

# Environmental Analysis

Biomonitoring  
Acute Toxicity  
Chronic Toxicity  
Storm Water 24 hr. Toxicity



*Sorrells Research*

8100 National Drive, Little Rock, AR 72209  
(501) 562-8139

HOPE, CITY OF  
PERMIT NO: AR0038466  
CHRONIC BIOMONITORING

METHOD 1000.0 - PIMEPHALES PROMELAS  
METHOD 1002.0 - CERIODAPHNIA DUBIA

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Report Prepared by:  
Sorrells Research Associates, Inc.  
8100 National Dr.  
Little Rock, AR 72209

Cecil A. Sorrells, Biomonitoring Laboratory Supervisor

K. E. Sorrells, M.S., Quality Assurance Officer

October 10, 2012

Laboratory Number: 14854.0001, 0002, 0003

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## INTRODUCTION AND SUMMARY

Chronic biomonitoring tests:

7 day ceriodaphnia dubia survival and reproduction (method 1002.0) was performed by Sorrells Research Associates for Hope 24 hour composite samples of plant effluent for dates 08/12-13/12, 08/14-15/12, 08/16-17/12.

The samples were delivered to Sorrells lab in ice chest, cooled to 4 degrees c.

These samples were logged in as 14854.0001, 0002, 0003. Chain of custody included in report.

Moderately hard 20% deionized mineral water was used as dilution water.

Testing was initiated 08/14/12 at 14:30 hours and continued through 08/22/12 at 14:30 hours.

The results of these tests are as follows:

**TEST 1000.0 FATHEAD MINNOW**

SURVIVAL - NOEL 100% Effluent

GROWTH - NOWL 100% Effluent

**TEST 1002.0 CERIODAPHNIA DUBIA**

SURVIVAL - 100% Effluent

REPRODUCTION - 100% Effluent

Fishers Exact Test statistics are included in this report for these observations. No other adjustments were made.

TEST ACCEPTANCE CRITERIA  
FOR CONTROL

TEST METHOD	ORGANISM	CRITERIA	RESULTS	PASS/FAIL
1000	Pimephales promelas	Control surv. >or= 80 %	100%	PASS
1002	Ceriodaphnia dubia	Control surv. >or= 80 %	100%	PASS
1000	Pimephales promelas	Control wt. .25 mg or> per larvae.	.317	PASS
1002	Ceriodaphnia dubia	Control repro. 15 or> neonates per surviving female.	18.0	PASS
1000	Pimephales promelas	Control CV 40 % or <	3.0	PASS
1002	Ceriodaphnia Dubia	Control CV 40 % or <	10.8	PASS

NOTE: The test acceptance criteria is based upon the synthetic laboratory control. Laboratory control is moderately hard 20% deionized mineral water, as directed by EPA/600/4-91/002.

OUTLINED REPORT

PERMIT NO: AR0038466  
PERMIT REQUIREMENTS:  
PLANT LOCATION:  
RECEIVING WATER BODY:

CLIENT: Hope, City of  
ADDRESS: P.O. Box 667  
PHONE NO: Hope, AR 71801

PLANT OPERATIONS

PRODUCT (S): n/a  
RAW MATERIALS: n/a  
OPERATING SCHEDULE:  
SCHEMATIC OF WASTE TREATMENT:

RETENTION TIME:

VOLUME OF WASTE FLOW (MGD, CFS, GPM)



(Cont.)

PHYSICAL AND CHEMICAL DATA:

100 % EFFLUENT	DATE 08/14/12	DATE 08/16/12	DATE 08/18/12
DO (mg/l)	7.92	8.10	8.27
pH (S.U.)	7.45	7.32	7.58
Conductivity (umhos)	1158	1396	1178
Alkalinity (mg/l)	294	353	289
Hardness (mg/l)	199	258	222
Res. Chlorine (mg/l)	0	0	0
Temperature .c	25	25	25

DILUTION WATER SAMPLES -

SOURCE: 20% DMW

COLLECTION DATE: N/A

TIME: N/A

PRETREATMENT: AERATED

Hardness is to be reported as mg/l CaCO<sub>3</sub>

D.O. Dissolved Oxygen mg/l

Temperature degrees centigrade

pH standard units

Conductivity = us/cm

Chlorine Residual = mg/l





DATA ANALYSIS

ACCORDING TO EPA/600/4-91/002.

STATISTICAL ANALYSES

TOXSTAT VERSION 3.3

**Percent minimum significant difference (PMSD) calculated for sub-lethal endpoints.**

This information for *C. dubia* reproduction is found in the inserted tables after page 8. We will highlight these values in Dunnetts Table 2, for all sub-lethal endpoints.

TITLE: HOPE 14854 CERIO REPS  
 FILE: 14854HCR  
 TRANSFORM: NO TRANSFORM

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	19.0000	19.0000
1	CONTROL	2	19.0000	19.0000
1	CONTROL	3	16.0000	16.0000
1	CONTROL	4	15.0000	15.0000
1	CONTROL	5	20.0000	20.0000
1	CONTROL	6	21.0000	21.0000
1	CONTROL	7	18.0000	18.0000
1	CONTROL	8	16.0000	16.0000
1	CONTROL	9	17.0000	17.0000
1	CONTROL	10	19.0000	19.0000
2	31.60	1	18.0000	18.0000
2	31.60	2	18.0000	18.0000
2	31.60	3	18.0000	18.0000
2	31.60	4	19.0000	19.0000
2	31.60	5	21.0000	21.0000
2	31.60	6	20.0000	20.0000
2	31.60	7	20.0000	20.0000
2	31.60	8	15.0000	15.0000
2	31.60	9	18.0000	18.0000
2	31.60	10	18.0000	18.0000
3	42.20	1	19.0000	19.0000
3	42.20	2	17.0000	17.0000
3	42.20	3	18.0000	18.0000
3	42.20	4	20.0000	20.0000
3	42.20	5	18.0000	18.0000
3	42.20	6	18.0000	18.0000
3	42.20	7	18.0000	18.0000
3	42.20	8	18.0000	18.0000
3	42.20	9	19.0000	19.0000
3	42.20	10	20.0000	20.0000
4	56.30	1	23.0000	23.0000
4	56.30	2	18.0000	18.0000
4	56.30	3	21.0000	21.0000
4	56.30	4	20.0000	20.0000
4	56.30	5	20.0000	20.0000
4	56.30	6	20.0000	20.0000
4	56.30	7	20.0000	20.0000
4	56.30	8	19.0000	19.0000
4	56.30	9	19.0000	19.0000
4	56.30	10	20.0000	20.0000
5	75.00	1	18.0000	18.0000
5	75.00	2	20.0000	20.0000
5	75.00	3	17.0000	17.0000
5	75.00	4	17.0000	17.0000
5	75.00	5	20.0000	20.0000
5	75.00	6	19.0000	19.0000
5	75.00	7	20.0000	20.0000
5	75.00	8	20.0000	20.0000
5	75.00	9	22.0000	22.0000
5	75.00	10	20.0000	20.0000

6	100.00	1	20.0000	20.0000
6	100.00	2	19.0000	19.0000
6	100.00	3	20.0000	20.0000
6	100.00	4	20.0000	20.0000
6	100.00	5	22.0000	22.0000
6	100.00	6	22.0000	22.0000
6	100.00	7	19.0000	19.0000
6	100.00	8	19.0000	19.0000
6	100.00	9	16.0000	16.0000
6	100.00	10	20.0000	20.0000

HOPE 14854 CERIO REPS  
File: 14854HCR Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	CONTROL	10	15.000	21.000	18.000
2	31.60	10	15.000	21.000	18.500
3	42.20	10	17.000	20.000	18.500
4	56.30	10	18.000	23.000	20.000
5	75.00	10	17.000	22.000	19.300
6	100.00	10	16.000	22.000	19.700

HOPE 14854 CERIO REPS  
File: 14854HCR Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	CONTROL	3.778	1.944	0.615
2	31.60	2.722	1.650	0.522
3	42.20	0.944	0.972	0.307
4	56.30	1.778	1.333	0.422
5	75.00	2.456	1.567	0.496
6	100.00	2.900	1.703	0.539

HOPE 14854 CERIO REPS  
File: 14854HCR Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	30.800	6.160	2.535
Within (Error)	54	131.200	2.430	

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 Total 59 162.000  
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Critical F value = 2.45 (0.05,5,40)  
 Since F > Critical F REJECT Ho:All groups equal

HOPE 14854 CERIO REPS  
 File: 14854HCR Transform: NO TRANSFORM

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	18.000	18.000		
2	31.60	18.500	18.500	-0.717	
3	42.20	18.500	18.500	-0.717	
4	56.30	20.000	20.000	-2.869	
5	75.00	19.300	19.300	-1.865	
6	100.00	19.700	19.700	-2.439	

-----  
 Dunnett table value = 2.31 (1 Tailed Value, P=0.05, df=40,5)

HOPE 14854 CERIO REPS  
 File: 14854HCR Transform: NO TRANSFORM

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	CONTROL	10			
2	31.60	10	1.610	8.9	-0.500
3	42.20	10	1.610	8.9	-0.500
4	56.30	10	1.610	8.9	-2.000
5	75.00	10	1.610	8.9	-1.300
6	100.00	10	1.610	8.9	-1.700

HOPE 14854 CERIO REPS  
 File: 14854HCR Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	CONTROL	10	18.000	18.000	18.000
2	31.60	10	18.500	18.500	18.500
3	42.20	10	18.500	18.500	18.500
4	56.30	10	20.000	20.000	19.650
5	75.00	10	19.300	19.300	19.650
6	100.00	10	19.700	19.700	19.700

HOPE 14854 CERIO REPS

File: 14854HCR

Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
CONTROL	18.000				
31.60	18.500	0.717		1.68	k= 1, v=54
42.20	18.500	0.717		1.76	k= 2, v=54
56.30	19.650	2.367	*	1.79	k= 3, v=54
75.00	19.650	2.367	*	1.80	k= 4, v=54
100.00	19.700	2.439	*	1.80	k= 5, v=54

s = 1.559

Note: df used for table values are approximate when v > 20.

HOPE 14854 CERIO REPS

File: 14854HCR

Transform: NO TRANSFORM

STEELS MANY-ONE RANK TEST - Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	18.000				
2	31.60	18.500	111.00	75.00	10.00	
3	42.20	18.500	111.00	75.00	10.00	
4	56.30	20.000	134.50	75.00	10.00	
5	75.00	19.300	125.50	75.00	10.00	
6	100.00	19.700	130.50	75.00	10.00	

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

TITLE: HOPE 14854 MINNOW WEIGHTS

FILE: 14854HMW

TRANSFORM: NO TRANSFORM

NUMBER OF GROUPS: 6

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GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	0.3180	0.3180
1	CONTROL	2	0.3090	0.3090
1	CONTROL	3	0.3300	0.3300
1	CONTROL	4	0.3110	0.3110
2	31.60	1	0.3110	0.3110
2	31.60	2	0.3190	0.3190
2	31.60	3	0.3310	0.3310
2	31.60	4	0.3160	0.3160
3	42.20	1	0.3050	0.3050
3	42.20	2	0.3040	0.3040
3	42.20	3	0.2570	0.2570
3	42.20	4	0.3110	0.3110
4	56.30	1	0.3150	0.3150
4	56.30	2	0.3250	0.3250
4	56.30	3	0.3120	0.3120
4	56.30	4	0.3070	0.3070
5	75.00	1	0.3190	0.3190
5	75.00	2	0.3120	0.3120
5	75.00	3	0.3330	0.3330
5	75.00	4	0.3140	0.3140
6	100.00	1	0.3000	0.3000
6	100.00	2	0.3280	0.3280
6	100.00	3	0.3220	0.3220
6	100.00	4	0.3150	0.3150

---

HOPE 14854 MINNOW WEIGHTS

File: 14854HMW

Transform: NO TRANSFORM

.SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

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GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	CONTROL	4	0.309	0.330	0.317
2	31.60	4	0.311	0.331	0.319
3	42.20	4	0.257	0.311	0.294
4	56.30	4	0.307	0.325	0.315
5	75.00	4	0.312	0.333	0.320
6	100.00	4	0.300	0.328	0.316

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HOPE 14854 MINNOW WEIGHTS

File: 14854HMW

Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

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GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	CONTROL	0.000	0.009	0.005
2	31.60	0.000	0.009	0.004
3	42.20	0.001	0.025	0.013
4	56.30	0.000	0.008	0.004
5	75.00	0.000	0.009	0.005
6	100.00	0.000	0.012	0.006

HOPE 14854 MINNOW WEIGHTS  
 File: 14854HMW Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.002	0.000	2.046
Within (Error)	18	0.003	0.000	
Total	23	0.005		

Critical F value = 2.77 (0.05, 5, 18)  
 Since  $F < \text{Critical } F$  FAIL TO REJECT  $H_0$ : All groups equal

HOPE 14854 MINNOW WEIGHTS  
 File: 14854HMW Transform: NO TRANSFORM

DUNNETTS TEST - TABLE 1 OF 2  $H_0$ : Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	0.317	0.317		
2	31.60	0.319	0.319	-0.237	
3	42.20	0.294	0.294	2.397	
4	56.30	0.315	0.315	0.237	
5	75.00	0.320	0.320	-0.263	
6	100.00	0.316	0.316	0.079	

Dunnett table value = 2.41 (1 Tailed Value,  $P=0.05$ ,  $df=18,5$ )

HOPE 14854 MINNOW WEIGHTS  
 File: 14854HMW Transform: NO TRANSFORM

DUNNETTS TEST - TABLE 2 OF 2  $H_0$ : Control < Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
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1	CONTROL	4			
2	31.60	4	0.023	7.2	-0.002
3	42.20	4	0.023	7.2	0.023
4	56.30	4	0.023	7.2	0.002
5	75.00	4	0.023	7.2	-0.003
6	100.00	4	0.023	7.2	0.001

HOPE 14854 MINNOW WEIGHTS  
 File: 14854HMW Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	CONTROL	4	0.317	0.317	0.318
2	31.60	4	0.319	0.319	0.318
3	42.20	4	0.294	0.294	0.311
4	56.30	4	0.315	0.315	0.311
5	75.00	4	0.320	0.320	0.311
6	100.00	4	0.316	0.316	0.311

HOPE 14854 MINNOW WEIGHTS  
 File: 14854HMW Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
CONTROL	0.318				
31.60	0.318	0.119		1.73	k= 1, v=18
42.20	0.311	0.613		1.82	k= 2, v=18
56.30	0.311	0.613		1.85	k= 3, v=18
75.00	0.311	0.613		1.86	k= 4, v=18
100.00	0.311	0.613		1.87	k= 5, v=18

s = 0.013

Note: df used for table values are approximate when v > 20.

HOPE 14854 MINNOW WEIGHTS  
 File: 14854HMW Transform: NO TRANSFORM

STEELS MANY-ONE RANK TEST - Ho: Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	0.317				
2	31.60	0.319	20.50	10.00	4.00	
3	42.20	0.294	11.50	10.00	4.00	

4	56.30	0.315	17.00	10.00	4.00
5	75.00	0.320	21.00	10.00	4.00
6	100.00	0.316	18.00	10.00	4.00

---

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

TEST METHOD  
1000.0

TEST METHOD USED: 1000.0  
END POINT(S) OF TEST: NOEL 100 %  
DEVIATIONS FROM REFERENCE METHOD: None

DATE AND TIME TEST STARTED: 08/14/12 1430  
DATE AND TIME TEST TERMINATED: 08/21/12 1430

TYPE OF TEST CHAMBERS: 500 ml  
VOLUME OF SOLUTIONS USED/CHAMBER: 400 ml  
NUMBER OF ORGANISMS/TEST CHAMBER: 10  
NUMBER OF REPLICATE TEST CHAMBERS/TREATMENT: 4

TEST TEMPERATURE (MEAN): mean = 25

TEST ORGANISMS

SCIENTIFIC NAME: Pimephales promelas  
AGE: 24 hours  
LIFE STAGE: Embryos  
SOURCE: Aquatic BioSystems, Inc.  
DISEASES AND TREATMENT: None  
FEEDING REGIME: 2/day Brine Shrimp  
\*\*ORGANISM HISTORY SHEETS ARE ATTACHED\*\*

RESULTS SUMMARY

FATHEAD MINNOW, PIMEPHALES PROMELAS, LARVAL SURVIVAL AND GROWTH TEST  
METHOD 1000.0

Larvae are exposed in a static renewal system for seven days to different concentrations of effluent or to receiving water. Test results are based on the survival and growth (increase in weight) of the larvae. Effluent dilutions chosen for this test were 100 %, 75%, 56.3%, 42.2% and 31.6% in accordance with the NPDES permit. The low flow or "critical" dilution is specified in the NPDES Permit as 100% effluent.

NOEL(S) ARE AS FOLLOWS:

100% Survival	100%	effluent
NOEL Growth	100%	effluent

BIOMONITORING REPORT  
FATHEAD MINNOW LARVAE GROWTH AND SURVIVAL

DATA TABLE FOR FATHEAD MINNOW SURVIVAL

Effluent Conc. %	Percent Survival In				Mean Percent			CV%*
	A	B	C	D	24h	48h	7d	
Dilution Water	100	100	100	100	100	100	100	0.0
31.6%	100	100	100	100	100	100	100	0.0
42.2%	100	100	90	100	100	100	97.5	5.1
56.3%	100	100	100	100	100	100	100	0.0
75%	100	100	100	100	100	100	100	0.0
100%	100	100	100	100	100	100	100	0.0

\*coefficient of variation = standard deviation x 100/mean

\*\*ph unadjusted 100% effluent

1. Dunnett's Procedure or Steel's Many-One Rank Test as appropriate:

Is the mean survival at 7xdays significantly different (XX0.5) than the control survival for the % effluent corresponding to:

- a.) LOW FLOW OR CRITICAL DILUTION (100%): YES [ ] NO [x]  
 b.) 1/2 LOW FLOW OR 2 X CRITICAL DILUTION (56.3 %): YES [ ] NO [x]

2. Dunnett's Procedure:

Is the mean dry weight (growth) at 7 days effluent significantly different (p=0.05) than the control's dry weight (growth) for the % effluent corresponding to (significant non-lethal effects):

- a.) LOW FLOW OR CRITICAL DILUTION (100%): YES [ ] NO [x]  
 b.) 1/2 LOW FLOW OR 2 X CRITICAL DILUTION (56.3 %): YES [ ] NO [x]

3. If you answered NO to 1.a) and 2.a) enter [0] otherwise enter [1]: [0]

4. If you answered NO to 1.b) and 2.b) enter [0] otherwise enter [1]: [0]

5. Enter response to item 3 on DMR Form, parameter # TEP6C.

6. Enter response to item 4 on DMR Form, parameter # TFP6C.

7. Enter percent effluent corresponding to each NOEL below and circle lowest number:

- a.) NOEL survival = 100% effluent  
 b.) NOEL growth = 100% effluent

FATHEAD MINNOW LARVAE GROWTH AND SURVIVAL  
(Pimephales promelas)

Permittee: **CITY OF HOPE** NPDES NO. AR0038466

Dilution water used: Receiving [ ] Reconstituted [ x ]

DATA TABLE FOR GROWTH

EFFLUENT CONC. %	AVERAGE DRY WEIGHT IN MILLIGRAMS IN REPLICATE CHAMBERS				MEAN DRY WEIGHT (MG) 7 days	CV%*
	A	B	C	D		
CONTROL	.318	.309	.330	.311	.317	3.0
31.6 %	.311	.319	.331	.316	.319	2.7
42.2 %	.305	.304	.257	.311	.294	8.5
56.3 %	.315	.325	.312	.307	.315	2.4
75 %	.319	.312	.333	.314	.320	3.0
100%	.300	.328	.322	.315	.316	<b>3.8</b>

\*Coefficient of variation = standard deviation X 100/mean

(Coef Of Var Statre 7Day Chronic Pimephales TQP6C = **3.8**)

TEST METHOD  
1002.0

TEST METHOD USED: 1002.0

DATE AND TIME TEST STARTED: 08/14/12 1430  
DATE AND TIME TEST TERMINATED: 08/22/12 1430  
TYPE OF TEST CHAMBERS: 30 ml  
VOLUME OF SOLUTIONS USED/CHAMBER: 15 ml  
NUMBER OF ORGANISMS/TEST CHAMBER: 1  
NUMBER OF REPLICATE TEST CHAMBERS/TREATMENT: 10

TEST TEMPERATURE (MEAN AND RANGE): 25

TEST ORGANISMS

SCIENTIFIC NAME: Ceriodaphnia dubia  
AGE: Less than 24 hours  
LIFE STAGE: Neonates  
SOURCE: Aquatic BioSystems, Inc.  
DISEASES AND TREATMENT: None  
FEEDING REGIME: Daily  
\*\*ORGANISM HISTORY SHEETS ARE ATTACHED\*\*

RESULTS SUMMARY  
CLADOCERAN, CERIODAPHNIA DUBIA, SURVIVAL AND REPRODUCTION TEST  
METHOD 1002.0

Ceriodaphnia are exposed in a static renewal system to different concentrations of effluent, and to receiving water until 60% of surviving control organisms have three broods of offspring (15 neonates per surviving female). Effluent dilutions for this test were 100%, 75%, 56.3%, 42.2%, and 31.6% in accordance with the NPDES Permit. The "critical" dilution is specified as 100% effluent. Test results are based on survival and reproduction. If the test is conducted as described, the control organism should produce three broods of young during a seven-day period.



BIOMONITORING REPORT  
CERIODAPHNIA DUBIA SURVIVAL AND REPRODUCTION

PERCENT SURVIVAL

Time of Reading	0 %	31.6%	42.2 %	56.3 %	75 %	100 %
24h	100	100	100	100	100	100
48h	100	100	100	100	100	100
7 day	100	100	90	100	100	100

1. Fisher's Exact Test:

Is the mean **survival** at 7 days significantly different ( $p=0.05$ ) than the control survival for the % effluent corresponding to (lethality):

a.) LOW FLOW OR CRITICAL DILUTION ( 100 %): YES [ ] NO [X]

b.) 1/2 LOW FLOW OR 2 X

CRITICAL DILUTION ( 56.3 %): YES [ ] NO [X]

2. Dunnett's Procedure or Steel's Many-One Rank Test as appropriate:

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

a.) LOW FLOW OR CRITICAL DILUTION (100 %): YES [ ] NO [ X ]

b.) 1/2 LOW FLOW OR 2 X

CRITICAL DILUTION (56.3 %): YES [ ] NO [ X ]

3. If you answered NO to 1.a) and 2.a) enter [ 0 ]  
otherwise enter [ 1 ]: [ 0 ]

4. If you answered NO to 1.b) and 2.b) enter [ 0 ]  
otherwise enter [ 1 ]: [ 0 ]

5. Enter response to item 3 on DMR Form, parameter #TEP3B.

6. Enter response to item 4 on DMR Form, parameter #TFP3B.

7. Enter percent effluent corresponding to each NOEL below and circle lowest number:

a.) NOEL survival = 100 % effluent

b.) NOEL reproduction = 100 % effluent

BIOMONITORING REPORT  
CERIODAPHNIA DUBIA SURVIVAL AND REPRODUCTION

Permittee: CITY OF HOPE                      NPDES NO. AR0038466  
Dilution water used:                      Receiving [    ]    Reconstituted [X]

NUMBER OF YOUNG PRODUCED PER FEMALE @ 7 DAYS

PERCENT EFFLUENT (%)

REP	0 %	31.6%	42.2%	56.3%	75 %	100 %
A	19	18	19	23	18	20
B	19	18	17	18	20	19
C	16	18	18	21	17	20
D	15	19	20	20	17	20
E	20	21	18	20	20	22
F	21	20	18	20	19	22
G	18	20	18	20	20	19
H	16	15	18	19	20	19
I	17	18	19	19	22	16
J	19	18	20	20	20	20
CV%	<b>10.80</b>	8.92	5.25	6.67	8.12	8.64

MEAN                      18.0      18.5      18.5      20.0      19.3      19.7

\*coefficient of variation = standard deviation x 100/mean

(Coef Of Var Statre 7Day Chronic Ceriodaphnia TQP3B = **10.80**)

STANDARD REFERENCE TOXICANTS

STANDARD TOXICANT USED AND SOURCE: SODIUM CHLORIDE  
DATE AND TIME OF MOST RECENT TEST: 09/18/12 1000  
DILUTION WATER USED IN TEST: 20% DMW  
RESULTS(LC50 OR, NOEC AND/OR ECL): LC50 = 1473 FATHEAD MINNOW  
RESULTS(LC50 OR, NOEC AND/OR ECL): LC50 = 743 CERIODAPHNIA  
ACCEPTABLE PERFORMANCE, STUDY 31= 100%  
PHYSICAL AND CHEMICAL METHODS USED:

SPECIFIC CONDUCTANCE METHOD 2510 B  
OXYGEN, DISSOLVED METHOD 4500- O G  
CHLORINE, TOTAL RESIDUAL METHOD 4500- C I F  
ALKALINITY, CACO3 METHOD 2320 B

SUMMARY OF REFERENCE TOXICANT (S) ARE AS FOLLOWS:

FATHEAD MINNOW

Standard Recovery FATHEAD MINNOW **90.4%**

CERIODAPHNIA

Standard Recovery CERIODAPHNIA **101.2%**

APPENDIX 1A  
TEST 1000.0

Permittee Hope 14854								
Effluent Conc.	Percent Survival In Rep. Chambers				Mean Percent Survival			CV%*
	A	B	C	D	24h	48h	7 days	
CONTROL	100	100	100	100	100	100	100	0.0
31.60%	100	100	100	100	100	100	100	0.0
42.20%	100	100	90	100	100	100	97.5	5.1
56.30%	100	100	100	100	100	100	100	0.0
75.00%	100	100	100	100	100	100	100	0.0
100.00%	100	100	100	100	100	100	100	0.0
Permittee Hope 14854								
Effluent Conc.	Average Dry Weight (mg)				Mean Dry Weight (mg)		CV%*	
	A	B	C	D	7 days			
CONTROL	0.318	0.309	0.330	0.311	0.317	3.0		
31.6	0.311	0.319	0.331	0.316	0.319	2.7		
42.2	0.305	0.304	0.257	0.311	0.294	8.5		
56.3	0.315	0.325	0.312	0.307	0.315	2.4		
75	0.319	0.312	0.333	0.314	0.320	3.0		
100	0.300	0.328	0.322	0.315	0.316	3.8		

Figure 2. Survival data for fathead minnow larval survival and growth to

Discharger: City of Hope Test Dates: 8-14-12  
 Location: 14854 Analyst: WJM

Conc:	Rep. No.	No. Survivors							Remarks
		Day							
		1	2	3	4	5	6	7	
Control	1	10	10	10	10	10	10	10	
	2	10	10	10	10	10	10	10	
	3	10	10	10	10	10	10	10	
	4	10	10	10	10	10	10	10	
31.6	5	10	10	10	10	10	10	10	
	6	10	10	10	10	10	10	10	
	7	10	10	10	10	10	10	10	
	8	10	10	10	10	10	10	10	
42.2	9	10	10	10	10	10	10	10	
	10	10	10	10	10	10	10	10	
	11	10	10	10	10	10	10	10	
	12	10	10	10	10	10	10	10	
56.3	13	10	10	10	10	10	10	10	
	14	10	10	10	10	10	10	10	
	15	10	10	10	10	10	10	10	
	16	10	10	10	10	10	10	10	
75	17	10	10	10	10	10	10	10	
	18	10	10	10	10	10	10	10	
	19	10	10	10	10	10	10	10	
	20	10	10	10	10	10	10	10	
100	21	10	10	10	10	10	10	10	
	22	10	10	10	10	10	10	10	
	23	10	10	10	10	10	10	10	
	24	10	10	10	10	10	10	10	

Comments:

Discharge: City of Hope  
 Location: 14854  
 Analyst: \_\_\_\_\_

Test Date(s): 8-14-12  
 Weighing Date: 9-28-12

Drying Temperature (°C): 104  
 Drying Time (h): 2

Conc:	Rep. No.	A Wgt. of boat (mg)	B Dry wgt: foil and larvae (mg)	B-A Total dry wgt of larvae (mg)	C No. of larvae	(B-A)/C Mean dry wgt of larvae (mg)	Remarks
Control	1	128381	128699	3.18	10	.318	
	2	127928	128237	3.09	10	.309	
	3	125360	125690	3.30	10	.330	
	4	124120	124431	3.11	10	.311	
Conc:	5	129806	130117	3.11	10	.311	
	6	123803	124022	3.19	10	.319	124122
	7	123724	124055	3.31	10	.331	
31.6	8	124544	124860	3.16	10	.316	
	9	122688	122993	3.05	10	.305	
45	10	129154	129458	3.04	10	.304	
	11	130079	130364	2.85	9	.257	
42.2	12	127672	127983	3.11	10	.311	
	13	125113	125428	3.15	10	.315	
Conc:	14	128405	128730	3.25	11	.325	
	15	129310	129622	3.12	10	.312	
56.3	16	126528	126835	3.07	10	.307	
	17	124358	124677	3.19	10	.319	
Conc:	18	123022	123334	3.12	10	.312	
	19	126303	126636	3.33	10	.333	
75	20	123496	123810	3.14	10	.314	
	21	129570	129870	3.00	10	.300	
Conc:	22	130320	130648	3.28	10	.328	
	23	130170	130492	3.22	10	.322	
100	24	124314	124629	3.15	10	.315	

<sup>1</sup>Adapted from Hughes, et al., 1987.

Control: 128625 128622

APPENDIX 2A  
TEST 1002.0



conc.	Hope 14854	CERIO	REPLICATE CONTAINERS								s.d. =	1.94365	CV% =	10.798059
control	DAY	1	2	3	4	5	6	7	8	9	10	#young	#adult	
temp:	1											0	10	0.00
temp:	2											0	10	0.00
temp:	3		1				1					2	10	0.20
temp:	4	4	3	2	2	4	1	3	3	3	3	28	10	2.80
temp:	5			2		1	3			1		7	10	0.70
temp:	6	6	5	3	5	7	6	5	5	7	7	56	10	5.60
temp:	7		5	5		1		3			1	15	10	1.50
temp:	8	9	5	4	8	7	10	7	7	6	9	72	10	7.20
TOTAL		19	19	16	15	20	21	18	16	17	19	180	10	18.00
conc.	31.60 DAY	REPLICATE CONTAINERS								s.d. =	1.64992	CV% =	8.9184639	
temp:	1	2	3	4	5	6	7	8	9	10	no. young	no. adults		
temp:	1										0	10	0.00	
temp:	2										0	10	0.00	
temp:	3		1	1		1					3	10	0.30	
temp:	4	2	3	2	4	4	3	3	3	3	30	10	3.00	
temp:	5			1		1		2			4	10	0.40	
temp:	6	8	7	6	6	7	5	5	5	7	62	10	6.20	
temp:	7			2		4					7	10	0.70	
temp:	8	8	7	6	9	9	7	10	7	8	8	79	10	7.90
TOTAL		18	18	18	19	21	20	20	15	18	18	185	10	18.50
CONC.	42.20 DAY	REPLICATE CONTAINERS								s.d. =	0.97183	CV% =	5.2531098	
temp:	1	2	3	4	5	6	7	8	9	10	no. young	no. adults		
temp:	1										0	10	0.00	
temp:	2										0	10	0.00	
temp:	3										0	10	0.00	
temp:	4	4	2	2	4	3	4	2	4	4	32	10	3.20	
temp:	5		2								2	10	0.20	
temp:	6	6	5	5	6	6	7	7	7	7	8	64	10	6.40
temp:	7		3		1		2		1		7	10	0.70	
temp:	8	9	5	11	9	9	6	7	8	8	8	80	10	8.00
TOTAL		19	17	18	20	18	18	18	18	19	20	185	10	18.50
CONC.	56.30 DAY	REPLICATE CONTAINERS								s.d. =	1.33333	CV% =	6.6666667	
temp:	1	2	3	4	5	6	7	8	9	10	no. young	no. adults		
temp:	1										0	10	0.00	
temp:	2										0	10	0.00	
temp:	3			2	1		1				1	5	10	0.50
temp:	4	3	4	1	3	5	2	2	2	4	3	29	10	2.90
temp:	5			3				4			1	8	10	0.80
temp:	6	6	3	7	7	7	8	4	7	6	6	61	10	6.10
temp:	7		4		1			3		2	1	11	10	1.10
temp:	8	14	7	8	8	8	9	7	10	7	8	86	10	8.60
TOTAL		23	18	21	20	20	20	20	19	19	20	200	10	20.00
CONC.	75.00 DAY	REPLICATE CONTAINERS								s.d. =	1.56702	CV% =	8.119281	
temp:	1	2	3	4	5	6	7	8	9	10	no. young	no. adults		
temp:	1										0	10	0.00	
temp:	2										0	10	0.00	
temp:	3					2		2			4	10	0.40	
temp:	4	4	1	3	3	1	4	2	3	3	4	28	10	2.80
temp:	5		3	2		1		2			8	10	0.80	
temp:	6	5	6	5	7	7	6	6	5	7	7	61	10	6.10
temp:	7	5	3		1			1	2		12	10	1.20	
temp:	8	4	7	7	6	9	9	9	8	12	9	80	10	8.00
TOTAL		18	20	17	17	20	19	20	20	22	20	193	10	19.30
CONC.	100.00 DAY	REPLICATE CONTAINERS								s.d. =	1.70294	CV% =	8.6443586	
temp:	1	2	3	4	5	6	7	8	9	10	no. young	no. adults		
temp:	1										0	10	0.00	
temp:	2										0	10	0.00	
temp:	3	1		1			2				4	10	0.40	
temp:	4	3	5	2	4	4	1	3	4	2	5	33	10	3.30
temp:	5			1			3		1		5	10	0.50	
temp:	6	6	5	5	7	7	6	6	5	7	5	59	10	5.90
temp:	7		1	3			1	2			1	8	10	0.80
temp:	8	10	8	8	9	11	9	10	7	7	9	88	10	8.80
TOTAL		20	19	20	20	22	22	19	19	16	20	197	10	19.70

City of Hope 14854 Cerio 8-14-12 1430

CONC.	DAY	REPLICATE CONTAINERS										s.d. =	0	CV% =	#DIV/O!	
control	DAY	1	2	3	4	5	6	7	8	9	10	no. youn	no. adults	young/adult		
temp:	1											0	10	#DIV/O!		
temp:	2											0	10	#DIV/O!		
temp:	3											0	10	#DIV/O!		
temp:	4	4	3	2	2	4	1	3	3	3	3	0	10	#DIV/O!		
temp:	5											0	10	#DIV/O!		
temp:	6	6	5	2	5	7	10	5	5	7	7	0	10	#DIV/O!		
temp:	7											0	10	#DIV/O!		
temp:	8	9	5	4	8	7	10	7	7	6	9	0	10	#DIV/O!		
* TOTAL		0	0	0	0	0	0	0	0	0	0	0	10	0.00		

CONC.	DAY	REPLICATE CONTAINERS										s.d. =	0	CV% =	#DIV/O!	
31.6	DAY	1	2	3	4	5	6	7	8	9	10	no. youn	no. adults	young/adult		
temp:	1											0	10	#DIV/O!		
temp:	2											0	10	#DIV/O!		
temp:	3											0	10	#DIV/O!		
temp:	4	2	3	2	4	4	3	3	3	3	3	0	10	#DIV/O!		
temp:	5											0	10	#DIV/O!		
temp:	6	8	7	6	6	7	5	5	7	6		0	10	#DIV/O!		
temp:	7											0	10	#DIV/O!		
temp:	8	8	7	6	9	9	7	10	7	8	8	0	10	#DIV/O!		
* TOTAL		0	0	0	0	0	0	0	0	0	0	0	10	0.00		

CONC.	DAY	REPLICATE CONTAINERS										s.d. =	0	CV% =	#DIV/O!	
42.2	DAY	1	2	3	4	5	6	7	8	9	10	no. youn	no. adults	young/adult		
temp:	1											0	10	#DIV/O!		
temp:	2											0	10	#DIV/O!		
temp:	3											0	10	#DIV/O!		
temp:	4	4	2	2	4	3	3	4	2	4	4	0	10	#DIV/O!		
temp:	5											0	10	#DIV/O!		
temp:	6	6	5	5	6	6	7	7	7	7	8	0	10	#DIV/O!		
temp:	7											0	10	#DIV/O!		
temp:	8	9	5	11	9	9	6	7	8	8	8	0	10	#DIV/O!		
* TOTAL		0	0	0	0	0	0	0	0	0	0	0	10	0.00		

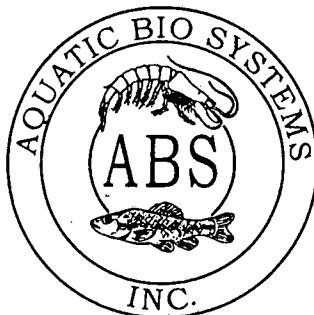
CONC.	DAY	REPLICATE CONTAINERS										s.d. =	0	CV% =	#DIV/O!	
56.3	DAY	1	2	3	4	5	6	7	8	9	10	no. youn	no. adults	young/adult		
temp:	1											0	10	#DIV/O!		
temp:	2											0	10	#DIV/O!		
temp:	3											0	10	#DIV/O!		
temp:	4	3	4	2	3	5	2	2	2	4	3	0	10	#DIV/O!		
temp:	5											0	10	#DIV/O!		
temp:	6	6	3	7	7	7	8	4	7	6	6	0	10	#DIV/O!		
temp:	7											0	10	#DIV/O!		
temp:	8	14	7	8	8	8	9	7	10	7	8	0	10	#DIV/O!		
* TOTAL		0	0	0	0	0	0	0	0	0	0	0	10	0.00		

CONC.	DAY	REPLICATE CONTAINERS										s.d. =	0	CV% =	#DIV/O!	
75	DAY	1	2	3	4	5	6	7	8	9	10	no. youn	no. adults	young/adult		
temp:	1											0	10	#DIV/O!		
temp:	2											0	10	#DIV/O!		
temp:	3											0	10	#DIV/O!		
temp:	4	4	1	3	3	1	4	2	3	3	4	0	10	#DIV/O!		
temp:	5											0	10	#DIV/O!		
temp:	6	5	6	5	7	7	6	6	5	7	7	0	10	#DIV/O!		
temp:	7											0	10	#DIV/O!		
temp:	8	5	7	7	6	9	9	9	8	12	9	0	10	#DIV/O!		
* TOTAL		0	0	0	0	0	0	0	0	0	0	0	10	0.00		

CONC.	DAY	REPLICATE CONTAINERS										s.d. =	0	CV% =	#DIV/O!	
100	DAY	1	2	3	4	5	6	7	8	9	10	no. youn	no. adults	young/adult		
temp:	1											0	10	#DIV/O!		
temp:	2											0	10	#DIV/O!		
temp:	3											0	10	#DIV/O!		
temp:	4	3	5	2	4	4	1	3	4	2	5	0	10	#DIV/O!		
temp:	5											0	10	#DIV/O!		
temp:	6	10	5	5	7	7	6	6	5	7	5	0	10	#DIV/O!		
temp:	7											0	10	#DIV/O!		
temp:	8	10	8	9	9	11	9	10	7	7	9	0	10	#DIV/O!		
* TOTAL		0	0	0	0	0	0	0	0	0	0	0	10	0.00		

APPENDIX B  
ORGANISM HISTORY

1300 Blue Spruce Drive, Suite C  
Fort Collins, Colorado 80524



Toll Free: 800/331-5916  
Tel: 970/484-5091 Fax: 970/484-2514

### ORGANISM HISTORY

DATE: 8/13/2012

SPECIES: *Pimephales promelas*

AGE: N/A

LIFE STAGE: Embryo

HATCH DATE: 8/13/2012

BEGAN FEEDING: N/A

FOOD: N/A

### Water Chemistry Record:

	Current	Range
TEMPERATURE:	<u>25°C</u>	<u>--</u>
SALINITY/CONDUCTIVITY:	<u>--</u>	<u>--</u>
TOTAL HARDNESS (as CaCO <sub>3</sub> ):	<u>134 mg/l</u>	<u>--</u>
TOTAL ALKALINITY (as CaCO <sub>3</sub> ):	<u>90 mg/l</u>	<u>--</u>
pH:	<u>8.20</u>	<u>--</u>

Comments:

Facility Supervisor

rec'd  
8-14-12  
14854

APPENDIX C  
CHAINS OF CUSTODY

8100 NATIONAL DRIVE, LITTLE ROCK, AR 72209  
 501-562-8139 800-331-8139  
 FAX 501-562-7025

### CHAIN OF CUSTODY RECORD

TURN AROUND TIME  
 RUSH 24HR. 48 HR.  
 5 DAY REG  
 OTHER \_\_\_\_\_

FOR LAB/OFFICE USE ONLY

LAB # 14854.0001B  
 CLIENT # 15020  
 P.O.# \_\_\_\_\_

STANDARD METHODS PRESERVATION PER EPA 40 CFR  
 C 4= COOL TO 4.C  
 S<2= SULFURIC ACID TO pH<2  
 N<2= NITRIC ACID TO pH<2  
 T= THIOSULFATE FOR DECHLORINATION  
 W= WINKLER AZIDE MODIFICATION  
 P= MEMBRANE ELECTRODE  
 NaOH= pH >12

NAME OF COMPANY, CITY, OR PROJECT

PROJECT NO:

SAMPLER(S) NAME: (PRINT)

110913k2

City of Hope

ISCO Auto Sampler

SAMPLE NO:	SAMPLE ID AND/OR COLLECTION LOCATION	START	END	COMP	FIELD ANALYSIS				D.O (W)	CONTAINER TYPE	ANALYSIS REQUIRED	
		DATE/TIME	DATE/TIME	GRAB	pH	TEMP	FLOW	CL2	D.O(P)	PRESERVATIVE		
	<u>WPFE</u>	<u>6 AM 8/12/12</u>	<u>6 AM 8/13/12</u>	<u>24HR Comp</u>		<u>CH</u>					<u>6-1/2 gal Plastic</u>	<u>W. E. T</u>
METHOD OF SHIPMENT (CIRCLE)		FIELD CALIBRATION RECORD			NOTES/COMMENTS/OBSERVATIONS							
FED EX WALK IN SRA UPS OTHER		pH 7			<u>Temp @ Lab 2.4°C</u>							
		pH 4										
		pH 10										
TYPE OF SAMPLE(S): (CIRCLE)		D.O			FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT							
WATER SOIL W/W SLUDGE OTHER												

RELINQUISHED BY: Carol Smith DATE/TIME: 8/13/12 @

RECEIVED BY: Danny Riddle DATE/TIME: 12:40 8/13/12

RELINQUISHED: Ken Holston DATE/TIME: 8/13/12 12:40

/ED BY (LAB): Danny Riddle



8100 NATIONAL DRIVE, LITTLE ROCK, AR 72209

501-562-8139 800-331-8139

FAX 501-562-7025

### CHAIN OF CUSTODY RECORD

TURN AROUND TIME

RUSH 24HR. 48 HR.

5 DAY REG

OTHER \_\_\_\_\_

FOR LAB/OFFICE USE ONLY

LAB # 14854.0003B

CLIENT # 15020

P.O.# \_\_\_\_\_

STANDARD METHODS PRESERVATION PER EPA 40 CFR

C 4= COOL TO 4.C

S<2= SULFURIC ACID TO pH<2

N<2= NITRIC ACID TO pH<2

T= THIOSULFATE FOR DECHLORINATION

W= WINKLER AZIDE MODIFICATION

P= MEMBRANE ELECTRODE

NaOH= pH >12

110913k2

NAME OF COMPANY, CITY, OR PROJECT

PROJECT NO:

SAMPLER(S) NAME: (PRINT)

City of Hope

ISCO Auto SAMPLER

AMPLE NO:	SAMPLE ID AND/OR COLLECTION LOCATION	START	END	COMP	FIELD ANALYSIS				D.O (W)	CONTAINER TYPE	ANALYSIS REQUIRED	
		DATE/TIME	DATE/TIME	GRAB	pH	TEMP	FLOW	CL2	D.O(P)	PRESERVATIVE		
	<u>WOPFE</u>	<u>6AM 8/16/12</u>	<u>6AM 8/17/12</u>	<u>24HR COMP</u>		<u>04</u>					<u>6-1/2 gal Plastic</u>	<u>W.E.T</u>

METHOD OF SHIPMENT (CIRCLE)  
FED EX WALK IN SRA UPS OTHER

FIELD CALIBRATION RECORD

NOTES/COMMENTS/OBSERVATIONS

pH 7  
pH 4  
pH 10  
D.O

Temp @ Lab 11.0 C

TYPE OF SAMPLE(S): (CIRCLE)

WATER SOIL W/W SLUDGE OTHER

FIELD ANALYSIS CONDUCTED BY: (CIRCLE) SRA CLIENT

RELINQUISHED BY:

Carol Smith

DATE/TIME: 8/17/12 @ 10:30A

RECEIVED BY:

Kim Holston

DATE/TIME: 8/17/12 10:30A

RELINQUISHED BY:

Kim Holston

DATE/TIME: 8/17/12 1:30p

RECEIVED BY (LAB):

Danny Riddle

DATE/TIME: 13



APPENDIX D  
LABORATORY CONTROL  
CERIO CULTURE RECORD



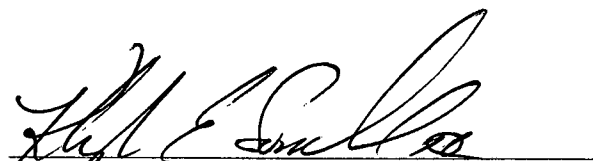
8-6-12 Verio

DATE START	*																	
DATE END	*																	
ANALYST	*																	
WATER TYPE	*					day 8						day 14						
% SURVIVAL	*					#VALUE!						#VALUE!						
#YOUNG MEAN						0												
stnd DEV from mean	0					#DIV/0!												
REPLICATE NUMBER											No.	No.	Young/					
DAY	1	2	3	4	5	6	7	8	9	10	Young	Adults	Adult					
1											0	10	#####					
2											0	10	#####					
3				1							0	10	#####					
4	3	2	2	3	1	4	2	2	4	4	0	10	#####					
5		4			2			1			0	10	#####					
6	6	2	6	5	5	3	7	6	6	5	0	10	#####					
7		4	1		3	4		2		4	0	10	#####					
8	9	6	7	8	8	9	10	8	7	6	0	10	#####					
total8	0	0	0	0	0	0	0	0	0	0	0		#####					
9											0		#####					
10											0		#####					
11											0		#####					
12											0		#####					
13											0		#####					
14											0		#####					
total14											0		#####					
REPLICATE NUMBER											No.	No.	Young/					
DAY	11	12	13	14	15	16	17	18	19	20	Young	Adults	Adult					
1											0	10	#####					
2											0	10	#####					
3		1		2					1		0	10	#####					
4	4	3	3	1	2	5	2	3	2	4	0	10	#####					
5			1		1		3				0	10	#####					
6	5	7	4	7	7	5	6	6	5	3	0	10	#####					
7	4		4		1	2		1		3	0	10	#####					
8	7	10	9	7	8	7	11	9	9	6	0	10	#####					
total8	0	0	0	0	0	0	0	0	0	0	0	10	0					
9											0		#####					
10											0		#####					
11											0		#####					
12											0		#####					
13											0		#####					
14											0		#####					
total14	0	0	0	0	0	0	0	0	0	0	0	10	0					

FIGURE 5  
page 82

BIOMONITORING ANALYSIS  
BY  
SORRELLS RESEARCH ASSOCIATES, INC.

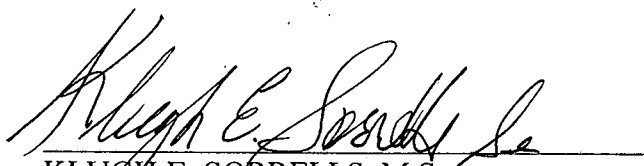
ANALYSIS



KLUGH E. SORRELLS, II  
LABORATORY TECHNICIAN



CECIL A. SORRELLS  
BIOMONITORING MANAGER/PRESIDENT



KLUGH E. SORRELLS, M.S.  
QUALITY ASSURANCE OFFICER

City of Hope  
PO BOX 667  
Hope, AR  
71802-0667



ADEQ  
NPDES ENFORCEMENT Section  
5301 Northshore Drive  
North Little Rock, AR

72218-5317