAL	21.3	21.6	20.9	21.9	22.1	21.0	22.5	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
ALKALINITY(mg/L)		28	→	→	→	→	→	→	
HARDNESS(mg/L)		42	→	→	→	→	→	→	
CONDUCTIVITY(umhos/cm)		158	→	→	→	→	→	→	
CHLORINE(mg/L)		<0.05	→	→	→	→	→	→	
CONC:		32%	32%	32%	32%	32%	32%	32%	
D.O (mg/L)	INITIAL	7.6	7.7	7.0	6.7	7.1	6.9	6.9	
	FINAL	7.2	7.4	7.1	6.4	6.4	6.3	6.3	
pH(mg/L)	INITIAL	7.8	7.7	8.1	7.3	8.2	7.8	8.1	
	FINAL	8.0	7.8	7.5	7.8	7.6	6.9	8.1	
temp(C)	INITIAL	21.3	21.6	20.9	22.1	22.1	21.0	22.5	
	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	7.5	7.6	7.0	6.9	7.3	7.1	7.0	
	FINAL	7.1	7.3	7.1	6.6	6.6	6.4	6.3	
pH(mg/L)	INITIAL	7.9	7.8	8.1	7.3	8.2	7.9	8.0	
	FINAL	7.9	7.7	7.5	7.8	7.6		8.1	
temp(C)	INITIAL	21.3	21.9	20.9	22.1	22.1	21.2	22.6	
	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	7.6	7.1	7.0	7.7	7.3	7.0	
	FINAL	7.1	7.3	7.0	6.7	6.6	6.5	6.3	
pH(mg/L)	INITIAL	7.9	7.7	8.0	7.2	8.1	8.0	8.1	
	FINAL	7.9	7.7	7.4	7.7	7.7	6.8	8.0	
temp(C)	INITIAL	21.3	22.0	20.9	22.1	22.1	21.3	22.7	
	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	7.5	7.3	7.0	8.0	7.4	7.1	
	FINAL	7.1	7.2	7.0	6.9	6.4	6.5	6.3	
pH(mg/L)	INITIAL	7.8	7.7	7.9	7.2	8.0	8.0	8.2	
	FINAL	7.8	7.7	7.4	7.8	7.6	6.7	7.9	
temp(C)	INITIAL	21.3	22.2	20.9	22.2	22.1	21.6	22.8	
	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	7.4	7.4	7.4	7.0	8.4	7.7	7.0	
	FINAL	7.0	7.2	7.0	6.8	6.7	6.5	6.3	
pH(mg/L)	INITIAL	7.9	7.6	7.8	7.1	7.9	8.0	8.1	
	FINAL	7.8	7.7	7.4	7.7	7.5	6.7	7.9	
temp(C)	INITIAL	21.3	22.7	20.9	22.2	22.1	22.1	22.9	
	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)		18	→	→	17	→	19	→	
HARDNESS(mg/L)		1390	→	→	1410	→	1400	→	
CONDUCTIVITY(umhos/cm)		2390	→	→	2400	→	2390	→	
CHLORINE(mg/L)		<0.05	→	→	<0.05	→	<0.05	→	

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING — Ceriodaphnia dubia

Lab # / Sample ID: 4408524 — Test Start (Date/Time): 8-20-04/0950

Client: Weston — Test End (Date/Time): 8-27-04/0920

		Day of Test								
		1	2	3	4	5	6	7	8	notes/remarks
Control		8/20	8/21	8/22	8/23	8/24	8/25	8/26		SS#110
D.O (mg/L)	INITIAL	7.6	7.7	6.9	6.3	6.4	6.8	6.7		
	FINAL	7.2	7.6	6.0	6.2	6.3	6.4	6.4		
pH	INITIAL	7.8	7.7	8.0	7.3	7.9	7.6	7.9		
	FINAL	7.9	7.8	8.2	8.2	8.0	7.9	7.8		
temp(C)	INITIAL	21.3	21.6	20.9	21.9	22.1	21.0	22.5		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
ALKALINITY(mg/L)		28	→	→	→	→	→	→		
HARDNESS(mg/L)		42	→	→	→	→	→	→		
CONDUCTIVITY(umhos/cm)		158	→	→	→	→	→	→		
CHLORINE(mg/L)		<0.05	→	→	→	→	→	→		
CONC:		32:1	32:1	32:1	32:1	32:1	32:1	32:1		
D.O (mg/L)	INITIAL	7.6	7.7	7.0	6.7	7.1	6.9	6.9		
	FINAL	7.2	7.5	6.2	6.4	6.3	6.4	6.5		
pH	INITIAL	7.8	7.7	8.1	7.3	8.2	7.8	8.1		
	FINAL	7.8	7.7	8.3	8.2	7.9	7.9	7.8		
temp(C)	INITIAL	21.3	21.6	20.9	22.1	22.1	21.0	22.5		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
CONC:		42:1	42:1	42:1	42:1	42:1	42:1	42:1		
D.O (mg/L)	INITIAL	7.5	7.6	7.0	6.9	7.3	7.1	7.0		
	FINAL	7.2	7.4	6.3	6.4	6.4	6.4	6.6		
pH	INITIAL	7.9	7.8	8.1	7.3	8.2	7.9	8.0		
	FINAL	7.8	7.7	8.3	8.2	7.9	7.8	7.9		
temp(C)	INITIAL	21.3	21.9	20.9	22.1	22.1	21.2	22.6		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
CONC:		56:1	56:1	56:1	56:1	56:1	56:1	56:1		
D.O (mg/L)	INITIAL	7.4	7.6	7.1	7.0	7.7	7.3	7.0		
	FINAL	7.1	7.4	6.3	6.5	6.4	6.5	6.7		
pH	INITIAL	7.9	7.7	8.0	7.2	8.1	8.0	8.1		
	FINAL	7.7	7.6	8.3	8.1	7.8	7.8	7.8		
temp(C)	INITIAL	21.3	22.0	20.9	22.1	22.1	21.3	22.7		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
CONC:		75:1	75:1	75:1	75:1	75:1	75:1	75:1		
D.O (mg/L)	INITIAL	7.4	7.5	7.3	7.0	8.0	7.4	7.1		
	FINAL	7.1	7.4	6.4	6.6	6.5	6.5	6.7		
pH	INITIAL	7.8	7.7	7.9	7.2	8.0	8.0	8.2		
	FINAL	7.6	7.6	8.2	8.0	7.7	7.8	7.8		
temp(C)	INITIAL	21.3	22.2	20.9	22.2	22.1	21.6	22.8		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
CONC:		100:1	100:1	100:1	100:1	100:1	100:1	100:1		
D.O (mg/L)	INITIAL	7.4	7.4	7.4	7.0	8.4	7.7	7.0		
	FINAL	7.0	7.3	6.5	6.6	6.5	6.6	6.7		
pH	INITIAL	7.9	7.6	7.8	7.1	7.9	8.0	8.1		
	FINAL	7.6	7.6	8.1	8.0	7.7	7.7	7.7		
temp(C)	INITIAL	21.3	22.7	20.9	22.2	22.1	22.1	22.9		
	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)		18	→	→	17	→	19	→		
HARDNESS(mg/L)		1390	→	→	1410	→	1400	→		
CONDUCTIVITY(umhos/cm)		2390	→	→	2400	→	2390	→		
CHLORINE(mg/L)		<0.05	→	→	<0.05	→	<0.05	→		

APPENDIX C

Fathead Minnow Raw Data and Statistics

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB #/ SAMPLE ID K408524 TEST START DATE 8-20 TIME 1000

CLIENT Weston TEST END DATE 8-27 TIME 1320

AGE AND SOURCE OF MINNOWS <48 hrs, Aquatox

		DAY (NUMBER SURVIVING)								SURVIVAL		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
CONC: Control	A	10	10	10	10	10	10	10	10	100	100	0%
	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		
CONC: 32%	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		
CONC: 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		
CONC: 56%	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		
CONC: 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		
CONC: 100%	A	10	10	10	10	10	10	10	10	100	98	4.5%
	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		
ANALYST:		mg	mg	mg	mg	mg	mg	MH	AF			
DATE:		8-20	8-21	8-22	8-23	8-24	8-25	8-26	8-27			
TIME:		1000	1500	1115	1600	1520	1230	1330	1320			

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

Pimephales promelas **FATHEAD MINNOW** TEST 1000.0

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB # / #s:	K408524				TEST DATES (BEGIN / END):		8/20-27/04	
CLIENT:	Weston				WEIGHING DATE / TIME:		9/1/04, 0950	
ANALYSTS:	mg, af				DRYING TEMP (DEGREES C):		60	
SAMPLE ID:					DRYING TIME (HOURS):		24	

	REP #	FINAL DRY WEIGHT TIN+LARVAE (g)	INITIAL WEIGHT TIN (g)	TOTAL DRY WEIGHT OF LARVAE (g)	NUMBER OF LARVAE	DRY WEIGHT OF LARVAE (mg)		
CONTROL	A	0.93578	0.93103	0.00475	10	0.475	AVG DRY	
	B	0.94651	0.94319	0.00332	10	0.332	WEIGHT (mg)	
	C	0.94010	0.93678	0.00332	10	0.332		0.389
	D	0.94722	0.94356	0.00366	10	0.366	CV	
	E	0.94637	0.94197	0.00440	10	0.440		16.8
CONC:	A	0.94683	0.94070	0.00613	10	0.613	AVG DRY	
	B	0.94207	0.93685	0.00522	10	0.522	WEIGHT (mg)	
32%	C	0.94455	0.93992	0.00463	10	0.463		0.559
	D	0.94865	0.94331	0.00534	10	0.534	CV	
	E	0.95187	0.94523	0.00664	10	0.664		
CONC:	A	0.94521	0.93978	0.00543	10	0.543	AVG DRY	
	B	0.94861	0.94183	0.00678	10	0.678	WEIGHT (mg)	
42%	C	0.95324	0.94710	0.00614	10	0.614		0.611
	D	0.95174	0.94660	0.00514	10	0.514	CV	
	E	0.95208	0.94502	0.00706	10	0.706		
CONC:	A	0.94298	0.93841	0.00457	10	0.457	AVG DRY	
	B	0.94258	0.93585	0.00673	10	0.673	WEIGHT (mg)	
56%	C	0.94668	0.94126	0.00542	10	0.542		0.599
	D	0.94489	0.93828	0.00661	10	0.661	CV	
	E	0.94308	0.93646	0.00662	10	0.662		
CONC:	A	0.95345	0.94572	0.00773	10	0.773	AVG DRY	
	B	0.93347	0.92661	0.00686	10	0.686	WEIGHT (mg)	
75%	C	0.94060	0.93852	0.00208	10	0.208		0.602
	D	0.95184	0.94586	0.00598	10	0.598	CV	
	E	0.95310	0.94567	0.00743	10	0.743		
CONC:	A	0.94905	0.94266	0.00639	10	0.639	AVG DRY	
	B	0.94234	0.93633	0.00601	10	0.601	WEIGHT (mg)	
100%	C	0.94703	0.93885	0.00818	10	0.818		0.693
	D	0.94685	0.93923	0.00762	10	0.762	CV	
	E	0.94345	0.93700	0.00645	10	0.645		13.3

CV = (STANDARD DEVIATION/MEAN)*100

REMARKS:

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

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB #/#S:	EY08524	TEST DATES (BEGIN/END):	8-20 / 8-27
CLIENT:	Weston	WEIGHING DATE/TIME:	9-1-04 / 0950
ANALYST/S:	AF, MJ	DRYING TEMPERATURE (DEGREES C):	60°C
SAMPLE ID:		DRYING TIME (HOURS):	24hrs.

	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	A 1	0.93578	0.93[illegible]103				AVG DRY	
	B 2	0.94651	0.94319				WEIGHT (mg)	
	C 3	0.94010	0.93678					
	D 4	0.94722	0.94356				CV	
	E 5	0.94637	0.94197					
CONC:	A 6	0.94683	0.94070				AVG DRY	
	B 7	0.94207	0.93685				WEIGHT(MG)	
32%.	C 8	0.94455	0.93[illegible]92					
	D 9	0.94865	0.94331				CV	
	E 10	0.95187	0.94523					
CONC:	A 11	0.94521	0.93978				AVG DRY	
	B 12	0.94861	0.94183				WEIGHT(MG)	
42%.	C 13	0.95324	0.94710					
	D 14	0.95174	0.94666				CV	
	E 15	0.95208	0.94[illegible]502					
CONC:	A 16	0.94298	0.93841				AVG DRY	
	B 17	0.94258	0.93586				WEIGHT(MG)	
56%.	C 18	0.94668	0.94[illegible]626					
	D 19	0.94489	0.93828				CV	
	E 20	0.94308	0.93646					
CONC:	A 21	0.95345	0.94572				AVG DRY	
	B 22	0.93347	0.92661				WEIGHT(MG)	
75%.	C 23	0.94060	0.93952					
	D 24	0.95184	0.94586				CV	
	E 25	0.95310	0.94567					
CONC:	A 26	0.94905	0.94266				AVG DRY	
	B 27	0.94234	0.93633				WEIGHT(MG)	
100%.	C 28	0.94703	0.93885					
	D 29	0.94685	0.93923				CV	
	E 30	0.94345	0.93700					

*CV = (STANDARD DEVIATION/MEAN)*100*

AA# K408524 FATHEAD MINNOW SURVIVAL, 8-20-04
File: k408524s Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.021

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# K408524 FATHEAD MINNOW SURVIVAL, 8-20-04
File: k408524s 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# K408524 FATHEAD MINNOW SURVIVAL, 8-20-04
FILE: k408524s
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 % EFLLUENT	1	1.0000	1.4120
3	42 % EFLLUENT	2	1.0000	1.4120
3	42 % EFLLUENT	3	1.0000	1.4120
3	42 % EFLLUENT	4	1.0000	1.4120
3	42 % EFLLUENT	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	0.9000	1.2490
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# K408524 FATHEAD MINNOW SURVIVAL, 8-20-04
File: k408524s 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 % EFLLUENT	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	1.379	25.00	16.00	5.00	

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

AA # K408524, FATHEAD MINNOW GROWTH, 8-20-04
File: k408524g Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.352

W = 0.890

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 # K408524, FATHEAD MINNOW GROWTH, 8-20-04
File: k408524g Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 9.37

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 # K408524, FATHEAD MINNOW GROWTH, 8-20-04
FILE: k408524g
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.4750	0.4750
1	CONTROL	2	0.3320	0.3320
1	CONTROL	3	0.3320	0.3320
1	CONTROL	4	0.3660	0.3660
1	CONTROL	5	0.4400	0.4400
2	32 % EFFLUENT	1	0.6130	0.6130
2	32 % EFFLUENT	2	0.5220	0.5220
2	32 % EFFLUENT	3	0.4630	0.4630
2	32 % EFFLUENT	4	0.5340	0.5340
2	32 % EFFLUENT	5	0.6640	0.6640
3	42 % EFFLUENT	1	0.5430	0.5430
3	42 % EFFLUENT	2	0.6780	0.6780
3	42 % EFFLUENT	3	0.6140	0.6140
3	42 % EFFLUENT	4	0.5140	0.5140
3	42 % EFFLUENT	5	0.7060	0.7060
4	56 % EFFLUENT	1	0.4570	0.4570
4	56 % EFFLUENT	2	0.6730	0.6730
4	56 % EFFLUENT	3	0.5420	0.5420
4	56 % EFFLUENT	4	0.6610	0.6610
4	56 % EFFLUENT	5	0.6620	0.6620
5	75 % EFFLUENT	1	0.7730	0.7730
5	75 % EFFLUENT	2	0.6860	0.6860
5	75 % EFFLUENT	3	0.2080	0.2080
5	75 % EFFLUENT	4	0.5980	0.5980
5	75 % EFFLUENT	5	0.7430	0.7430
6	100 % EFFLUENT	1	0.6390	0.6390
6	100 % EFFLUENT	2	0.6010	0.6010
6	100 % EFFLUENT	3	0.8180	0.8180
6	100 % EFFLUENT	4	0.7620	0.7620
6	100 % EFFLUENT	5	0.6450	0.6450

AA # K408524, FATHEAD MINNOW GROWTH, 8-20-04
File: k408524g Transform: NO TRANSFORMATION

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

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	0.389				
2	32 % EFFLUENT	0.559	39.00	16.00	5.00	
3	42 % EFFLUENT	0.611	40.00	16.00	5.00	
4	56 % EFFLUENT	0.599	39.00	16.00	5.00	
5	75 % EFFLUENT	0.602	35.00	16.00	5.00	
6	100 % EFFLUENT	0.693	40.00	16.00	5.00	

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

APPENDIX D

Ceriodaphnia dubia Raw Data and Statistics

Ceriodaphnia dubia — **SURVIVAL AND REPRODUCTION TEST**

Discharger: Weston | Lab Number/s: V408524 | Analyst: mg

Location: | Test Start-Date/Time: 8-20 at 1050

Date Sample Collected: See COC | Test Stop-Date/Time: 8-27-04 / 0920

Conc 1 (Control)

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adults	Young/ Adult	Analyst
	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	0	10	0	mg
	3	0	0	0	0	0	0	0	0	0	0	0	10	0	mg
	4	5	2	0	3	1	4	3	4	2	0	24	10	2.4	mg
	5	3	7	7	5	0	4	5	0	9	7	47	10	4.7	mg
	6	1	0	2	3	8	6	10	8	0	7	45	10	4.5	mg
	7	8	8	0	9	3	2	3	10	4	0	47	10	4.7	mg
	8														
	Total	17	17	9	20	12	16	21	22	15	14	163	$\bar{X}$=16.3 CV= 24.91		

60% 3rd brood

Conc 2 (32)

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adults	Young/ Adult	Analyst
	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	0	10	0	mg
	3	0	0	0	0	0	0	0	0	0	0	0	10	0	mg
	4	4	4	2	4	6	2	1	4	3	3	35	10	3.5	mg
	5	8	6	3	7	4	7	5	8	6	2	56	10	5.6	mg
	6	5	2	8	8	5	8	0	0	8	8	52	10	5.2	mg
	7	0	7	0	3	6	8	10	12	2	1	49	10	4.9	mg
	8														
	Total	19	19	13	22	21	25	16	24	19	14	192			

Conc 3 (42)

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adults	Young/ Adult	Analyst
	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	0	10	0	mg
	3	0	0	0	0	0	2	0	0	0	0	2	10	0.2	mg
	4	6	4	4	4	3	6	4	7	4	5	47	10	4.7	mg
	5	9	9	9	10	6	12	10	9	9	4	87	10	8.7	mg
	6	0	0	12	13	10	0	13	0	8	0	56	10	5.6	mg
	7	10	11	0	0	3	2	1	10	0	11	48	10	4.8	mg
	8														
	Total	25	24	25	27	22	22	28	26	21	20	240			

Conc 4 (56)

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adults	Young/ Adult	Analyst
	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	0	10	0	mg
	3	0	0	0	0	0	0	0	0	0	0	0	10	0	mg
	4	4	4	4	4	0	3	5	5	2	4	35	10	3.5	mg
	5	9	9	7	7	10	9	9	8	7	9	84	10	8.4	mg
	6	14	12	12	9	0	10	11	10	6	12	96	10	9.6	mg
	7	0	2	1	0	8	7	0	2	9	8	37	10	3.7	mg
	8														
	Total	27	27	24	20	18	29	25	25	24	33	252			

Conc 5 (75)

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adults	Young/ Adult	Analyst
	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	0	10	0	mg
	3	0	0	0	0	0	0	0	0	0	0	0	10	0	mg
	4	3	4	3	0	4	4	4	0	6	2	30	10	3.0	mg
	5	11	8	8	8	7	9	7	8	8	8	82	10	8.2	mg
	6	13	0	11	0	10	10	12	9	3	12	79	10	7.9	mg
	7	0	5	3	10	0	0	2	6	16	0	42	10	4.2	mg
	8														
	Total	27	17	25	18	21	23	25	23	32	22	233			

Conc 6 (100)

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adults	Young/ Adult	Analyst
	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	0	10	0	mg
	3	0	0	0	0	0	0	0	0	0	0	0	10	0	mg
	4	1	4	4	1	2	0	4	2	4	0	22	10	2.2	mg
	5	5	8	6	7	7	10	6	0	7	0	56	10	5.6	mg
	6	10	14	9	2	3	0	11	7	12	6	74	10	7.4	mg
	7	6	2	8	7	9	5	2	8	4	0	51	10	5.1	mg
	8														
	Total	22	28	27	17	21	15	23	17	27	6	203	$\bar{X}$= 20.3 CV= 33.4%		

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

	NUMBER OF		
IDENTIFICATION	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

	NUMBER OF		
IDENTIFICATION	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# K408524, CERIODAPHNIA REPRODUCTION, 8-20-04
File: k408524c 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# K408524, CERIODAPHNIA REPRODUCTION, 8-20-04
File: k408524c Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 7.79

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# K408524, CERIODAPHNIA REPRODUCTION, 8-20-04
FILE: k408524c
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	17.0000	17.0000
1	CONTROL	2	17.0000	17.0000
1	CONTROL	3	9.0000	9.0000
1	CONTROL	4	20.0000	20.0000
1	CONTROL	5	12.0000	12.0000
1	CONTROL	6	16.0000	16.0000
1	CONTROL	7	21.0000	21.0000
1	CONTROL	8	22.0000	22.0000
1	CONTROL	9	15.0000	15.0000
1	CONTROL	10	14.0000	14.0000
2	32 % EFFLUENT	1	19.0000	19.0000
2	32 % EFFLUENT	2	19.0000	19.0000
2	32 % EFFLUENT	3	13.0000	13.0000
2	32 % EFFLUENT	4	22.0000	22.0000
2	32 % EFFLUENT	5	21.0000	21.0000
2	32 % EFFLUENT	6	25.0000	25.0000
2	32 % EFFLUENT	7	16.0000	16.0000
2	32 % EFFLUENT	8	24.0000	24.0000
2	32 % EFFLUENT	9	19.0000	19.0000
2	32 % EFFLUENT	10	14.0000	14.0000
3	42 % EFFLUENT	1	25.0000	25.0000
3	42 % EFFLUENT	2	24.0000	24.0000
3	42 % EFFLUENT	3	25.0000	25.0000
3	42 % EFFLUENT	4	27.0000	27.0000
3	42 % EFFLUENT	5	22.0000	22.0000
3	42 % EFFLUENT	6	22.0000	22.0000
3	42 % EFFLUENT	7	28.0000	28.0000
3	42 % EFFLUENT	8	26.0000	26.0000
3	42 % EFFLUENT	9	21.0000	21.0000
3	42 % EFFLUENT	10	20.0000	20.0000
4	56 % EFFLUENT	1	27.0000	27.0000
4	56 % EFFLUENT	2	27.0000	27.0000
4	56 % EFFLUENT	3	24.0000	24.0000
4	56 % EFFLUENT	4	20.0000	20.0000
4	56 % EFFLUENT	5	18.0000	18.0000
4	56 % EFFLUENT	6	29.0000	29.0000
4	56 % EFFLUENT	7	25.0000	25.0000
4	56 % EFFLUENT	8	25.0000	25.0000
4	56 % EFFLUENT	9	24.0000	24.0000
4	56 % EFFLUENT	10	33.0000	33.0000
5	75 % EFFLUENT	1	27.0000	27.0000
5	75 % EFFLUENT	2	17.0000	17.0000
5	75 % EFFLUENT	3	25.0000	25.0000
5	75 % EFFLUENT	4	18.0000	18.0000
5	75 % EFFLUENT	5	21.0000	21.0000
5	75 % EFFLUENT	6	23.0000	23.0000
5	75 % EFFLUENT	7	25.0000	25.0000
5	75 % EFFLUENT	8	23.0000	23.0000
5	75 % EFFLUENT	9	32.0000	32.0000

5	75	%	EFFLUENT	10	22.0000	22.0000
6	100	%	EFFLUENT	1	22.0000	22.0000
6	100	%	EFFLUENT	2	28.0000	28.0000
6	100	%	EFFLUENT	3	27.0000	27.0000
6	100	%	EFFLUENT	4	17.0000	17.0000
6	100	%	EFFLUENT	5	21.0000	21.0000
6	100	%	EFFLUENT	6	15.0000	15.0000
6	100	%	EFFLUENT	7	23.0000	23.0000
6	100	%	EFFLUENT	8	17.0000	17.0000
6	100	%	EFFLUENT	9	27.0000	27.0000
6	100	%	EFFLUENT	10	6.0000	6.0000

AA# K408524, CERIODAPHNIA REPRODUCTION, 8-20-04
File: k408524c Transform: NO TRANSFORMATION

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

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	16.300				
2	32 % EFFLUENT	19.200	123.00	75.00	10.00	
3	42 % EFFLUENT	24.000	150.00	75.00	10.00	
4	56 % EFFLUENT	25.200	149.50	75.00	10.00	
5	75 % EFFLUENT	23.300	146.00	75.00	10.00	
6	100 % EFFLUENT	20.300	128.50	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 8-19-04 ARK Analytical

SPECIES Pimephales promelas

QUANTITY SHIPPED 300

AGE/LIFE STAGE 42 hrs 8/19 1st Instar

BROODSTOCK SOURCE Aquatox Mfg, Ark

CULTURE WATER Groundwater

ALKALINITY (Mg/l as $CaCO_3$) =150

HARDNESS (Mg/l as $CaCO_3$)/Salinity (ppt) =160

FEEDING Artemia

COMMENTS

PACKAGED BY

BILL HALL PRINTERS 3171

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

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

ORGANISM HISTORY

DATE: 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:	24 °C	21-24°C
SALINITY/CONDUCTIVITY:	--	--
TOTAL HARDNESS (as $CaCO_3$):	112 mg/l	90-124 mg/l
TOTAL ALKALINITY (as $CaCO_3$):	85 mg/l	50-85 mg/l
pH:	8.09	7.68-8.14

Comments:

Facility Supervisor

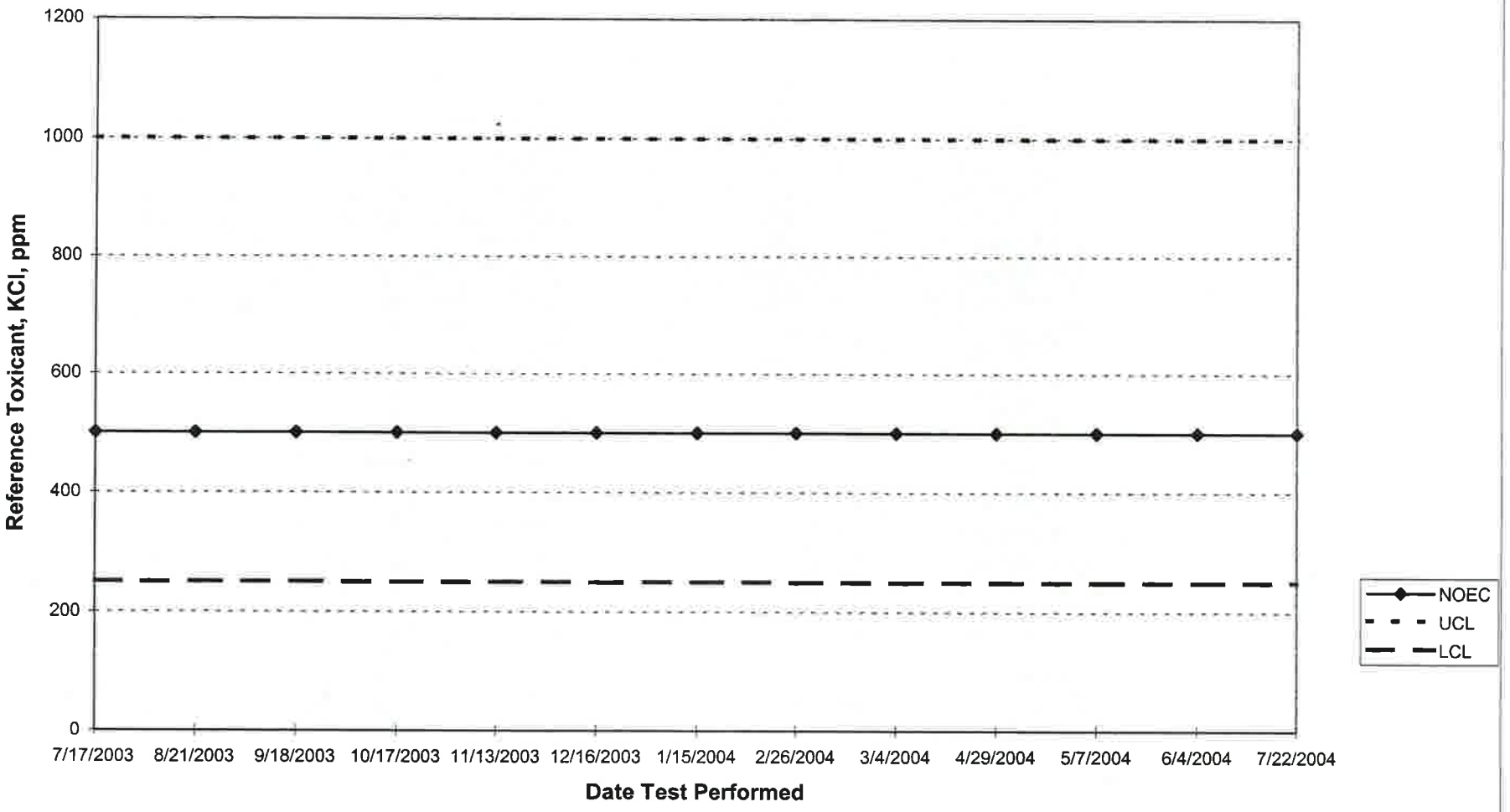
APPENDIX F

Quality Assurance Charts

ARKANSAS ANALYTICAL, INC.

FATHEAD MINNOW SURVIVAL

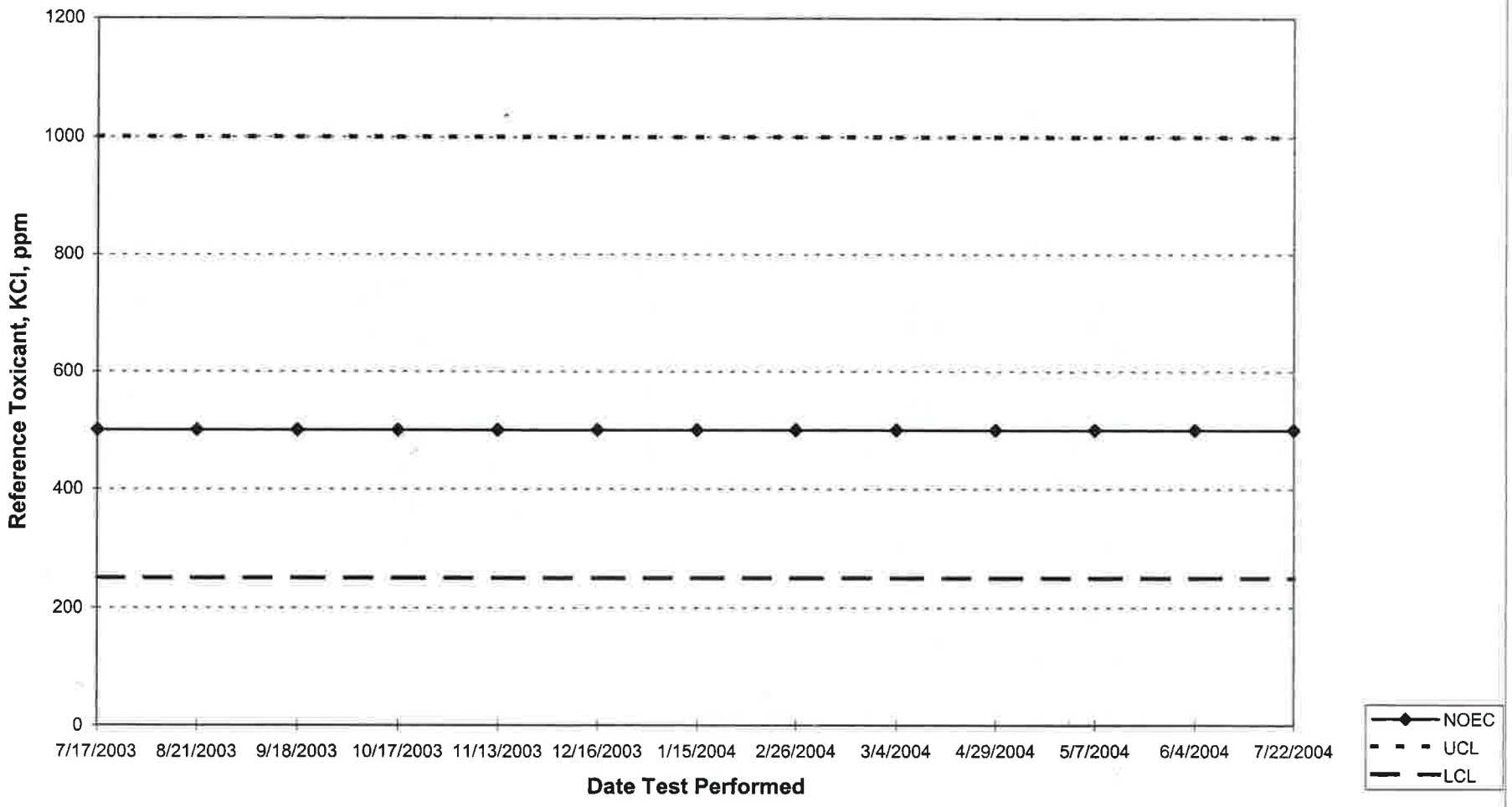
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

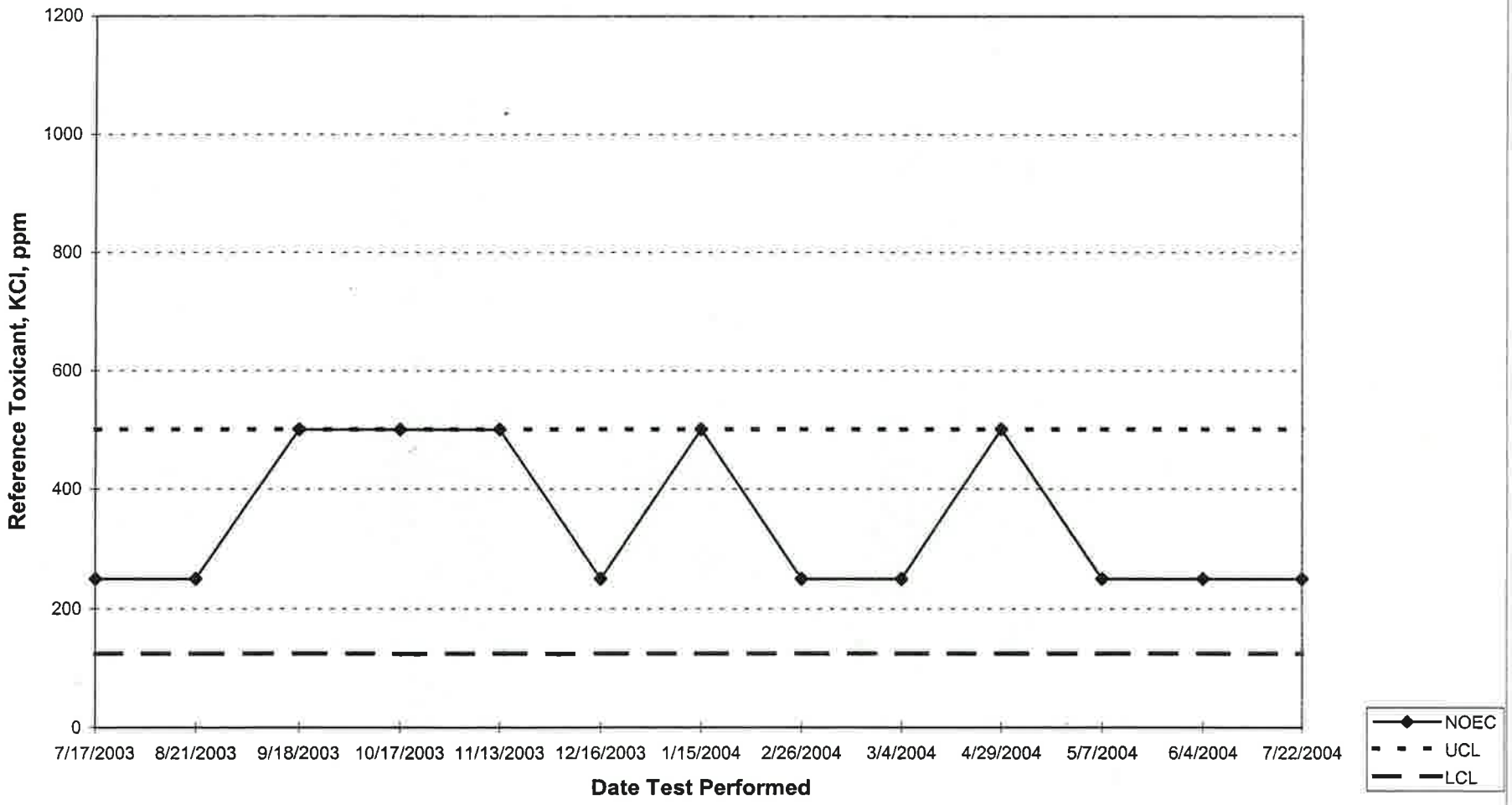
FATHEAD MINNOW GROWTH

QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

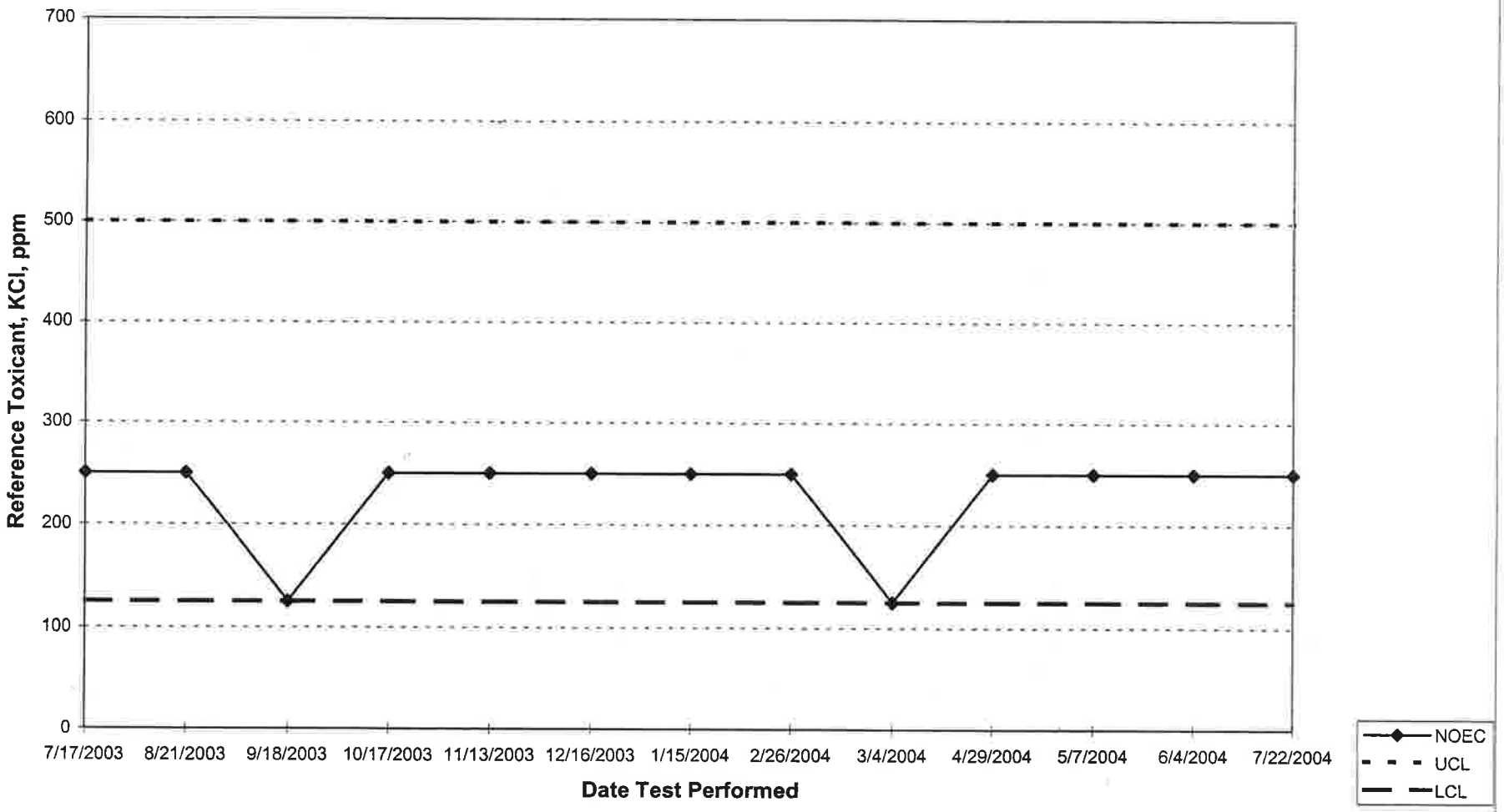
CERIODAPHNIA DUBIA SURVIVAL
QUALITY ASSURANCE



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		

October 24, 2003
Date

J. H. Sembleski
Quality Assurance Officer

LITHO IN U.S.A.

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

Laboratory Control Number: K408524 Date: 9-1-04

Client: Weston Sample ID: _____

	Pass	Fail
Fathead Minnow Survival Test	✓	
Fathead Minnow Growth Test	✓	
Ceriodaphnia dubia Survival Test	✓	
Ceriodaphnia dubia Reproduction Test	✓	

Analyst Initials MLY