

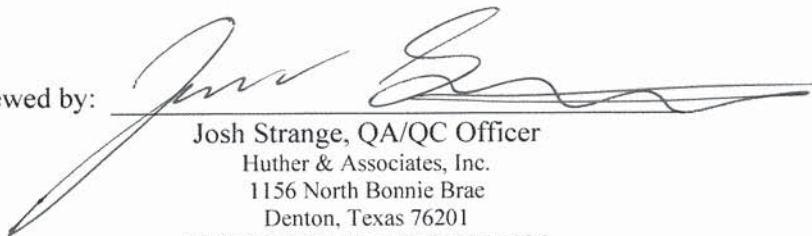
CITY OF ROGERS
OUTFALL 001

Chronic Biomonitoring Report
Permit Number NPDES AR0043397
AFIN 04-00155

Ceriodaphnia dubia
Pimephales promelas

June 15, 2021

Reviewed by:



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TOXICITY TEST REPORT - CHRONIC

Client City of Rogers Laboratory I.D. 32835
Permit No. NPDES AR0043397 Begin Date June 15, 2021
Sample.....Outfall 001

Results: Pass Ceriodaphnia dubia survival and reproduction and Pimephales promelas survival and growth at the critical concentration (82% effluent).

SAMPLE COLLECTION

Composite effluent samples from City of Rogers were delivered by Federal Express courier to Huthur & Associates on June 15, June 17, and June 19, 2021. 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, 23rd 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 1515 hours, June 15, 2021. Five concentrations were prepared (26%, 35%, 46%, 62% and 82% effluent) utilizing distilled, deionized laboratory water reconstituted to match the hardness, alkalinity and pH of the receiving stream (Osage Creek). 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.

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

CLIENT City of Rogers	SAMPLE TYPE 24 Hour Composite
NPDES # AR0043397	DATE COLLECTED 06/14/21 06/16/21 06/18/21
LAB ID # 32835	DATE RECEIVED 06/15/21 06/17/21 06/19/21
TEST TYPE 7 Day Chronic	BEGIN DATE/TIME 06/15/21 1515
TEST ORGANISM <i>Ceriodaphnia dubia</i>	END DATE/TIME 06/22/21 1515
ORGANISM AGE < 24-Hours	TEST TEMPERATURE (°C) 25 ± 1
ORGANISM SOURCE In House	PHOTO PERIOD 16-hr. Light 8-hr. Dark
RECEIVING WATER Osage Creek	LIGHT INTENSITY 50-100 ft. cndl.
DILUTION WATER Laboratory	TECHNICIAN D. Medina

SURVIVAL & REPRODUCTION SUMMARY

Control										
Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
06/16/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/17/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/18/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/19/21	5	3	2	2	3	3	3	2	5	4
	5	3	2	2	3	3	3	2	5	4
06/20/21	A	A	A	A	A	A	A	A	A	A
	5	3	2	2	3	3	3	2	5	4
06/21/21	11	6	6	8	7	9	10	7	8	10
	16	9	8	10	10	12	13	9	13	14
06/22/21	13	12	12	13	13	14	13	12	12	13
	29	21	20	23	23	26	26	21	25	27
x # Young 24.1					C.V. 12.29%					
x%Survival 100%					C.V. 0.00%					

26%Effluent										
Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
06/16/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/17/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/18/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/19/21	3	3	2	4	3	5	3	2	5	3
	3	3	2	4	3	5	3	2	5	3
06/20/21	A	A	A	A	A	A	A	A	A	A
	3	3	2	4	3	5	3	2	5	3
06/21/21	8	6	10	9	6	7	11	8	7	6
	11	9	12	13	9	12	14	10	12	9
06/22/21	12	12	14	13	12	13	13	14	13	12
	23	21	26	26	21	25	27	24	25	21
x # Young 23.9					C.V. 9.55%					
x%Survival 100%					C.V. 0.00%					

35%Effluent										
Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
06/16/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/17/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/18/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/19/21	4	3	2	5	2	3	3	3	4	5
	4	3	2	5	2	3	3	3	4	5
06/20/21	A	A	A	A	A	A	A	A	A	A
	4	3	2	5	2	3	3	3	4	5
06/21/21	9	9	6	11	8	7	9	7	10	8
	13	12	8	16	10	10	12	10	14	13
06/22/21	13	13	12	14	12	12	13	12	14	13
	26	25	20	30	22	22	25	22	26	26
x # Young 24.6					C.V. 12.60%					
x%Survival 100%					C.V. 0.00%					

46%Effluent										
Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
06/16/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/17/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/18/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/19/21	5	2	2	4	4	4	3	2	2	5
	5	2	2	4	4	4	3	2	2	5
06/20/21	A	A	A	A	A	A	A	A	A	A
	5	2	2	4	4	4	3	2	2	5
06/21/21	7	9	11	6	8	9	7	10	7	9
	12	11	13	10	12	13	10	12	9	14
06/22/21	12	13	13	12	12	13	12	13	12	14
	24	24	26	22	24	26	22	25	21	28
x # Young 24.2					C.V. 8.88%					
x%Survival 100%					C.V. 0.00%					

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

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

Rogers

Lab ID# 32835

Test Date: June 15, 2021

62% Effluent										
Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
06/16/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/17/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/18/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/19/21	3	2	5	4	3	4	4	4	5	3
	3	2	5	4	3	4	4	4	5	3
06/20/21	A	A	A	A	A	A	A	A	A	A
	3	2	5	4	3	4	4	4	5	3
06/21/21	11	7	8	7	9	9	10	8	6	9
	14	9	13	11	12	13	14	12	11	12
06/22/21	14	12	13	13	12	13	14	13	12	12
	28	21	26	24	24	26	28	25	23	24
x# Young 24.9					C.V. 8.77%					
x%Survival 100%					C.V. 0.00%					

82% Effluent										
Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
06/16/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/17/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/18/21	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
06/19/21	4	3	2	5	3	2	2	5	3	3
	4	3	2	5	3	2	2	5	3	3
06/20/21	A	A	A	A	A	A	A	A	A	A
	4	3	2	5	3	2	2	5	3	3
06/21/21	8	11	6	10	9	8	6	7	9	8
	12	14	8	15	12	10	8	12	12	11
06/22/21	13	14	12	13	13	12	12	13	14	12
	25	28	20	28	25	22	20	25	26	23
x# Young 24.2					C.V. 11.98%					
x%Survival 100%					C.V. 0.00%					

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

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

Rogers

Lab ID# 32835

Test Date: June 15, 2021

WET CHEMISTRY MEASUREMENTS

Date	Time	Temp	Samp. No.	pH of Solution						Analyst
				CON	26%	35%	46%	62%	82%	
06/15/21	Start	25.0	1	7.77	8.30	8.21	8.13	8.05	7.95	ID
06/16/21	24 Hr.	24.0	1	8.28	8.30	8.29	8.26	8.25	8.24	ID
06/16/21	Renew	25.0	1	8.26	8.13	8.11	8.07	7.99	7.97	JF
06/17/21	48 Hr.	24.0	1	8.24	8.26	8.28	8.25	8.21	8.18	JF
06/17/21	Renew	25.0	2	8.57	8.48	8.41	8.33	8.28	8.22	JS
06/18/21	72 Hr.	24.0	2	8.52	8.49	8.47	8.45	8.44	8.40	ID
06/18/21	Renew	23.9	2	8.28	8.24	8.20	8.12	8.10	7.99	JF
06/19/21	96 Hr.	23.4	3	8.61	8.52	8.53	8.49	8.47	8.39	ID
06/19/21	Renew	25.0	3	8.61	8.52	8.53	8.49	8.47	8.39	ID
06/20/21	120 Hr.	24.1	3	8.58	8.49	8.45	8.41	8.40	8.34	JF
06/20/21	Renew	25.0	3	8.54	8.44	8.43	8.41	8.41	8.37	JF
06/21/21	144 Hr.	24.0	3	8.44	8.38	8.32	8.28	8.30	8.14	JS
06/21/21	Renew	23.9	3	8.35	8.32	8.26	8.25	8.28	8.11	JF
06/22/21	168 Hr.	24.7	3	8.47	8.47	8.47	8.48	8.48	8.48	ID

Date	Time	Temp	Samp. No.	DO (mg/L) of Solution						Analyst
				CON	26%	35%	46%	62%	82%	
06/15/21	Start	25.0	1	8.09	8.09	8.07	7.69	7.95	7.08	ID
06/16/21	24 Hr.	24.0	1	8.37	8.29	8.01	7.74	8.35	8.36	ID
06/16/21	Renew	25.0	1	8.60	8.64	8.63	8.64	8.64	8.62	JF
06/17/21	48 Hr.	24.0	1	8.65	8.57	8.56	8.52	7.71	8.29	JF
06/17/21	Renew	25.0	2	7.31	8.59	8.66	7.81	7.83	7.76	JS
06/18/21	72 Hr.	24.0	2	7.91	8.14	7.45	8.33	8.01	8.27	ID
06/18/21	Renew	23.9	2	7.18	8.57	8.44	8.60	8.43	8.60	JF
06/19/21	96 Hr.	23.4	3	8.07	7.54	7.82	8.10	8.34	7.71	ID
06/19/21	Renew	25.0	3	8.07	7.54	7.82	8.10	8.34	7.71	ID
06/20/21	120 Hr.	24.1	3	7.64	7.81	7.68	8.65	8.44	7.86	JF
06/20/21	Renew	25.0	3	7.66	7.92	8.62	8.58	8.55	8.50	JF
06/21/21	144 Hr.	24.0	3	8.28	7.71	8.60	8.52	8.47	8.09	JS
06/21/21	Renew	23.9	3	8.60	7.72	8.65	8.49	7.29	8.63	JF
06/22/21	168 Hr.	24.7	3	7.52	8.63	7.91	7.38	8.53	8.58	ID

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

Rogers

Lab ID# 32835

Test Date: June 15, 2021

INITIAL CHEMISTRY MEASUREMENTS @ 100% EFFLUENT

Date	Samp. No.	pH ¹	DO ¹	Hardness mg/L CaCO ₃ ¹	Alkalinity mg/L CaCO ₃ ¹	Conduct. μS/cm ¹	Resid.Cl ₂ mg/L ¹	Dechlor(mL) Na ₂ S ₂ O ₃ mg/L ¹	Analyst
06/15/21	1	8.00	7.87	132	108	668	<0.01	N/A	ID
06/17/21	2	7.93	8.26	152	94	693	<0.01	N/A	ID
06/19/21	3	7.82	8.50	120	98	676	<0.01	N/A	ID
06/15/21	CON	7.77	8.09	120	72	412	-	-	JS

¹ 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	20.000	29.000	24.100
2	26% Effluent	10	21.000	27.000	23.900
3	35% Effluent	10	20.000	30.000	24.600
4	46% Effluent	10	21.000	28.000	24.200
5	62% Effluent	10	21.000	28.000	24.900
6	82% Effluent	10	20.000	28.000	24.200

Summary Statistics on Transformed Data Table 2 of 2

Grp	Identification	Variance	Sd	Sem	C.V. %
1	Control	8.767	2.961	0.936	12.29
2	26% Effluent	5.211	2.283	0.722	9.55
3	35% Effluent	9.600	3.098	0.980	12.60
4	46% Effluent	4.622	2.150	0.680	8.88
5	62% Effluent	4.767	2.183	0.690	8.77
6	82% Effluent	8.400	2.898	0.917	11.98

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	1	17	23	16	3

Calculated Chi-Square goodness of fit test statistic = 3.1023
 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 = 2.42

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	6.683	1.337	0.194
Within (Error)	54	372.300	6.894	
Total	59	378.983		

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

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

Grp	Identification	Transformed	Mean	T Stat	Sig
		Mean	Calculated In Original Units		
1	Control	24.100	24.100		
2	26% Effluent	23.900	23.900	0.170	
3	35% Effluent	24.600	24.600	-0.426	
4	46% Effluent	24.200	24.200	-0.085	
5	62% Effluent	24.900	24.900	-0.681	
6	82% Effluent	24.200	24.200	-0.085	

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

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

Grp	Identification	Num of Reps	Minimum	Sig	Difference from Control
			Diff (In Orig. Units)	% of Control	
1	Control	10			
2	26% Effluent	10	2.713	11.3	0.200
3	35% Effluent	10	2.713	11.3	-0.500
4	46% Effluent	10	2.713	11.3	-0.100
5	62% Effluent	10	2.713	11.3	-0.800
6	82% Effluent	10	2.713	11.3	-0.100

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

CLIENT	City of Rogers	SAMPLE TYPE	24 Hour Composite
NPDES #	AR0043397	DATE COLLECTED	06/14/21 06/16/21 06/18/21
LAB ID #	32835	DATE RECEIVED	06/15/21 06/17/21 06/19/21
TEST TYPE	7 Day Chronic	BEGIN DATE/TIME	06/15/21 1530
TEST ORGANISM	<i>Pimephales promelas</i>	END DATE/TIME	06/22/21 1530
ORGANISM AGE	< 24-Hours	TEST TEMPERATURE (°C)	25 ± 1
ORGANISM SOURCE	In House	PHOTO PERIOD	16-hr. Light 8-hr. Dark
RECEIVING WATER	Osage Creek	LIGHT INTENSITY	50-100 ft. cndi.
DILUTION WATER	Laboratory	TECHNICIAN	J. Castillo

SURVIVAL SUMMARY

Conc.	06/16/21					06/17/21					06/18/21					06/19/21					06/20/21				
	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
26%	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
35%	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
46%	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
62%	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
82%	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.	06/21/21					06/22/21					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
26%	8	8	8	8	8	8	8	8	8	8	100.0	0.00
35%	8	8	8	8	8	8	8	8	8	8	100.0	0.00
46%	8	8	8	8	8	8	8	8	8	8	100.0	0.00
62%	8	8	8	8	8	8	8	8	8	8	100.0	0.00
82%	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	0.4520	0.4270	0.4350	0.4450	0.4670	0.4452	3.47
26%	0.4720	0.4830	0.4210	0.4490	0.4720	0.4594	5.40
35%	0.4830	0.4490	0.4410	0.4750	0.4210	0.4538	5.58
46%	0.4690	0.4710	0.4230	0.4580	0.4890	0.4620	5.30
62%	0.4500	0.4610	0.4740	0.4520	0.4750	0.4624	2.55
82%	0.4850	0.4270	0.4560	0.4440	0.4800	0.4584	5.31

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

Rogers

Lab ID# 32835

Test Date: June 15, 2021

WET CHEMISTRY MEASUREMENTS

Date	Time	Temp	Samp. No.	pH of Solution						Analyst
				CON	26%	35%	46%	62%	82%	
06/15/21	Start	25.0	1	7.77	8.30	8.21	8.13	8.05	7.95	ID
06/16/21	24 Hr.	24.1	1	8.00	7.95	7.99	7.98	7.93	8.02	JF
06/16/21	Renew	25.0	1	8.26	8.13	8.11	8.07	7.99	7.97	JF
06/17/21	48 Hr.	24.1	1	8.04	7.96	7.96	7.93	7.88	7.84	ID
06/17/21	Renew	25.0	2	8.57	8.48	8.41	8.33	8.28	8.22	JS
06/18/21	72 Hr.	24.2	2	7.71	7.69	7.75	7.78	7.74	7.83	JF
06/18/21	Renew	23.9	2	8.28	8.24	8.20	8.12	8.10	7.99	JF
06/19/21	96 Hr.	24.2	2	7.95	7.88	7.83	7.82	7.82	7.85	ID
06/19/21	Renew	25.0	3	8.61	8.52	8.53	8.49	8.47	8.39	ID
06/20/21	120 Hr.	24.0	3	8.28	8.29	8.33	8.35	8.34	8.30	JF
06/20/21	Renew	25.0	3	8.54	8.44	8.43	8.41	8.41	8.37	JF
06/21/21	144 Hr.	24.0	3	8.42	8.35	8.33	8.33	8.29	8.27	JS
06/21/21	Renew	23.9	3	8.35	8.32	8.26	8.25	8.28	8.11	JF
06/22/21	168 Hr.	24.5	3	8.20	8.18	8.18	8.18	8.15	8.17	JS

Date	Time	Temp	Samp. No.	DO (mg/L) of Solution						Analyst
				CON	26%	35%	46%	62%	82%	
06/15/21	Start	25.0	1	8.09	8.09	8.07	7.69	7.95	7.08	ID
06/16/21	24 Hr.	24.1	1	7.80	8.56	8.43	8.44	8.37	7.98	JF
06/16/21	Renew	25.0	1	8.60	8.64	8.63	8.64	8.64	8.62	JF
06/17/21	48 Hr.	24.1	1	8.43	8.51	8.23	8.42	8.44	8.44	ID
06/17/21	Renew	25.0	2	7.31	8.59	8.66	7.81	7.83	7.76	JS
06/18/21	72 Hr.	24.2	2	8.37	8.19	8.35	8.42	8.44	8.46	JF
06/18/21	Renew	23.9	2	7.18	8.57	8.44	8.60	8.43	8.60	JF
06/19/21	96 Hr.	24.2	2	7.73	8.56	8.49	8.61	8.55	8.12	ID
06/19/21	Renew	25.0	3	8.07	7.54	7.82	8.10	8.34	7.71	ID
06/20/21	120 Hr.	24.0	3	7.77	8.61	7.84	7.85	7.10	7.71	JF
06/20/21	Renew	25.0	3	7.66	7.92	8.62	8.58	8.55	8.50	JF
06/21/21	144 Hr.	24.0	3	7.50	7.90	8.40	8.26	7.58	8.22	JS
06/21/21	Renew	23.9	3	8.60	7.72	8.65	8.49	7.29	8.63	JF
06/22/21	168 Hr.	24.5	3	7.57	8.62	8.41	8.53	7.73	7.86	JS

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

Rogers

Lab ID# 32835

Test Date: June 15, 2021

INITIAL CHEMISTRY MEASUREMENTS @ 100% EFFLUENT

Date	Samp. No.	pH ¹	DO ¹	Hardness mg/L CaCO ₃ ¹	Alkalinity mg/L CaCO ₃ ¹	Conduct. μS/cm ¹	Resid.Cl ₂ mg/L ¹	Dechlor(mL) Na ₂ S ₂ O ₃ mg/L ¹	Analyst
06/15/21	1	8.00	7.87	132	108	668	<0.01	N/A	ID
06/17/21	2	7.93	8.26	152	94	693	<0.01	N/A	ID
06/19/21	3	7.82	8.50	120	98	676	<0.01	N/A	ID
06/15/21	CON	7.77	8.09	120	72	412	-	-	JS

¹ 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	0.467	0.445
2	26% Effluent	5	0.421	0.483	0.459
3	35% Effluent	5	0.421	0.483	0.454
4	46% Effluent	5	0.423	0.489	0.462
5	62% Effluent	5	0.450	0.475	0.462
6	82% Effluent	5	0.427	0.485	0.458

Summary Statistics on Transformed Data Table 2 of 2

Grp	Identification	Variance	Sd	Sem	C.V.%
1	Control	0.000	0.015	0.007	3.47
2	26% Effluent	0.001	0.025	0.011	5.40
3	35% Effluent	0.001	0.025	0.011	5.58
4	46% Effluent	0.001	0.024	0.011	5.30
5	62% Effluent	0.000	0.012	0.005	2.55
6	82% Effluent	0.001	0.024	0.011	5.31

Shapiro - Wilk's Test For Normality

D = 0.011

W = 0.944

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 = 3.10

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	0.448
Within (Error)	24	0.011	0.000	
Total	29	0.012		

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	0.445	0.445			
2	26% Effluent	0.459	0.459		-1.034	
3	35% Effluent	0.454	0.454		-0.627	
4	46% Effluent	0.462	0.462		-1.224	
5	62% Effluent	0.462	0.462		-1.253	
6	82% Effluent	0.458	0.458		-0.962	

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 Diff (In Orig. Units)	Sig		Difference from Control
				% of Control	Control	
1	Control	5				
2	26% Effluent	5	0.032	7.3		-0.014
3	35% Effluent	5	0.032	7.3		-0.009
4	46% Effluent	5	0.032	7.3		-0.017
5	62% Effluent	5	0.032	7.3		-0.017
6	82% Effluent	5	0.032	7.3		-0.013

**APPENDIX A
RAW DATA**

7-DAY CERIODAPHNIA DUBIA SURVIVAL & REPRODUCTION

DAILY RAW DATA TABLE

PAGE 1 OF 2

CLIENT Rogers
 OUTFALL 001
 LAB ID # 32835

START DATE/TIME 06-15-21 0M 1515
 END DATE/TIME 06-22-21 0M 1515

Con

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
06/16	A	A	A	A	A	A	A	A	A	A	DM	1515
06/17	A	A	A	A	A	A	A	A	A	A	TG	1430
06/18	A	A	A	A	A	A	A	A	A	A	DM	1345
06/19	5	3	2	2	3	3	3	2	5	4	TG	1430
06/20	A	A	A	A	A	A	A	A	A	A	TG	1415
06/21	11	6	6	8	7	9	10	7	8	10	DM	1445
06/22	13	12	12	13	13	14	13	12	12	13	DM	1515
	27	21	20	23	23	26	26	21	25	27		

③ 29
 \bar{x} # Young w/o Dead = 24.1 CV% = 12.29
 \bar{x} # Young w/Dead = CV% =
 \bar{x} % Survival = 100 CV% = 0.00

26

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
06/16	A	A	A	A	A	A	A	A	A	A	DM	1515
06/17	A	A	A	A	A	A	A	A	A	A	TG	1430
06/18	A	A	A	A	A	A	A	A	A	A	DM	1345
06/19	3	3	2	4	3	5	3	2	5	3	TG	1430
06/20	A	A	A	A	A	A	A	A	A	A	TG	1415
06/21	8	6	10	9	6	7	11	8	7	6	DM	1445
06/22	12	12	14	13	12	13	13	14	13	12	DM	1515
	23	21	26	26	21	25	27	24	25	21		

\bar{x} # Young w/o Dead = 23.9 CV% = 9.55
 \bar{x} # Young w/Dead = CV% =
 \bar{x} % Survival = 100 CV% = 0.00

35

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
06/16	A	A	A	A	A	A	A	A	A	A	DM	1515
06/17	A	A	A	A	A	A	A	A	A	A	TG	1430
06/18	A	A	A	A	A	A	A	A	A	A	DM	1345
06/19	4	3	2	5	2	3	3	3	4	5	TG	1430
06/20	A	A	A	A	A	A	A	A	A	A	TG	1415
06/21	9	9	6	11	8	7	9	7	10	8	DM	1445
06/22	13	13	12	14	12	12	13	12	14	13	DM	1515
	26	26	20	28	28	22	25	22	28	26		

③ 25 ④ 30 ⑤ 22
 \bar{x} # Young w/o Dead = 24.6 CV% = 12.60
 \bar{x} # Young w/Dead = CV% =
 \bar{x} % Survival = 100 CV% = 0.00

46

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
06/16	A	A	A	A	A	A	A	A	A	A	DM	1515
06/17	A	A	A	A	A	A	A	A	A	A	TG	1430
06/18	A	A	A	A	A	A	A	A	A	A	DM	1345
06/19	5	2	2	4	4	4	3	2	2	5	TG	1430
06/20	A	A	A	A	A	A	A	A	A	A	TG	1415
06/21	7	9	11	6	8	9	7	10	7	9	DM	1445
06/22	12	13	13	12	12	13	12	13	12	14	DM	1515
	24	24	26	22	24	26	22	25	21	28		

\bar{x} # Young w/o Dead = 24.2 CV% = 8.88
 \bar{x} # Young w/Dead = CV% =
 \bar{x} % Survival = 100 CV% = 0.00

① A.B. 6-22-21 ② A.D. 6-22-21 ③ A.B. 6-22-21 ④ A.B. 6-22-21

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

CLIENT/FACILITY Rogers DATE/TIME STARTED 6-15-21 Jc 1530
 OUTFALL # 001 PROJECT # 32835 DATE/TIME ENDED 6-22-21 Jc 1530
 ORGANISM ID# PF0-21-165

Conc.	6-16-21 Jc 1530					6-17-21 Jc 945					6-18-21 MH 0850					6-19-21 Jc 1110					6-20-21 Jc 940									
	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	8	8	8	8	8
26	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	8	8	8	8	8
35	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	8	8	8	8	8
46	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	8	8	8	8	8
62	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	8	8	8	8	8
82	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	8	8	8	8	8

Conc.	6-21-21 MH 0850					6-22-21 Jc 1530					C.V. %
	A	B	C	D	E	A	B	C	D	E	
Con	8	8	8	8	8	8	8	8	8	8	0.00
26	8	8	8	8	8	8	8	8	8	8	0.00
35	8	8	8	8	8	8	8	8	8	8	0.00
46	8	8	8	8	8	8	8	8	8	8	0.00
62	8	8	8	8	8	8	8	8	8	8	0.00
82	8	8	8	8	8	8	8	8	8	8	0.00

Initials
Date/Time

Client / Facility Rogers
 Lab ID Number 32835
 Outfall Number 001
 Test Date 6-15-21

INITIAL CHEMISTRY MEASUREMENTS @ 100% EFFLUENT

Date	Samp. No.	pH	DO	Hardness mg/L CaCO ₃	Alkalinity mg/L CaCO ₃	Conduct. umhos/cm	Resid. Cl ₂ mg/L	Dechlor(mL) Na ₂ S ₂ O ₃ mg/L	Analyst
6-15-21	1	8.00	7.87	132	108	668	LO.01	N/A	ID
6-17-21	2	7.93	8.26	152	94	693	<0.01	N/A	ID
6-19-21	3	7.82	8.50	120	98	676	<0.01	N/A	ID
6-15-21	CON	7.77	8.09	120	72	412	-	-	JS

INITIAL CHEMISTRY MEASUREMENTS @ RECEIVING WATER

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

Notes:

**APPENDIX B
REFERENCE TOXICANTS**

CHRONIC REFERENCE TOXICANT TEST RESULTS

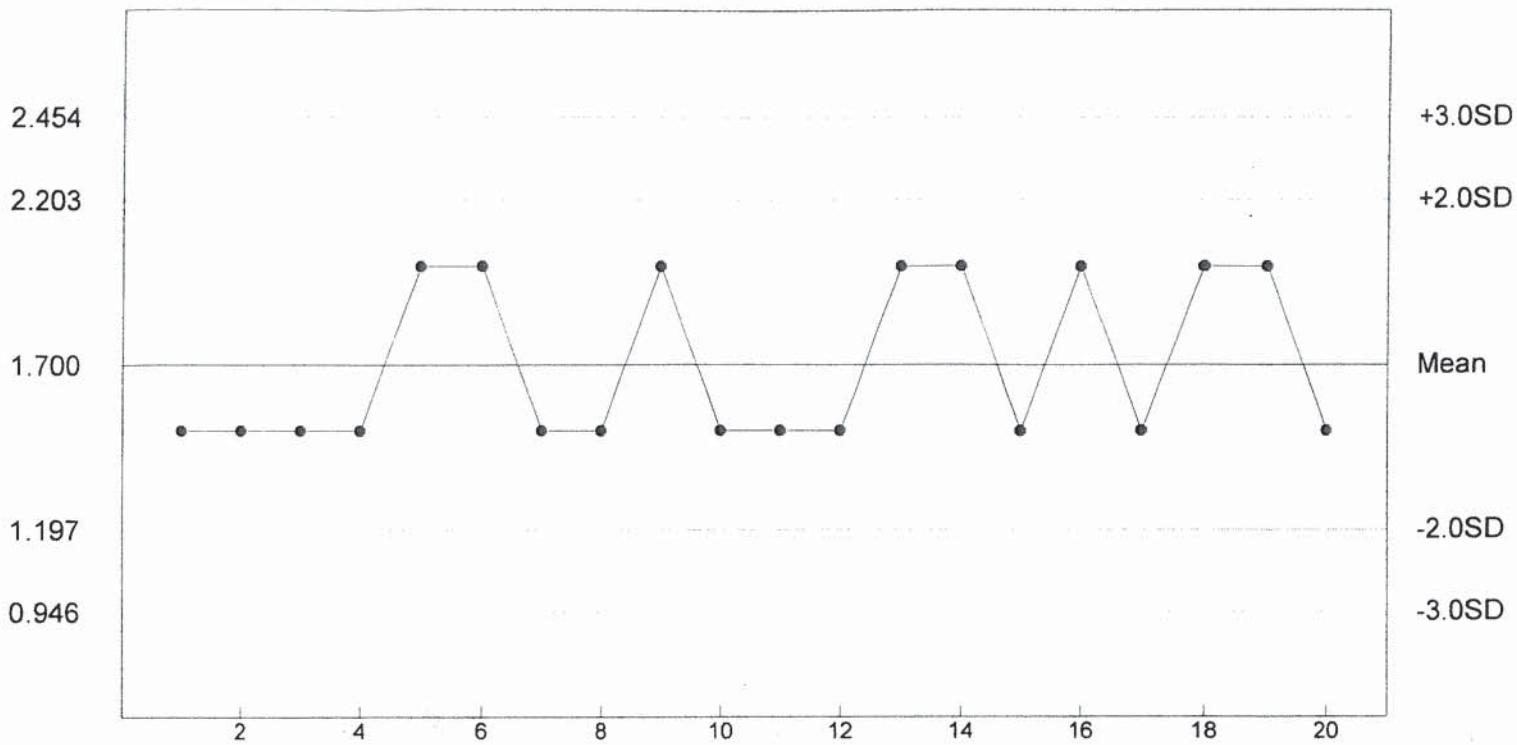
SPECIES: *Ceriodaphnia dubia*
 CHEMICAL: Sodium Chloride
 DURATION: 7-Days
 TEST NUMBER: 6
 TEST DATE: 06/01/21 - 06/08/21
 1500 Hrs - 1500 Hrs
 STATISTICAL METHOD: Dunnetts/Steels

CONCENTRATION (g/L)	NUMBER EXPOSED	NUMBER DEAD
0.5	10	0
1.0	10	0
1.5	10	0
2.0	10	8
2.5	10	10
3.0	10	10
4.0	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

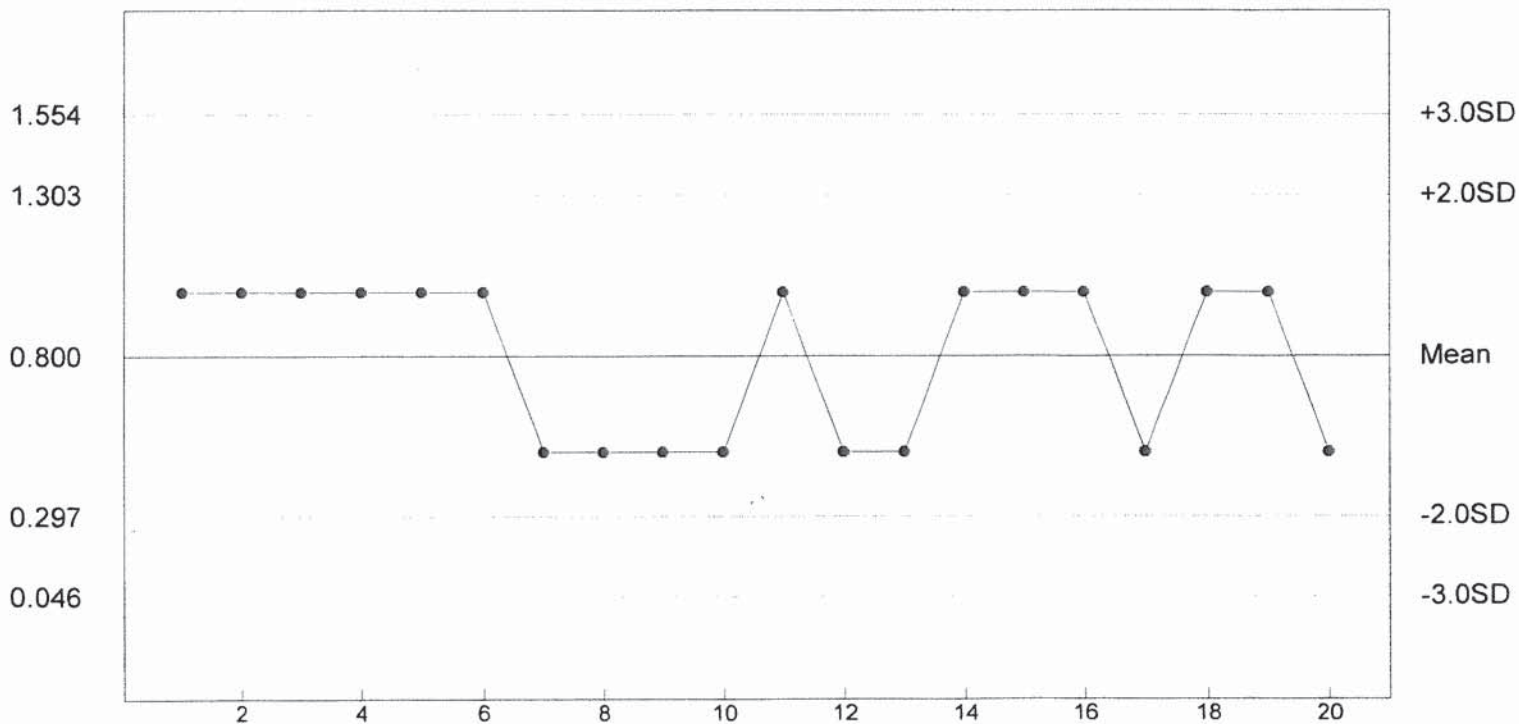
C. dubia Survival - NOEC



n= 20 Mean= 1.700 SD= 0.251 CV= 14.78% Min= 1.500 Max= 2.000

Reference Tox Sodium Chloride g/L

C. dubia Reproduction - NOEC



n= 20 Mean= 0.800 SD= 0.251 CV= 31.41% Min= 0.500 Max= 1.000

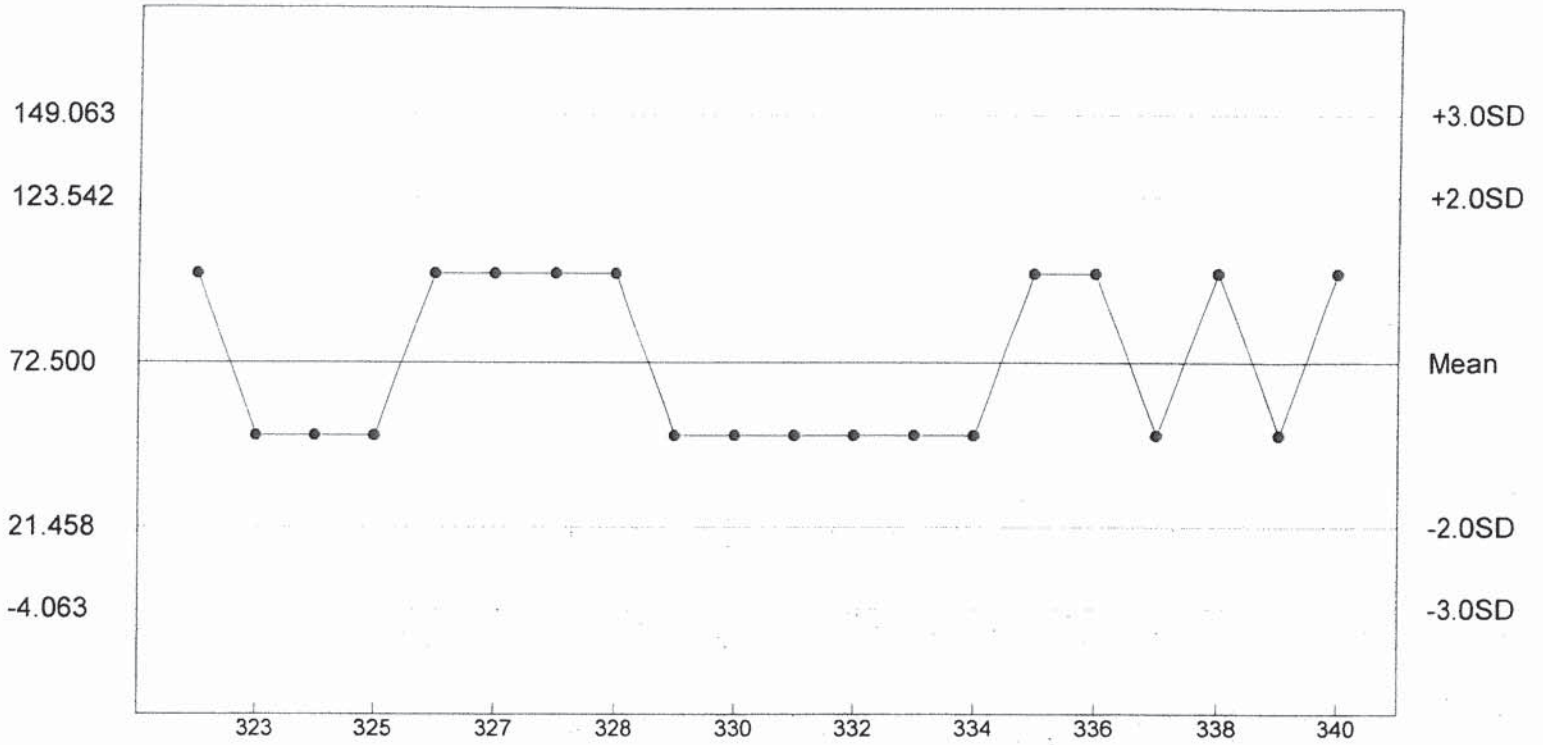
CHRONIC REFERENCE TOXICANT TEST RESULTS

SPECIES: *Pimephales promelas*
 CHEMICAL: Copper Nitrate
 DURATION: 7-Days
 TEST NUMBER: 6
 TEST DATE: 06/01/21 - 06/08/21
 1500 Hrs -1500 Hrs
 STATISTICAL METHOD: Dunnetts/Steels

CONCENTRATION (ug/L)	NUMBER EXPOSED	NUMBER DEAD
12.5	40	0
25	40	0
50	40	0
100	40	2
200	40	7
400	40	33
800	40	40

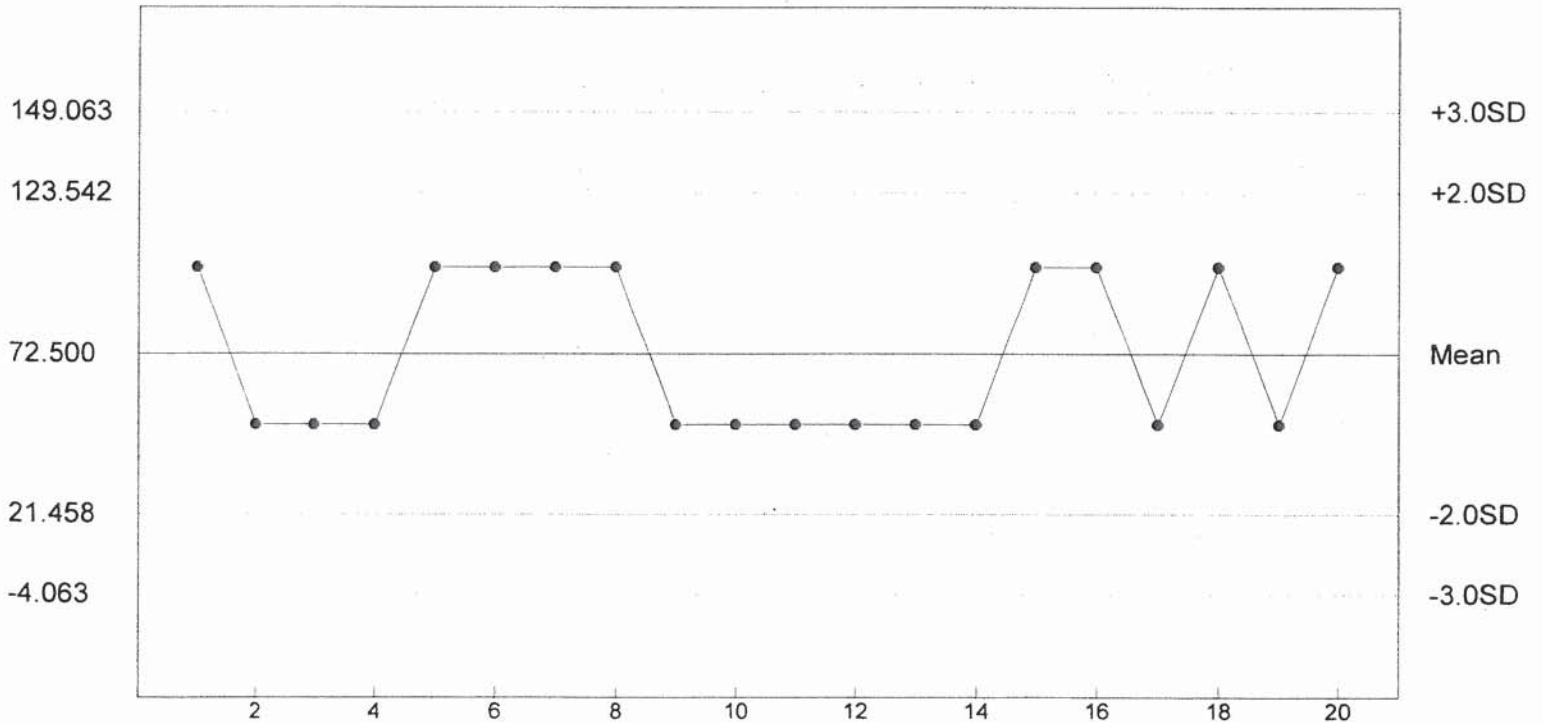
LOEC FOR SURVIVAL	NOEC FOR SURVIVAL	LOEC FOR GROWTH	NOEC FOR GROWTH
200 ug/L	100 ug/L	200 ug/L	100 ug/L

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= 72.500 SD= 25.521 CV= 35.20% Min= 50.000 Max= 100.000

**APPENDIX C
CHAIN OF CUSTODY SHEETS**

**CITY OF ROGERS
NPDES PERMIT NO. AR0043397
AFIN NUMBER: 04-00155
BIOMONITORING REPORTING
TEST DATE: 06/15/21**

I. *Ceriodaphnia dubia*

Response

(A) If the NOEC for survival is less than the critical dilution, enter a "1"; otherwise, enter a "0". Parameter No. TLP3B.	0
(B) Report the NOEC value for survival, Parameter No. TOP3B.	82%
(C) Report the NOEC value for reproduction, Parameter No. TPP3B.	82%
(D) If the NOEC for reproduction is less than the critical dilution, enter a "1"; otherwise, enter a "0". Parameter No. TGP3B.	0
(E) Report the higher (critical dilution or control) Coefficient of Variation, Parameter No. TQP3B.	12.29%

II. *Pimephales promelas* (fathead minnow)

Response

(A) If the No Observed Effect Concentration (NOEC) for survival is less than the critical dilution, enter a "1"; otherwise, enter a "0". Parameter No. TLP6C.	0
(B) Report the NOEC value for survival, Parameter No. TOP6C.	82%
(C) Report the NOEC value for growth, Parameter No. TPP6C.	82%
(D) If the No Observed Effect Concentration (NOEC) for growth is less than the critical dilution, enter a "1"; otherwise, enter a "0". Parameter No. TGP6C.	0
(E) Report the highest (critical dilution or control) Coefficient of Variation, Parameter No. TQP6C.	5.31%
22414 - 10	82%
22414 - PO	82%