



Forrest City Water Utility  
303 N. Rosser St  
Forrest City, AR 72335

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07/27/2016

Transmittal Letter

Arkansas Department of Environmental Quality  
5301 North Shore Dr.  
North Little Rock, AR 72118-5317  
ATTN: Water Division- Enforcement Branch

Please find Enclosed for your distribution the following:

June 2016 - DMR

June 2016 – SSO

June 2016 – 1<sup>st</sup> Chronic Biomonitoring Report

Sincerely,

A handwritten signature in black ink, appearing to read "W.H. Calvin Murdock".

Forrest City Water Utility  
W.H. Calvin Murdock, Manager  
(870)633-2921 – Office  
(870)261-2849 Cell  
[WHCM2@Forrestcitywater.com](mailto:WHCM2@Forrestcitywater.com)

**CITY OF FORREST CITY WWTP  
OUTFALL 001**

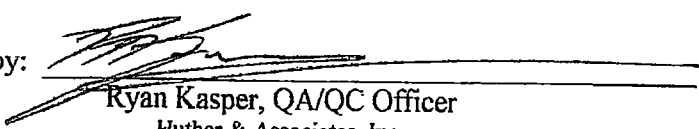
Chronic Biomonitoring Report  
Permit Number NPDES AR0020087  
AFIN 62-00070

*Ceriodaphnia dubia*  
*Pimephales promelas*

June 21, 2016

1st

Reviewed by:

  
Ryan Kasper, QA/QC Officer

Huther & Associates, Inc.

1156 North Bonnie Brae

Denton, Texas 76201

(940) 387-1025, Fax: (940) 387-1036

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TOXICITY TEST REPORT - CHRONIC

Client .....City of Forrest City WWTP Laboratory I.D. ....25331
Permit No. ....NPDES AR0020087 Begin Date .....June 21, 2016
Sample..... Outfall 001

Results: Pass Ceriodaphnia dubia survival and reproduction and Pimephales promelas survival and growth at the critical low flow concentration (100% effluent).

SAMPLE COLLECTION

Composite effluent samples from City of Forrest City WWTP were delivered by Greyhound Package Express courier to Huthier & Associates on June 21, June 23, and June 25. Effluent samples were collected and composited from Outfall 001 using an automatic sampler by facility personnel. Two toxicity tests were requested: a seven-day Ceriodaphnia dubia survival and reproduction test (EPA Method 1002.0), and a seven-day Pimephales promelas larval survival and growth test (EPA Method 1000.0). Test organisms, procedures and quality assurance requirements were in accordance with the EPA manual, "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition" (EPA-821-R-02-013).

The effluent samples were analyzed for total residual chlorine (Standard Methods, 22nd Edition, 4500-Cl D) and contained <0.01 mg/L, <0.01 mg/L, and <0.01 mg/L, respectively. Effluent and laboratory dilution water hardness, alkalinity, conductivity, pH, and dissolved oxygen data were collected and recorded.

TEST SETUP Ceriodaphnia dubia



The seven-day Ceriodaphnia dubia survival and reproduction test was initiated at 1615 hours, June 21, 2016. Five concentrations were prepared (32%, 42%, 56%, 75%, and 100% effluent) utilizing distilled, deionized laboratory water reconstituted to match the hardness, alkalinity and pH of the receiving stream (unnamed tributary of L'Anguille River). The test was conducted in 25 mL distilled water rinsed plastic beakers containing 15 mL of solution (one organism per beaker, ten beakers per concentration). C. dubia neonates were less than 24-hours-old and within eight hours of the same age at test initiation. Neonates were placed in beakers following a randomized block test design. Fresh solutions were prepared and renewed daily. Daily feeding consisted of 0.5 mL Selenastrum capricornutum and cerophyll per test chamber. The test proceeded for seven days during which survival, reproduction and water quality data were collected daily.

A control of ten replicate beakers containing one neonate each in distilled, deionized, reconstituted water (same as diluent) was conducted concurrently with the test. There was 100% survival in the control. The test ended at 1615 hours, June 28, 2016. Survival and reproduction data were statistically analyzed ( $p = 0.05$ ) according to EPA procedures to determine the Lowest Observable Effect Concentration (LOEC) and the No Observable Effect Concentration (NOEC).

**SURVIVAL*****Ceriodaphnia dubia***

There was 100% survival to *C. dubia* in all of the effluent concentrations tested. Therefore, statistical analyses were not required to determine a no effect concentration.

**LOEC: Not Applicable**

**NOEC: 100% Effluent**

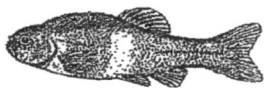
**REPRODUCTION*****Ceriodaphnia dubia***

*C. dubia* reproduction data were normally distributed at the 0.01 alpha level (13.277) using Chi-Square test for normality. Reproduction data were homogeneous using Bartlett's test at the 0.01 alpha level (15.09) without data transformations. Therefore, a parametric test was performed on the homogeneous data. Dunnett's test on *C. dubia* reproduction data demonstrated that there were no statistically significant differences between the control and any of the effluent concentrations.

**LOEC: Not Applicable**

**NOEC: 100% Effluent**

**PMSD: 7.1%**

**TEST SETUP*****Pimephales promelas***

The seven-day *Pimephales promelas* larval survival and growth test was initiated at 1645 hours, June 21, 2016. Five concentrations were prepared (32%, 42%, 56%, 75%, and 100% effluent) utilizing distilled, deionized laboratory water reconstituted to match the hardness, alkalinity and pH of the receiving stream (unnamed tributary of L' Anguille River). The test was conducted in 300 mL distilled water rinsed plastic beakers containing 250 mL of solution (eight larvae per beaker, five beakers per concentration). *P. promelas* larvae were less than 24-hours-old at test initiation and originated from a minimum of three in-house spawnings. Fresh solutions were prepared and renewed daily. Larvae in each test chamber were fed <24-hour-old *Artemia* (brine shrimp) three times per day. The test proceeded for seven days during which survival and water quality data were collected daily.

A control of five replicate chambers containing eight larvae each in distilled, deionized, reconstituted water (same as diluent) was conducted concurrently with the test. There was 100% survival in the control. The test ended at 1645 hours, June 28, 2016. At test termination, all larvae were sacrificed, dried for 24-hours, and weighed. Survival and growth (weight) data were statistically analyzed ( $p = 0.05$ ) according to EPA procedures to determine the Lowest Observable Effect Concentration (LOEC) and the No Observable Effect Concentration (NOEC).

Huth and Associates  
7-Day/3 Brood *Ceriodaphnia dubia* Survival and Reproduction Chronic Toxicity Test

Forrest City WWTP

Lab ID# 25331

Test Date: June 21, 2016

75% Effluent

Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
06/22/16	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/23/16	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/24/16	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/25/16	4	2	3	3	5	3	4	2	4	2
	4	2	3	3	5	3	4	2	4	2
06/26/16	A	A	A	A	A	A	A	A	A	A
	4	2	3	3	5	3	4	2	4	2
06/27/16	7	10	8	8	9	10	8	7	6	9
	11	12	11	11	14	13	12	9	10	11
	12	13	14	12	14	14	12	14	13	14
06/28/16	23	25	25	23	28	27	24	29	23	25
<p>x # Young 24.6 C.V. 7.22%</p> <p>x% Survival 100% C.V. 0.00%</p>										

100% Effluent

Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
06/22/16	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/23/16	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/24/16	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/25/16	3	5	4	5	3	3	2	4	5	3
	3	5	4	5	3	3	2	4	5	3
06/26/16	A	A	A	A	A	A	A	A	A	A
	3	5	4	5	3	3	2	4	5	3
06/27/16	10	8	7	8	6	9	9	10	8	7
	13	13	11	13	9	12	11	14	13	10
	14	14	14	14	14	13	14	12	14	14
06/28/16	27	27	25	27	23	25	25	26	27	24
<p>x # Young 25.6 C.V. 5.59%</p> <p>x% Survival 100% C.V. 0.00%</p>										

where: A = Alive  
5 = Alive, 5 young  
D = Dead  
D5 = 5 Young, Female died

ex 1: 

A
4

 alive today  
total young to date

ex 2: 

5
12

 alive, 5 young today  
total young to date

Huther and Associates  
7-Day/3 Brood *Ceriodaphnia dubia* Survival and Reproduction Chronic Toxicity Test

Forrest City WWTP

Lab ID# 25331

Test Date: June 21, 2016

**WET CHEMISTRY MEASUREMENTS**

Date	Time	Temp	Samp. No.	pH of Solution						Analyst
				CON	32%	42%	56%	75%	100%	
06/21/16	Start	25.0	1	7.39	8.25	8.44	8.45	8.48	8.44	RP
06/22/16	24 Hr.	25.8	1	8.54	8.67	8.81	8.87	8.92	8.98	TB
06/22/16	Renew	25.7	1	8.30	8.43	8.46	8.48	8.49	8.50	TB
06/23/16	48 Hr.	25.8	1	8.46	8.49	8.60	8.67	8.73	8.80	LT
06/23/16	Renew	25.3	2	8.28	8.38	8.54	8.56	8.57	8.59	LT
06/24/16	72 Hr.	25.7	2	8.47	8.45	8.51	8.52	8.54	8.59	LT
06/24/16	Renew	25.3	2	8.48	8.45	8.51	8.54	8.54	8.56	LT
06/25/16	96 Hr.	25.7	2	8.77	8.66	8.62	8.59	8.56	8.55	RP
06/25/16	Renew	25.0	3	8.50	8.52	8.57	8.57	8.56	8.20	RP
06/26/16	120 Hr.	25.9	3	8.75	8.62	8.59	8.56	8.54	8.54	RP
06/26/16	Renew	25.7	3	8.36	8.43	8.49	8.50	8.51	8.53	RP
06/27/16	144 Hr.	25.9	3	8.63	8.57	8.58	8.58	8.57	8.58	LT
06/27/16	Renew	25.6	3	8.61	8.57	8.60	8.61	8.59	8.59	LT
06/28/16	168 Hr.	25.8	3	8.60	8.62	8.70	8.73	8.79	8.86	LT

Date	Time	Temp	Samp. No.	DO (mg/L) of Solution						Analyst
				CON	32%	42%	56%	75%	100%	
06/21/16	Start	25.0	1	8.37	8.69	8.32	8.27	7.86	8.10	RP
06/22/16	24 Hr.	25.8	1	8.15	8.14	8.37	8.32	8.25	8.15	TB
06/22/16	Renew	25.7	1	7.49	7.35	7.72	7.80	7.82	7.75	TB
06/23/16	48 Hr.	25.8	1	7.14	7.71	7.58	7.43	7.61	7.62	LT
06/23/16	Renew	25.3	2	7.62	7.85	8.25	8.15	7.70	8.02	LT
06/24/16	72 Hr.	25.7	2	8.76	7.93	8.37	7.85	8.66	8.53	LT
06/24/16	Renew	25.3	2	8.56	8.24	7.45	8.23	8.47	8.53	LT
06/25/16	96 Hr.	25.7	2	7.84	7.87	7.70	7.59	7.61	7.82	RP
06/25/16	Renew	25.0	3	7.65	8.34	7.85	8.42	8.04	7.45	RP
06/26/16	120 Hr.	25.9	3	8.22	7.75	7.84	7.59	7.83	7.83	RP
06/26/16	Renew	25.7	3	7.07	8.12	8.05	8.01	7.69	7.64	RP
06/27/16	144 Hr.	25.9	3	8.86	8.17	8.04	8.12	7.65	7.54	LT
06/27/16	Renew	25.6	3	7.40	7.85	7.22	7.46	8.00	8.04	LT
06/28/16	168 Hr.	25.8	3	7.07	7.85	7.44	7.89	7.69	7.64	LT

Huthier and Associates  
7-Day/3 Brood *Ceriodaphnia dubia* Survival and Reproduction Chronic Toxicity Test

Forrest City WWTP

Lab ID# 25331

Test Date: June 21, 2016

**INITIAL CHEMISTRY MEASUREMENTS @ 100% EFFLUENT**

Date	Samp No.	pH	DO	Hardness mg/L CaCO <sub>3</sub> <sup>1</sup>	Alkalinity mg/L CaCO <sub>3</sub> <sup>1</sup>	Conduct umhos/cm <sup>1</sup>	Resid.Cl <sub>2</sub> mg/L <sup>1</sup>	Dechlor(mL) Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> mg/L <sup>1</sup>	Analyst
06/21/16	1	8.44	8.10	280	220	1076	<0.01	N/A	RK
06/23/16	2	8.59	8.02	272	226	1000	<0.01	N/A	RK
06/25/16	3	8.20	7.45	268	220	888	<0.01	N/A	RK
06/21/16	Con	7.39	8.37	72	58	247	-	-	RK

<sup>1</sup> Measurements taken in 100% solution.



**CERIODAPHNIA DUBIA STATISTICAL ANALYSES**  
 Reproduction

Summary Statistics on Transformed Data Table 1 of 2

Grp	Identification	N	Min	Max	Mean
1	Control	10	24.000	28.000	25.400
2	32% Effluent	10	21.000	27.000	24.800
3	42% Effluent	10	22.000	29.000	25.500
4	56% Effluent	10	22.000	28.000	25.100
5	75% Effluent	10	23.000	28.000	24.600
6	100% Effluent	10	23.000	27.000	25.600

Summary Statistics on Transformed Data Table 2 of 2

Grp	Identification	Variance	Sd	Sem	C.V. %
1	Control	1.822	1.350	0.427	5.31
2	32% Effluent	2.622	1.619	0.512	6.53
3	42% Effluent	4.722	2.173	0.687	8.52
4	56% Effluent	4.100	2.025	0.640	8.07
5	75% Effluent	3.156	1.776	0.562	7.22
6	100% Effluent	2.044	1.430	0.452	5.59

Chi-Square Test For Normality: Actual And Expected Frequencies

Interval	< -1.5	-1.5 to -0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
Expected	4.020	14.520	22.920	14.520	4.020
Observed	4	13	26	14	3

Calculated Chi-Square goodness of fit test statistic = 0.8505  
 Table Chi-Square value (alpha = 0.01) = 13.277

Data Pass normality test. Continue analysis.

Bartlett's Test For Homogeneity of Variance

Calculated B1 statistic = 3.05

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.

ANOVA Table

SOURCE	DF	SS	MS	F
Between	5	8.133	1.627	0.529
Within (Error)	54	166.200	3.078	
Total	59	174.333		

Critical F value = 2.45 (0.05,5,40)  
 Since F < Critical F Fail to Reject Ho: All equal

Dunnett's Test - Table 1 of 2 Ho:Control<Treatment

Grp	Identification	Transformed	Mean	T Stat	Sig
		Mean	Calculated In Original Units		
1	Control	25.400	25.400		
2	32% Effluent	24.800	24.800	0.765	
3	42% Effluent	25.500	25.500	-0.127	
4	56% Effluent	25.100	25.100	0.382	
5	75% Effluent	24.600	24.600	1.020	
6	100% Effluent	25.600	25.600	-0.255	

Dunnett table value = 2.31 (1 Tailed Value, P=0.05, DF=40,5)  
 No statistically significant difference

Dunnett's Test - Table 2 of 2 Ho:Control<Treatment

Grp	Identification	Num of Reps	Minimum Sig	% of Control	Difference from Control
			Diff (In Orig. Units)		
1	Control	10			
2	32% Effluent	10	1.812	7.1	0.600
3	42% Effluent	10	1.812	7.1	-0.100
4	56% Effluent	10	1.812	7.1	0.300
5	75% Effluent	10	1.812	7.1	0.800
6	100% Effluent	10	1.812	7.1	-0.200

Huthur and Associates  
7-Day *Pimephales promelas* Survival and Growth Chronic Toxicity Test

CLIENT	City of Forrest City WWTP	SAMPLE TYPE	24 Hour Composite
NPDES #	AR0020087	DATE COLLECTED	06/20/16 06/22/16 06/24/16
LAB ID #	25331	DATE RECEIVED	06/21/16 06/23/16 06/25/16
TEST TYPE	7 Day Chronic	BEGIN DATE/TIME	06/21/16 1645
TEST ORGANISM	<i>Pimephales promelas</i>	END DATE/TIME	06/28/16 1645
ORGANISM AGE	<24 Hours	TEST TEMPERATURE (°C)	25 ± 1
ORGANISM SOURCE	In House	PHOTO PERIOD	16-hr Light 8-hr Dark
RECEIVING WATER	unnamed tributary of the L'Anguille River	LIGHT INTENSITY	50-100 ft. cndl
DILUTION WATER	Laboratory	TECHNICIAN	G. Price

**SURVIVAL SUMMARY**

Conc.	06/22/16					06/23/16					06/24/16					06/25/16					06/26/16				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
Con	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
32%	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
42%	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
56%	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
75%	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
100%	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8

Conc.	06/27/16					06/28/16					x % Survival	C.V. %
	A	B	C	D	E	A	B	C	D	E		
Con	8	8	8	8	8	8	8	8	8	8	100.0	0.00
32%	8	8	8	8	8	8	8	8	8	8	100.0	0.00
42%	8	8	8	8	8	8	8	8	8	8	100.0	0.00
56%	8	8	8	8	8	8	8	8	8	8	100.0	0.00
75%	8	8	8	8	8	8	8	8	8	8	100.0	0.00
100%	8	8	8	8	8	8	8	8	8	8	100.0	0.00

**MEAN DRY WEIGHT PER REP**

% Effluent	Rep A	Rep B	Rep C	Rep D	Rep E	x	C.V.%
Con	0.4580	0.4950	0.4270	0.4390	0.4620	0.4562	5.69
32%	0.4410	0.4260	0.4830	0.4950	0.4580	0.4606	6.21
42%	0.4760	0.5040	0.4450	0.4900	0.4260	0.4682	6.87
56%	0.4560	0.5070	0.4120	0.4830	0.4500	0.4616	7.77
75%	0.4620	0.4910	0.4250	0.5020	0.4980	0.4756	6.80
100%	0.4710	0.4560	0.5030	0.4290	0.4860	0.4690	6.05

Huthner and Associates  
7-Day *Pimephales promelas* Survival and Growth Chronic Toxicity Test

Forrest City WWTP

Lab ID# 25331

Test Date: June 21, 2016

**WET CHEMISTRY MEASUREMENTS**

Date	Time	Temp	Samp. No.	pH of Solution						Analyst
				CON	32%	42%	56%	75%	100%	
06/21/16	Start	25.0	1	7.39	8.25	8.44	8.45	8.48	8.44	RP
06/22/16	24 Hr.	25.9	1	8.34	8.31	8.51	8.56	8.59	8.64	TB
06/22/16	Renew	25.7	1	8.30	8.43	8.46	8.48	8.49	8.50	TB
06/23/16	48 Hr.	25.9	1	8.15	8.19	8.42	8.49	8.66	8.74	LT
06/23/16	Renew	25.3	2	8.28	8.38	8.54	8.56	8.57	8.59	LT
06/24/16	72 Hr.	25.9	2	8.45	8.52	8.70	8.74	8.81	8.85	LT
06/24/16	Renew	25.3	2	8.48	8.45	8.51	8.54	8.54	8.56	LT
06/25/16	96 Hr.	25.9	2	8.76	8.67	8.74	8.85	8.89	8.93	RP
06/25/16	Renew	25.0	3	8.50	8.52	8.57	8.57	8.56	8.70	RP
06/26/16	120 Hr.	25.9	3	8.44	8.28	8.46	8.53	8.60	8.66	RP
06/26/16	Renew	25.7	3	8.36	8.43	8.49	8.50	8.51	8.53	RP
06/27/16	144 Hr.	25.9	3	7.69	7.71	8.02	8.15	8.24	8.38	LT
06/27/16	Renew	25.9	3	8.61	8.57	8.60	8.61	8.59	8.59	LT
06/28/16	168 Hr.	25.9	3	8.03	8.14	8.51	8.49	8.61	8.63	LT

Date	Time	Temp	Samp. No.	DO (mg/L) of Solution						Analyst
				CON	32%	42%	56%	75%	100%	
06/21/16	Start	25.0	1	8.37	8.69	8.32	8.27	7.86	8.10	RP
06/22/16	24 Hr.	25.9	1	7.72	7.65	7.64	7.94	8.08	8.13	TB
06/22/16	Renew	25.7	1	7.49	7.35	7.72	7.80	7.82	7.75	TB
06/23/16	48 Hr.	25.9	1	7.76	7.82	7.81	7.33	7.54	7.55	LT
06/23/16	Renew	25.3	2	7.62	7.85	8.25	8.15	7.70	8.02	LT
06/24/16	72 Hr.	25.9	2	8.08	7.33	7.71	6.91	7.39	7.01	LT
06/24/16	Renew	25.3	2	8.56	8.24	7.45	8.23	8.47	8.53	LT
06/25/16	96 Hr.	25.9	2	6.19	6.31	7.21	6.62	7.15	7.23	RP
06/25/16	Renew	25.0	3	7.65	8.34	7.85	8.42	8.04	7.45	RP
06/26/16	120 Hr.	25.9	3	8.31	7.10	7.14	6.79	6.60	6.34	RP
06/26/16	Renew	25.7	3	7.07	8.12	8.05	8.01	7.69	7.64	RP
06/27/16	144 Hr.	25.9	3	8.59	7.21	7.72	6.92	7.27	7.88	LT
06/27/16	Renew	25.9	3	7.40	7.85	7.22	7.46	8.00	8.04	LT
06/28/16	168 Hr.	25.9	3	8.44	7.40	7.94	7.37	6.97	7.07	LT

Huthier and Associates  
7-Day *Pimephales promelas* Survival and Growth Chronic Toxicity Test

Forrest City WWTP

Lab ID# 25331

Test Date: June 21, 2016

**INITIAL CHEMISTRY MEASUREMENTS @ 100% EFFLUENT**

Date	Samp. No.	pH	DO	Hardness mg/L CaCO <sub>3</sub> <sup>1</sup>	Alkalinity mg/L CaCO <sub>3</sub> <sup>1</sup>	Conduct umhos/cm <sup>1</sup>	Resid Cl <sub>2</sub> mg/L <sup>1</sup>	Dechlor(mL) Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> mg/L <sup>1</sup>	Analyst
06/21/16	1	8.44	8.10	280	220	1076	<0.01	N/A	RK
06/23/16	2	8.59	8.02	272	226	1000	<0.01	N/A	RK
06/25/16	3	8.20	7.45	268	220	888	<0.01	N/A	RK
06/21/16	Con	7.39	8.37	72	58	247	-	-	RK

<sup>1</sup> Measurements taken in 100% solution.

*PIMEPHALES PROMELAS* STATISTICAL ANALYSES  
 Growth

Summary Statistics on Transformed Data Table 1 of 2

Grp	Identification	N	Min	Max	Mean
1	Control	5	0.427	0.495	0.456
2	32% Effluent	5	0.426	0.495	0.461
3	42% Effluent	5	0.426	0.504	0.468
4	56% Effluent	5	0.412	0.507	0.462
5	75% Effluent	5	0.425	0.502	0.476
6	100% Effluent	5	0.429	0.503	0.469

Summary Statistics on Transformed Data Table 2 of 2

Grp	Identification	Variance	Sd	Sem	C.V. %
1	Control	0.001	0.026	0.012	5.69
2	32% Effluent	0.001	0.029	0.013	6.21
3	42% Effluent	0.001	0.032	0.014	6.87
4	56% Effluent	0.001	0.036	0.016	7.77
5	75% Effluent	0.001	0.032	0.014	6.80
6	100% Effluent	0.001	0.028	0.013	6.05

Shapiro - Wilk's Test For Normality

D = 0.023

W = 0.954

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.

Bartlett's Test For Homogeneity of Variance

Calculated B1 statistic = 0.50

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.

ANOVA Table

SOURCE	DF	SS	MS	F
Between	5	0.001	0.000	0.261
Within (Error)	24	0.023	0.001	
Total	29	0.024		

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

Since F < Critical F Fail to Reject Ho: All equal

Dunnett's Test - Table 1 of 2 Ho:Control<Treatment

Grp	Identification	Transformed Mean	Mean	T Stat	Sig
			Calculated In Original Units		
1	Control	0.456	0.456		
2	32% Effluent	0.461	0.461	-0.226	
3	42% Effluent	0.468	0.468	-0.618	
4	56% Effluent	0.462	0.462	-0.278	
5	75% Effluent	0.476	0.476	-0.999	
6	100% Effluent	0.469	0.469	-0.659	

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

No statistically significant difference

Dunnett's Test - Table 2 of 2 Ho:Control<Treatment

Grp	Identification	Num of Reps	Minimum Sig	% of Control	Difference from Control
			Diff (In Orig. Units)		
1	Control	5			
2	32% Effluent	5	0.046	10.1	-0.004
3	42% Effluent	5	0.046	10.1	-0.012
4	56% Effluent	5	0.046	10.1	-0.005
5	75% Effluent	5	0.046	10.1	-0.019
6	100% Effluent	5	0.046	10.1	-0.013

**APPENDIX A  
RAW DATA**

7-DAY CERIODAPHNIA DUBIA SURVIVAL & REPRODUCTION  
DAILY RAW DATA TABLE  
PAGE 1 OF 2

CLIENT Forrest City  
OUTFALL 001  
LAB ID # 25331

START DATE/TIME 6-21-16 TB 1615  
END DATE/TIME 6-28-16 MH 1615

Con

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
6/22	A	A	A	A	A	A	A	A	A	A	BB	1615
6/23	A	A	A	A	A	A	A	A	A	A	TB	1415
6/24	A	A	A	A	A	A	A	A	A	A	TB	1405
6/25	4	2	3	4	4	5	2	5	3	3	BB	1400
6/26	A	A	A	A	A	A	A	A	A	A	BB	1350
6/27	7	9	10	8	8	10	9	7	9	11	TB	1120
6/28	14	14	13	13	12	13	13	12	14	13	MH	1615
	25	25	26	25	24	28	24	24	26	27		

$\bar{x}$  # Young w/o Dead = 25.4 CV% = 5.31  
 $\bar{x}$  # Young w/Dead = CV% =  
 $\bar{x}$  % Survival = 100.0 CV% = 0.00

32

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
6/22	A	A	A	A	A	A	A	A	A	A	BB	1615
6/23	A	A	A	A	A	A	A	A	A	A	TB	1415
6/24	A	A	A	A	A	A	A	A	A	A	TB	1405
6/25	4	5	4	2	4	3	4	4	3	2	BB	1400
6/26	A	A	A	A	A	A	A	A	A	A	BB	1350
6/27	8	6	9	10	7	8	8	9	10	7	TB	1120
6/28	13	14	14	14	14	13	12	12	13	12	MH	1615
	25	25	27	26	25	24	24	25	26	21		

$\bar{x}$  # Young w/o Dead = 24.8 CV% = 6.53  
 $\bar{x}$  # Young w/Dead = CV% =  
 $\bar{x}$  % Survival = 100.0 CV% = 0.00

42

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
6/22	A	A	A	A	A	A	A	A	A	A	BB	1615
6/23	A	A	A	A	A	A	A	A	A	A	TB	1415
6/24	A	A	A	A	A	A	A	A	A	A	TB	1405
6/25	2	5	5	2	3	5	4	5	2	4	BB	1400
6/26	A	A	A	A	A	A	A	A	A	A	BB	1350
6/27	8	7	10	9	9	8	10	6	9	10	TB	1120
6/28	12	14	14	14	13	14	14	12	13	12	MH	1615
	22	26	29	25	25	27	28	23	24	26		

$\bar{x}$  # Young w/o Dead = 25.5 CV% = 8.52  
 $\bar{x}$  # Young w/Dead = CV% =  
 $\bar{x}$  % Survival = 100.0 CV% = 0.00

56

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
6/22	A	A	A	A	A	A	A	A	A	A	BB	1615
6/23	A	A	A	A	A	A	A	A	A	A	TB	1415
6/24	A	A	A	A	A	A	A	A	A	A	TB	1405
6/25	2	5	4	3	2	4	2	5	4	3	BB	1400
6/26	A	A	A	A	A	A	A	A	A	A	BB	1350
6/27	9	10	8	7	8	6	10	9	9	8	TB	1120
6/28	14	13	14	14	12	13	14	13	14	12	MH	1615
	25	28	26	24	22	23	26	27	23	23		

$\bar{x}$  # Young w/o Dead = 25.1 CV% = 8.07  
 $\bar{x}$  # Young w/Dead = CV% =  
 $\bar{x}$  % Survival = 100.0 CV% = 0.00

7-DAY CERIODAPHNIA DUBIA SURVIVAL & REPRODUCTION  
 DAILY RAW DATA TABLE  
 PAGE 2 OF 2

CLIENT Forrest City  
 OUTFALL 001  
 LAB ID # 25331

START DATE/TIME 6-21-16 TB 1615  
 END DATE/TIME 6-28-16 MH 1615

75

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
6/22	A	A	A	A	A	A	A	A	A	A	BB	1615
6/23	A	A	A	A	A	A	A	A	A	A	TB	1415
6/24	A	A	A	A	A	A	A	A	A	A	TB	1405
6/25	4	2	3	3	5	3	4	2	4	2	BB	1400
6/26	A	A	A	A	A	A	A	A	A	A	BB	1355
6/27	7	10	8	8	9	10	8	7	6	9	TB	1120
6/28	12	13	14	12	14	14	12	14	13	14	MH	1615
	23	25	25	23	28	27	24	23	23	25		

$\bar{x}$  # Young w/o Dead = 24.6 CV% = 7.22  
 $\bar{x}$  # Young w/Dead = CV% =  
 $\bar{x}$  % Survival = 100.0 CV% = 0.00

100

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
6/22	A	A	A	A	A	A	A	A	A	A	BB	1615
6/23	A	A	A	A	A	A	A	A	A	A	TB	1415
6/24	A	A	A	A	A	A	A	A	A	A	TB	1405
6/25	3	5	4	5	3	3	2	4	5	3	BB	1400
6/26	A	A	A	A	A	A	A	A	A	A	BB	1355
6/27	10	8	7	8	6	9	9	10	8	7	TB	1120
6/28	14	14	14	14	14	13	14	12	14	14	MH	1615
	27	27	25	27	23	25	25	26	27	24		

$\bar{x}$  # Young w/o Dead = 25.6 CV% = 5.59  
 $\bar{x}$  # Young w/Dead = CV% =  
 $\bar{x}$  % Survival = 100.0 CV% = 0.00

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time

$\bar{x}$  # Young w/o Dead = CV% =  
 $\bar{x}$  # Young w/Dead = CV% =  
 $\bar{x}$  % Survival = CV% =

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time

$\bar{x}$  # Young w/o Dead = CV% =  
 $\bar{x}$  # Young w/Dead = CV% =  
 $\bar{x}$  % Survival = CV% =



**7-DAY CHRONIC TOXICITY TEST  
PIMEPHALES PROMELAS (fathead minnow) SURVIVAL**

CLIENT/FACILITY Forrest City  
 OUTFALL # 001 PROJECT # 25331  
 ORGANISM ID# FPD-16-172

DATE/TIME STARTED 6/21/16 GP 1645  
 DATE/TIME ENDED 6-28-16 BR 1645

Conc.	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E					
Con	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8					
32	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8					
42	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8					
56	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8					
75	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8					
100	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8					
Initials Date/Time	6/22/16 GP 1645					6/23/16 GP 0925					6-24-16 MH 0850					6/25/16 GP 0935					6/26/16 GP 0925				

Conc.	A	B	C	D	E	A	B	C	D	E	Mean Survival	C.V. %
Con	8	8	8	8	8	8	8	8	8	8	100.0	0.00
32	8	8	8	8	8	8	8	8	8	8	100.0	0.00
42	8	8	8	8	8	8	8	8	8	8	100.0	0.00
56	8	8	8	8	8	8	8	8	8	8	100.0	0.00
75	8	8	8	8	8	8	8	8	8	8	100.0	0.00
100	8	8	8	8	8	8	8	8	8	8	100.0	0.00
Initials Date/Time	6-27-16 MH 0815					6-28-16 BR 1645						





**Huther and Associates, Inc.**

*environmental toxicologists, biologists, and consultants*

Client / Facility Forrest City  
Lab ID Number 25331  
Outfall Number 001  
Test Date 6-21-16

**INITIAL CHEMISTRY MEASUREMENTS @ 100% EFFLUENT**

Date	Samp. No.	pH	DO	Hardness mg/L CaCO <sub>3</sub> <sup>1</sup>	Alkalinity mg/L CaCO <sub>3</sub> <sup>1</sup>	Conduct. umhos/cm <sup>1</sup>	Resid. Cl <sub>2</sub> mg/L <sup>1</sup>	Dechlor(mL) Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> mg/L <sup>1</sup>	Analyst
6-21	1	8.44	8.10	280	220	1076	20.01	N/A	RK
6-23	2	8.59	8.02	272	226	1000	↓	↓	↓
6-25	3	8.20	7.45	268	220	888	↓	↓	↓
6-21	Con	7.39	8.37	72	58	247	—	—	↓

**INITIAL CHEMISTRY MEASUREMENTS @ RECEIVING WATER**

Date	Samp. No.	pH	DO	Hardness mg/L CaCO <sub>3</sub> <sup>1</sup>	Alkalinity mg/L CaCO <sub>3</sub> <sup>1</sup>	Conduct. umhos/cm <sup>1</sup>	Resid. Cl <sub>2</sub> mg/L <sup>1</sup>	Dechlor(mL) Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> mg/L <sup>1</sup>	Analyst

Notes:

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**APPENDIX B  
REFERENCE TOXICANTS**

**CHRONIC REFERENCE TOXICANT TEST RESULTS**

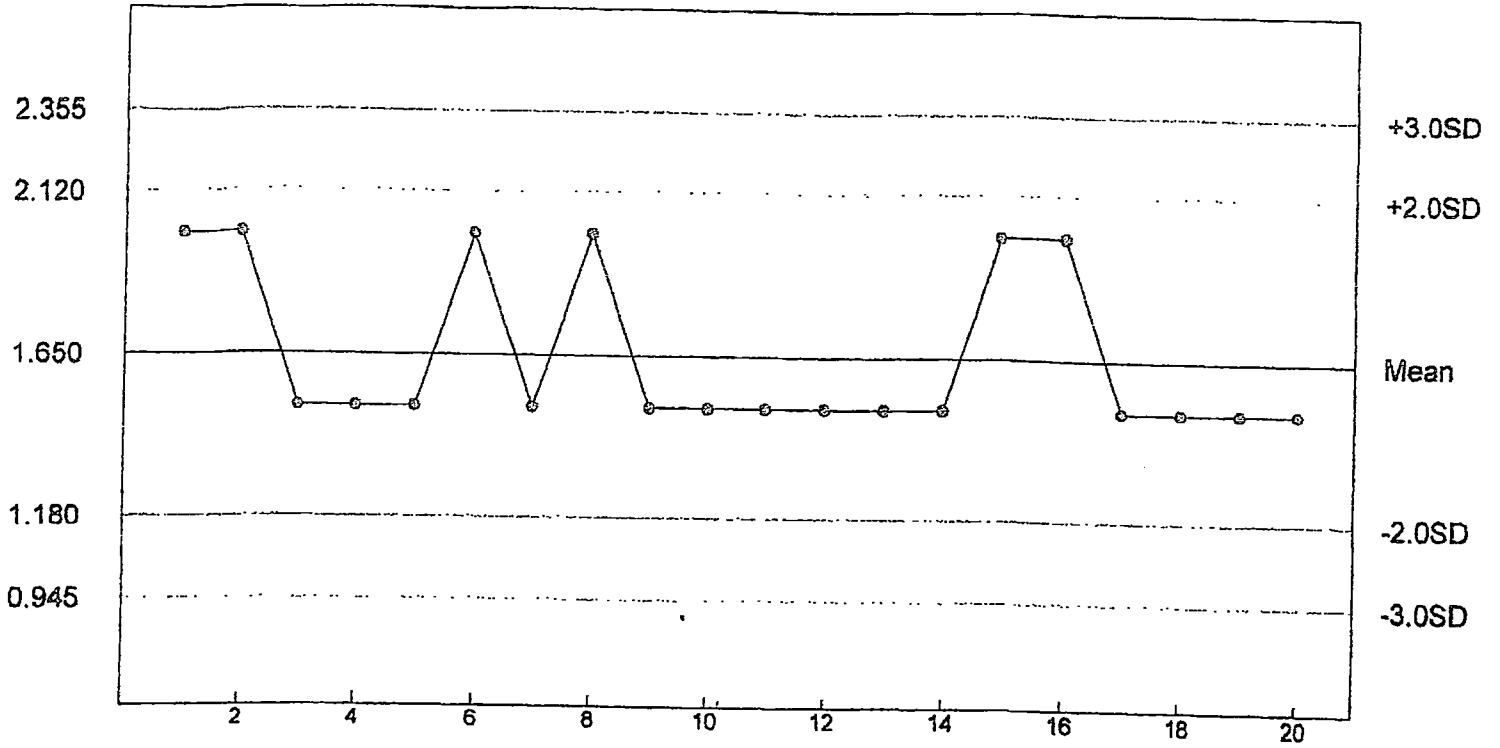
SPECIES: *Ceriodaphnia dubia*  
 CHEMICAL: Sodium Chloride  
 DURATION: 7-Days  
 TEST NUMBER: 6  
 TEST DATE: 06/01/16 - 06/08/16  
 1645 Hrs - 1645 Hrs  
 STATISTICAL METHOD: Dunnetts/Steels

CONCENTRATION (g/L)	NUMBER EXPOSED	NUMBER DEAD
0.5	10	0
1.0	10	0
1.5	10	0
2.0	10	4
2.5	10	10
3.0	10	10

LOEC FOR SURVIVAL	NOEC FOR SURVIVAL	LOEC FOR REPRODUCTION	NOEC FOR REPRODUCTION
2.0 g/L	1.5 g/L	1.0 g/L	0.5 g/L

Reference Tox Sodium Chloride g/L

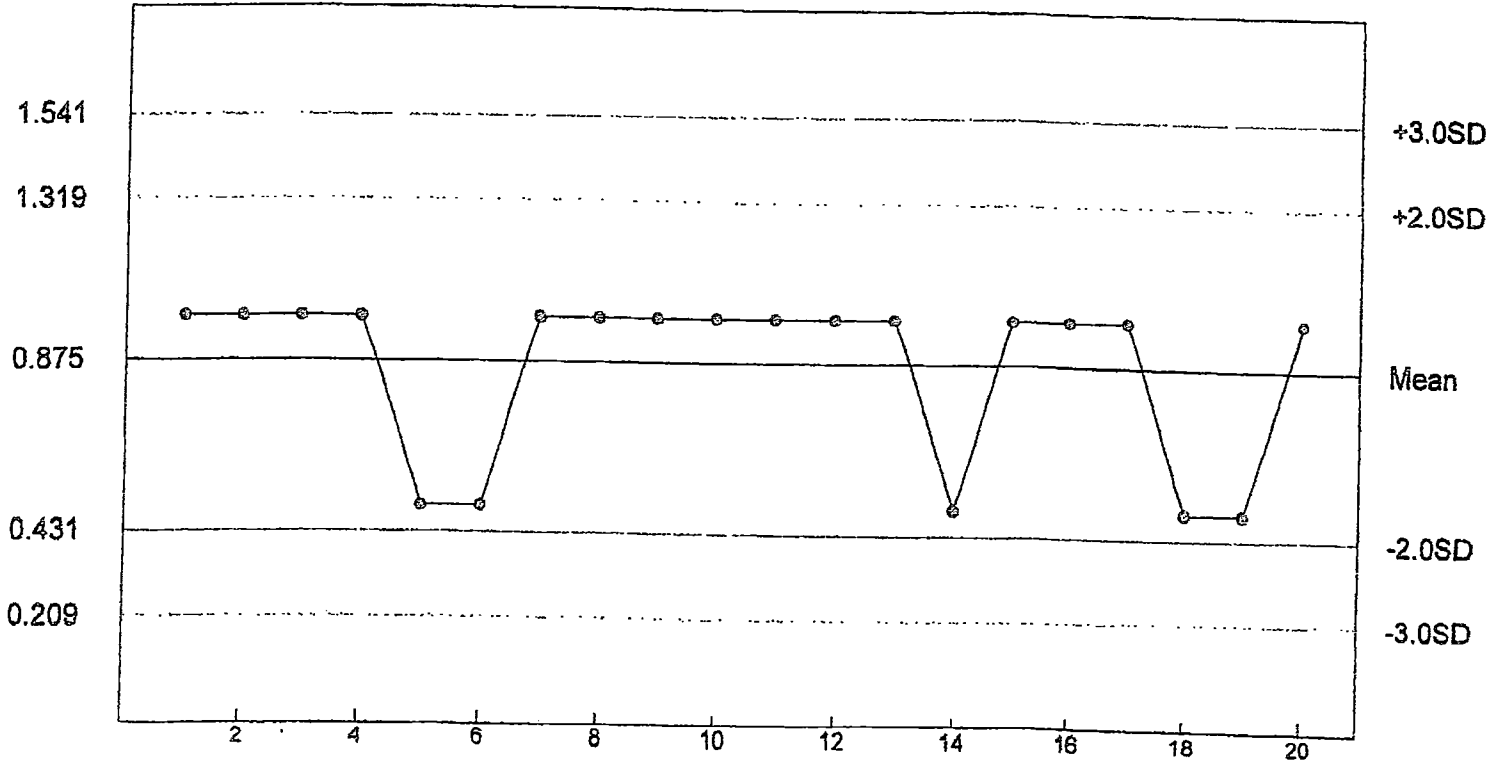
C. dubia Survival - NOEC



n= 20 Mean= 1.650 SD= 0.235 CV= 14.25% Min= 1.500 Max= 2.000

Reference Tox Sodium Chloride g/L

C. dubia Reproduction - NOEC



n= 20 Mean= 0.875 SD= 0.222 CV= 25.39% Min= 0.500 Max= 1.000

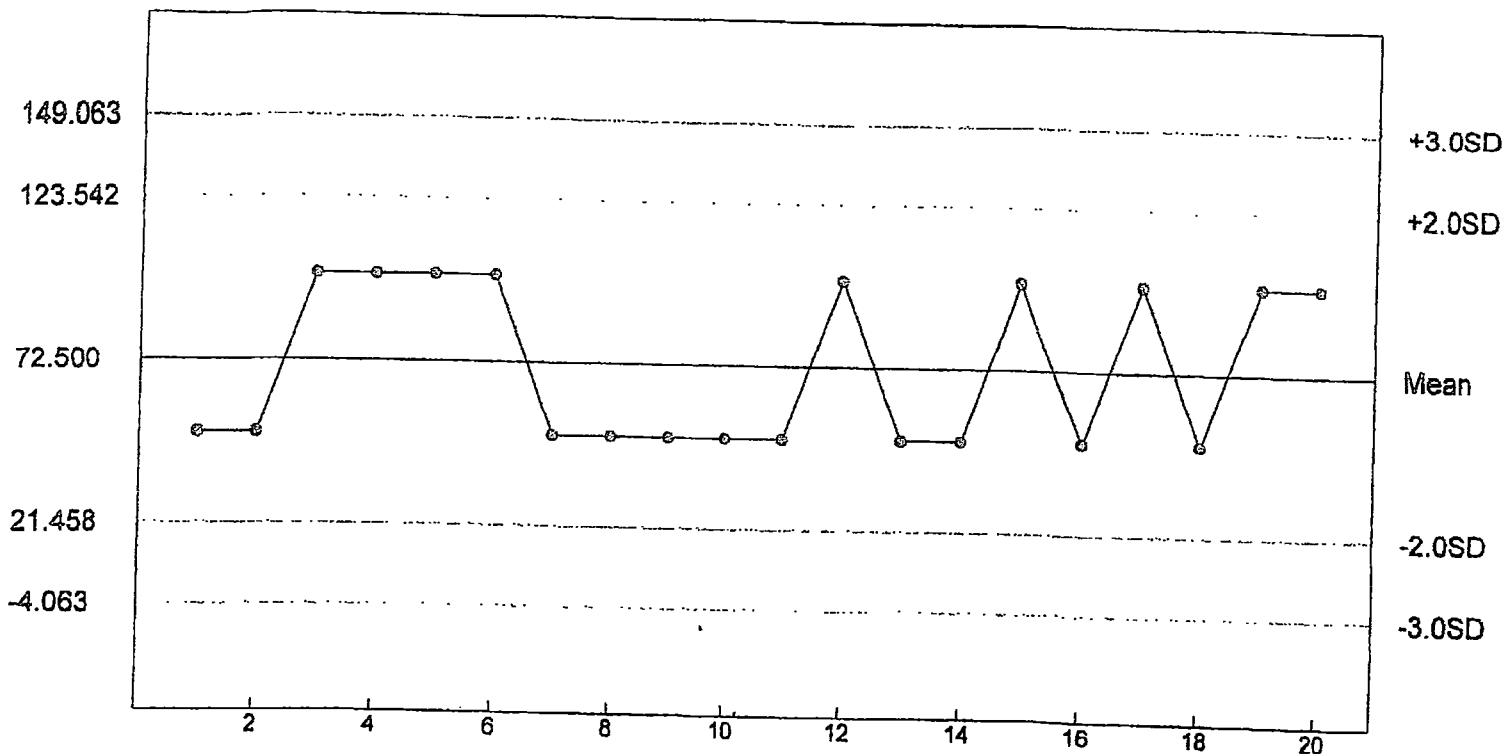
**CHRONIC REFERENCE TOXICANT TEST RESULTS**

SPECIES: *Pimephales promelas*  
 CHEMICAL: Copper Nitrate  
 DURATION: 7-Days  
 TEST NUMBER: 6  
 TEST DATE: 06/01/16 - 06/08/16  
 1015 Hrs - 1015 Hrs  
 STATISTICAL METHOD: Dunnetts/Steels

CONCENTRATION (ug/L)	NUMBER EXPOSED	NUMBER DEAD
25	40	1
50	40	2
100	40	3
200	40	36
400	40	40
800	40	40

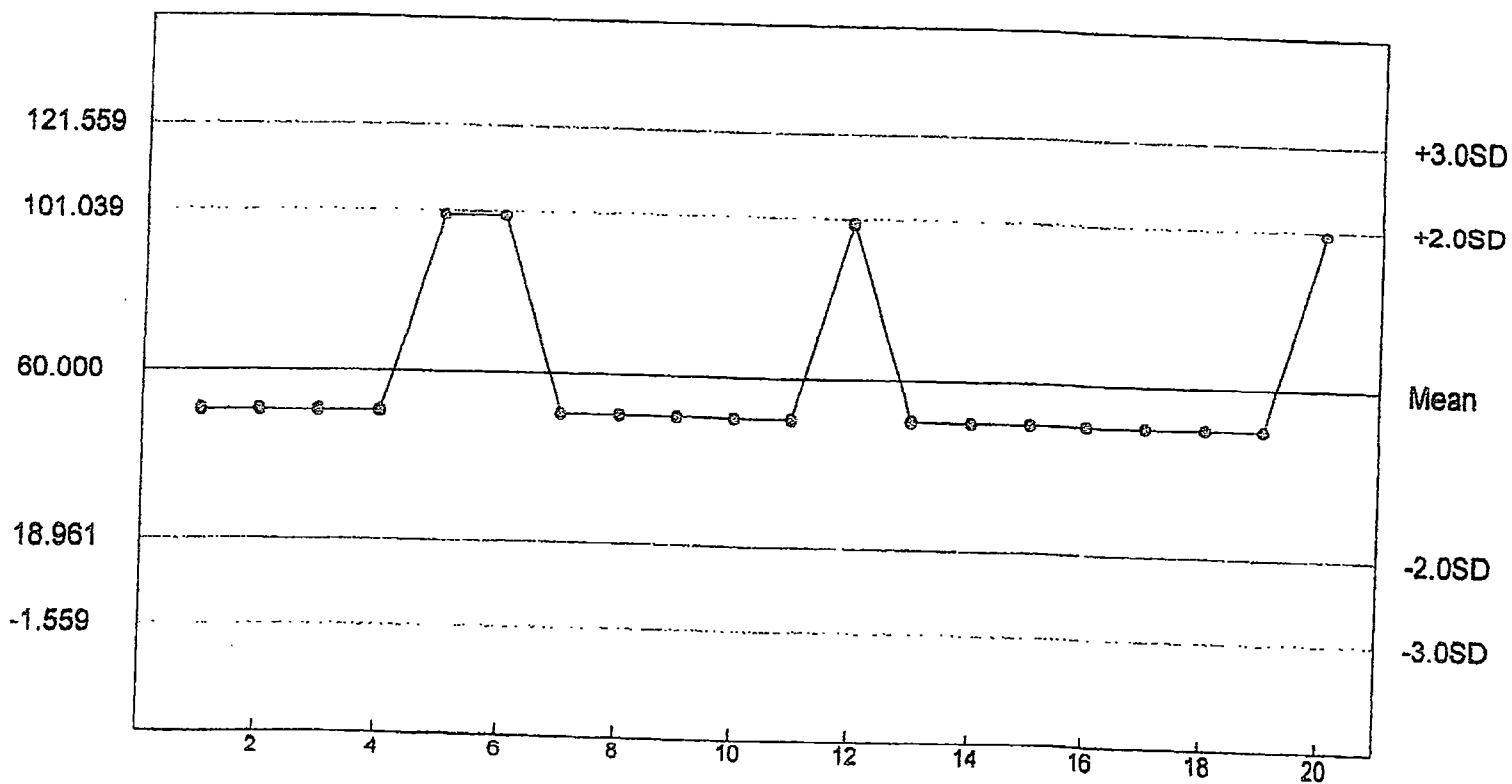
LOEC FOR SURVIVAL	NOEC FOR SURVIVAL	LOEC FOR GROWTH	NOEC FOR GROWTH
200 ug/L	100 ug/L	50 ug/L	100 ug/L

Reference Tox Copper Nitrate ug/L  
*P. promelas* Chronic Survival - NOEC



n= 20 Mean= 72.500 SD= 25.521 CV= 35.20% Min= 50.000 Max= 100.000

Reference Tox Copper Nitrate ug/L  
*P. promelas* Growth - NOEC



n= 20 Mean= 60.000 SD= 20.520 CV= 34.20% Min= 50.000 Max= 100.000



**APPENDIX C**  
**CHAIN OF CUSTODY SHEETS**

### CHAIN OF CUSTODY RECORD

PROJECT # 25331 PROJECT NAME Forrest City PERMIT# NPDES AL0020087

#### OUTFALL SAMPLES

24-Hr Flow Weighted Composite  Other

OUTFALL NUMBER	PERSON TAKING SAMPLE	START DATE/TIME	END DATE/TIME	# OF PORTIONS COMPOSITED	METHODS OF COLLECTION AND COMPOSITE			# OF CONTAINERS TO BE SHIPPED
					AUTO COLL. AUTO COMP.	MANUAL COLL. MANUAL COMP.	AUTO COLL. MANUAL COMP.	
001	Joel R. Thurford	6-19-16 10:00AM	6-20-16 10:00AM	242	X			1

#### RECEIVING WATER SAMPLES

SAMPLE IDENTIFICATION (FOR REC'NG) H <sub>2</sub> O GRABS. GIVE NAME OF STREAM AND LOCATION	PERSON TAKING SAMPLE	DATE	TIME	# OF CONTAINERS TO BE SHIPPED
<i>(This section is crossed out with a diagonal line)</i>				

TYPE OF TEST 7 day 9/F

NAME OF RECEIVING WATER UT

DILUTION WATER USED FOR THIS TEST Lab

RELINQUISHED BY: Joel R. Thurford DATE: 6-20-16 TIME: 11:15 AM RECEIVED BY AT THIS DATE/TIME \_\_\_\_\_

RELINQUISHED BY: \_\_\_\_\_ DATE: \_\_\_\_\_ TIME: \_\_\_\_\_ RECEIVED BY AT THIS DATE/TIME \_\_\_\_\_

RELINQUISHED BY: \_\_\_\_\_ DATE: \_\_\_\_\_ TIME: \_\_\_\_\_ RECEIVED BY AT THIS DATE/TIME \_\_\_\_\_

METHOD OF SHIPMENT: Greyhound  Pick Up \_\_\_\_\_ Client Delivered \_\_\_\_\_ Other \_\_\_\_\_

RECEIVED: Matt Horner DATE: 6-21-16 TIME: 1045 SAMPLE TEMP. @ RECEIPT. 1.4

HUTHER & ASSOCIATES  
 1156 NORTH BONNIE BRAE STREET  
 DENTON, TX 76201  
 (940) 387-1025 • FAX (940) 387-1036

### CHAIN OF CUSTODY RECORD

PROJECT # 25331 PROJECT NAME Forrest City PERMIT# NPOES AR 0020087

#### OUTFALL SAMPLES

24-Hr Flow Weighted Composite  Other \_\_\_\_\_

OUTFALL NUMBER	PERSON TAKING SAMPLE	START DATE/TIME	END DATE/TIME	# OF PORTIONS COMPOSITED	METHODS OF COLLECTION AND COMPOSITE			# OF CONTAINERS TO BE SHIPPED
					AUTO COLL. AUTO COMP.	MANUAL COLL. MANUAL COMP.	AUTO COLL. MANUAL COMP.	
001	Joel R. Thefford	6-21-16 10:00AM	6-22-16 10:00AM	240	X			1

#### RECEIVING WATER SAMPLES

SAMPLE IDENTIFICATION (FOR REC'NG) H <sub>2</sub> O GRABS, GIVE NAME OF STREAM AND LOCATION	PERSON TAKING SAMPLE	DATE	TIME	# OF CONTAINERS TO BE SHIPPED
<i>[Diagonal line through table]</i>				

TYPE OF TEST 7 day C/F

NAME OF RECEIVING WATER U T

DILUTION WATER USED FOR THIS TEST Lab

RELINQUISHED BY: Joel R. Thefford DATE: 6-22-16 TIME: 11:15am RECEIVED BY AT THIS DATE/TIME \_\_\_\_\_

RELINQUISHED BY: \_\_\_\_\_ DATE: \_\_\_\_\_ TIME: \_\_\_\_\_ RECEIVED BY AT THIS DATE/TIME \_\_\_\_\_

RELINQUISHED BY: \_\_\_\_\_ DATE: \_\_\_\_\_ TIME: \_\_\_\_\_ RECEIVED BY AT THIS DATE/TIME \_\_\_\_\_

METHOD OF SHIPMENT: Greyhound  Pick Up \_\_\_\_\_ Client Delivered \_\_\_\_\_ Other \_\_\_\_\_

RECEIVED: [Signature] DATE: 6/23/16 TIME: 09:35 SAMPLE TEMP. @ RECEIPT. 1.0

HUTHER & ASSOCIATES  
 1156 NORTH BONNIE BRAE STREET  
 DENTON, TX 76201  
 (940) 387-1025 • FAX (940) 387-1036

### CHAIN OF CUSTODY RECORD

PROJECT # 25331 PROJECT NAME Forrest City PERMIT# NPDES AR0020087

#### OUTFALL SAMPLES

24-Hr Flow Weighted Composite  Other \_\_\_\_\_

OUTFALL NUMBER	PERSON TAKING SAMPLE	START DATE/TIME	END DATE/TIME	# OF PORTIONS COMPOSITED	METHODS OF COLLECTION AND COMPOSITE			# OF CONTAINERS TO BE SHIPPED
					AUTO COLL. AUTO COMP.	MANUAL COLL. MANUAL COMP.	AUTO COLL. MANUAL COMP.	
001	Joel R. Thefford	6-23-16 10:00AM	6-24-16 10:00AM	263	X			1

#### RECEIVING WATER SAMPLES

SAMPLE IDENTIFICATION (FOR REC'NG) H.O GRABS, GIVE NAME OF STREAM AND LOCATION	PERSON TAKING SAMPLE	DATE	TIME	# OF CONTAINERS TO BE SHIPPED
/				

TYPE OF TEST 7day C/F

NAME OF RECEIVING WATER U T

DILUTION WATER USED FOR THIS TEST db

RELINQUISHED BY: Joel R. Thefford DATE: 6-24-16 TIME: 11:30AM RECEIVED BY AT THIS DATE/TIME \_\_\_\_\_

RELINQUISHED BY: \_\_\_\_\_ DATE: \_\_\_\_\_ TIME: \_\_\_\_\_ RECEIVED BY AT THIS DATE/TIME \_\_\_\_\_

RELINQUISHED BY: \_\_\_\_\_ DATE: \_\_\_\_\_ TIME: \_\_\_\_\_ RECEIVED BY AT THIS DATE/TIME \_\_\_\_\_

METHOD OF SHIPMENT: Greyhound  Pick Up \_\_\_\_\_ Client Delivered \_\_\_\_\_ Other \_\_\_\_\_

RECEIVED: JD DATE: 6/25/16 TIME: 1030 SAMPLE TEMP. @ RECEIPT. 3.1

CITY OF FORREST CITY WWTP  
 NPDES PERMIT NO. AR0020087  
 BIOMONITORING REPORTING  
 TEST DATE: 06/21/16

**I. *Ceriodaphnia dubia***

	<b>Response</b>
a. If the NOEC for survival is less than the critical dilution, enter a "1"; otherwise, enter a "0". <b>Parameter No. TLP3B.</b>	0
b. Report the NOEC value for survival, <b>Parameter No. TOP3B.</b>	100%
c. Report the NOEC value for reproduction, <b>Parameter No. TPP3B.</b>	100%
d. If the NOEC for reproduction is less than the critical dilution, enter a "1"; otherwise, enter a "0". <b>Parameter No. TGP3B.</b>	0
e. Report the higher coefficient of variation (critical dilution or control), <b>Parameter No. TQP3B.</b>	5.59%


**II. *Pimephales promelas***

	<b>Response</b>
a. If the No Observed Effect Concentration (NOEC) for survival is less than the critical dilution, enter a "1"; otherwise, enter a "0". <b>Parameter No. TLP6C.</b>	0
b. Report the NOEC value for survival, <b>Parameter No. TOP6C.</b>	100%
c. Report the NOEC value for growth, <b>Parameter No. TPP6C.</b>	100%
d. If the No Observed Effect Concentration (NOEC) for growth is less than the critical dilution, enter a "1"; otherwise, enter a "0". <b>Parameter No. TGP6C.</b>	0
e. Report the highest coefficient of variation (critical dilution or control) <b>Parameter No. TQP6C.</b>	6.05%



Forrest City Water Utility  
303 N. Rosser/P.O. Box 816  
Forrest City, AR 72336



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