Arkansas Analytical, Inc.

Toxicity Test Results

MAGCOBAR MINE SITE
NPDES PERMIT NUMBER: AR0049794
June 2005

Fathead Minnow, *Pimephales promelas,* Larval Survival and Growth Test
Test 1000.0

Ceriodaphnia dubia, Survival and Reproduction Test
Test 1002.0

Prepared for: **Mr. David Friedman**
EEMA O&M Services Group
P.O. Box 232
Kulpsville, PA 19443

Prepared by: Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, Arkansas 72209
Lab Number K506197

Friday, June 24, 2005

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 Ouachita River in Segment 2F of the Ouachita River Basin.

The permit requires chronic biomonitoring testing bi-monthly for both *Ceriodaphnia dubia* and *Pimephales promelas.* The test results in this report represent the testing for June of 2005.

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:	06-07-05, 0930	06-08-05, 0930
Sample #2:	06-08-05, 0930	06-09-05, 0930
Sample #3:	06-13-05, 0930	06-14-05, 0930

The samples were composites 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	Temp. upon Receipt (°C)
Sample #1:	06-08-05, 1040	2
Sample #2:	06-09-05, 1100	-1
Sample #3:	06-14-05, 1200	-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 < 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	20.5	X	
At least 60% of surviving females should have produced 3 broods	70%	X	
The percent coefficient of variation between replicates must be 40% or less for the young of surviving females	22.6%	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	0.332	X	
The percent coefficient of variation between replicates must be 40% or less for growth	12.5%	X	

Reference Toxicant

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

REFERENCE TOXICANT

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

Quality Assurance charts are provided in Appendix F.

Summary of Results
Magcobar Mine Site

Pimephales promelas		*Pimephales promelas (UV Treated)*	
NOEC / LOEC survival	100% / NA	NOEC / LOEC survival	100% / NA
NOEC / LOEC growth	100% / NA	NOEC / LOEC growth	100% / NA
%CV survival (critical dilution)	4.56%	%CV survival (critical dilution)	4.56%
Mean dry weight (critical dilution) in milligrams	0.431	Mean dry weight (critical dilution) in milligrams	0.534
%CV growth (critical dilution)	8.58%	%CV growth (critical dilution)	15.3%
Ceriodaphnia dubia		*Ceriodaphnia dubia (UV Treated)*	
NOEC / LOEC survival	100% / NA	NOEC / LOEC survival	100% / NA
NOEC / LOEC reproduction	100% /NA	NOEC / LOEC reproduction	100% / NA
Mean number of neonates (critical dilution)	19.8	Mean number of neonates (critical dilution)	19.3
%CV Reproduction (critical dilution)	20.2%	%CV Reproduction (critical dilution)	22.8%

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

Biomonitoring Analysts:

Melissa Green

Tracy Bounds

Teresa Thomas

Jennifer Morales

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:	06-07-05, 0930	06-08-05, 0930
Sample #2:	06-08-05, 0930	06-09-05, 0930
Sample #3:	06-13-05, 0930	06-14-05, 0930

Test initiated (date, time): 06-09-05, 1400 Test terminated (date, time): 06-16-05, 1000

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	90	90	100	100		100	100	96	
56%	100	100	100	100	100		100	100	100	
75%	100	90	100	100	100		100	98	98	
100%	100	100	100	100	90		98	98	98	4.56

DATA TABLE FOR GROWTH OF FATHEAD MINNOWS

Average Dry Weight in milligrams in replicate chambers

Effluent Conc %	A	B	C	D	E		Mean Dry Weight	CV%
0%	0.320	0.325	0.398	0.332	0.284		0.332	12.5
32%	0.396	0.460	0.406	0.439	0.493		0.439	
42%	0.344	0.354	0.435	0.431	0.478		0.408	
56%	0.419	0.545	0.417	0.467	0.570		0.484	
75%	0.445	0.424	0.408	0.514	0.585		0.475	
100%	0.447	0.476	0.389	0.445	0.396		0.431	8.58

Coefficient of Variation = standard deviation / mean * 100

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

Pimephales promelas

Test initiated (date, time): 6-9-05, 1500 Test terminated (date, time): 6-16-05, 1050

Dilution water used: Soft Synthetic

DATA TABLE FOR FATHEAD MINNOW SURVIVAL (UV Treated)

	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%	90	100	100	100	100		100	98	98	
42%	100	100	90	100	100		100	100	98	
56%	100	90	100	100	100		100	98	98	
75%	100	100	100	100	100		100	100	100	
100%	100	90	100	100	100		100	100	98	4.56

DATA TABLE FOR GROWTH OF FATHEAD MINNOWS (UV Treated)

Effluent Conc %	A	B	C	D	E		Mean Dry Weight	CV%
0%	0.320	0.325	0.398	0.332	0.284		0.332	12.5
32%	0.381	0.451	0.580	0.464	0.469		0.469	
42%	0.474	0.547	0.478	0.511	0.531		0.508	
56%	0.562	0.514	0.621	0.432	0.635		0.553	
75%	0.530	0.598	0.432	0.546	0.609		0.543	
100%	0.509	0.456	0.444	0.580	0.631		0.524	15.3

Coefficient of Variation = standard deviation / mean * 100

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 Coefficient of Variation, parameter TQP6C: _____**4.56**_____%

6. Enter percent effluent corresponding to each NOEC below and circle the lowest number:

   a) NOEC survival, parameter TOP6C = _____**100**_____% effluent

   b) NOEC growth, parameter TPP6C = _____**100**____% effluent

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:	06-07-05, 0930	06-08-05, 0930
Sample #2:	06-08-05, 0930	06-09-05, 0930
Sample #3:	06-13-05, 0930	06-14-05, 0930

Test initiated (date, time): 06-09-05, 1120 Test terminated (date, time): 06-15-05, 0850

Dilution water used: Soft Synthetic

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

Replicate	0%	32%	42%	56%	75%	100%
A	22	11	14	18	15	15
B	23	10	11	18	11	16
C	11	18	20	25	23	16
D	23	25	21	28	19	19
E	19	24	16	21	33	19
F	26	16	24	23	16	17
G	21	20	20	16	22	23
H	23	21	23	22	19	27
I	14	21	23	20	24	23
J	23	27	20	15	24	23
Mean	20.5	19.3	19.2	20.6	20.6	19.8
Mean/surviving female	20.5	19.3	19.2	20.6	20.6	19.8
CV%*	22.6					20.2

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
UV Treated Sample

Permittee: Magcobar Mine Site **NPDES #: AR0049794**

Test initiated (date, time): 6-9-05, 1145 Test terminated (date, time): 6-15-05, 0910

Dilution water used: Soft Synthetic

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

Replicate	0%	32%	42%	56%	75%	100%
A	13	20	23	22	X0	22
B	21	21	22	18	23	23
C	18	21	21	23	19	18
D	17	23	11	17	24	X0
E	26	19	21	19	22	17
F	23	20	18	23	X0	19
G	25	23	20	23	20	25
H	23	13	19	18	24	22
I	23	10	23	0	29	10
J	15	24	24	17	17	18
Mean	20.4	19.4	20.2	18.0	17.8	17.4
Mean/surviving female	20.4	19.4	20.2	18.0	22.3	19.3
CV%*	21.6					22.8

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**

Test initiated (date, time): 6-9-05, 1145 Test terminated (date, time): 6-15-05, 0910

Dilution water used: Soft Synthetic

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

Replicate	0%	32%	42%	56%	75%	100%
A	13	20	23	22	X0	22
B	21	21	22	18	23	23
C	18	21	21	23	19	18
D	17	23	11	17	24	X0
E	26	19	21	19	22	17
F	23	20	18	23	X0	19
G	25	23	20	23	20	25
H	23	13	19	18	24	22
I	23	10	23	0	29	10
J	15	24	24	17	17	18
Mean	20.4	19.4	20.2	18.0	17.8	17.4
Mean/surviving female	20.4	19.4	20.2	18.0	22.3	19.3
CV%*	21.6					22.8

X= Dead Adult; M= Male (Not considered in statistics)
*Coefficient of Variation = standard deviation/ mean * 100; CV% calculation based on young per surviving female

APPENDIX A

Chain of Custody Forms

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION	Project Description	Turnaround Time
EEMA O&M 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: Darrel Scott	Bill to/P.O.	Preservative Code:
		Bottle Type

Preservation Codes:

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

Samplers:(Signature/s): Darrel Scott

Samplers:(Printed): Darrel Scott

Field Number	Sample Collection Date/s	Time/s	Grab	Comp	# of Containers	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	Chronic Bio	TEST PARAMETERS	Arkansas Analytical Lab #
FD68COMP	6/8/2005	9:30		X	4		Facilty Discharge	X		K506197A-1
UVPATHOGEN	6/8/2005	9:30		X	2		Facilty Discharge			

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

1 Relinquished by:(Signature)	Date/Time	1.Received by:(Signature)
Bob Davis	06 08 05 1040	
2.Relinquished by:(Signature)	Date/Time	2.Received by laboratory :(Signature)
	6-8-05 1040	Sydney James

For completion by laboratory

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

Per 2°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
EEMA O&M 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: Darrel Scott	Bill to/P.O.	Preservative Code:
		Bottle Type

Preservation Codes:

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

Samplers:(Signature/s): Darrel Scott

Samplers:(Printed): Darrel Scott

Field Number	Sample Collection Date/s	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		
FD69COMP	6/9/2005	9:30		X	4		Facilty Discharge	X		K5061973
UVPATHOGEN	6/9/2005	9:30		X	2		Facilty Discharge			

1 Relinquished by:(Signature)	Date/Time	1.Received by:(Signature)
Bill Boston	6-09-05 11:00	
2.Relinquished by:(Signature)	Date/Time	2.Received by laboratory :(Signature)
	6-9-05, 1100	Sydney James

For completion by laboratory

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

REMARKS

Temp. on Receipt - 1°C

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION	Project Description	Turnaround Time
EEMA O&M 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: Darrel Scott	Bill to/P.O.	Preservative Code:
		Bottle Type: P

Preservation Codes:

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

Samplers:(Signature/s): Darrel Scott

Samplers:(Printed): Darrel Scott

Field Number	Sample Collection Date/s	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 #
FD614COMP	6/14/2005	9:30		X	4		Facilty Discharge	X		K506197C
UVPATHOGEN	6/14/2005	9:30		X	2		Facilty Discharge			

1 Relinquished by:(Signature)	Date/Time	1.Received by:(Signature)
Bob Davis	06-14-05 1200	1200
2.Relinquished by:(Signature)	Date/Time	2.Received by laboratory :(Signature)
	6/14/05 1205	Bruce Harris

For completion by laboratory

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

REMARKS

Temp on Receipt - 2°C

APPENDIX B

Effluent and Dilution Water Data

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING — Ceriodaphnia dubia

Lab # / Sample ID: KSC6197 — Test Start (Date/Time): 6-9-05/1120

Client: Weston — Test End (Date/Time): 6-15-05/0850

		Day of Test 1	2	3	4	5	6	7	8	notes/remarks
Control		6/9	6/10	6/11	6/12	6/13	6/14	6/15		SS 125
D.O (mg/L)	INITIAL	7.9	8.0	7.8	7.0	8.3	6.8	8.5		
	FINAL	8.0	7.0	6.7	6.7	8.4	8.0	NA		
pH	INITIAL	6.3	6.8	6.4	7.3	6.8	7.0	6.9		
	FINAL	6.4	6.2	7.0	7.2	7.0	7.0			
temp(C)	INITIAL	20.1	20.0	20.3	20.3	19.8	19.7	20.8		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0			
ALKALINITY(mg/L)		22	—	—	—	—	—	→		
HARDNESS(mg/L)		30	—	—	—	—	—	→		
CONDUCTIVITY(umhos/cm)		145	—	—	—	—	—	→		
CHLORINE(mg/L)		<0.05	—	—	—	—	—	→		
CONC:		32%	32%	32%	32%	32%	32%	32%		
D.O (mg/L)	INITIAL	8.1	7.9	7.7	7.3	8.3	8.9	8.1		
	FINAL	8.0	7.0	6.8	6.8	8.3	8.2	NA		
pH	INITIAL	6.2	6.8	6.0	7.1	6.9	6.7	6.0		
	FINAL	6.4	6.0	6.8	7.2	6.8	6.8			
temp(C)	INITIAL	20.1	20.0	20.3	20.0	20.4	19.8	20.8		
	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	7.9	7.7	7.6	8.3	8.5	8.1		
	FINAL	7.9	7.1	6.9	6.8	8.5	8.1	NA		
pH	INITIAL	6.3	6.8	6.1	7.1	7.0	6.7	6.3		
	FINAL	6.4	6.1	6.8	7.1	7.4	6.8			
temp(C)	INITIAL	20.1	20.8	20.4	20.0	21.1	19.9	20.9		
	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	8.4	7.8	7.8	7.6	8.3	8.5	8.4		
	FINAL	7.9	7.1	7.0	6.7	8.6	8.1	NA		
pH	INITIAL	6.5	6.8	6.2	7.2	7.0	6.7	6.6		
	FINAL	6.5	6.2	6.8	7.1	7.2	6.9			
temp(C)	INITIAL	20.1	20.9	20.6	20.1	21.1	20.1	21.0		
	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	7.8	7.7	7.6	8.4	8.7	8.2		
	FINAL	7.8	7.1	7.0	6.7	8.8	8.3	NA		
pH	INITIAL	6.6	6.8	6.3	7.2	7.1	6.7	6.8		
	FINAL	6.5	6.2	6.9	7.1	7.4	6.9			
temp(C)	INITIAL	20.5	21.0	20.7	20.2	21.1	20.5	21.2		
	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	8.5	7.8	7.7	7.8	8.8	8.6	8.4		
	FINAL	7.8	7.1	7.0	6.7	8.6	8.3	NA		
pH	INITIAL	7.0	6.8	6.4	7.2	7.2	6.7	6.8		
	FINAL	6.5	6.3	6.8	7.0	7.3	6.9			
temp(C)	INITIAL	20.7	21.1	20.7	20.3	21.2	20.5	21.6		
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0			
CONC:	**100%**	A	A	A	B	B	C	C		
ALKALINITY((mg/L)		20	—	→	22	→	23	→		
HARDNESS(mg/L)		1210	—	→	1200	→	1230	→		
CONDUCTIVITY(umhos/cm)		2400	—	→	2410	→	2350	→		
CHLORINE(mg/L)		<0.05	—	→	<0.05	→	<0.05	→		

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING — Fathead Minnow

Lab # / Sample ID: K506197 — Test Start (Date/Time): 6-9-05/1100

Client: Weston — Test End (Date/Time): 6-16-05/1000

		Day of Test							
		1	2	3	4	5	6	7	notes/remarks
Control		6/9	6/10	6/11	6/12	6/13	6/14	6/15	SS 125
D.O (mg/L)	INITIAL	7.9	8.0	7.8	7.0	8.3	6.8	8.5	
	FINAL	6.1	7.0	6.8	7.3	6.9	6.7	7.1	
pH(mg/L)	INITIAL	6.3	6.8	6.4	7.3	6.8	7.0	6.9	
	FINAL	6.7	6.2	7.0	6.8	6.9	7.1	6.4	
temp(C)	INITIAL	20.1	20.6	20.3	20.3	19.8	19.7	20.8	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
ALKALINITY(mg/L)		22	—					→	
HARDNESS(mg/L)		30	—					→	
CONDUCTIVITY(umhos/cm)		145	—					→	
CHLORINE(mg/L)		<0.05	—					→	
CONC:		32%	32%	32%	32%	32%	32%	32%	
D.O (mg/L)	INITIAL	8.1	7.9	7.7	7.3	8.3	8.9	8.1	
	FINAL	6.2	7.0	6.9	7.2	6.7	6.9	7.3	
pH(mg/L)	INITIAL	6.2	6.8	6.0	7.1	6.9	6.7	6.0	
	FINAL	6.5	6.0	6.8	6.7	6.7	7.0	6.2	
temp(C)	INITIAL	20.1	20.6	20.3	20.0	20.4	19.8	20.8	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:		42%	42%	42%	42%	42%	42%	42%	
D.O (mg/L)	INITIAL	8.3	7.9	7.7	7.6	8.3	8.5	8.1	
	FINAL	6.4	7.1	7.1	7.3	6.8	7.0	7.5	
pH(mg/L)	INITIAL	6.3	6.8	6.1	7.1	7.0	6.7	6.3	
	FINAL	6.6	6.1	6.9	6.6	6.7	6.9	6.5	
temp(C)	INITIAL	20.1	20.8	20.4	20.0	21.1	19.9	20.9	
	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	8.4	7.8	7.8	7.6	8.3	8.5	8.4	
	FINAL	6.5	7.1	7.2	7.2	6.9	7.1	7.4	
pH(mg/L)	INITIAL	6.5	6.8	6.2	7.2	7.0	6.7	6.6	
	FINAL	6.6	6.2	6.9	6.6	6.8	6.9	6.5	
temp(C)	INITIAL	20.1	20.9	20.6	20.1	21.1	20.1	21.0	
	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	8.4	7.8	7.7	7.6	8.4	8.7	8.2	
	FINAL	6.8	7.1	7.2	7.2	6.9	7.1	7.4	
pH(mg/L)	INITIAL	6.6	6.8	6.3	7.2	7.1	6.7	6.8	
	FINAL	6.6	6.7	6.9	6.6	6.9	6.8	6.5	
temp(C)	INITIAL	20.5	21.0	20.7	20.2	21.1	20.5	21.2	
	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	7.8	7.7	7.8	8.3	8.6	8.4	
	FINAL	6.8	7.1	7.1	7.2	6.9	7.2	7.3	
pH(mg/L)	INITIAL	67.0	6.8	6.4	7.2	7.2	6.7	6.8	
	FINAL	6.6	6.3	6.9	6.0	6.9	6.8	6.6	
temp(C)	INITIAL	20.7	21.1	20.7	20.3	21.2	20.5	21.6	
	FINAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
CONC:	100%	A	A	A	B	B	C	C	
ALKALINITY((mg/L)		20	—	—	22	→	23	→	
HARDNESS(mg/L)		1210	—	→	1200	→	1230	→	
CONDUCTIVITY(umhos/cm)		2400	—	→	2410	→	2350	→	
CHLORINE(mg/L)		<0.05	—	→	<0.05	=	<0.05	→	

APPENDIX C

Fathead minnow raw data and statistics

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB #/ SAMPLE ID KS06197 TEST START DATE 6-9-06 TIME 1400

CLIENT Weston TEST END DATE 6-16 TIME 1000

AGE AND SOURCE OF MINNOWS < 24 hrs. / Aquator

		DAY (NUMBER SURVIVING)								SURVIVAL		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
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%	0.00%
	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%	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	9	9	9	9	90		
	C	|	10	10	10	9	9	9	9	90	96%	
42%	D	|	10+9	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		
	C	|	10	10	10	10	10	10	10	100	100%	
56%	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	9	9	9	9	9	9	90		
	C	|	10	10	10	10	10	10	10	100	98%	
75%	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		
	C	|	10	10	10	10	10	10	10	100	98%	4.56%
100%	D	|	10	10	10	10	10	10	10	100		
	E	⊥	9	9	9	9	9	9	9	90		
ANALYST:		TLT	TLT	JM	TB	TLT	mg	mg	mg			
DATE:		6-9	6-10	6-11	6-12	6-13	6-14	6-15	6-16			
TIME:		1400	1130	1050	1100	1400	1100	1100	1000			

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

SURVIVAL DATA FOR FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

LAB #/ SAMPLE ID K5060197 TEST START DATE 6-9-05 TIME 1500

CLIENT Weston UV TEST END DATE 6-16 TIME 1050

AGE AND SOURCE OF MINNOWS <24 hrs. Aquatox

		DAY (NUMBER SURVIVING)								SURVIVAL		
	REP #	start	1	2	3	4	5	6	7	%	MEAN %	CV
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	9/10	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	9	9/10th	9	9	9	9	90		
	B	|	10	10	10	10	10	10	10	100		
32%	C	|	10	10	10	10	10	10	10	100	98	
	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	9	9	9	9	90	98	
	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	9	9	9	9	9	9	90		
56%	C	|	10	10	10	10	10	10	10	100	98	
	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	9	9	9	9	9	90		
100%	C	|	10	10	10	10	10	10	10	100	98	4.5%
	D	|	10	10	10	10	10	10	10	100		
	E	⊥	10	10	10	10	10	10	10	100		
ANALYST:		TLT	mg	JM	tb/mg	TLT	CS	mg	mg			
DATE:		6-9	6-10	6-11	6-12	6-13	6-14	6-15	6-16			
TIME:		1500	1135	1100	1010	1625	1045	1200	1050			

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

Pimephales promelas

FATHEAD MINNOW

TEST 1000.0

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB # / #s:	K506197
CLIENT:	Weston
ANALYSTS:	
SAMPLE ID:	

TEST DATES (BEGIN / END):	6/9-6/16/05
WEIGHING DATE / TIME:	
DRYING TEMP (DEGREES C):	60
DRYING TIME (HOURS):	24

	REP #	FINAL DRY WEIGHT TIN+LARVAE (g)	INITIAL WEIGHT TIN (g)	TOTAL DRY WEIGHT OF LARVAE (g)	NUMBER OF LARVAE	DRY WEIGHT OF LARVAE (mg)	
CONTROL	A	0.93467	0.93147	0.00320	10	0.320	AVG DRY
	B	0.93647	0.93322	0.00325	10	0.325	WEIGHT (mg)
	C	0.93344	0.92946	0.00398	10	0.398	0.332
	D	0.92701	0.92369	0.00332	10	0.332	CV
	E	0.93064	0.92780	0.00284	10	0.284	12.5
CONC:	A	0.93903	0.93507	0.00396	10	0.396	AVG DRY
	B	0.93480	0.93020	0.00460	10	0.460	WEIGHT (mg)
32%	C	0.94110	0.93704	0.00406	10	0.406	0.439
	D	0.93879	0.93440	0.00439	10	0.439	CV
	E	0.93830	0.93337	0.00493	10	0.493	
CONC:	A	0.93695	0.93351	0.00344	10	0.344	AVG DRY
	B	0.93814	0.93460	0.00354	10	0.354	WEIGHT (mg)
42%	C	0.93725	0.93290	0.00435	10	0.435	0.408
	D	0.94034	0.93603	0.00431	10	0.431	CV
	E	0.93527	0.93049	0.00478	10	0.478	
CONC:	A	0.93434	0.93015	0.00419	10	0.419	AVG DRY
	B	0.93639	0.93094	0.00545	10	0.545	WEIGHT (mg)
56%	C	0.93149	0.92732	0.00417	10	0.417	0.484
	D	0.93417	0.92950	0.00467	10	0.467	CV
	E	0.93676	0.93106	0.00570	10	0.570	
CONC:	A	0.93386	0.92941	0.00445	10	0.445	AVG DRY
	B	0.93298	0.92874	0.00424	10	0.424	WEIGHT (mg)
75%	C	0.92772	0.92364	0.00408	10	0.408	0.475
	D	0.93763	0.93249	0.00514	10	0.514	CV
	E	0.93571	0.92986	0.00585	10	0.585	
CONC:	A	0.94476	0.94029	0.00447	10	0.447	AVG DRY
	B	0.93893	0.93417	0.00476	10	0.476	WEIGHT (mg)
100%	C	0.94669	0.94280	0.00389	10	0.389	0.431
	D	0.95317	0.94872	0.00445	10	0.445	CV
	E	0.94787	0.94391	0.00396	10	0.396	8.58

CV = (STANDARD DEVIATION/MEAN)*100

REMARKS:

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

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB # / #s: V5010197					TEST DATES (BEGIN / END): 6/9-16/05		
CLIENT: Weston					WEIGHING DATE / TIME: 6/17/05, 1020		
ANALYSTS:					DRYING TEMP (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 LARVAE (mg)	
CONTROL	A 56	0.93467	0.93147				AVG DRY
	B 57	0.93647	0.93322				WEIGHT (mg)
	C 58	0.93344	0.92946				
	D 59	0.92701	0.92369				CV
	E 60	0.93064	0.92780				
CONC: 32%	A 61	0.93903	0.93507				AVG DRY
	B 62	0.93480	0.93020				WEIGHT (mg)
	C 63	0.94113	0.93704				
	D 64	0.93879	0.93440				CV
	E 65	0.93830	0.93337				
CONC: 42%	A 66	0.93695	0.93351				AVG DRY
	B 67	0.93814	0.93460				WEIGHT (mg)
	C 68	0.93725	0.93290				
	D 69	0.94034	0.93603				CV
	E 70	0.93527	0.93049				
CONC: 56%	A 71	0.93434	0.93015				AVG DRY
	B 72	0.93639	0.93094				WEIGHT (mg)
	C 73	0.93149	0.92732				
	D 74	0.93417	0.92950				CV
	E 75	0.93676	0.93106				
CONC: 75%	A 76	0.93356	0.92941				AVG DRY
	B 77	0.93298	0.92874				WEIGHT (mg)
	C 78	0.92772	0.92365				
	D 79	0.93763	0.93249				CV
	E 80	0.93571	0.92986				
CONC: 100%	A 81	0.94476	0.94029				AVG DRY
	B 82	0.93893	0.93417				WEIGHT (mg)
	C 83	0.94669	0.94280				
	D 84	0.95317	0.94872				CV
	E 85	0.94787	0.94391				

CV = (STANDARD DEVIATION/MEAN)*100

REMARKS:

Pimephales promelas **FATHEAD MINNOW** TEST 1000.0

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB # / #s:	K506197
CLIENT:	Weston
ANALYSTS:	
SAMPLE ID:	UV Treated

TEST DATES (BEGIN / END):	6/9-6/16/05
WEIGHING DATE / TIME:	
DRYING TEMP (DEGREES C):	60
DRYING TIME (HOURS):	24

	REP #	FINAL DRY WEIGHT TIN+LARVAE (g)	INITIAL WEIGHT TIN (g)	TOTAL DRY WEIGHT OF LARVAE (g)	NUMBER OF LARVAE	DRY WEIGHT OF LARVAE (mg)	
CONTROL	A	0.93467	0.93147	0.00320	10	0.320	AVG DRY
	B	0.93647	0.93322	0.00325	10	0.325	WEIGHT (mg)
	C	0.93344	0.92946	0.00398	10	0.398	0.332
	D	0.92701	0.92369	0.00332	10	0.332	CV
	E	0.93064	0.92780	0.00284	10	0.284	12.5
CONC:	A	0.94358	0.93977	0.00381	10	0.381	AVG DRY
	B	0.95182	0.94731	0.00451	10	0.451	WEIGHT (mg)
32%	C	0.95066	0.94486	0.00580	10	0.580	0.469
	D	0.94930	0.94466	0.00464	10	0.464	CV
	E	0.95158	0.94689	0.00469	10	0.469	
CONC:	A	0.94424	0.93950	0.00474	10	0.474	AVG DRY
	B	0.94079	0.93532	0.00547	10	0.547	WEIGHT (mg)
42%	C	0.94496	0.94018	0.00478	10	0.478	0.508
	D	0.94697	0.94186	0.00511	10	0.511	CV
	E	0.94811	0.94280	0.00531	10	0.531	
CONC:	A	0.94356	0.93794	0.00562	10	0.562	AVG DRY
	B	0.93946	0.93432	0.00514	10	0.514	WEIGHT (mg)
56%	C	0.95048	0.94427	0.00621	10	0.621	0.553
	D	0.94123	0.93691	0.00432	10	0.432	CV
	E	0.94334	0.93699	0.00635	10	0.635	
CONC:	A	0.94428	0.93898	0.00530	10	0.530	AVG DRY
	B	0.94273	0.93675	0.00598	10	0.598	WEIGHT (mg)
75%	C	0.95596	0.95164	0.00432	10	0.432	0.543
	D	0.94128	0.93582	0.00546	10	0.546	CV
	E	0.95292	0.94683	0.00609	10	0.609	
CONC:	A	0.94192	0.93683	0.00509	10	0.509	AVG DRY
	B	0.94794	0.94338	0.00456	10	0.456	WEIGHT (mg)
100%	C	0.93897	0.93453	0.00444	10	0.444	0.524
	D	0.94844	0.94264	0.00580	10	0.580	CV
	E	0.94446	0.93815	0.00631	10	0.631	15.3

CV = (STANDARD DEVIATION/MEAN)*100

REMARKS:

Pimephales promelas **FATHEAD MINNOW** TEST 1000.0

WEIGHT DATA FOR LARVAL SURVIVAL AND GROWTH TEST

LAB # / #s:	K506197
CLIENT:	WESTON - LCV
ANALYSTS:	
SAMPLE ID:	
TEST DATES (BEGIN / END):	6/9-16/05
WEIGHING DATE / TIME:	6/17/05, 1040
DRYING TEMP (DEGREES C):	60°C
DRYING TIME (HOURS):	24hrs.

	REP #	FINAL DRY WEIGHT TIN+LARVAE (g)	INITIAL WEIGHT TIN (g)	TOTAL DRY WEIGHT OF LARVAE (g)	NUMBER OF LARVAE	DRY WEIGHT OF LARVAE (mg)	
CONTROL	A 86	0.934107	0.93147				AVG DRY
	B 87	0.931647	0.93322				WEIGHT (mg)
	C 88	0.93344	0.929460				
	D 89	0.927701	0.923609				CV
	E 90	0.930604	0.92780				
CONC: 32%	A 86	0.94358	0.93977				AVG DRY
	B 87	0.95182	0.94731				WEIGHT (mg)
	C 88	0.95066	0.94486				
	D 89	0.94930	0.94466				CV
	E 90	0.95158	0.94689				
CONC: 42%	A 91	0.94429	0.93950				AVG DRY
	B 92	0.94079	0.93532				WEIGHT (mg)
	C 93	0.94496	0.94018				
	D 94	0.94697	0.94186				CV
	E 95	0.94811	0.94280				
CONC: 56%	A 96	0.94356	0.93794				AVG DRY
	B 97	0.93946	0.93432				WEIGHT (mg)
	C 98	0.95048	0.94427				
	D 99	0.94123	0.93691				CV
	E 100	0.94334	0.93699				
CONC: 75%	A 101	0.94428	0.93898				AVG DRY
	B 102	0.94273	0.93675				WEIGHT (mg)
	C 103	0.95596	0.95164				
	D 104	0.94128	0.93582				CV
	E 105	0.95292	0.94683				
CONC: 100%	A 106	0.94192	0.93683				AVG DRY
	B 107	0.94794	0.94338				WEIGHT (mg)
	C 108	0.93897	0.93453				
	D 109	0.94844	0.94264				CV
	E 110	0.94446	0.93815				

CV = (STANDARD DEVIATION/MEAN)*100

REMARKS:

AA# K506197, FATHEAD MINNOW SURVIVAL, 6-6-05
File: k506197s Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.074

W = 0.760

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# K506197, FATHEAD MINNOW SURVIVAL, 6-6-05
File: k506197s 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# K506197, FATHEAD MINNOW SURVIVAL, 6-6-05
FILE: k506197s
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	0.9000	1.2490
3	42 % EFLLUENT	3	0.9000	1.2490
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	0.9000	1.2490
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	0.9000	1.2490

AA# K506197, FATHEAD MINNOW SURVIVAL, 6-6-05
File: k506197s 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	1.347	22.50	16.00	5.00	
4	56 % EFFLUENT	1.412	27.50	16.00	5.00	
5	75 % EFFLUENT	1.379	25.00	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 # K506197, FATHEAD MINNOW GROWTH, 06-09-05
'ile: k506197g Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.073

I = 0.945

Critical W (P = 0.05) (n = 30) = 0.927
Critical W (P = 0.01) (n = 30) = 0.900

)ata PASS normality test at P=0.01 level. Continue analysis.

AA # K506197, FATHEAD MINNOW GROWTH, 06-09-05
File: k506197g Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 3.40

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 # K506197, FATHEAD MINNOW GROWTH, 06-09-05
FILE: k506197g
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.3200	0.3200
1	CONTROL	2	0.3250	0.3250
1	CONTROL	3	0.3980	0.3980
1	CONTROL	4	0.3320	0.3320
1	CONTROL	5	0.2840	0.2840
2	32 % EFFLUENT	1	0.3960	0.3960
2	32 % EFFLUENT	2	0.4600	0.4600
2	32 % EFFLUENT	3	0.4090	0.4090
2	32 % EFFLUENT	4	0.4390	0.4390
2	32 % EFFLUENT	5	0.4930	0.4930
3	42 % EFFLUENT	1	0.3440	0.3440
3	42 % EFFLUENT	2	0.3540	0.3540
3	42 % EFFLUENT	3	0.4350	0.4350
3	42 % EFFLUENT	4	0.4310	0.4310
3	42 % EFFLUENT	5	0.4780	0.4780
4	56 % EFFLUENT	1	0.4190	0.4190
4	56 % EFFLUENT	2	0.5450	0.5450
4	56 % EFFLUENT	3	0.4170	0.4170
4	56 % EFFLUENT	4	0.4670	0.4670
4	56 % EFFLUENT	5	0.5700	0.5700
5	75 % EFFLUENT	1	0.4450	0.4450
5	75 % EFFLUENT	2	0.4240	0.4240
5	75 % EFFLUENT	3	0.4080	0.4080
5	75 % EFFLUENT	4	0.5140	0.5140
5	75 % EFFLUENT	5	0.5850	0.5850
6	100 % EFFLUENT	1	0.4470	0.4470
6	100 % EFFLUENT	2	0.4760	0.4760
6	100 % EFFLUENT	3	0.3890	0.3890
6	100 % EFFLUENT	4	0.4450	0.4450
6	100 % EFFLUENT	5	0.3960	0.3960

AA # K506197, FATHEAD MINNOW GROWTH, 06-09-05
File: k506197g Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.075	0.015	4.941
Within (Error)	24	0.073	0.003	
Total	29	0.149		

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

AA # K506197, FATHEAD MINNOW GROWTH, 06-09-05
File: k506197g 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	0.332	0.332		
2	32 % EFFLUENT	0.439	0.439	-3.078	
3	42 % EFFLUENT	0.408	0.408	-2.191	
4	56 % EFFLUENT	0.484	0.484	-4.342	
5	75 % EFFLUENT	0.475	0.475	-4.102	
6	100 % EFFLUENT	0.431	0.431	-2.826	

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

AA # K506197, FATHEAD MINNOW GROWTH, 06-09-05
File: k506197g 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	0.083	24.9	-0.108
3	42 % EFFLUENT	5	0.083	24.9	-0.077
4	56 % EFFLUENT	5	0.083	24.9	-0.152
5	75 % EFFLUENT	5	0.083	24.9	-0.143
6	100 % EFFLUENT	5	0.083	24.9	-0.099

AA# K506197, UV TREATED FATHEAD MINNOW SURVIVAL, 6-6-05
File: c:\toxstat\weston\K506197S. Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.085

I = 0.596

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# K506197, UV TREATED FATHEAD MINNOW SURVIVAL, 6-6-05
File: c:\toxstat\weston\K506197S. 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# K506197, UV TREATED FATHEAD MINNOW SURVIVAL, 6-6-05
FILE: c:\toxstat\weston\K506197S.
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	0.9000	1.2490
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	0.9000	1.2490
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	0.9000	1.2490
4	56 % EFFLUENT	3	1.0000	1.4120
4	56 % EFFLUENT	4	1.0000	1.4120
4	56 % EFFLUENT	5	1.0000	1.4120
5	75 % EFFLUENT	1	1.0000	1.4120
5	75 % EFFLUENT	2	1.0000	1.4120
5	75 % EFFLUENT	3	1.0000	1.4120
5	75 % EFFLUENT	4	1.0000	1.4120
5	75 % EFFLUENT	5	1.0000	1.4120
6	100 % EFFLUENT	1	1.0000	1.4120
6	100 % EFFLUENT	2	0.9000	1.2490
6	100 % EFFLUENT	3	1.0000	1.4120
6	100 % EFFLUENT	4	1.0000	1.4120
6	100 % EFFLUENT	5	1.0000	1.4120

AA# K506197, UV TREATED FATHEAD MINNOW SURVIVAL, 6-6-05
File: c:\toxstat\weston\K506197S. 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 % EFLLUENT	1.379	25.00	16.00	5.00	
4	56 % EFFLUENT	1.379	25.00	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 # K506197, UV TREATED FATHEAD MINNOW GROWTH, 6-9-05
File: k506197g Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.105

W = 0.971

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 # K506197, UV TREATED FATHEAD MINNOW GROWTH, 6-9-05
File: k506197g Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 4.52

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 # K506197, UV TREATED FATHEAD MINNOW GROWTH, 6-9-05
FILE: k506197g
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.3200	0.3200
1	CONTROL	2	0.3250	0.3250
1	CONTROL	3	0.3980	0.3980
1	CONTROL	4	0.3320	0.3320
1	CONTROL	5	0.2840	0.2840
2	32 % EFFLUENT	1	0.3810	0.3810
2	32 % EFFLUENT	2	0.4510	0.4510
2	32 % EFFLUENT	3	0.5800	0.5800
2	32 % EFFLUENT	4	0.4640	0.4640
2	32 % EFFLUENT	5	0.4690	0.4690
3	42 % EFFLUENT	1	0.4740	0.4740
3	42 % EFFLUENT	2	0.5470	0.5470
3	42 % EFFLUENT	3	0.4780	0.4780
3	42 % EFFLUENT	4	0.5110	0.5110
3	42 % EFFLUENT	5	0.5310	0.5310
4	56 % EFFLUENT	1	0.5620	0.5620
4	56 % EFFLUENT	2	0.5140	0.5140
4	56 % EFFLUENT	3	0.6210	0.6210
4	56 % EFFLUENT	4	0.4320	0.4320
4	56 % EFFLUENT	5	0.6350	0.6350
5	75 % EFFLUENT	1	0.5300	0.5300
5	75 % EFFLUENT	2	0.5980	0.5980
5	75 % EFFLUENT	3	0.4320	0.4320
5	75 % EFFLUENT	4	0.5460	0.5460
5	75 % EFFLUENT	5	0.6090	0.6090
6	100 % EFFLUENT	1	0.5090	0.5090
6	100 % EFFLUENT	2	0.4560	0.4560
6	100 % EFFLUENT	3	0.4440	0.4440
6	100 % EFFLUENT	4	0.5800	0.5800
6	100 % EFFLUENT	5	0.6310	0.6310

AA # K506197, UV TREATED FATHEAD MINNOW GROWTH, 6-9-05
File: k506197g Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.168	0.034	7.723
Within (Error)	24	0.105	0.004	
Total	29	0.273		

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

AA # K506197, UV TREATED FATHEAD MINNOW GROWTH, 6-9-05
File: k506197g 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	0.332	0.332		
2	32 % EFFLUENT	0.469	0.469	-3.285	
3	42 % EFFLUENT	0.508	0.508	-4.223	
4	56 % EFFLUENT	0.553	0.553	-5.291	
5	75 % EFFLUENT	0.543	0.543	-5.056	
6	100 % EFFLUENT	0.524	0.524	-4.601	

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

AA # K506197, UV TREATED FATHEAD MINNOW GROWTH, 6-9-05
File: k506197g 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	0.099	29.7	-0.137
3	42 % EFFLUENT	5	0.099	29.7	-0.176
4	56 % EFFLUENT	5	0.099	29.7	-0.221
5	75 % EFFLUENT	5	0.099	29.7	-0.211
6	100 % EFFLUENT	5	0.099	29.7	-0.192

APPENDIX D

Ceriodaphnia dubia Raw Data and Statistics

Ceriodaphnia dubia **SURVIVAL AND REPRODUCTION TEST**

Discharger:
Location: Western
Date Sample Collected: see COC

Lab Number/s
K506197

Analyst: TLT, TB, Mg
Test Start-Date/Time: 6-9-05/1120
Test Stop-Date/Time: 6-15-05/0850

Conc 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	TLT
2	0	0	0	0	0	0	0	0	0	0	0	10	0	TB
3	0	0	0	0	0	3	0	0	0	3	6	10	0.6	TB
4	3	4	4	4	7	1	4	5	4	6	42	10	4.2	mg
5	7	9	7	10	0	8	7	9	10	2	69	10	6.9	mg
6	12	10	0	9	12	14	10	9	0	12	88	10	8.8	mg
7														
8														
Total	22	23	11	23	19	26	21	23	14	23	205	$\bar{X}$ = 20.5		

control

70% 2nd brood
CV = ~~45%~~ 22.4%

Conc 2

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	TLT
2	0	0	0	0	0	0	0	0	0	0	0	10	0	TB
3	0	0	4	0	4	0	0	0	0	4	12	10	1.2	TB
4	4	3	0	5	8	1	4	3	0	9	37	10	3.7	mg
5	7	5	9	10	0	8	6	9	10	1	65	10	6.5	mg
6	0	2	5	10	12	7	10	9	11	13	79	10	7.9	mg
7														
8														
Total	11	10	18	25	24	16	20	21	21	27	193			

32

Conc 3

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	TLT
2	0	0	0	0	0	0	0	0	0	0	0	10	0	TB
3	0	0	0	0	0	5	0	0	3	4	12	10	1.2	TB
4	5	4	4	4	0	0	4	4	0	8	42	10	4.2	mg
5	7	7	9	7	0	10	8	9	9	5	71	10	7.1	mg
6	2	0	7	10	7	9	8	10	11	3	67	10	6.7	mg
7														
8														
Total	14	11	20	21	16	24	20	23	23	20	192			

42

Conc 4

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	TLT
2	0	0	0	0	0	0	0	0	0	0	0	10	0	TB
3	0	0	0	0	4	4	0	0	0	4	12	10	1.2	TB
4	3	5	5	4	6	0	4	3	3	0	33	10	3.3	mg
5	8	6	8	1	10	0	8	7	11	9	68	10	6.8	mg
6	4	0	10	14	13	12	10	9	10	11	93	10	9.3	mg
7														
8														
Total	15	11	23	19	33	16	22	19	24	24	206			

56

Conc 5

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	TLT
2	0	0	0	0	0	0	0	0	0	0	0	10	0	TB
3	0	0	0	0	4	1	0	0	5	4	14	10	1.4	TB
4	3	2	4	4	6	1	4	5	0	6	35	10	3.5	mg
5	9	1	8	9	0	9	11	11	7	0	65	10	6.5	mg
6	4	0	13	16	10	12	11	10	9	5	90	10	9	mg
7														
8														
Total	16	3	25	29	20	23	26	26	21	15	204			

75

Conc 6

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	TLT
2	0	0	0	0	0	0	0	0	0	0	0	10	0	TB
3	0	0	0	0	0	1	0	0	4	3	8	10	0.8	TB
4	3	4	3	5	7	1	4	5	0	0	32	10	3.2	mg
5	6	10	8	7	0	6	9	9	8	8	71	10	7.1	mg
6	6	2	5	7	12	9	10	13	11	12	87	10	8.7	mg
7														
8														
Total	15	16	16	19	19	17	23	27	23	23	193			

100

20.2%
CV = ~~27.5%~~
$\bar{X}$ = 19.8

X=DEAD; Y=MALE

Ceriodaphnia dubia — **SURVIVAL AND REPRODUCTION TEST**

Discharger:
Location: Weston UV
Date Sample Collected: See COC

Lab Number/s: K506197

Analyst: TLT, TB, mg
Test Start-Date/Time: 10-9-05/1145
Test Stop-Date/Time: 10-15-05/0910

Conc 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	TLT
2	0	0	0	0	0	0	0	0	0	0	0	10	0	TB
3	0	0	0	0	0	0	0	0	0	0	0	10	0	TB
4	7	5	3	3	4	5	5	5	4	4	45	10	4.5	mg
5	5	6	6	8	12	7	8	7	9	11	79	10	7.9	mg
6	1	10	9	6	10	11	12	11	10	10	80	10	8.0	mg
7														
8												80% 3rd brood		
Total	13	21	18	17	26	23	25	23	23	15	204	$\bar{Y}$=20.4 CV=21.6%		

Control

Conc 2

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	TLT
2	0	0	0	0	0	0	0	0	0	0	0	10	0	TB
3	0	0	0	0	0	0	0	0	0	0	0	10	0	TB
4	4	2	0	7	2	1	4	5	4	0	24	10	2.4	mg
5	6	7	7	7	7	9	8	8	6	10	76	10	7.6	mg
6	10	12	13	14	10	10	11	0	0	14	94	10	9.4	mg
7														
8														
Total	20	21	21	23	19	20	23	13	10	24	194			

32

Conc 3

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	TLT
2	0	0	0	0	0	0	0	0	0	0	0	10	0	TB
3	0	0	0	0	0	0	0	0	0	0	0	10	0	TB
4	6	0	5	4	3	4	4	4	4	6	40	10	4	mg
5	7	7	6	7	8	12	9	7	10	8	81	10	8.1	mg
6	10	15	10	0	10	2	7	8	9	10	81	10	8.1	mg
7														
8														
Total	23	22	21	11	21	18	20	19	23	24	202			

42

Conc 4

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	TLT
2	0	0	0	0	0	0	0	0	0	0	0	10	0	TB
3	0	0	0	0	0	0	0	0	0	0	0	10	0	TB
4	5	0	4	2	7	2	3	3	0	3	29	10	2.9	mg
5	6	5	8	7	2	8	9	8	0	12	63	10	6.3	mg
6	11	13	11	8	12	13	11	7	0	2	88	10	8.8	mg
7														
8														
Total	22	18	23	17	19	23	23	18	0	17	180			

54

Conc 5

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	TLT
2	0	0	0	0	0	X	0	0	0	0	0	9	0	TB
3	0	0	0	0	0	–	0	0	0	0	0	9	0	TB
4	X0	0	1	5	4	–	3	5	5	5	28	8	3.1	mg
5	–	9	6	9	7	–	8	9	11	9	68	8	8.5	mg
6	–	14	12	10	11	–	9	10	13	3	82	8	10	mg
7														
8														
Total	X0	23	19	24	22	X0	20	24	29	17	178			

75

Conc 6

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adults	Young/ Adult	Analyst
1	0	0	0	X	0	0	0	0	0	0	0	9	0	TLT
2	0	0	0	–	0	0	0	0	0	0	0	9	0	TB
3	0	0	0	–	0	0	0	0	0	0	0	9	0	TB
4	4	4	3	–	2	4	4	4	0	4	29	9	3.2	mg
5	7	9	5	–	7	8	8	10	10	7	72	9	8.0	mg
6	11	10	10	–	8	7	13	10	0	4	73	9	8.1	mg
7														
8														
Total	22	23	18	X0	17	19	25	22	10	18	174	$\bar{Y}$=19.3		

100

CV=22.8%

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	

TITLE: AA# K506197, C DUBIA REPRODUCTION, 06-09-05
FILE: k506197c
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	22.0000	22.0000
1	CONTROL	2	23.0000	23.0000
1	CONTROL	3	11.0000	11.0000
1	CONTROL	4	23.0000	23.0000
1	CONTROL	5	19.0000	19.0000
1	CONTROL	6	26.0000	26.0000
1	CONTROL	7	21.0000	21.0000
1	CONTROL	8	23.0000	23.0000
1	CONTROL	9	14.0000	14.0000
1	CONTROL	10	23.0000	23.0000
2	32 % EFFLUENT	1	11.0000	11.0000
2	32 % EFFLUENT	2	10.0000	10.0000
2	32 % EFFLUENT	3	18.0000	18.0000
2	32 % EFFLUENT	4	25.0000	25.0000
2	32 % EFFLUENT	5	24.0000	24.0000
2	32 % EFFLUENT	6	16.0000	16.0000
2	32 % EFFLUENT	7	20.0000	20.0000
2	32 % EFFLUENT	8	21.0000	21.0000
2	32 % EFFLUENT	9	21.0000	21.0000
2	32 % EFFLUENT	10	27.0000	27.0000
3	42 % EFFLUENT	1	14.0000	14.0000
3	42 % EFFLUENT	2	11.0000	11.0000
3	42 % EFFLUENT	3	20.0000	20.0000
3	42 % EFFLUENT	4	21.0000	21.0000
3	42 % EFFLUENT	5	16.0000	16.0000
3	42 % EFFLUENT	6	24.0000	24.0000
3	42 % EFFLUENT	7	20.0000	20.0000
3	42 % EFFLUENT	8	23.0000	23.0000
3	42 % EFFLUENT	9	23.0000	23.0000
3	42 % EFFLUENT	10	20.0000	20.0000
4	56 % EFFLUENT	1	15.0000	15.0000
4	56 % EFFLUENT	2	11.0000	11.0000
4	56 % EFFLUENT	3	23.0000	23.0000
4	56 % EFFLUENT	4	19.0000	19.0000
4	56 % EFFLUENT	5	33.0000	33.0000
4	56 % EFFLUENT	6	16.0000	16.0000
4	56 % EFFLUENT	7	22.0000	22.0000
4	56 % EFFLUENT	8	19.0000	19.0000
4	56 % EFFLUENT	9	24.0000	24.0000
4	56 % EFFLUENT	10	24.0000	24.0000
5	75 % EFFLUENT	1	16.0000	16.0000
5	75 % EFFLUENT	2	3.0000	3.0000
5	75 % EFFLUENT	3	25.0000	25.0000
5	75 % EFFLUENT	4	29.0000	29.0000
5	75 % EFFLUENT	5	20.0000	20.0000
5	75 % EFFLUENT	6	23.0000	23.0000
5	75 % EFFLUENT	7	26.0000	26.0000
5	75 % EFFLUENT	8	26.0000	26.0000
5	75 % EFFLUENT	9	21.0000	21.0000

5	75	%	EFFLUENT	10	15.0000	15.0000
6	100	%	EFFLUENT	1	15.0000	15.0000
6	100	%	EFFLUENT	2	16.0000	16.0000
6	100	%	EFFLUENT	3	16.0000	16.0000
6	100	%	EFFLUENT	4	19.0000	19.0000
6	100	%	EFFLUENT	5	19.0000	19.0000
6	100	%	EFFLUENT	6	17.0000	17.0000
6	100	%	EFFLUENT	7	23.0000	23.0000
6	100	%	EFFLUENT	8	27.0000	27.0000
6	100	%	EFFLUENT	9	23.0000	23.0000
6	100	%	EFFLUENT	10	23.0000	23.0000

```
AA# K506197, C DUBIA REPRODUCTION, 06-09-05
'ile: k506197c        Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality
 ---------------------------------------------------------------------------

        ******** Shapiro - Wilk's Test is aborted ********

 'his test can not be performed because total number of replicates
ıs greater than 50.

 'otal number of replicates =   60

---------------------------------------------------------------------------
```

AA# K506197, C DUBIA REPRODUCTION, 06-09-05
File: k506197c Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 5.32

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# K506197, C DUBIA REPRODUCTION, 06-09-05
FILE: k506197c
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	22.0000	22.0000
1	CONTROL	2	23.0000	23.0000
1	CONTROL	3	11.0000	11.0000
1	CONTROL	4	23.0000	23.0000
1	CONTROL	5	19.0000	19.0000
1	CONTROL	6	26.0000	26.0000
1	CONTROL	7	21.0000	21.0000
1	CONTROL	8	23.0000	23.0000
1	CONTROL	9	14.0000	14.0000
1	CONTROL	10	23.0000	23.0000
2	32 % EFFLUENT	1	11.0000	11.0000
2	32 % EFFLUENT	2	10.0000	10.0000
2	32 % EFFLUENT	3	18.0000	18.0000
2	32 % EFFLUENT	4	25.0000	25.0000
2	32 % EFFLUENT	5	24.0000	24.0000
2	32 % EFFLUENT	6	16.0000	16.0000
2	32 % EFFLUENT	7	20.0000	20.0000
2	32 % EFFLUENT	8	21.0000	21.0000
2	32 % EFFLUENT	9	21.0000	21.0000
2	32 % EFFLUENT	10	27.0000	27.0000
3	42 % EFFLUENT	1	14.0000	14.0000
3	42 % EFFLUENT	2	11.0000	11.0000
3	42 % EFFLUENT	3	20.0000	20.0000
3	42 % EFFLUENT	4	21.0000	21.0000
3	42 % EFFLUENT	5	16.0000	16.0000
3	42 % EFFLUENT	6	24.0000	24.0000
3	42 % EFFLUENT	7	20.0000	20.0000
3	42 % EFFLUENT	8	23.0000	23.0000
3	42 % EFFLUENT	9	23.0000	23.0000
3	42 % EFFLUENT	10	20.0000	20.0000
4	56 % EFFLUENT	1	15.0000	15.0000
4	56 % EFFLUENT	2	11.0000	11.0000
4	56 % EFFLUENT	3	23.0000	23.0000
4	56 % EFFLUENT	4	19.0000	19.0000
4	56 % EFFLUENT	5	33.0000	33.0000
4	56 % EFFLUENT	6	16.0000	16.0000
4	56 % EFFLUENT	7	22.0000	22.0000
4	56 % EFFLUENT	8	19.0000	19.0000
4	56 % EFFLUENT	9	24.0000	24.0000
4	56 % EFFLUENT	10	24.0000	24.0000
5	75 % EFFLUENT	1	16.0000	16.0000
5	75 % EFFLUENT	2	3.0000	3.0000
5	75 % EFFLUENT	3	25.0000	25.0000
5	75 % EFFLUENT	4	29.0000	29.0000
5	75 % EFFLUENT	5	20.0000	20.0000
5	75 % EFFLUENT	6	23.0000	23.0000
5	75 % EFFLUENT	7	26.0000	26.0000
5	75 % EFFLUENT	8	26.0000	26.0000
5	75 % EFFLUENT	9	21.0000	21.0000

5	75	%	EFFLUENT	10	15.0000	15.0000
6	100	%	EFFLUENT	1	15.0000	15.0000
6	100	%	EFFLUENT	2	16.0000	16.0000
6	100	%	EFFLUENT	3	16.0000	16.0000
6	100	%	EFFLUENT	4	19.0000	19.0000
6	100	%	EFFLUENT	5	19.0000	19.0000
6	100	%	EFFLUENT	6	17.0000	17.0000
6	100	%	EFFLUENT	7	23.0000	23.0000
6	100	%	EFFLUENT	8	27.0000	27.0000
6	100	%	EFFLUENT	9	23.0000	23.0000
6	100	%	EFFLUENT	10	23.0000	23.0000

AA# K506197, C DUBIA REPRODUCTION, 06-09-05
File: k506197c Transform: NO TRANSFORMATION

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

ROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	20.500				
2	32 % EFFLUENT	19.300	97.50	75.00	10.00	
3	42 % EFFLUENT	19.200	94.50	75.00	10.00	
4	56 % EFFLUENT	20.600	104.00	75.00	10.00	
5	75 % EFFLUENT	20.400	110.50	75.00	10.00	
6	100 % EFFLUENT	19.800	99.00	75.00	10.00	

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

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

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
75% effluent	8	2	10
TOTAL	18	2	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 8.
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	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
100% effluent	9	1	10
TOTAL	19	1	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 9.
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	2	
5	100% effluent	10	1	

AA# K506197, UV Treated C DUBIA REPRODUCTION, 6-9-05
File: C:\TOXSTAT\WESTON\K506197C. 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# K506197, UV Treated C DUBIA REPRODUCTION, 6-9-05
File: C:\TOXSTAT\WESTON\K506197C. Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 12.23

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# K506197, UV Treated C DUBIA REPRODUCTION, 6-9-05
FILE: C:\TOXSTAT\WESTON\K506197C.
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	13.0000	13.0000
1	CONTROL	2	21.0000	21.0000
1	CONTROL	3	18.0000	18.0000
1	CONTROL	4	17.0000	17.0000
1	CONTROL	5	26.0000	26.0000
1	CONTROL	6	23.0000	23.0000
1	CONTROL	7	25.0000	25.0000
1	CONTROL	8	23.0000	23.0000
1	CONTROL	9	23.0000	23.0000
1	CONTROL	10	15.0000	15.0000
2	32 % EFFLUENT	1	20.0000	20.0000
2	32 % EFFLUENT	2	21.0000	21.0000
2	32 % EFFLUENT	3	21.0000	21.0000
2	32 % EFFLUENT	4	23.0000	23.0000
2	32 % EFFLUENT	5	19.0000	19.0000
2	32 % EFFLUENT	6	20.0000	20.0000
2	32 % EFFLUENT	7	23.0000	23.0000
2	32 % EFFLUENT	8	13.0000	13.0000
2	32 % EFFLUENT	9	10.0000	10.0000
2	32 % EFFLUENT	10	24.0000	24.0000
3	42 % EFFLUENT	1	23.0000	23.0000
3	42 % EFFLUENT	2	22.0000	22.0000
3	42 % EFFLUENT	3	21.0000	21.0000
3	42 % EFFLUENT	4	11.0000	11.0000
3	42 % EFFLUENT	5	21.0000	21.0000
3	42 % EFFLUENT	6	18.0000	18.0000
3	42 % EFFLUENT	7	20.0000	20.0000
3	42 % EFFLUENT	8	19.0000	19.0000
3	42 % EFFLUENT	9	23.0000	23.0000
3	42 % EFFLUENT	10	24.0000	24.0000
4	56 % EFFLUENT	1	22.0000	22.0000
4	56 % EFFLUENT	2	18.0000	18.0000
4	56 % EFFLUENT	3	23.0000	23.0000
4	56 % EFFLUENT	4	17.0000	17.0000
4	56 % EFFLUENT	5	19.0000	19.0000
4	56 % EFFLUENT	6	23.0000	23.0000
4	56 % EFFLUENT	7	23.0000	23.0000
4	56 % EFFLUENT	8	18.0000	18.0000
4	56 % EFFLUENT	9	0.0000	0.0000
4	56 % EFFLUENT	10	17.0000	17.0000
5	75 % EFFLUENT	1	0.0000	0.0000
5	75 % EFFLUENT	2	23.0000	23.0000
5	75 % EFFLUENT	3	19.0000	19.0000
5	75 % EFFLUENT	4	24.0000	24.0000
5	75 % EFFLUENT	5	22.0000	22.0000
5	75 % EFFLUENT	6	0.0000	0.0000
5	75 % EFFLUENT	7	20.0000	20.0000
5	75 % EFFLUENT	8	24.0000	24.0000
5	75 % EFFLUENT	9	29.0000	29.0000

5	75	%	EFFLUENT	10	17.0000	17.0000
6	100	%	EFFLUENT	1	22.0000	22.0000
6	100	%	EFFLUENT	2	23.0000	23.0000
6	100	%	EFFLUENT	3	18.0000	18.0000
6	100	%	EFFLUENT	4	0.0000	0.0000
6	100	%	EFFLUENT	5	17.0000	17.0000
6	100	%	EFFLUENT	6	19.0000	19.0000
6	100	%	EFFLUENT	7	25.0000	25.0000
6	100	%	EFFLUENT	8	22.0000	22.0000
6	100	%	EFFLUENT	9	10.0000	10.0000
6	100	%	EFFLUENT	10	18.0000	18.0000

AA# K506197, UV Treated C DUBIA REPRODUCTION, 6-9-05
File: C:\TOXSTAT\WESTON\K506197C. Transform: NO TRANSFORMATION

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

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	20.400				
2	32 % EFFLUENT	19.400	97.50	75.00	10.00	
3	42 % EFFLUENT	20.200	101.50	75.00	10.00	
4	56 % EFFLUENT	18.000	95.50	75.00	10.00	
5	75 % EFFLUENT	17.800	103.00	75.00	10.00	
6	100 % EFFLUENT	17.400	93.50	75.00	10.00	

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

APPENDIX E

Organism History

AQUATOX, INC.

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

TEST ORGANISM HISTORY

DATE SHIPPED 6-9-05 Arkansas Analytical

SPECIES Pimephales promelas

QUANTITY SHIPPED 1,100+

AGE/LIFE STAGE 24 hrs 6/9 1500 ct

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

Aquatic Research Organisms

DATA SHEET

I. Organism History

Species: Ceriodaphnia dubia

Source: Lab reared X Hatchery reared _____ Field collected _____

Hatch date 01/05 Receipt date _____

Lot number 02 07 05 CD Strain ARO

Brood Origination EPA OH

II. Water Quality

Temperature 24 °C Salinity — ppt DO SAT

pH 7.4 Hardness ≈ 75 ppm

III. Culture Conditions

System: FW static renewal

Diet: Flake Food _____ Phytoplankton X Trout Chow _____

Brine Shrimp _____ Rotifers _____ Other YCT

Prophylactic Treatments: _____

Comments: All gravid as of 2:00pm EST

IV. Shipping Information

Client: Arkansas Analytical # of Organisms: Culture

Carrier: Fed Ex Date Shipped: 2/7/05

Biologist: _____

1 - 800 - 927 - 1650

PO Box 1271 • One Lafayette Road • Hampton, NH 03842 • (603) 926-1650

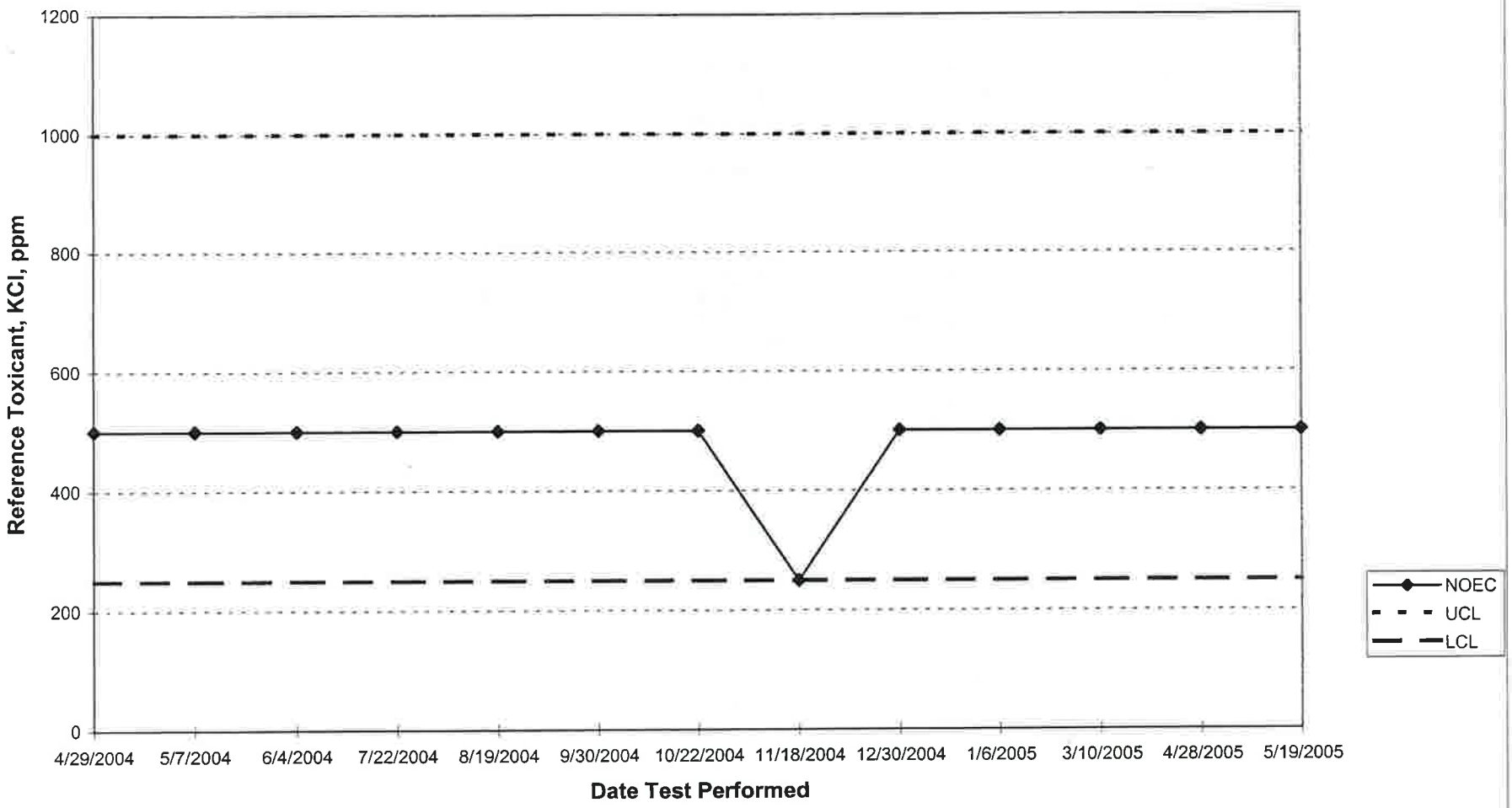
APPENDIX F

Quality Assurance Charts

ARKANSAS ANALYTICAL, INC.

FATHEAD MINNOW SURVIVAL

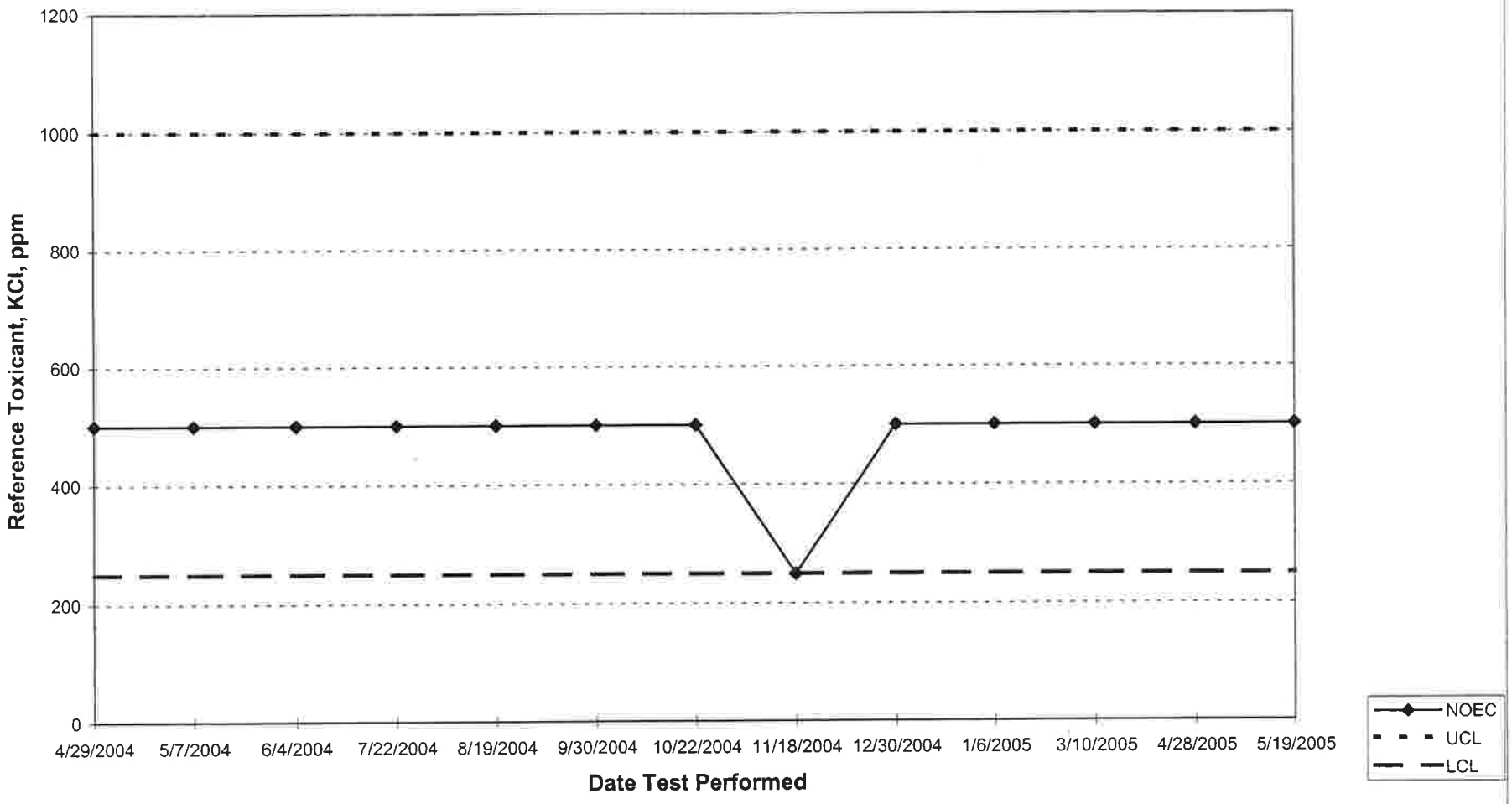
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

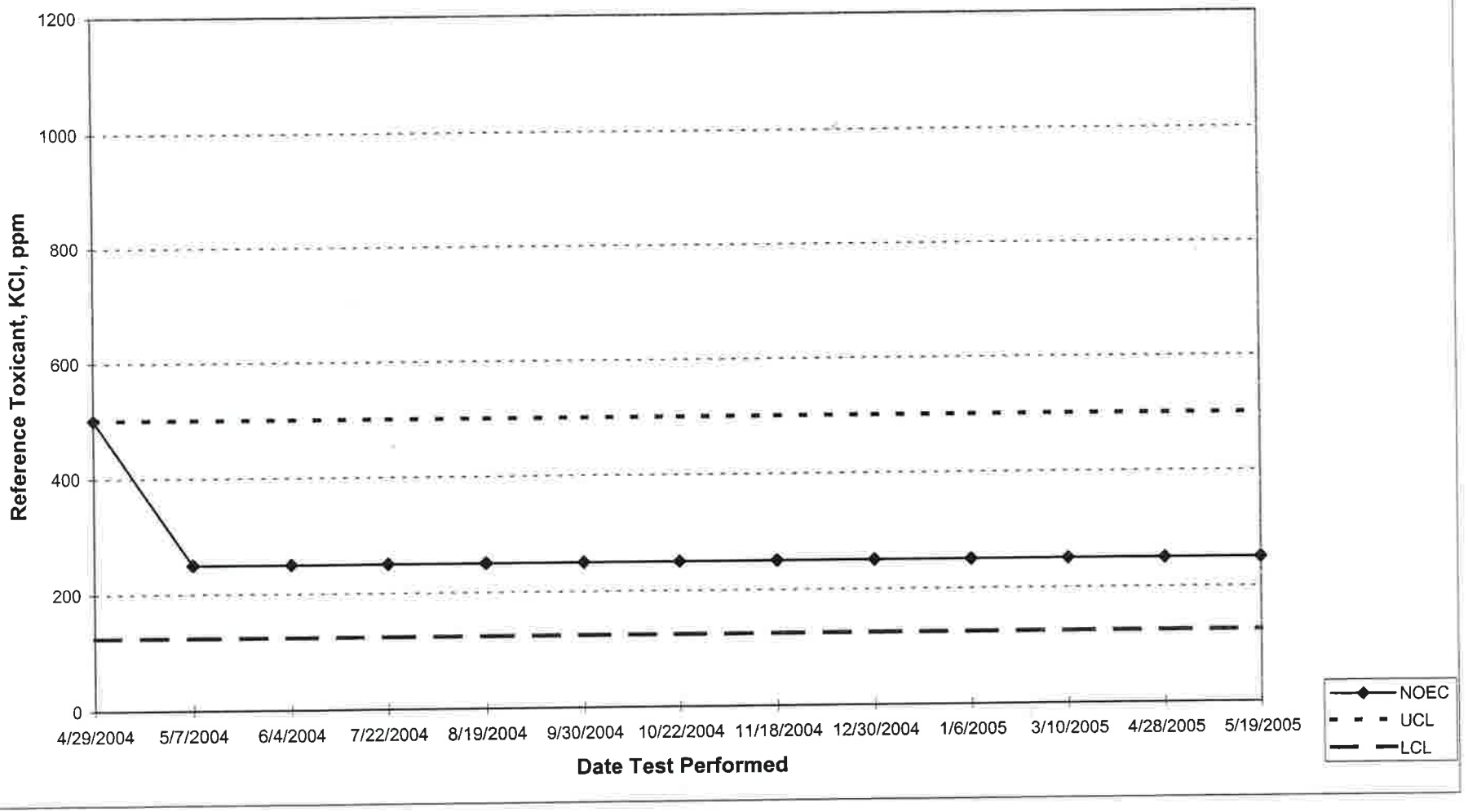
FATHEAD MINNOW GROWTH

QUALITY ASSURANCE



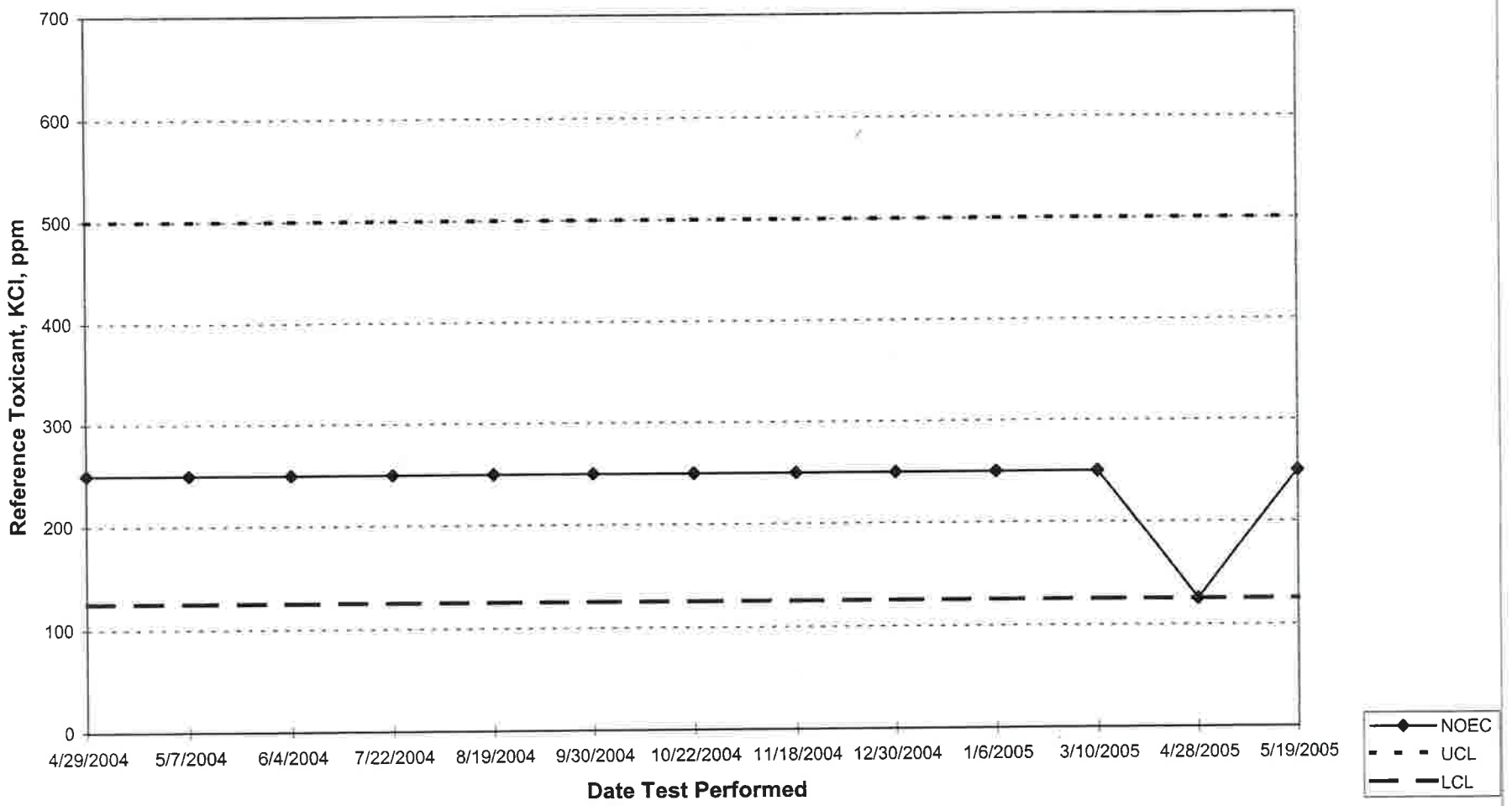
ARKANSAS ANALYTICAL, INC.

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

Arkansas Analytical, Inc.

Little Rock, AR

has earned certification by law in accordance with Code Annotated §8-2-201 et seq., the State Environmental Laboratory Certification Program Act for the following parameters:

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

Laboratory ID: **60-1754**

Certificate Number: **04-075-0**

Issued Date: **30 October 2004**

Expired Date: **30 October 2005**

J A Semlerski

ADEQ Quality Assurance Officer

Date October 27, 2004