DOE/OR/22012--T12

STANDARD REPORT FORM

STATIC RENEWAL TESTS USING PIMEPHALES PROMELAS
(FATHEAD MINNOWS) AND CERIODAPHNIA DUBIA (DAPHNIDS)

Test Title: Clinch River - Environmental Restoration Program (CR-ERP) Study, Ambient Water Toxicity

Principal Investigator: Cynthia L. Russell

Starting Date: July 22, 1993

Ending Date: July 29, 1993

1.0 EXECUTIVE SUMMARY

Clinch River - Environmental Restoration Program (CR-ERP) personnel and Tennessee Valley Authority (TVA) personnel conducted a study during the week of July 22-29, 1993, as described in the Statement of Work (SOW) document. [1] The organisms specified for testing were larval fathead minnows, Pimephales promelas, and the daphnid, Ceriodaphnia dubia. Surface water samples were collected by TVA Field Engineering personnel from Clinch River Mile 19.0 and Mile 22.0 on July 21, 23, and 26. Samples were split and provided to the CR-ERP and TVA toxicology laboratories for testing.

Exposure of test organisms to these samples resulted in no toxicity (survival, growth, or reproduction) to either species in testing conducted by TVA.

2.0 SAMPLE COLLECTION/TREATMENTS

2.1 Test Sample Identification (Chemical/Effluent/Elutriate, etc.): Samples were collected for biomonitoring at the following two sites: Clinch River Mile 19.0, downstream of the mouth of White Oak Creek and upstream of Grubb Island, and Clinch River Mile 22.0, downstream of Melton Hill Dam and upstream of White Oak Creek. Clinch River samples were collected at approximately mid-channel.

2.2 Control and/or Dilution Water: Laboratory culture medium consisting of moderately hard reconstituted water was used as control and dilution water for toxicity tests. The water used for daphnid testing was enriched with 10 percent filtered Tennessee River water and selenium as described in Section 3.2.2.

2.3 Sample Dates and Times: Test samples were collected on July 21, 23, and 26, 1993. Collection times were between 0900 and 1200 CDT.

DISCLAIMER

2.4 Sampling Method: All samples were collected using an Isco peristaltic pump with the inlet tubing lowered to approximately 1.0-1.5 meters below the surface. Pumping rate was approximately two liters per minute. A 20 L composite was collected at each station and partitioned (split) according to the workplan for shipping to the TVA Aquatic Research Laboratory (ARL) at Browns Ferry Nuclear Plant site or direct transfer to ORNL (DOE) personnel in the field.

2.5 Pertinent Site Conditions: Weather conditions were clear and sunny during sampling on July 21, 23, and 26.

2.6 Sample Storage/Handling: All samples were placed on ice in ice chests after partitioning. Zero headspace was established in each container by filling full and expressing any air bubbles before sealing. Samples remained on ice until shipped or transferred directly to ORNL (DOE) personnel. Excess composite sample was discarded. Samples were stored in refrigerators at 4°C $\pm$ 1°C after arrival at the Aquatic Research Laboratory (ARL).

2.7 Sample Transport: Samples collected on July 21, 23, and 26 were transported to Browns Ferry Nuclear Plant by overnight TVA mail courier. Personnel from ARL picked up samples from the mailroom and transported them to ARL.

2.8 Sample Pretreatment: Sample temperature was raised to 25°C in a warm water bath and samples were aerated as necessary to bring DO levels down to near 100 percent saturation. Adequate water for use in test initiation or daily renewal was filtered through a 100 µm nylon mesh filter into 2000 mL beakers, and appropriate dilutions were prepared where applicable.

2.9 Test Treatments: Samples from Clinch River Mile 19.0 and Mile 22.0 were tested at 100 percent (undiluted) and diluted to 50 percent using the appropriate culture media.

3.0 TEST ORGANISMS/CULTURING CONDITIONS

3.1 Species: Pimephales promelas, Fathead minnow

3.1.1 Source: ARL inhouse culture

3.1.2 Culture Water: Culture medium consisted of 50 percent dechlorinated tap water and 50 percent moderately hard reconstituted water. Dechlorination was achieved by activated carbon filtration and verified by DPD titration. Reagents for reconstituted water were added to reverse osmosis product water.

Both waters were passed through a pack column degasser to bring dissolved gases to saturation. Culture medium was continuously aerated to help ensure aseptic conditions. Total hardness was approximately 95 mg/L as $CaCO_3$.

3.1.3 Temperature of Culture: 25°C ± 1°C

3.1.4 General Maintenance: Adult fathead minnows are maintained in glass aquaria in a flow through recirculating system. Flow rate to aquaria used for spawning is one aquarium volume per hour.

Approximately 20 percent of the water volume is replaced twice weekly. Adults are fed three times daily. Sexually mature fish are placed in 21-L glass aquaria (one male, four females) and reproduction is checked and recorded daily. Spawns are removed from aquaria and incubated in 1-L glass beakers under aeration to the proper stage of development for the target test.

Fish health is monitored regularly and corrective action is taken if necessary. Spawning frequency from individual aquaria is tracked and sexually spent individuals are replaced as necessary. Every 4-6 months a group of the same age fish from at least three spawns is reared to adults for replacement spawners.

3.1.5 Spawn Date: July 17, 1993

3.1.6 Hatch Date/Time: July 21, 1993/1015 CDT - July 22, 1993/0645 CDT

3.1.7 Culture/Acclimation Water: Moderately hard reconstituted water

3.1.8 Acclimation Temperature: 25°C ± 1°C

3.1.9 Mean Dry Weight at Start of Test: 0.06 mg

3.1.10 Diseases and Treatment: None.

3.1.11 Food and Feeding: Larvae were fed brine shrimp (Artemia) nauplii <24-h old twice daily beginning after hatching to ensure food availability if larvae began feeding prior to test initiation.

3.2 Species: Ceriodaphnia dubia, daphnids

3.2.1 Source: Inhouse culture, TVA, Aquatic Research Laboratory

3.2.2 Culture Water: Moderately hard reconstituted water containing 10 percent filtered Tennessee River water and 1.0 ppb selenium. [2] Total hardness was approximately 95 mg $CaCO_3$/L.

3.2.3 Temperature of Culture: 25°C ± 1°C

3.2.4 General Maintenance: Adults used to produce neonates for test initiation are selected as neonates from broods as described below on 2 or 3 consecutive days 6-10 days prior to test initiation. (Adults up to 14 days old may be used for neonate production.) These animals are raised individually (a brood may be raised as a group until Day 3 at which time animals are transferred to

individual cups), and a record is made of their reproduction. Their fourth brood is generally the second brood with 8 or more young and is the earliest brood used for test initiation.

Mass cultures may also be maintained in 8-L glass battery jars in light and temperature controlled incubators. New cultures are started weekly (7-10 days) with approximately 50 neonates. These neonates are selected from the third or fourth brood of the adult, from broods containing 8 or more young.

3.2.5 Food and Feeding: Food used for Ceriodaphnia cultures and this study was obtained from a commercial source (Aquastar) and consists of YCT and Selenastrum prepared according to EPA requirements. Individual animals contained in cups with 15 mL medium were fed 0.1 mL food and algae at renewal.

4.0 TEST METHODS

4.1 Fathead Minnow (Pimephales promelas) Larval Survival and Growth Test, EPA Test Method 1000.0. [3]

4.1.1 Modification/Amendments to Method 1000.0:

4.1.1.1 A 100-micron mesh nylon screen was used to filter samples rather than a 60-micron mesh as described in EPA methods.

4.1.1.2 The Clinch River Mile 19.0 sample storage temperature on Day 6 and the Clinch River Mile 22.0 sample storage temperature on Day 1 were below the prescribed 4°C ± 1°. These temperatures were 2.8°C and 2.5°C, respectively. Temperatures of samples received on ice ranged from 1.7°C to 3.7°C.

4.1.2 Date/Time Test Initiated: July 22, 1993/1010 CDT

4.1.3 Date/Time Test Terminated: July 29, 1993/0930 CDT

4.1.4 Test Chamber: 600-mL borosilicate glass beakers
Volume per chamber: 350 mL

4.1.5 Number of Test Organisms per Chamber: 10

4.1.6 Number of Replicates per Treatment: 4

4.1.7 Dilution Water/Control Water: Moderately hard reconstituted water

4.1.8 Renewal Period: 24-h

4.1.9 Test Temperature: 25.0°C ± 1°C

4.1.10 Feeding Regime During Test: Fathead minnow larvae were fed brine shrimp (Artemia) nauplii <24-h old 3 times daily ad libitum.

4.1.11 Physical and Chemical Parameters Measured: Parameters measured daily (initially) on test solutions and control waters were temperature (temperature was adjusted to equal "final" temperature before renewal), DO, pH and conductivity. In addition, alkalinity, hardness, and total residual chorine were measured on each new sample at the time of first use (7/22, 7/24 and 7/27).

Final measurements taken daily before renewal were temperature and DO in every test beaker and pH and conductivity in one replicate per treatment. Mean values and ranges are reported in section 6.3.

4.1.12 Statistics:

Revised statistical procedures contained in the second edition of EPA's short-term chronic toxicity methods require a decision process for testing statistical assumptions before selecting a specific test method to determine toxicity endpoints. [3] Decision processes followed for testing survival and sublethal (growth) effects are shown in sections 6.1.2.2 and 6.1.3.1. Based on tests for normal distribution and homogenous variance of data, the statistical test used for endpoint determination of survival data was Steel's Many-one Rank Test and for growth data was Dunnett's Test.

4.2 Ceriodaphnia Survival and Reproduction Test, EPA Test Method 1002.0. [3]

4.2.1 Modifications/Deviations to Method 1002.0:

4.2.1.1 Enriched culture medium (see Section 3.2.2.).

4.2.1.2 A 100-micron mesh nylon screen was used to filter samples rather than a 60-micron mesh as described in EPA methods.

4.2.1.3 The Clinch River Mile 19.0 sample storage temperature on Day 6 and the Clinch River Mile 22.0 sample storage temperature on Day 1 were below the prescribed 4°C $\pm$ 1°. These temperatures were 2.8°C and 2.5°C, respectively. Temperatures of samples received on ice ranged from 1.7°C to 3.7°C.

4.2.2 Date/Time Test Initiated: July 22, 1993/1045 CDT

4.2.3 Date/Time Test Terminated: July 29, 1993/1000 CDT

4.2.4 Test Chamber: 1-ounce plastic cups (Plastics, Inc., #P.I.-1)
Volume per Chamber: 15 mL

4.2.5 Number of test organisms per chamber: 1

4.2.6 Number of replicates per treatment: 10

4.2.7 Dilution Water/Control Water: Enriched moderately hard reconstituted water

4.2.8 Renewal Period: 24 hours

4.2.9 Test Temperature: 25.0°C ± 1°C

4.2.10 Feeding Regime During Test: Each organism was fed 0.1 mL of prepared food and algae concentrate daily (added to renewal water before introduction of test organism).

4.2.11 Physical and Chemical Parameters Measured: Parameters measured daily ("initial") on test solutions and control waters were temperature (temperature was adjusted to equal "final" temperature before renewal), DO, pH and conductivity. In addition, alkalinity, hardness, and total residual chlorine were measured on each new sample at the time of first use (7/22, 7/24, and 7/27).

"Final" measurements of temperature were made in 10 randomly selected cups when the tray was removed from the incubator. DO and pH were measured daily in 1 cup per treatment following renewal. Mean values and ranges are reported in section 6.3.

4.2.12 Statistics:

Revised statistical procedures contained in the second edition of EPA's short-term chronic toxicity methods require decision process for testing statistical assumptions before selecting a specific statistical test to determine toxicity endpoints. [3] Fisher's Exact Test was used to evaluate Ceriodaphnia survival effects during the study. Statistical evaluation of daphnid reproduction was not required because all treatment values were greater than the control.

5.0 QUALITY ASSURANCE

5.1 Toxicity Test Methods: All phases of the study including, but not limited to, sample collection, handling and storage; glassware preparation; test organism culturing/acquisition and acclimation; test organism handling during test; and maintaining appropriate test conditions were conducted according to the protocol as described in this report and EPA/600/4-89/001. [3] Any known deviations were noted during the study and are reported herein.

5.2 Physical and Chemical Methods

5.2.1 Reagents, Titrants, Buffers, etc.: All chemicals were certified products used before expiration dates (where applicable). All ARL chemicals are recorded in a bound Laboratory Chemical Logbook and specific chemicals used were documented on a chemical record sheet contained in the study notebook.

5.2.2 Instruments: All identification, service, calibration, and standardization information pertaining to ARL laboratory instruments is contained in bound Laboratory Instrument Logbooks and specific instruments used were documented on an instrument record sheet contained in the study notebook.

5.2.3 Temperature was measured using glass mercury thermometers. The instrument was standardized and inspected with readings made according to TVA procedure DS-42.11. [4]

5.2.4 Dissolved oxygen was measured using a YSI Model 57 oxygen meter. The instrument was standardized (using the Winkler method) and readings were taken according to TVA procedures S&F DS-43.6 and DS-42.4, respectively. [4]

5.2.5 The pH was measured using an Orion Model SA250 meter equipped with an Orion Ross combination electrode. The instrument was standardized and readings were made according to TVA procedures DS-43.7 and DS-42.8, respectively. [4]

5.2.6 Conductance was measured using a YSI Model 32 SCT meter. The instrument was standardized and readings were taken according to TVA procedures DS-43.3 and DS-42.3, respectively. [4]

5.2.7 Alkalinity was measured by titration of 100 mL samples with 0.02 N H_2SO_4 to an end point of 4.5 according to TVA procedure DS-42.1. [4]

5.2.8 Hardness was determined by titration of 50 mL samples with EDTA to a colorimetric endpoint using an indicator (Instructions provided by Reagent Manufacturer [Calgon]), Schwarzenbach Method.

5.2.9 Total residual chlorine (TRC) was determined using the DPD Titrimetric Method according to TVA procedure DS-42.9, Rev. 0. [4]

5.3 Reference Toxicant Tests

5.3.1 Test Type: Fish - 7-day chronic (NOEC)

Daphnids - 7-day chronic (NOEC)

5.3.2 Standard Toxicants Used:

Copper Sulfate Reference Toxicant Solution - fish and daphnids
Source/Brand: EPA

5.3.3 Dilution Water Used: Moderately hard reconstituted water (enriched for daphnids) - fish and daphnid chronic.

5.3.4 Statistics: Chronic Test, FH Survival/Growth and Ceriodaphnia Reproduction, NOEC - Dunnett's Test or Steel's Many-one Rank Test, EPA Bootstrap Procedure - IC_{25}

Ceriodaphnia Survival - Fisher's Exact Test

6.0 RESULTS

6.1 Fathead Minnow Larval Survival and Growth Test

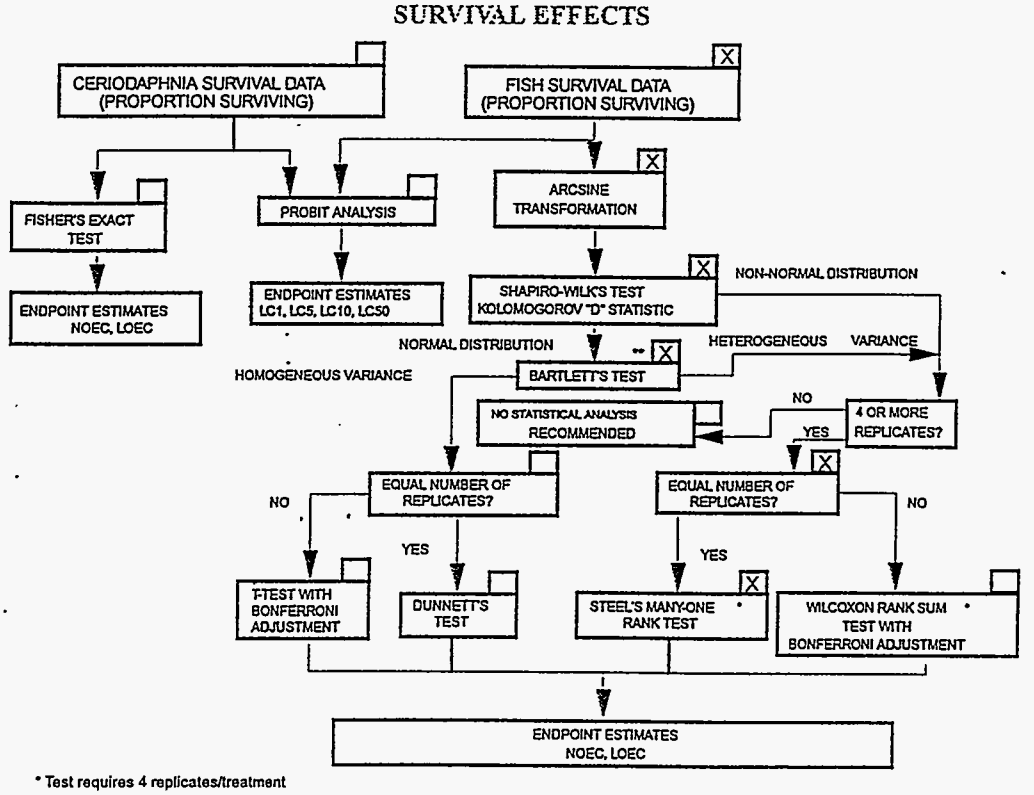
6.1.1 Summary of Results: No survival or growth effects were demonstrated in fathead minnows exposed to Clinch River Mile 19.0 or Mile 22.0 samples during the CR-ERP Ambient Water Toxicity Study conducted from July 22-29, 1993.

6.1.2 Results, Survival Data:

6.1.2.1 Daily Percent Survival Summary for Fathead Minnow Larval Survival Test, CR-ERP Study, July 22-29, 1993.

Treatment	Total Daily % Survival						
Day	1	2	3	4	5	6	7
Medium	100	100	100	100	100	100	100
CRM 19.0-50%	100	100	100	100	100	100	100
CRM 19.0-100%	100	100	100	100	100	100	100
CRM 22.0-50%	100	100	100	100	100	100	100
CRM 22.0-100%	100	100	100	100	100	98	98

6.1.2.2 Statistical Decision Process for Determining Toxicity Endpoints for 7-Day Survival of Fathead Minnows, CR-ERP Study, July 22-29, 1993.



* Test requires 4 replicates/treatment

** Levene's Test used due to variance equal to zero for one or more treatments.

6.1.2.3 Analysis of Survival Data Using Steel's Many-one Rank Test for Fathead Minnow 7-Day Larval Survival Test, CR-ERP Study, July 22-29, 1993.

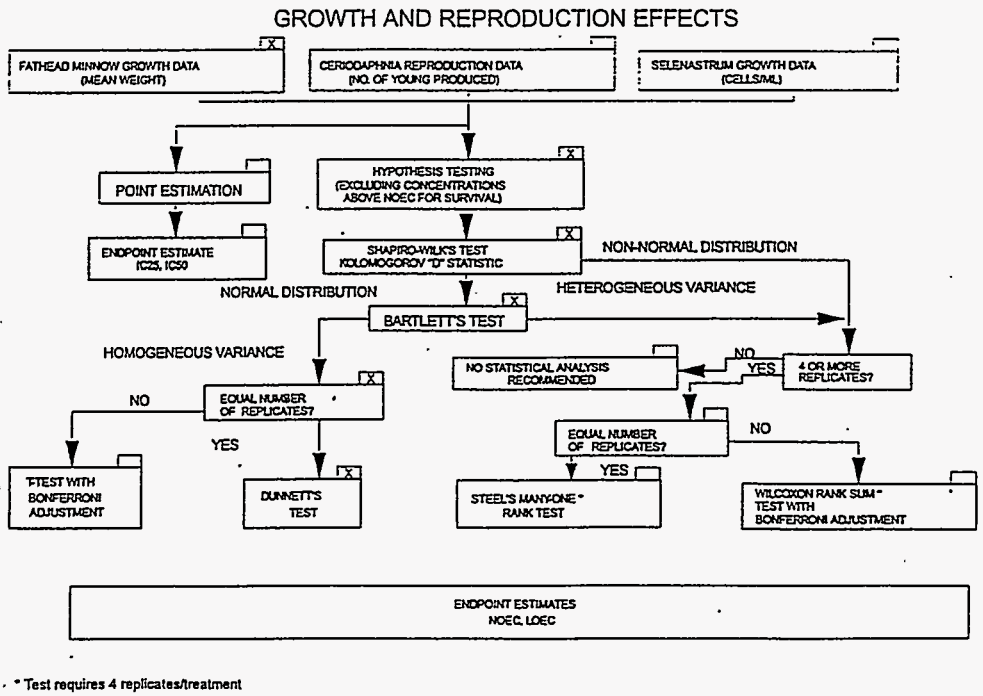
	Survival (%) Data											
	Replicate											
Group	1	2	3	4	5	6	7	8	9	10	Mean	S*
Medium	100	100	100	100							100	
CRM 19.0-50%	100	100	100	100							100	
CRM 19.0-100%	100	100	100	100							100	
CRM 22.0-50%	100	100	100	100							100	
CRM 22.0-100%	100	100	90	100							98	

	Steel's Many-one Rank Test		
Treatment	Replicates	Critical Rank Sum	Rank Sum*
CRM 19.0-50%	4	10	18.0
CRM 19.0-100%	4	10	18.0
CRM 22.0-50%	4	10	18.0
CRM 22.0-100%	4	10	16.0

*Values less than or equal to the Critical Rank Sum are significantly less than the control (Medium).

6.1.3 Results, Growth Data:

6.1.3.1 Statistical Decision Process for Determining Toxicity Endpoints for 7-Day Growth of Fathead Minnows, CR-ERP Study, July 22-29, 1993.



* Test requires 4 replicates/treatment

6.1.3.2 Analysis of Dry Weight (mg) Data Using Dunnett's Test for Fathead Minnow 7-Day Larval Growth Test, CR-ERP Study, July 22-29, 1993.

No transformation applied before data analysis. For this set of data, the minimum significant difference is 0.09.

This represents an 18.42% decrease in dry weight, mg.
T = 2.36 Alpha = 0.05 (one-tailed test)

Treatment	Growth Data (mg) Replicate										Mean	S*
	1	2	3	4	5	6	7	8	9	10		
Medium	0.43	0.55	0.43	0.47							0.47	
CRM 19.0-50%	0.47	0.42	0.48	0.53							0.47	
CRM 19.0-100%	0.49	0.54	0.39	0.43							0.46	
CRM 22.0-50%	0.43	0.53	0.46	0.44							0.47	
CRM 22.0-100%	0.48	0.38	0.45	0.42							0.43	

*Values significantly less than the control (Medium). EMS = 0.003.

6.2 Ceriodaphnia Survival and Reproduction Test

6.2.1 Summary of Results: No survival or reproduction effects were demonstrated in daphnids exposed to Clinch River Mile 19.0 or Mile 22.0 samples during the CR-ERP Ambient Water Toxicity Study conducted from July 22-29, 1993.

6.2.2 Results, Survival Data:

6.2.2.1 Daily percent survival summary for Ceriodaphnia Survival Test, CR-ERP Study, July 22-29, 1993.

Treatment	Total Daily % Survival					
	1	2	3	4	5	6
Medium	100	100	100	100	100	100
CRM 19.0-50%	100	100	100	100	100	100
CRM 19.0-100%	100	100	100	100	100	100
CRM 22.0-50%	100	100	100	100	100	100
CRM 22.0-100%	100	100	100	100	100	100

6.2.3 Results, Reproduction Data:

6.2.3.1 Statistical Decision Process for Determining Toxicity Endpoints for 7-Day (3-Brood) Reproduction of Ceriodaphnia, CR-ERP Study, July 22-29, 1993.

Not applicable.

6.2.3.2 Reproduction (# young/female/7 days) Data for Ceriodaphnia (7-Day) Reproduction Test, CR-ERP Study, July 22-29, 1993.

Treatment	Reproduction (# young/female/7 days) Data										Mean	S*
	Replicate											
	1	2	3	4	5	6	7	8	9	10		
Medium	17	22	20	21	20	21	18	21	16	14	19.00	
CRM 19.0-50%	17	16	22	20	20	21	22	21	24	18	20.10	
CRM 19.0-100%	18	21	17	41	18	19	25	23	20	13	21.50	
CRM 22.0-50%	19	19	21	24	23	22	25	22	18	19	21.20	
CRM 22.0-100%	22	25	24	27	21	19	33	22	16	22	23.10	
TR	18	18	19	23	24	22	22	22	9	14	19.10	

*Indicates values significantly less than control (TR).

6.3 Physical/Chemical Parameters

6.3.1 Overall Test Temperature

6.3.1.1 Fathead Minnow: 24.9°C (24.5°-25.2°C)

6.3.1.2 Ceriodaphnia: 25.3°C (25.1°-25.6°C)

6.3.2 Water chemistry summary for CR-ERP Study, July 22-29, 1993.

See: Appendix A Water Chemistry Mean Values and Ranges for Fathead Minnow and Ceriodaphnia Tests, CR-ERP Study, July 22-29, 1993

6.4 Reference Toxicant Tests

6.4.1 Summary of Results:

Reference toxicant tests conducted prior to CR-ERP Study showed chronic results consistent with ARL control chart ranges for fathead minnows and daphnids.

6.4.2 Fathead Minnows

6.4.2.1 Date/Time of Most Recent Test:
July 6, 1993/1055 CDT to July 13, 1993/1000 CDT

6.4.2.2 LOEC: 0.02 mg Cu/L
NOEC: 0.008 mg Cu/L
IC_{25}: 0.012 mg Cu/L

6.4.2.3 Control Chart Information:

Number of standard tests completed by laboratory: 45

LOEC Range: 0.008–0.02 mg Cu/L (one concentration increment)
NOEC Range: 0.003–0.008 mg Cu/L (one concentration increment)
IC_{25} Range: 0.004–0.012 mg Cu/L

6.4.3 Ceriodaphnia

6.4.3.1 Date/Time of most recent test:

July 12, 1993/0935 CDT to July 18, 1993/1028 CDT

6.4.3.2 LOEC: 0.05 mg Cu/L
NOEC: 0.02 mg Cu/L
IC_{25}: 0.026 mg Cu/L

6.4.3.3 Control Chart Information:

Number of standard tests completed by laboratory: 43

LOEC Range: 0.008–0.05 mg Cu/L (two concentration increments)
NOEC Range: 0.003–0.02 mg Cu/L (two concentration increments)
IC_{25} Range: 0.011–0.030 mg Cu/L

7.0 CONCLUSION

Tests conducted using Clinch River Mile 19.0 and Mile 22.0 samples collected on July 21, 23, and 26 showed no toxicity (survival, growth, or reproduction effects) to fathead minnows or Ceriodaphnia.

8.0 REFERENCES

1. Phipps, T. L., and L. A. Kszos, Statement of Work, Environmental Sciences Division, Biomonitoring Group, Oak Ridge National Laboratory (April 1993, revised June 1993).
2. Weber, C. I. (ed.), Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, EPA/600/4-90/027 (September 1991).
3. Weber, C. I., W. H. Peltier, T. J. Norberg-King, W. B. Horning, F. A. Kessler, J. R. Menkdick, T. W. Neiheisel, P. A. Lewis, D. J. Klemm, Q. H. Pickering, F. L. Robinson, J. M. Lazorchak, L. J. Wymer, and R. W. Freyberg. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. EPA/600/4-89/001 (March 1989) and EPA/600/4-89/001a (September 1989).
4. Field Operations Natural Resource Engineering Procedures Manual, Vol. 1, Division of Natural Resource Operations, Tennessee Valley Authority.

PLARC501-1739

Appendix A

Water Chemistry Mean Values and Ranges for Fathead Minnow and Ceriodaphnia Tests,
CR-ERP Study, July 22-29, 1993

Source	Temperature		Dissolved Oxygen			pH			Conductivity		Alk	Hardness	Chlorine
	Fish	Cerio	Initial	Final Fish	Final Cerio	Initial	Final Fish	Final Cerio	Initial	Final Fish	Initial	Initial	Initial
	(°C)	(°C)	(mg/L)	(mg/L)	(mg/L)	(S.U.)	(S.U.)	(S.U.)	(µmhos)	(µmhos)	*	*	(mg/L)
CRM 19.0-50% w/F.Medium†	24.9 (24.5-25.2)	-	8.4 (8.3-8.4)	6.0 (5.2-6.5)	-	7.9 (7.7-8.1)	7.8 (7.7-7.9)	-	304 (298-308)	307 (301-312)	-	-	-
CRM 19.0-50% w/E.Medium‡	-	25.3 (25.1-25.6)	8.3 (8.3-8.4)	-	7.4 (7.3-7.5)	7.9 (7.8-8.1)	-	8.1 (8.1-8.2)	294 (289-296)	-	-	-	-
CRM 19.0-100%	24.9 (24.5-25.2)	25.3 (25.1-25.6)	8.3 (8.3-8.4)	6.0 (5.6-6.5)	7.4 (7.3-7.5)	7.7 (7.5-7.9)	7.9 (7.8-7.9)	8.2 (8.2-8.3)	270 (268-276)	273 (270-280)	105 (104-105)	123.7 (121.4-128.3)	<0.1 (<0.1-<0.1)
CRM 22.0-50% w/F.Medium†	24.9 (24.8-25.1)	-	8.3 (8.3-8.4)	6.0 (5.3-6.5)	-	7.9 (7.7-8.1)	7.8 (7.7-7.8)	-	302 (298-306)	306 (300-311)	-	-	-
CRM 22.0-50% w/E.Medium‡	-	25.3 (25.1-25.6)	8.3 (8.3-8.4)	-	7.4 (7.3-7.4)	8.0 (7.8-8.1)	-	8.2 (8.1-8.2)	293 (291-294)	-	-	-	-
CRM 22.0-100%	24.9 (24.6-25.2)	25.3 (25.1-25.6)	8.3 (8.3-8.4)	6.1 (5.5-6.5)	7.4 (7.2-7.4)	7.8 (7.5-8.1)	7.9 (7.9-8.0)	8.3 (8.2-8.4)	269 (267-270)	271 (270-273)	106 (105-108)	124.3 (123.1-124.8)	<0.1 (<0.1-<0.1)
Fish Medium†	24.8 (24.5-25.1)	-	8.3 (8.2-8.3)	6.3 (5.9-6.7)	-	8.2 (8.1-8.3)	7.8 (7.8-7.9)	-	342 (335-348)	344 (335-350)	-	-	-
Enriched Medium‡	-	25.3 (25.1-25.6)	8.3 (8.2-8.3)	-	7.4 (7.3-7.5)	8.2 (8.1-8.3)	-	8.0 (7.9-8.1)	324 (320-328)	-	-	-	-
TR	-	25.3 (25.1-25.6)	6.9 (6.6-7.4)	-	7.4 (7.2-7.5)	7.9 (7.6-8.2)	-	8.0 (7.9-8.1)	160 (156-162)	-	53 (50-55)	61.6 (59.9-66.7)	<0.1 (<0.1-<0.1)

*mg/L as CaCO3 †Fathead Minnow Test ‡Ceriodaphnia Test

PLARC501-1740

ATTACHMENT I

CR-ERP AMBIENT WATER TOXICITY STUDY
Chain-of-Custody Forms - Originals

TVA → B. Ferry

FIELD CHAIN OF CUSTODY

CLINCH RIVER ER PROJECT	SAMPLING DATE: 21 Jul 93	FIELD COC ID: 0721934	PAGE 1 OF 1
TASK: S3	MATRIX: H_2O	KIT CONTAINER ID:	
TEAM LEADER: J. Stockburger	SAMPLING TEAM:		
FIELD CUSTODIAN: J. Stockburger	M. Lowe		

SAMPLE ID	SAMPLING LOCATION	SAMPLE TYPE	CONTAINER		ANALYSIS	SAMPLING DEVICE	COLLECTION SOP	REMARKS
			TYPE	VOLUME				
2008	CRM 19	SP	HDPE	1 L	thm cd H_2O chem	pump	N/A	
2010	CRM 22	↓	↓	↓	↓	↓	↓	

CONTAINER TYPES:

SAMPLE TYPES: *RB* - Rinse Blank; *FB* - Field Blank; *SPK* - Spike; *TB* - Trip Blank; *FLD* - Field Sample; *FD* - Field Duplicate; *SP* - Split; *CP* - Composite; *VCP* - Vertical Composit

ANALYSIS TYPES: *RAD* - Rads; *MET* - Metals; *ORG* - Organics; *INO* - Inorganics; *PHY* - Physical; *PW* - Pore Water

RELINQUISHED BY:	DATE: 7-21-93	TIME: 13:15	RELINQUISHED BY:	DATE:	TIME:
RECEIVED BY: D. Harcum	DATE: 7-22-93	TIME: 06:30	RECEIVED BY:	DATE:	TIME:

FCOC Rev. 4 01JUL93

DOCUMENT ID:

FIELD CHAIN OF CUSTODY

TVA → B. Ferry

CLINCH RIVER ER PROJECT	SAMPLING DATE: 23 Jul 93	FIELD COC ID: 0723934	PAGE 1 OF 1
TASK: S3	MATRIX: H_2O	KIT CONTAINER ID:	
TEAM LEADER: J. Stockburger	SAMPLING TEAM: M. Lowe		
FIELD CUSTODIAN: J. Stockburger			

SAMPLE ID	SAMPLING LOCATION	SAMPLE TYPE	CONTAINER TYPE	CONTAINER VOLUME	ANALYSIS	SAMPLING DEVICE	COLLECTION SOP	REMARKS
2037	CRM 19	Sp	HDPE	10L	fhm, cd H_2O stem	pump	N/A	
2039	CRM 22	↓	↓	↓	↓	↓	↓	

CONTAINER TYPES:

SAMPLE TYPES: *RB* - Rinse Blank; *FB* - Field Blank; *SPK* - Spike; *TB* - Trip Blank; *FLD* - Field Sample; *FD* - Field Duplicate; *SP* - Split; *CP* - Composite; *VCP* - Vertical Composit

ANALYSIS TYPES: *RAD* - Rads; *MET* - Metals; *ORG* - Organics; *INO* - Inorganics; *PHY* - Physical; *PW* - Pore Water

RELINQUISHED BY: James E. Stockburger	DATE: 7-23-93	TIME: 14:30	RELINQUISHED BY:	DATE:	TIME:
RECEIVED BY: [illegible]	DATE: 7-24-93	TIME: 6:30 am	RECEIVED BY:	DATE:	TIME:

FCOC Rev. 4 01JUL93

DOCUMENT ID:

FIELD CHAIN OF CUSTODY

TVA → B. Ferry

CLINCH RIVER ER PROJECT	SAMPLING DATE: 26 Jul 93	FIELD COC ID: 0726934	PAGE 1 OF 1
TASK: S3	MATRIX: H_2O	KIT CONTAINER ID:	
TEAM LEADER: J. Stockburger	SAMPLING TEAM: M. Love		
FIELD CUSTODIAN: J. Stockburger			

SAMPLE ID	SAMPLING LOCATION	SAMPLE TYPE	CONTAINER		ANALYSIS	SAMPLING DEVICE	COLLECTION SOP	REMARKS
			TYPE	VOLUME				
20066	CRM 19	Sp	HDPE	10L	Hum. cd. H_2O chem	pump	—	
20068	CRM 22	↓	↓	↓	↓	↓	↓	

CONTAINER TYPES:

SAMPLE TYPES: *RB* - Rinse Blank; *FB* - Field Blank; *SPK* - Spike; *TB* - Trip Blank; *FLD* - Field Sample; *FD* - Field Duplicate; *SP* - Split; *CP* - Composite; *VCP* - Vertical Composit

ANALYSIS TYPES: *RAD* - Rads; *MET* - Metals; *ORG* - Organics; *INO* - Inorganics; *PHY* - Physical; *PW* - Pore Water

RELINQUISHED BY: James E Stockburger	DATE: 7-26-93	TIME: 16:30	RELINQUISHED BY:	DATE:	TIME:
RECEIVED BY: [illegible]	DATE: 07-27-93	TIME: 0615	RECEIVED BY:	DATE:	TIME:

FCOC Rev. 4 01JUL93

DOCUMENT ID:

ATTACHMENT II

CR-ERP AMBIENT WATER TOXICITY STUDY
Toxicity Test Bench Sheets and Statistical Analyses

ARL CHRONIC TOXICITY TEST MASTER CHECKLIST Study: DOE

Date Issued: 7-19-93 To: DRH From: JM

1. Test organism availability: FH Minnows-T.L.* ✓ C.U.† ✓ Date JM
   Daphnids - T.L. ✓ C.U. ✓ Date (6-22-93)

2. Sample Collection Coordination: Date 7-19 By JM With L. Graser / T. Phipps

3. Glassware availability: T.L. OH Tech. EEF Date 7-21-93

4. Glassware prep. complete: Date 7-21-93 By OH

5. Data Sheet prep. complete: Date 7-22-~~93~~ 21 93 By OH

6. Test organism availability verification: FH-OK? JS Daphnids-OK? OH

7. FH Minnow acclimation:
   Day 1 2
   By N/A

8. Test Initiation: FH-Date/Time 7/22/93/1010 Daphnid-Date/Time 7-22-93/10:45
   FH Sample, By: OH

9. Test Renewal:

Day #:		0	1	2	3	4	5	6	7
Log Samples -	T.L.	OH	N/A	OH	N/A	N/A	OH	~~OH~~	N/A
	T.M.#		N/A	N/A	NA	N/A	N/A	N/A	N/A
Initial Chem. -	T.L.	OH	OH	OH	OH	OH	OH	OH	N/A
	T.M.	TS	TS	TS	TS	T.S.	CUE	T.S	N/A
Final Chem. -	T.L.	N/A	OH	OH	OH	OH	OH	OH	OH
	T.M.	N/A	TS	TS	TS	T.S.	CUE	TS	CUE
F.H. -	T.L.	OH	OH	OH	OH	OH	OH	OH	OH
	T.M.	TS	TS	TS	TS	T.S	CUE	TS	CUE
Daphnid -	T.L.	OH	OH	OH	OH	OH	OH	OH	OH
	T.M.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

10. Test Termination: FH-Date/Time 7-29-93/09:30 Daphnid-Date/Time 7-29-93/10:00
    Clean-up, By: _____, _____

11. Weigh Fish: Date 7-30-93 By OH

12. Run Stats: Date 07-30-93 / 07-29-93 By CUE

13. Report Prep.: Date 08-09-93 By CUE

14. Report Final: Date 8-18-93 By JM Approved: DCW

*Team Leader †Culture Unit #Team Member

CHRONIC STUDY (FATHEAD MINNOW) RECORD SHEET

Study DOE July 93

Beginning Date/Time 7-22-93 / 10:10

Ending Date/Time 7-25-93 9:30

Personnel QH

Control/Dilution Water F-med

Sample ID	Sample #	Used	Sample ID	Sample #	Used
1. CRM 19	2008	7-22-93	1. CRM 22	2010	7-22-93
2. CRM 19	2008	7-23-93	2. CRM 22	2010	7-23-93
3. CRM 19	2037	7-24-93	3. CRM 22	2037	7-24-93
4. CRM 19	2037	7-25-93	4. CRM 22	2037	7-25-93
5. CRM 19	2037	7-26-93	5. CRM 22	2037	7-26-93
6. CRM 19	2066	7-27-93	6. CRM 22	2068	7-27-93
7. CRM 19	2066	7-28-93	7. CRM 22	2068	7-28-93

Test Treatment Identification:

1. CRM 19 50%
2. CRM 19 100%
3. CRM 22 50%
4. CRM 22 100%
5. F-med
6.
7.
8.

Spawn Date	Tile #	Hatch Date/Time to Date/Time	
07-17-93	10, 13, 21, 22, 23, 25, 28	07-21-93 / 1015	07-22-93 / 0645

Test #
LOEC >100%
NOEC >100%
Notes:

H 7/21 AF 1015
BF 0645 7:2

7/17 Hs 10, 13, 21, 22, 23, 25, 28

FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

Study: DOE July 93
Beginning Date/Time: 7-22-93/10:10
Ending Date/Time: 07-29-93/0930
Personnel: [illegible], Russell, [illegible]

— Number Alive —

Treatment	Rep	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
CRM 19 50%	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
	By:	DH	DH	DH	DH	DH	DH	DH
CRM 19 100%	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
	By:	DH	DH	DH	DH	DH	DH	DH
CRM 22 50%	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
	By:	DH/TS	DH/TS	DH/TS	DH/TS	DH	DH/TS	DH/CR
CRM 22 100%	1	10	10	10	10	10	10	10
	2	10	10	10	10	10	10	10
	3	10	10	10	10	10*	** 9	9
	4	10	10	10	10	10	10	10
	By:	TS	TS	TS	TS	CR	TS	CR
F med	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
	By:	TS	TS	TS	TS	CR	TS	CR
	1							
	2							
	3							
	4							
	By:							

Notes:

* two fish that [illegible] [illegible] alive but are [illegible] [illegible] piece. stuck in the mouth/gill area [illegible]

** one of the two mentioned above died.

	0	1	2	3	4	5	6	
Fed- Time/By:		0630/DH	0645/DH	0645/DH	0645/DH	0630/DH	0630/DH	
	1015/TS	9:56/DH	0950/DH	0945/TS	9:55/TS	10:00 DH	0955/TS	
	15:32/DH	15:30/DH	15:30/DH		1545/DH	15:30/DH	0153/CR	
Dilution Water ID:	1401	1402	1404	1404	1407	1408	1410	
(PLARC501-257) Reviewed By:	~~1402~~ DH	DH	DH	DH	DH	DH	DH	

Analysis of Survival

DOE #2
Starting Date: 07/22/93

Survival (%) Data

Treatment	Replicate 1	2	3	4	5	6	7	8	9	10	Mean
MEDIUM	1.00	1.00	1.00	1.00	.	.	.	.	.	.	1.00
CRM19 50%	1.00	1.00	1.00	1.00	.	.	.	.	.	.	1.00
CRM19 100%	1.00	1.00	1.00	1.00	.	.	.	.	.	.	1.00
crm22 50%	1.00	1.00	1.00	1.00	.	.	.	.	.	.	1.00
crm22 100%	1.00	1.00	0.90	1.00	.	.	.	.	.	.	0.98

Steel's Many-One Rank Test

Treatment	No. of Replicates	Critical Rank Sum	Rank Sum*
RM19 50%	4	10	18
RM19 100%	4	10	18
rm22 50%	4	10	18
rm22 100%	4	10	16

* Values less than Critical Rank Sum significantly less than the control (MEDIUM).

FATHEAD DRY WEIGHT RECORD SHEET

Study/Date DOE July 93

Personnel DH

Pans:Date/Time of Drying 7-29-93/7:00-8:00 Fish:Date/Time of Drying 7-30-93/7:45-9:45

Pans:Date/Time of Weighing 7-29-93/11:30-1:00 Fish:Date/Time of Weighing 7-30-93/10:15-

Notes:

Sample ID		Tare Wt.	Tare + Fish Wt.	Fish Wt.	# Fish	Mean Wt.	Mean Wt. Difference	
Initial	1.	1.03860	1.03921		10			
	2.	1.06234	1.02684		10			
	3.	1.03834	1.03890		10			
	4.	1.05305	1.05369		10			
Initial Mean Wt.								
19-50%	1.	1.03689	1.04162		10			
	2.	1.04474	1.04893		10			
	3.	1.03336	1.03811		10			
	4.	1.12182	1.12661		9 ~~10~~			
19-100%	1.	1.03410	1.03903		10			
	2.	1.11456	1.11993 ~~1.12~~		10			
	3.	1.08257	1.08645		10			
	4.	1.11070	1.11502		10			
22-50%	1.	1.05444	1.05870		10			
	2.	1.02072	1.02600		10			
	3.	1.04893	1.05353		10			
	4.	1.05134	1.05570		10			
22-100%	1.	1.07163	1.07646		10			
	2.	1.06815	1.07193		10			
	3.	1.10938	1.11345		9			
	4.	1.04756	1.05177		10			
Fwed	1.	1.06745	1.07176		10			
	2.	1.03263	1.03813		10			
	3.	1.08797	1.09230		10			
	4.	1.10916	1.11388		10			
	1.							
	2.							
	3.							
	4.							

Reviewed By: [illegible] 7/30/93

Page 1 of 1

FATHEAD DRY WEIGHT RECORD SHEET

Study/Date DOE July 93 Rewt.

Personnel CH

Pans:Date/Time of Drying 7-30-93

Fish:Date/Time of Drying 7-30-93

Pans:Date/Time of Weighing 7-30-93

Fish:Date/Time of Weighing 7-30-93

Sample ID		Tare Wt.	Tare + Fish Wt.	Fish Wt.	# Fish	Mean Wt.	Mean Wt. Difference	
	1.							
Initial	2.	0.99854	0.99915	0.00061	#10	0.000061		
	3.							
	4.							
Initial Mean Wt.								
	1.							
	2.							
	3.							
	4.							
CRM 19.0 10050	1.							
	2.	1.01396	1.01931	0.00535	10	0.000535		
	3.	1.02484	1.02869	0.00385	10	0.000385		
	4.							
	1.							
	2.							
	3.							
	4.							
	1.							
	2.							
	3.							
	4.							
	1.							
	2.							
	3.							
	4.							
	1.							
	2.							
	3.							
	4.							

Notes:

Reviewed By: CWE

FATHEAD DRY WEIGHT RECORD SHEET

Study/Date: DOE #2

Personnel: DRH

Pans:Date/Time of Drying: 07-29-93/0700 Fish:Date/Time of Drying: 07-30-93/0745

Pans:Date/Time of Weighing: 07-29-93/1130 Fish:Date/Time of Weighing: 07-30-93/1015

Sample ID		Tare Wt.	Tare + Fish Wt.	Fish Wt.	# Fish	Mean Wt. grams	Mean Wt. Difference	Mean Wt mg	Notes:
	1.	1.03860	1.03921	0.00061	10	0.000061	-	-	
	Rewigh	0.99854	0.99915	0.00061	10	0.000061			
Initial	2.	1.06234	1.02684	-0.03550	10	-0.003550	-	-	
	3.	1.03834	1.03890	0.00056	10	0.000056	-	-	
	4.	1.05305	1.05369	0.00064	10	0.000064	-	-	
Initial Mean Wt.							-0.0008422		
	1.	1.06745	1.07176	0.00431	10	0.000431	0.001273	0.431	
MEDIUM	2.	1.03263	1.03813	0.00550	10	0.000550	0.001392	0.550	
	3.	1.08797	1.09230	0.00433	10	0.000433	0.001275	0.433	
	4.	1.10916	1.11388	0.00472	10	0.000472	0.001314	0.472	
	1.	1.03689	1.04162	0.00473	10	0.000473	0.001315	0.473	
CRM 19.0 50%	2.	1.04474	1.04893	0.00419	10	0.000419	0.001261	0.419	
	3.	1.03336	1.03811	0.00475	10	0.000475	0.001317	0.475	
	4.	1.12182	1.12661	0.00479	9	0.000532	0.001374	0.532	
	1.	1.03410	1.03903	0.00493	10	0.000493	0.001335	0.493	
CRM 19.0 100%	2.	1.11456	1.11993	0.00537	10	0.000537	0.001379	0.537	Rewigh
	3.	1.08257	1.08645	0.00388	10	0.000388	0.001230	0.388	

	4.	1.11070	1.11502	0.00432	10	0.000432	0.001274	0.432
	1.	1.05444	1.05870	0.00426	10	0.000426	0.001268	0.426
CRM 22 50%	2.	1.02072	1.02600	0.00528	10	0.000528	0.001370	0.528
	3.	1.04893	1.05353	0.00460	10	0.000460	0.001302	0.460
	4.	1.05134	1.05570	0.00436	10	0.000436	0.001278	0.436
	1.	1.07163	1.07646	0.00483	10	0.000483	0.001325	0.483
CRM 22 100%	2.	1.06815	1.07193	0.00378	10	0.000378	0.001220	0.378
	3.	1.10938	1.11345	0.00407	9	0.000452	0.001294	0.452
	4.	1.04756	1.05177	0.00421	10	0.000421	0.001263	0.421

Reviewed By: Russell

07-30-93 CM

Analysis of 7-day Larval Growth Test

DOE #2
Starting Date: 07/22/93

Analysis of Dry Weight (mg) Data Dunnett's Test

No transformation applied before data analysis.
For this set of data, the minimum significant difference is 0.09

This represents a 18.42 % reduction in Dry Weight (mg).

T = 2.36 ALPHA = 0.05

Dry Weight (mg) Data

	Replicate											
TREATMENT	1	2	3	4	5	6	7	8	9	10	MEAN	S
1 MEDIUM	0.43	0.55	0.43	0.47	.	.	.	.	.	.	0.47	
2 CRM1950%	0.47	0.42	0.48	0.53	.	.	.	.	.	.	0.47	
3 CRM19100%	0.49	0.54	0.39	0.43	.	.	.	.	.	.	0.46	
4 CRM22 50%	0.43	0.53	0.46	0.44	.	.	.	.	.	.	0.47	
5 CRM22 100%	0.48	0.38	0.45	0.42	.	.	.	.	.	.	0.43	

Asterisk (*) indicates values significantly less than control (MEDIUM).

Analysis of Variance

Source	DF	Sum OF Sq.	Mean Sq.	Calc F	F(0.05)
Among	4	0.004	0.001	0.410	0.7975
Within	15	0.040	0.003		
Total	19	0.000			

DOE #2	072293 MINS	1 MEDIUM	10.00	10.00	10.00	10.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00
DOE #2	072293 MINS	2 CRM19 50%	10.00	10.00	10.00	10.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00
DOE #2	072293 MINS	3 CRM19 100%	10.00	10.00	10.00	10.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00
DOE #2	072293 MINS	4 crm22 50%	10.00	10.00	10.00	10.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00
DOE #2	072293 MINS	5 crm22 100%	10.00	10.00	9.00	10.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00

DOE #2	072293 MING	1 MEDIUM	0.43	0.55	0.43	0.47
DOE #2	072293 MING	2 CRM1950%	0.47	0.42	0.48	0.53
DOE #2	072293 MING	3 CRM19100%	0.49	0.54	0.39	0.43
DOE #2	072293 MING	4 CRM22 50%	0.43	0.53	0.46	0.44
DOE #2	072293 MING	5 CRM22 100%	0.48	0.38	0.45	0.42

CHRONIC STUDY (C. dubia) RECORD SHEET

Study DOE July 93

Beginning Date/Time 7-22-93 / 10:45

Ending Date/Time 7-29-93 / 10:00 Am

Personnel DH

Control/Dilution Water C-med

	Sample ID	Sample #	Used		Sample ID	Sample #	Used
1.	C2M 19	2008	7-22-93	1.	CRM 22	2010	7-22-93
2.	CRM 19	2008	7-23-93	2.	CRM 22	2010	7-23-93
3.	CRM 19	2037	7-24-93	3.	CRM 22	2039	7-24-93
4.	CRM 19	2037	7-25-93	4.	CRM 22	2039	7-25-93
5.	CRM 19	2037	7-26-93	5.	CRM 22	2039	7-26-93
6.	CRM 19	2066	7-27-93	6.	CRM 22	2068	7-27-93
7.	CRM 19	2066	7-28-93	7.	CRM 22	2068	7-28-93
8.				8.			

Test Treatment Identification:

1. CRM 19.0 50%
2. CRM 19.0 100%
3. CRM 220 50%
4. CRM 220 100%
5. TR.
6. C-med
7.
8.

Released From: Date	Time	To: Date	Time
7-21-93	10:00pm	7-22-93	6:00 Am

Test #

LOEC >100%

NOEC >100%

Notes:

CERIODAPHNIA SURVIVAL AND REPRODUCTION TEST

Page 1 of 2

Study: OCE July 93 Personnel: Hanaway

Beginning Date: 7-22-93 Time: 10:45

Ending Date: 7-29-93 Time: 10:00

---- Number of Young/Day ----

	Treatment	By Rep.	1	2	3	4	5	6	7	8	Total Young
1	CRm 19 50%	1	C	C	0	3	6	0	8		17
		2			0	3	6	0	7		16
		3			0	3	8	0	11		22
		4			0	4	8	8	0		20
		5			0	3	8	9	0		20
		6			0	4	7	10	0		21
		7			0	4	8	10	0		22
		8			0	4	8	0	9		21
		9			0	5	9	0	10		24
		10			0	4	7	7	0		18
2	CRm 19 100%	1	C	C	0	3	6	0	9		18
		2			0	4	7	0	10		21
		3			0	0	4	6	7		17
		4			0	4	8	13	16		41
		5			0	3	6	9	0		18
		6			0	3	6	10	0		19
		7			0	4	7	14	0		25
		8			0	4	8	0	11		23
		9			0	3	8	9	0		20
		10			0	2	5	0	6		13
3	CRm 27 50%	1	C	C	0	3	6	10	0		19
		2			0	4	6	0	9		19
		3			0	4	8	9	0		21
		4			0	3	6	12	0		24
		5			0	4	8	11	0		23
		6			0	4	7	11	0		22
		7			0	4	9	12	0		25
		8			0	5	8	9	0		22
		9			0	3	7	0	8		18
		10			0	3	7	0	9		19
4	CRm 27 100%	1	C	C	0	4	7	0	11		22
		2			0	5	8	0	12		25
		3			0	4	8	0	12		24
		4			0	4	9	14	0		27
		5			0	3	6	12	0		21
		6			0	2	7	10	0		19
		7			0	4	7	10	12		26 33
		8			0	3	8	0	11		22
		9			0	0	6	0	10		16
		10			0	4	7 8	0	10		22

	0	1	2	3	4	5	6	7	8
Chow ID#:	AS-5	AS-5	AS-5	AS 5	AS-6	AS-6	AS-6		
Algae ID#:	AS-4	AS-4	AS-5	AS-5	AS-5	AS-5	AS-5		
Dilution Water ID#:	1399	1399	1400	1400	1400	1405	1405		
Reviewed By:	~~DH~~ 344	DH	DH	DH	DH	DH	DH		

Notes:

PLARC501-310

CERIODAPHNIA SURVIVAL AND REPRODUCTION TEST

Page 2 of 2

Study: UOF July 93 Personnel:

Beginning Date: 7-22-93 Time: 1045

Ending Date: 07-29-93 Time: 1000

---- Number of Young/Day ----

Treatment	By Rep.	DH 1	DH 2	DH 3	DH 4	DH 5	DH 6	DH 7	8	Total Young
(5) TR.	1	C	C	0	4	6	8	0		18
	2			0	4	6	0	8		18
	3			0	2	67	10	0		19
	4			0	3	8	12	0		23
	5			0	4	9	11	0		24
	6			0	3	7	12	0		22
	7			0	2	9	11	0		22
	8			0	3	8	0	11		22
	9			0	2	0	3	4		9
	10			0	3	4	0	7		14
(6) C-med.	1	C	C	0	3	86	0	8		17
	2			0	3	7	0	12		22
	3			0	3	7	0	10		20
	4			0	3	8	10	0		21
	5			0	3	7	10	0		20
	6			0	3	8	0	10		21
	7			0	4	6	8	0		18
	8			0	3	7	0	11		21
	9			0	3	5	0	8		16
	10			0	3	4	0	DM 67		14
	1									
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
	1									
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									

0 1 2 3 4 5 6 7 8

Chow ID#: _____

Algae ID#: _____

Dilution Water ID#: _____

Reviewed By: CLR CLR CLR CLR CLR CLR _____ _____ CLR

Notes:

PLARC501-310

CERIODAPHNIA RANDOMIZATION

Study DOE July 93 Personnel ION

Beginning Date 7-22-93

Ending Date 7-29-93

		Treatment											
Rep	10	2	4	7	3	5	6	1					
	9	2	3	5	6	7	1	4					
	8	3	7	1	6	4	5	2					
	7	4	3	5	7	1	6	2					
	6	7	2	5	4	6	3	1					
	5	6	1	3	2	7	5	4					
	4	2	5	4	6	3	1	7					
	3	5	6	1	3	2	7	4					
	2	3	2	7	1	6	5	4					
	1	7	1	5	2	4	6	3					

Treatment Identification:

1. CRM 19.0 50%
2. CRM 19.0 100%
3. CRM 22.0 50%
4. CRM 22.0 100%
5. TR
6. C-med
7. Temp
8. _____
9. _____
10. _____

Notes:

CERIODAPHNIA BROOD RECORD SHEET

Batch ID#: 1218
0 Date: 7-13-93
Tray: # 2

Page No.: 1 of
Personnel: JH/AH
Reviewed by: LH/JM

Brood Source

Row 14- (Brood/Number Young)

10	4	5	0	11	13	15	
9	4	7	0	10	13	12	
8	4	6	10	0	13	10-6 16	-2
7	4	7	11	0	13	10-6 17	-1
6	4	7	12	0	13	10-6 15	
5	4	7	10	0	16	10-6 16	-3
4	4	5	10	0	15	A 3	
3	3	6	11	0	14	10-6 14	-0
2	4	5	11	0	13	16	
1	5	7	12	0	8	10-6 17	-9
Day	4th	5th	6th	7th	8th	9th	

1209-F-4-7 ♀

Row B (Brood/Number Young)

10	2	8	11	0	13	15	
9	5	8	13	0	12	A 0	
8	4	6	0	6	8	8	
7	4	7	13	0	14	10-6 15	-7
6	3	6	3	0	13	A 2	
5	2	5	11	0	13	A 3	
4	2	8	10	0	17	12	
3	4	5	13	0	11	10-6 15	-6
2	5	7	11	0	12	A 3	
1	3	8	11	0	15	10-6 12	
Day	4th	5th	6th	7th	8th	9th	

1209-F-2-7 ♀

Row C (Brood/Number Young)

10	0	7	10	0	13	10-6 11	
9	4	5	12	0	12	10-6 15	
8	4	7	11	0	11	10-6 14	
7	4	8	12	0	16	10-6 15	
6	3	6	9	0	10	10-6 16	-5
5	3	6	12	0	11	10-6 14	-4
4	3	6	10	0	0/6		
3	4	7	12	0	11	A 1	
2	4	7	10	0	14	10-6 11	
1	4	8	0	12	14	10-6 12	
Day	4th	5th	6th	7th	8th	9th	

1209 F-10-7 ♀

1218

Day	Date	Time	Temp	Hod	Food	Algae
0	7-13-93	11:20	23.5	1382	AS-3	AS-3
1	7-14	1300	25.2	1342	AS-3	AS-3
2	7-15	900	25.3	1342	AS-3	AS-3
3	7-16	940	25.5	1352	AS-3	AS-3
4	7-17	815	25.0	1393	AS-4	AS-3
5	7-18	8:30	25.0	1353	AS-4	SH-4
6	7-19	900	25.2	1396	AS-4	AS-4
7	7-20	930	25.2	1345	AS-4	AS-4

Day	Date	Time	Temp	Hod	Food	Algae
8	7-21	1045	25.3	1399	AS-5	AS-4
9	7-22	1250	25.3	1315	AS-5	AS-4
10						
11						
12						
13						
14						

NOTE: * 0's on 3rd DAY - (A-F)

10-6 = 10:00pm 7-21-93 to 6:00 AM 7-22-93

1 = Young present in brood cup at 3 days or more than one brood present in individual cup at renewal.

(10/11)

CERIODAPHNIA BROOD RECORD SHEET

Batch ID: 1219
0 Date: 7-13-93
Tray: #2

Page No.: 1 of
Personnel: SJP/DRH
Reviewed By: DRH/SJM

Brood Source

Row D (Brood/Number Young)

10	4	0	7	10	11	0							
9	2	0	7	12	5	15							
8	4	6	0	12	18	13							
7	0	2	3	6	7	0							
6	4	0	4	12	13	13							
5	4	4	0	10	13	12							
4	5	0	7	11	16	14							
3	0	7	0	10	9	10→6 DH							
2	3	0	6	11	12	13							
1	4	0	7	11	6	0							
Day	4th	5th	6th	7th	8th	9th							

1208-C-3 7th

Row E (Brood/Number Young)

10	5	6	0	9	9	12							
9	5	6	0	10	19	10→6 15							
8	5	6	0	11	15	10→6 13							
7	3	6	0	11	13	10→6 10							
6	4	6	0	11	15	13							
5	0	4	6	0	10	8							
4	2	6	0	10	13	10→6 15							
3	4	5	0	10	16	10→6 15							
2	0	6	9	13	0	4							
1	4	6	0	11	13	15							
Day	4th	5th	6th	7th	8th	9th							

1208 C-4 7th

Row F (Brood/Number Young).

10	4	6	0	10	10	9							
9	3	5	0	11	12	13							
8	4	5	0	10	11	10→6 14							
7	4	6	0	11	13	13							
6	4	5	0	11	10	10							
5	2	4	0	7	11	15							
4	3	8	0	9	17	16							
3	4	6	0	10	10	10→6 16							
2	4	7	0	9	12	10→6 14							
1	4	5	0	9	11	16							
Day	4th	5th	6th	7th	8th	9th							

1208 B-6 7th

Day	Date	Time	Temp	Hod	Food	Algae
0	7-13	11:20	23.5	1382	AS-3	AS-3
1	7-14	1300	25.2	1347	AS-3	AS-3
2	7-15	900	25.3	1392	AS-3	AS-3
3	7-16	940	25.3	1392	AS-3	AS-3
4	7-17	815	25.0	1393	AS-4	AS-3
5	7-18	8:30	25.0	1383	AS-4	AS-4
6	7-19	900	25.2	1345	AS-4	AS-4
7	7-20	930	25.2	1395	AS-4	AS-4

1219

Day	Date	Time	Temp	Hod	Food	Algae
8	7-21	1045	24.3	1390	AS-5	AS-4
9	7-22	1150	23.5	1390	AS-5	AS-4
10						
11						
12						
13						
14						

Notes: * 0's on 3rd day - (A-F)

10-6 = 10:00 pm 7-21-93 to 6:00 7-22-93

4 = Young present in brood cup at 3 days or more than one brood present in individual cup at removal.

(DRH/11)

INITIAL CHEMISTRY

Study DOE July 93

Beginning Date 7-22-93

Ending Date 7-28-93 (29) CWL 08-09-93

Date 7/22/93

Personnel [illegible]

By	DH	DH	DH	DH	DH	DH	CWL	DH	CWL	DH	CWL
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
CRM19-50%-C		25.4	8.1	7.8	289						
CRM19 50%-F		25.1	8.4	7.7	298						
CRM19-100% 2008	3.7	25.2	8.4	7.5	271	7.1	121.4	10 5	105	<0.1	20.1
2000 10:07 CRM22 50%-C		25.5	8.6/8.3	7.7/7.9	291						
2002 10:02 CRM22 50% F		25.1	8.6/8.3	7.6/7.8	298						
2000 10:03 CRM22 100% 2010	2.1	25.1	8.6/8.3	7.4/7.7	270	7.3	124.8	10 8	108	<0.1	20.1
TR Ceriodaily	29.9	25.3	7.4	7.7	156	35	59.9	5.3	53		
F-med 1402	22.7	25.3	8.3	8.1	335						
C-med 1399	22.8	25.4	8.3	8.1	320						

NOTES:

PLARC501-252

Reviewed By: DH

INITIAL CHEMISTRY

Study DOE July 93

Beginning Date 7-22-93

Ending Date 7-28-93 (corr. 08-09-93)

Date 7-23-93

Personnel Hanaway, Seeley

By	ON	ON	ON	ON	ON	TS	cwe	TS	cwe		
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
CRM19-50%-C		25.2	8.4	7.9	295						
CRM19 50%-F		25.4	8.4	7.8	302						
7:44 7:46 CRM19-100% 2008	3.5	25.3	7.6/8.3	7.6/7.7	270						
CRM22 50%-C		25.4	8.4	7.8	294						
:44 7:46 CRM22 50% F		25.5	8.6/8.3	7.7/7.8	301						
:44 7:46 CRM22 100% 2010	2.5	25.3	8.7/8.3	7.5/7.6	270						
TR cerio only	28.9	25.0	7.0	7.6	161	3.5	59.9	5.2	5.2		
F-med 1402	23.1	25.2	8.2	8.2	336						
C-med 1359	22.6	25.4	8.2	8.2	323						

NOTES:

PLARC501-252

Reviewed By: SH

INITIAL CHEMISTRY

Study DOE July 93

Beginning Date 7-22-93

Ending Date 07-24-93

Date 7-24-93

Personnel Sabu
Wanaway

By	Ddl	Ddl	Ddl	Ddl	Ddl	TS	Cur	T	Cur	TS	Cur
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
CRM19-50%-C		25.4	8.3	7.8	296			10.4			
CRM19 50%-F		25.4	8.4	7.7	305						
801 8:04 CRM19-100% 2037	2.1	25.4	8.4/8.3	7.5/7.6	268	7.1	121.4	10.4	104	<0.1	40.1
2801 8:0 CRM22 50%-C		25.5	8.3/8.3	8.0/8.1	294						
801 8:04 CRM22 50% F		25.4	8.4/8.3	8.0/8.1	304						
801 8:06 CRM22 100% 2039	1.7	25.2	8.7/8.3	7.9/8.0	267	7.2	123.1	10.5	105	<0.1	40.1
TR cerio only	30.4	25.2	6.6	8.0	161	36	61.6	5.4	54	40.1	40.1
F-med 1404	23.4	25.4	8.2	8.3	346						
C-med 1400	23.6	25.5	8.2	8.3	326						

NOTES:

PLARC501-252

Reviewed By:

INITIAL CHEMISTRY

Study DOE July 93

Beginning Date 7-22-93

Ending Date 07-29-93

Date 7-25-93

Personnel DM
TS

By	DM	DM	DM	DM	DM	TS	CLR	TS	CLR		
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
7:55 7:57 CRM19-50%-C		25.5	8.6 / 8.3	7.8 / 8.0	294						
7:55 8:00 CRM19 50%-F		25.5	8.7 / 8.3	7.7 / 7.9	305						
7:55 8:01 CRM19-100%-C 2037	3.0	25.4	8.9 / 8.4	7.5 / 7.7	270						
7:55 - CRM22 50%-C		25.4	8.6 / 8.3	8.1 / 8.1	291						
7:55 8:01 CRM22 50% F		25.5	8.8 / 8.3	8.0 / 8.1	306						
7:55 8:02 CRM22 100% 2039	3.1	25.2	8.9 / 8.3	7.9 / 8.0	268						
TR Cerio only	30.7	25.3	7.0	8.2	160	3.5	59.9	5.0	50		
F-med 1404	22.4	25.4	8.3	8.2	347						
C-med 1400	22.6	25.3	8.2	8.3	326						

NOTES:

PLARC501-252

Reviewed By: DM

INITIAL CHEMISTRY

Study DOE July 93

Date 7-26-93

Personnel GH
Dsler

Beginning Date 7-22-93

Ending Date 07-24-93

By	OH	OH	OH	OH	OH	OH	Cre	S.A.	C.A.		
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
0757 0800 CRM19-50%-C		25.4	8.8/8.3	7.8/8.0	296						
0757 0803 CRM19 50%-F		25.4	9.1/8.3	7.7/8.0	308						
0757 0806 CRM19 2037 -100%-	4.2	25.3	9.6/8.3	7.5/7.9	268						
0757 CRM22 50%-C		25.3	9.0/8.4	8.0/8.1	294						
0757 0803 CRM22 50% F		25.2	9.1/8.3	8.0/8.1	304						
0757 0806 CRM22 2035 100%-	3.7	25.0	9.7/8.3	7.8/8.1	268						
TR Cerio only	30.7	25.2	6.6	7.9	162	3.7	63.3	5.4	54		
F-med 1407	22.5	25.2	8.3	8.2	348						
C-med 1400	22.4	25.4	8.3	8.2	328						

NOTES:

PLARC501-252

Reviewed By: GH

INITIAL CHEMISTRY

Study DOE July 93

Date 7-27-93

Personnel Harcuvar

Beginning Date 7-22-93

Ending Date 01-29-93

By	DH	DH	DH	DH	DH	Calc	Calc	DH	Calc	Calc	Calc
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
CRM19-50%-C		25.4	8.3	7.9	294						
CRM19 50%-F		25.3	8.4	7.3	304						
CRM19 2066 -100%	2.5	25.4	8.4	7.6	270	7.5*	128.3	10.5	10.5	20.1	20.1
CRM22 50%-C		25.4	8.4	7.8	294						
CRM22 50% F		25.4	8.4	7.7	303						
CRM22 2068 100%	2.1	25.2	8.4	7.5	268	7.3	124.8	10.5	10.5	20.1	20.1
TR cerio only	30.2	25.4	6.6	8.1	162	3.9	66.7	5.3	5.3		
F-med 1408	23.0	25.4	8.3	8.2	340						
C-med 1405	22.5	25.3	8.3	8.2	321						

NOTES: *recalculated Calc

PLARC501-252

Reviewed By: [illegible]

INITIAL CHEMISTRY

Study DOE July 93

Date 7-28-93

Personnel DH TS

Beginning Date 7-22-93

Ending Date 7-29 DH 93

By	DH	DH	DH	DH	DH	TS	CLC	DH	CLC		
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
7:54 CRM19-50%-C		25.5	8.7/8.3	7.9/8.1	295						
7:57 CRM19 50%-F		25.3	8.8/8.3	7.8/8.1	305						
7:59 CRM19-100%	2.8	25.3	9.0/8.3	7.6/7.9	276						
7:54 CRM22 50%-C		25.3	8.7/8.3	7.8/8.1	291						
:57 CRM22 50% F		25.1	8.9/8.3	7.7/8.0	301						
7:59 CRM22 100%	3.2	25.0	9.2/8.3	7.5/7.9	269						
TR cervio only	29.8	25.4	7.0	8.0	161	3.5	59.9	5.5	55		
F-med 1410	21.8	25.3	8.3	8.2	342						
C-med 1405	21.5	25.5	8.3	8.2	326						

NOTES:

PLARC501-252

Reviewed By: CLC

FINAL CHEMISTRY

Study DOE July 93

Beginning Date 7-22-93

Ending Date 7-29-93

Date 7/23/93

Personnel DH

Sample ID	By Rep.	Fish Temp.	DO	pH	Cond.
CRM 19 50%	1	25.0	6.4	7.8	
	2	25.1	6.2		301
	3	25.1	6.5		
	4	25.1	6.4		
CRM 19 100%	1	25.1	6.4	7.9	
	2	25.1	6.5		273
	3	25.1	6.4		
	4	25.2	6.4		
CRM 22 50%	1	25.0	6.3	7.8	
	2	25.0	6.2		300
	3	25.0	6.3		
	4	25.0	6.5		
CRM 22 100%	1	25.1	6.5	8.0	
	2	25.0	6.4		271
	3	25.2	6.3		
	4	25.0	6.4		
F-med	1	25.0	6.6	7.8	
	2	25.1	6.7		335
	3	25.0	6.6		
	4	25.1	6.7		
	1				
	2				
	3				
	4				
	1				
	2				
	3				
	4				

Ceriodaphnia

Temp.	Sample ID	DO	pH
25.5	① CRM 19 37%	7.3	8.1
25.4	② CRM 19 100%	7.3	8.2
25.4	③ CRM 22 37%	7.3	8.1
25.3	④ CRM 22 100%	7.2	8.2
25.3	⑤ T.R.	7.2	7.9
25.4	⑥ C-med.	7.3	7.9
25.3			
25.2			
25.2			
25.1			

NOTES:

Reviewed By: DH

PLARC501-255

FINAL CHEMISTRY

Study DOE July 93

Beginning Date 7-22-93

Ending Date 7-29-93

Date 7/24/93

Personnel C.A.
T.S

Sample ID	By Rep.	Fish Temp.	DO	pH	Cond.
CRM 19 50%	1	24.8	7.1		
	2	24.9	5.8	7.8	
	3	24.8	6.0		304
	4	24.8	6.1		
CRM 19 100%	1	25.0	5.6		
	2	24.9	5.6	7.9	
	3	24.8	5.9		273
	4	24.8	6.0		
CRM 22 50%	1	24.8	6.0		
	2	24.9	5.5	7.7	
	3	24.8	5.7		304
	4	24.8	6.5		
CRM 22 100%	1	24.6	6.2		
	2	24.8	6.2	7.9	
	3	24.9	6.0		272
	4	24.9	5.9		
F-med	1	24.5	6.0		
	2	24.8	6.4	7.8	
	3	24.9	6.3		337
	4	24.8	6.4		
	1				
	2				
	3				
	4				
	1				
	2				
	3				
	4				

Ceriodaphnia

Temp.	Sample ID	DO	pH
25.5	① CRM 19 50%	7.3	8.2
25.3	② CRM 19 100%	7.3	8.3
25.4	③ CRM 22 50%	7.3	8.2
25.4	④ CRM 22 100%	7.3	8.3
25.4	⑤ TR	7.2	8.0
25.5	⑥ C-med	7.3	8.0
25.3			
25.4			
25.3			
25.3			

NOTES:

Reviewed By: [illegible]

PLARC501-255

FINAL CHEMISTRY

Study DOE July 93

Beginning Date 7-22-93

Ending Date 07-29-93

Date 7/25/93

Personnel JCS
TH

Sample ID	By Rep.		Fish Temp.	DO	pH	Cond.
CRM 19 50%	1		24.8	6.4		
	2		24.8	6.3		
	3		25.0	6.3	7.8	
	4		25.0	6.1		310
CRM 19 100%	1		24.9	6.2		
	2		24.9	6.0		
	3		25.0	6.0	7.9	
	4		25.0	5.9		271
CRM 22 50%	1		24.9	5.8		
	2		24.9	6.2		
	3		25.1	5.5	7.8	
	4		25.0	5.8		310
CRM 22 100%	1		25.0	5.5		
	2		25.1	5.6		
	3		24.9	6.0	8.0	
	4		24.7	6.0		272
F-med	1		24.9	6.0		
	2		24.9	6.2		
	3		24.9	6.4	7.9	
	4		24.8	6.1		34.8
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					

NOTES:

Ceriodaphnia

Temp.	Sample ID	DO	pH
25.2	① CRM 19 37%	7.5	8.2
25.4	② CRM 19 100%	7.5	8.3
25.3	③ CRM 22 37%	7.4	8.2
25.4	④ CRM 22 100%	7.4	8.4
25.4	⑤ TR	7.5	8.1
25.5	⑥ C-med	7.5	8.1
25.6			
25.5			
25.5			
25.4			

Reviewed By: [signature]

PLARC501-255

FINAL CHEMISTRY

Study DOE July 93

Beginning Date 7-22-93

Ending Date 07-24-93

Date 7/26/93

Personnel [illegible]

Sample ID	By Rep.	Fish Temp.	Fish DO	Fish pH	Fish Cond.
CRM 19 50%	1	25.1	6.2		308
	2	25.2	5.2		
	3	25.1	6.0		
	4	24.9	6.0	7.8	
CRM 19 100%	1	24.5	6.2		374 TDS
	2	25.1	6.2		275
	3	25.0	6.0		
	4	25.0	5.8	7.8	
CRM 22 50%	1	24.9	6.0		308
	2	25.1	5.7		
	3	24.9	6.0		
	4	25.0	6.1	7.8	
CRM 22 100%	1	25.1	6.1		270
	2	24.8	6.2		
	3	25.0	6.0		
	4	25.1	5.9	7.9	
F-med	1	24.8	6.7		350
	2	24.9	6.5		
	3	24.9	6.4		
	4	24.7	6.4	7.8	
	1				
	2				
	3				
	4				
	1				
	2				
	3				
	4				

Ceriodaphnia Temp.	Sample ID	Ceriodaphnia DO	Ceriodaphnia pH
25.3	① CRM 19 37%	7.4	8.1
25.3	② CRM 19 100%	7.4	8.3
25.4	③ CRM 22 50%	7.4	8.2
25.4	④ CRM 22 100%	7.4	8.3
25.5	⑤ T.R.	7.4	8.0
25.4	⑥ C-med.	7.4	8.0
25.4			
25.5			
25.4			
25.4			

NOTES:

Reviewed By: [illegible]

PLARC501-255

FINAL CHEMISTRY

Study DOE July 93

Beginning Date 7-22-93

Ending Date 07-29-93

Date 07-27-93

Personnel Heaney

Sample ID	By Rep.		Fish Temp.	DO	pH	Cond.
CRM 19 50%	1		24.8	6.0	7.8	
	2		25.1	5.6		310
	3		24.9	5.8		
	4		24.5	6.0		
CRM 19 100%	1		25.1	5.8	7.9	
	2		25.1	5.8		272
	3		24.9	5.6		
	4		24.8	5.6		
CRM 22 50%	1		24.9	5.3	7.7	
	2		25.0	5.4		311
	3		25.0	5.8		
	4		24.8	6.2		
CRM 22 100%	1		25.0	5.9	7.9	
	2		24.9	5.8		271
	3		24.9	5.8		
	4		24.8	6.2		
F-med	1		24.9	6.1	7.8	
	2		24.9	6.1		350
	3		24.6	6.3		
	4		24.7	6.3		
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					

Ceriodaphnia

Temp.	Sample ID	DO	pH
25.5	① CRM 19 50%	7.4	8.1
25.4	② CRM 19 100%	7.4	8.2
25.4	③ CRM 22 50%	7.4	8.1
25.5	④ CRM 22 100%	7.4	8.2
25.4	⑤ TR-	7.4	8.0
25.3	⑥ C-med-	7.4	8.0
25.4			
25.5			
25.5			
25.4			

NOTES:

Reviewed By: Cwaff --

PLARC501-255

FINAL CHEMISTRY

Study DOE July 93

Beginning Date 7-22-93

Ending Date 07-29-93

Date 7/28/93

Personnel DH

TS

Sample ID	By Rep.	Fish					Ceriodaphnia			
			Temp.	DO	pH	Cond.	Temp.	Sample ID	DO	pH
CRM 19 50%	1		25.1	5.5			25.1	① CRM 19 37%	75	8.1
	2		25.0	5.5	7.7		25.1	② CRM 19 12.5%	75	8.2
	3		24.8	5.9		305	25.3	③ CRM 22 37%	74	8.2
	4		24.9	5.8			25.2	④ CRM 22 12.5%	74	8.2
CRM 19 100%	1		25.0	5.9			25.2	⑤ TR	74	7.9
	2		24.9	5.9	7.9		25.4	⑥ C-med	74	80
	3		24.9	6.0		270	25.3			
	4		24.9	6.0			25.3			
CRM 22 50%	1		24.8	5.9			25.2			
	2		24.9	5.8	7.8		25.1			—
	3		24.9	5.9		306				
	4		24.9	5.8						
CRM 22 100%	1		25.0	5.6						
	2		24.9	6.0	7.9					
	3		24.8	5.6		273				
	4		24.9	6.1						
F-med	1		24.9	5.9						
	2		24.7	6.1	7.8					
	3		24.7	6.1		346				
	4		24.8	6.1						
	1									
	2									
	3									
	4									
	1									
	2									
	3									
	4									

NOTES:

Reviewed By: DH

PLARC501-255

FINAL CHEMISTRY

Study DOE July 93

Beginning Date 7-22-93

Ending Date 7-29-93

Date 7-29-93

Personnel GH
LLR

Sample ID	By Rep.	Fish DH Temp.	DH DO	DH pH	DH Cond.
CRM 19 50%	1	25.0	6.2		
	2	24.6	6.2		
	3	24.7	6.2	7.9	
	4	24.7	6.3		312
CRM 19 100%	1	24.9	6.0		
	2	24.7	6.1		
	3	24.9	6.0	7.9	
	4	24.9	5.8		280
CRM 22 50%	1	24.9	6.2		
	2	25.0	6.3		
	3	24.9	6.1	7.8	
	4	24.8	6.4		305
CRM 22 100%	1	24.9	6.3		
	2	24.8	6.5		
	3	24.9	6.4	8.0	
	4	24.8	6.4		271
F-med	1	24.8	6.3		
	2	24.7	6.4		
	3	24.7	6.6	7.8	
	4	24.7	6.7		345
	1				
	2				
	3				
	4				
	1				
	2				
	3				
	4				

Ceriodaphnia

Temp.	Sample ID	DO	pH
25.1	① CRM 19 50%	7.4	8.1
25.1	② CRM 19 100%	7.4	8.2
25.3	③ CRM 22 50%	7.4	8.1
25.4	④ CRM 22 100%	7.4	8.2
25.4	⑤ TR	7.4	7.9
25.5	⑥ C-med	7.4	8.0
25.4			
25.3			
25.2			
25.1			

NOTES:

Reviewed By: GH

PLARC501-255

DOE - 07/91 -- JULY 22-29, 1993 -- INITIAL AND FINAL CHEMISTRY

INITIAL CHEMISTRY

MEDIUM (FISH)

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	22.7	25.3	8.3	8.1	335	---	-	-
1	23.1	25.2	8.2	8.2	336	---		-
2	21.4	25.4	8.2	8.3	346	---	-	-
3	22.4	25.4	8.3	8.2	347	---		--
4	22.5	25.2	8.3	8.2	348	---	--	--
5	23.0	25.4	8.3	8.2	340	---	--	---
6	21.8	25.3	8.3	8.2	342	---	--	---
MEAN	22.7	25.3	8.3	8.2	342	0.0	0	---
MIN	21.8	25.2	8.2	8.1	335	0.0	0	--
MAX	23.4	25.4	8.3	8.3	348	0.0	0	--

CRM 19.0 50% W/F-MEDIUM

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	--	25.1	8.4	7.7	298	---	---	--
1	--	25.4	8.4	7.8	302	---	---	--
2	--	25.4	8.4	7.7	305	---	-	---
3	--	25.5	8.3	7.9	305	---	--	--
4	--	25.4	8.3	8.0	308	---	--	--
5	--	25.3	8.4	7.8	304	---	--	-
6	--	25.3	8.3	8.1	305	---	--	-
MEAN	0.0	25.3	8.4	7.9	304	0.0		
MIN	0.0	25.1	8.3	7.7	298	0.0	0	---
MAX	0.0	25.5	8.4	8.1	308	0.0	0	---

CRM 19.0 100% W/F-MEDIUM

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	3.7	25.2	8.4	7.5	271	121.4	105	<0.1
1	3.5	25.3	8.3	7.7	270	---	---	--
2	2.1	25.4	8.3	7.6	268	121.4	104	<0.1
3	3.0	25.4	8.4	7.7	270	---	---	---
4	4.2	25.3	8.3	7.9	268	---	---	---
5	2.5	25.4	8.4	7.6	270	128.3	105	<0.1
6	2.8	25.3	8.3	7.9	276	---	---	---
MEAN	3.1	25.3	8.3	7.7	270	123.7	105	<0.1
MIN	2.1	25.2	8.3	7.5	268	121.4	104	<0.1
MAX	4.2	25.4	8.4	7.9	276	128.3	105	<0.1

CRM 22.0 50% W/F-MEDIUM

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	--	25.1	8.3	7.8	298	---	---	--
1	--	25.5	8.3	7.8	301	---	---	---
2	--	25.4	8.3	8.1	304	---	---	---
3	--	25.5	8.3	8.1	306	---	---	---
4	--	25.2	8.3	8.1	304	---	---	---
5	--	25.4	8.4	7.7	303	---	---	---
6	--	25.1	8.3	8.0	301	---	---	---
MEAN	0.0	25.3	8.3	7.9	302	0.0	0	---
MIN	0.0	25.1	8.3	7.7	298	0.0	0	---
MAX	0.0	25.5	8.4	8.1	306	0.0	0	--

TR

CRM 22.0 100% W/F-MEDIUM

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	2.1	25.1	8.3	7.7				<0.1
1	2.5	25.3	8.3	7.8				<0.1
2	1.7	25.2	8.3	7.9				
3	3.1	25.2	8.3	8.0				
4	3.7	25.0	8.3	8.1				<0.1
5	2.1	25.2	8.4	7.9				
6	1.2	25.0	8.3	7.9				
MEAN	2.6	25.1	8.3	7.9				<0.1
MIN	1.7	25.0	8.3	7.7				<0.1
MAX	3.7	25.3	8.4	8.1				<0.1

MEDIUM (PERIO)

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	22.8	25.4	8.3	8.1				-
1	22.6	25.4	8.2	8.2				--
2	23.6	25.5	8.2	8.3				-
3	22.6	25.3	8.2	8.3				--
4	22.4	25.4	8.3	8.2				-
5	22.5	25.3	8.3	8.2				-
6	21.5	25.5	8.3	8.2				-
MEAN	22.6	25.4	8.3	8.2				
MIN	21.5	25.3	8.2	8.1				
MAX	23.6	25.5	8.3	8.3				

CRM 19.0 50% W/C-MEDIUM

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	--	25.4	8.4	7.8				--
1	--	25.2	8.4	7.9				--
2	--	25.4	8.3	7.9				-
3	--	25.5	8.3	8.0				--
4	--	25.4	8.3	8.0				--
5	--	25.4	8.3	7.9				--
6	--	25.5	8.3	8.1				--
MEAN	0.0	25.4	8.3	7.9				--
MIN	0.0	25.2	8.3	7.8				--
MAX	0.0	25.5	8.4	8.1				--

CRM 22.0 50% W/C-MEDIUM

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	--	25.5	8.3	7.9				--
1	--	25.4	8.4	7.9				--
2	--	25.5	8.3	8.1				--
3	--	25.4	8.3	8.1				--
4	--	25.3	8.4	8.1				-
5	--	25.4	8.4	7.9				--
6	--	25.3	8.3	8.1				--
MEAN	0.0	25.4	8.3	8.0				--
MIN	0.0	25.3	8.3	7.8				--
MAX	0.0	25.5	8.4	8.1				--

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	[illegible]
0	29.9	25.1	7.4	7.7	156	59.9	[illegible]	--
1	28.9	25.0	7.0	7.6	161	59.9	52	--
2	30.4	25.2	6.6	8.0	161	61.6	54	0.
3	30.7	25.3	7.0	8.2	160	59.9	54	--
4	30.7	25.2	6.6	7.9	162	63.3	54	--
5	30.2	25.4	6.6	8.1	162	66.7	57	--
6	29.8	25.4	7.0	8.0	161	59.9	55	--
MEAN	30.1	25.3	6.9	7.9	160	61.6	54	0.
MIN	28.9	25.0	6.6	7.6	156	59.9	52	0.
MAX	30.7	25.4	7.4	8.2	162	66.7	57	0.

FISH FINAL

CRM 19.0 50% W/F-MEDIUM

DAY	TEMP	DO	pH	COND
1	25.2	6.4	7.8	
	25.1	6.2		301
	25.1	6.5		
	25.1	6.4		
2	24.8	6.1		
	24.9	5.8	7.8	
	24.8	6.0		304
	24.8	6.1		
3	24.8	6.4		
	24.8	6.3		
	25.0	6.3	7.8	
	25.0	6.1		310
4	25.1	6.2		309
	25.2	5.2		
	25.1	6.0		
	24.9	6.0	7.8	
5	24.8	6.0	7.8	
	25.1	5.6		310
	24.2	5.8		
	24.5	6.0		
6	25.1	5.5		
	25.0	5.5	7.7	
	24.8	5.9		305
	24.9	5.8		
7	25.0	6.2		
	24.6	6.2		
	24.7	6.2	7.9	
	24.7	6.3		312
MEAN	24.9	6.0	7.8	307
MIN	24.5	5.2	7.7	301
MAX	25.2	6.5	7.9	312

CRM 19.0 [illegible]

DAY	TEMP	DO	pH	COND
1	25.1	6.4	7.9	
	25.1	6.3		273
	25.1	6.4		
	25.2	6.3		
2	25.2	5.7		
	24.9	5.8	7.9	
	24.9	5.9		271
	24.8	6.0		
3	24.9	6.2		
	24.9	6.0		
	25.0	6.0	7.9	
	25.0	5.9		271
4	24.9	6.2		275
	25.1	6.3		
	25.0	6.0		
	25.0	5.9	7.8	
5	25.1	5.8	7.9	
	25.1	5.8		272
	24.9	5.8		
	24.8	5.8		
6	25.0	5.8		
	24.9	5.9	7.9	
	24.9	6.0		270
	24.9	6.2		
7	24.9	6.0		
	24.7	6.1		
	24.9	6.0	7.9	
	24.9	5.9		280
MEAN	24.9	6.0	7.9	273
MIN	24.5	5.6	7.8	270
MAX	25.2	6.5	7.9	280

CRM 22.0 50% [illegible]

DAY	TEMP	DO	pH	COND
1	25.0	[illegible]	[illegible]	
	25.0	[illegible]		
	25.0	[illegible]		
	25.0	[illegible]		
2	24.8	[illegible]		
	24.9	[illegible]	[illegible]	
	24.8	[illegible]		
	24.8	[illegible]		
3	24.9	[illegible]		
	24.9	6.2		
	25.1	6.3	7.8	
	25.0	5.8		
4	24.9	6.3		
	25.1	5.7		
	24.9	6.0		
	25.0	[illegible]	[illegible]	
5	24.9	5.1		
	25.0	5.3		
	25.0	5.6		
	24.8	6.1		
6	24.8	5.8		
	24.9	[illegible]	[illegible]	
	24.9	5.9		
	24.9	5.8		
7	24.9	6.2		
	25.0	6.1		
	24.9	6.1	[illegible]	
	24.8	6.4		
MEAN	24.9	6.0	7.8	
MIN	24.8	5.1	[illegible]	
MAX	25.1	6.5	[illegible]	

CRM 22.0 100%

DAY	TEMP	DO	pH	COND
1	25.1	6.5	8.0	
	25.0	6.4		271
	25.2	6.3		
	25.0	6.4		
2	24.6	6.2		
	24.8	6.2	7.9	
	24.9	6.0		272
	24.9	5.9		
3	25.0	5.5		
	25.1	5.6		
	24.9	6.0	8.0	
	24.7	6.0		272
4	25.1	6.1		270
	24.8	6.2		
	25.0	6.0		
	25.1	5.9	7.9	
5	25.0	5.9	7.9	
	24.9	5.8		271
	24.9	5.8		
	24.8	6.2		

MEDIUM

DAY	TEMP	DO	pH	COND
1	25.0	6.6	7.8	
	25.1	6.7		335
	25.0	6.6		
	25.1	6.7		
2	24.5	6.6		
	24.8	6.4	7.8	
	24.9	6.3		337
	24.8	6.1		
3	24.9	6.0		
	24.9	6.2		
	24.9	6.4	7.9	
	24.8	6.1		348
4	24.8	6.2		350
	24.9	6.2		
	24.9	6.2		
	24.7	6.4	7.8	
5	24.9	6.1	7.8	
	24.9	6.1		350
	24.6	6.1		
	24.7	6.1		

Project Instrument Record Sheet

Project Study DOE July 93

Beginning Date 7-22-93

Ending Date 7-29-93

DO Meter

Model YSI Model 57
TVA Tag 557673
Calibration Date 4-28-93

pH Meter(s)

Model ORION SA250
~~TVA Tag~~ SN 8147
Calibration Date 4-30-93

Model ORION 407A
TVA Tag 557674
Calibration Date 4-14-93

Conductivity Meter

Model YSI Model 32
TVA Tag 543389
Calibration Date 2-8-93

Thermometer(s)

Model Elico SAMIA CT-40
TVA Tag M-205 / 3331
Calibration Date 5-20-93

Model Elico Siam CT-40
TVA Tag M-254 SN-4516
Calibration Date 12-8-92

PROJECT REAGENT RECORD SHEET

Project/Study: DOE July 93
Personnel: OH

Beginning Date: 7-22-93
Ending Date: 7-29-93

WINKLER TITRATION METHOD

Alkaline-Iodide-Azide:
Brand Fisher
Lot # 910067-24
Exp. Feb 93

Manganous Sulfate:
Brand Fisher
Lot # 910067-24
Exp. April 93

Sodium Thiosulfate:
Brand RICCA
Lot # A267
Exp. April 94

Sulfuric Acid:
Brand Fisher
Lot # 854507
Exp. Indef

Thyodene:
Brand Fisher
Lot # 912254
Exp. Indef.

pH BUFFER SOLUTIONS

pH 4:
Brand Spectrum
Lot # HH150
Exp. Sept 93

pH 7:
Brand Mallinckrodt
Lot # 0098KIAN
Exp. 6-94

pH 10:
Brand Mallinckrodt
Lot # 0099KJXJ
Exp. 12-93

pH ____:
Brand N/A
Lot #
Exp.

CONDUCTIVITY STANDARD SOLUTIONS

200 µmhos:
Brand Beckman
Lot # J302C
Exp. 11-94

720 µmhos:
Brand Beckman
Lot # E052H
Exp. 5-94

____ µmhos:
Brand N/A
Lot #
Exp.

ALKALINITY TITRATION

Sulfuric Acid Solution N/50:
Brand Mallinckrodt
Lot # H366KHKJ
Exp. Indef

HARDNESS TITRATION

Hardness Titrating Solution:
Brand CALGON
Lot # R237700
Exp. Indef.

Hardness Indicator:
Brand Calgon
Lot # 01E93
Exp. Indef

Hardness Buffer Solution:
Brand CALGON
Lot # 266-63
Exp. Indef

CHLORINE TITRATION

DPD Powder Pillows:
Brand HACH
Lot # 03CM
Exp. Indef

Potassium Iodide:
Brand Fisher
Lot # 863184A
Exp. Indef

FAS:
Brand RICCA
Lot # E238
Exp. 8-20-93

PLARC501-632

ATTACHMENT III

CR-ERP AMBIENT WATER TOXICITY STUDY
Reference Toxicant Test Information

Chronic Reference Toxicant Test

Fathead Minnows - ARL

		Survival		Growth			Corrective Action Taken
Test #	Date	LOEC	NOEC	LOEC	NOEC	IC25	
1	01/18/90	0.05	0.02	<0.008	0.008		
2	02/08/90	0.02	0.008	<0.008	0.008		
3	02/21/90	0.125	0.05	0.02	0.008		
4	03/07/90	0.05	0.02	0.008	0.003		
5	03/28/90	0.05	0.02	0.008	0.003		
6	04/23/90	0.05	0.02	0.02	0.008		
7	05/10/90	0.05	0.02	0.02	0.008		
8	06/06/90	0.05	0.02	0.02	0.008		
9	07/09/90	0.05	0.02	0.02	0.008		
10	08/02/90	0.05	0.02	0.008	0.003		
11	09/06/90	0.05	0.02	0.02	0.008		
12	10/10/90	0.05	0.02	0.008	0.003		
13	10/31/90	0.02	0.008	0.008	0.003		
14	11/27/90	0.05	0.02	0.02	0.008		
15	01/03/91	0.05	0.02	0.008	0.003		
16	02/06/91	0.125	0.05	0.02	0.008		
17	02/28/91	0.05	0.02	0.008	0.003		
18	03/25/91	0.05	0.02	0.008	0.003		
19	05/02/91	0.02	0.008	0.008	0.003		
20	05/30/91	0.02	0.008	0.008	0.003		
21	07/12/91	0.05	0.02	0.008	0.003		
22	08/02/91	0.05	0.02	0.008	0.003		
23	09/03/91	0.05	0.02	0.008	0.003		
24	10/02/91	0.02	0.008	0.008	0.003		
25	10/30/91	<0.05	0.05	0.008	0.003		
26	12/02/91	0.05	0.02	0.008	0.003		
27	01/09/92	0.05	0.02	0.02	0.008	0.0109	
28	01/29/92	0.05	0.02	0.008	0.003	0.0089	
29	02/27/92	0.05	0.02	0.008	0.003	0.0067	
30	04/06/92	0.02	0.008	0.008	0.003	0.0059	
31	04/30/92	0.02	0.008	0.008	0.003	0.0085	
32	05/27/92	0.05	0.02	0.02	0.008	0.01	*0.003 was significant
33	07/07/92	0.02	0.008	0.008	0.003	0.0059	
34	07/28/92	0.05	0.02	0.008	0.003	0.0078	
35	08/27/92	0.02	0.008	0.008	0.003	0.0061	
36	09/29/92*	0.02	0.008	0.008	0.003	0.0061	* started using less than
37	10/27/92*	0.02	0.008	0.008	0.003	0.006	24hr old fish
38	12/01/92*	0.05	0.02	0.008	0.003	0.0068	
39	01/05/93*	0.02	0.008	0.008	0.003	0.0056	
40	01/26/93*	0.008	0.003	0.008	0.003	0.0039	
41	02/24/93*	0.02	0.008	0.008	0.003	0.0052	
42	03/23/93*	0.05	0.02	0.008	0.003	0.0056	
43	04/26/93*	0.02	0.008	0.008	0.003	0.0055	
44	06/01/93*	0.05	0.02	0.008	0.003	0.0074	
45	07/06/93**	0.05	0.02	0.02	0.008	0.0119	**fish were 24hrs & 53mins
	Mean=	0.041	0.018	Mean= 0.011	0.004	0.0071	

Chronic Reference Toxicant Record Sheet

Study July Reflex #45

Test Organism Fathead

Beginning Date/Time 07-06-93 / 1653

Ending Date/Time 07-13-93 / 1000

Personnel Knaed, Rosseel

Toxicant Cu

Source EPA

Lot # 188

Concentration 50 mg/mL

Stock Concentration(s) Control, 0.3, 0.9, 24, 6.0, 15.0 mg/L

Test Concentrations Control, 0.001, 0.003, 0.008, 0.02, 0.05

Dilution Water Fish medium

Spawn Date	Tile #	Hatch Date
07-01-93	18, 19, 21, 22, 10, 11	07-05-93 AM 1000, Bet 0700 on 07-06-93
07-01-93	12, 14	"

Test # 45

NOEC 0.008

LOEC 0.02

Notes:

fish used were 24 hr 53 mins old. cer 07-06-93

IC_{25} = 0.0119

A 7/5 AF 1000
BF ~~0700~~ 7/6

7/1 #18, 19

7/1 #21, 22

7/1 #10, 11

7/1 #12, 14

FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

Page 1 of 1

Study: Reflex #45 Personnel: Kinard, Russell

Beginning Date/Time: 07-06-93/1053 Ending Date/Time: 07-13-93/1000

— Number Alive —

Treatment	Rep	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
	By:	CLR	CLR	CLR	CLR	CLR	CLR	CLR
0.001	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
	By:	CLR	CLR	CLR	CLR	CLR	CLR	CLR
0.003	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
	By:	GKK/CLR	GKK	CLR	CLR	CLR	CLR	CLR
0.008	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
	By:	GKK/	GKK	CLR	GKK	GKK/KR	GKK	KR
0.02	1	10	10	10	10	8	8	8
	2	10	10	10	10	10	10	10
	3	10	10	10	10	9	8	8
	4	10	10	10	10	10	10	10
	By:	GKK	GKK	JM/TC	GKK	GKK	GKK	GKK
0.05	1	9	8	7	7	7	7	6
	2	10	10	9	8	8	8	8
	3	10	10	10	9	7	5	5
	4	10	10	10	9	9	8	7
	By:	GKK	GKK	JM	GKK	GKK	GKK	GKK

Notes:

	0	1	2	3	4	5	6
Fed- Time/By:		0618/CLR	0610/CLR	0620/CLR	0640/CLR	0645/CLR	0602/CLR
	1107/GKK	1130/GKK 0618 07-07-93	1150/GKK	1120/TC	1100/GKK	1100/GKK	1115/CLR
	1507/CLR	1600/DH	1530/DH	1550/DH			1530/DH
Dilution Water ID:	1373	1377	1373&1377	1379	1379	1385	1385
(PLARC501-257) Reviewed By:		CLR	CLR	CLR	CLR	CLR	CLR

Analysis of Survival

REFTOX #45
Starting Date: 07/06/93

Survival (%) Data

Treatment	Replicate 1	2	3	4	5	6	7	8	9	10	Mean
CONTROL	1.00	1.00	1.00	1.00	.	.	.	.	.	.	1.00
0.001	1.00	1.00	1.00	1.00	.	.	.	.	.	.	1.00
0.003	1.00	1.00	1.00	1.00	.	.	.	.	.	.	1.00
0.008	1.00	1.00	1.00	1.00	.	.	.	.	.	.	1.00
0.02	0.80	1.00	0.80	1.00	.	.	.	.	.	.	0.90
0.05	0.60	0.80	0.50	0.70	.	.	.	.	.	.	0.65

Steel's Many-One Rank Test

Treatment	No. of Replicates	Critical Rank Sum	Rank Sum*
0.001	4	10	18
0.003	4	10	18
0.008	4	10	18
0.02	4	10	14
0.05	4	10	10 *

* Values less than Critical Rank Sum significantly less than the control (CONTROL).

Analysis of 7-day Larval Growth Test

REFTOX #45
Starting Date: 07/06/93

Analysis of Dry Weight (mg) Data Dunnett's Test

No transformation applied before data analysis.
For this set of data, the minimum significant difference is 0.03

This represents a 8.00 % reduction in Dry Weight (mg).

T = 2.36 ALPHA = 0.05

Dry Weight (mg) Data

	Replicate											
TREATMENT	1	2	3	4	5	6	7	8	9	10	MEAN	S
1 CONTROL	0.45	0.40	0.42	0.41	.	.	.	.	.	.	0.42	
2 0.001	0.48	0.47	0.49	0.46	.	.	.	.	.	.	0.47	
3 0.003	0.49	0.49	0.52	0.54	.	.	.	.	.	.	0.51	
4 0.008	0.43	0.45	0.42	0.47	.	.	.	.	.	.	0.44	
5 0.02	0.18	0.15	0.15	0.14	.	.	.	.	.	.	0.16	*

Asterisk (*) indicates values significantly less than control (CONTROL).

Analysis of Variance

Source	DF	Sum OF Sq.	Mean Sq.	Calc F	F(0.05)
Among	4	0.320	0.080	197.420	0.0001
Within	15	0.006	0.000		
Total	19	0.000			

THE NUMBER OF RESAMPLES IS 80

*** LISTING OF GROUP CONCENTRATIONS (% EFF.) AND RESPONSE MEANS ***

CONC. (%EFF)	RESPONSE MEAN	MEAN AFTER POOLING
.000	.421	.468
.001	.474	.468
.003	.508	.468
.008	.444	.444
.020	.154	.154
.050	.087	.087

THE LINEAR INTERPOLATION ESTIMATE OF THE TOTAL IMPACT CONCENTRATION
FROM THE INPUT SAMPLE IS .0119.-

.050	.087	.087

THE LINEAR INTERPOLATION ESTIMATE OF THE TOTAL IMPACT CONCENTRATION
FROM THE INPUT SAMPLE IS .0119.

****
* BOOTSTRAP PROCEDURE TO ESTIMATE VARIABILITY *
* OF THE ESTIMATED ICp *
****

THE MEAN OF THE BOOTSTRAP ESTIMATES IS .0118.

THE STANDARD DEVIATION OF THE BOOTSTRAP ESTIMATES IS .0003.

AN EMPIRICAL 95.0% CONFIDENCE INTERVAL FOR THE
BOOTSTRAP ESTIMATE IS (.0112, .0124).

C:\BOOTSTRP>

Chronic Reference Toxicant Test

Cerio - ARL

Test #	Date		Survival LOEC	Survival NOEC		Reproduction LOEC	Reproduction NOEC	IC25	Corrective Action Taken
1	01/24/90		0.02	0.008		>0.008	0.008		
2	03/23/90		0.05	0.02		0.05	0.02		
3	03/29/90		0.05	0.02		0.05	0.02		
4	05/05/90	void							
5	05/10/90		0.05	0.02		0.05	0.02		
		void							
6	06/11/90	void							
7	07/06/90	void							
8	07/17/90		0.05	0.02		0.008	0.02		
9	08/01/90		0.05	0.02		0.02	0.008		
10	09/06/90		0.02	0.008		0.008	0.003		
11	11/06/90		0.05	0.02		0.05	0.02		
12	11/27/90		0.05	0.02		0.02	0.008		
13	01/10/91		0.05	0.02		0.02	0.008		
14	02/8/91		0.05	0.02		0.02	0.008		
15	03/16/91		0.05	0.02		0.02	0.008		
16	03/27/91		0.05	0.02		0.05	0.02		
17	05/02/91		0.05	0.02		0.05	0.02		
18	05/31/91		0.05	0.02		0.02	0.008		
19	07/12/91		0.05	0.02		0.02	0.008		
20	08/01/91		0.05	0.02		0.02	0.008		
21	09/04/91		0.05	0.02		0.02	0.008		
22	10/03/91		0.05	0.02		0.02	0.008		
23	10/30/91		0.05	0.02		0.02	0.008		
24	12/03/91		0.05	0.02		0.05	0.02		
25	01/09/92		0.05	0.02		0.02	0.008	0.0157	
26	01/29/92		0.05	0.02		0.02	0.008	0.0119	
27	02/27/92		0.05	0.02		0.02	0.008	0.0107	
28	04/07/92		0.05	0.02		0.02	0.02	0.022	
29	05/01/92		0.05	0.02		0.008	0.003	0.0185	
30	05/28/92		0.05	0.02		0.02	0.008	0.0111	
31	07/07/92		0.05	0.02		0.05	0.02	0.0254	
32	07/31/92		0.05	0.02		0.05	0.02	0.0275	
33	08/27/92		0.05	0.02		0.05	0.02	0.0275	
34	09/30/92		0.05	0.02		0.05	0.02	0.0272	
35	10/27/92		0.05	0.02		0.05	0.02	0.0229	
36	12/01/92		0.05	0.02		0.05	0.02	0.0284	
37	01/05/93		0.05	0.02		0.02	0.008	0.0116	
38	01/26/93		0.05	0.02		0.02	0.008	0.0187	
39	02/24/93		0.05	0.02		0.05	0.02	0.0258	
40	03/23/93		0.05	0.02		0.02	0.008	0.0123	
41	04/27/93		>0.05	0.05		0.02	0.008	0.0141	
42	06/01/93		0.05	0.02		0.05	0.02	0.0297	
43	07/12/93		0.05	0.02		0.05	0.02	0.0255	
		Mean=	0.05	0.02	Mean=	0.03	0.01	0.0203	

Chronic Reference Toxicant Record Sheet

Study Cerio Reflex July #~~42~~ 43 (CR 07-21-93) Restart (Aq. Stu. Test)

Test Organism Cerio

Beginning Date/Time 07-12-93/0935

Ending Date/Time 07-13-93/1028

Personnel Russell

Toxicant Cu

Source EPA

Lot # 188

Concentration 50 mg/L

Stock Concentration(s) Control, 0.3, 0.9, 2.4, 6.0, 15.0 mg/L Cu

Test Concentrations Control, 0.001, 0.003, 0.008, 0.02, 0.05

Dilution Water Enriched Cerio medium w/ 10% TR + Se

Released From Date	Time	To Date	Time
07-11-93	1300	07-12-93	0900

Test # ~~42~~ 43 (CR 07-21-93)

NOEC 0.02

LOEC 0.05

Notes:

IC_{25} = 0.0255

CERIODAPHNIA SURVIVAL AND REPRODUCTION TEST

Page 1 of 2

Study: Reflex Rocket July B 42443

Personnel:

Beginning Date: 07-12-93 Time: 0935

Ending Date: 07-18-93 Time: 1038

---- Number of Young/Day ----

	Treatment	By Rep.	1	2	3	4	5	6	7	8	Total Young
(1)	Control	1	0	0	0	4	6	12			22
		2				3	6	9			18
		3				3	5	2			10
		4				4	6	11			21
		5				5	6	0			11
		6				2	3	4			9
		7				3	5	0			8
		8				4	6	7			17
		9				4	8	10			22
		10				4	7	8			19
(2)	0.001	1	4	0	0	4	8	11			23
		2				4	3	0			7
		3				2	6	4			12
		4				4	8	10			22
		5				0	6	0			6
		6				3	6	6			15
		7				0	0	3			3
		8				4	6	7			17
		9				3	6	10			19
		10				4	7	0			11
(3)	0.003	1	0	0	0	4	8	9			21
		2				0	4	6			10
		3				4	8	9			21
		4				2	6	8			16
		5				4	6	0			10
		6				3	6	8			17
		7				3	7	8			18
		8				0	7	8			15
		9				3	7	8			18
		10				2	7	13			22
(4)	0.008	1	0	0	0	2	4	6			12
		2				3	5	0			8
		3				4	7	11			22
		4				3	6	0			9
		5				4	6	0			10
		6				4	6	8			18
		7				3	6	8			17
		8				4	6	8			18
		9				4	7	8			19
		10				3	0	11			14
			0	1	2	3	4	5	6	7	8

Chow ID#: AgStd#2 AgStd#2 AgStd#3 AgStd#3 AgStd#4 AgStd#4 ____ ____ ____

Algae ID#: AgStd#2 AgStd#2 AgStd#3 AgStd#3 AgStd#3 AgStd#4 ____ ____ ____

Dilution Water ID#: 1380 1380 1382 1382 1382 1382 ____ ____ ____

Reviewed By: ____ ____ ____ ____ ____ ____ ____ ____ ____

Notes:

PLARC501-310

Corrected 7-21-93

CERIODAPHNIA SURVIVAL AND REPRODUCTION TEST

Study: Reflux Effluent July '93 #42-43 Personnel: Russell, Cur

Beginning Date: 07-12-93 Time: 0935

Ending Date: 07-19-93 Time: 1028

--- Number of Young/Day ---

Treatment	By Rep.	1	2	3	4	5	6	7	8	Total Young
0.02 (5)	1	0	0	0	3	5	8			16
	2				0	2	0			2
	3				4	7	9			20
	4				4	7	0			11
	5				3	6	0			9
	6				2	4	0			6
	7				5	6	8			19
	8				4	7	9			20
	9				4	7	8			19
	10				3	6	9			18
0.05 (6)	1	0/D	—	—	—	—				0
	2	/D	—	—	—	—				0
	3	/D	—	—	—	—				0
	4		0	0	0/D	—				0
	5		0	0	0	0/0				0
	6		0	0	0	4	5			9
	7		0/D	—	—	—	—			0
	8		0	0	0	0/D	—			0
	9		0/D	—	—	—	—			0
	10		0	0	3	7	0			10
	1	@Cur								
	2	07/13-93								
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
	1									
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									

	0	1	2	3	4	5	6	7	8
Chow ID#:	Ag Stk #2	Ag Stk #2	Ag Stk #3	Ag Stk #3	Ag Stk #4	Ag Stk #4			
Algae ID#:	Ag Stk #2	Ag Stk #2	Ag Stk #3	Ag Stk #3	Ag Stk #3	Ag Stk #4			
Dilution Water ID#:	1380	1380	1382	1382	1392	1392			
Reviewed By:	Cur	Cur	Cur	Cur	Cur	Cur			Cur

Notes:

Analysis of Reproduction (# young/female/6 days)

REFTOX #43
Starting Date: 07/12/93

Reproduction (# young/female/6 days) Data

Treatment	Replicate 1	2	3	4	5	6	7	8	9	10	Mean
1 CONTROL	22.0	18.0	10.0	21.0	11.0	9.0	8.0	17.0	22.0	19.0	15.70
2 0.001	23.0	7.0	17.0	22.0	6.0	15.0	3.0	17.0	19.0	11.0	14.00
3 0.003	21.0	10.0	21.0	16.0	10.0	17.0	18.0	15.0	18.0	22.0	16.80
4 0.008	12.0	8.0	22.0	9.0	10.0	18.0	17.0	18.0	19.0	14.0	14.70
5 0.02	16.0	2.0	20.0	11.0	9.0	6.0	19.0	20.0	19.0	18.0	14.00

Steel's Many-One Rank Test

Treatment		No. of Replicates	Critical Rank Sum	Rank Sum*
0.001	–	10	76	97.0
0.003		10	76	107.5
0.008		10	76	98.5
0.02		10	76	96.5

* Values less than Critical Rank Sum significantly less than the control (CONTROL).

THE NUMBER OF RESAMPLES IS 80

*** LISTING OF GROUP CONCENTRATIONS (% EFF.) AND RESPONSE MEANS ***

CONC. (%EFF)	RESPONSE MEAN	MEAN AFTER POOLING
.000	15.700	15.700
.001	14.000	15.400
.003	16.800	15.400
.008	14.700	14.700
.020	14.000	14.000
.050	1.900	1.900

THE LINEAR INTERPOLATION ESTIMATE OF THE TOTAL IMPACT CONCENTRATION
FROM THE INPUT SAMPLE IS .0255.

.050	1.900	1.900

THE LINEAR INTERPOLATION ESTIMATE OF THE TOTAL IMPACT CONCENTRATION
FROM THE INPUT SAMPLE IS .0255.

****
* BOOTSTRAP PROCEDURE TO ESTIMATE VARIABILITY *
* OF THE ESTIMATED ICp *
****

THE MEAN OF THE BOOTSTRAP ESTIMATES IS .0234.

THE STANDARD DEVIATION OF THE BOOTSTRAP ESTIMATES IS .0044.

AN EMPIRICAL 95.0% CONFIDENCE INTERVAL FOR THE
BOOTSTRAP ESTIMATE IS (.0130, .0288).

C:\BOOTSTRP>

INITIAL CHEMISTRY

Study [illegible] Date 01-06-93 Personnel [illegible]

Beginning Date [illegible] [illegible]

Ending Date [illegible]

By	[illegible]	[illegible]	CAR	[illegible]	[illegible]	CAR	CAR	GKK	CAR		
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
[illegible]											
0.001											
0.003											
0.008	—										
0.02		—	—	—							
0.05											
Control [illegible]	[illegible]	24.9	8.2	7.1	347	5.3	90.6	5.0	50		
0.001		24.9	8.1	7.1	347	5.4	92.3	5.0	50		
0.003		24.8	8.1	7.1	347						
0.008		24.8	8.1	7.2	347						
0.02		24.8	8.2	7.1	345						
0.05		24.8	8.2	7.1	345	5.4	92.3	5.0	50		

NOTES:

PLARC501-252

Reviewed By: CAR/GKK

INITIAL CHEMISTRY

Study [illegible]

Date [illegible]

Personnel Kinard

Russell

Beginning Date [illegible]

Ending Date [illegible]

By	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1,0
Control [illegible]	22.7	25.2	8.2	7.2	331	5.8	99.2	5.1	51		
0.001		25.1	8.2	7.1	332	5.5	94.1	5.0	50		
0.003		25.1	8.2	7.1	331						
0.008		25.1	8.2	7.1	330				-		
0.02		25.0	8.2	7.1	331						
0.05		25.1	8.2	7.1	331	5.4	92.3	5.0	50		
Control [illegible]	24.8	25.2	8.0	7.0	330	5.2	88.9	4.9	49		
0.001		25.1	8.0	7.0	330	5.3	90.6	4.9	49		
0.003		25.0	8.0	7.1	330						
0.009		25.0	8.0	7.1	330						
0.02		25.0	8.0	7.1	331						
0.05		25.1	8.0	7.0	330	5.5	94.1	4.9	49		
[illegible]		25.0	8.0	7.8	332	5.5	94.1	6.4	64		

Control

Fish

NOTES:

PLARC501-252

Reviewed By: [illegible]

INITIAL CHEMISTRY

Study [illegible] Personnel Kinard

Date [illegible]

Beginning Date [illegible] Russell

Ending Date [illegible]

	By											
	Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
Cerio	Control [illegible]	23.4		8.2	7.1	328	5.3	90.6	5.0	50		
	0.001			8.2	7.1	321	5.2	88.9	5.0	50		
	0.003			8.2	7.1	320						
	0.008			8.2	7.1	321						
	0.02			8.2	7.1	318						
	0.05			8.2	7.1	317	5.2	88.9	5.0	50		
Fish	Control [illegible]	23.2	25.2	8.4	7.1	342	5.4	92.3	5.2	52		
	0.001		24.9	8.4	7.1	342	5.3	90.6	5.1	51		
	0.003		25.1	8.4	7.1	342						
	0.008		25.1	8.4	7.1	342						
	0.02		25.1	8.4	7.1	341						
	0.05		25.1	8.4	7.1	341	5.4	92.3	5.1	51		

NOTES:

PLARC501-252

Reviewed By: [illegible]

INITIAL CHEMISTRY

Study [illegible] [illegible] Cerio

Date [illegible]

Personnel Kincaid, Russell

Beginning Date [illegible] Fish
[illegible] Tr[illegible] Cerio

Ending Date [illegible] Fish

	By											
	Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
Cerio	Control # [illegible]	23.3	24.9	8.1	7.1	328	5.1	87.2	5.1	51		
	0.001		25.0	8.1	7.1	311	5.2	88.9	5.0	50		
	0.003		24.9	8.1	7.2	327						
	0.008		24.4	8.1	7.2	328						
	0.02		24.9	8.1	7.2	321						
	0.05		25.0	8.1	7.1	[illegible]	5.1	81.2	5.0	50		
Fish	Control # [illegible]	[illegible]	25.2	8.0	7.1	345	5.4	92.3	5.2	52		
	0.001		25.0	8.0	7.1	344	5.3	90.6	5.1	52		
	0.003		25.0	8.0	7.1	344	–					
	0.008		25.0	8.1	7.1	344						
	0.02		25.0	8.1	7.1	344	[illegible]					
	0.05		25.1	8.1	7.1	345	5.4	91.8	5.2	52		

NOTES:

PLARC501-252

Reviewed By: [illegible]

INITIAL CHEMISTRY

Study [illegible] Personnel Kinnard

Date 07-1-93

Beginning Date [illegible] Russell

Ending Date [illegible]

	By	CAR	CAR	CAR	CAR	CAR						
	Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
Cedar	Control µ H2O	26.5	25.2	8.1	7.1	345						
	0.001		25.3	8.2	7.2	350						
	0.003		25.3	8.2	7.2	350						
	0.008		25.3	8.2	7.1	340						
	0.02		25.3	8.1	7.23	340						
	0.05		25.3	8.2	7.2	345						
Fish	Control µ H2O	21.5	25.1	8.2	7.2	345						
	0.001		25.1	8.2	7.2	345						
	0.003		25.0	8.2	7.2	345						
	0.008		25.1	8.2	7.2	345						
	0.02		25.2	8.2	7.2	345						
	0.05		25.1	8.1	7.1	346						

NOTES:

PLARC501-252

Reviewed By: [illegible]

INITIAL CHEMISTRY

Study [illegible] Personnel Kincaid

Date 6/11/93 Russell

Beginning Date [illegible] 6/11/93 Terminated Early

Ending Date 6/15/93 Final

By											
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
Control 1	21.3	24.9	8.4	7.1	328						
0.001		25.2	8.3	7.2	321						
0.003		24.9	8.4	7.1	329						
0.008		25.2	8.3	7.2	320						
0.02		24.8	8.4	7.2	328						
0.05		25.2	8.4	7.1	328						
Control 2	21.2	25.1	8.3	7.1	349	5.5	94.1	5.2	52		
0.001		24.9	8.4	7.1	349	5.4	92.3	5.2	52		
0.003		25.1	8.3	7.1	350						
0.008		24.9	8.4	7.1	349						
0.02		25.0	8.4	7.1	350						
0.05		25.0	8.4	7.1	350	5.4	92.3	5.1	51		

NOTES:

PLARC501-252

Reviewed By: GK / GKK

INITIAL CHEMISTRY

Study [illegible] Personnel Kincaid

Date 01-12-93

Beginning Date [illegible] Russell

Terminated Ceriodaphnia

Ending Date 01-15-93 FM

By	Cak	Cak	Cak	Cak	Cak	Cak	Cak	Cak	Cak		
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
Ceriodaphnia Control	21.9	25.0	8.2	7.1	327	5.2 25.0	88.9	5.2	52		
0.001		25.0	8.2	7.2	328	5.3	90.6	5.0	50		
0.003		24.8	8.2	7.2	328						
0.008		25.2	8.3	7.2	328						
0.02		25.3	8.2	7.2	328						
0.05	"	25.3	8.3	7.1	325	5.3	90.6	5.1	51		
Control Fish	22.1	25.2	8.2	7.1	350						
0.001		25.1	8.3	7.1	351						
0.003		25.2	8.2	7.1	350						
0.008		25.1	8.3	7.1	351						
0.02		25.1	8.3	7.1	350						
0.05		25.1	8.3	7.1	350						

NOTES:

PLARC501-252

Reviewed By: CAK / GKK

INITIAL CHEMISTRY

Study Coeur d'Alene Project

Date 07-13-93

Personnel Russell

Beginning Date 7-12-93

Ending Date 07-15-93

By	Cw2	Cw2	Cw2	Cw2	Cw2						
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
Control 1500	22.9	25.2	8.1	7.2	332						
0.003		25.2	8.1	7.2	332						
0.006		25.3	8.1	7.2	333						
0.012		25.2	8.1	7.2	334						
0.024		25.3	8.1	7.2	332						
0.048		25.1	8.1	7.2	333						

NOTES:

PLARC501-252

Reviewed By: Cw2

INITIAL CHEMISTRY

Study Ceriodaphnia Reflex Repeat

Date 01-17-93

Personnel Burgess

Beginning Date 07-12-93

Ending Date 01-13-93

By	C.R.	C.R.	C.R.	C.R.	C.R.	C.R.	C.R.	C.R.	C.R.		
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
Control	21.1	25.4	8.2	7.1	337	5.3	90.6	5.5	55		
0.001		24.4	8.2	7.1	336	5.4	92.3	5.5	55		
0.003		24.3	8.2	7.2	34[illegible]						
0.008		25.0	8.2	7.2	333						
0.02		25.0	8.3	7.2	330						
0.05		24.9	8.2	7.1	33[illegible]	5.4	92.3	5.4	54		

NOTES:

PLARC501-252

Reviewed By: [illegible]

INITIAL CHEMISTRY

Study Ceriodaphnia Reduction Reject

Date 07-15-93

Personnel Russell
K. Webb

Beginning Date 07-12-93

Ending Date 07-15-93

By											
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
Control	24.1	25.3	8.3	7.1	338						
0.001		25.4	8.3	7.2	338						
0.003		25.4	8.3	7.2	340						
0.008		25.2	8.3	7.2	340						
0.02		25.2	8.3	7.2	341						
0.05		25.3	8.3	7.2	342						

NOTES:

PLARC501-252

Reviewed By: CK

INITIAL CHEMISTRY

Study Ceriodaphnia Reproduction

Date 01 16 93

Personnel Russell
Kinard

Beginning Date 01 12 93

Ending Date 01 15 93

By	CMK	LAB	CMK	CMK	CMK	GKK	CMK	GKK	CMK		
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
Control ~ 1.3 ml	25.1	25.1	8.3	7.2	333	5.0	85.5	5.2	52		
0.001		25.2	8.3	7.2	334	5.0	85.5	5.2	52		
0.003		25.3	8.3	7.2	334						
0.008		24.3	8.3	7.2	335						
0.02		25.0	8.3	7.2	334						
0.05		25.1	8.3	7.2	334	5.0	85.5	5.1	51		

NOTES:

PLARC501-252

Reviewed By: CMK/GKK

INITIAL CHEMISTRY

Study Ceriodaphnia Reproduction Date 07-17-93 Personnel Runnells

Beginning Date 07-12-93

Ending Date 07-15-93

By	CAR	CAR	CAR	CAR	CAR						
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
Control 7342	23.4	25.2	8.1	7.2	341						
0.001		24.9	8.1	7.2	341						
0.003		24.8	8.1	7.2	341						
0.008		25.0	8.1	7.2	342						
0.02		25.0	8.2	7.2	342						
0.05		24.8	8.2	7.2	341						

NOTES:

PLARC501-252

Reviewed By: CAR

FINAL CHEMISTRY

Study July Rel Inv. 07-07-93 Ceriod
Beginning Date 01-06-93 Fish
01-17-93 Ceriod Terminated
Ending Date 07-13-93 Fish

Date 7-7-93

Personnel Kincaid
Russell

Sample ID	By Rep.	Fish Temp.	DO	pH	Cond.
Control	1	25.0	6.2	7.5	
	2	24.8	6.4		352
	3	25.0	6.1		
	4	25.3	6.2		
0.001	1	25.1	6.1	7.5	
	2	24.8	6.0		352
	3	25.5	6.0		
	4	25.5	6.5		
0.003	1	24.8	6.4	7.5	
	2	24.9	6.4		351
	3	24.9	5.8		
	4	24.9	6.4		
0.005	1	24.7	6.3	7.5	
	2	24.8	6.6		353
	3	24.8	6.5		
	4	24.9	6.4		
0.02	1	25.0	6.6	7.5	
	2	25.0	6.5		348
	3	24.8	6.5		
	4	25.0	6.4		
0.05	1	25.1	6.7	7.5	
	2	25.1	6.8		350
	3	25.1	6.6		
	4	24.9	6.8		
	1				
	2				
	3				
	4				

Ceriodaphnia Temp.	Sample ID	DO	pH
	① Control		
	0.001 ②		
	0.003 ③		
	0.005 ④		
	0.02 ⑤		
	0.05 ⑥		

NOTES:

Reviewed By: [illegible] / GKK
PLARC501-255

FINAL CHEMISTRY

Study July Rel Tox

Beginning Date 07-07-93 Ceriod
07-06-93 Fish

Ending Date 07-12-93 Ceriod Terminated
07-13-93 Fish

Date 7-8-93

Personnel Kincaid
Russell

Sample ID	By Rep.	Fish GH/Cor Temp.	DO	pH	GH/Cor Cond.
Control	1	24.7	5.4		
	2	24.0	5.8	7.4	
	3	24.3	5.8		345
	4	24.3	5.8		
0.001	1	24.0	5.6		
	2	24.5	5.6	7.4	
	3	24.0	5.9		347
	4	24.4	5.5		
0.003	1	24.0	5.5		
	2	24.5	5.5	7.4	
	3	24.3	5.7		347
	4	24.5	5.3		
0.005	1	24.5	5.9		
	2	24.1	5.8	7.4	
	3	23.9	6.1		348
	4	24.0	6.0		
0.01	1	24.6	6.2		
	2	24.5	5.8	7.4	
	3	24.4	5.8		347
	4	23.9	6.5		
0.05	1	24.7	6.2		
	2	24.2	6.0	7.5	
	3	24.5	5.9		347
	4	24.0	6.1		
	1				
	2				
	3				
	4				

NOTES:

Ceriodaphnia Temp.	Sample ID	DO	pH
25.5	① Control	7.5	7.8
25.5	0.001 ②	7.6	7.8
25.5	0.003 ③	7.6	7.8
25.5	0.008 ④	7.6	7.8
25.7	0.02 ⑤	7.6	7.8
25.6	0.05 ⑥	7.7	7.8
25.4			
25.4			
25.4			
25.7			

Reviewed By: Cwc

PLARC501-255

FINAL CHEMISTRY

Study July Rel Inv. 07-07-93 Ceriod

Beginning Date 07-06-93 Fish 07-12-93 Ceriod Terminated

Ending Date 07-13-93 Fish

Date 07-09-93

Personnel Kinard, Russell

Fish

Sample ID	By Rep.	Temp.	DO	pH	Cond.
Control	1	24.7	6.1		
	2	24.7	5.2		
	3	24.4	6.7	7.6	
	4	24.4	5.8		352
0.001	1	24.6	4.7		
	2	24.7	5.5		
	3	25.0	5.0	7.4	
	4	24.6	5.6		353
0.003	1	25.1	5.7		
	2	25.2	4.6		
	3	24.5	5.8	7.5	
	4	24.8	5.2		353
0.005	1	24.7	5.8		
	2	24.8	5.7		
	3	24.6	5.9	7.5	
	4	24.7	5.6		352
0.02	1	24.4	5.9		
	2	24.4	6.0		
	3	24.9	4.9	7.4	Exc7-04-12
	4	25.0	5.3		349
0.05	1	24.7	4.3		
	2	24.8	5.7		
	3	24.8	6.3	7.5	
	4	24.8	6.0		350
	1				
	2				
	3				
	4				

Ceriodaphnia

Temp.	Sample ID	DO	pH
25.1	① Control	7.6	7.8
25.4	0.001 ②	7.7	7.8
25.3	0.003 ③	7.7	7.8
25.2	0.008 ④	7.7	7.8
25.4	0.02 ⑤	7.6	7.8
25.2	0.05 ⑥	7.7	7.8
25.2			
25.4			
25.5			
25.7			

NOTES:

Reviewed By: CM

PLARC501-255

FINAL CHEMISTRY

Study July Rel Iss

Beginning Date 07-06-93 Fish
07-07-93 Cerio
07-12-93 Cerio Terminated

Ending Date 07-13-93 Fish

Date 07-10-93

Personnel Kinard
Russell

Fish

Sample ID	By Rep.	Temp.	DO	pH	Cond.
Control	1	24.9	6.0		348
	2	24.7	6.2		
	3	25.0	6.2		
	4	24.4	6.3	7.5	
0.001	1	24.9	6.1		348
	2	24.9	6.5		
	3	24.5 ~~25.5~~	6.3		
	4	~~24.1~~ 24.1	6.5	7.6	
0.003	1	24.4	6.6		349
	2	24.9	6.1		
	3	24.5	6.3		
	4	24.7	6.0	7.6	
0.005	1	24.9	6.4		351
	2	24.8	6.2		
	3	24.7	6.3		
	4	24.8	6.3	7.6	
0.02	1	24.9	6.1		349
	2	25.2	5.9		
	3	24.7	6.5		
	4	24.6	6.5	7.6	
0.05	1	24.7	6.6		349
	2	24.5	6.4		
	3	25.0	6.4		
	4	24.4	6.1	7.5	
	1				
	2				
	3				
	4				

Ceriodaphnia

Temp.	Sample ID	DO	pH
25.3	① Control	7.7	7.9
25.3	0.001 ②	7.3	8.0
25.3	0.003 ③	7.7	7.9
25.2	0.008 ④	7.7	7.9
25.3	0.02 ⑤	7.7	7.9
25.0	0.05 ⑥	7.7	7.9
25.0			
25.2			
25.1			
25.6			

NOTES:

Reviewed By: [signature]
PLARC501-255

FINAL CHEMISTRY

Study 14d. Rel Tox. 07 06 93 Fish

Beginning Date 07 11 93 Cerio 07 12 93 Cerio Transferred

Ending Date 07 13 93 Fish

Date 07 11 93

Personnel Kinnard, Russell

Sample ID	By Rep.	Fish Temp.	Fish DO	Fish pH	Fish Cond.
Control	1	24.9	6.8	7.5	
	2	25.0	6.4		352
	3	24.4	6.8		
	4	24.6	6.6		
0.001	1	24.3	6.6	7.4	
	2	24.9	6.6		352
	3	24.5	6.5		
	4	24.6	6.4		
0.003	1	24.8	6.5	7.4	
	2	25.1	6.6		349
	3	25.0	6.7		
	4	24.5	6.6		
0.005	1	24.7	6.5	7.4	
	2	24.4	6.6		351
	3	24.5	6.5		
	4	24.9	6.7		
0.01	1	24.8	7.1	7.7	
	2	24.5	6.6		349
	3	24.8	7.0		
	4	24.6	6.9		
0.05	1	24.6	7.0	7.7	
	2	24.4	7.0		350
	3	24.5	7.0		
	4	24.6	7.1		
	1				
	2				
	3				
	4				

Ceriodaphnia Temp.	Sample ID	Ceriodaphnia DO	Ceriodaphnia pH
25.2	(1) Control	7.5	7.9
25.1	(2) 0.001	7.7	7.9
25.1	(3) 0.003	7.7	7.9
25.0	(4) 0.005	7.6	7.9
25.1	(5) 0.01	7.6	7.9
24.9	(6) 0.05	7.7	7.9
25.0			
25.1			
25.2			
25.1			

NOTES:

Reviewed By: [illegible]

PLARC501-255

FINAL CHEMISTRY

Study [illegible]

Beginning Date [illegible]
07-12-93 Ceriodaphnia

Ending Date 07-13-93 Fish

Date 07/12/93

Personnel Krasnod
Russell

Sample ID	By Rep.	Fish Temp.	DO	pH	Cond.
Control	1	25.1	[illegible]		
	2	25.2	[illegible]	[illegible]	
	3	24.7	[illegible]		[illegible]
	4	24.9	[illegible]		
0.001	1	24.3	[illegible]		
	2	[illegible]	[illegible]	[illegible]	
	3	[illegible]	[illegible]		[illegible]
	4	[illegible]	[illegible]		
0.003	1	24.6	[illegible]		
	2	24.5	[illegible]	[illegible]	
	3	24.3	[illegible]		[illegible]
	4	[illegible]	[illegible]		
0.005	1	25.1	[illegible]		
	2	[illegible]	[illegible]	[illegible]	
	3	[illegible]	[illegible]		[illegible]
	4	[illegible]	[illegible]		
0.01	1	25.1	[illegible]		
	2	[illegible]	[illegible]	[illegible]	
	3	[illegible]	[illegible]		[illegible]
	4	[illegible]	[illegible]		
0.05	1	[illegible]	[illegible]		
	2	[illegible]	[illegible]	[illegible]	
	3	[illegible]	[illegible]		[illegible]
	4	[illegible]	[illegible]		
	1				
	2				
	3				
	4				

Ceriodaphnia Temp.	Sample ID	DO	pH
	(1) Control		
	0.001 (3)		
	0.003 (4)		
	0.005 (2)		
	0.01 (5)		
	0.05 (6)		
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	

NOTES:

Reviewed By: [illegible]
PLARC501-255

FINAL CHEMISTRY

Study [illegible]

Beginning Date [illegible]

Ending Date 07-13 93 Fish

Date 07 13 93

Personnel [illegible]

[illegible] 95

Sample ID	By Rep.		Fish Temp.	DO	pH	Cond.
Control	1		25.6	[illegible]		
	2		25.2	[illegible]		
	3		25.3	[illegible]	[illegible]	
	4		25.1	[illegible]		[illegible]
0.001	1		25.5	[illegible]		
	2		25.0	[illegible]		
	3		25.3	[illegible]	[illegible]	
	4		24.9	[illegible]		[illegible]
0.003	1		25.2	[illegible]		
	2		24.7	[illegible]		
	3		25.5	[illegible]	[illegible]	
	4		25.5	[illegible]		[illegible]
0.005	1		25.0	[illegible]		
	2		25.3	[illegible]		
	3		24.6	[illegible]		
	4		25.2	[illegible]	[illegible]	[illegible]
0.01	1		25.5	[illegible]		
	2		25.7	[illegible]		
	3		24.9	[illegible]		
	4		25.2	[illegible]	[illegible]	[illegible]
0.05	1		25.2	[illegible]		
	2		24.9	[illegible]		
	3		24.9	[illegible]		
	4		25.1	[illegible]	[illegible]	[illegible]
	1					
	2					
	3					
	4					

Ceriodaphnia			
Temp.	Sample ID	DO	pH
	Control		
	[illegible]		
	[illegible]		
	[illegible]		
	[illegible]		
	[illegible]		
	[illegible]		

NOTES:

Reviewed By: CR

PLARC501-255

Page 1 of 1

FINAL CHEMISTRY

Study Ceric Roller Restant

Beginning Date 07-12-93

Ending Date 07-18-93

Date 07-13-93

Personnel [illegible]

Sample ID	By / Rep.	Fish	Temp.	DO	pH	Cond.
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					

Ceriodaphnia[1]

Cont. Temp.	Sample ID	[illegible] DO	[illegible] pH
25.2	[illegible]	7.5	7.9
25.2	0.003	7.4	7.9
25.3	0.01	7.5	7.9
25.3	[illegible]	7.4	7.9
25.3	0.02	7.4	7.9
25.1	0.05	7.4	7.9
25.3			
25.[illegible]			
25.[illegible]			
25.1			

NOTES:

Reviewed By: [illegible]

PLARC501-255

Page 1 of 1

FINAL CHEMISTRY

Study Cerio Reflox Restart

Beginning Date 07-12-93

Ending Date 01-18-93

Date 01-14-93

Personnel [illegible]

Sample ID	By Rep.	Fish				
			Temp.	DO	pH	Cond.
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					

Ceriodaphnia			
Cer		Cer	Cer
Temp.	Sample ID	DO	pH
25.0	Control	7.8	8.1
25.2	0.001	7.7	8.1
25.2	0.003	7.9	8.1
25.2	0.005	7.9	8.1
25.2	0.02	7.8	8.1
25.0	0.05	7.8	8.1
25.0			
25.0			
25.2			
24.6			

NOTES:

Reviewed By:

PLARC501 255

Page 1 of 1

FINAL CHEMISTRY

Study Cerio Reflow Restart

Beginning Date 07-12-93

Ending Date 07 18-93

Date 07-15-93

Personnel [illegible]

Sample ID	By Rep.	Fish				
			Temp.	DO	pH	Cond.
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					

Ceriodaphnia			
Temp.	Sample ID	DO	pH
25.3	Control	[illegible]	7.8
25.3	0.001	[illegible]	7.8
25.2	0.00[illegible]	[illegible]	7.8
25.1	0.008	[illegible]	7.8
25.1	0.02	7.6	7.7
25.2	0.05	[illegible]	7.8
25.2			
25.2			
25.2			
24.4			

NOTES:

Reviewed By: [illegible]

PLARC501 255

Page 1 of 1

FINAL CHEMISTRY

Study Cerio Reflux Restart

Beginning Date 07-12-93

Ending Date 07-16-93

Date 07-16-93

Personnel [illegible]

Sample ID	By Rep.	Fish				
			Temp.	DO	pH	Cond.
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					

Ceriodaphnia			
Cont.		Cont.	Cont.
Temp.	Sample ID	DO	pH
25.4	Control (1)	[illegible]	7.8
25.4	0.001 (2)	[illegible]	7.7
25.4	0.002 (3)	[illegible]	7.8
25.4	0.004 (4)	[illegible]	7.8
25.3	0.02 (5)	[illegible]	7.8
25.3	0.05 (6)	[illegible]	7.8
25.3			
25.3			
25.3			
25.2			

NOTES:

Reviewed By: [illegible]

PLARC501-255

Page 1 of 1

FINAL CHEMISTRY

Study Cerio Reflex Restart

Beginning Date 07-12-93

Ending Date 07-18-93

Date 07/17/93

Personnel [illegible]

Sample ID	By	Fish				
	Rep.		Temp.	DO	pH	Cond.
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					

Ceriodaphnia			
Cur.		[illegible]	Cur.
Temp.	Sample ID	DO	pH
26.0	Control	[illegible]	7.6
25.8	0.001	[illegible]	7.7
25.8	0.002	[illegible]	7.7
25.7	0.005	[illegible]	7.7
25.8	0.02	[illegible]	7.7
25.6	0.05	[illegible]	7.7
25.6			
25.6			
25.6			
25.6			

NOTES:

Reviewed By: [illegible]
PLARC501 255

Page [illegible] of [illegible]

FINAL CHEMISTRY

Study [illegible]

Beginning Date [illegible] 12-[illegible]

Ending Date [illegible] 13-[illegible]

Date [illegible]

Personnel [illegible]

Sample ID	By Rep.	Fish				
			Temp.	DO	pH	Cond.
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					
	1					
	2					
	3					
	4					

Ceriodaphnia			
[illegible]		[illegible]	[illegible]
Temp.	Sample ID	DO	pH
25.[illegible]	[illegible]	[illegible]	7.3
24.[illegible]	[illegible]	[illegible]	7.5
24.[illegible]	[illegible]	[illegible]	7.6
24.[illegible]	[illegible]	[illegible]	7.5
24.[illegible]	[illegible]	[illegible]	7.[illegible]
24.[illegible]	[illegible]	7.[illegible]	7.8
24.[illegible]			
24.[illegible]			
24.[illegible]			
24.[illegible]			

NOTES:

Reviewed By:
PLARC501-255