

May 18, 2012

Test Results of
Second Quarter
Chronic 7-Day Renewal
Biomonitoring Testing
for
Outfall 001

Control No. 157593-1

Prepared for:

Mr. John Davis
Malvern Water Works
506 Overman
Malvern, AR 72104

Prepared by:

AMERICAN INTERPLEX CORPORATION
8600 Kanis Road
Little Rock, AR 72204-2322



Malvern Water Works
ATTN: Mr. John Davis
506 Overman
Malvern, AR 72104

Re: Chronic 7-Day Renewal utilizing *Pimephales promelas* (Fathead minnow)
- Outfall 001
NPDES Permit No. AR0034126 AFIN 30-00040

Dear Mr. John Davis:

This report is the analytical results and supporting information for the samples submitted to American Interplex Corporation (AIC). The following results are applicable only to the sample identified by the control number referenced above. Accurate assessment of the data requires access to the entire document. Each section of the report has been reviewed and approved by the laboratory director or qualified designee.

Testing procedures and Quality Assurance were in accordance with "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" EPA-821-R-02-013, Fourth Edition, October 2002. Test results are summarized below:

Method 1000.0 Chronic *Pimephales promelas* (Fathead minnow) Survival and Growth Test: The No Observable Effects Concentration (NOEC) for survival occurred at 8.5 % effluent, which is above the critical dilution of 6.5 %. The NOEC for growth occurred at 8.5 % effluent, which is above the critical dilution of 6.5 %. **The sample, therefore, PASSED both lethal and sub-lethal effects for the Fathead minnow test.**

AMERICAN INTERPLEX CORPORATION

A handwritten signature in black ink, appearing to read 'John Overbey', is written over a horizontal line.

John Overbey
Laboratory Director

PDF cc: Malvern Water Works
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Malvern Water Works
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I. Control Acceptance Criteria

Pimephales promelas (Fathead minnow) Method 1000.0

CRITERIA	RESULTS	PASS/FAIL
Control Survival > or = 80%	100	PASS
Control Growth > or = 0.25 mg per Surviving minnow	0.500	PASS
Control Growth CV < or = 40%	9.62	PASS
Growth Minimum Significant Difference 12 to 30%	13.5	PASS
Critical Dilution CV < or = 40%	13.7	PASS

II. Outlined Report

A. Introduction

1. Permit Number: AR0034126 AFIN 30-00040
2. Test Requirements: Test Method 1000.0
3. Receiving Stream: Ouachita River Basin

B. Source of Effluent/Dilution Water

1. Effluent Samples:
 - a. Sampling Point:
 - b. Chemical Data:

Analysis	Sample 1	Sample 2	Sample 3
Dissolved oxygen (mg/l)	7.5	8.0	7.9
pH (standard units)	5.4	5.7	7.1
Alkalinity (mg/l as CaCO ₃)	6.8	7.7	9.4
Hardness (mg/l as CaCO ₃)	36	34	35
Conductivity (umhos/cm)	120	120	180
Residual Chlorine (mg/l)	<0.05	<0.05	<0.05
Ammonia as N (mg/l)	0.58	0.14	0.26

2. Dilution Water Samples: Synthetic Laboratory Soft Water #4225

- a. Dates Prepared: April 26 through May 10, 2012
- b. Chemical Data:

Analysis	Sample 1	Sample 2	Sample 3
Dissolved oxygen (mg/l)	7.8	8.1	7.8
pH (standard units)	7.7	7.6	7.7
Alkalinity (mg/l as CaCO ₃)	31	31	31
Hardness (mg/l as CaCO ₃)	41	41	41
Conductivity (umhos/cm)	85	84	140
Residual Chlorine (mg/l)	<0.05	<0.05	<0.05

C. Test Methods

1. Test methods used:

Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, EPA-821-R-02-013; test Method 1000.0, Fathead Minnow Survival and Growth.

2. Endpoint: No Observable Effects Concentration (NOEC)

3. Test Conditions:

Pimephales promelas (Fathead minnow) Survival and Growth Method 1000.0

Date & Time Test Initiated: May 8, 2012 at 1615

Date & Time Test Terminated: May 15, 2012 at 1600

Type & Volume of Test Chamber: 500 ml disposable beaker

Volume of Sample: 250 ml

Number of Organisms per replicate: 8

Number of Replicates per dilution: 5

4. Acclimation of test organisms: Obtained from in-house cultures

5. Test Temperature: 25 +/- 1 degree Celsius

D. Test Organisms

1. Scientific Name

a. Test 1000.0 *Pimephales promelas*

III. Data Analysis

The data was analyzed using American Interplex Corporation's Laboratory Information Management Software based on Toxstat.

Pimephales promelas (Fathead minnow) survival data was transformed using the Arc Sine transformation. Normality and homogeneity of variance were checked using Shapiro-Wilk's. The survival data was then analyzed using Steel's Many-One Rank Test to determine the No Observable Effects Concentration (NOEC).

Fathead minnow growth data was analyzed for normality and homogeneity of variance using Shapiro-Wilk's and Bartlett's test. Dunnett's Test was used to determine the No Observable Effects Concentration (NOEC) for growth.

IV. Standard Reference Toxicants

American Interplex Corporation has an ongoing test organism culturing program. The sensitivity of the offspring is determined by performing a standard reference toxicant test with each effluent test. Sodium chloride in synthetic moderately hard water is used as prescribed in EPA-821-R-02-013.

Pimephales promelas (Fathead minnow)

Chronic reference tests are performed monthly.

A chronic reference test was performed on April 3, 2012 at 1600 to April 10, 2012 at 1500

The results were as follows: (Control No. 156622-2.)

Survival LC-50: 6157 mg/l

Growth IC-25: 5394 mg/l

Growth PMSD: 27.4

V. Chemical Analysis/Quality Control

Parameter	Method	% Recovery	Relative % Difference
Alkalinity	SM 2320 B	NA	0.00
Hardness	EPA 200.7	101	1.06
pH	SM 4500-H+ B	100	0.135
Conductivity	EPA 120.1	99.4	1.22

VI. Organism History

Pimephales promelas (Fathead minnow)

Date: May 8, 2012

Age: <24 hours

Source: In-house culture

Water Chemistry Record:

Alkalinity: 57-64 mg/l

Hardness: 80-100 mg/l

Temperature: 25 deg.C

VII. Results Summary *Pimephales promelas*, Fathead minnow Larval Survival and Growth Test -- Method 1000.0

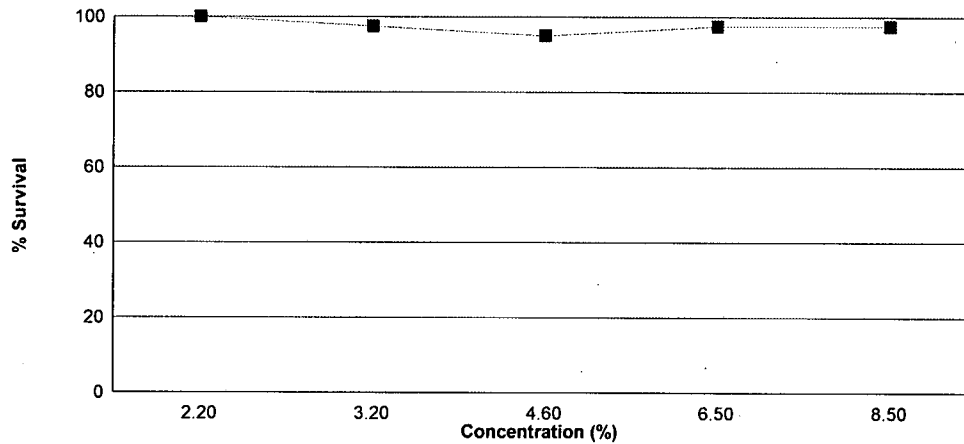
Larvae are exposed in a static renewal system for seven days to different concentrations of effluent with dilution water. Test results are based on the survival and growth (increase in weight) of the larvae.

Effluent dilutions for this test were 2.2 %, 3.2 %, 4.6 %, 6.5 %, 8.5 % in accordance with the NPDES permit.

The low flow or 'critical' dilution is specified in the NPDES permit as 6.5 % effluent.

The test was initiated on May 8, 2012 at 1615 and continued through May 15, 2012 at 1600. Statistical analyses were performed on the observed data and the no observable effects concentrations (NOECs) were as follows:

- a.) NOEC survival = 8.5 % effluent
- b.) NOEC growth = 8.5 % effluent



Summary of the 7-day Fathead Minnow Survival and Growth		
Concentration	Percent Survival	Mean Growth (mg)
Control	100	0.500
2.2 %	100	0.482
3.2 %	97.5	0.523
4.6 %	95.0	0.461
6.5 %	97.5	0.484
8.5 %	97.5	0.433

Appendix A1: Test 1000.0

Pimephales promelas (Fathead Minnow) 7-Day Survival

Date and Time Test Initiated: May 8, 2012 at 1615

Date and Time Test Terminated: May 15, 2012 at 1600

Concentration	Replicate	Number of Survivors						
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Control	A	8	8	8	8	8	8	8
	B	8	8	8	8	8	8	8
	C	8	8	8	8	8	8	8
	D	8	8	8	8	8	8	8
	E	8	8	8	8	8	8	8
2.2 %	A	8	8	8	8	8	8	8
	B	8	8	8	8	8	8	8
	C	8	8	8	8	8	8	8
	D	8	8	8	8	8	8	8
	E	8	8	8	8	8	8	8
3.2 %	A	8	8	8	8	7	7	7
	B	8	8	8	8	8	8	8
	C	8	8	8	8	8	8	8
	D	8	8	8	8	8	8	8
	E	8	8	8	8	8	8	8
4.6 %	A	8	8	8	8	8	8	8
	B	8	8	8	8	8	7	7
	C	8	8	8	8	8	8	8
	D	8	8	8	8	8	8	8
	E	8	8	7	7	7	7	7
6.5 %	A	8	8	8	8	8	8	8
	B	8	8	7	7	7	7	7
	C	8	8	8	8	8	8	8
	D	8	8	8	8	8	8	8
	E	8	8	8	8	8	8	8
8.5 %	A	8	8	8	8	8	8	8
	B	8	8	8	8	8	8	8
	C	8	8	8	7	7	7	7
	D	8	8	8	8	8	8	8
	E	8	8	8	8	8	8	8

Appendix A1: Test 1000.0

Pimephales promelas (Fathead Minnow) 7-Day Growth

Test Initiated: May 8, 2012 at 1615
Test Terminated: May 15, 2012 at 1600

Drying Started: May 14, 2012 at 1800
Drying Ended: May 16, 2012 at 1520

Concentration	Replicate	Weight of pan	Weight of pan + fish	Total weight of fish (g)	Original # of fish	Mean dry weight (mg)
Control	A	.95014	.95355	0.00341	8	0.426
	B	.95384	.95793	0.00409	8	0.511
	C	.96266	.96652	0.00386	8	0.482
	D	.95785	.96222	0.00437	8	0.546
	E	.96348	.96776	0.00428	8	0.535
2.2 %	A	.94074	.94420	0.00346	8	0.432
	B	.94438	.94807	0.00369	8	0.461
	C	.96442	.96850	0.00408	8	0.510
	D	.96447	.96853	0.00406	8	0.508
	E	.94746	.95145	0.00399	8	0.499
3.2 %	A	.96458	.96801	0.00343	8	0.429
	B	.96378	.96842	0.00464	8	0.580
	C	.96331	.96753	0.00422	8	0.528
	D	.96269	.96688	0.00419	8	0.524
	E	.96388	.96833	0.00445	8	0.556
4.6 %	A	.96335	.96710	0.00375	8	0.469
	B	.96168	.96518	0.00350	8	0.438
	C	.96034	.96418	0.00384	8	0.480
	D	.95837	.96185	0.00348	8	0.435
	E	.95910	.96295	0.00385	8	0.481
6.5 %	A	.95787	.96110	0.00323	8	0.404
	B	.95605	.95973	0.00368	8	0.460
	C	.94863	.95287	0.00424	8	0.530
	D	.94542	.94999	0.00457	8	0.571
	E	.94221	.94585	0.00364	8	0.455
8.5 %	A	.94060	.94402	0.00342	8	0.428
	B	.94005	.94334	0.00329	8	0.411
	C	.94020	.94373	0.00353	8	0.441
	D	.94176	.94553	0.00377	8	0.471
	E	.94061	.94391	0.00330	8	0.412

Appendix A2: Statistics

Pimephales promelas (Fathead minnow) Survival

Transformation of Data			Transform: Arc Sin(Square Root(Y))	
Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.39310
1	Control	2	1.00000	1.39310
1	Control	3	1.00000	1.39310
1	Control	4	1.00000	1.39310
1	Control	5	1.00000	1.39310
2	2.2 %	1	1.00000	1.39310
2	2.2 %	2	1.00000	1.39310
2	2.2 %	3	1.00000	1.39310
2	2.2 %	4	1.00000	1.39310
2	2.2 %	5	1.00000	1.39310
3	3.2 %	1	0.87500	1.20940
3	3.2 %	2	1.00000	1.39310
3	3.2 %	3	1.00000	1.39310
3	3.2 %	4	1.00000	1.39310
3	3.2 %	5	1.00000	1.39310
4	4.6 %	1	1.00000	1.39310
4	4.6 %	2	0.87500	1.20940
4	4.6 %	3	1.00000	1.39310
4	4.6 %	4	1.00000	1.39310
4	4.6 %	5	0.87500	1.20940
5	6.5 %	1	1.00000	1.39310
5	6.5 %	2	0.87500	1.20940
5	6.5 %	3	1.00000	1.39310
5	6.5 %	4	1.00000	1.39310
5	6.5 %	5	1.00000	1.39310
6	8.5 %	1	1.00000	1.39310
6	8.5 %	2	1.00000	1.39310
6	8.5 %	3	0.87500	1.20940
6	8.5 %	4	1.00000	1.39310
6	8.5 %	5	1.00000	1.39310

Appendix A2: Statistics

Pimephales promelas (Fathead minnow) Survival

Shapiro - Wilk's Test for Normality		Transform: Arc Sin(Square Root(Y))
<p>D = 0.1215 W = 0.7519 Critical W = 0.9 (alpha = 0.01, N = 30) Critical W = 0.927 (alpha = 0.05, N = 30)</p> <p>Data FAIL normality test (alpha = 0.01).</p>		

Steel's Many-One Rank Test				Transform: Arc Sin(Square Root(Y))	
Ho: Control < Treatment					
Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	2.2 %	27.50	16.00	5.00	
3	3.2 %	25.00	16.00	5.00	
4	4.6 %	22.50	16.00	5.00	
5	6.5 %	25.00	16.00	5.00	
6	8.5 %	25.00	16.00	5.00	
Critical values are 1 tailed (k=5)					

Appendix A2: Statistics

Pimephales promelas (Fathead minnow) Growth

Shapiro - Wilk's Test for Normality	No Transformation
<p>D = 0.04914 W = 0.9713 Critical W = 0.9 (alpha = 0.01, N = 30) Critical W = 0.927 (alpha = 0.05, N = 30)</p> <p>Data PASS normality test (alpha = 0.01).</p>	

Bartlett's Test for Homogeneity of Variance	No Transformation
<p>Calculated B1 statistic = 6.551 Critical B = 15.086 (alpha = 0.01, df = 5)</p> <p>Data PASS B1 homogeneity test at 0.01 level.</p>	

Appendix A2: Statistics

Pimephales promelas (Fathead minnow) Growth

ANOVA Table				No Transformation	
SOURCE	DF	SS	MS	F	
Between	5	0.02463	0.004926	2.405	
Within (Error)	24	0.04914	0.002048		
Total	29	0.07377			
Critical F = 3.9 (alpha = 0.01, df = 5,24)					
2.62 (alpha = 0.05, df = 5,24)					
Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)					

Dunnett's Test - Table 1 of 2					No Transformation	
Ho: Control < Treatment						
Group	Identification	Transformed Mean	Mean In Original Units	T Stat	Sig 0.05	
1	Control	0.5	0.5			
2	2.2 %	0.482	0.482	0.6289		
3	3.2 %	0.5234	0.5234	-0.8176		
4	4.6 %	0.4606	0.4606	1.377		
5	6.5 %	0.484	0.484	0.559		
6	8.5 %	0.4326	0.4326	2.355		
Dunnett's critical value = 2.36 (1 Tailed, alpha = 0.05, df = 5,24)						

Dunnett's Test - Table 2 of 2					No Transformation	
Ho: Control < Treatment						
Group	Identification	Num of Reps	Min Sig Diff (In Orig. Units)	% of Control	Difference From Control	
1	Control	5				
2	2.2 %	5	0.06755	13.5	0.018	
3	3.2 %	5	0.06755	13.5	-0.0234	
4	4.6 %	5	0.06755	13.5	0.0394	
5	6.5 %	5	0.06755	13.5	0.016	
6	8.5 %	5	0.06755	13.5	0.0674	

Appendix A3: Water Chemistry

Routine Chemical and Physical Data

Date and Time Test Initiated: May 8, 2012 at 1223

Date and Time Test Terminated: May 15, 2012 at 1600

Effluent Conc.: Control		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	7.8	7.8	8.1	7.8	7.8	8.3	7.9
	Final	8.0	6.1	7.9	6.8	6.5	6.9	7.1
pH, units	Initial	7.7	8.0	7.6	7.8	7.7	7.8	8.0
	Final	7.5	7.2	7.5	7.3	7.6	7.4	7.5
Alkalinity, mg CaCO ₃ /l		31	NA	31	NA	31	NA	NA
Hardness, mg CaCO ₃ /l		41	NA	41	NA	41	NA	NA
Conductivity, umhos/cm		85	100	84	91	140	140	130
Res. Chlorine, mg/l		<0.05	NA	<0.05	NA	<0.05	NA	NA

Effluent Conc.: 2.2 %		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	7.9	7.8	8.7	7.8	7.7	8.4	7.9
	Final	6.8	5.2	8.0	6.8	6.5	6.4	6.7
pH, units	Initial	7.6	7.9	7.7	7.8	7.7	7.7	7.8
	Final	7.4	7.0	7.5	7.3	7.4	7.3	7.4

Effluent Conc.: 3.2 %		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	7.8	7.8	8.0	7.7	8.0	8.6	8.0
	Final	7.3	5.6	8.0	7.0	6.2	6.6	6.6
pH, units	Initial	7.6	7.8	7.7	7.8	7.6	7.7	7.8
	Final	7.4	7.0	7.5	7.3	7.4	7.4	7.3

Appendix A3: Water Chemistry

Routine Chemical and Physical Data

Date and Time Test Initiated: May 8, 2012 at 1223

Date and Time Test Terminated: May 15, 2012 at 1600

Effluent Conc.: 4.6 %		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	8.0	7.8	8.0	7.9	8.1	8.6	8.1
	Final	7.2	5.5	7.9	6.9	6.5	6.8	6.7
pH, units	Initial	7.6	7.8	7.6	7.8	7.6	7.7	7.7
	Final	7.4	7.0	7.6	7.3	7.4	7.3	7.3

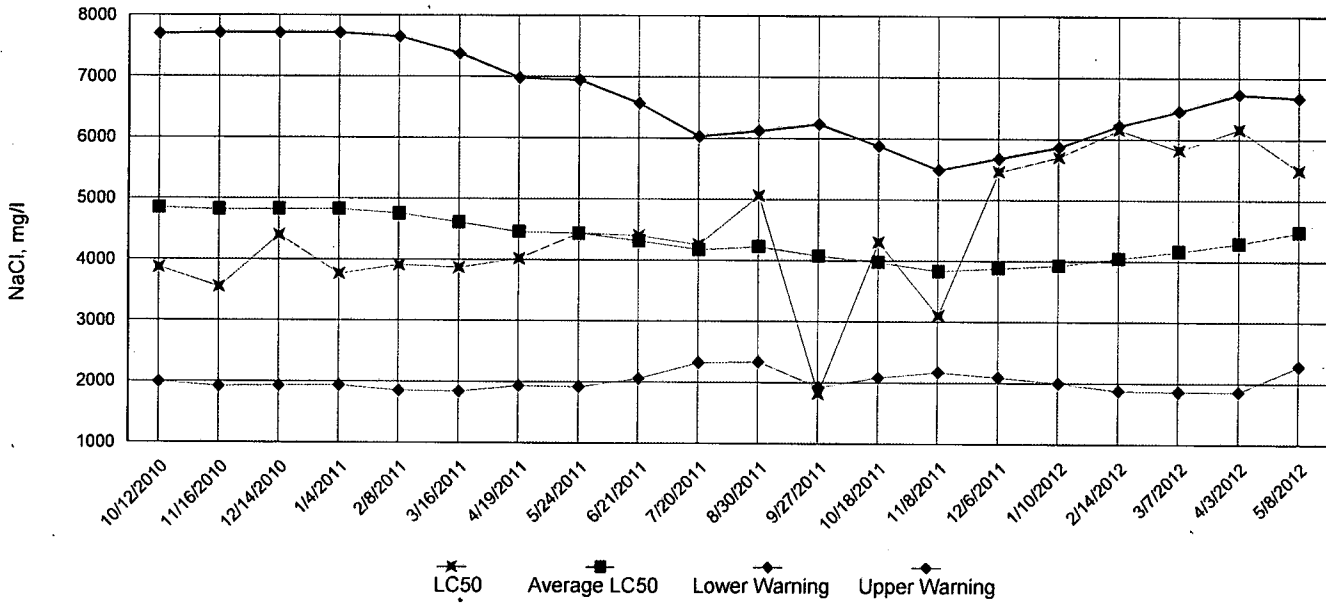
Effluent Conc.: 6.5 %		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	7.8	7.8	8.4	7.6	7.8	8.5	7.9
	Final	7.3	5.8	7.8	6.9	6.4	7.0	6.6
pH, units	Initial	7.6	7.8	7.6	7.7	7.6	7.7	7.7
	Final	7.5	7.1	7.5	7.3	7.3	7.4	7.3
Alkalinity, mg CaCO ₃ /l		35	NA	35	NA	33	NA	NA
Hardness, mg CaCO ₃ /l		43	NA	44	NA	42	NA	NA
Conductivity, umhos/cm		86	110	85	91	140	140	130
Res. Chlorine, mg/l		<0.05	NA	<0.05	NA	<0.05	NA	NA

Effluent Conc.: 8.5 %		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	7.6	7.9	8.0	7.6	7.9	8.5	8.0
	Final	7.5	5.7	7.9	6.9	6.6	6.7	7.3
pH, units	Initial	7.6	7.8	7.6	7.7	7.6	7.7	7.7
	Final	7.5	7.0	7.5	7.3	7.4	7.4	7.5

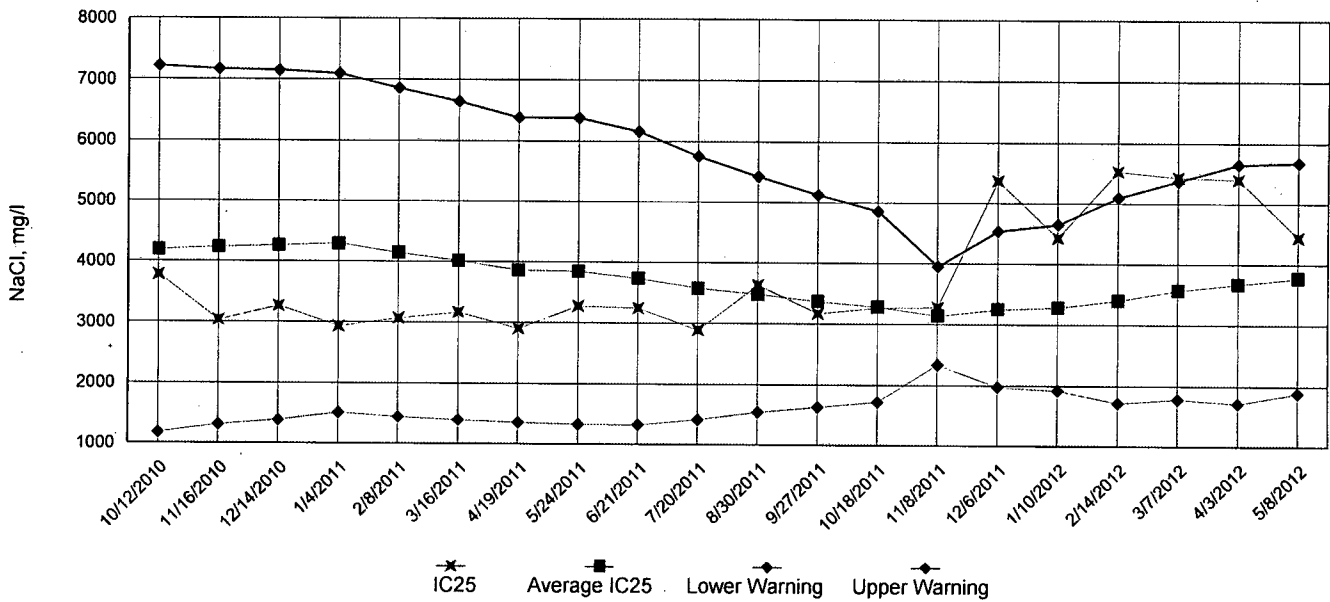
Appendix A4: Test 1000.0

Chronic Reference Toxicant, *Pimephales promelas* (Fathead Minnow)

LC50 Survival Data



IC25 Growth Data



Appendix B: Test 1000.0
SUMMARY REPORTING FORMS
CHRONIC BIOMONITORING
Pimephales promelas (Fathead Minnow)
SURVIVAL AND GROWTH

Permittee: Malvern Water Works

NPDES No.: AR0034126 AFIN 30-00040

Date and Time Test Initiated: May 8, 2012 at 1615

Date and Time Test Terminated: May 15, 2012 at 1600

Dilution water used: Synthetic Laboratory Soft Water #4225

DATA TABLE FOR SURVIVAL

Effluent Conc. %	Percent Survival in replicate chambers					Mean percent survival			CV%
	A	B	C	D	E	24 hr	48 hr	7 days	
Control	100	100	100	100	100	100	100	100	0.00
2.2 %	100	100	100	100	100	100	100	100	0.00
3.2 %	87.5	100	100	100	100	100	100	97.5	5.73
4.6 %	100	87.5	100	100	87.5	100	100	95.0	7.21
6.5 %	100	87.5	100	100	100	100	100	97.5	5.73
8.5 %	100	100	87.5	100	100	100	100	97.5	5.73

DATA TABLE FOR GROWTH

Effluent Conc. %	Average dry weight, mg replicate chambers					Mean dry weight, mg	CV%
	A	B	C	D	E		
Control	0.426	0.511	0.482	0.546	0.535	0.5	9.62
2.2 %	0.432	0.461	0.510	0.508	0.499	0.482	7.10
3.2 %	0.429	0.580	0.528	0.524	0.556	0.523	11.0
4.6 %	0.469	0.438	0.480	0.435	0.481	0.461	4.89
6.5 %	0.404	0.460	0.530	0.571	0.455	0.484	13.7
8.5 %	0.428	0.411	0.441	0.471	0.412	0.433	5.73

CV = Coefficient of variation = standard deviation * 100 / mean

Appendix B: Test 1000.0
SUMMARY REPORTING FORMS
CHRONIC BIOMONITORING
Pimephales promelas (Fathead Minnow)
SURVIVAL AND GROWTH

1. Steel's Many-One Rank Test:

Is the mean survival significantly different ($p=0.05$) than the control survival for the % effluent corresponding to (lethality):

a.) LOW FLOW OR CRITICAL DILUTION	(6.5 %)	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
b.) 1/2 LOW FLOW DILUTION	(NA)	<input type="checkbox"/> YES	<input type="checkbox"/> NO

2. Dunnett's Test:

Is the mean dry weight (growth) significantly different ($p=0.05$) than the control's dry weight (growth) for the % effluent corresponding to (significant non-lethal effects):

a.) LOW FLOW OR CRITICAL DILUTION	(6.5 %)	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
b.) 1/2 LOW FLOW DILUTION	(NA)	<input type="checkbox"/> YES	<input type="checkbox"/> NO

3. If you answered NO to 1.a) enter [0] otherwise enter [1]: 0 (TLP6C)
4. If you answered NO to 2.a) enter [0] otherwise enter [1]: 0 (TGP6C)
5. NOEC Pimephales Lethality: 8.5 % (TOP6C)
6. LOEC Pimephales Lethality: 8.5 % (TXP6C)
7. NOEC Pimephales Sublethality: 8.5 % (TPP6C)
8. LOEC Pimephales Sublethality: 8.5 % (TYP6C)
9. Coefficient of variation for Pimephales growth: 13.7 (TQP6C)

Appendix B: Test 1000.0

CHRONIC TOXICITY SUMMARY FORM
Pimephales promelas (Fathead minnow)
CHEMICAL PARAMETERS CHART

PERMITTEE: Malvern Water Works
NPDES NO.: AR0034126 AFIN 30-00040
CONTACT: Mr. John Davis
ANALYST: 275, 280, 298, 304

1238

Test Initiated: DATE: May 8, 2012 TIME: 1615
Test Terminated: DATE: May 15, 2012 TIME: 1600

DILUTION Control	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.8	7.8	8.1	7.8	7.8	8.3	7.9
Final	8.0	6.1	7.9	6.8	6.5	6.9	7.1
pH Initial	7.7	8.0	7.6	7.8	7.7	7.8	8.0
Final	7.5	7.2	7.5	7.3	7.6	7.4	7.5
Alkalinity	31	NA	31	NA	31	NA	NA
Hardness	41	NA	41	NA	41	NA	NA
Conductivity	85	100	84	91	140	140	130
Chlorine	<0.05	NA	<0.05	NA	<0.05	NA	NA

DILUTION 2.2 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.9	7.8	8.7	7.8	7.7	8.4	7.9
Final	6.8	5.2	8.0	6.8	6.5	6.4	6.7
pH Initial	7.6	7.9	7.7	7.8	7.7	7.7	7.8
Final	7.4	7.0	7.5	7.3	7.4	7.3	7.4
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	85	100	84	90	140	140	130
Chlorine	NA	NA	NA	NA	NA	NA	NA

DILUTION 3.2 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.8	7.8	8.0	7.7	8.0	8.6	8.0
Final	7.3	5.6	8.0	7.0	6.2	6.6	6.6
pH Initial	7.6	7.8	7.7	7.8	7.6	7.7	7.8
Final	7.4	7.0	7.5	7.3	7.4	7.4	7.3
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	86	100	84	90	140	140	130
Chlorine	NA	NA	NA	NA	NA	NA	NA

DILUTION 4.6 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	8.0	7.8	8.0	7.9	8.1	8.6	8.1
Final	7.2	5.5	7.9	6.9	6.5	6.8	6.7
pH Initial	7.6	7.8	7.6	7.8	7.6	7.7	7.7
Final	7.4	7.0	7.6	7.3	7.4	7.3	7.3
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	86	100	85	91	140	140	130
Chlorine	NA	NA	NA	NA	NA	NA	NA

DILUTION 6.5 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.8	7.8	8.4	7.6	7.8	8.5	7.9
Final	7.3	5.8	7.8	6.9	6.4	7.0	6.6
pH Initial	7.6	7.8	7.6	7.7	7.6	7.7	7.7
Final	7.5	7.1	7.5	7.3	7.3	7.4	7.3
Alkalinity	35	NA	35	NA	33	NA	NA
Hardness	43	NA	44	NA	42	NA	NA
Conductivity	86	110	85	91	140	140	130
Chlorine	<0.05	NA	<0.05	NA	<0.05	NA	NA

DILUTION 8.5 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.6	7.9	8.0	7.6	7.9	8.5	8.0
Final	7.5	5.7	7.9	6.9	6.6	6.7	7.3
pH Initial	7.6	7.8	7.6	7.7	7.6	7.7	7.7
Final	7.5	7.0	7.5	7.3	7.4	7.4	7.5
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	87	110	86	92	140	140	130
Chlorine	NA	NA	NA	NA	NA	NA	NA



CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

PAGE OF

Client: MALVERN WASTEWATER			PO No.		NO OF BOTTLES	ANALYSES REQUESTED										AIC CONTROL NO: 157593								
Project Reference:			SAMPLE MATRIX			BOTTLES <i>BSC - CARBONATE FH (CALIF)</i>											AIC PROPOSAL NO:							
Project Manager:			G R A B	C O M P	W A T E R		S O I L											Carrier:						
Sampled By: JOHN DAVEY																Received Temperature C: 2 C								
AIC No.	Sample Identification	Date/Time Collected																Remarks						
1	MALVERN WASTEWATER	5/8/12 8:08 AM		X																				
		Container Type																	Field pH calibration on _____ @ _____					
		Preservative																	Buffer:					
G = Glass P = Plastic V = VOA vials H = HCl to pH2 T = Sodium Thiosulfate																								
NO = none S = Sulfuric acid pH2 N = Nitric acid pH2 B = NaOH to pH2 Z = Zinc acetate																								
Turnaround Time Requested: (Please circle) NORMAL or EXPEDITED IN _____ DAYS					Relinquished By: <i>[Signature]</i>					Date/Time: 5/8/12 12:08 PM					Received By: _____					Date/Time: _____				
Expedited results requested by: _____					Relinquished By: _____					Date/Time: _____					Received in Lab By: <i>[Signature]</i>					Date/Time: 5-8-12 12:08 pm				
Who should AIC contact with questions: _____					Comments:																			
Phone: _____ Fax: _____																								
Report Attention to: _____																								
Report Address to: _____																								



CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

PAGE OF

Client: MALVERN WASTEWATER (1.387)			PO No.		NO OF BOTTLES	ANALYSES REQUESTED										AIC CONTROL NO: 157593					
Project Reference:			SAMPLE MATRIX													AIC PROPOSAL NO:					
Project Manager:			GRA B	COMP	WATER	SOIL	BOTTLES	PBB-CHEMISEC FIT	NO3+NO2+ TP											Carrier:	
Sampled By: JOHN DAINE																				Received Temperature C: 20	
AIC No.	Sample Identification	Date/Time Collected																Remarks			
2	MALVERN WASTEWATER	5/10/12 9:37 AM	X				1	X										AIC # 157693			
	MALVERN WASTEWATER	5/10/12 12:39 PM	X				1		X												
Container Type																				Field pH calibration on @	
Preservative																				Buffer:	
G = Glass NO = none			P = Plastic S = Sulfuric acid pH2			V = VOA vials N = Nitric acid pH2			H = HCl to pH2 B = NaOH to pH12			T = Sodium Thiosulfate Z = Zinc acetate									
Turnaround Time Requested: (Please circle) NORMAL or EXPEDITED IN ___ DAYS							Relinquished By: [Signature]			Date/Time: 5/10/12 1:36 PM			Received By:			Date/Time:					
Expedited results requested by: _____							Relinquished By:			Date/Time:			Received in Lab By: [Signature]			Date/Time: 5-10-12 1:36 pm					
Who should AIC contact with questions: _____							Comments:														
Phone: _____ Fax: _____																					
Report Attention to:																					
Report Address to:																					



CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

PAGE OF

Client: <u>Malden Waste Water</u>			PO No.		NO OF BOTTLES	ANALYSES REQUESTED										AIC CONTROL NO: <u>157593</u>				
Project Reference:			SAMPLE MATRIX													AIC PROPOSAL NO:				
Project Manager:			G R A B	C O M P		W A T E R	S O I L											Carrier:		
Sampled By:															Received Temperature C: <u>2</u>					
AIC No.	Sample Identification	Date/Time Collected																		Remarks
<u>3</u>	<u>Malden Wastewater</u>	<u>5-11-2012 10:00 AM</u>																		
Turnaround Time Requested: (Please circle) NORMAL or EXPEDITED IN ___ DAYS		Relinquished By: <u>Marlon Morgan</u>		Date/Time: <u>11:40 AM</u>		Received By:		Date/Time:		G = Glass		P = Plastic		V = VOA vials		H = HCl to pH2		T = Sodium Thiosulfate		
Expedited results requested by: _____		Relinquished By:		Date/Time:		Received in Lab By: <u>Lugan Hopton</u>		Date/Time: <u>5-11-12</u>		NO = none		S = Sulfuric acid pH2		N = Nitric acid pH2		B = NaOH to pH12		Z = Zinc acetate		
Who should AIC contact with questions: _____		Comments:																		
Phone: _____ Fax: _____																				
Report Attention to:																				
Report Address to:																				



March 26, 2012
Control No. 156051-1
Page 1 of 19

March 26, 2012

Test Results of
First Quarter
Chronic 7-Day Renewal
Biomonitoring Testing
for
Malvern Wastewater

Control No. 156051-1

Prepared for:

Mr. John Davis
Malvern Water Works
506 Overman
Malvern, AR 72104

Prepared by:

AMERICAN INTERPLEX CORPORATION
8600 Kanis Road
Little Rock, AR 72204-2322



Malvern Water Works
ATTN: Mr. John Davis
506 Overman
Malvern, AR 72104

Re: Chronic 7-Day Renewal utilizing *Ceriodaphnia dubia*
Malvern Wastewater
NPDES Permit No. AR0034126 AFIN 30-00040

Dear Mr. John Davis:

This report is the analytical results and supporting information for the samples submitted to American Interplex Corporation (AIC). The following results are applicable only to the sample identified by the control number referenced above. Accurate assessment of the data requires access to the entire document. Each section of the report has been reviewed and approved by the laboratory director or qualified designee.

Testing procedures and Quality Assurance were in accordance with "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" EPA-821-R-02-013, Fourth Edition, October 2002. Test results are summarized below:

Method 1002.0 Chronic *Ceriodaphnia dubia* Survival and Reproduction Test: The No Observable Effects Concentration (NOEC) for survival occurred at 8.5 % effluent, which is above the critical dilution of 6.5 %. The NOEC for reproduction occurred at 8.5 % effluent, which is above the critical dilution of 6.5 %. **The sample, therefore, PASSED both lethal and sub-lethal effects for the *Ceriodaphnia dubia* test.**

AMERICAN INTERPLEX CORPORATION

A handwritten signature in black ink, appearing to read 'John Overbey', is written over a horizontal line.

John Overbey
Laboratory Director

PDF cc: Malvern Water Works
ATTN: Mr. John Davis
jdavis@malvernar.gov

Malvern Water Works
ATTN: Mr. Carl Wheatley
cwheatley@malvernar.gov

Table of Contents

- I. Control Acceptance Criteria
- II. Outlined Report
- III. Data Analysis
- IV. Standard Reference Toxicants
- V. Chemical Analysis/Quality Control
- VI. Organism History
- VII. Results Summary
 - Ceriodaphnia dubia*

Appendix A: Raw Data

- A1: Test 1002.0
 - Ceriodaphnia dubia* Survival and Reproduction
- A2: Statistics
- A3: Water Chemistry
- A4: Reference Toxicant

Appendix B: Chains of Custody

I. Control Acceptance Criteria

Ceriodaphnia dubia Method 1002.0

CRITERIA	RESULTS	PASS/FAIL
Control Survival > or = 80%	100	PASS
Control Reproduction > or = 15 per Surviving Female	19.1	PASS
Control CV < or = 40% per Surviving Female	17.2	PASS
Reproduction Minimum Significant Difference 13 to 47%	21.9	PASS
Critical Dilution CV < or = 40%	34.4	PASS

II. Outlined Report

A. Introduction

1. Permit Number: AR0034126 AFIN 30-00040
2. Test Requirements: Test Method 1002.0
3. Receiving Stream: Ouachita River Basin

B. Source of Effluent/Dilution Water

1. Effluent Samples:
 - a. Sampling Point: Malvern Wastewater
 - b. Chemical Data:

Analysis	Sample 1	Sample 2	Sample 3
Dissolved oxygen (mg/l)	8.0	7.5	8.0
pH (standard units)	7.6	7.7	7.9
Alkalinity (mg/l as CaCO ₃)	44	45	48
Hardness (mg/l as CaCO ₃)	29	46	47
Conductivity (umhos/cm)	190	170	190
Residual Chlorine (mg/l)	<0.05	<0.05	<0.05
Ammonia as N (mg/l)	8.0	8.1	8.0

2. Dilution Water Samples: Synthetic Laboratory Soft Water #2426

- a. Dates Prepared: March 4 through March 18, 2012
- b. Chemical Data:

Analysis	Sample 1	Sample 2	Sample 3
Dissolved oxygen (mg/l)	7.8	7.9	7.6
pH (standard units)	7.8	8.0	8.0
Alkalinity (mg/l as CaCO ₃)	31	31	31
Hardness (mg/l as CaCO ₃)	46	42	42
Conductivity (umhos/cm)	110	100	120
Residual Chlorine (mg/l)	<0.05	<0.05	<0.05

C. Test Methods

1. Test methods used:

Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, EPA-821-R-02-013; test Method 1002.0, *Ceriodaphnia dubia* Survival and Reproduction.

2. Endpoint: No Observable Effects Concentration (NOEC)

3. Test Conditions:

Ceriodaphnia dubia Survival and Growth Method 1002.0

Date & Time Test Initiated: March 13, 2012 at 1425
Date & Time Test Terminated: March 20, 2012 at 1445
Type & Volume of Test Chamber: 30 ml disposable beaker
Volume of Sample: 15 ml
Number of Organisms per replicate: 1
Number of Replicates per dilution: 10

4. Acclimation of test organisms: Obtained from in-house cultures

5. Test Temperature: 25 +/- 1 degree Celsius

D. Test Organisms

1. Scientific Name

a. Test 1002.0 *Ceriodaphnia dubia*

III. Data Analysis

The data was analyzed using American Interplex Corporation's Laboratory Information Management Software based on Toxstat.

Ceriodaphnia dubia survival data was analyzed with Fisher's Exact Test. Reproduction data was analyzed using Kolmogorov's Test for Normality and analyzed with Wilcoxon's Rank Sum with Bonferroni Adjustment to determine the No Observable Effects Concentration (NOEC) for reproduction. Dunnett's Test was used to calculate the PMSD.

IV. Standard Reference Toxicants

American Interplex Corporation has an ongoing test organism culturing program. The sensitivity of the offspring is determined by performing a standard reference toxicant test with each effluent test. Sodium chloride in synthetic moderately hard water is used as prescribed in EPA-821-R-02-013.

Ceriodaphnia dubia

Chronic reference tests are performed monthly.

A chronic reference test was performed on March 7, 2012 at 1415 to March 15, 2012 at 1450

The results were as follows: (Control No. 155848-1.)

Survival LC-50: 2003 mg/l

Growth IC-25: 1447 mg/l

Growth PMSD: 21.6

V. Chemical Analysis/Quality Control

Parameter	Method	% Recovery	Relative % Difference
Alkalinity	SM 2320 B	NA	0.00
Hardness	EPA 200.7	99.5	6.33
pH	SM 4500-H+ B	101	0.267
Conductivity	EPA 120.1	90.6	1.42

VI. Organism History

Ceriodaphnia dubia

Date: March 13, 2012

Age: <24 hours

Source: In-house culture

Water Chemistry Record:

Alkalinity: 57-64 mg/l

Hardness: 80-100 mg/l

Temperature: 25 deg.C

VII. Results Summary *Ceriodaphnia dubia*, Cladoceran Survival and Reproduction Test -- Method 1002.0

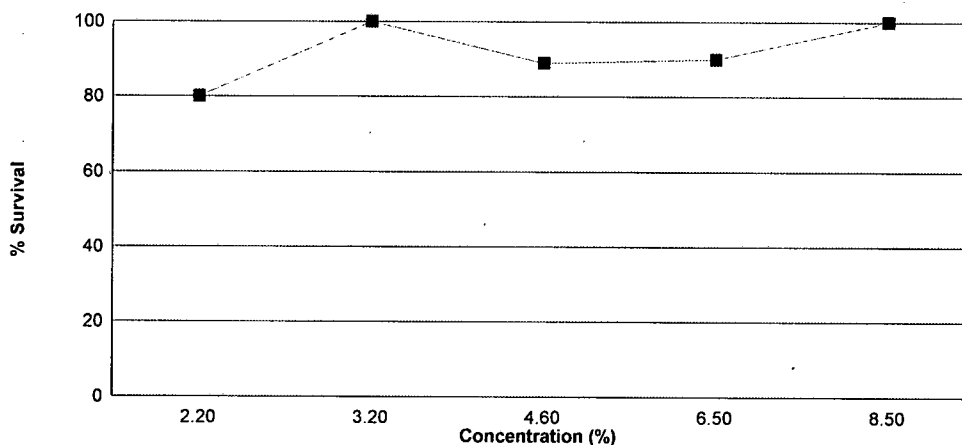
Neonates are exposed in a static renewal system to different concentrations of effluent with dilution water until 60% of surviving control organisms have three broods of offspring with an average of at least 15 young per female.

Effluent dilutions for this test were 2.2 %, 3.2 %, 4.6 %, 6.5 %, 8.5 % in accordance with the NPDES permit.

The low flow or 'critical' dilution is specified in the NPDES permit as 6.5 % effluent.

The test was initiated on March 13, 2012 at 1425 and continued through March 20, 2012 at 1445. Statistical analyses were performed on the observed data and the no observable effects concentrations (NOECs) were as follows:

- a.) NOEC survival = 8.5 % effluent
- b.) NOEC reproduction = 8.5 % effluent



Concentration	Percent Survival	Mean Reproduction
Control	100	19.1
2.2 %	80.0	16.2
3.2 %	100	20.0
4.6 %	88.9	17.7
6.5 %	90.0	17.2
8.5 %	100	18.1

Appendix A1: Test 1002.0

Ceriodaphnia dubia Survival and Reproduction

Date and Time Test Initiated: March 13, 2012 at 1425

Date and Time Test Terminated: March 20, 2012 at 1445

Concentration: Control														
Day	Replicate										No. of Young	No. of Adults	Young per Adult	
	1	2	3	4	5	6	7	8	9	10				
1	0	0	0	0	0	0	0	0	0	0	0	0	10	0.00
2	0	0	0	0	0	0	0	0	0	0	0	0	10	0.00
3	0	0	0	0	0	0	0	0	0	0	0	0	10	0.00
4	1	4	1	3	4	1	3	4	2	1	24	10	2.40	
5	8	5	6	4	7	8	7	5	6	5	61	10	6.10	
6	0	1	1	1	0	0	0	1	0	0	4	10	0.400	
7	9	13	13	11	12	11	10	9	8	6	102	10	10.2	
8														
TOTAL	18	23	21	19	23	20	20	19	16	12	191	10	19.1	

Concentration: 2.2 %														
Day	Replicate										No. of Young	No. of Adults	Young per Adult	
	1	2	3	4	5	6	7	8	9	10				
1	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
2	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
3	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
4	3	2	X	2	3X	3	2	3	3	2	23	8	2.88	
5	4	8	X	7	X	9	9	0	0	8	45	8	5.62	
6	0	6	X	9	X	0	0	8	8	8	39	8	4.88	
7	10	6E	X	0	X	12	11	10	11	1	55	8	6.88	
8														
TOTAL	17	16	0	18	3	24	22	21	22	19	162	10	16.2	

E = Excluded fourth brood neonates

Concentration: 3.2 %														
Day	Replicate										No. of Young	No. of Adults	Young per Adult	
	1	2	3	4	5	6	7	8	9	10				
1	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
2	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
3	0	0	0	0	0	0	0	0	0	0	0	10	0.00	
4	3	1	3	2	3	1	2	3	2	3	23	10	2.30	
5	6	8	10	8	8	8	8	7	6	6	75	10	7.50	
6	1	10	0	0	0	11	6	0	0	1	29	10	2.90	
7	11	1	11	9	9	0	0	11	9	12	73	10	7.30	
8														
TOTAL	21	20	24	19	20	20	16	21	17	22	200	10	20.0	

Appendix A1: Test 1002.0

Ceriodaphnia dubia Survival and Reproduction

Date and Time Test Initiated: March 13, 2012 at 1425

Date and Time Test Terminated: March 20, 2012 at 1445

Concentration: 4.6 %														
Day	Replicate										No. of Young	No. of Adults	Young per Adult	
	1	2	3	4	5	6	7	8	9	10				
1	0	0	0	0	0	0	0	0	0	0	0	0	10	0.00
2	0	0	0	0	LIA	0	0	0	0	0	0	0	9	0.00
3	0	0	0	0	LIA	0	0	0	0	0	0	0	9	0.00
4	4	4	4	2	LIA	2	1	X	1	4	22	8	2.75	
5	0	7	6	6	LIA	7	8	X	6	0	40	8	5.00	
6	8	10	0	0	LIA	0	6	X	0	7	31	8	3.88	
7	9	1	9	9	LIA	14	0	X	12	12	66	8	8.25	
8														
TOTAL	21	22	19	17		23	15	0	19	23	159	9	17.7	

LIA = Lost in Analysis X = Death of Mother

Concentration: 6.5 %														
Day	Replicate										No. of Young	No. of Adults	Young per Adult	
	1	2	3	4	5	6	7	8	9	10				
1	0	0	0	0	0	0	0	0	0	0	0	0	10	0.00
2	0	0	0	0	0	0	0	0	0	0	0	0	10	0.00
3	0	0	0	0	0	0	0	0	0	0	0	0	10	0.00
4	3	3	3	2	0	2	6	0	1	2	22	10	2.20	
5	6	X	6	7	6	9	0	6	2	7	49	9	5.44	
6	0	X	0	0	8	0	11	9	0	5	33	9	3.67	
7	9	X	10	11	10	9	14	0	5	0	68	9	7.56	
8														
TOTAL	18	3	19	20	24	20	31	15	8	14	172	10	17.2	

Concentration: 8.5 %														
Day	Replicate										No. of Young	No. of Adults	Young per Adult	
	1	2	3	4	5	6	7	8	9	10				
1	0	0	0	0	0	0	0	0	0	0	0	0	10	0.00
2	0	0	0	0	0	0	0	0	0	0	0	0	10	0.00
3	0	0	0	0	0	0	0	0	0	0	0	0	10	0.00
4	0	3	2	3	0	3	3	2	2	2	20	10	2.00	
5	5	5	4	6	6	6	5	6	0	6	49	10	4.90	
6	8	0	7	0	7	1	8	0	8	7	46	10	4.60	
7	10	13	0	12	0	12	0	10	9	0	66	10	6.60	
8														
TOTAL	23	21	13	21	13	22	16	18	19	15	181	10	18.1	

Appendix A2: Statistics

Ceriodaphnia dubia Survival

Fisher's Exact Test			
Identification	Alive	Dead	Total Animals
Control	10	0	10
2.2 %	8	2	10
Total	18	2	20

Critical Fisher's value (10,10,10) (alpha=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	Alive	Dead	Total Animals
Control	10	0	10
3.2 %	10	0	10
Total	20	0	20

Critical Fisher's value (10,10,10) (alpha=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	Alive	Dead	Total Animals
Control	10	0	10
4.6 %	8	1	9
Total	18	1	19

Critical Fisher's value (10,9,10) (alpha=0.05) is 5. b value is 8. Since b is greater than 5 there is NO SIGNIFICANT DIFFERENCE between CONTROL and TREATMENT at the 0.05 level.

Fisher's Exact Test			
Identification	Alive	Dead	Total Animals
Control	10	0	10
6.5 %	9	1	10
Total	19	1	20

Critical Fisher's value (10,10,10) (alpha=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.

Appendix A2: Statistics

Ceriodaphnia dubia Survival

Fisher's Exact Test			
Identification	Alive	Dead	Total Animals
Control	10	0	10
8.5 %	10	0	10
Total	20	0	20

Critical Fisher's value (10,10,10) ($\alpha=0.05$) 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 Test				
Group	Identification	Exposed	Dead	Sig 0.05
0	Control	10	0	
1	2.2 %	10	2	
2	3.2 %	10	0	
3	4.6 %	9	1	
4	6.5 %	10	1	
5	8.5 %	10	0	

Appendix A2: Statistics

Ceriodaphnia dubia Reproduction

Chi-Square Test for Normality	No Transformation
Chi-Square = 7.2661 Critical Chi-Square = 13.28 (alpha = 0.01, df = 4)	
Data PASS normality test (alpha = 0.01).	

Kolmogorov Test for Normality	No Transformation
D = 0.162 D* = 1.261 Critical D* = 1.035 (alpha = 0.01, N = 59)	
Data FAIL normality test (alpha = 0.01).	

Wilcoxon's Rank Sum w/ Bonferroni Adjustment					No Transformation
Ho: Control < Treatment					
Group	Identification	Rank Sum	Critical Value	Reps	Sig 0.05
1	Control				
2	2.2 %	98.50	74.00	10	
3	3.2 %	113.50	74.00	10	
4	4.6 %	89.50	59.00	9	
5	6.5 %	95.50	74.00	10	
6	8.5 %	98.00	74.00	10	
Critical values are 1 tailed (k=5)					

Appendix A2: Statistics

Ceriodaphnia dubia Reproduction

Dunnett's Test for PMSD Calculation (excluding deaths if applicable)

ANOVA Table				No Transformation	
SOURCE	DF	SS	MS	F	
Between	5	27.33	5.466	0.3746	
Within (Error)	49	715.1	14.59		
Total	54	742.4			

Critical F = 3.42 (alpha = 0.01, df = 5,49)
2.41 (alpha = 0.05, df = 5,49)

Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)

Dunnett's Test - Table 1 of 2					No Transformation	
Ho:Control<Treatment						
Group	Identification	Transformed Mean	Mean In Original Units	T Stat	Sig 0.05	
1	Control	19.1	19.1			
2	2.2 %	19.875	19.875	-0.4277		
3	3.2 %	20	20	-0.5269		
4	4.6 %	19.875	19.875	-0.4277		
5	6.5 %	18.778	18.778	0.1835		
6	8.5 %	18.1	18.1	0.5854		

Dunnett's critical value = 2.31 (1 Tailed, alpha = 0.05, df [used] = 5,40) (Actual df = 5,49)
WARNING - Unequal replicate sizes. Critical values assuming equal replicate sizes have been used.

Dunnett's Test - Table 2 of 2					No Transformation	
Ho:Control<Treatment						
Group	Identification	Num of Reps	Min Sig Diff (In Orig. Units)	% of Control	Difference From Control	
1	Control	10				
2	2.2 %	8	4.185	21.9	-0.775	
3	3.2 %	10	3.946	20.7	-0.9	
4	4.6 %	8	4.185	21.9	-0.775	
5	6.5 %	9	4.054	21.2	0.322	
6	8.5 %	10	3.946	20.7	1	

Appendix A3: Water Chemistry

Routine Chemical and Physical Data

Date and Time Test Initiated: March 13, 2012 at 1255

Date and Time Test Terminated: March 20, 2012 at 1445

Effluent Conc.: Control	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
DO, mg/l	Initial	7.8	7.6	7.9	7.4	7.6	7.1	7.8
	Final	7.9	7.8	7.4	7.5	7.2	7.7	7.1
pH, units	Initial	7.8	8.1	8.0	7.9	8.0	8.0	7.8
	Final	8.1	8.1	8.0	8.2	8.2	8.2	7.9
Alkalinity, mg CaCO ₃ /l	31	NA	31	NA	31	NA	NA	
Hardness, mg CaCO ₃ /l	46	NA	42	NA	42	NA	NA	
Conductivity, umhos/cm	110	NA	100	NA	120	NA	NA	
Res. Chlorine, mg/l	<0.05	NA	<0.05	NA	<0.05	NA	NA	

Effluent Conc.: 2.2 %	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
DO, mg/l	Initial	7.8	7.6	7.8	7.5	7.9	7.3	7.6
	Final	7.5	7.5	7.4	7.3	7.2	7.5	7.1
pH, units	Initial	7.8	7.9	7.9	7.9	8.0	7.9	7.8
	Final	8.0	8.0	8.0	8.4	8.1	8.2	7.7

Effluent Conc.: 3.2 %	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
DO, mg/l	Initial	8.0	7.5	7.6	7.7	7.8	6.9	7.8
	Final	7.9	7.7	7.5	7.5	7.7	7.5	6.9
pH, units	Initial	7.8	7.9	7.9	7.8	8.0	7.8	7.8
	Final	8.0	NA	8.0	8.4	8.1	8.1	7.7

Appendix A3: Water Chemistry

Routine Chemical and Physical Data

Date and Time Test Initiated: March 13, 2012 at 1255

Date and Time Test Terminated: March 20, 2012 at 1445

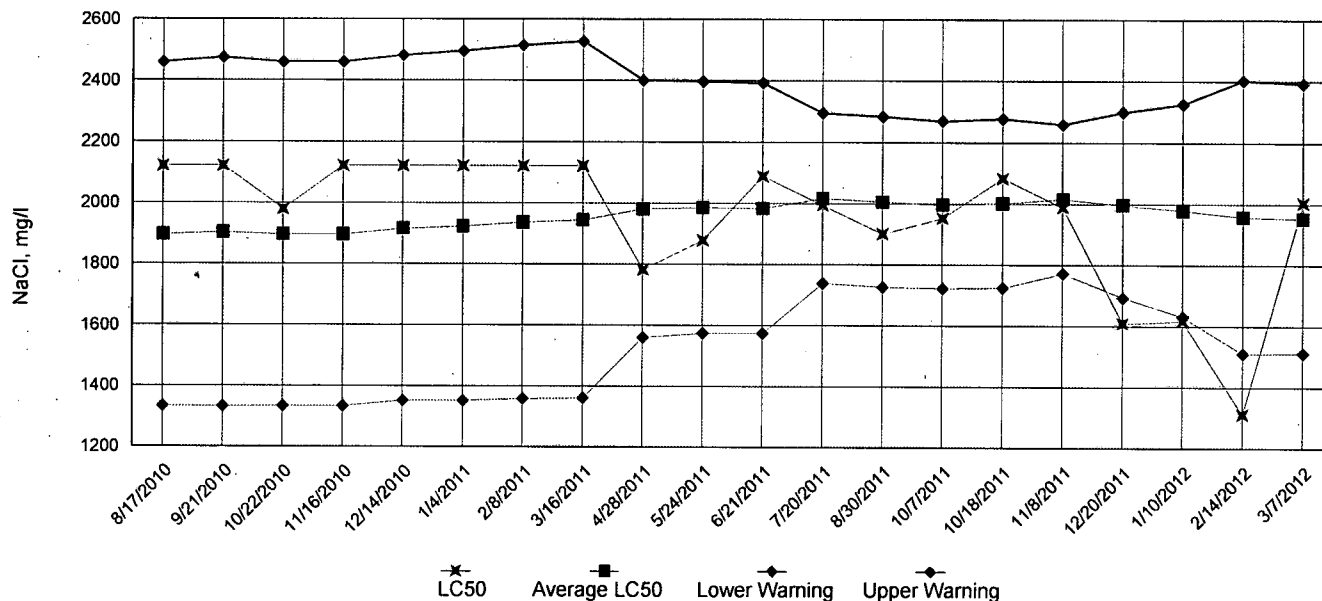
Effluent Conc.: 4.6 %		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	7.7	7.4	7.6	7.3	7.5	7.1	7.7
	Final	7.8	7.6	7.5	7.7	7.7	7.6	6.9
pH, units	Initial	7.8	7.8	7.9	7.8	8.0	7.8	7.8
	Final	7.9	8.0	8.0	8.4	8.1	8.1	7.6

Effluent Conc.: 6.5 %		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	7.8	7.6	7.8	7.3	7.8	7.4	7.8
	Final	7.2	7.4	7.5	7.8	7.6	7.2	6.5
pH, units	Initial	7.8	7.8	7.9	7.8	8.0	7.8	7.8
	Final	7.9	7.9	8.0	8.3	8.1	8.1	7.6
Alkalinity, mg CaCO ₃ /l		47	NA	53	NA	41	NA	NA
Hardness, mg CaCO ₃ /l		35	NA	110	NA	56	NA	NA
Conductivity, umhos/cm		120	NA	110	NA	100	NA	NA
Res. Chlorine, mg/l		<0.05	NA	<0.05	NA	<0.05	NA	NA

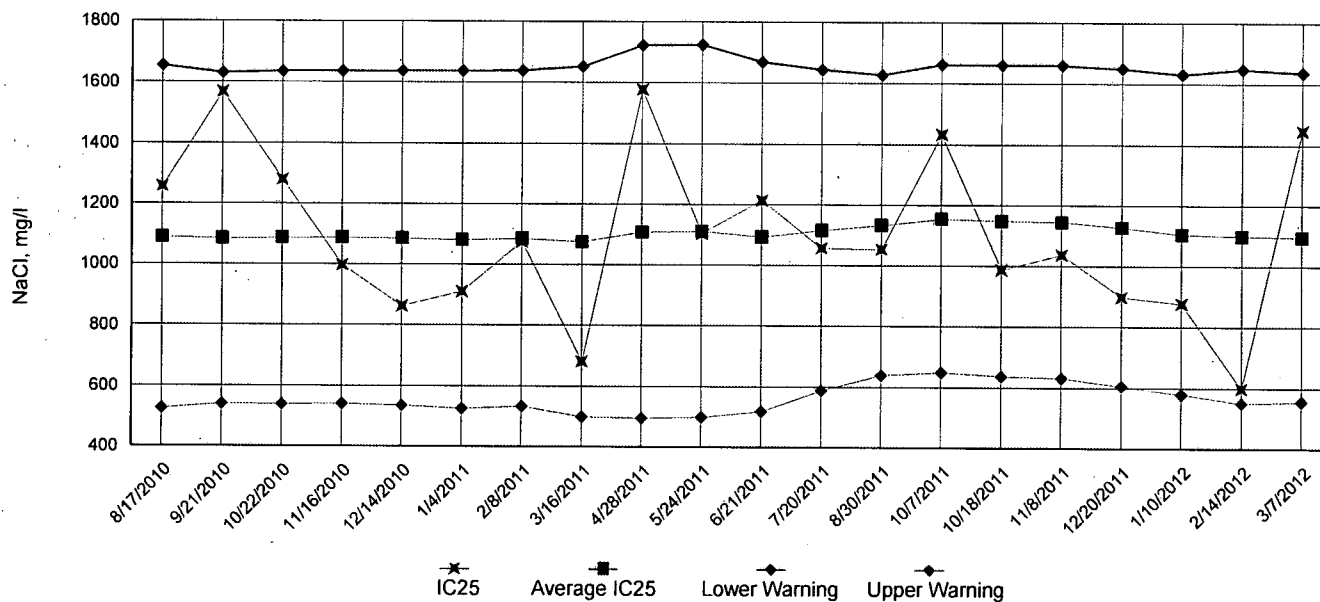
Effluent Conc.: 8.5 %		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DO, mg/l	Initial	8.0	7.6	7.4	7.4	8.0	7.3	7.7
	Final	7.6	7.3	7.3	7.5	7.6	7.4	6.8
pH, units	Initial	7.8	7.8	7.9	7.9	7.9	7.8	7.8
	Final	7.9	7.9	8.0	8.3	8.1	8.1	7.6

Appendix A4: Test 1002.0
Chronic Reference Toxicant, *Ceriodaphnia dubia*

LC50 Survival Data



IC25 Reproduction Data



Appendix B: Test 1002.0
SUMMARY REPORTING FORMS
CHRONIC BIOMONITORING
Ceriodaphnia dubia
SURVIVAL AND REPRODUCTION

Permittee: Malvern Water Works

NPDES No.: AR0034126 AFIN 30-00040

Date and Time Test Initiated: March 13, 2012 at 1425

Date and Time Test Terminated: March 20, 2012 at 1445

Dilution water used: Synthetic Laboratory Soft Water #2426

PERCENT SURVIVAL

Time of Reading	Control	Percent Effluent				
		2.2 %	3.2 %	4.6 %	6.5 %	8.5 %
24 hour	100	100	100	111	100	100
48 hour	100	100	100	100	100	100
7 day	100	80.0	100	88.9	90.0	100

NUMBER OF YOUNG PRODUCED PER FEMALE @ 7 DAYS

Replicates	Control	Percent Effluent				
		2.2 %	3.2 %	4.6 %	6.5 %	8.5 %
A	18	17	21	21	18	23
B	23	16	20	22	3	21
C	21	0	24	19	19	13
D	19	18	19	17	20	21
E	23	3	20		24	13
F	20	24	20	23	20	22
G	20	22	16	15	31	16
H	19	21	21	0	15	18
I	16	22	17	19	8	19
J	12	19	22	23	14	15
Mean per Adult	19.1	16.2	20.0	17.7	17.2	18.1
Mean per Surviving Adult	19.1	19.9	20.0	19.9	18.8	18.1
CV %	17.2	14.1	11.5	14.6	34.4	20.4

CV = Coefficient of variation = standard deviation * 100 / mean
(calculated based on young produced by surviving females)

Appendix B: Test 1002.0
SUMMARY REPORTING FORMS
CHRONIC BIOMONITORING
Ceriodaphnia dubia
SURVIVAL AND REPRODUCTION

1. Fisher's Exact Test:

Is the mean survival significantly different ($p=0.05$) than the control survival for the % effluent corresponding to (lethality):

a.) LOW FLOW OR CRITICAL DILUTION	(6.5 %)	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
b.) 1/2 LOW FLOW DILUTION	(NA)	<input type="checkbox"/> YES	<input type="checkbox"/> NO

2. Wilcoxon's Rank Sum with Bonferroni Adjustment Test:

Is the mean number of young produced per female significantly different ($p=0.05$) than the control's number of young per female for the % effluent corresponding to (significant non-lethal effects):

a.) LOW FLOW OR CRITICAL DILUTION	(6.5 %)	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
b.) 1/2 LOW FLOW DILUTION	(NA)	<input type="checkbox"/> YES	<input type="checkbox"/> NO

3. If you answered NO to 1.a) enter [0] otherwise enter [1]: 0 (TLP3B)

4. If you answered NO to 2.a) enter [0] otherwise enter [1]: 0 (TGP3B)

5. NOEC Ceriodaphnia Lethality: 8.5 % (TOP3B)

6. LOEC Ceriodaphnia Lethality: 8.5 % (TXP3B)

7. NOEC Ceriodaphnia Sublethality: 8.5 % (TPP3B)

8. LOEC Ceriodaphnia Sublethality: 8.5 % (TYP3B)

9. Coefficient of variation for Ceriodaphnia Reproduction: 34.4 (TQP3B)

Appendix B: Test 1002.0

CHRONIC TOXICITY SUMMARY FORM
Ceriodaphnia dubia
CHEMICAL PARAMETERS CHART

PERMITTEE: Malvern Water Works SAMPLE No. 1 COLLECTED ending: DATE: March 13, 2012 TIME: 0900
 NPDES NO.: AR0034126 AFIN 30-00040 SAMPLE No. 2 COLLECTED ending: DATE: March 14, 2012 TIME: 0900
 CONTACT: Mr. John Davis SAMPLE No. 3 COLLECTED ending: DATE: March 16, 2012 TIME: 0800
 ANALYST: 275, 280, 298, 304 Test Initiated: DATE: March 13, 2012 TIME: 1425
 Test Terminated: DATE: March 20, 2012 TIME: 1445

DILUTION Control	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.8	7.6	7.9	7.4	7.6	7.1	7.8
Final	7.9	7.8	7.4	7.5	7.2	7.7	7.1
pH Initial	7.8	8.1	8.0	7.9	8.0	8.0	7.8
Final	8.1	8.1	8.0	8.2	8.2	8.2	7.9
Alkalinity	31	NA	31	NA	31	NA	NA
Hardness	46	NA	42	NA	42	NA	NA
Conductivity	110	NA	100	NA	120	NA	NA
Chlorine	<0.05	NA	<0.05	NA	<0.05	NA	NA

DILUTION 2.2 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.8	7.6	7.8	7.5	7.9	7.3	7.6
Final	7.5	7.5	7.4	7.3	7.2	7.5	7.1
pH Initial	7.8	7.9	7.9	7.9	8.0	7.9	7.8
Final	8.0	8.0	8.0	8.4	8.1	8.2	7.7
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	NA	NA	NA	NA	NA	NA	NA
Chlorine	NA	NA	NA	NA	NA	NA	NA

DILUTION 3.2 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	8.0	7.5	7.6	7.7	7.8	6.9	7.8
Final	7.9	7.7	7.5	7.5	7.7	7.5	6.9
pH Initial	7.8	7.9	7.9	7.8	8.0	7.8	7.8
Final	8.0	NA	8.0	8.4	8.1	8.1	7.7
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	NA	NA	NA	NA	NA	NA	NA
Chlorine	NA	NA	NA	NA	NA	NA	NA

DILUTION 4.6 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.7	7.4	7.6	7.3	7.5	7.1	7.7
Final	7.8	7.6	7.5	7.7	7.7	7.6	6.9
pH Initial	7.8	7.8	7.9	7.8	8.0	7.8	7.8
Final	7.9	8.0	8.0	8.4	8.1	8.1	7.6
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	NA	NA	NA	NA	NA	NA	NA
Chlorine	NA	NA	NA	NA	NA	NA	NA

DILUTION 6.5 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	7.8	7.6	7.8	7.3	7.8	7.4	7.8
Final	7.2	7.4	7.5	7.8	7.6	7.2	6.5
pH Initial	7.8	7.8	7.9	7.8	8.0	7.8	7.8
Final	7.9	7.9	8.0	8.3	8.1	8.1	7.6
Alkalinity	47	NA	53	NA	41	NA	NA
Hardness	35	NA	110	NA	56	NA	NA
Conductivity	120	NA	110	NA	100	NA	NA
Chlorine	<0.05	NA	<0.05	NA	<0.05	NA	NA

DILUTION 8.5 %	DAY						
	1	2	3	4	5	6	7
D.O. Initial	8.0	7.6	7.4	7.4	8.0	7.3	7.7
Final	7.6	7.3	7.3	7.5	7.6	7.4	6.8
pH Initial	7.8	7.8	7.9	7.9	7.9	7.8	7.8
Final	7.9	7.9	8.0	8.3	8.1	8.1	7.6
Alkalinity	NA	NA	NA	NA	NA	NA	NA
Hardness	NA	NA	NA	NA	NA	NA	NA
Conductivity	NA	NA	NA	NA	NA	NA	NA
Chlorine	NA	NA	NA	NA	NA	NA	NA




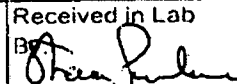
CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

PAGE OF

Client: <u>MALVERN WASTEWATER</u>			PO No.		NO OF BOTTLES	ANALYSES REQUESTED										AIC CONTROL NO. <u>156051</u>								
Project Reference:			SAMPLE MATRIX			1											AIC PROPOSAL NO.							
Project Manager:			WATER														Carrier:							
Sampled By: <u>John Davis</u>			G	C	A	S											Received Temperature C. <u>20C</u>							
AIC No.	Sample Identification	Date/Time Collected	R	O	T	E	I											Remarks						
1	<u>WASTEWATER</u>	<u>3/12/12 10am</u>		X				1	X															
Container Type													Field pH calibration on _____ @ _____											
Preservative													Buffer:											
G = Glass P = Plastic V = VOA vials H = HCl to pH2 T = Sodium Thiosulfate																								
NO = none S = Sulfuric acid pH2 N = Nitric acid pH2 B = NaOH to pH12 Z = Zinc acetate																								
Turnaround Time Requested: (Please circle) <u>NORMAL</u> or EXPEDITED IN _____ DAYS					Relinquished By: <u>[Signature]</u>					Date/Time <u>3/12/12 12:23 P</u>					Received By: _____					Date/Time _____				
Expedited results requested by: _____					Relinquished By: _____					Date/Time _____					Received in Lab By: <u>[Signature]</u>					Date/Time <u>3-13-12 12:23pm</u>				
Who should AIC contact with questions: _____					Comments:																			
Phone: _____ Fax: _____																								
Report Attention to: _____																								
Report Address to: _____																								

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

PAGE OF

Client: MALVERN WASTEWATER			PO No.		NO OF BOTTLES 1	ANALYSES REQUESTED												AIC CONTROL NO: 156051			
Project Reference:			SAMPLE MATRIX			Bottle # 156051-01													AIC PROPOSAL NO:		
Project Manager:			WATER	SOIL															Carrier: John		
Sampled By: John Davi							G R A B	C O M P													Received Temperature C: 2°C
AIC No.	Sample Identification	Date/Time Collected															Remarks				
2	MALVERN WASTEWATER	3/8-14/12 10AM/4A	Y																		
			Container Type														Field pH calibration on _____ @ _____				
			Preservative														Buffer: _____				
			G = Glass NO = none		P = Plastic S = Sulfuric acid pH2		V = VOA vials N = Nitric acid pH2		H = HCl to pH2 B = NaOH to pH12			T = Sodium Thiosulfate Z = Zinc acetate									
Turnaround Time Requested: (Please circle) NORMAL or EXPEDITED IN _____ DAYS					Relinquished By: 			Date/Time: 3/14/12 11:55A			Received By: 			Date/Time: 3.14.12 11:45A							
Expedited results requested by: _____					Relinquished By: _____			Date/Time: _____			Received in Lab			Date/Time: 11:45A							
Who should AIC contact with questions: _____					Comments:																
Phone: _____ Fax: _____																					
Report Attention to: _____																					
Report Address to: _____																					

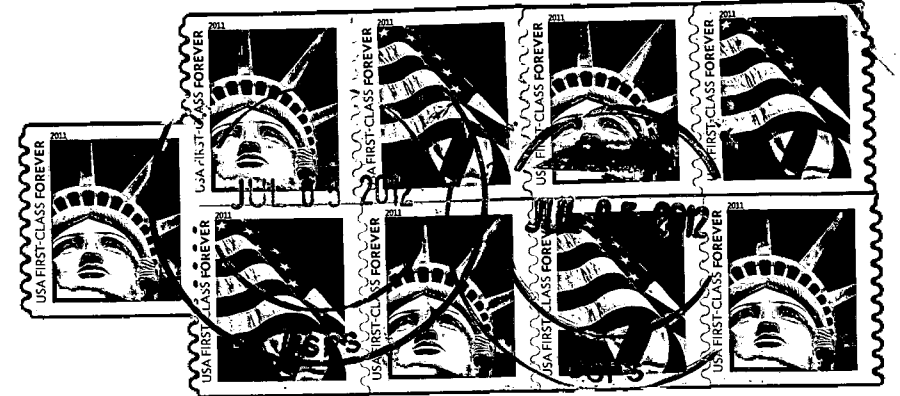
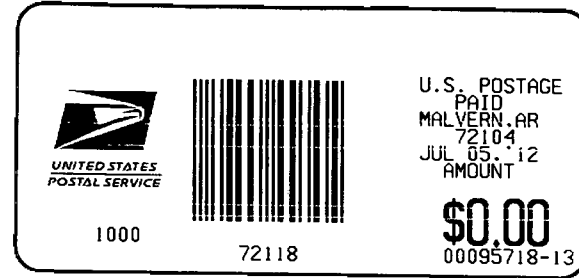


CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

PAGE OF

Client: MALVERN WASTEWATER			PO No.		NO OF BOTTLES	ANALYSES REQUESTED										AIC CONTROL NO: 156 051				
Project Reference:			SAMPLE MATRIX			1											AIC PROPOSAL NO:			
Project Manager:			G R A B	C O M P	W A T E R		S O I L	1	X											Carrier:
Sampled By: MARL MORGAN																Received Temperature C: 2				
AIC No.	Sample Identification	Date/Time Collected																		Remarks
3	MALVERN WASTEWATER	3/14/12		X																3-15-12 9 Am
		3/16/12 8:00 AM																		
Container Type																				Field pH calibration on @
Preservative																				Buffer:
G = Glass NO = none			P = Plastic S = Sulfuric acid pH2			V = VOA vials N = Nitric acid pH2			H = HCl to pH2 B = NaOH to pH12			T = Sodium Thiosulfate Z = Zinc acetate								
Turnaround Time Requested: (Please circle) NORMAL or EXPEDITED IN ____ DAYS					Relinquished By: <i>[Signature]</i>			Date/Time: 3/14/12 11:40 AM			Received By:			Date/Time:						
Expedited results requested by: _____					Relinquished By:			Date/Time:			Received in Lab By: <i>[Signature]</i>			Date/Time: 3-16-12 1140						
Who should AIC contact with questions: _____					Comments:															
Phone: _____ Fax: _____																				
Report Attention to:																				
Report Address to:																				

Malvern Water Works
Wastewater Division
P.O.Box 638
Malvern, AR 72104



ADEQ
Water Division - Enforcement Branch
5301 Northshore Drive
North Little Rock, AR.
72118-5317