



Arkansas Analytical, Inc.

Toxicity Test Results

MAGCOBAR MINE SITE
NPDES PERMIT NUMBER: AR0049794
September 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.
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Little Rock, Arkansas 72209
Lab Number K309479

Tuesday, October 7, 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 September 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:	9-17-03, 1000	9-18-03, 1000
Sample #2:	9-18-03, 1000	9-19-03, 1000
Sample #3:	9-22-03, 0900	9-23-03, 0900

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:	9-18-03, 1450	2
Sample #2:	9-19-03, 1658	Not Taken
Sample #3:	9-23-03, 1609	7

Chain of custody documentation is located in Appendix A.

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

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

Dilution Series

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

Test Methods

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

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

Test Organisms

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

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

Quality Assurance

Test Acceptability

TEST ACCEPTANCE CRITERIA for *Ceriodaphnia dubia*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	90%	X	
Average of 15 or more young per surviving female	19.3	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	37.4%	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	0.501	X	
The percent coefficient of variation between replicates must be 40% or less for growth	13.2%	X	

Reference Toxicant

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

REFERENCE TOXICANT

<i>Ceriodaphnia dubia</i>		<i>Pimephales promelas</i>	
NOEC Survival:	250 ppm KCl	NOEC Survival:	500 ppm KCl
LOEC Survival:	500 ppm KCl	LOEC Survival:	1000 ppm KCl
NOEC Reproduction:	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)	20.7	%CV survival (critical dilution)	0%
%CV Reproduction (critical dilution)	35.1%	Mean dry weight (critical dilution) in milligrams	0.526
		%CV growth (critical dilution)	21.9%

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


Teresa Canfield


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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:	9-17-03, 1000	9-18-03, 1000
Sample #2:	9-18-03, 1000	9-19-03, 1000
Sample #3:	9-22-03, 0900	9-23-03, 0900

Test initiated (date, time): 9-18-03, 1600 Test terminated (date, time): 9-25-03, 1340

Dilution water used: Soft Synthetic

DATA TABLE FOR FATHEAD MINNOW SURVIVAL

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

Effluent Conc %	Average Dry Weight in milligrams in replicate chambers					Mean Dry Weight	CV%
	A	B	C	D	E		
0%	0.548	0.410	0.537	0.452	0.558	0.501	13.2
32%	0.454	0.584	0.658	0.654	0.714	0.613	
42%	0.502	0.594	0.544	0.669	0.569	0.576	
56%	0.496	0.671	0.704	0.571	0.560	0.600	
75%	0.550	0.417	0.362	0.477	0.471	0.455	
100%	0.599	0.603	0.327	0.572	0.529	0.526	21.9

Coefficient of Variation = standard deviation / mean * 100

SUMMARY REPORTING FORMS FOR CHRONIC BIOMONITORING
FATHEAD MINNOW LARVAE GROWTH AND SURVIVAL
Pimephales promelas

1. Dunnett's procedure or Steel's Many-One Rank Test as appropriate:
Is the mean survival at 7 days significantly different ($p=0.05$) than the control survival for:
 - a) LOW FLOW OR CRITICAL DILUTION, (100%) YES _____ NO X

2. Dunnett's Procedure
Is the mean dry weight (growth) at 7 days significantly different ($p=0.05$) than the control's dry weight (growth) for:
 - a) LOW FLOW OR CRITICAL DILUTION, (100%) YES _____ NO X

3. If NO was answered to 1.a) enter [0] otherwise enter [1] (parameter TLP6C): _____ 0

4. If NO was answered to 2.a) enter [0] otherwise enter [1] (parameter TGP6C): _____ 0

5. Enter percentage corresponding to each parameter below:
 - a) NOEC survival (parameter TOP6C)= _____ 100 % effluent
 - b) NOEC growth (parameter TPP6C)= _____ 100 % effluent
 - c) Coefficient of variation (parameter TQP6C)= _____ 0 %

SUMMARY REPORTING FORMS FOR CHRONIC BIOMONITORING
Ceriodaphnia dubia SURVIVAL AND REPRODUCTION

Permittee: Magcobar Mine Site

NPDES #: AR0049794

Sample Collection:	Date, Time Started	Date, Time Ended
Sample #1:	9-17-03, 1000	9-18-03, 1000
Sample #2:	9-18-03, 1000	9-19-03, 1000
Sample #3:	9-22-03, 0900	9-23-03, 0900

Test initiated (date, time): 9-18-03, 1100 Test terminated (date, time): 9-24-03, 0915

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	9	22	28	34	12	23
B	14	21	21	0	33	16
C	25	34	28	28	23	29
D	25	33	31	31	17	18
E	14	31	27	26	4	21
F	30	31	28	27	12	26
G	X0	35	27	28	25	6
H	27	28	31	30	23	28
I	14	32	30	31	23	14
J	16	29	24	23	25	26
Mean	17.4	29.6	27.5	25.8	19.7	20.7
Mean/surviving female	19.3	29.6	27.5	25.8	19.7	20.7
CV%*	37.4					35.1

X= Dead Adult; M= Male (Not considered in statistics)

*Coefficient of Variation = standard deviation/ mean * 100; CV% calculation based on young per surviving female

SUMMARY REPORTING FORMS FOR CHRONIC BIOMONITORING *Ceriodaphnia dubia* SURVIVAL AND REPRODUCTION

Permittee: Magcobar Mine Site

NPDES #: AR0049794

PERCENT SURVIVAL

PERCENT EFFLUENT	0%	32%	42%	56%	75%	100%
Time of Reading: 24 HOURS	100	100	100	100	100	100
48 HOURS	100	100	100	100	100	100
Test termination	90	100	100	100	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)= 37.4 %



APPENDIX A

Chain of Custody Forms

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION				Project Description				Turnaround Time				Preservation Codes:			
Weston Solutions, Inc.				MAGCOBAR Mine Site				(CIRCLE ONE)				1. Cool, 4 degrees Centigrade 2. Sulfuric Acid, pH <2 3. Nitric Acid, pH <2 4. Thiosulfate for dechlorination 5. Hydrochloric Acid for Y04 6. Sodium Hydroxide, pH >12			
P.O. Box 699				Reporting Information				24 hour				TEST PARAMETERS G=glass; P=HDPE V=septum; A=amber			
2000 Darby Lane				Telephone: 501/467-8355				48 hour							
Malvern, AR 72104				FAX: 501/467-8687				routine							
Attn: Alan Brown				Bill to P.O.				PRESERVATION CODE:							
<i>Dave Scott</i>				Samplers: (Printed)				Bottle Type				P			
Field Number	Date/s	Sample Collection Date/Time	Grab	Comp	# of Containers	SAMPLE IDENTIFICATION/ DESCRIPTION		REMARKS							
						Sample Matrix	IDENTIFICATION/ DESCRIPTION								
FD0918COMP	18-Sep	10:00	X		5		Facility Discharge	For completion by laboratory Condition of samples: A. Containers Correct? <input type="checkbox"/> yes <input type="checkbox"/> no B. Preservation Correct? <input type="checkbox"/> yes <input type="checkbox"/> no C. Seals intact? <input type="checkbox"/> yes <input type="checkbox"/> no							
1. Relinquished by: (Signature) <i>Dave Scott</i>				1. Received by: (Signature) 				Date/Time 9-18-03 1450							
2. Relinquished by: (Signature) 				2. Received by: (Signature) <i>Suzanne James</i>											
Date/Time 9-18-03 1450				Date/Time 9-18-03 1450											

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION			Project Description			Turnaround Time			Preservation Codes:					
Weston Solutions 2000 Derby Lane Melvern, AR 72104 Attn: Alan Brown			Reporting Information Telephone: FAX: Bill to/P.O.			(CIRCLE ONE) 24 hour 48 hour routine			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: (Printed) Sample Matrix			Bottle type code G-glass; P-HDPE V-septum; A-amber			TEST PARAMETERS					
Alan B. Brown			SAMPLE IDENTIFICATION/ DESCRIPTION Facility Discharge			Chronic Bio			Arkansas Analytical Lab # K309479B					
Field Number	Date/s	Sample Collection Time/s	Grab	Comp	# of Containers	ONSITE MEASUREMENTS								
F00190mp	9/19	10:00	X		3	pH	Temperature	Time	Sample	Duplicate	% Variance	Average	QC	Recovery
1. Relinquished by (Signature) Alan B. Brown						For completion by laboratory Condition of samples: A. Containers Correct? <input checked="" type="checkbox"/> yes <input type="checkbox"/> no B. Preservation Correct? <input checked="" type="checkbox"/> yes <input type="checkbox"/> no C. Seals Intact? <input checked="" type="checkbox"/> yes <input type="checkbox"/> no								
2. Relinquished by (Signature)						REMARKS								

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION	Project Description	Turnaround Time (CIRCLE ONE)	Preservation Codes:					
Weston Solutions 2000 Darby Lane Malvern, AR 72104 Attn: Alan Brown [Signature]	Reporting Information Telephone: FAX: Bill to/P.O.: Alan B. Brown	24 hour 48 hour <input checked="" type="checkbox"/> routine	1. Cool, 4 degrees Centigrade 2. Sulfuric Acid, pH < 2 3. Nitric Acid, pH < 2 4. Thiosulfate for dechlorination 5. Hydrochloric Acid for YDA 6. Sodium Hydroxide, pH > 12					
Samplers: (Signature/s)		Bottle Type						
[Signature]		G-glass; P-HDPE V-septum; A-number						
Field Number	Sample Collection Date/s	Time/s	# of Containers	Grab	Comp	SAMPLE IDENTIFICATION/ DESCRIPTION	Bottle type code	
FD0923comp	9/23	09:00	4	X		Facility Discharge Chronic Bio X	G-glass: P-HDPE V-septum: A-number Arkansas Analytical Lab # 09479C	
1. Relinquished by: (Signature)	Date/Time	1. Received by: (Signature)		For completion by laboratory				REMARKS
[Signature]	9/23/03 11:09	[Signature]		Condition of samples:	yes	no	Temp - 70C	
2. Relinquished by: (Signature)	Date/Time	2. Received by: (Signature)		A. Containers Correct?	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
[Signature]	9/23/03 1609	Alan Brown		B. Preservation Correct?	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
				C. Seals Intact?	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

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



APPENDIX B

Effluent and Dilution Water Data

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING

Ceriodaphnia dubia

Lab # / Sample ID		K309479							Test Start (Date/Time)	9-18-03/1100
Client		WESTON							Test End (Date/Time)	9-24-03/0915
		Day of Test								
		1	2	3	4	5	6	7	8	notes/remarks
Control		9/18	9/19	9/20	9/21	9/22	9/23	9/24		SS 72
D.O (mg/L)	INITIAL	8.2	8.4	7.0	6.9	7.4	7.3	7.0		9/20 SS 74
	FINAL	8.2	8.7	7.4	7.4	7.57	7.3	NA		9/22 SS 75
pH	INITIAL	7.2	7.2	7.4	7.2	7.7	6.9	6.9		
	FINAL	6.9	7.2	7.2	7.1	7.5	6.9	NA		
temp(C)	INITIAL	21.6	21.2	21.8	21.3	21.6	21.6	21.2		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	NA		
ALKALINITY(mg/L)		28	→	24	→	22	→	→		
HARDNESS(mg/L)		41	→	41	→	39	→	→		
CONDUCTIVITY(umhos/cm)		1160	→	149	→	153	→	→		
CHLORINE(mg/L)		0.05	→	0.05	→	0.05	→	→		
CONC:		32%	32%	32%	32%	32%	32%	32%		
D.O (mg/L)	INITIAL	8.4	8.5	7.0	7.0	7.6	7.3	7.2		
	FINAL	8.2	8.8	7.5	7.5	7.8	7.4	NA		
pH	INITIAL	7.5	7.5	7.5	7.5	7.5	7.1	7.2		
	FINAL	7.3	7.5	7.5	7.3	7.5	7.1	NA		
temp(C)	INITIAL	21.7	22.2	23.7	22.4	22.0	22.9	21.9		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	NA		
CONC:		42%	42%	42%	42%	42%	42%	42%		
D.O (mg/L)	INITIAL	8.4	8.5	6.9	7.0	7.4	7.3	7.3		
	FINAL	8.2	8.9	7.5	7.5	7.3	7.4	NA		
pH	INITIAL	7.5	7.5	7.5	7.5	7.5	7.2	7.2		
	FINAL	7.4	7.6	7.6	7.3	7.5	7.2	NA		
temp(C)	INITIAL	21.9	22.5	24.6	23.4	22.5	23.0	21.8		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	NA		
CONC:		56%	56%	56%	56%	56%	56%	56%		
D.O (mg/L)	INITIAL	8.3	8.4	6.5	6.9	7.5	7.7	7.2		
	FINAL	8.2	8.9	7.6	7.5	7.3	7.4	NA		
pH	INITIAL	7.5	7.5	7.6	7.5	7.5	7.2	7.2		
	FINAL	7.5	7.6	7.6	7.3	7.5	7.1	NA		
temp(C)	INITIAL	22.0	22.8	24.9	24.0	22.3	23.2	22.1		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	NA		
CONC:		75%	75%	75%	75%	75%	75%	75%		
D.O (mg/L)	INITIAL	8.3	8.5	6.5	7.0	7.8	7.3	7.2		
	FINAL	8.3	8.9	7.4	7.5	7.6	7.4	NA		
pH	INITIAL	7.5	7.5	7.5	7.5	7.5	7.3	7.2		
	FINAL	7.5	7.6	7.5	7.3	7.6	7.2	NA		
temp(C)	INITIAL	22.7	22.8	25.9	24.8	22.5	23.5	22.5		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	NA		
CONC:		100%	100%	100%	100%	100%	100%	100%		
D.O (mg/L)	INITIAL	8.7	8.9	6.5	7.1	7.3	7.3	7.4		
	FINAL	8.3	8.9	7.6	7.5	7.6	7.5	NA		
pH	INITIAL	7.6	7.4	7.6	7.5	7.4	7.3	7.2		
	FINAL	7.5	7.6	7.5	7.2	7.6	7.1	NA		
temp(C)	INITIAL	22.8	22.9	25.8	25.9	22.6	24.3	25.3		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	NA		
CONC:	100%	A	A	A	B	B	C	C		
ALKALINITY(mg/L)		27			31		22			
HARDNESS(mg/L)		1450			1320		1440			
CONDUCTIVITY(umhos/cm)		2380			2390		2410			
CHLORINE(mg/L)		0.05	0.05	0.05	0.05	0.05	0.05	0.05		

20.05



APPENDIX C

Fathead Minnow Raw Data and Statistics

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

SURVIVAL DATA FOR LARVAE

Lab #/s: Weston K309479 TEST START DATE 9-18 TIME 1600
 TEST END DATE 9-25 TIME 1340
 AGE AND SOURCE OF MINNOWS 24hrs; Aquatox

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		
327	A	10	10	10	10	10	10	10	10	100	98	
	B	10	10	10	10	10	10	10	10	100		
	C	10	10	10	10	10	10	10	10	100		
	D	10	10	10	9	9	9	9	9	90		
	E	10	10	10	10	10	10	10	10	100		
427	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		
567	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		
757	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		
1007	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		
ANALYST:		AD	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC
DATE:		9-18	9-19	9-20	9-21	9-22	9-23	9-24	9-25			
TIME:		1600	1400	1115	1200	1035	1450	1600	1340			

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

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB #/S: K309479	TEST DATES (BEGIN/END): 9-18-03/9-25-03
CLIENT: Weston	WEIGHING DATE/TIME:
ANALYST/S:	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	A 1	0.98492	0.97954	0.00548	10	0.548	AVG DRY WEIGHT (mg) 0.501 CV 13.2%
	B 2	0.98546	0.98136	0.00410	10	0.410	
	C 3	0.99256	0.98719	0.00537	10	0.537	
	D 4	0.98484	0.98032	0.00452	10	0.452	
	E 5	0.98392	0.97834	0.00558	10	0.558	
CONC: 32%	A 6	0.97899	0.97445	0.00454	10	0.454	AVG DRY WEIGHT(MG) 0.613 CV
	B 7	0.97823	0.97239	0.00584	10	0.584	
	C 8	0.98720	0.98062	0.00658	10	0.658	
	D 9	0.98125	0.97471	0.00654	10	0.654	
	E 10	0.98553	0.97839	0.00714	10	0.714	
CONC: 42%	A 11	0.98509	0.98007	0.00502	10	0.502	AVG DRY WEIGHT(MG) 0.576 CV
	B 12	0.98852	0.98258	0.00594	10	0.594	
	C 13	0.98467	0.97923	0.00544	10	0.544	
	D 14	0.98333	0.97664	0.00669	10	0.669	
	E 15	0.98523	0.97954	0.00569	10	0.569	
CONC: 56%	A 16	0.97807	0.97321	0.00496	10	0.496	AVG DRY WEIGHT(MG) 0.600 CV
	B 17	0.98340	0.97669	0.00671	10	0.671	
	C 18	0.98736	0.98032	0.00704	10	0.704	
	D 19	0.98293	0.97722	0.00571	10	0.571	
	E 20	0.98117	0.97557	0.00560	10	0.560	
CONC: 75%	A 21	0.97828	0.97278	0.00550	10	0.550	AVG DRY WEIGHT(MG) 0.455 CV
	B 22	0.97911	0.97494	0.00417	10	0.417	
	C 23	0.97618	0.97256	0.00362	10	0.362	
	D 24	0.97640	0.97163	0.00477	10	0.477	
	E 25	0.97841	0.97370	0.00471	10	0.471	
CONC: 100%	A 26	0.98423	0.97824	0.00599	10	0.599	AVG DRY WEIGHT(MG) 0.526 CV 21.9%
	B 27	0.98951	0.98348	0.00603	10	0.603	
	C 28	0.97667	0.97340	0.00327	10	0.327	
	D 29	0.98594	0.98022	0.00572	10	0.572	
	E 30	0.98008	0.97479	0.00529	10	0.529	

CV = (STANDARD DEVIATION/MEAN)*100

AA# K309479 FATHEAD MINNOW SURVIVAL, 9-18-03
File: k309479s 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# K309479 FATHEAD MINNOW SURVIVAL, 9-18-03
File: k309479s 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# K309479 FATHEAD MINNOW SURVIVAL, 9-18-03
FILE: k309479s
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	0.9000	1.2490
2	32 % EFFLUENT	5	1.0000	1.4120
3	42 % EFFLUENT	1	1.0000	1.4120
3	42 % EFFLUENT	2	1.0000	1.4120
3	42 % EFFLUENT	3	1.0000	1.4120
3	42 % EFFLUENT	4	1.0000	1.4120
3	42 % EFFLUENT	5	1.0000	1.4120
4	56 % EFFLUENT	1	1.0000	1.4120
4	56 % EFFLUENT	2	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# K309479 FATHEAD MINNOW SURVIVAL, 9-18-03

File: k309479s

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	1.379	25.00	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	1.412	27.50	16.00	5.00	

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

AA # K309479, FATHEAD MINNOW GROWTH, 9-18-03
File: k309479g Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.175

W = 0.940

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 # K309479, FATHEAD MINNOW GROWTH, 9-18-03
File: k309479g Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 2.25

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 # K309479, FATHEAD MINNOW GROWTH, 9-18-03

FILE: k309479g

TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.5480	0.5480
1	CONTROL	2	0.4100	0.4100
1	CONTROL	3	0.5370	0.5370
1	CONTROL	4	0.4520	0.4520
1	CONTROL	5	0.5580	0.5580
2	32 % EFFLUENT	1	0.4540	0.4540
2	32 % EFFLUENT	2	0.5840	0.5840
2	32 % EFFLUENT	3	0.6580	0.6580
2	32 % EFFLUENT	4	0.6540	0.6540
2	32 % EFFLUENT	5	0.7140	0.7140
3	42 % EFFLUENT	1	0.5020	0.5020
3	42 % EFFLUENT	2	0.5940	0.5940
3	42 % EFFLUENT	3	0.5440	0.5440
3	42 % EFFLUENT	4	0.6690	0.6690
3	42 % EFFLUENT	5	0.5690	0.5690
4	56 % EFFLUENT	1	0.4960	0.4960
4	56 % EFFLUENT	2	0.6710	0.6710
4	56 % EFFLUENT	3	0.7040	0.7040
4	56 % EFFLUENT	4	0.5710	0.5710
4	56 % EFFLUENT	5	0.5600	0.5600
5	75 % EFFLUENT	1	0.5500	0.5500
5	75 % EFFLUENT	2	0.4170	0.4170
5	75 % EFFLUENT	3	0.3620	0.3620
5	75 % EFFLUENT	4	0.4770	0.4770
5	75 % EFFLUENT	5	0.4710	0.4710
6	100 % EFFLUENT	1	0.5990	0.5990
6	100 % EFFLUENT	2	0.6030	0.6030
6	100 % EFFLUENT	3	0.3270	0.3270
6	100 % EFFLUENT	4	0.5720	0.5720
6	100 % EFFLUENT	5	0.5290	0.5290

AA # K309479, FATHEAD MINNOW GROWTH, 9-18-03
File: k309479g Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.095	0.019	2.597
Within (Error)	24	0.175	0.007	
Total	29	0.270		

Critical F value = 2.62 (0.05,5,24)

Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All equal

AA # K309479, FATHEAD MINNOW GROWTH, 9-18-03
 File: k309479g 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	0.501	0.501		
2	32 % EFFLUENT	0.613	0.613	-2.070	
3	42 % EFFLUENT	0.576	0.576	-1.382	
4	56 % EFFLUENT	0.600	0.600	-1.841	
5	75 % EFFLUENT	0.455	0.455	0.844	
6	100 % EFFLUENT	0.526	0.526	-0.463	

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

AA # K309479, FATHEAD MINNOW GROWTH, 9-18-03
 File: k309479g 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	0.127	25.4	-0.112
3	42 % EFFLUENT	5	0.127	25.4	-0.075
4	56 % EFFLUENT	5	0.127	25.4	-0.099
5	75 % EFFLUENT	5	0.127	25.4	0.046
6	100 % EFFLUENT	5	0.127	25.4	-0.025



APPENDIX D

Ceriodaphnia dubia Raw Data and Statistics

SURVIVAL AND REPRODUCTION TEST

Ceriodaphnia dubia

Discharger: Weston

Location: Weston

Date Sample Collected: See coc

Analyst: A.E., T.C., AD
 Test Start-Date/Time: 9-18-03 / 1100
 Test Stop-Date/Time: 9-24-03 / 0915

Conc 1	Replicate													No. of Young Adults	Analyst
	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adults		
		1	2	3	4	5	6	7	8						
%	1	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
	3	4	0	4	5	4	6	0	6	0	3	34	10	3.4	TC
	4	0	3	0	9	0	6	0	5	4	3	30	10	3.0	TC
	5	3	4	4	10	10	18	0	16	10	10	85	10	8.5	AD
	6	2	7	15	1	0	0	0	0	0	0	25	9	2.5	AD
	7														
	8														
Total	9	14	25	25	14	30	30	30	27	14	14	174	174	19.3	CV = 37.4%
Control															
Conc 2	Replicate													No. of Young Adults	Analyst
	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adults		
		1	2	3	4	5	6	7	8						
%	1	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
	3	0	0	4	4	4	6	5	0	4	0	31	10	3.1	TC
	4	4	5	2	12	7	7	0	6	5	7	55	10	5.5	TC
	5	8	5	10	17	18	20	10	17	11	18	134	10	13.4	AD
	6	10	11	18	0	2	0	19	0	16	0	76	10	7.6	AD
	7														
	8														
Total	22	21	34	33	31	31	35	28	32	29	29	296	296		
Conc 3	Replicate													No. of Young Adults	Analyst
	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adults		
		1	2	3	4	5	6	7	8						
%	1	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
	3	5	0	6	5	5	5	6	0	3	0	40	10	4.0	TC
	4	0	4	0	7	4	6	8	4	4	5	42	10	4.2	TC
	5	6	7	7	19	17	16	14	21	10	14	133	10	13.3	AD
	6	17	10	15	0	1	1	0	0	14	0	60	10	6.0	AD
	7														
	8														
Total	28	21	28	31	27	28	27	31	30	24	24	275	275		
Conc 4	Replicate													No. of Young Adults	Analyst
	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adults		
		1	2	3	4	5	6	7	8						
%	1	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
	3	6	0	6	5	4	5	6	0	5	0	42	10	4.2	TC
	4	0	0	0	8	9	6	9	7	4	5	48	10	4.8	TC
	5	9	0	7	18	12	15	14	14	10	13	114	10	11.4	AD
	6	19	0	15	0	1	0	1	0	17	0	54	10	5.4	AD
	7														
	8														
Total	34	0	28	31	22	27	28	30	31	23	23	258	258		
Conc 5	Replicate													No. of Young Adults	Analyst
	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adults		
		1	2	3	4	5	6	7	8						
%	1	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
	3	3	0	4	0	0	5	4	0	4	0	24	10	2.4	TC
	4	2	4	0	3	0	6	6	4	7	3	36	10	3.6	TC
	5	0	15	5	9	4	0	14	9	14	0	84	10	8.4	AD
	6	7	14	14	1	0	6	0	1	10	0	53	10	5.3	AD
	7														
	8														
Total	12	33	23	17	4	12	25	23	23	25	25	197	197		
Conc 6	Replicate													No. of Young Adults	Analyst
	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adults		
		1	2	3	4	5	6	7	8						
%	1	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	TC
	3	4	0	4	4	5	6	4	5	0	5	37	10	3.7	TC
	4	0	0	1	9	7	7	0	7	1	7	39	10	3.9	TC
	5	10	9	8	5	8	12	2	16	6	13	89	10	8.9	AD
	6	9	7	16	0	1	1	0	0	7	1	42	10	4.2	AD
	7														
	8														
Total	23	14	29	18	21	24	26	28	14	26	23	207	207	20.7	CV = 35.1%

X=DEAD; Y=MALE

FISHER'S EXACT TEST

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

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

FISHER'S EXACT TEST

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

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

FISHER'S EXACT TEST

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

TOTAL 1 19 20

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

FISHER'S EXACT TEST

NUMBER OF

IDENTIFICATION	DEAD	ALIVE	TOTAL ANIMALS
CONTROL	1	9	10
75% EFFLUENT	0	10	10
TOTAL	1	19	20

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

FISHER'S EXACT TEST

NUMBER OF

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

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

SUMMARY OF FISHER'S EXACT TESTS

GROUP	IDENTIFICATION	NUMBER EXPOSED	NUMBER DEAD	SIG (P=.05)
1	CONTROL	10	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# K309479, CERIODAPHNIA REPRODUCTION, 9-18-03
File: K309479C 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# K309479, CERIODAPHNIA REPRODUCTION, 9-18-03
File: K309479C Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 13.16

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# K309479, CERIODAPHNIA REPRODUCTION, 9-18-03
FILE: K309479C
TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	9.0000	9.0000
1	CONTROL	2	14.0000	14.0000
1	CONTROL	3	25.0000	25.0000
1	CONTROL	4	25.0000	25.0000
1	CONTROL	5	14.0000	14.0000
1	CONTROL	6	30.0000	30.0000
1	CONTROL	7	0.0000	0.0000
1	CONTROL	8	27.0000	27.0000
1	CONTROL	9	14.0000	14.0000
1	CONTROL	10	16.0000	16.0000
2	32 % EFFLUENT	1	22.0000	22.0000
2	32 % EFFLUENT	2	21.0000	21.0000
2	32 % EFFLUENT	3	34.0000	34.0000
2	32 % EFFLUENT	4	33.0000	33.0000
2	32 % EFFLUENT	5	31.0000	31.0000
2	32 % EFFLUENT	6	31.0000	31.0000
2	32 % EFFLUENT	7	35.0000	35.0000
2	32 % EFFLUENT	8	28.0000	28.0000
2	32 % EFFLUENT	9	32.0000	32.0000
2	32 % EFFLUENT	10	29.0000	29.0000
3	42 % EFFLUENT	1	28.0000	28.0000
3	42 % EFFLUENT	2	21.0000	21.0000
3	42 % EFFLUENT	3	28.0000	28.0000
3	42 % EFFLUENT	4	31.0000	31.0000
3	42 % EFFLUENT	5	27.0000	27.0000
3	42 % EFFLUENT	6	28.0000	28.0000
3	42 % EFFLUENT	7	27.0000	27.0000
3	42 % EFFLUENT	8	31.0000	31.0000
3	42 % EFFLUENT	9	30.0000	30.0000
3	42 % EFFLUENT	10	24.0000	24.0000
4	56 % EFFLUENT	1	34.0000	34.0000
4	56 % EFFLUENT	2	0.0000	0.0000
4	56 % EFFLUENT	3	28.0000	28.0000
4	56 % EFFLUENT	4	31.0000	31.0000
4	56 % EFFLUENT	5	26.0000	26.0000
4	56 % EFFLUENT	6	27.0000	27.0000
4	56 % EFFLUENT	7	28.0000	28.0000
4	56 % EFFLUENT	8	30.0000	30.0000
4	56 % EFFLUENT	9	31.0000	31.0000
4	56 % EFFLUENT	10	23.0000	23.0000
5	75 % EFFLUENT	1	12.0000	12.0000
5	75 % EFFLUENT	2	33.0000	33.0000
5	75 % EFFLUENT	3	23.0000	23.0000
5	75 % EFFLUENT	4	17.0000	17.0000
5	75 % EFFLUENT	5	4.0000	4.0000
5	75 % EFFLUENT	6	12.0000	12.0000
5	75 % EFFLUENT	7	25.0000	25.0000
5	75 % EFFLUENT	8	23.0000	23.0000
5	75 % EFFLUENT	9	23.0000	23.0000
5	75 % EFFLUENT	10	25.0000	25.0000

6	100	%	EFFLUENT	1	23.0000	23.0000
6	100	%	EFFLUENT	2	16.0000	16.0000
6	100	%	EFFLUENT	3	29.0000	29.0000
6	100	%	EFFLUENT	4	18.0000	18.0000
6	100	%	EFFLUENT	5	21.0000	21.0000
6	100	%	EFFLUENT	6	26.0000	26.0000
6	100	%	EFFLUENT	7	6.0000	6.0000
6	100	%	EFFLUENT	8	28.0000	28.0000
6	100	%	EFFLUENT	9	14.0000	14.0000
6	100	%	EFFLUENT	10	26.0000	26.0000

AA# K309479, CERIODAPHNIA REPRODUCTION, 9-18-03
 File: K309479C Transform: NO TRANSFORMATION

STEEL'S MANY-ONE RANK TEST

- Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	17.400				
2	32 % EFFLUENT	29.600	145.00	75.00	10.00	
3	42 % EFFLUENT	27.500	140.50	75.00	10.00	
4	56 % EFFLUENT	25.800	135.50	75.00	10.00	
5	75 % EFFLUENT	19.700	108.00	75.00	10.00	
6	100 % EFFLUENT	20.700	117.00	75.00	10.00	

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



APPENDIX E

Organism History

AQUATOX, INC.

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

TEST ORGANISM HISTORY

DATE SHIPPED 9-18-03 Arkansas Analytical

SPECIES Pimephales promelas

QUANTITY SHIPPED 1,000⁺

AGE/LIFE STAGE 24hrs 9/19 150015T

BROODSTOCK SOURCE Anderson Farms, AR

CULTURE WATER groundwater

ALKALINITY (Mg/l as CaCO₃) = 180

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

FEEDING ARTIFICIAL

COMMENTS _____

PACKAGED BY AA

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:

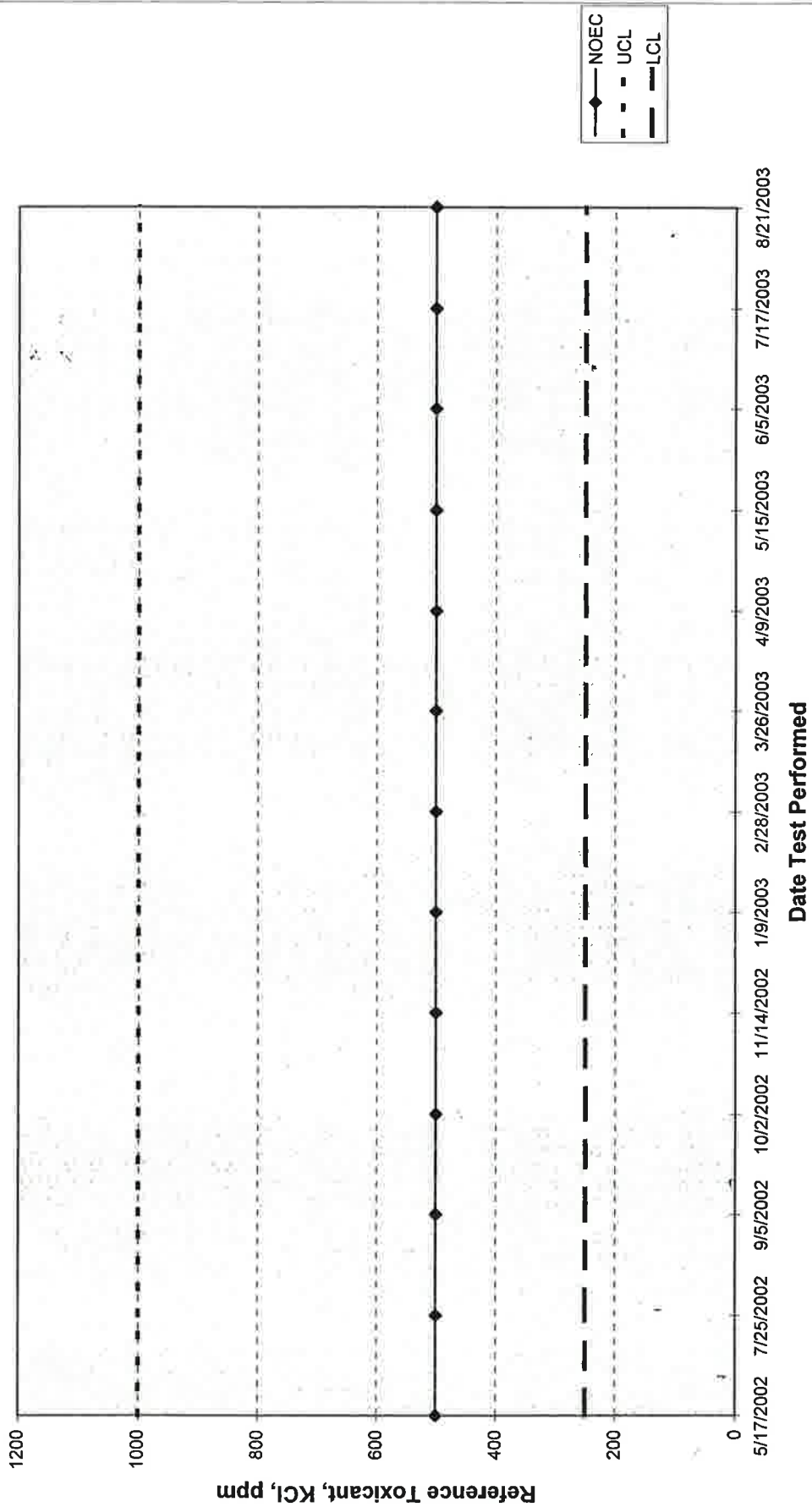
Facility Supervisor



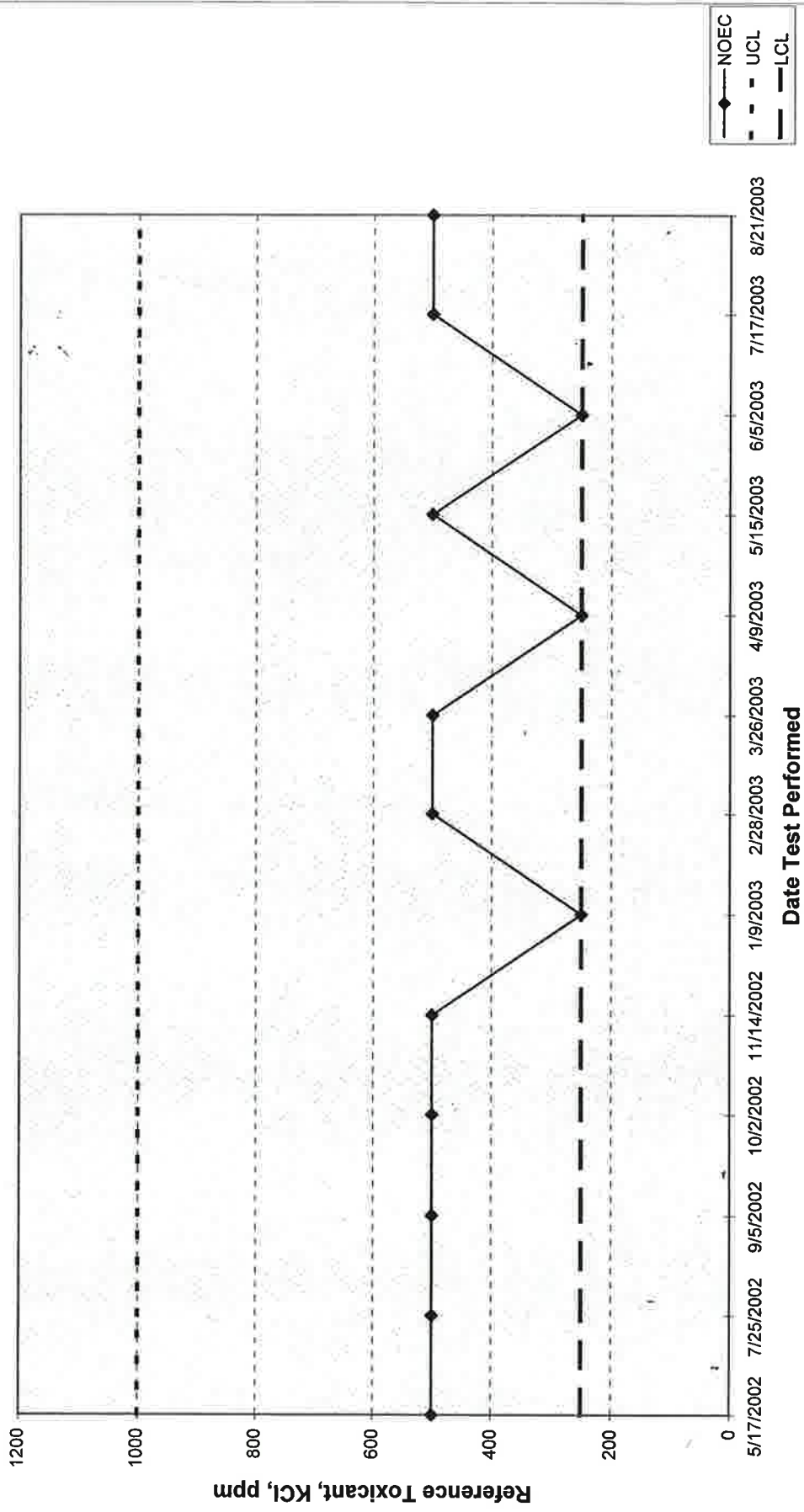
APPENDIX F

Quality Assurance Charts

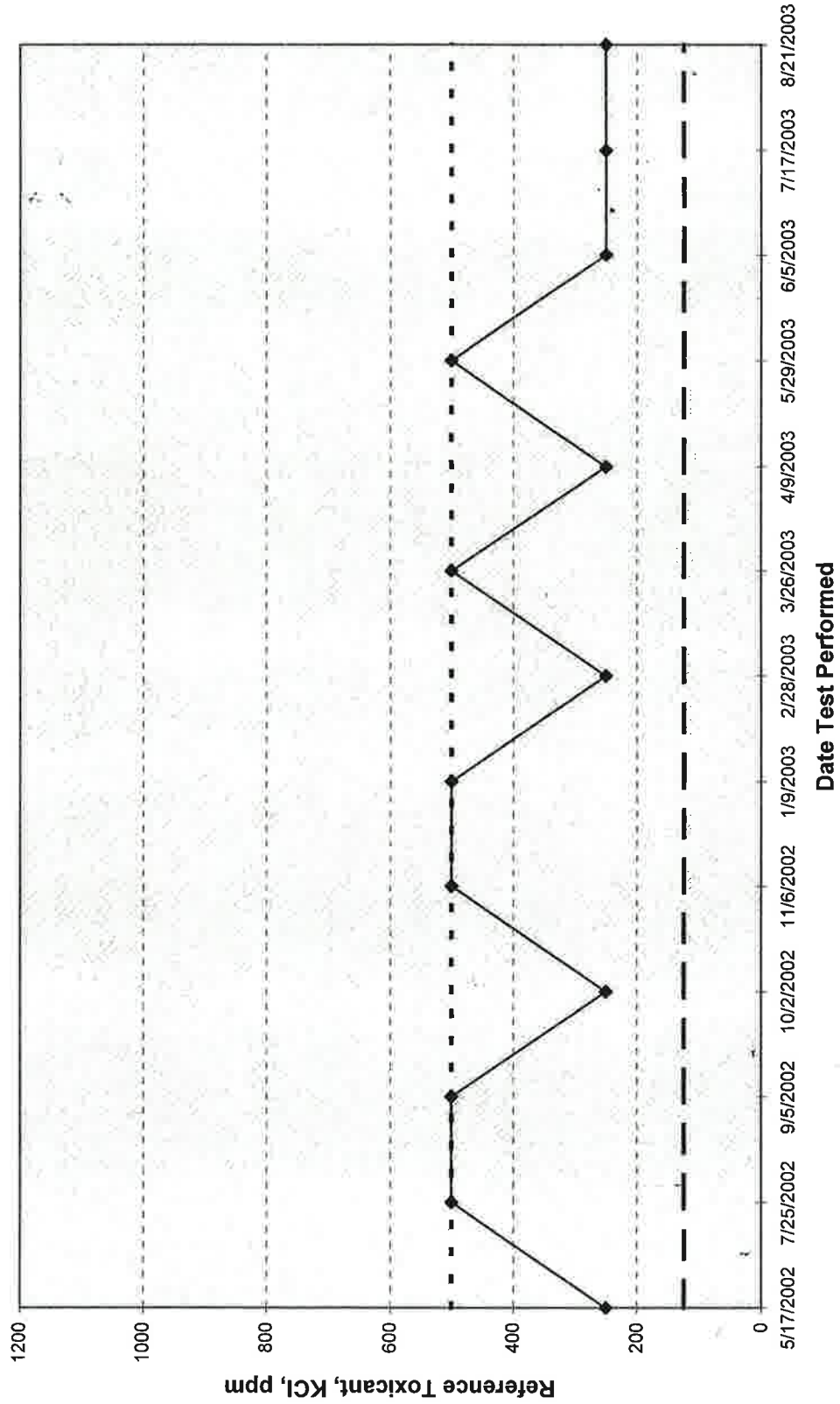
ARKANSAS ANALYTICAL, INC.
FATHEAD MINNOW SURVIVAL
QUALITY ASSURANCE



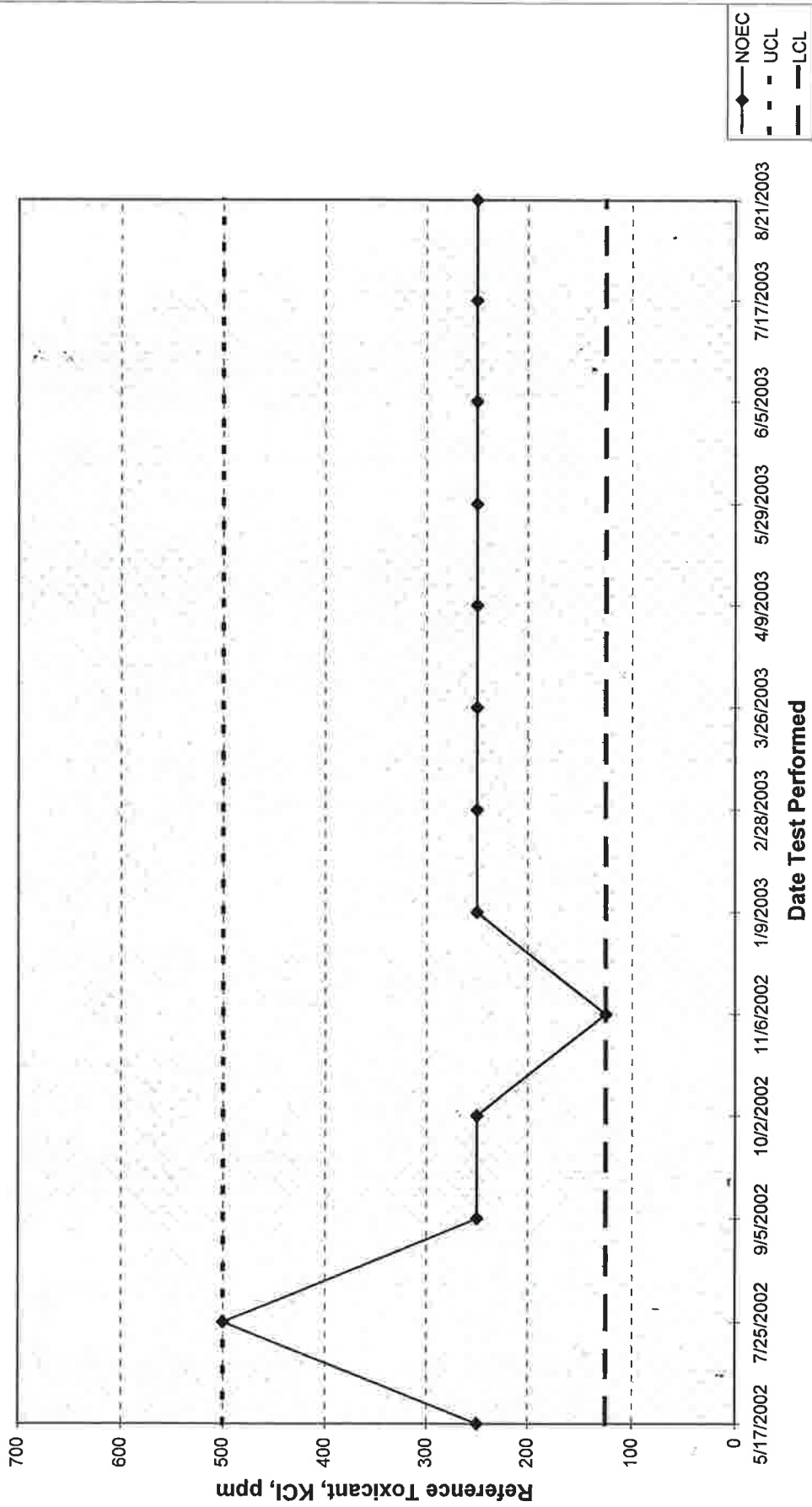
ARKANSAS ANALYTICAL, INC.
FATHEAD MINNOW GROWTH
QUALITY ASSURANCE



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

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 | | |

J.A. Sembracki
Quality Assurance Officer

May 15 2003 Date

ARKANSAS ANALYTICAL, INCORPORATED

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

Laboratory Control Number: K309479 Date: 10-7-03

Client: Weston Sample ID: plant effluent

Pass Fail

Fathead Minnow Survival Test

Fathead Minnow Growth Test

Ceriodaphnia dubia Survival Test

Ceriodaphnia dubia Reproduction Test

Analyst Initials MA