

CITY OF ROGERS
OUTFALL 001

Chronic Biomonitoring Report
Permit Number NPDES AR0043397

Ceriodaphnia dubia
Pimephales promelas

April 16, 2019

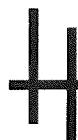
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TOXICITY TEST REPORT - CHRONIC

Client City of Rogers Laboratory I.D. 30065
Permit No. NPDES AR0043397 Begin Date April 16, 2019
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 Huthier & Associates on April 16, April 18, and April 20, 2019. 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 1545 hours, April 16, 2019. 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.

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 1545 hours, April 23, 2019. 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: 82% 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: 82% Effluent

PMSD: 11.1%

TEST SETUP
Pimephales promelas



The seven-day *Pimephales promelas* larval survival and growth test was initiated at 1510 hours, April 16, 2019. 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 300 mL distilled water rinsed plastic beakers containing 250 mL of solution (eight organisms 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 beakers 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 1510 hours, April 23, 2019. 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).

SURVIVAL***Pimephales promelas***

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

LOEC: Not Applicable

NOEC: 82% Effluent

GROWTH***Pimephales promelas***

P. promelas growth data were normally distributed at the 0.01 alpha level (0.900) using Shapiro Wilk's test for normality. Growth 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 *P. promelas* growth data demonstrated that there were no statistically significant differences between the control and any of the effluent concentrations.

LOEC: Not Applicable

PMSD: 8.0%

NOEC: 82% Effluent

SUMMARY

There were no statistically significant differences between the control and the critical low flow concentration (82% effluent) for *C. dubia* survival and reproduction and *P. promelas* survival and growth. Based on biomonitoring requirements for Outfall 001 contained in Permit Number NPDES AR0043397 for City of Rogers, Outfall 001 **passed** for this testing period.

Huthur 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	04/15/19 04/17/19 04/19/19
LAB ID #	30065	DATE RECEIVED	04/16/19 04/18/19 04/20/19
TEST TYPE	7 Day Chronic	BEGIN DATE/TIME	04/16/19 1545
TEST ORGANISM	<i>Ceriodaphnia dubia</i>	END DATE/TIME	04/23/19 1545
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	M. Horner

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
04/17/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/18/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/19/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/20/19	2	2	3	5	4	3	3	3	2	5
	2	2	3	5	4	3	3	3	2	5
04/21/19	6	8	6	11	11	11	A	10	7	A
	8	10	9	16	15	14	3	13	9	5
04/22/19	A	A	A	A	A	A	8	A	A	6
	8	10	9	16	15	14	11	13	9	11
04/23/19	13	13	12	14	13	12	13	12	12	13
	21	23	21	30	28	26	24	25	21	24
x # Young 24.3 C.V. 12.58% 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
04/17/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/18/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/19/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/20/19	4	2	3	3	4	2	2	5	3	2
	4	2	3	3	4	2	2	5	3	2
04/21/19	A	7	11	A	9	10	6	6	6	8
	4	9	14	3	13	12	8	11	9	10
04/22/19	6	A	A	8	A	A	A	A	A	A
	10	9	14	11	13	12	8	11	9	10
04/23/19	12	13	14	13	12	13	12	13	13	13
	22	22	28	24	25	25	20	24	22	23
x # Young 23.5 C.V. 9.46% 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
04/17/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/18/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/19/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/20/19	5	4	5	3	2	4	2	3	5	2
	5	4	5	3	2	4	2	3	5	2
04/21/19	6	A	9	6	8	8	A	10	11	8
	11	4	14	9	10	12	2	13	16	10
04/22/19	A	8	A	A	A	A	6	A	A	A
	11	12	14	9	10	12	8	13	16	10
04/23/19	14	14	12	12	13	13	12	13	13	12
	25	26	26	21	23	25	20	26	29	22
x # Young 24.3 C.V. 11.32% 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
04/17/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/18/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/19/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/20/19	5	2	3	3	5	5	3	5	4	2
	5	2	3	3	5	5	3	5	4	2
04/21/19	7	10	6	9	A	7	10	7	8	A
	12	12	9	12	5	12	13	12	12	2
04/22/19	A	A	A	A	10	A	A	A	A	11
	12	12	9	12	15	12	13	12	12	13
04/23/19	13	13	12	14	13	13	13	12	12	13
	25	25	21	26	28	25	26	24	24	26
x # Young 25.0 C.V. 7.30% x%Survival 100% C.V. 0.00%										

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

ex 1:

A	alive today
4	total young to date

ex 2:

5	alive, 5 young today
12	total young to date

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

Rogers

Lab ID# 30065

Test Date: April 16, 2019

62%Effluent										
Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
04/17/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/18/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/19/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/20/19	4	2	4	2	5	3	5	5	5	3
	4	2	4	2	5	3	5	5	5	3
04/21/19	6	7	9	10	9	8	A	9	A	6
	10	9	13	12	14	11	5	14	5	9
04/22/19	A	A	A	A	A	A	10	A	8	A
	10	9	13	12	14	11	15	14	13	9
04/23/19	12	12	12	13	13	12	14	13	13	12
	22	21	25	25	27	23	29	27	26	21
x # Young 24.6 C.V. 11.21% 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
04/17/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/18/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/19/19	A	A	A	A	A	A	A	A	A	A
	0	0	0	0	0	0	0	0	0	0
04/20/19	2	2	2	3	2	4	5	3	2	5
	2	2	2	3	2	4	5	3	2	5
04/21/19	9	A	11	A	9	6	11	6	11	9
	11	2	13	3	11	10	16	9	13	14
04/22/19	A	7	A	7	A	A	A	A	A	A
	11	9	13	10	11	10	16	9	13	14
04/23/19	12	13	13	13	12	12	14	13	12	14
	23	22	26	23	23	22	30	22	25	28
x # Young 24.4 C.V. 11.46% 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# 30065

Test Date: April 16, 2019

WET CHEMISTRY MEASUREMENTS

Date	Time	Temp	Samp. No.	pH of Solution						Analyst
				CON	26%	35%	46%	62%	82%	
04/16/19	Start	25.0	1	7.96	7.91	7.84	7.78	7.68	7.62	SD
04/17/19	24 Hr.	25.3	1	8.04	7.93	7.91	7.78	7.72	7.69	JS
04/17/19	Renew	25.0	1	7.88	7.82	7.75	7.69	7.57	7.53	JS
04/18/19	48 Hr.	25.2	1	8.41	8.30	8.15	8.06	7.94	7.84	SD
04/18/19	Renew	25.0	2	8.54	8.50	8.35	8.23	8.11	7.96	SD
04/19/19	72 Hr.	24.5	2	8.22	8.08	7.87	7.78	7.64	7.56	LM
04/19/19	Renew	24.3	2	8.37	8.23	8.05	7.93	7.80	7.65	LM
04/20/19	96 Hr.	24.5	2	8.31	8.33	8.01	7.98	7.70	7.70	SD
04/20/19	Renew	25.0	3	8.43	8.32	8.26	8.04	7.87	7.78	SD
04/21/19	120 Hr.	24.7	3	8.37	8.19	8.04	7.90	7.77	7.75	LM
04/21/19	Renew	24.5	3	8.41	8.28	8.06	7.87	7.80	7.67	LM
04/22/19	144 Hr.	25.2	3	8.40	8.23	8.06	7.92	7.82	7.78	LM
04/22/19	Renew	25.0	3	8.69	8.52	8.24	8.03	7.90	7.80	LM
04/23/19	168 Hr.	25.2	3	8.33	8.29	8.26	8.23	8.20	8.19	SD

Date	Time	Temp	Samp. No.	DO (mg/L) of Solution						Analyst
				CON	26%	35%	46%	62%	82%	
04/16/19	Start	25.0	1	8.04	8.14	7.97	7.99	8.05	7.98	SD
04/17/19	24 Hr.	25.3	1	7.87	7.63	8.05	8.32	7.80	8.46	JS
04/17/19	Renew	25.0	1	8.21	7.72	7.93	8.24	7.56	8.05	JS
04/18/19	48 Hr.	25.2	1	7.03	8.07	8.13	8.29	8.24	8.19	SD
04/18/19	Renew	25.0	2	8.49	8.45	8.28	8.23	8.41	8.26	SD
04/19/19	72 Hr.	24.5	2	8.54	8.40	8.53	8.45	8.52	8.47	LM
04/19/19	Renew	24.3	2	8.49	8.53	7.03	8.46	8.22	8.46	LM
04/20/19	96 Hr.	24.5	2	7.49	7.77	8.42	8.31	8.18	8.27	SD
04/20/19	Renew	25.0	3	7.54	7.76	8.07	8.03	8.00	8.07	SD
04/21/19	120 Hr.	24.7	3	8.34	8.33	8.34	8.33	7.66	8.36	LM
04/21/19	Renew	24.5	3	8.34	8.42	8.42	8.42	8.41	8.41	LM
04/22/19	144 Hr.	25.2	3	8.36	8.34	8.29	8.26	8.23	8.21	LM
04/22/19	Renew	25.0	3	8.32	8.28	8.25	8.21	8.25	8.28	LM
04/23/19	168 Hr.	25.2	3	7.20	8.41	7.73	7.21	7.74	7.97	SD

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

Rogers

Lab ID# 30065

Test Date: April 16, 2019

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
04/16/19	1	7.50	7.84	92	78	734	<0.01	N/A	SD
04/18/19	2	7.47	8.14	112	80	661	<0.01	N/A	SD
04/20/19	3	7.56	8.25	108	86	675	<0.01	N/A	SD
04/16/19	CON	7.96	8.04	116	68	392	-	-	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	21.000	30.000	24.300
2	26% Effluent	10	20.000	28.000	23.500
3	35% Effluent	10	20.000	29.000	24.300
4	46% Effluent	10	21.000	28.000	25.000
5	62% Effluent	10	21.000	29.000	24.600
6	82% Effluent	10	22.000	30.000	24.400

Summary Statistics on Transformed Data Table 2 of 2

Grp	Identification	Variance	Sd	Sem	C.V.%
1	Control	9.344	3.057	0.967	12.58
2	26% Effluent	4.944	2.224	0.703	9.46
3	35% Effluent	7.567	2.751	0.870	11.32
4	46% Effluent	3.333	1.826	0.577	7.30
5	62% Effluent	7.600	2.757	0.872	11.21
6	82% Effluent	7.822	2.797	0.884	11.46

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	3	20	16	15	6

Calculated Chi-Square goodness of fit test statistic = 5.4074
 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 = 2.83

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	12.150	2.430	0.359
Within (Error)	54	365.500	6.769	
Total	59	377.650		

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	Mean Calculated In Original Units	T Stat	Sig
1	Control	24.300	24.300		
2	26% Effluent	23.500	23.500	0.688	
3	35% Effluent	24.300	24.300	0.000	
4	46% Effluent	25.000	25.000	-0.602	
5	62% Effluent	24.600	24.600	-0.258	
6	82% Effluent	24.400	24.400	-0.086	

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 Diff (In Orig. Units)	Sig % of Control	Difference from Control
1	Control	10			
2	26% Effluent	10	2.688	11.1	0.800
3	35% Effluent	10	2.688	11.1	0.000
4	46% Effluent	10	2.688	11.1	-0.700
5	62% Effluent	10	2.688	11.1	-0.300
6	82% Effluent	10	2.688	11.1	-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	04/15/19 04/17/19 04/19/19
LAB ID #	30065	DATE RECEIVED	04/16/19 04/18/19 04/20/19
TEST TYPE	7 Day Chronic	BEGIN DATE/TIME	04/16/19 1510
TEST ORGANISM	<i>Pimephales promelas</i>	END DATE/TIME	04/23/19 1510
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	J. Castillo

SURVIVAL SUMMARY

Conc.	04/17/19					04/18/19					04/19/19					04/20/19					04/21/19				
	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.	04/22/19					04/23/19					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	0.4450	0.4270	0.4680	0.4820	0.4310	0.4506	5.28
26%	0.4290	0.4670	0.4500	0.4750	0.4850	0.4612	4.79
35%	0.4670	0.4830	0.4850	0.4290	0.4630	0.4654	4.84
46%	0.4450	0.4690	0.4720	0.4350	0.4880	0.4618	4.65
62%	0.4290	0.4670	0.4250	0.4810	0.4850	0.4574	6.25
82%	0.4790	0.4220	0.4650	0.4830	0.4790	0.4656	5.44

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

Rogers

Lab ID# 30065

Test Date: April 16, 2019

WET CHEMISTRY MEASUREMENTS

Date	Time	Temp	Samp. No.	pH of Solution						Analyst
				CON	26%	35%	46%	62%	82%	
04/16/19	Start	25.0	1	7.96	7.91	7.84	7.78	7.68	7.62	SD
04/17/19	24 Hr.	25.3	1	8.01	7.94	7.96	7.90	7.83	7.76	JS
04/17/19	Renew	25.0	1	7.88	7.82	7.75	7.69	7.57	7.53	JS
04/18/19	48 Hr.	25.2	1	7.66	7.76	7.82	7.78	7.75	7.74	SD
04/18/19	Renew	25.0	2	8.54	8.50	8.35	8.23	8.11	7.96	SD
04/19/19	72 Hr.	24.5	2	7.79	7.86	7.66	7.68	7.64	7.53	LM
04/19/19	Renew	24.3	2	8.37	8.23	8.05	7.93	7.80	7.65	LM
04/20/19	96 Hr.	24.5	2	7.81	7.72	7.69	7.69	7.66	7.65	SD
04/20/19	Renew	25.0	3	8.43	8.32	8.26	8.04	7.87	7.78	SD
04/21/19	120 Hr.	24.8	3	7.96	7.84	7.81	7.79	7.74	7.75	LM
04/21/19	Renew	24.5	3	8.41	8.28	8.06	7.87	7.80	7.67	LM
04/22/19	144 Hr.	25.3	3	7.84	7.77	7.75	7.69	7.64	7.49	LM
04/22/19	Renew	25.0	3	8.69	8.52	8.24	8.03	7.90	7.80	LM
04/23/19	168 Hr.	25.4	3	8.05	8.04	8.06	8.04	8.03	7.99	SD

Date	Time	Temp	Samp. No.	DO (mg/L) of Solution						Analyst
				CON	26%	35%	46%	62%	82%	
04/16/19	Start	25.0	1	8.04	8.14	7.97	7.99	8.05	7.98	SD
04/17/19	24 Hr.	25.3	1	8.41	8.41	8.34	7.98	8.28	8.20	JS
04/17/19	Renew	25.0	1	8.21	7.72	7.93	8.24	7.56	8.05	JS
04/18/19	48 Hr.	25.2	1	8.13	8.39	8.05	8.51	8.52	8.51	SD
04/18/19	Renew	25.0	2	8.49	8.45	8.28	8.23	8.41	8.26	SD
04/19/19	72 Hr.	24.5	2	7.69	7.95	7.62	7.90	7.94	8.18	LM
04/19/19	Renew	24.3	2	8.49	8.53	7.03	8.46	8.22	8.46	LM
04/20/19	96 Hr.	24.5	2	7.75	8.56	8.28	8.46	8.55	8.42	SD
04/20/19	Renew	25.0	3	7.54	7.76	8.07	8.03	8.00	8.07	SD
04/21/19	120 Hr.	24.8	3	8.43	8.48	8.55	8.55	8.55	8.54	LM
04/21/19	Renew	24.5	3	8.34	8.42	8.42	8.42	8.41	8.41	LM
04/22/19	144 Hr.	25.3	3	8.53	8.49	8.39	8.19	8.38	8.41	LM
04/22/19	Renew	25.0	3	8.32	8.28	8.25	8.21	8.25	8.28	LM
04/23/19	168 Hr.	25.4	3	8.56	8.22	8.52	8.52	8.51	8.38	SD

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

Rogers

Lab ID# 30065

Test Date: April 16, 2019

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
04/16/19	1	7.50	7.84	92	78	734	<0.01	N/A	SD
04/18/19	2	7.47	8.14	112	80	661	<0.01	N/A	SD
04/20/19	3	7.56	8.25	108	86	675	<0.01	N/A	SD
04/16/19	CON	7.96	8.04	116	68	392	-	-	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	0.482	0.451
2	26% Effluent	5	0.429	0.485	0.461
3	35% Effluent	5	0.429	0.485	0.465
4	46% Effluent	5	0.435	0.488	0.462
5	62% Effluent	5	0.425	0.485	0.457
6	82% Effluent	5	0.422	0.483	0.466

Summary Statistics on Transformed Data Table 2 of 2

Grp	Identification	Variance	Sd	Sem	C.V.%
1	Control	0.001	0.024	0.011	5.28
2	26% Effluent	0.000	0.022	0.010	4.79
3	35% Effluent	0.001	0.023	0.010	4.84
4	46% Effluent	0.000	0.021	0.010	4.65
5	62% Effluent	0.001	0.029	0.013	6.25
6	82% Effluent	0.001	0.025	0.011	5.44

Shapiro - Wilk's Test For Normality

D = 0.014

W = 0.925

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 = 0.43

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	0.275
Within (Error)	24	0.014	0.001	
Total	29	0.015		

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

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

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

Grp	Identification	Transformed Mean	Mean		T Stat	Sig
			Calculated In	Original Units		
1	Control	0.451	0.451			
2	26% Effluent	0.461	0.461	-0.696		
3	35% Effluent	0.465	0.465	-0.972		
4	46% Effluent	0.462	0.462	-0.735		
5	62% Effluent	0.457	0.457	-0.447		
6	82% Effluent	0.466	0.466	-0.985		

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

No statistically significant difference

Dunnnett'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	26% Effluent	5	0.036		8.0	-0.011
3	35% Effluent	5	0.036		8.0	-0.015
4	46% Effluent	5	0.036		8.0	-0.011
5	62% Effluent	5	0.036		8.0	-0.007
6	82% Effluent	5	0.036		8.0	-0.015

APPENDIX A RAW DATA

7-DAY CERIODAPHNIA DUBIA SURVIVAL & REPRODUCTION

DAILY RAW DATA TABLE

PAGE 1 OF 2

CLIENT Rogers
 OUTFALL 001
 LAB ID # 30065

START DATE/TIME 4-16-19 MH 1545
 END DATE/TIME 4-23-19 JS 1545

con

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
4/17	A	A	A	A	A	A	A	A	A	A	MH	1545
4/18	A	A	A	A	A	A	A	A	A	A	MH	1545
4/19	A	A	A	A	A	A	A	A	A	A	JS	1100
4/20	2	2	3	5	4	3	3	3	2	5	MH	1415
4/21	6	8	6	11	11	11	A	10	7	A	MH	1200
4/22	A	A	A	A	A	A	8	A	A	6	JS	1430
4/23	13	13	12	14	13	12	13	12	12	13	JS	1545
	21	23	21	30	28	26	24	25	21	24		

 $\bar{x}$ # Young w/o Dead = 24.3 CV% = 12.58 $\bar{x}$ # Young w/Dead = CV% = $\bar{x}$ % Survival = 100.0 CV% = 0.00

26

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
4/17	A	A	A	A	A	A	A	A	A	A	MH	1545
4/18	A	A	A	A	A	A	A	A	A	A	MH	1545
4/19	A	A	A	A	A	A	A	A	A	A	JS	1100
4/20	4	2	3	3	4	2	2	5	3	2	MH	1415
4/21	A	7	11	A	9	10	6	6	6	8	MH	1200
4/22	6	A	A	8	A	A	A	A	A	A	JS	1430
4/23	12	13	14	13	12	13	12	13	13	13	JS	1545
	22	22	28	24	25	25	20	24	22	23		

 $\bar{x}$ # Young w/o Dead = 23.5 CV% = 9.46 $\bar{x}$ # Young w/Dead = CV% = $\bar{x}$ % Survival = 100.0 CV% = 0.00

35

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
4/17	A	A	A	A	A	A	A	A	A	A	MH	1545
4/18	A	A	A	A	A	A	A	A	A	A	MH	1545
4/19	A	A	A	A	A	A	A	A	A	A	JS	1100
4/20	5	4	5	3	2	4	2	3	5	2	MH	1415
4/21	6	A	9	6	8	8	A	10	11	8	MH	1200
4/22	A	8	A	A	A	A	6	A	A	A	JS	1430
4/23	14	14	12	12	13	13	12	13	13	12	JS	1545
	25	26	26	21	23	25	20	26	29	22		

 $\bar{x}$ # Young w/o Dead = 24.3 CV% = 11.82 $\bar{x}$ # Young w/Dead = CV% = $\bar{x}$ % Survival = 100.0 CV% = 0.00

46

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
4/17	A	A	A	A	A	A	A	A	A	A	MH	1545
4/18	A	A	A	A	A	A	A	A	A	A	MH	1545
4/19	A	A	A	A	A	A	A	A	A	A	JS	1100
4/20	5	2	3	3	5	5	3	5	4	2	MH	1415
4/21	7	10	6	9	A	7	10	7	8	A	MH	1200
4/22	A	A	A	A	10	A	A	A	A	11	JS	1430
4/23	13	13	12	14	13	13	13	12	12	13	JS	1545
	25	25	21	26	28	25	26	24	24	26		

 $\bar{x}$ # Young w/o Dead = 25.0 CV% = 7.30 $\bar{x}$ # Young w/Dead = CV% = $\bar{x}$ % Survival = 100.0 CV% = 0.00

PAGE 2 OF 2

LAB ID # 30065

END DATE/TIME 4-23-19 JS 1545

62

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
4/17	A	A	A	A	A	A	A	A	A	A	MH	1545
4/18	A	A	A	A	A	A	A	A	A	A	MH	1545
4/19	A	A	A	A	A	A	A	A	A	A	JS	1100
4/20	4	2	4	2	5	3	5	5	5	3	MH	1415
4/21	6	7	9	10	9	8	A	9	A	6	MH	1200
4/22	A	A	A	A	A	A	10	A	8	A	JS	1430
4/23	12	12	12	13	13	12	14	13	13	12	JS	1545
	22	21	25	25	27	23	29	27	26	21		

$$\bar{x} \% \text{ Survival} = 100.0 \quad CV\% = 0.00$$

82

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
4/17	A	A	A	A	A	A	A	A	A	A	MH	1545
4/18	A	A	A	A	A	A	A	A	A	A		
4/19	A	A	A	A	A	A	A	A	A	A	JS	1100
4/20	2	2	2	3	2	4	5	3	2	5	MH	1415
4/21	9	A	11	A	9	6	11	6	11	9	MH	1200
4/22	A	7	A	7	A	A	A	A	A	A		
4/23	12	13	13	13	12	12	14	13	12	14	JS	1545
	23	22	26	23	23	22	30	27	25	28		

$$\bar{x} \% \text{ Survival} = 100.0 \quad CV\% = 0.00$$
[illegible]
$$\bar{x} \% \text{ Survival} = \quad \quad \quad CV\% =$$
[illegible]
$$\bar{x} \% \text{ Survival} = \quad \quad \quad \text{CV}\% =$$

7-DAY CHRONIC TOXICITY TEST

CLIENT/FACILITY

OUTFALL #

ORGANISM ID#

Rogers

PROJECT # 30065

PPD-19-105

DATE/TIME STARTED

DATE/TIME ENDED 4-23-19 TG 15/0

Conc.	4-17-19					4-18-19					4-19-19					4-20-19					4-21-19				
	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
38	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
Initials Date/Time	4-17-19 JAE 1510					4-18-19 TC 0415					4-19-19 TC 0915					4-20-19 JAE 1030					4-21-19 JAE 930				

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
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
Initials Date/Time	4-22-14 TG 0930					4-23-14 TG 1510						

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

Client Rogers

Date/Time Start 4/16/19 1510

Project# 20065

Date/Time End 4/23/19 1510

Date Weighed: 4/24/19 21

% Effluent	Rep A	Rep B	Rep C	Rep D	Rep E	$\bar{x}$	C.V. %	Analyst
Con	.4450	.4270	.4680	.4820	.4210	.4506	5.28	BH
26	.4290	.4670	.4500	.4750	.4850	.4612	4.79	↓
25	.4670	.4830	.4850	.4290	.4630	.4654	4.84	
46	.4450	.4690	.4720	.4350	.4850	.4618	4.65	
62	.4290	.4670	.4250	.4610	.4850	.4574	6.25	
82	.4790	.4220	.4650	.4830	.4790	.4656	5.44	

Huther and Associates, Inc.

environmental toxicologists, biologists, and consultants

Client / Facility

Rogers

Lab ID Number

30065

Outfall Number

001

Test Date

4-16-19

INITIAL CHEMISTRY MEASUREMENTS @ 100% EFFLUENT

Date	Samp. No.	pH	DO	Hardness mg/L CaCO ₃ ¹	Alkalinity mg/L CaCO ₃ ¹	Conduct. umhos/cm ¹	Resid. Cl ₂ mg/L ¹	Dechlor(mL) Na ₂ S ₂ O ₃ mg/L ¹	Analyst
4-16	1	7.50	7.84	92	78	734	40.01	n/c	SD
4-18	2	7.47	8.14	112	80	661	40.01	n/c	SD
4-20	3	7.56	8.25	108	86	675	40.01	n/c	SD
4-16	Con	7.96	8.04	116	68	392	—	—	JS

INITIAL CHEMISTRY MEASUREMENTS @ RECEIVING WATER

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

Notes:

APPENDIX B
REFERENCE TOXICANTS



CHRONIC REFERENCE TOXICANT TEST RESULTS

SPECIES: *Ceriodaphnia dubia*

CHEMICAL: Sodium Chloride

DURATION: 7-Days

TEST NUMBER: 04

TEST DATE: 04/03/19 - 04/10/19
1600 Hrs - 1600 Hrs

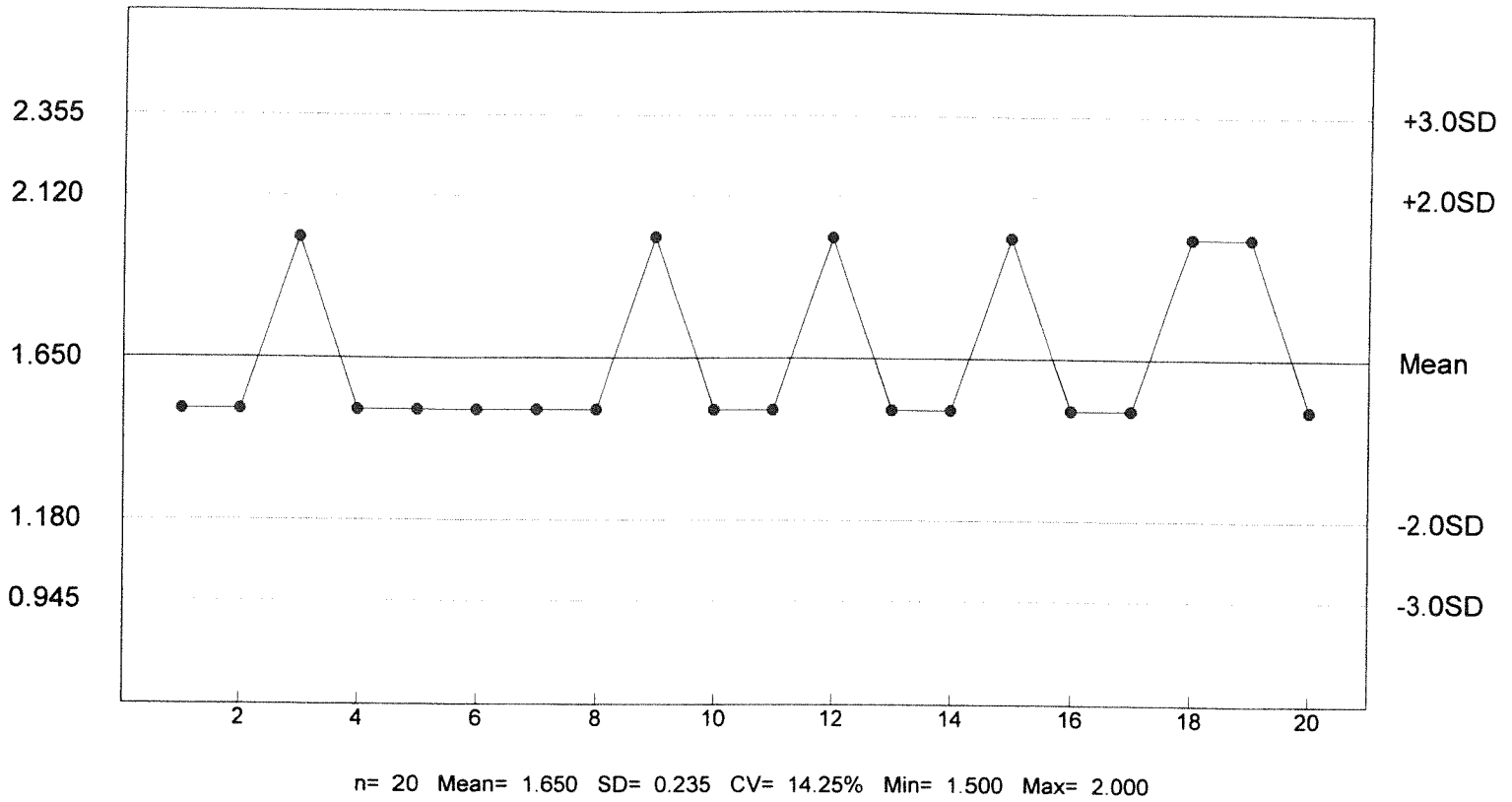
STATISTICAL METHOD: Dunnetts/Steels

CONCENTRATION (g/L)	NUMBER EXPOSED	NUMBER DEAD
0.5	10	0
1.0	10	0
1.5	10	1
2.0	10	5
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	1.5 g/L	1.0 g/L

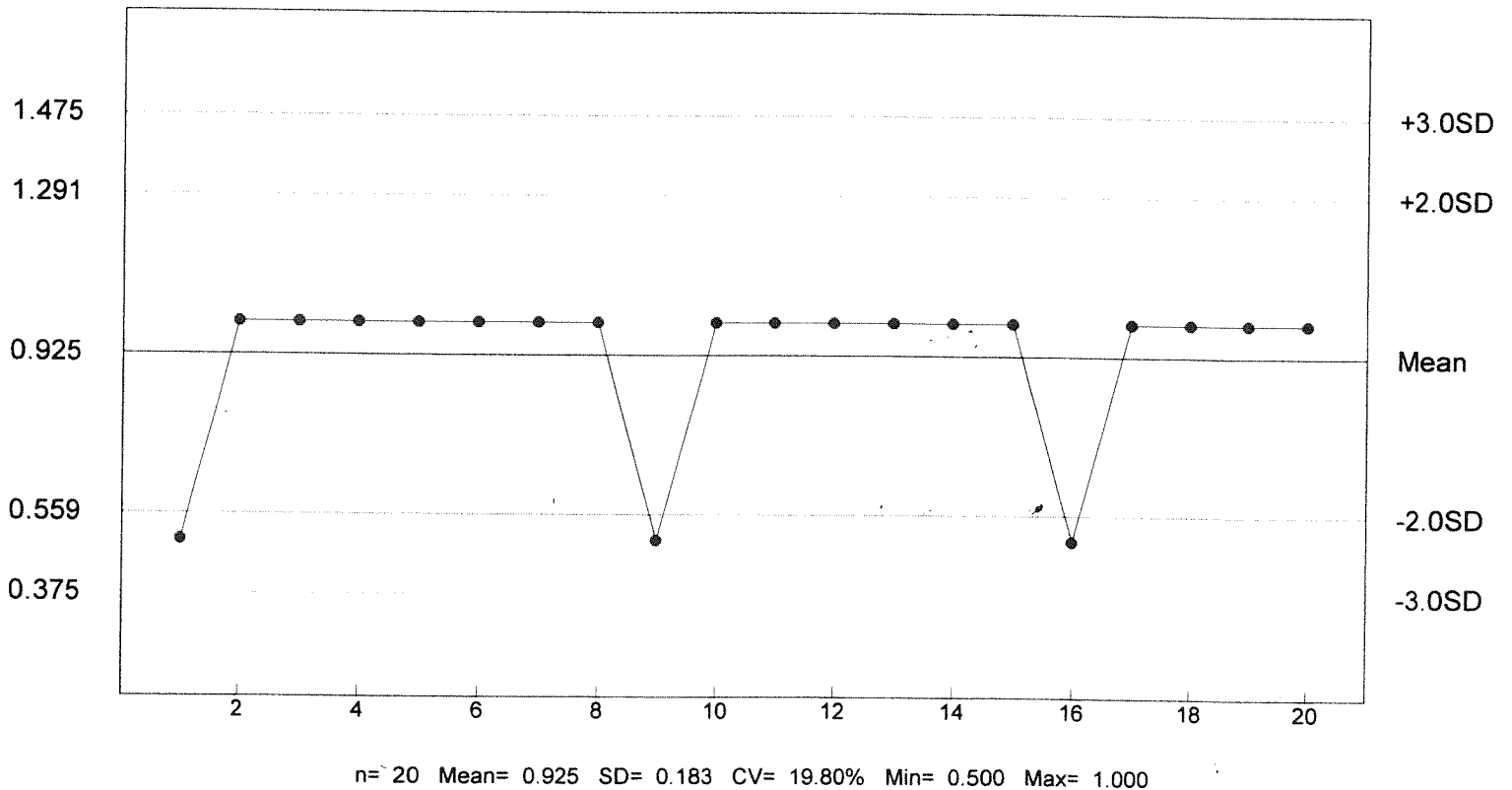
Reference Tox Sodium Chloride g/L

C. dubia Survival - NOEC



Reference Tox Sodium Chloride g/L

C. dubia Reproduction - NOEC



CHRONIC REFERENCE TOXICANT TEST RESULTS

SPECIES: *Pimephales promelas*

CHEMICAL: Copper Nitrate

DURATION: 7-Days

TEST NUMBER: 04

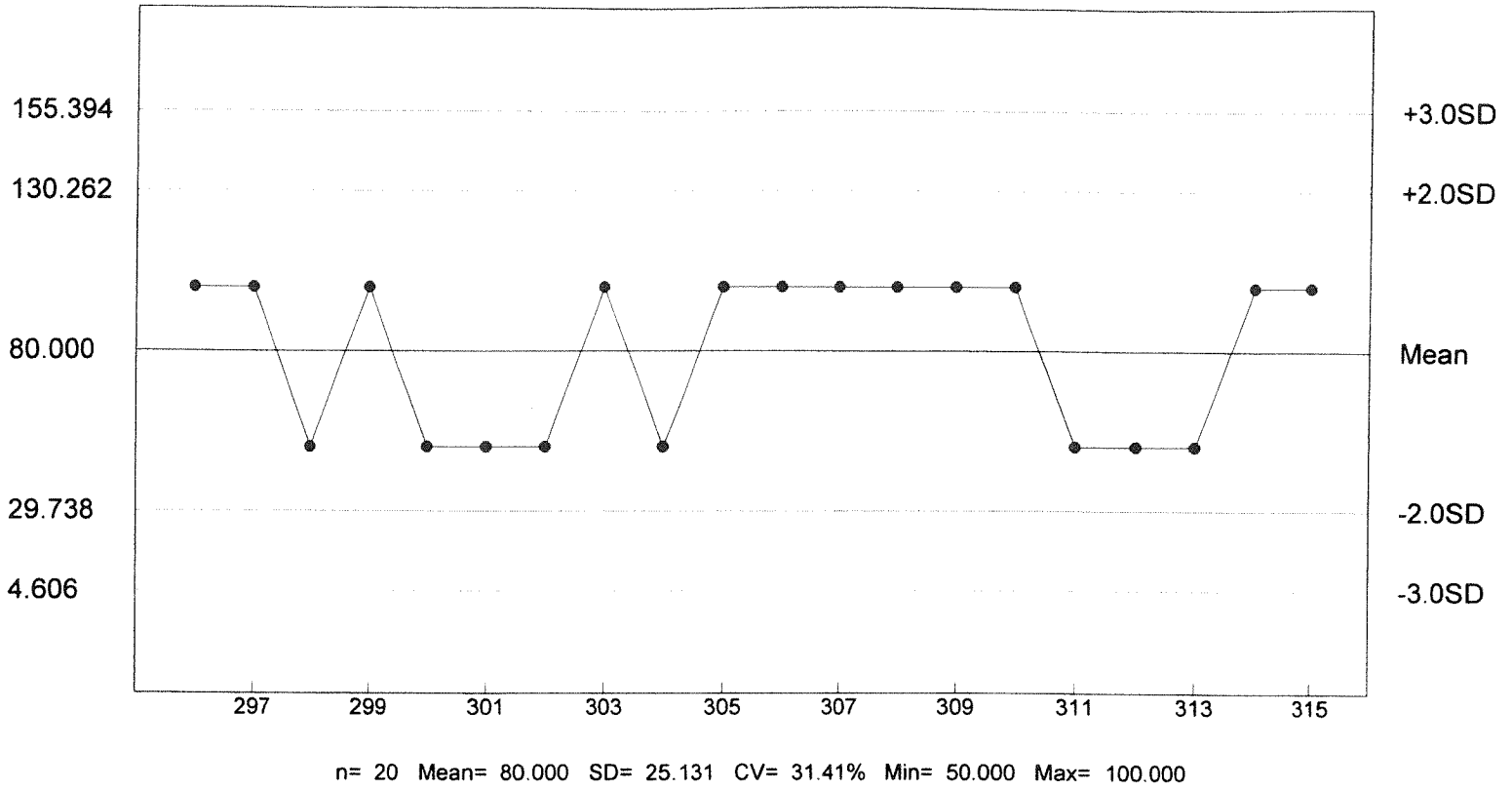
TEST DATE: 04/03/19 - 04/10/19
1545 Hrs - 1545 Hrs

STATISTICAL METHOD: Dunnetts/Steels

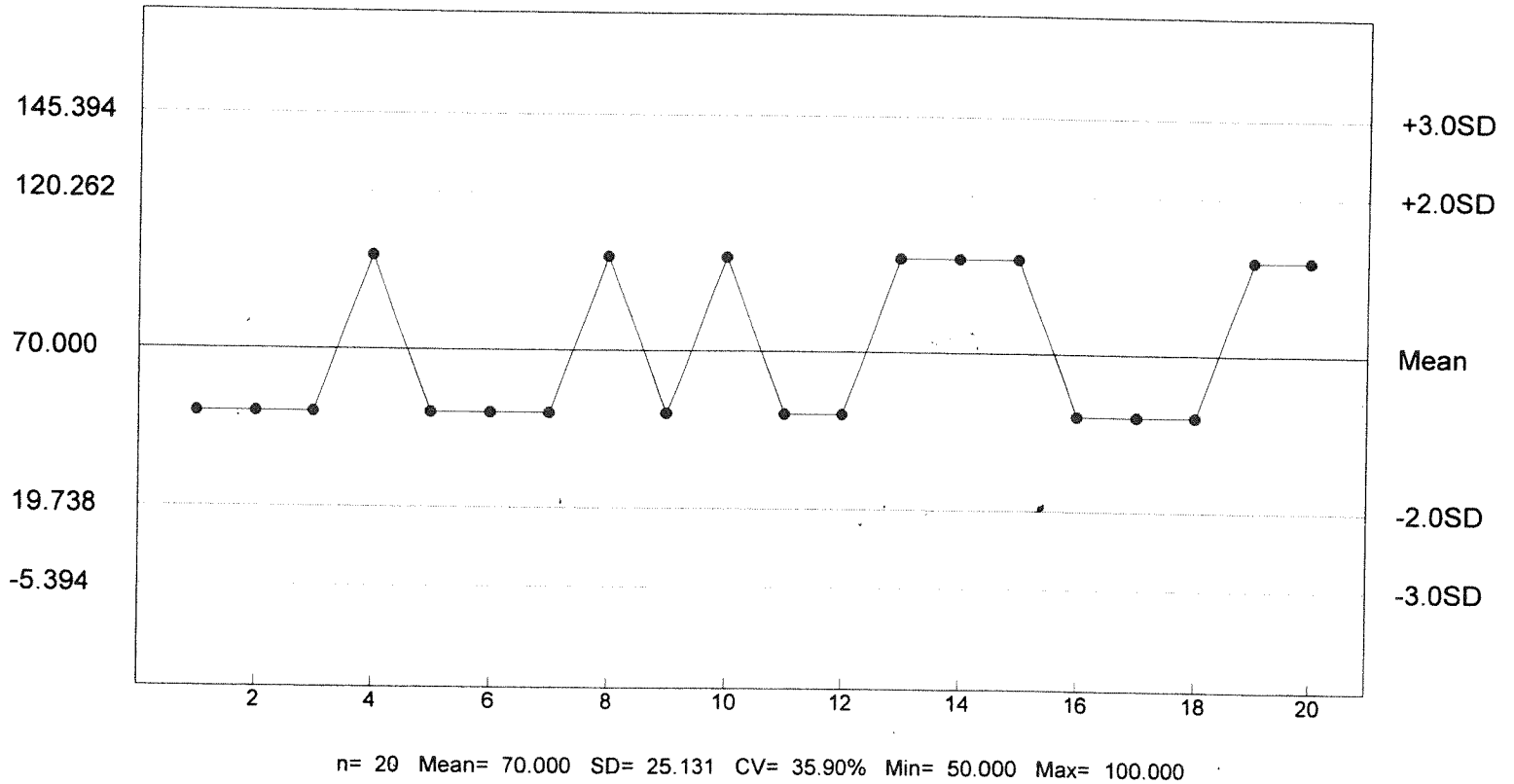
CONCENTRATION (ug/L)	NUMBER EXPOSED	NUMBER DEAD
12.5	40	0
25	40	0
50	40	0
100	40	0
200	40	11
400	40	35
800	40	40

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



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



APPENDIX C
CHAIN OF CUSTODY SHEETS

ROGERS POLLUTION CONTROL FACILITY CHAIN OF CUSTODY

ANALYSES

[illegible]

COMMENTS:

5.40C IRI

feed/Ex

On: Marlo S. Off: Marlo S.

Metals: Ag, As, Be, Cd, Cr, Cu, Mo, Ni, Pb, Sb, Se, Tl, Zn (preserved with HNO₃)

WET: Whole Effluent Toxicity (Biomonitoring).

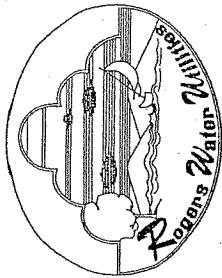
ITC Scan: Table II - Organic Toxic Pollutants as defined by 40 CFR 122 appendix D. (Volatiles, Acid Compounds, Base/Neutral, Pesticides)

NH₃-N, TN, TP and O&G preserved with H₂SO₄

* CN preserved with NaOH

PHENOL preserved with CuSO_4 + Phos Acid

Rogers 30065 FedEx T4



ROGERS POLLUTION CONTROL FACILITY CHAIN OF CUSTODY

SAMPLE DESCRIPTION	SAMPLE ID	COLLECTION		CONTAINER		TYPE	METH A/M	TEMP °C	ANALYSES									
		DATE	TIME	L	G/P				C	T	S	O	D	N	O	2	&	N
Effluent		On: 4-16-19	0830	18	P	C	A	3.1										
		Off: 4-17-19	0830															
Influent		On: 4-16-19	0836	9.4	P	C	A	3.4										
		Off: 4-17-19	0836															
		On:																
		Off:																
		On:																
		Off:																

Relinquished by:	Received by:	Date:	Time:	Relinquished by:	Received by:	Date:	Time:
Marco S.	Jane Dejes	4-18-19	0945		Jane Dejes	4-18-19	0945
Relinquished by:	Received by:	Date:	Time:	Relinquished by:	Received by:	Date:	Time:

COMMENTS: FedEx Temp: (IR1) -2.8°C
 SAMPLER(S):
 On: Marco S. Off: Marco S.

- * Metals: Ag, As, Be, Cd, Cr, Cu, Mo, Ni, Pb, Sb, Se, Ti, Zn (preserved with HNO₃)
- * WET: Whole Effluent Toxicity (Biomonitoring)
- * TIO Scan: Table II - Organic Toxic Pollutants as defined by 40 CFR 122 appendix D. (Volatiles, Acid Compounds, Base / Neutral, Pesticides)
- * NH₃-N, TN, TP and O&G preserved with H₂SO₄ * CN preserved with NaOH * PHENOL preserved with CuSO₄ + Phos Acid

04-18-19 T4

ROGERS POLLUTION CONTROL FACILITY
CHAIN OF CUSTODY

ANALYSES

[illegible]

COMMENTS:

Food Ex

2.1 IRI

SAMPLER(S):

On: _____

Off.

off: Matt Fowler

Metals: Ag, As, Be, Cd, Cr, Cu, Mo, Ni, Pb, Sb, Se, Tl, Zn (preserved with HNO_3)

WET: Whole Effluent Toxicity (Biomonitoring).

RTO Scan: Table II - Organic Toxic Pollutants as defined by 40 CFR 122 appendix D. (Volatiles, Acid Compounds, Base/Neutral, Pesticides)

NH₃-N, TN, TP and O&G preserved with H₂SO₄

*CN preserved with NaOH

* Id

PHENOL preserved with CuSO_4 + Phos Acid

CITY OF ROGERS
NPDES PERMIT NO. AR0043397
AFIN NUMBER: 04-00155
BIOMONITORING REPORTING
TEST DATE: 04/16/19

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.

12.58%

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.

5.44%

22414 - 10

82%

22414 - PO

82%
