



Arkansas Analytical, Inc.

Toxicity Test Results

MAGCOBAR MINE SITE
NPDES PERMIT NUMBER: AR0049794
December 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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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 December 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:	12-10-03, 0945	12-11-03, 0945
Sample #2:	12-11-03, 1000	12-12-03, 1000
Sample #3:	12-15-03, 1145	12-16-03, 1145

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:	12-11-03, 1445	4
Sample #2:	12-12-03, 1505	4
Sample #3:	12-16-03, 1647	4

Chain of custody documentation is located in Appendix A.

The permit designates the receiving water to be used as dilution water for the toxicity tests. Synthetic dilution water was substituted either because zero flow conditions existed or due to an earlier characterization of the receiving water as being toxic.

Each sample was analyzed for pH, hardness, total alkalinity, and conductivity. Results are provided in Appendix B.

Dilution Series

Five dilutions in addition to a control (0% effluent) were used in the toxicity tests. The dilutions, which were made with synthetic water, were 32%, 42%, 56%, 75%, and 100%. The low-flow effluent concentration (**critical dilution**) was defined as **100% effluent**.

Test Methods

EPA Method 1000.0, Fathead Minnow, *Pimephales promelas*, Larval Survival and Growth Test, was used in this bioassay. Larvae are exposed in a static renewal system for seven days and the results are based on the survival and growth (increase in weight) of the larvae. There were no deviations from the reference method. The test chambers were 500 ml plastic cups, and each chamber contained ten organisms in a test solution volume of 250 mls. The test temperature was 25 degrees Centigrade. Raw data and statistics are provided in Appendix C.

EPA Method 1002.0, Cladoceran, *Ceriodaphnia dubia*, Survival and Reproduction Test, was also used. Neonates are exposed in a static renewal system until at least 60% of the control organisms have produced a third brood. Results are based on the survival and reproduction of the organisms. One neonate was placed in each of ten replicate chambers using a randomizing template. Test chambers were 30 ml plastic cups filled with 15 ml of test solution. The test temperature was 25 degrees Centigrade. Raw data and statistics are provided in Appendix D.

Test Organisms

The organisms used in Test 1000.0 were < 24 hour old Fathead Minnows, *Pimephales promelas*, which were purchased from Aquatox; a copy of the organism history is provided in Appendix E.

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

Quality Assurance

Test Acceptability

TEST ACCEPTANCE CRITERIA for *Ceriodaphnia dubia*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	100%	X	
Average of 15 or more young per surviving female	29.7	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	17.1%	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	0.561	X	
The percent coefficient of variation between replicates must be 40% or less for growth	13.7%	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)	24.8	%CV survival (critical dilution)	4.56%
%CV Reproduction (critical dilution)	18.9%	Mean dry weight (critical dilution) in milligrams	0.579
		%CV growth (critical dilution)	10.5%

Conclusion

Chronic static renewal larval survival and growth test using fathead minnow, *Pimephales promelas*, (Method 1000.0).

The permit issued to the Magcobar Mine Site, AR0049794, specifies that the **critical dilution is 100% effluent**. The effluent samples did not exhibit lethal effects or sublethal effects at the critical dilution, and, as such, **passed** both portions of the test.

Chronic static renewal survival and reproduction test using *Ceriodaphnia dubia*, (Method 1002.0).

The permit issued to the Magcobar, AR0049794, specifies that the **critical dilution is 100% effluent**. The effluent samples did not exhibit lethal effects or sublethal effects at the critical dilution, and, as such, **passed** both portions of the test.

Biomonitoring Analysts:



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**SUMMARY REPORTING FORMS FOR CHRONIC BIOMONITORING
FATHEAD MINNOW LARVAE GROWTH AND SURVIVAL
*PIMEPHALES PROMELAS***

PERMITTEE: Magcobar Mine Site

NPDES #: AR0049794

Sample Collection:	Date, Time Started	Date, Time Ended
Sample #1:	12-10-03, 0945	12-11-03, 0945
Sample #2:	12-11-03, 1000	12-12-03, 1000
Sample #3:	12-15-03, 1145	12-16-03, 1145

Test initiated (date, time): 12-12-03, 1510 Test terminated (date, time): 12-19-03, 1400

Dilution water used: Soft Synthetic

DATA TABLE FOR FATHEAD MINNOW SURVIVAL

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

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%	0.695	0.501	0.547	0.533	0.528	0.561	13.7
32%	0.571	0.591	0.491	0.503	0.556	0.542	
42%	0.653	0.525	0.423	0.525	0.540	0.533	
56%	0.599	0.442	0.500	0.671	0.630	0.568	
75%	0.664	0.607	0.531	0.565	0.566	0.587	
100%	0.627	0.530	0.633	0.499	0.605	0.579	10.5

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 %

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:	12-10-03, 0945	12-11-03, 0945
Sample #2:	12-11-03, 1000	12-12-03, 1000
Sample #3:	12-15-03, 1145	12-16-03, 1145

Test initiated (date, time): 12-12-03, 1045 Test terminated (date, time): 12-18-03, 1015

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	28	26	29	28	34	21
B	36	30	34	37	27	32
C	34	30	26	35	30	28
D	32	33	28	30	33	19
E	26	24	24	27	32	22
F	31	33	29	27	25	32
G	27	30	34	25	24	22
H	35	15	30	31	39	21
I	29	25	30	33	33	24
J	19	24	33	34	11	27
Mean	29.7	27.0	29.7	30.7	28.8	24.8
Mean/surviving female	29.7	27.0	29.7	30.7	28.8	24.8
CV%*	17.1					18.9

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)= 18.9 %



APPENDIX A

Chain of Custody Forms



APPENDIX B

Effluent and Dilution Water Data

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING

Fathead Minnow

Lab # / Sample ID		K312286		Test Start (Date/Time)		12-12-03/1510		notes/remarks	
Client		Weston		Test End (Date/Time)		12-19-03/1400			
		Day of Test							
		1	2	3	4	5	6	7	
Control		12/12	12/13	12/14	12/15	12/16	12/17	12/18	SS 83
D.O (mg/L)	INITIAL	8.2	8.5	8.7	8.6	8.7	8.7	8.1	SS 84 12/15
	FINAL	7.7	8.1	8.3	9.2	8.6	6.9	8.3	
pH(mg/L)	INITIAL	6.8	7.2	7.1	7.5	8.0	7.6	7.7	
	FINAL	7.5	7.1	6.7	7.8	7.8	7.6	6.9	
temp(C)	INITIAL	20.4	20.5	20.0	20.3	21.7	22.0	22.0	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
ALKALINITY(mg/L)		25			30				
HARDNESS(mg/L)		46			42				
CONDUCTIVITY(umhos/cm)		160			158				
CHLORINE(mg/L)		6.05			6.05				
CONC:		32%	32%	32%	32%	32%	32%	32%	
D.O (mg/L)	INITIAL	8.2	8.6	8.5	8.6	8.8	8.8	8.2	
	FINAL	7.9	7.9	8.3	8.8	8.6	7.0	8.3	
pH(mg/L)	INITIAL	7.3	7.1	7.1	7.2	7.5	7.6	7.7	
	FINAL	7.4	7.1	6.9	7.6	7.8	7.2	6.8	
temp(C)	INITIAL	20.6	20.3	20.6	21.0	21.7	22.0	22.1	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:		42%	42%	42%	42%	42%	42%	42%	
D.O (mg/L)	INITIAL	8.3	8.5	8.4	8.7	9.0	8.8	8.3	
	FINAL	7.9	7.6	8.2	8.8	8.6	7.0	8.0	
pH(mg/L)	INITIAL	7.4	7.1	7.2	7.3	7.5	7.6	7.6	
	FINAL	7.4	7.2	6.9	7.4	7.7	7.2	6.9	
temp(C)	INITIAL	20.9	20.5	21.0	21.5	21.7	22.1	22.3	
	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	8.3	8.7	8.5	8.7	9.2	8.8	8.3	
	FINAL	7.8	7.8	8.2	8.8	8.6	7.0	8.2	
pH(mg/L)	INITIAL	7.4	7.2	7.2	7.3	7.5	7.6	7.6	
	FINAL	7.4	7.2	6.9	7.4	7.7	7.1	7.0	
temp(C)	INITIAL	21.0	20.7	21.5	21.8	21.7	22.1	22.6	
	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	8.4	8.7	8.7	8.9	9.3	8.9	8.2	
	FINAL	7.9	7.8	8.2	8.8	8.6	7.0	8.4	
pH(mg/L)	INITIAL	7.4	7.2	7.3	7.2	7.5	7.6	7.6	
	FINAL	7.4	7.2	6.9	7.4	7.7	7.1	7.0	
temp(C)	INITIAL	21.1	20.9	21.7	23.0	21.7	22.1	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	8.4	8.8	8.8	7.8	9.3	8.9	8.5	
	FINAL	7.8	7.8	8.2	8.7	8.6	7.0	8.3	
pH(mg/L)	INITIAL	7.5	7.2	7.3	7.1	7.4	7.5	7.5	
	FINAL	7.3	7.2	6.9	7.3	7.6	7.1	6.9	
temp(C)	INITIAL	21.4	21.0	22.0	25.3	21.1	22.2	23.0	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:		100%	A	A	B	B	A	C	
ALKALINITY(mg/L)		22			19		22	20	
HARDNESS(mg/L)		1454			1450		1454	1390	
CONDUCTIVITY(umhos/cm)		2400			2420		2400	2330	
CHLORINE(mg/L)		6.05			6.05	<0.05	6.05	6.05	

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING

Ceriodaphnia dubia

Lab # / Sample ID		K312286		Test Start (Date/Time)		12-12-03 / 1045		Client		Weston		Test End (Date/Time)		12-18-03 / 1015	
		Day of Test								notes/remarks					
		1	2	3	4	5	6	7	8						
Control		12/12	12/13	12/14	12/15	12/16	12/17	12/18		SS 83					
D.O (mg/L)	INITIAL	8.2	8.5	8.7	8.6	8.7	8.7			SS 84 12/15					
	FINAL	8.1	8.2	8.6	9.2	8.6	7.7								
pH	INITIAL	6.8	7.2	7.1	7.5	8.0	7.6								
	FINAL	6.9	7.4	6.5	7.8	8.1	7.3								
temp(C)	INITIAL	20.4	20.5	20.0	20.3	21.7	22.0								
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0								
ALKALINITY(mg/L)		25			30										
HARDNESS(mg/L)		40			42										
CONDUCTIVITY(umhos/cm)		160			158										
CHLORINE(mg/L)		0.05			0.05										
CONC:		32%	32%	32%	32%	32%	32%	32%							
D.O (mg/L)	INITIAL	8.2	8.6	8.5	8.6	8.8	8.8								
	FINAL	8.1	8.4	8.6	9.2	8.7	7.8								
pH	INITIAL	7.3	7.1	7.1	7.2	7.5	7.6								
	FINAL	6.9	7.4	7.4	7.5	8.1	7.0								
temp(C)	INITIAL	20.6	20.3	20.6	21.0	21.7	22.0								
	FINAL	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	8.3	8.5	8.4	8.7	9.0	8.8								
	FINAL	8.1	8.5	8.5	9.0	8.7	8.0								
pH	INITIAL	7.4	7.1	7.2	7.3	7.5	7.6								
	FINAL	7.2	7.5	7.5	7.7	8.1	7.0								
temp(C)	INITIAL	20.9	20.5	21.0	21.5	21.7	22.1								
	FINAL	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	8.3	8.7	8.5	8.7	9.2	8.8								
	FINAL	7.9	8.6	8.5	8.9	8.7	8.2								
pH	INITIAL	7.4	7.2	7.2	7.3	7.5	7.6								
	FINAL	7.3	7.5	7.5	7.5	8.1	7.9								
temp(C)	INITIAL	21.0	20.7	21.5	21.8	21.7	22.1								
	FINAL	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	8.4	8.7	8.7	8.9	9.3	8.9								
	FINAL	7.8	8.7	8.5	8.9	8.7	8.3								
pH	INITIAL	7.4	7.2	7.3	7.2	7.5	7.6								
	FINAL	7.4	7.6	7.5	7.5	8.1	7.0								
temp(C)	INITIAL	21.1	20.9	21.7	23.0	21.7	22.1								
	FINAL	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	8.4	8.8	8.8	7.8	9.3	8.9								
	FINAL	7.9	8.7	8.5	8.9	8.7	8.4								
pH	INITIAL	7.5	7.2	7.3	7.1	7.4	7.5								
	FINAL	7.4	7.6	7.5	7.4	8.0	7.0								
temp(C)	INITIAL	21.4	21.0	22.0	25.3	21.6	22.2								
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0								
CONC:		100%	A	A	B	B	A	C							
ALKALINITY (mg/L)		22			19		22	20							
HARDNESS(mg/L)		1454			1450		1454	1290							
CONDUCTIVITY(umhos/cm)		2400			2420		2400	2330							
CHLORINE(mg/L)		0.05			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

Weston		TEST START DATE 12-12-03 TIME 1510
Lab #/s: K312286		TEST END DATE 12-19 TIME 1400
AGE AND SOURCE OF MINNOWS < 24hrs; Aquatex		

CONC:	REP #	DAY (NUMBER SURVIVING)								SURVIVAL		
		start	1	2	3	4	5	6	7	%	MEAN %	
Control	A	10	10	10	10	10	10	10	10	100	100	0%
	B	10	10	10	10	10	10	10	10	100		
	C	10	10	10	10	10	10	10	10	100		
	D	10	10	10	10	10	10	10	10	100		
	E	10	10	10	10	10	10	10	10	100		
32%	A	10	10	10	10	10	10	10	10	100	100	
	B	10	10	10	10	10	10	10	10	100		
	C	10	10	10	10	10	10	10	10	100		
	D	10	10	10	10	10	10	10	10	100		
	E	10	10	10	10	10	10	10	10	100		
42%	A	10	10	10	10	10	10	10	10	100	100	
	B	10	10	10	10	10	10	10	10	100		
	C	10	10	10	10	10	10	10	10	100		
	D	10	10	10	10	10	10	10	10	100		
	E	10	10	10	10	10	10	10	10	100		
50%	A	10	10	10	10	10	10	10	10	100	100	
	B	10	10	10	10	10	10	10	10	100		
	C	10	10	10	10	10	10	10	10	100		
	D	10	10	10	10	10	10	10	10	100		
	E	10	10	10	10	10	10	10	10	100		
75%	A	10	10	10	10	10	10	10	10	100	100	
	B	10	10	10	10	10	10	10	10	100		
	C	10	10	10	10	10	10	10	10	100		
	D	10	10	10	10	10	10	10	10	100		
	E	10	10	10	10	10	10	10	10	100		
100%	A	10	10	10	10	10	10	10	10	100	98	45%
	B	10	10	10	10	10	10	10	10	100		
	C	10	10	10	10	10	10	10	10	100		
	D	10	10	10	10	10	10	10	9	90		
	E	10	10	10	10	10	10	10	10	100		
ANALYST:		TC	tb	tb	TR	AD	TC	mg	AF			
DATE:		12-12	12-13	12-14	12-15	12-16	12-17	12-18	12-19			
TIME:		1510	1145	1030	1325	1410	1015	1520	1400			

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

Pimephales promelas

FATHEAD MINNOW

TEST 1000.0

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB #/S:	K312286	TEST DATES (BEGIN/END):	12-12-03 / 12-19-03
CLIENT:	Weston	WEIGHING DATE/TIME:	12-22-03/1600
ANALYST/S:	TC, TB, AD, MB	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	A1	0.96968	0.96273	0.00695	10	0.695	AVG DRY	
	B2	0.96908	0.96407	0.00501	10	0.501	WEIGHT (mg)	
	C3	0.97286	0.96739	0.00547	10	0.547	0.561	
	D4	0.97239	0.96706	0.00533	10	0.533	CV	
	E5	0.97176	0.96648	0.00528	10	0.528	13.7%	
CONC:	A6	0.97478	0.96907	0.00571	10	0.571	AVG DRY	
	B7	0.97020	0.96429	0.00591	10	0.591	WEIGHT(MG)	
	C8	0.97589	0.97098	0.00491	10	0.491	0.542	
	D9	0.98155	0.97652	0.00503	10	0.503	CV	
	E10	0.97780	0.97224	0.00556	10	0.556		
CONC:	A11	0.97818	0.97165	0.00653	10	0.653	AVG DRY	
	B12	0.97921	0.97396	0.00525	10	0.525	WEIGHT(MG)	
	C13	0.97616	0.97193	0.00423	10	0.423	0.533	
	D14	0.97723	0.97198	0.00525	10	0.525	CV	
	E15	0.97097	0.96557	0.00540	10	0.540		
CONC:	A16	0.97378	0.96779	0.00599	10	0.599	AVG DRY	
	B17	0.97553	0.97111	0.00442	10	0.442	WEIGHT(MG)	
	C18	0.97078	0.96578	0.00500	10	0.500	0.508	
	D19	0.97402	0.96731	0.00671	10	0.671	CV	
	E20	0.97679	0.97049	0.00630	10	0.630		
CONC:	A21	0.97517	0.96853	0.00664	10	0.664	AVG DRY	
	B22	0.97441	0.96834	0.00607	10	0.607	WEIGHT(MG)	
	C23	0.97478	0.96947	0.00531	10	0.531	0.587	
	D24	0.97428	0.96863	0.00565	10	0.565	CV	
	E25	0.97556	0.96990	0.00566	10	0.566		
CONC:	A26	0.97464	0.96837	0.00627	10	0.627	AVG DRY	
	B27	0.97603	0.97073	0.00530	10	0.530	WEIGHT(MG)	
	C28	0.97640	0.96909	0.00731	10	0.731	0.579	
	D29	0.97306	0.96807	0.00499	10	0.499	CV	
	E30	0.97357	0.96752	0.00605	10	0.605	10.5%	

32%

42%

56%

75%

100%

CV = (STANDARD DEVIATION/MEAN)*100

AA# K312286 FATHEAD MINNOW SURVIVAL, 12-12-03
File: k312286s 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# K312286 FATHEAD MINNOW SURVIVAL, 12-12-03
File: k312286s 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# K312286 FATHEAD MINNOW SURVIVAL, 12-12-03
FILE: k312286s
TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	1.0000	1.4120
1	CONTROL	2	1.0000	1.4120
1	CONTROL	3	1.0000	1.4120
1	CONTROL	4	1.0000	1.4120
1	CONTROL	5	1.0000	1.4120
2	32 % EFFLUENT	1	1.0000	1.4120
2	32 % EFFLUENT	2	1.0000	1.4120
2	32 % EFFLUENT	3	1.0000	1.4120
2	32 % EFFLUENT	4	1.0000	1.4120
2	32 % EFFLUENT	5	1.0000	1.4120
3	42 % EFFLUENT	1	1.0000	1.4120
3	42 % EFFLUENT	2	1.0000	1.4120
3	42 % EFFLUENT	3	1.0000	1.4120
3	42 % EFFLUENT	4	1.0000	1.4120
3	42 % EFFLUENT	5	1.0000	1.4120
4	56 % EFFLUENT	1	1.0000	1.4120
4	56 % EFFLUENT	2	1.0000	1.4120
4	56 % EFFLUENT	3	1.0000	1.4120
4	56 % EFFLUENT	4	1.0000	1.4120
4	56 % EFFLUENT	5	1.0000	1.4120
5	75 % EFFLUENT	1	1.0000	1.4120
5	75 % EFFLUENT	2	1.0000	1.4120
5	75 % EFFLUENT	3	1.0000	1.4120
5	75 % EFFLUENT	4	1.0000	1.4120
5	75 % EFFLUENT	5	1.0000	1.4120
6	100 % EFFLUENT	1	1.0000	1.4120
6	100 % EFFLUENT	2	1.0000	1.4120
6	100 % EFFLUENT	3	1.0000	1.4120
6	100 % EFFLUENT	4	0.9000	1.2490
6	100 % EFFLUENT	5	1.0000	1.4120

AA# K312286 FATHEAD MINNOW SURVIVAL, 12-12-03

File: k312286s

Transform: ARC SINE(SQUARE ROOT(Y))

STEEL'S MANY-ONE RANK TEST

-

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	1.412				
2	32 % EFFLUENT	1.412	27.50	16.00	5.00	
3	42 % EFFLUENT	1.412	27.50	16.00	5.00	
4	56 % EFFLUENT	1.412	27.50	16.00	5.00	
5	75 % EFFLUENT	1.412	27.50	16.00	5.00	
6	100 % EFFLUENT	1.379	25.00	16.00	5.00	

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

AA # K312286, FATHEAD MINNOW GROWTH, 12-12-03
File: k312286g Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.119

W = 0.985

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 # K312286, FATHEAD MINNOW GROWTH, 12-12-03
File: k312286g Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 3.06

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 # K312286, FATHEAD MINNOW GROWTH, 12-12-03
FILE: k312286g
TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.6950	0.6950
1	CONTROL	2	0.5010	0.5010
1	CONTROL	3	0.5470	0.5470
1	CONTROL	4	0.5330	0.5330
1	CONTROL	5	0.5280	0.5280
2	32 % EFFLUENT	1	0.5710	0.5710
2	32 % EFFLUENT	2	0.5910	0.5910
2	32 % EFFLUENT	3	0.4910	0.4910
2	32 % EFFLUENT	4	0.5030	0.5030
2	32 % EFFLUENT	5	0.5560	0.5560
3	42 % EFFLUENT	1	0.6530	0.6530
3	42 % EFFLUENT	2	0.5250	0.5250
3	42 % EFFLUENT	3	0.4230	0.4230
3	42 % EFFLUENT	4	0.5250	0.5250
3	42 % EFFLUENT	5	0.5400	0.5400
4	56 % EFFLUENT	1	0.5990	0.5990
4	56 % EFFLUENT	2	0.4420	0.4420
4	56 % EFFLUENT	3	0.5000	0.5000
4	56 % EFFLUENT	4	0.6710	0.6710
4	56 % EFFLUENT	5	0.6300	0.6300
5	75 % EFFLUENT	1	0.6640	0.6640
5	75 % EFFLUENT	2	0.6070	0.6070
5	75 % EFFLUENT	3	0.5310	0.5310
5	75 % EFFLUENT	4	0.5650	0.5650
5	75 % EFFLUENT	5	0.5660	0.5660
6	100 % EFFLUENT	1	0.6270	0.6270
6	100 % EFFLUENT	2	0.5300	0.5300
6	100 % EFFLUENT	3	0.6330	0.6330
6	100 % EFFLUENT	4	0.4990	0.4990
6	100 % EFFLUENT	5	0.6050	0.6050

AA # K312286, FATHEAD MINNOW GROWTH, 12-12-03
File: k312286g Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.011	0.002	0.433
Within (Error)	24	0.119	0.005	
Total	29	0.130		

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

AA # K312286, FATHEAD MINNOW GROWTH, 12-12-03
 File: k312286g 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	0.561	0.561		
2	32 % EFFLUENT	0.542	0.542	0.413	
3	42 % EFFLUENT	0.533	0.533	0.620	
4	56 % EFFLUENT	0.568	0.568	-0.171	
5	75 % EFFLUENT	0.587	0.587	-0.580	
6	100 % EFFLUENT	0.579	0.579	-0.404	

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

AA # K312286, FATHEAD MINNOW GROWTH, 12-12-03
 File: k312286g 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	0.105	18.7	0.018
3	42 % EFFLUENT	5	0.105	18.7	0.028
4	56 % EFFLUENT	5	0.105	18.7	-0.008
5	75 % EFFLUENT	5	0.105	18.7	-0.026
6	100 % EFFLUENT	5	0.105	18.7	-0.018



APPENDIX D

Ceriodaphnia dubia Raw Data and Statistics

Ceriodaphnia dubia

SURVIVAL AND REPRODUCTION TEST

Discharger: Weston

Lab Number/s
K3 12286

Analyst:
TE, TB, MG

Location:

Test Start-Date/Time: 12-12-03/1045

Date Sample Collected: see LOC

Test Stop-Date/Time: 12-18-03/1015

Conc 1	Day	Replicate												No. of Young/Adults		Analyst		
		A	B	C	D	E	F	G	H	I	J	Young	Adult					
%	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	tb
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	tb
	3	4	4	0	5	4	5	4	6	6	2	40	10	4.0	TC			TC
	4	8	8	7	1	0	0	10	0	10	1	45	10	4.5	TC			TC
	5	16	13	11	12	11	13	12	12	13	7	120	10	12.0	TC			TC
	6	0	11	16	14	11	13	1	17	0	9	92	10	9.2	MG			MG
	7																	
	8																	
	Total	28	36	34	32	26	31	27	35	29	19	297	100	29.7	CV=17.1%			

Conc 2	Day	Replicate												No. of Young/Adults		Analyst		
		A	B	C	D	E	F	G	H	I	J	Young	Adult					
%	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	tb
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	tb
	3	5	0	0	7	5	4	6	3	5	4	39	10	3.9	TC			TC
	4	0	7	0	7	0	0	12	12	3	10	7	58	10	5.8	TC		TC
	5	11	9	11	13	12	16	12	9	10	0	103	10	10.3	TC			TC
	6	10	14	12	13	7	1	0	0	0	13	70	10	7.0	MG			MG
	7																	
	8																	
	Total	24	30	30	33	24	33	30	15	25	24	270	100	27.0				

Conc 3	Day	Replicate												No. of Young/Adults		Analyst		
		A	B	C	D	E	F	G	H	I	J	Young	Adult					
%	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	tb
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	tb
	3	4	0	0	6	5	6	7	7	5	0	45	10	4.5	TC			TC
	4	1	7	6	0	0	8	13	1	0	0	36	10	3.6	TC			TC
	5	11	10	9	10	9	16	15	10	11	12	113	10	11.3	TC			TC
	6	13	17	11	12	10	0	0	12	16	10	103	10	10.3	MG			MG
	7																	
	8																	
	Total	29	34	26	28	24	29	34	30	30	33	297	100	29.7				

Conc 4	Day	Replicate												No. of Young/Adults		Analyst		
		A	B	C	D	E	F	G	H	I	J	Young	Adult					
%	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	tb
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	tb
	3	6	0	0	6	0	5	5	6	5	6	39	10	3.9	TC			TC
	4	9	7	5	0	6	8	10	0	11	6	64	10	6.4	TC			TC
	5	13	12	13	12	9	0	12	15	13	1	100	10	10.0	TC			TC
	6	0	18	17	12	12	14	0	0	15	16	104	10	10.4	MG			MG
	7																	
	8																	
	Total	28	37	35	30	27	27	25	31	33	34	307	100	30.7				

Conc 5	Day	Replicate												No. of Young/Adults		Analyst		
		A	B	C	D	E	F	G	H	I	J	Young	Adult					
%	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	tb
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	tb
	3	6	0	0	6	0	4	5	5	6	5	37	10	3.7	TC			TC
	4	0	4	8	0	6	9	9	0	11	1	48	10	4.8	TC			TC
	5	11	10	9	12	13	12	10	13	16	5	111	10	11.1	TC			TC
	6	17	13	13	15	13	0	0	21	0	0	92	10	9.2	MG			MG
	7																	
	8																	
	Total	34	27	30	33	32	25	24	39	33	11	288	100	28.8				

Conc 6	Day	Replicate												No. of Young/Adults		Analyst		
		A	B	C	D	E	F	G	H	I	J	Young	Adult					
%	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	tb
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	tb
	3	6	0	0	7	3	5	4	4	0	6	35	10	3.5				
	4	6	7	6	0	0	1	8	7	7	6	48	10	4.8				
	5	9	11	10	3	10	7	10	9	6	1	76	10	7.6				
	6	0	14	12	9	9	19	0	1	11	14	89	10	8.9				
	7																	
	8																	
	Total	21	32	28	19	22	32	22	21	24	27	248	100	24.8				

X=DEAD; Y=MALE
CV = 18.9%

FISHER'S EXACT TEST

=====			
NUMBER OF			
IDENTIFICATION	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

=====			
NUMBER OF			
IDENTIFICATION	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

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

TOTAL 20 0 20
=====

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

FISHER'S EXACT TEST

=====

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

=====

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

FISHER'S EXACT TEST

=====

IDENTIFICATION	NUMBER OF		
	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
100% effluent	10	0	10
TOTAL	20	0	20

=====

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

SUMMARY OF FISHER'S EXACT TESTS

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

AA# K312286, CERIODAPHNIA REPRODUCTION, 12-12-03
File: k312286c 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# K312286, CERIODAPHNIA REPRODUCTION, 12-12-03
File: k312286c Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 8.33

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# K312286, CERIODAPHNIA REPRODUCTION, 12-12-03
 FILE: k312286c
 TRANSFORM: NO TRANSFORM NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	28.0000	28.0000
1	CONTROL	2	36.0000	36.0000
1	CONTROL	3	34.0000	34.0000
1	CONTROL	4	32.0000	32.0000
1	CONTROL	5	26.0000	26.0000
1	CONTROL	6	31.0000	31.0000
1	CONTROL	7	27.0000	27.0000
1	CONTROL	8	35.0000	35.0000
1	CONTROL	9	29.0000	29.0000
1	CONTROL	10	19.0000	19.0000
2	32 % EFFLUENT	1	26.0000	26.0000
2	32 % EFFLUENT	2	30.0000	30.0000
2	32 % EFFLUENT	3	30.0000	30.0000
2	32 % EFFLUENT	4	33.0000	33.0000
2	32 % EFFLUENT	5	24.0000	24.0000
2	32 % EFFLUENT	6	33.0000	33.0000
2	32 % EFFLUENT	7	30.0000	30.0000
2	32 % EFFLUENT	8	15.0000	15.0000
2	32 % EFFLUENT	9	25.0000	25.0000
2	32 % EFFLUENT	10	24.0000	24.0000
3	42 % EFFLUENT	1	29.0000	29.0000
3	42 % EFFLUENT	2	34.0000	34.0000
3	42 % EFFLUENT	3	26.0000	26.0000
3	42 % EFFLUENT	4	28.0000	28.0000
3	42 % EFFLUENT	5	24.0000	24.0000
3	42 % EFFLUENT	6	29.0000	29.0000
3	42 % EFFLUENT	7	34.0000	34.0000
3	42 % EFFLUENT	8	30.0000	30.0000
3	42 % EFFLUENT	9	30.0000	30.0000
3	42 % EFFLUENT	10	33.0000	33.0000
4	56 % EFFLUENT	1	28.0000	28.0000
4	56 % EFFLUENT	2	37.0000	37.0000
4	56 % EFFLUENT	3	35.0000	35.0000
4	56 % EFFLUENT	4	30.0000	30.0000
4	56 % EFFLUENT	5	27.0000	27.0000
4	56 % EFFLUENT	6	27.0000	27.0000
4	56 % EFFLUENT	7	25.0000	25.0000
4	56 % EFFLUENT	8	31.0000	31.0000
4	56 % EFFLUENT	9	33.0000	33.0000
4	56 % EFFLUENT	10	34.0000	34.0000
5	75 % EFFLUENT	1	34.0000	34.0000
5	75 % EFFLUENT	2	27.0000	27.0000
5	75 % EFFLUENT	3	30.0000	30.0000
5	75 % EFFLUENT	4	33.0000	33.0000
5	75 % EFFLUENT	5	32.0000	32.0000
5	75 % EFFLUENT	6	25.0000	25.0000
5	75 % EFFLUENT	7	24.0000	24.0000
5	75 % EFFLUENT	8	39.0000	39.0000
5	75 % EFFLUENT	9	33.0000	33.0000

5	75	%	EFFLUENT	10	11.0000	11.0000
6	100	%	EFFLUENT	1	21.0000	21.0000
6	100	%	EFFLUENT	2	32.0000	32.0000
6	100	%	EFFLUENT	3	28.0000	28.0000
6	100	%	EFFLUENT	4	19.0000	19.0000
6	100	%	EFFLUENT	5	22.0000	22.0000
6	100	%	EFFLUENT	6	32.0000	32.0000
6	100	%	EFFLUENT	7	22.0000	22.0000
6	100	%	EFFLUENT	8	21.0000	21.0000
6	100	%	EFFLUENT	9	24.0000	24.0000
6	100	%	EFFLUENT	10	27.0000	27.0000

AA# K312286, CERIODAPHNIA REPRODUCTION, 12-12-03
File: k312286c Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	237.350	47.470	1.742
Within (Error)	54	1471.500	27.250	
Total	59	1708.850		

Critical F value = 2.45 (0.05,5,40)
Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All equal

AA# K312286, CERIODAPHNIA REPRODUCTION, 12-12-03
 File: k312286c 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	29.700	29.700		
2	32 % EFFLUENT	27.000	27.000	1.157	
3	42 % EFFLUENT	29.700	29.700	0.000	
4	56 % EFFLUENT	30.700	30.700	-0.428	
5	75 % EFFLUENT	28.800	28.800	0.386	
6	100 % EFFLUENT	24.800	24.800	2.099	

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

AA# K312286, CERIODAPHNIA REPRODUCTION, 12-12-03
 File: k312286c 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	5.393	18.2	2.700
3	42 % EFFLUENT	10	5.393	18.2	0.000
4	56 % EFFLUENT	10	5.393	18.2	-1.000
5	75 % EFFLUENT	10	5.393	18.2	0.900
6	100 % EFFLUENT	10	5.393	18.2	4.900



APPENDIX E

Organism History

AQUATOX, INC.

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

TEST ORGANISM HISTORY

DATE SHIPPED 12-12-03 Ark Analytical

SPECIES Prismepholes promelas

QUANTITY SHIPPED 800+

AGE/LIFE STAGE cyphus 12/12 180ctns

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 UM

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



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

ORGANISM HISTORY

DATE: 1/17/01

SPECIES: Ceriodaphnia dubia

AGE: Variable

LIFE STAGE: Adult

HATCH DATE: Variable

BEGAN FEEDING: Immediately

FOOD: YTC, Selenastrum

Water Chemistry Record:

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

Comments:



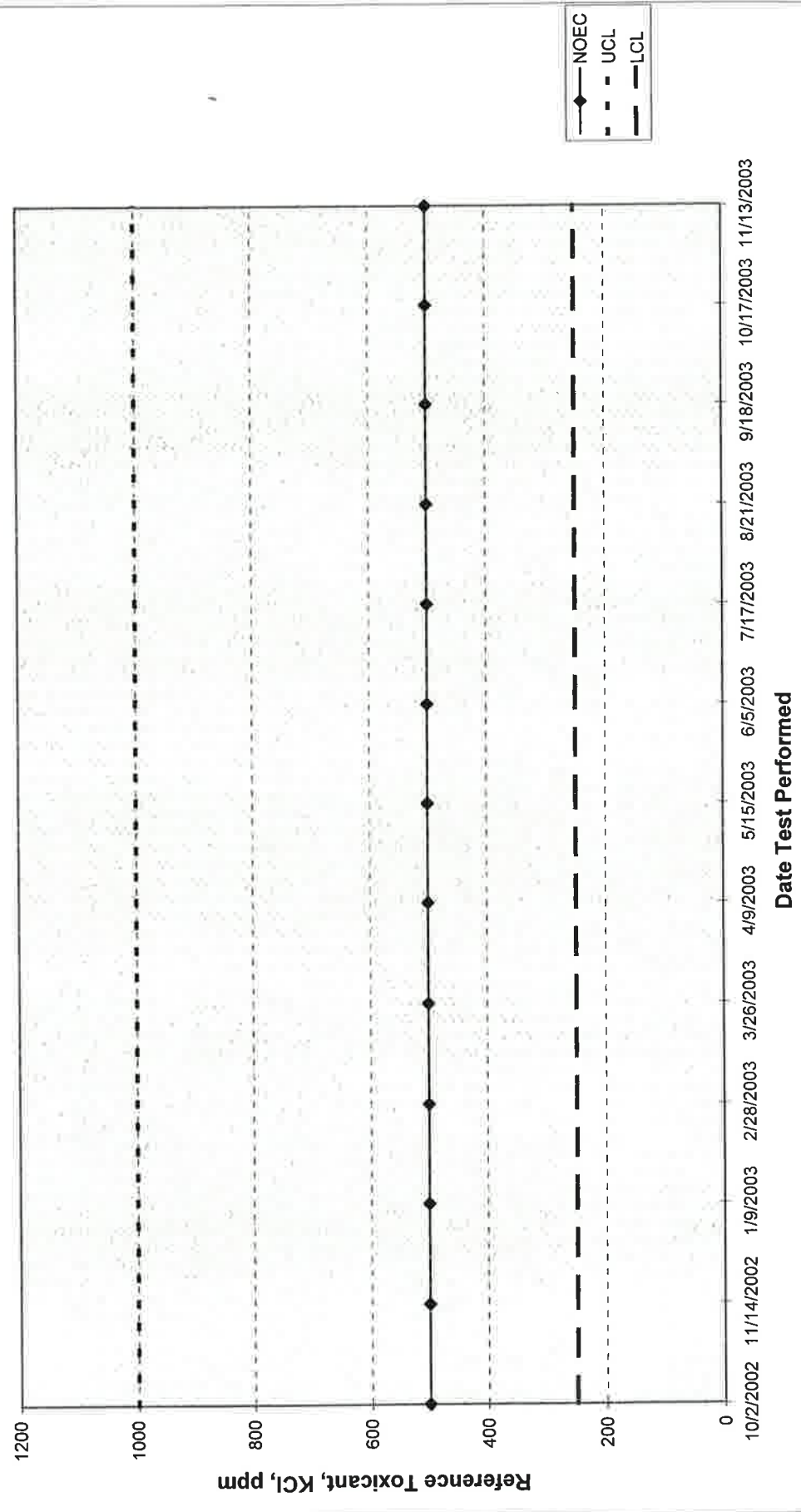
Facility Supervisor



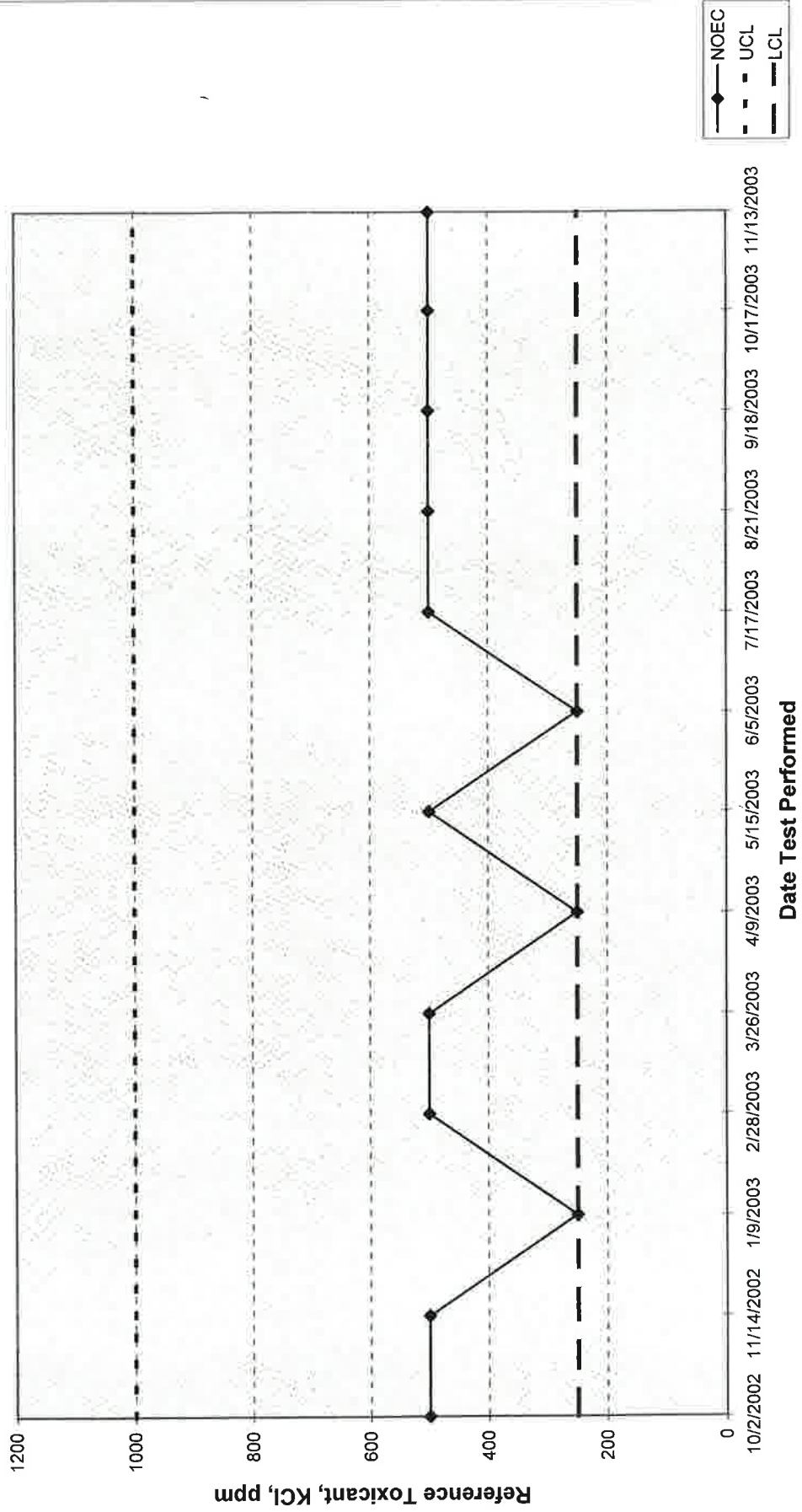
APPENDIX F

Quality Assurance Charts

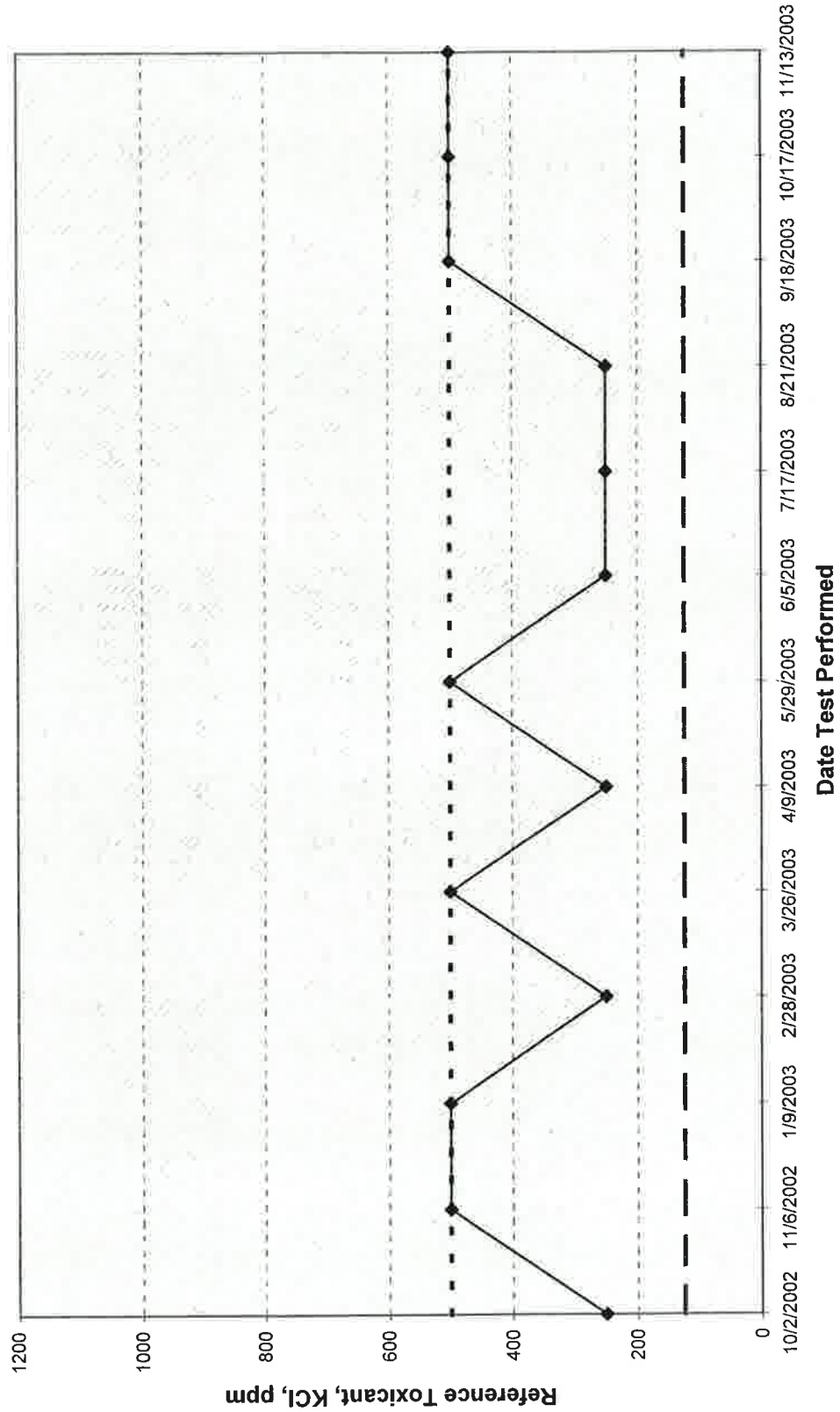
ARKANSAS ANALYTICAL, INC.
FATHEAD MINNOW SURVIVAL
QUALITY ASSURANCE



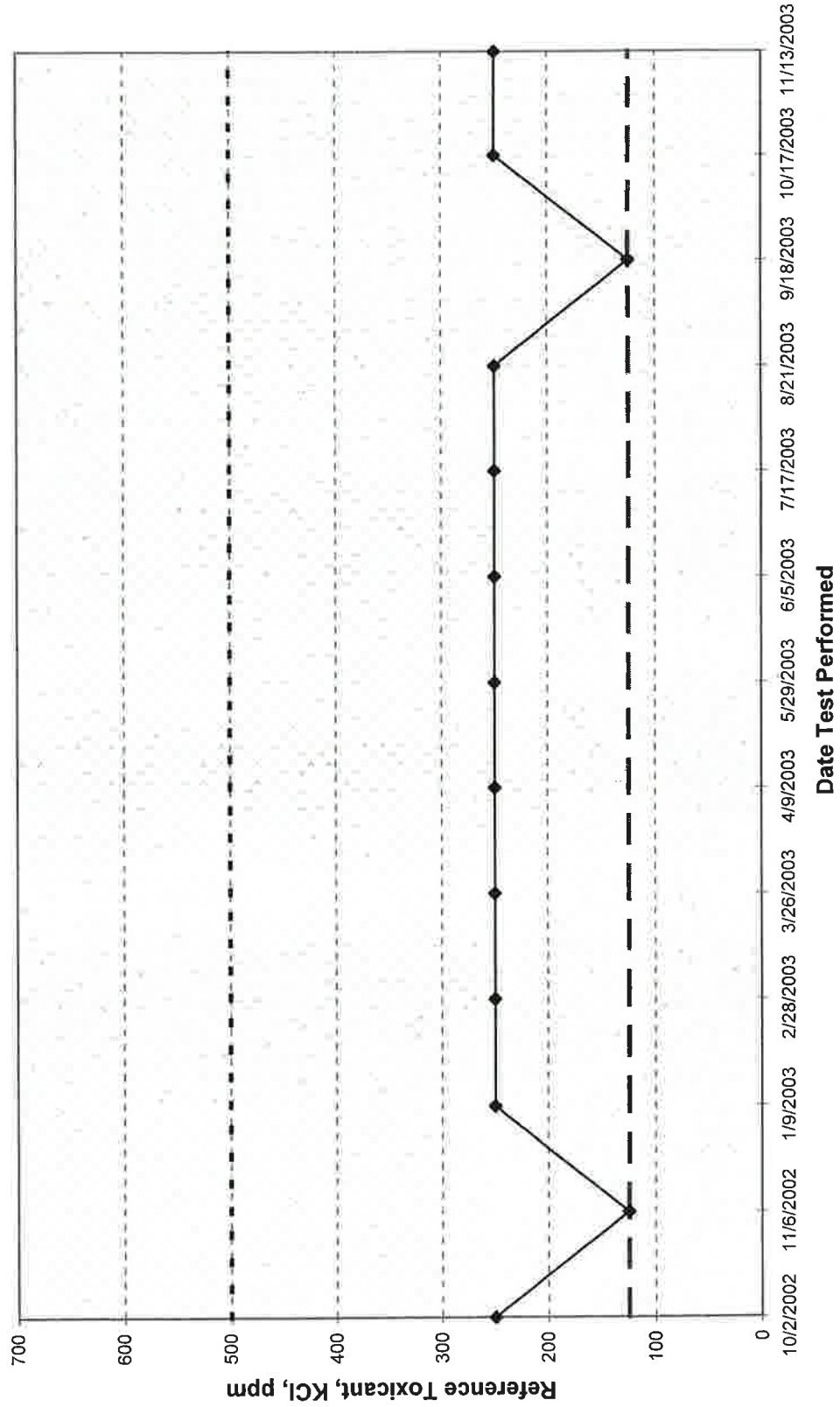
ARKANSAS ANALYTICAL, INC.
FATHEAD MINNOW GROWTH
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.
CERIODAPHNIA DUBIA SURVIVAL
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.
CERIODAPHNIA DUBIA REPRODUCTION
QUALITY ASSURANCE





APPENDIX G

Lab Certification



State of Arkansas
 Department of Environmental Quality
 Laboratory Certification Program



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

Laboratory ID # 60-1754

Certificate # 03-079-0

The following parameters are certified:

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

J. Semberki
 Quality Assurance Officer

October 24, 2003
 Date

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

Laboratory Control Number: K312281 Date: 1-6-04

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 MA