Arkansas Analytical, Inc.

Toxicity Test Results

MAGCOBAR MINE SITE
NPDES PERMIT NUMBER: AR0049794
October 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**
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 K310651

Tuesday, November 18, 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 month for both *Ceriodaphnia dubia* and *Pimephales promelas.* The test results in this report represent the testing for October 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:	10-22-03, 0930	10-23-03, 0930
Sample #2:	10-23-03, 0915	10-24-03, 0915
Sample #3:	10-27-03, 1100	10-18-03, 1100

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	Temperature Upon Receipt (°C)
Sample #1:	10-23-03, 1450	6
Sample #2:	10-24-03, 1500	4
Sample #3:	10-28-03, 1647	2

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	31.8	X	
At least 60% of surviving females should have produced 3 broods	100%	X	
The percent coefficient of variation between replicates must be 40% or less for the young of surviving females	11.7%	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	0.410	X	
The percent coefficient of variation between replicates must be 40% or less for growth	8.80%	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:	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

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)	26.4	%CV survival (critical dilution)	0%
%CV Reproduction (critical dilution)	13.5%	Mean dry weight (critical dilution) in milligrams	0.690
		%CV growth (critical dilution)	9.42%

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

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:	10-22-03, 0930	10-23-03, 0930
Sample #2:	10-23-03, 0915	10-24-03, 0915
Sample #3:	10-27-03, 1100	10-18-03, 1100

Test initiated (date, time): 10-24-03, 1200 Test terminated (date, time): 10-31-03, 1125

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	100	100	100	100		100	100	100	0.00

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%	0.420	0.370	0.461	0.381	0.418		0.410	8.80
32%	0.620	0.601	0.730	0.624	0.585		0.632	
42%	0.547	0.606	0.536	0.555	0.603		0.569	
56%	0.607	0.560	0.456	0.527	0.568		0.544	
75%	0.657	0.700	0.534	0.620	0.545		0.611	
100%	0.787	0.728	0.650	0.637	0.649		0.690	9.43

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**_____%

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:	10-22-03, 0930	10-23-03, 0930
Sample #2:	10-23-03, 0915	10-24-03, 0915
Sample #3:	10-27-03, 1100	10-18-03, 1100

Test initiated (date, time): 10-24-03, 1150 Test terminated (date, time): 10-30-03, 0950

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	30	34	21	37	30	27
B	32	30	36	32	31	27
C	26	21	31	25	21	26
D	29	40	39	32	22	33
E	31	35	31	35	31	25
F	31	28	35	29	31	25
G	30	31	34	27	28	23
H	39	33	27	30	33	20
I	34	35	36	34	36	29
J	36	34	33	28	25	29
Mean	31.8	32.1	32.3	30.9	28.8	26.4
Mean/surviving female	31.8	32.1	32.3	30.9	28.8	26.4
CV%*	11.7					13.5

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)= _____**13.5**_____%

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

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): Daniel Scott

Samplers:(Printed)

Field Number	Sample Collection Date/s	Time/s	Grab	Comp	# of Containers	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	TEST PARAMETERS: Chronic Bio	Bottle type code G=glass;P=HDPE V=septum;A=amber: P	Arkansas Analytical Lab #
FD10230930	10/23/2003	9:30		X	4		Facilty Discharge	X		K3106S1A

1.Relinquished by:(Signature)	Date/Time	1.Received by:(Signature)
Daniel Scott	10-23-03 1450	
2.Relinquished by:(Signature)	Date/Time	2.Received by laboratory :(Signature)
	10-2303, 1450	Sydney James

For completion by laboratory

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

REMARKS

Temp - 6°C

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): Daniel Scott

Samplers:(Printed)

Field Number	Sample Collection Date/s	Time/s	Grab	Comp	# of Containers	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	TEST PARAMETERS: Chronic Bio	Bottle type code G=glass;P=HDPE V=septum;A=amber	Arkansas Analytical Lab #
								P		
FD10240915	10/24/2003	9:15		X	3		Facilty Discharge	X		103106518

1.Relinquished by:(Signature)	Date/Time	1.Received by:(Signature)
Daniel Scott	10-24-03 1500	
2.Relinquished by:(Signature)	Date/Time	2.Received by laboratory :(Signature)
	10/24/03 1500	Bruce Young

For completion by laboratory

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

Ice on ice 4°C

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 (CIRCLE ONE)
Weston Solutions		24 hour
2000 Darby Lane	Reporting Information	48 hour routine
Malvern, AR 72104	Telephone:	Preservative Code:
Attn: Alan Brown	FAX:	Bottle Type
	Bill to/P.O.	

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

Alan B. Brown — Samplers:(Signature/s)

Alan B. Brown — Samplers:(Printed)

Field Number	Sample Collection Date/s	Time/s	Grab	Comp	# of Containers	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	Chronic Bio	TEST PARAMETERS	Bottle type code G=glass;P=HDPE V=septum;A=amber	Arkansas Analytical Lab #
FD10280omp	10/28	11:00		X	3		Facility Discharge	X			K3106510

1 Relinquished by:(Signature)	Date/Time	1.Received by:(Signature)
Alan B. Brown	10/28/03 16:47	
2.Relinquished by:(Signature)	Date/Time	2.Received by laboratory :(Signature)
	10/28/03 1647	Andrea JX

For completion by laboratory

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

REMARKS

2 C

APPENDIX B

Effluent and Dilution Water Data

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING — Fathead Minnow

Lab # / Sample ID: K3|0651 — Test Start (Date/Time): 10-24-03 / 1200

Client: WESTON — Test End (Date/Time): 10-31-03 / 1125

		Day of Test							
		1	2	3	4	5	6	7	notes/remarks
Control		10/24	10-25	10-26	10-27	10-28	10-29	10-30	SS TT
D.O (mg/L)	INITIAL	7.8	7.9	7.7	8.1	7.0	8.0	7.7	
	FINAL	7.4	7.3	7.1	6.9	7.0	7.1	7.2	
pH(mg/L)	INITIAL	7.1	7.0	7.1	7.3	7.9	7.7	7.6	
	FINAL	7.0	7.1	7.3	7.8	7.9	7.8	7.6	
temp(C)	INITIAL	21.1	22.0	21.6	21.9	22.3	22.0	21.9	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
ALKALINITY(mg/L)		25	—	—	—	—	—	→	
HARDNESS(mg/L)		46	—	—	—	—	—	→	
CONDUCTIVITY(umhos/cm)		160	—	—	—	—	—	→	
CHLORINE(mg/L)		<0.05	—	—	—	—	—	→	
CONC:		32%	32%	32%	32%	32%	32%	32%	
D.O (mg/L)	INITIAL	8.4	8.0	8.3	8.3	7.9	8.0	7.7	
	FINAL	8.0	7.7	7.0	7.0	7.0	7.1	7.2	
pH(mg/L)	INITIAL	7.2	7.1	7.2	7.3	7.6	7.7	7.6	
	FINAL	7.0	7.0	7.3	7.4	7.7	7.7	7.6	
temp(C)	INITIAL	20.8	21.6	21.4	22.0	22.5	22.3	22.3	
	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	8.5	8.3	8.2	8.3	7.9	8.0	7.6	
	FINAL	8.0	7.6	7.0	7.0	7.1	7.0	7.1	
pH(mg/L)	INITIAL	7.3	7.1	7.0	7.4	7.6	7.7	7.5	
	FINAL	7.2	6.9	7.3	7.4	7.6	7.5	7.5	
temp(C)	INITIAL	20.9	21.9	21.3	22.1	22.5	22.6	22.7	
	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	8.5	8.3	8.2	8.3	7.8	8.1	7.7	
	FINAL	8.0	7.8	7.0	6.9	7.0	7.0	7.0	
pH(mg/L)	INITIAL	7.3	7.1	7.2	7.4	7.6	7.6	7.5	
	FINAL	7.1	6.9	7.3	7.4	7.6	7.5	7.6	
temp(C)	INITIAL	20.9	21.4	21.6	22.1	22.5	22.9	23.0	
	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	8.5	8.0	8.4	8.3	7.9	8.1	7.6	
	FINAL	8.2	7.9	7.0	6.9	7.0	6.9	7.0	
pH(mg/L)	INITIAL	7.3	7.1	7.1	7.5	7.5	7.7	7.4	
	FINAL	7.3	7.0	7.3	7.4	7.4	7.6	7.6	
temp(C)	INITIAL	21.0	22.0	21.5	22.2	22.5	23.1	23.4	
	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	8.5	8.3	8.2	8.2	7.9	8.1	7.6	
	FINAL	8.3	8.0	7.1	6.9	7.0	6.9	7.0	
pH(mg/L)	INITIAL	7.3	7.1	7.1	7.5	7.5	7.7	7.4	
	FINAL	7.0	7.1	7.2	7.3	7.4	7.5	7.6	
temp(C)	INITIAL	21.1	22.0	21.4	22.1	22.6	23.3	23.8	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:	**100%**	A	A	B	B	A	C	C	
ALKALINITY((mg/L)		20	→	25	→	20	11	→	
HARDNESS(mg/L)		1840	→	1360	→	1840	1600	→	
CONDUCTIVITY(umhos/cm)		2470	→	2470	→	2470	2450	→	
CHLORINE(mg/L)		<0.05	→	<0.05	→	<0.05	<0.05	→	

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING — Ceriodaphnia dubia

Lab # / Sample ID: K310651 — Test Start (Date/Time): 10-24-03/1150

Client: Weston — Test End (Date/Time): 10-30-03/0950

		Day of Test								
		1	2	3	4	5	6	7	8	notes/remarks
Control		10-24	10-25	10-26	10-27	10-28	10-29			SS77
D.O (mg/L)	INITIAL	7.8	7.9	7.7	8.1	7.0	8.0			
	FINAL	7.6	7.4	7.0	7.1	7.2	7.6			
pH	INITIAL	7.1	7.0	7.1	7.3	7.9	7.7			
	FINAL	7.0	7.1	7.7	7.5	7.6	7.7			
temp(C)	INITIAL	21.1	22.0	21.6	21.9	22.3	22.0			
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0			
ALKALINITY(mg/L)		25	→	→	→	→	→			
HARDNESS(mg/L)		46	→	→	→	→	→			
CONDUCTIVITY(umhos/cm)		160	→	→	→	→	→			
CHLORINE(mg/L)		<0.05	→	→	→	→	→			
CONC:		32%	32%	32%	32%	32%	32%			
D.O (mg/L)	INITIAL	8.4	8.0	8.3	8.3	7.9	8.0			
	FINAL	8.0	7.8	7.1	7.1	7.0	7.3			
pH	INITIAL	7.2	7.1	7.2	7.3	7.6	7.7			
	FINAL	7.3	7.1	7.6	7.5	7.6	7.7			
temp(C)	INITIAL	20.8	21.6	21.4	22.0	22.5	22.3			
	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	8.5	8.3	8.2	8.3	7.9	8.0			
	FINAL	8.0	8.0	7.1	7.0	7.0	7.3			
pH	INITIAL	7.3	7.1	7.0	7.4	7.6	7.7			
	FINAL	7.1	7.2	7.6	7.5	7.5	7.6			
temp(C)	INITIAL	20.9	21.9	21.3	22.1	22.5	22.6			
	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	8.5	8.3	8.2	8.3	7.8	8.1			
	FINAL	7.9	7.8	7.1	7.1	7.0	7.3			
pH	INITIAL	7.3	7.1	7.2	7.4	7.6	7.6			
	FINAL	7.4	7.2	7.6	7.6	7.5	7.6			
temp(C)	INITIAL	20.9	21.4	21.6	22.1	22.5	22.9			
	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	8.5	8.0	8.4	8.3	7.9	8.1			
	FINAL	8.0	7.7	7.1	7.1	6.9	7.2			
pH	INITIAL	7.3	7.1	7.1	7.5	7.5	7.7			
	FINAL	7.3	7.3	7.6	7.6	7.6	7.6			
temp(C)	INITIAL	21.0	22.0	21.5	22.2	22.5	23.1			
	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	8.6	8.3	8.2	8.2	7.9	8.1			
	FINAL	7.9	7.7	7.1	7.1	6.9	7.1			
pH	INITIAL	7.3	7.1	7.1	7.5	7.5	7.7			
	FINAL	7.4	7.4	7.5	7.6	7.6	7.6			
temp(C)	INITIAL	21.1	22.0	21.4	22.7	22.6	23.3			
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0			
CONC: 100%		A	A	B	B	A	C			
ALKALINITY((mg/L)		20	→	25	→	20	11			
HARDNESS(mg/L)		1840	→	1300	→	1840	1600			
CONDUCTIVITY(umhos/cm)		2470	→	2470	→	2470	2450			
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 10-24 TIME 1200

Lab #/#s: K310L51 TEST END DATE 10-31 TIME 1125

Weston AGE AND SOURCE OF MINNOWS <48 hrs; Aquatox

		DAY (NUMBER SURVIVING)								SURVIVAL		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	
CONC:	A	10	10	10	10	10	10	10	10	100		
	B	↓	10	10	10	10	10	10	10	100		
Control	C	↓	10	10	10	10	10	10	10	100	100	0%
	D	↓	10	10	10	10	10	10	10	100		
	E	↓	10	10	10	10	10	10	10	100		
CONC:	A	10	10	10	10	10	10	10	10	100		
	B	↓	10	10	10	10	10	10	10	100		
32%	C	↓	10	10	10	10	10	10	10	100	100	
	D	↓	10	10	10	10	10	10	10	100		
	E	↓	10	10	10	10	10	10	10	100		
CONC:	A	10	10	10	10	10	10	10	10	100		
	B	↓	10	10	10	10	10	10	10	100		
42%	C	↓	10	10	10	10	10	10	10	100	100	
	D	↓	10	10	10	10	10	10	10	100		
	E	↓	10	10	10	10	10	10	10	100		
CONC:	A	10	10	10	10	10	10	10	10	100		
	B	↓	10	10	10	10	10	10	10	100		
56%	C	↓	10	10	10	10	10	10	10	100	100	
	D	↓	10	10	10	10	10	10	10	100		
	E	↓	10	10	10	10	10	10	10	100		
CONC:	A	10	10	10	10	10	10	10	10	100		
	B	↓	10	10	10	10	10	10	10	100		
75%	C	↓	10	10	10	10	10	10	10	100	100	
	D	↓	10	10	10	10	10	10	10	100		
	E	↓	10	10	10	10	10	10	10	100		
CONC:	A	10	10	10	10	10	10	10	10	100		
	B	↓	10	10	10	10	10	10	10	100		
100%	C	↓	10	10	10	10	10	10	10	100	100	0%
	D	↓	10	10	10	10	10	10	10	100		
	E	↓	10	10	10	10	10	10	10	100		
ANALYST:		mg	WH	WH	AF	AF	AF	TC	TC			
DATE:		10-24	10-25	10-26	10-27	10-28	10-29	10-30	10-31			
TIME:		1200	0900	0900	1330	1345	1430	1415	1125			

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

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

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB #/#S: K3101651	TEST DATES (BEGIN/END): 10-24-03 / 10-31-03
CLIENT: Weston	WEIGHING DATE/TIME: 11-6-03/1015
ANALYST/S: TC, mg	DRYING TEMPERATURE (DEGREES C): 60°C
SAMPLE ID:	DRYING TIME (HOURS): 24 hrs.

	REP #	FINAL DRY WEIGHT TIN+LARVAE (g)	INITIAL WEIGHT TIN (g)	TOTAL DRY WEIGHT OF LARVAE (g)	NUMBER OF LARVAE	DRY WEIGHT OF LARVA (mg)		REMARKS
CONTROL	A86	0.98728	0.98308	0.00420	10	0.420	AVG DRY	
	B87	0.98777	0.98407	0.00370	10	0.370	WEIGHT (mg)	
Control	C88	0.98545	0.98084	0.004161	10	0.461	0.410	
	D89	0.98932	0.98551	0.00381	10	0.381	CV	
	E90	0.99025	0.98607	0.00418	10	0.418	8.80%	
CONC:	A91	0.99318	0.98698	0.00620	10	0.620	AVG DRY	
	B92	0.99358	0.98757	0.00601	10	0.601	WEIGHT(MG)	
32%	C93	0.99695	0.98965	0.00730	10	0.730	0.632	
	D94	0.99976	0.99352	0.00624	10	0.624	CV	
	E95	0.99752	0.99167	0.00585	10	0.585		
CONC:	A96	0.99761	0.99214	0.00547	10	0.547	AVG DRY	
	B97	0.99533	0.98927	0.00606	10	0.606	WEIGHT(MG)	
42%	C98	0.98984	0.98448	0.00536	10	0.536	0.569	
	D99	0.99134	0.98579	0.00555	10	0.555	CV	
	E100	0.99159	0.98556	0.00603	10	0.603		
CONC:	A101	0.99230	0.98623	0.00607	10	0.607	AVG DRY	
	B102	0.99852	0.99292	0.00560	10	0.560	WEIGHT(MG)	
56%	C103	0.98989	0.98533	0.00456	10	0.456	0.544	
	D104	0.98890	0.98363	0.00527	10	0.527	CV	
	E105	0.99119	0.98551	0.00568	10	0.568		
CONC:	A106	0.98755	0.98098	0.00657	10	0.657	AVG DRY	
	B107	0.99080	0.98380	0.00700	10	0.700	WEIGHT(MG)	
75%	C108	0.98519	0.97985	0.00534	10	0.534	0.611	
	D109	0.98462	0.97842	0.00620	10	0.620	CV	
	E110	0.98080	0.97535	0.00545	10	0.545		
CONC:	A111	0.98807	0.98020	0.00787	10	0.787	AVG DRY	
	E112	0.98763	0.98035	0.00728	10	0.728	WEIGHT(MG)	
100%	C113	0.99141	0.98491	0.00650	10	0.650	0.690	
	D114	0.98797	0.98160	0.00637	10	0.637	CV	
	E115	0.98993	0.98344	0.00649	10	0.649	9.42%	

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

AA# K310651 FATHEAD MINNOW SURVIVAL, 10-24-03
File: k310651s Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.000

W = 0.000

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# K310651 FATHEAD MINNOW SURVIVAL, 10-24-03
File: k310651s 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# K310651 FATHEAD MINNOW SURVIVAL, 10-24-03
FILE: k310651s
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	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# K310651 FATHEAD MINNOW SURVIVAL, 10-24-03
File: k310651s 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	1.412	27.50	16.00	5.00	

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

AA # K310651, FATHEAD MINNOW GROWTH, 10-24-03
File: k310651g Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.083

W = 0.948

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 # K310651, FATHEAD MINNOW GROWTH, 10-24-03
File: k310651g Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 2.19

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 # K310651, FATHEAD MINNOW GROWTH, 10-24-03
FILE: k310651g
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.4200	0.4200
1	CONTROL	2	0.3700	0.3700
1	CONTROL	3	0.5370	0.5370
1	CONTROL	4	0.4610	0.4610
1	CONTROL	5	0.4180	0.4180
2	32 % EFFLUENT	1	0.6200	0.6200
2	32 % EFFLUENT	2	0.6010	0.6010
2	32 % EFFLUENT	3	0.7300	0.7300
2	32 % EFFLUENT	4	0.6240	0.6240
2	32 % EFFLUENT	5	0.5850	0.5850
3	42 % EFFLUENT	1	0.5470	0.5470
3	42 % EFFLUENT	2	0.6060	0.6060
3	42 % EFFLUENT	3	0.5360	0.5360
3	42 % EFFLUENT	4	0.5550	0.5550
3	42 % EFFLUENT	5	0.6030	0.6030
4	56 % EFFLUENT	1	0.6070	0.6070
4	56 % EFFLUENT	2	0.5600	0.5600
4	56 % EFFLUENT	3	0.4560	0.4560
4	56 % EFFLUENT	4	0.5270	0.5270
4	56 % EFFLUENT	5	0.5680	0.5680
5	75 % EFFLUENT	1	0.6570	0.6570
5	75 % EFFLUENT	2	0.7000	0.7000
5	75 % EFFLUENT	3	0.5340	0.5340
5	75 % EFFLUENT	4	0.6200	0.6200
5	75 % EFFLUENT	5	0.5450	0.5450
6	100 % EFFLUENT	1	0.7870	0.7870
6	100 % EFFLUENT	2	0.7280	0.7280
6	100 % EFFLUENT	3	0.6500	0.6500
6	100 % EFFLUENT	4	0.6370	0.6370
6	100 % EFFLUENT	5	0.6490	0.6490

AA # K310651, FATHEAD MINNOW GROWTH, 10-24-03
File: k310651g Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.183	0.037	10.548
Within (Error)	24	0.083	0.003	
Total	29	0.266		

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

AA # K310651, FATHEAD MINNOW GROWTH, 10-24-03
File: k310651g 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	0.441	0.441		
2	32 % EFFLUENT	0.632	0.632	-5.127	
3	42 % EFFLUENT	0.569	0.569	-3.445	
4	56 % EFFLUENT	0.544	0.544	-2.752	
5	75 % EFFLUENT	0.611	0.611	-4.569	
6	100 % EFFLUENT	0.690	0.690	-6.692	

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

AA # K310651, FATHEAD MINNOW GROWTH, 10-24-03
File: k310651g 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	0.088	19.9	-0.191
3	42 % EFFLUENT	5	0.088	19.9	-0.128
4	56 % EFFLUENT	5	0.088	19.9	-0.102
5	75 % EFFLUENT	5	0.088	19.9	-0.170
6	100 % EFFLUENT	5	0.088	19.9	-0.249

APPENDIX D

Ceriodaphnia dubia Raw Data and Statistics

Ceriodaphnia dubia — **SURVIVAL AND REPRODUCTION TEST**

Discharger: Weston | Lab Number/s: K3106S1 | Analyst: mg, WH, AF, TC

Location: | Test Start-Date/Time: 10-24-03/1150

Date Sample Collected: See COC | Test Stop-Date/Time: 10-30-03/0950

Conc 1 (Control 1)

%	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	WH
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	AF
	3	5	7	0	5	5	5	0	6	7	0	40	10	4.0	AF
	4	11	10	6	0	12	13	7	10	0	8	77	10	7.7	AF
	5	0	0	8	8	0	0	10	4	12	12	54	10	5.4	TC
	6	14	15	12	16	14	13	13	19	15	16	147	10	14.7	TC
	7														
	8												100% 3rd brood		
	Total	30	32	26	29	31	31	30	39	34	36	318	$\bar{X}$=31.8	CV=11.7%	

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	WH
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	AF
	3	6	6	0	6	6	4	6	4	5	6	49	10	4.9	AF
	4	12	13	6	1	10	9	10	13	1	0	75	10	7.5	AF
	5	0	0	7	14	0	15	0	1	13	13	63	10	6.3	TC
	6	16	11	8	19	19	0	15	15	16	15	134	10	13.4	TC
	7														
	8														
	Total	34	30	21	40	35	28	31	33	35	34	321			

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	WH
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	AF
	3	6	7	0	6	5	7	0	5	7	5	48	10	4.8	AF
	4	0	11	5	0	11	12	7	7	10	0	63	10	6.3	AF
	5	5	1	11	13	0	0	10	0	2	12	54	10	5.4	TC
	6	10	17	15	20	5	16	17	15	17	16	158	10	15.8	TC
	7														
	8														
	Total	21	36	31	39	31	35	34	27	36	33	323			

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	WH
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	AF
	3	7	6	0	7	6	5	0	6	5	0	42	10	4.2	AF
	4	11	12	4	0	9	10	6	7	0	4	63	10	6.3	AF
	5	0	2	8	11	2	2	9	10	11	11	56	10	5.6	TC
	6	19	12	13	14	18	12	12	17	18	13	148	10	14.8	TC
	7														
	8														
	Total	37	32	25	32	35	29	27	30	34	28	309			

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	WH
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	AF
	3	6	6	0	3	5	5	0	6	5	6	42	10	4.2	AF
	4	11	10	6	0	12	0	7	8	14	0	68	10	6.8	AF
	5	0	1	8	7	0	11	10	3	0	9	49	10	4.9	TC
	6	13	14	7	12	14	15	11	16	17	10	129	10	12.9	TC
	7														
	8														
	Total	30	31	21	22	31	31	28	33	36	25	288			

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	WH
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	AF
	3	5	6	0	0	5	4	0	0	4	6	30	10	3.0	AF
	4	10	9	0	10	9	0	3	0	0	0	31	10	3.1	AF
	5	0	0	16	18	1	9	10	9	11	10	104	10	10.4	TC
	6	12	12	10	15	10	12	10	11	14	13	109	10	10.9	
	7														
	8														
	Total	27	27	26	33	25	25	23	20	29	29	264	$\bar{X}$=26.4	CV=13.5%	

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# K310651, CERIODAPHNIA REPRODUCTION, 10-24-03
File: C:\TOXSTAT\WESTON\K310651C. 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# K310651, CERIODAPHNIA REPRODUCTION, 10-24-03
File: C:\TOXSTAT\WESTON\K310651C. Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 131.90

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)
Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data FAIL B1 homogeneity test at 0.01 level. Try another transformation.

TITLE: AA# K310651, CERIODAPHNIA REPRODUCTION, 10-24-03
FILE: C:\TOXSTAT\WESTON\K310651C.
TRANSFORM: NO TRANSFORM NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	30.0000	30.0000
1	CONTROL	2	32.0000	32.0000
1	CONTROL	3	26.0000	26.0000
1	CONTROL	4	29.0000	29.0000
1	CONTROL	5	31.0000	31.0000
1	CONTROL	6	31.0000	31.0000
1	CONTROL	7	30.0000	30.0000
1	CONTROL	8	29.0000	29.0000
1	CONTROL	9	34.0000	34.0000
1	CONTROL	10	36.0000	36.0000
2	32 % EFFLUENT	1	34.0000	34.0000
2	32 % EFFLUENT	2	30.0000	30.0000
2	32 % EFFLUENT	3	21.0000	21.0000
2	32 % EFFLUENT	4	40.0000	40.0000
2	32 % EFFLUENT	5	35.0000	35.0000
2	32 % EFFLUENT	6	28.0000	28.0000
2	32 % EFFLUENT	7	31.0000	31.0000
2	32 % EFFLUENT	8	33.0000	33.0000
2	32 % EFFLUENT	9	35.0000	35.0000
2	32 % EFFLUENT	10	34.0000	34.0000
3	42 % EFFLUENT	1	21.0000	21.0000
3	42 % EFFLUENT	2	36.0000	36.0000
3	42 % EFFLUENT	3	31.0000	31.0000
3	42 % EFFLUENT	4	39.0000	39.0000
3	42 % EFFLUENT	5	31.0000	31.0000
3	42 % EFFLUENT	6	35.0000	35.0000
3	42 % EFFLUENT	7	34.0000	34.0000
3	42 % EFFLUENT	8	27.0000	27.0000
3	42 % EFFLUENT	9	36.0000	36.0000
3	42 % EFFLUENT	10	33.0000	33.0000
4	56 % EFFLUENT	1	37.0000	37.0000
4	56 % EFFLUENT	2	32.0000	32.0000
4	56 % EFFLUENT	3	25.0000	25.0000
4	56 % EFFLUENT	4	32.0000	32.0000
4	56 % EFFLUENT	5	35.0000	35.0000
4	56 % EFFLUENT	6	29.0000	29.0000
4	56 % EFFLUENT	7	27.0000	27.0000
4	56 % EFFLUENT	8	30.0000	30.0000
4	56 % EFFLUENT	9	34.0000	34.0000
4	56 % EFFLUENT	10	28.0000	28.0000
5	75 % EFFLUENT	1	30.0000	30.0000
5	75 % EFFLUENT	2	31.0000	31.0000
5	75 % EFFLUENT	3	21.0000	21.0000
5	75 % EFFLUENT	4	22.0000	22.0000
5	75 % EFFLUENT	5	31.0000	31.0000
5	75 % EFFLUENT	6	31.0000	31.0000
5	75 % EFFLUENT	7	28.0000	28.0000
5	75 % EFFLUENT	8	33.0000	33.0000
5	75 % EFFLUENT	9	36.0000	36.0000

5	75	%	EFFLUENT	10	25.0000	25.0000
6	100	%	EFFLUENT	1	27.0000	27.0000
6	100	%	EFFLUENT	2	27.0000	27.0000
6	100	%	EFFLUENT	3	26.0000	26.0000
6	100	%	EFFLUENT	4	33.0000	33.0000
6	100	%	EFFLUENT	5	25.0000	25.0000
6	100	%	EFFLUENT	6	25.0000	25.0000
6	100	%	EFFLUENT	7	23.0000	23.0000
6	100	%	EFFLUENT	8	20.0000	20.0000
6	100	%	EFFLUENT	9	29.0000	29.0000
6	100	%	EFFLUENT	10	29.0000	29.0000

AA# K310651, CERIODAPHNIA REPRODUCTION, 10-24-03
File: C:\TOXSTAT\WESTON\K310651C. Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	252.683	50.537	2.741
Within (Error)	54	995.500	18.435	
Total	59	1248.183		

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

AA# K310651, CERIODAPHNIA REPRODUCTION, 10-24-03
File: C:\TOXSTAT\WESTON\K310651C. Transform: NO TRANSFORM

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

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	30.800	30.800		
2	32 % EFFLUENT	32.100	32.100	-0.677	
3	42 % EFFLUENT	32.300	32.300	-0.781	
4	56 % EFFLUENT	30.900	30.900	-0.052	
5	75 % EFFLUENT	28.800	28.800	1.042	
6	100 % EFFLUENT	26.400	26.400	2.291	

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

AA# K310651, CERIODAPHNIA REPRODUCTION, 10-24-03
File: C:\TOXSTAT\WESTON\K310651C. Transform: NO TRANSFORM

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

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	CONTROL	10			
2	32 % EFFLUENT	10	4.436	14.4	-1.300
3	42 % EFFLUENT	10	4.436	14.4	-1.500
4	56 % EFFLUENT	10	4.436	14.4	-0.100
5	75 % EFFLUENT	10	4.436	14.4	2.000
6	100 % EFFLUENT	10	4.436	14.4	4.400

APPENDIX E

Organism History

AQUATOX, INC.

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

TEST ORGANISM HISTORY

DATE SHIPPED 10-23-03 ARKANSAS Analytical

SPECIES Pimephales promelas

QUANTITY SHIPPED ~1200+

AGE/LIFE STAGE 44hrs 10/23 1500CST

BROODSTOCK SOURCE Anderson Farms, AR

CULTURE WATER groundwater

ALKALINITY (Mg/l as $CaCO_3$) =180

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

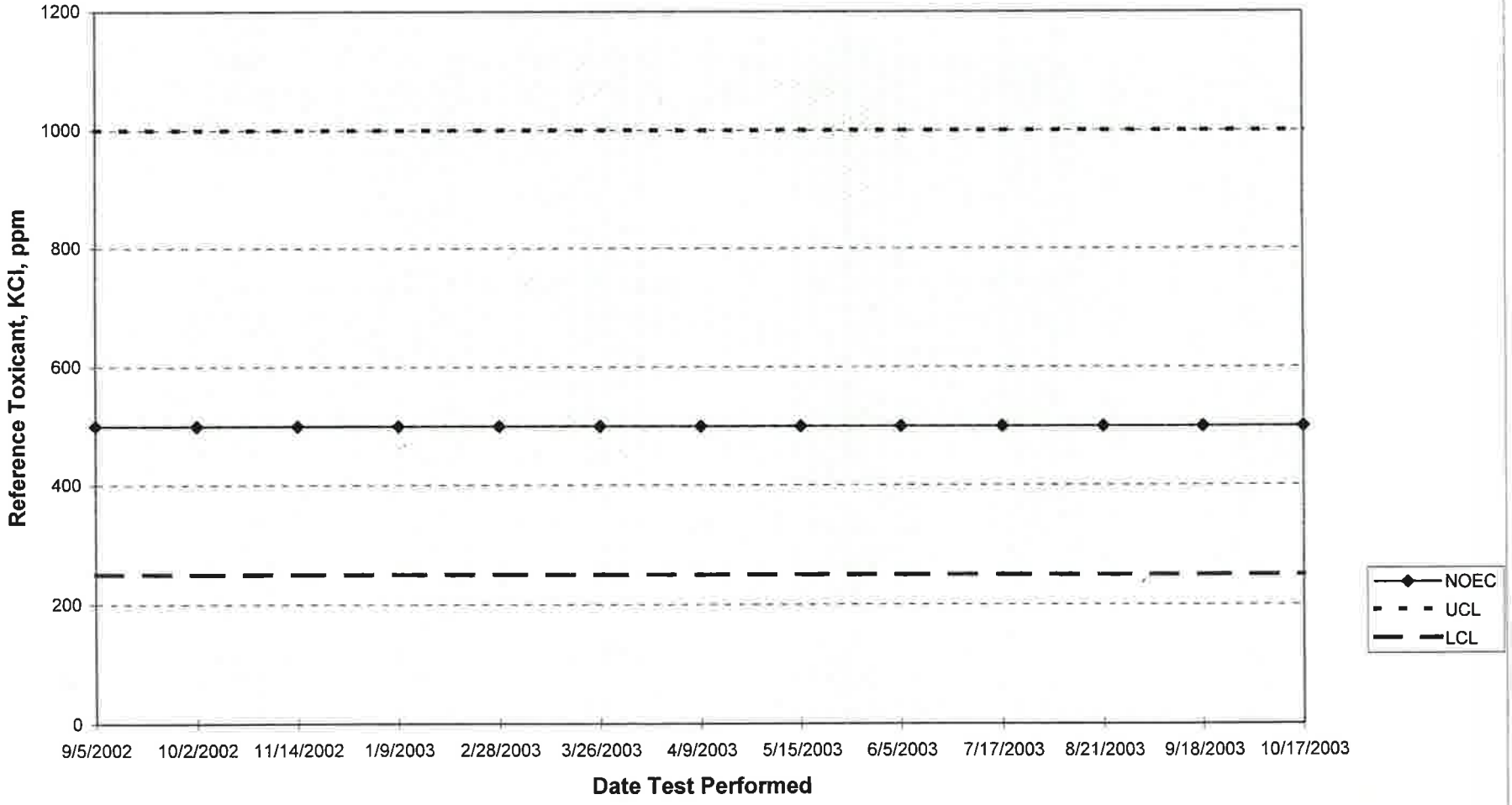
APPENDIX F

Quality Assurance Charts

ARKANSAS ANALYTICAL, INC.

FATHEAD MINNOW SURVIVAL

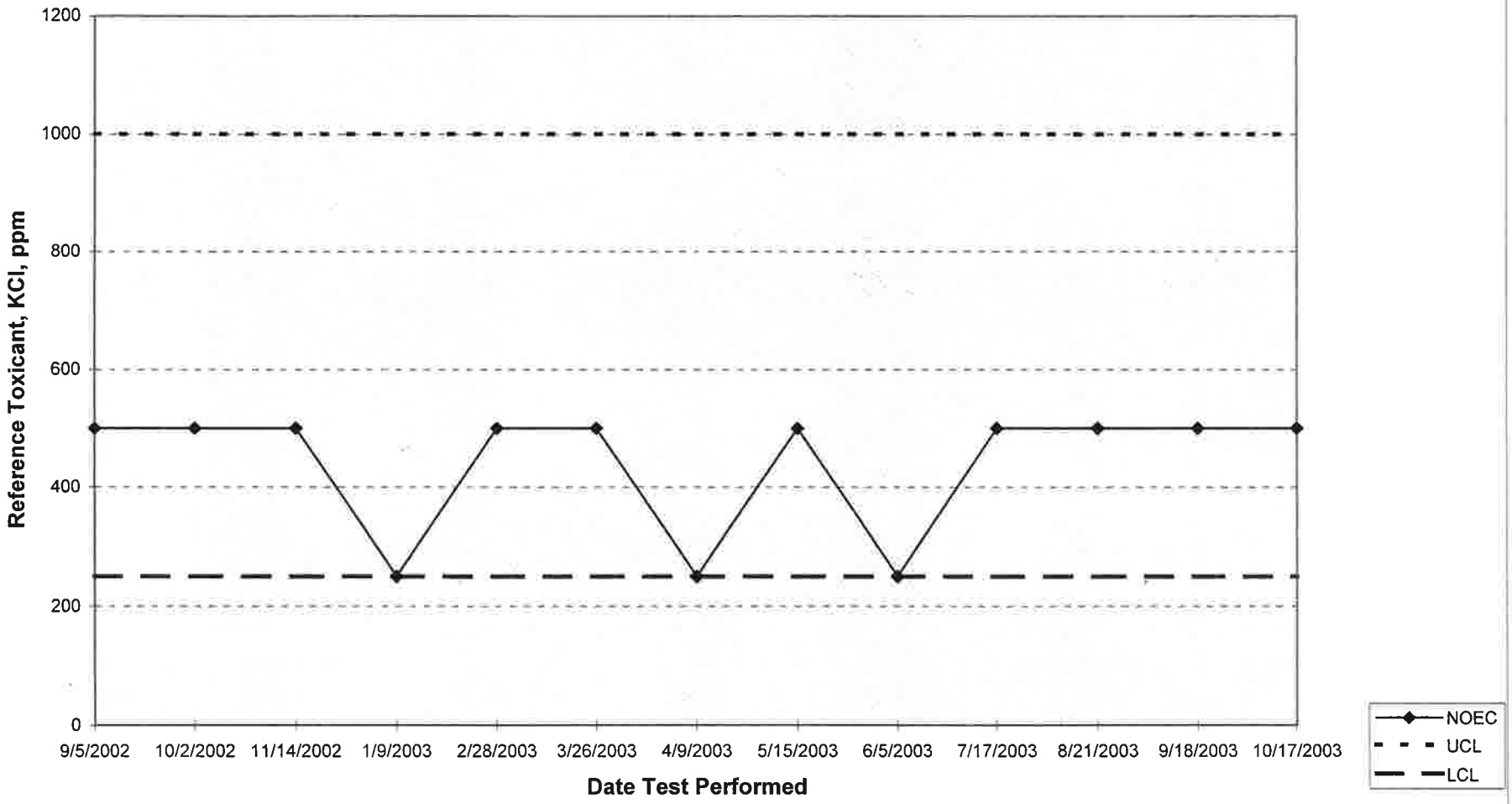
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

FATHEAD MINNOW GROWTH

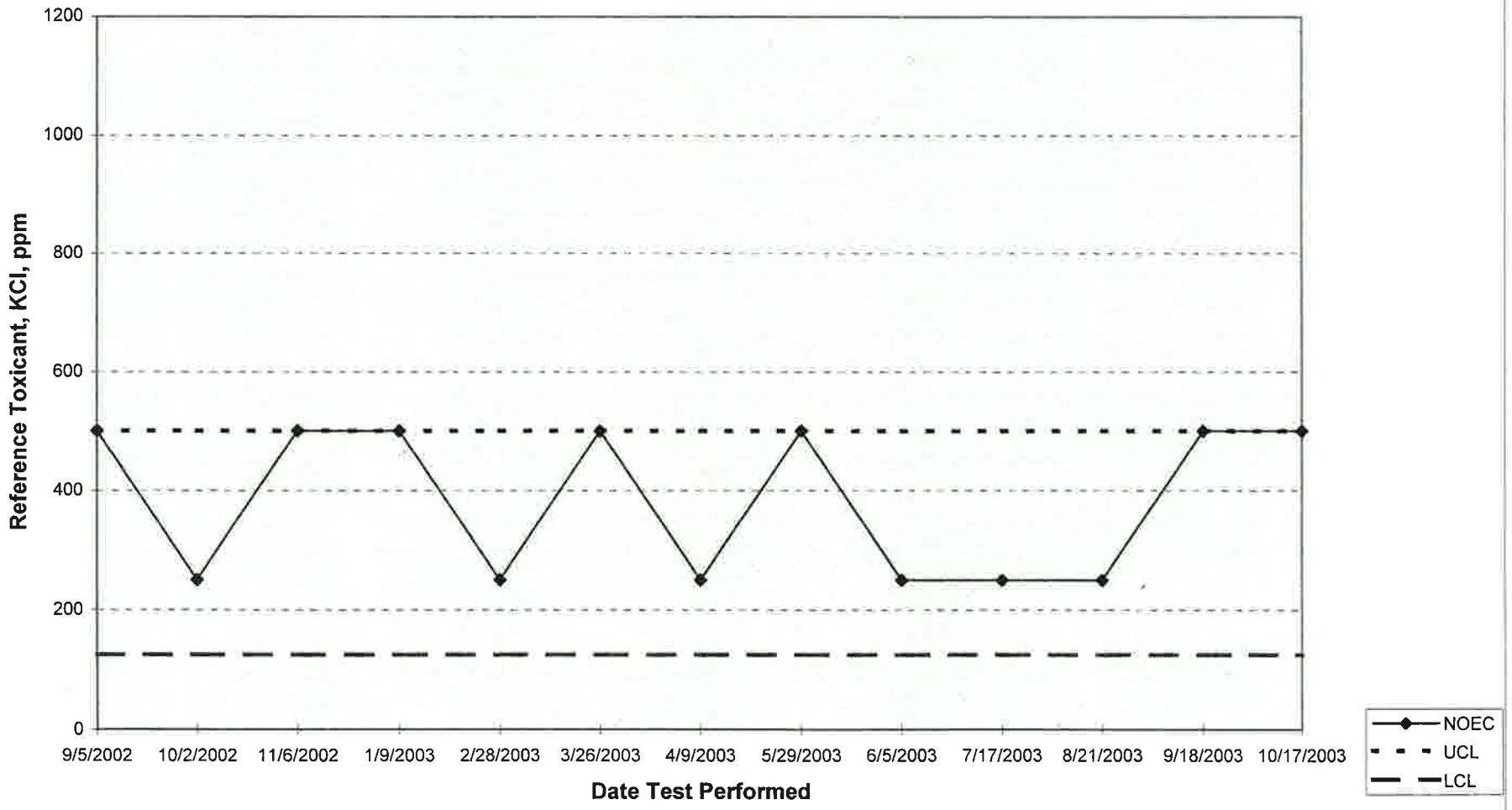
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA SURVIVAL

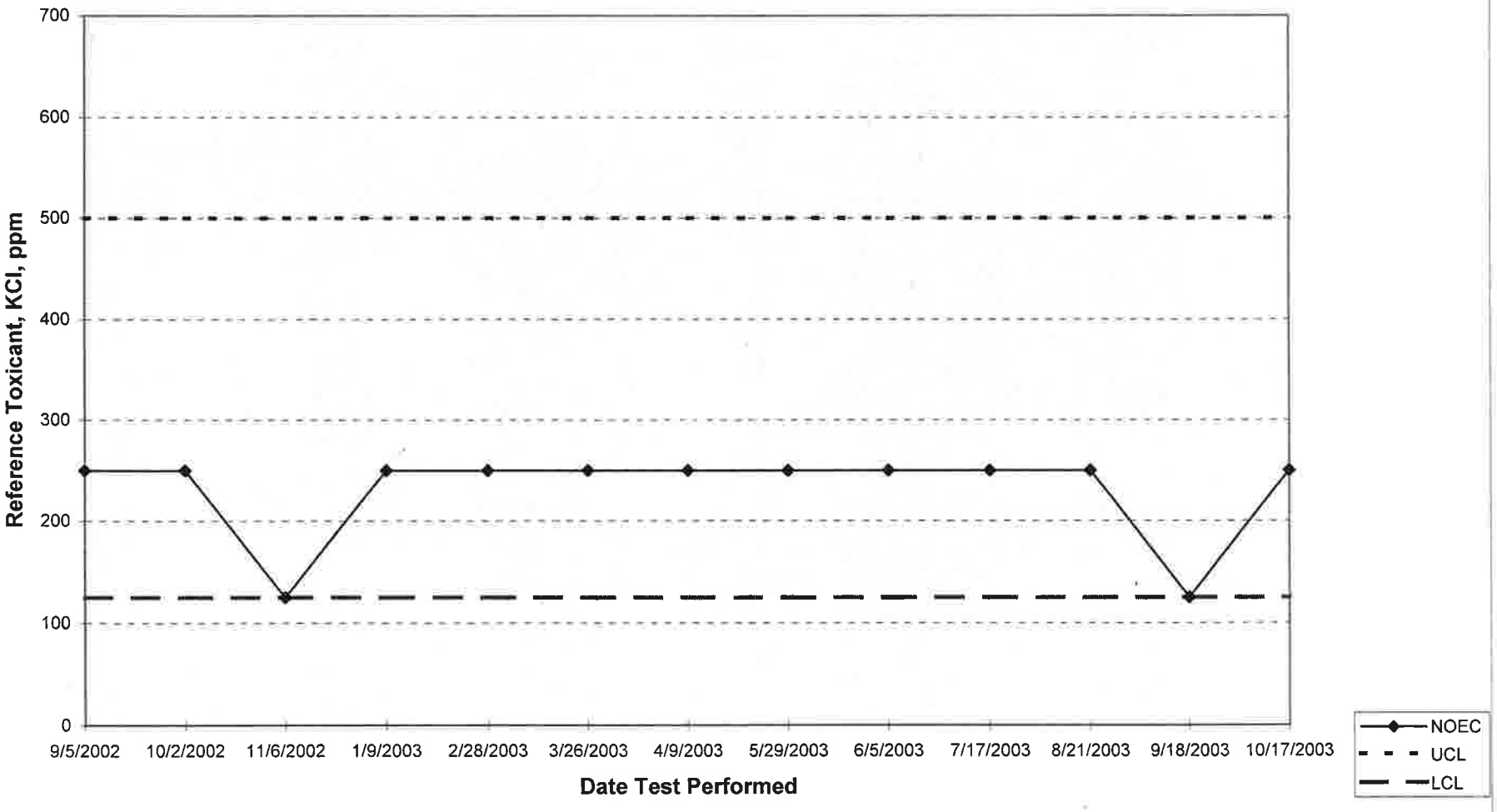
QUALITY ASSURANCE



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

May 14, 2003 to October 30, 2003

Laboratory ID # 60-1754 **Certificate # 03-031-1**

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		

May 15, 2003
Date

J A Semberski
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: K3106651 Date: 11-18-03

Client: Weston Sample ID: facility discharge

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

Analyst Initials MJ