

DOE/OR/22012--714

STANDARD REPORT FORM

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

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

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Report Preparation: Jennifer Moses

Starting Date: April 22, 1993

Ending Date: April 29, 1993

1.0 EXECUTIVE SUMMARY

Clinch River - Environmental Restoration Program (CR-ERP) personnel and Tennessee-Valley Authority (TVA) personnel conducted a pilot study during the week of April 22-29, 1993, prior to initiation of CR-ERP Phase II Sampling and Analysis activities 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 9.0 and Poplar Creek Kilometer 1.6 on April 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 9.0, downstream of the mouth of Poplar Creek and upstream of Brashean Island, and Poplar Creek Kilometer 1.6, downstream of the K-25 powerhouse. Clinch River samples were collected approximately 10 yards from the right bank (facing upstream), and Poplar Creek samples were collected approximately 10 feet from the right bank (facing upstream).

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- 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 three days: April 21, 23, and 26, 1993. Collection times were between 1000 and 1130 CDT.
- 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: Rainfall (light/steady) occurred during sampling on April 21. April 23 and 26 sample days were clear and sunny.
- 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 $4^{\circ}\text{C} \pm 1^{\circ}\text{C}$ after arrival at the Aquatic Research Laboratory (ARL).
- 2.7 Sample Transport: Samples collected on April 21 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. Samples collected on April 23, 1993, were shipped to ARL by Federal Express "next day service."
- 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 $100\ \mu\text{m}$ nylon mesh filter into 2000 mL beakers, and appropriate dilutions were prepared where applicable.
- 2.9 Test Treatments: Samples from Clinch River Mile 9.0 and Poplar Creek Kilometer 1.6 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: $25^\circ\text{C} \pm 1^\circ\text{C}$

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: April 17, 1993

3.1.6 Hatch Date/Time: April 21, 1993/1200 CDT - April 22, 1993/0700 CDT

3.1.7 Culture/Acclimation Water: Moderately hard reconstituted water

3.1.8 Acclimation Temperature: $25^\circ\text{C} \pm 1^\circ\text{C}$

3.1.9 Mean Dry Weight at Start of Test: 0.07 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 CaCO₃/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: Ceriodaphnia are fed food made according to methods modified from EPA/600/4-89/013 with tropical fish food substituted for trout chow and alfalfa substituted for Cerophyll. [3]

In addition to the yeast/alfalfa/fish food recipe, the alga Selenastrum capricornutum concentrated to 50 x 10⁶ cells/mL is also fed as part of the regular diet. Medium used for algal culture contains approximately 1.0 ppb selenium. The feeding rate for mass cultures is 5 mL prepared food and 5 mL algae concentrate at culture initiation and 5 mL prepared food only every other day thereafter. Individual animals contained in cups with 15 mL medium are fed 0.1 mL of food and 0.2 mL of algae at renewal and 0.1 mL food recipe only on intermediate days.

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 Temperatures measured in Clinch River and Poplar Creek samples upon receipt on 4/24 were 6.6°C and 6.2°C, respectively. Although ice was still present in the cooler, the samples had not cooled to the prescribed 4°C $\pm$ 1°C storage temperature. The samples were placed in a refrigerator following removal of the sample volumes needed that day and stored at the proper temperature the remaining two days the samples were used.
- 4.1.2 Date/Time Test Initiated: April 22, 1993/1050 CDT
- 4.1.3 Date/Time Test Terminated: April 29, 1993/0950 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 $\pm$ 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 chlorine were measured on each new sample at the time of first use (4/22, 4/24 and 4/27).
- 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 item 3.2.2.).
- 4.2.1.2 Prepared food recipe (see item 3.2.5).
- 4.2.1.3 Algal cell density (see item 3.2.5).
- 4.2.1.4 Feeding regime (see item 4.2.10)
- 4.2.1.5 A 100-micron mesh nylon screen was used to filter samples rather than a 60-micron mesh as described in EPA methods.
- 4.2.1.6 Temperatures measured in Clinch River and Poplar Creek samples upon receipt on 4/24 were 6.6°C and 6.2°C, respectively. Although ice was still present in the cooler, the samples had not cooled to the prescribed 4°C $\pm$ 1°C storage temperature. The samples were placed in a refrigerator following removal of the sample volumes needed that day and stored at the proper temperature the remaining two days the samples were used.
- 4.2.2 Date/Time Test Initiated: April 22, 1993/1115 CDT
- 4.2.3 Date/Time Test Terminated: April 28, 1993/1115 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 $\pm$ 1°C
- 4.2.10 Feeding Regime During Test: Each organism was fed 0.1 mL of prepared food and 0.2 mL algae (50 x 10⁶ cells/mL) 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 (4/22, 4/24, and 4/27).

"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. The decision process followed for testing sublethal (reproduction) effects is shown in section 6.2.3.1. Based on tests for normal distribution and homogeneous variance of data, the statistical test used for endpoint determination was Dunnett's Test.

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 H₂SO₄ 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 - IC₂₅
Ceriodaphnia Survival - Fisher's Exact Test

6.0 RESULTS

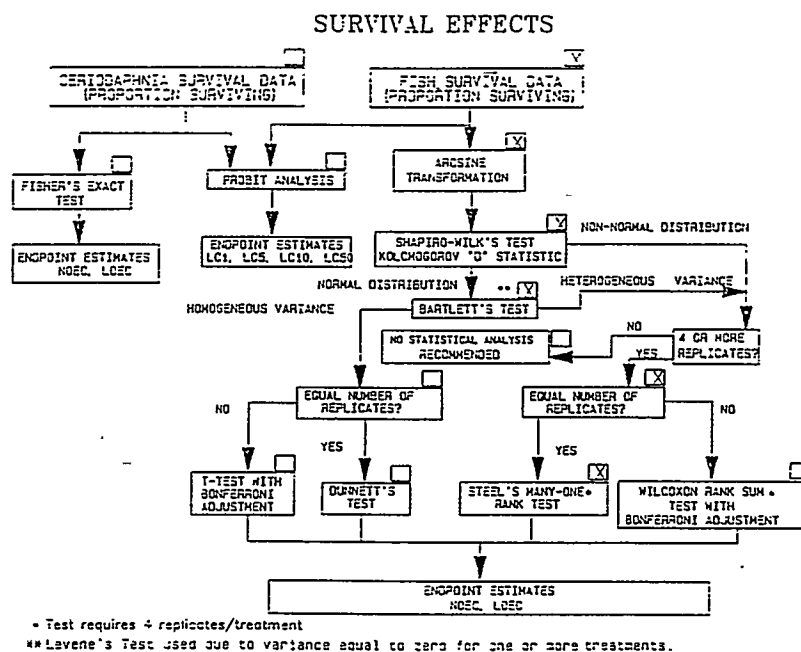
- 6.1 Fathead Minnow Larval Survival and Growth Test
 - 6.1.1 Summary of Results: No survival or growth effects were demonstrated in fathead minnows exposed to Clinch River Mile 9.0 or Poplar Creek Kilometer 1.6 samples during the CR-ERP Ambient Water Toxicity Pilot Study conducted from April 22-29, 1993.

6.1.2 Results, Survival Data:

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

Treatment	Total Daily % Survival						
	Day 1	2	3	4	5	6	7
Medium	100	100	100	100	100	98	98
CRM 9.0-50%	100	100	100	100	100	100	100
CRM 9.0-100%	100	100	100	100	100	98	98
PCK 1.6-50%	100	100	100	100	100	100	95
PCK 1.6-100%	100	100	100	100	100	98	95

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



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 Pilot Study, April 22-29, 1993.

Group	Survival (%) Data										Mean	S*
	Replicate											
	1	2	3	4	5	6	7	8	9	10		
Medium	90	100	100	100							98	
CRM 9.0-50%	100	100	100	100							100	
CRM 9.0-100%	100	90	100	100							98	
PCK 1.6-50%	100	100	90	90							95	
PCK 1.6-100%	100	90	90	100							95	

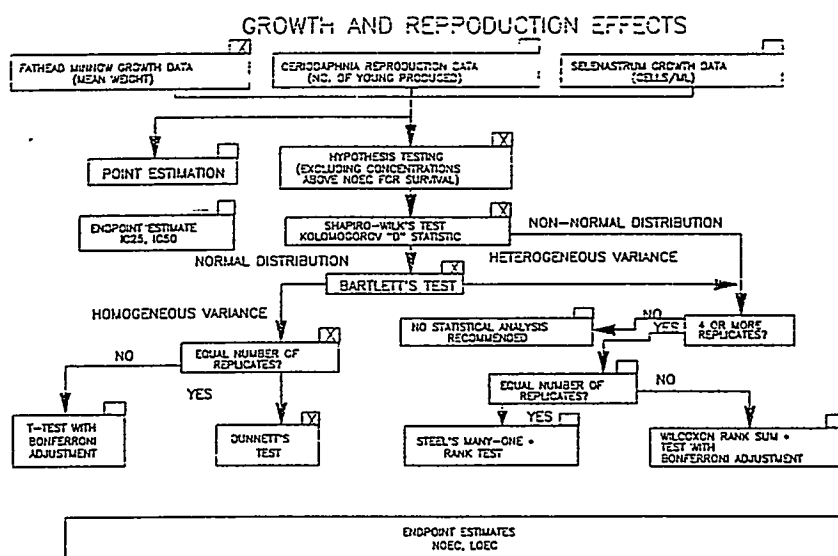
IC₂₅ >100% DSN001.

Steel's Many-one Rank Test			
Treatment	Replicates	Critical Rank Sum	Rank Sum*
CRM 9.0-50%	4	10	20.0
CRM 9.0-100%	4	10	18.0
PCK 1.6-50%	4	10	16.0
PCK 1.6-100%	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 Pilot Study, April 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 Pilot Study, April 22-29, 1993.

No transformation applied before data analysis. For this set of data, the minimum significant difference is 0.07.

This represents an 12.51% decrease in dry weight, mg.

T = 2.36 Alpha = 0.05 (one-tailed test)

Treatment	Growth Data (mg)										Mean	S*
	Replicate											
	1	2	3	4	5	6	7	8	9	10		
Medium	0.47	0.59	0.52	0.60							0.54	
CRM 9.0-50%	0.57	0.57	0.47	0.50							0.53	
CRM 9.0-100%	0.53	0.56	0.52	0.52							0.53	
PCK 1.6-50%	0.54	0.53	0.52	0.56							0.54	
PCK 1.6-100%	0.52	0.47	0.56	0.51							0.52	

*Values significantly less than the control (Medium). EMS = 0.002.
IC25 >100% DSN001.

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 9.0 or Poplar Creek Kilometer 1.6 samples during the CR-ERP Ambient Water Toxicity Pilot Study conducted from April 22-28, 1993.

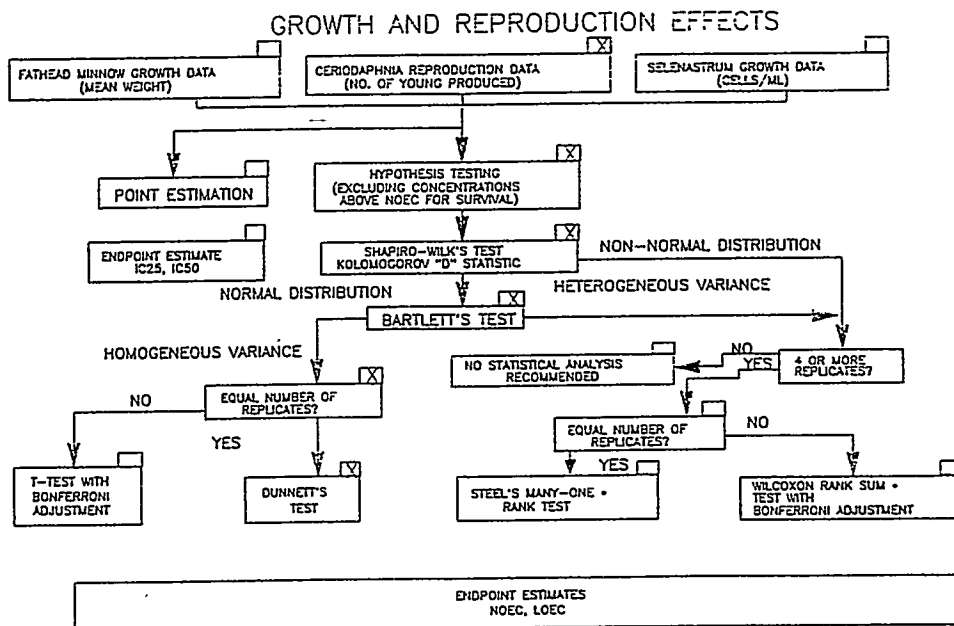
6.2.2 Results, Survival Data:

6.2.2.1 Daily percent survival summary for Ceriodaphnia Survival Test, CR-ERP Pilot Study, April 22-28, 1993.

Treatment	Total Daily % Survival					
	1	2	3	4	5	6
Medium	100	100	100	100	100	100
CRM 9.0-50%	100	100	100	100	100	100
CRM 9.0-100%	100	100	100	100	100	100
PCK 1.6-50%	100	100	100	100	100	100
PCK 1.6-100%	100	100	100	100	100	100

6.2.3 Results, Reproduction Data:

6.2.3.1 Statistical Decision Process for Determining Toxicity Endpoints for 6-Day (3-Brood) Reproduction of Ceriodaphnia, CR-ERP Pilot Study, April 22-28, 1993.



* Test requires 4 replicates/treatment

6.2.3.2 Analysis of Reproduction (# young/female/6 days) Data Using Dunnett's Test for Ceriodaphnia (6-Day) Reproduction Test, CR-ERP Pilot Study, April 22-28, 1993.

No transformation applied before data analysis. For this set of data, the minimum significant difference is 2.17.

This represents a 10.81% reduction in Reproduction (# young/female/6 days). T = 2.22 Alpha = 0.05

Treatment	Reproduction (# young/female/6 days) Data										Mean	S*
	Replicate											
	1	2	3	4	5	6	7	8	9	10		
Medium	19	17	22	19	22	19	18	20	23	22	20.10	
CRM 6.0-50%	20	23	22	22	21	21	22	20	23	22	21.60	
CRM 6.0-100%	21	27	27	27	29	24	23	25	28	29	26.00	
PCK 1.6-50%	23	24	20	26	24	24	23	24	20	25	23.30	
PCK 1.6-100%	20	26	27	28	30	25	24	24	28	25	25.70	

*Values significantly less than the control (Medium). EMS = 4.79.
IC25 >100%.

6.3 Physical/Chemical Parameters

6.3.1 Overall Test Temperature

6.3.1.1 Fathead Minnow: 25.1°C (24.6°-25.4°C)

6.3.1.2 Ceriodaphnia: 25.4°C (25.3°-25.7°C)

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

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

6.4 Reference Toxicant Tests

6.4.1 Summary of Results:

Reference toxicant tests conducted prior to CR-ERP Pilot 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:
March 23-30, 1993/1010 CDT

6.4.2.2 LOEC: 0.008 mg Cu/L
NOEC: 0.003 mg Cu/L
IC25: 0.006 mg Cu/L

6.4.2.3 Control Chart Information:

Number of standard tests completed by laboratory: 42

LOEC Range: 0.008-0.02 mg Cu/L (one concentration increment)

NOEC Range: 0.003-0.008 mg Cu/L (one concentration increment)

IC₂₅ Range: 0.004-0.011 mg Cu/L

6.4.3 Ceriodaphnia

6.4.3.1 Date/Time of most recent test:

March 23-30, 1993/0930 CDT

6.4.3.2 LOEC: 0.02 mg Cu/L

NOEC: 0.008 mg Cu/L

IC₂₅: 0.012 mg Cu/L

6.4.3.3 Control Chart Information:

Number of standard tests completed by laboratory: 40

LOEC Range: 0.008-0.05 mg Cu/L (two concentration increments)

NOEC Range: 0.003-0.02 mg Cu/L (two concentration increments)

IC₂₅ Range: 0.011-0.028 mg Cu/L

7.0 CONCLUSION

Tests conducted using Clinch River Mile 9.0 and Poplar Creek Kilometer 1.6 samples collected on April 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).
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.

PLARC501-1531

Appendix A

Water Chemistry Mean Values and Ranges for Fathead Minnow and Ceriodaphnia Tests, CR-ERP Pilot Study, April 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	Final	Initial	Final	Initial	Final
	(°C)	(°C)	(mg/L)	(mg/L)	(mg/L)	(S.U.)	(S.U.)	(S.U.)	(µmhos)	(µmhos)	*	(µmhos)	*	(µmhos)	(mg/L)	(mg/L)
CRM 9.0-50% w/F. Medium†	25.1 (24.9-25.4)	-	8.2 (8.1-8.3)	5.7 (4.5-6.5)	-	8.2 (8.1-8.3)	7.8 (7.7-8.1)	-	304 (298-310)	308 (303-316)	-	-	-	-	-	-
CRM 9.0-50% w/E. Medium‡	-	25.4 (25.3-25.7)	8.1 (8.1-8.2)	-	7.4 (7.2-7.6)	8.2 (8.0-8.3)	-	8.2 (8.1-8.2)	291 (285-301)	-	-	-	-	-	-	-
CRM 9.0-100%	25.2 (24.8-25.3)	25.4 (25.3-25.7)	8.3 (8.3-8.4)	5.6 (4.6-6.6)	7.4 (7.2-7.6)	8.2 (8.0-8.3)	7.9 (7.8-8.1)	8.3 (8.2-8.4)	267 (261-275)	272 (265-279)	105 (100-108)	128.3 (123.1-131.7)	<0.1 (<0.1-0.1)	-	-	-
PCK 1.6-50% w/F. Medium†	25.1 (24.6-25.4)	-	8.2 (8.1-8.3)	5.7 (4.4-6.5)	-	8.1 (8.0-8.2)	7.7 (7.6-7.9)	-	274 (267-286)	276 (270-290)	-	-	-	-	-	-
PCK 1.6-50% w/E. Medium‡	-	25.4 (25.3-25.7)	8.2 (8.1-8.3)	-	7.4 (7.2-7.6)	8.0 (7.9-8.2)	-	8.1 (8.0-8.1)	259 (252-269)	-	-	-	-	-	-	-
PCK 1.6-100%	25.1 (24.9-25.3)	25.4 (25.3-25.7)	8.3 (8.3-8.4)	5.7 (4.7-6.5)	7.5 (7.3-7.6)	7.9 (7.8-8.1)	7.7 (7.6-7.8)	8.0 (8.0-8.1)	203 (187-226)	206 (189-232)	62 (56-73)	90.2 (83.8-102.6)	<0.1 (<0.1-0.1)	-	-	-
Fish Medium†	25.2 (24.9-25.4)	-	8.2 (7.9-8.4)	6.0 (5.0-6.9)	-	8.3 (8.1-8.3)	7.8 (7.7-7.9)	-	344 (337-350)	346 (340-354)	63 (61-65)	95.8 (94.1-97.5)	-	-	-	-
Enriched Medium‡	-	25.4 (25.3-25.7)	8.3 (8.2-8.4)	-	7.4 (7.2-7.6)	8.2 (8.1-8.3)	-	8.1 (8.0-8.1)	324 (320-334)	-	63 (63-63)	94.1 (94.1-94.1)	-	-	-	-

*mg/L as CaCO3

†Fathead Minnow Test

‡Ceriodaphnia Test

PLARC501-1532

ATTACHMENT I

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

CLINCH RIVER RFT FIELD CHAIN-OF-CUSTO_L /FORM FOR SURFACE WATER SAMPLES[illegible]

V.3.4. 2/24/92

24/92 - 22.9.73 - 3.20.1974 25.00.1975

FCN: COCEN-1047 280CT92

CLINCH RIVER RFI FIELD CHAIN-OF-CUSTODY FORM FOR SURFACE WATER SAMPLES

Site: PCK 1.6, cem a.0

Field Custodian: *[Signature]*

Sampling Team Signatures:

C-of-C Form No.: 0423933

Page 1 of 1

Return to: C. J. Ford
P.O. Box 2008, M.S. 6036
Oak Ridge, TN 37831-6036

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Department/Floor No.

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Sample to Analysis

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TVA → AL566

V.3.4. 2/24/92

ATTACHMENT II

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

ARL CHRONIC TOXICITY TEST MASTER CHECKLIST

Study: Vibrio DOE (Lentilina)

Date Issued: 3-26-93 To: DRH From: Jm

1. Test organism availability: FH Minnows-T.L. *OK C.U. † Date 3-26
Daphnids - T.L. OK C.U. OK Date 3-24
2. Sample Collection Coordination: Date 4-6-93 By Jm With ORNL/E. Eng.
3. Glassware availability: T.L. OK Tech. EEP Date 4-20-93
4. Glassware prep. complete: Date 4-23-93 By GKK
5. Data Sheet prep. complete: Date 4-23-93 By QJS
6. Test organism availability verification: FH-OK? ✓ Daphnids-OK? OK

7. FH Minnow acclimation:

Day 1
By N/A

8. Test Initiation: FH-Date/Time 4-22-93/10:50 Daphnid-Date/Time 4-22-93/11:15
FH Sample, By: OK

9. Test Renewal:	Day #:	0	1	2	3	4	5	6	7
Log Samples	T.L.	<u>OK</u>	<u>NA</u>	<u>OK</u>	<u>NA</u>	<u>NA</u>	<u>OK</u>	<u>NA</u>	<u>NA</u>
	T.M. #	<u>QJS</u>	<u>NA</u>	<u>OK</u>	<u>NA</u>	<u>NA</u>	<u>OK</u>	<u>NA</u>	<u>NA</u>
Initial Chem.	T.L.	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>NA</u>
	T.M.	<u>QJS</u>	<u>QJS</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>NA</u>
Final Chem.	T.L.	<u>NA</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
	T.M.	<u>NA</u>	<u>QJS</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
F.H.	T.L.	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
	T.M.	<u>QJS</u>	<u>QJS</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
Daphnid	T.L.	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>NA</u>
	T.M.	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>NA</u>

10. Test Termination: FH-Date/Time 4-29-93/10:50 Daphnid-Date/Time 4-29-93/11:15
Clean-up, By: OK

11. Weigh Fish: Date 4-29-93 By DRH

12. Run Stats: Date 4-30-93 By CLR

13. Report Prep.: Date 5-13-93 By Jm

14. Report Final: Date 5-25-93 By Jm (DRH) Approved: Jm/DRH

*Team Leader

†Culture Unit

#Team Member

Chronic Study Fathead Record Sheet

Study IRL Study I (CRERP Pilot Study)
 Test Organism Pimephales promelas
 Beginning Date/Time 4-22-93 / 1050
 Ending Date/Time 04-29-93 / 1050 04-29-93
 Personnel Simone H. Hargrave

Control/Dilution Water F-MED (H'son chem. effects)

Test Treatment Identification

1. F-MED (Control)
2. CRM 7.0 50%
3. CRM 4.0 100%
4. PCK 1.0 50%
5. PCK 1.0 100%
6. _____
7. _____
8. _____

Spawn Date

4/17/93

Tile #

10, 11, 12, 14

Hatch Date

4/21 A 1200

4/22 B 0700

21, 22, 23, 24

25, 27

Test # 1 (Pilot study)

NOEC > 100%

LOEC > 100%

Notes: CRM 7.0

Sample #

1. 1284 Q

2. 1290 Q

3. 1296 Q

Dates Used

4/22, 04/23

04/24, 04/25, 04/26

04/27, 04/28

PCK 1.0

1. 1274 Q

2. 1285 Q

3. 1291 Q

4/22, 04/23

04/24, 04/25, 04/26

04/27, 04/28

FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

Page 1 of 1

Study DOE Study 7 (PERP Pilot Study)

Beginning Date/Time 4-22-93/1050

Ending Date/Time 04-24-93/0900 ⁰⁴⁻²⁹⁻⁹³

Personnel Sinclair, H. & R. Rucinski

— Number Alive —

Treatment	Rep	- Day -						
		1	2	3	4	5	6	7
CONTROL	1	10	10	10	10	10	9	9
	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:		DRH	CHK	SH	DL	DL	DL	DL
CRUI 90	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:		DRH	CHK	SH	DL	DL	DL	DL
CRUI 90	1	10	10	10	10	10	10	10
	2	10	10	10 ^Δ	10	10	9 ^Δ	9
	3	10	10	10	10	10	10	10
	4	10	10	10	10	10	10	10
By:		DRH	CHK	SH/CHK	DL	SH/CHK	CHK/CHK	DL/CHK
CRUI 90	1	10	10	10	10	10	10	10
	2	10	10	10	10	10	10	10
	3	10	10	10 ^Δ	10	10	10	9
	4	10	10	10 ^Δ	10	10	10	9
By:		DRH	CHK/CHK	CHK	CHK	CHK	CHK	CHK
PERK 10	1	10	10	10	10	10	10	10
	2	10	10	10 ^Δ	10	10	9 ^Δ	9
	3	10	10	10 ^Δ	10	10	10	9 ^Δ
	4	10	10	10	10	10	10	10
By:		DRH	SH	CHK	CHK	CHK	CHK	CHK
1								
2								
3								
4								
By:								

Notes: Used only 300 mL per rep. on Day 0. Returned to 550 mL per rep on Day 1

Δ Non-feeder
x Non-feeder dead

Fed- Time/By: 1100/CHK 1100/CHK 1100/CHK 1100/CHK 1100/CHK 1100/CHK 1100/CHK
1600/CHK 1600/CHK 1600/CHK 1600/CHK 1600/CHK 1600/CHK 1600/CHK
1600/CHK 1600/CHK 1600/CHK 1600/CHK 1600/CHK 1600/CHK 1600/CHK

Dilution Water ID: 1308 1310 1310 1310 1310 1310 1317
 (PLARC501-257) Reviewed By: DRH CHK CHK CHK CHK CHK CHK

Analysis of Survival

DOE #1
Starting Date: 04/22/93

Survival (%) Data

Treatment	Replicate										Mean
	1	2	3	4	5	6	7	8	9	10	
MEDIUM	0.90	1.00	1.00	1.00	.	.	.	.	.	.	0.98
CRM9.0 50%	1.00	1.00	1.00	1.00	.	.	.	.	.	.	1.00
CRM9 100%	1.00	0.90	1.00	1.00	.	.	.	.	.	.	0.98
PCK1.6 50%	1.00	1.00	0.90	0.90	.	.	.	.	.	.	0.95
PCK1.6 100%	1.00	0.90	0.90	1.00	.	.	.	.	.	.	0.95

Steel's Many-One Rank Test

Treatment	No. of Replicates	Critical Rank Sum	Rank Sum*
RM9.0 50%	4	10	20
RM9 100%	4	10	18
CK1.6 50%	4	10	16
CK1.6 100%	4	10	16

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

I

[illegible]

1	DOE	#1	042293	MINS	2	0	10	4	4	4	4	4	4	4	STEEL	1	CRM9.0	50%	16
2	DOE	#1	042293	MINS	2	0	10	4	4	4	4	4	4	4	STEEL	2	CRM9.0	50%	20
3	DOE	#1	042293	MINS	3	0	10	4	4	4	4	4	4	4	STEEL	1	CRM9	100%	18
4	DOE	#1	042293	MINS	3	0	10	4	4	4	4	4	4	4	STEEL	3	CRM9	100%	18
5	DOE	#1	042293	MINS	4	0	10	4	4	4	4	4	4	4	STEEL	1	PCK1.6	50%	20
6	DOE	#1	042293	MINS	4	0	10	4	4	4	4	4	4	4	STEEL	4	PCK1.6	50%	16
7	DOE	#1	042293	MINS	5	0	10	4	4	4	4	4	4	4	STEEL	1	PCK1.6	100%	20
8	DOE	#1	042293	MINS	5	0	10	4	4	4	4	4	4	4	STEEL	5	PCK1.6	100%	16

Non-parametric analysis of toxicity data

2

12:26 Thursday, July 2, 1992

----- STUDY=DOE #1 ST_DATE=042293 PARM=MINS TEST=STEEL -----

OBS	TREATMENT	N CONTROL	N EFFLUENT	RANK SUM	CRITICAL RANK SUM	SIGNIFICANT DIFFERENCE
1	CRM9.0 50%	4	4	20	10	
2	CRM9 100%	4	4	18	10	
3	PCK1.6 50%	4	4	16	10	
4	PCK1.6 100%	4	4	16	10	

TEST FOR NORMAL DISTRIBUTION

12:22 Thursday, July 2, 1992

----- STUDY=DOE #1 ST_DATE=042293 PARM=MINS -----

UNIVARIATE PROCEDURE

Variable=CENTER

Moments

N	20	Sum Wgts	20
Mean	0	Sum	0
Std Dev	0.069946	Variance	0.004893
Skewness	-0.55475	Kurtosis	-1.07773
USS	0.092958	CSS	0.092958
CV	.	Std Mean	0.015641
T:Mean=0	0	Prob> T	1.0000
Sgn Rank	3	Prob> S	0.9077
Num ^= 0	16		
W:Normal	0.865298	Prob<W	0.0089

Quantiles (Def=5)

100% Max	0.081485	99%	0.081485
75% Q3	0.040743	95%	0.081485
50% Med	0.020371	90%	0.081485
25% Q1	-0.08149	10%	-0.10186
0% Min	-0.12223	5%	-0.12223
		1%	-0.12223
Range	0.203713		
Q3-Q1	0.122228		
Mode	0.040743		

Extremes

Lowest	Obs	Highest	Obs
-0.12223(	22)	0.040743(	24)
-0.12223(	1)	0.081485(	31)
-0.08149(	43)	0.081485(	32)
-0.08149(	42)	0.081485(	41)
-0.08149(	34)	0.081485(	44)

Missing Value

Count	30
% Count/Nobs	60.00

TEST FOR NORMAL DISTRIBUTION

12:22 Thursday, July 2, 1992

----- STUDY=DOE #1 ST_DATE=042293 PARM=MINS -----

UNIVARIATE PROCEDURE

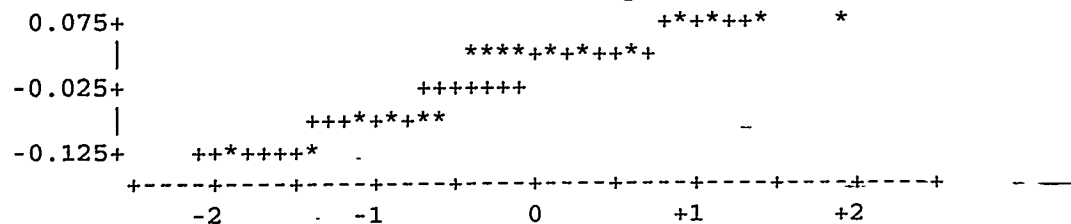
Variable=CENTER

Stem Leaf	#	Boxplot
0 8888	4	
0 0000444444	10	+---+---+
-0		
-0 8888	4	+---+---+
-1 22	2	

-----+-----+-----+

Multiply Stem.Leaf by 10**-1

Normal Probability Plot

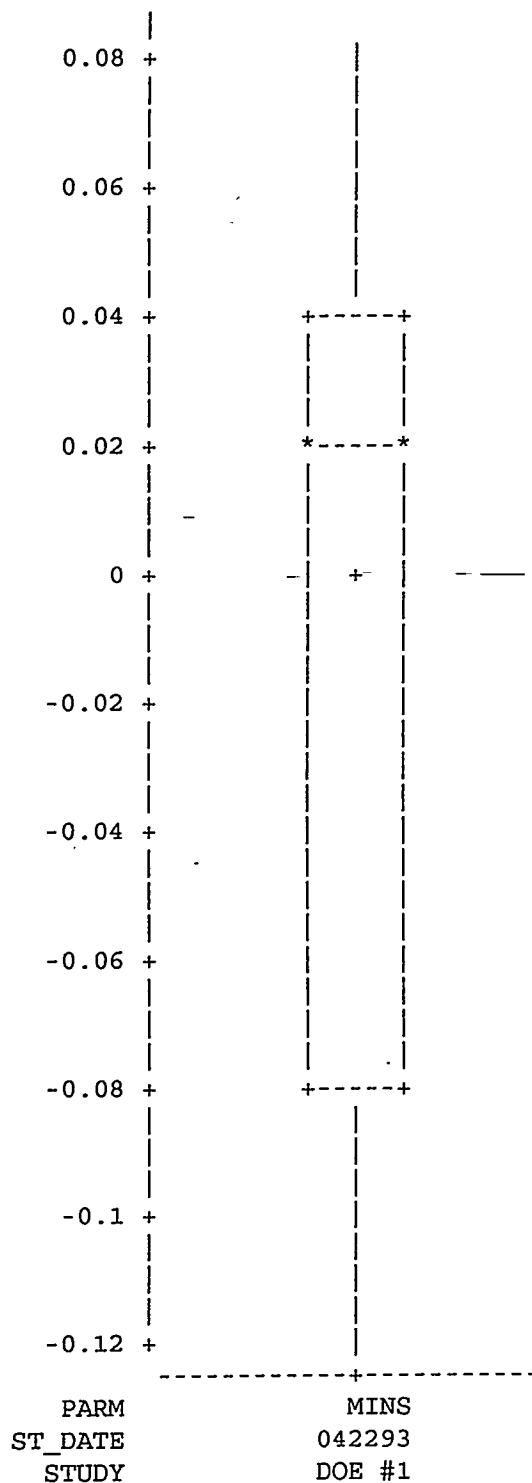


TEST FOR NORMAL DISTRIBUTION

12:22 Thursday, July 2, 1992

UNIVARIATE PROCEDURE
Schematic Plots

Variable=CENTER

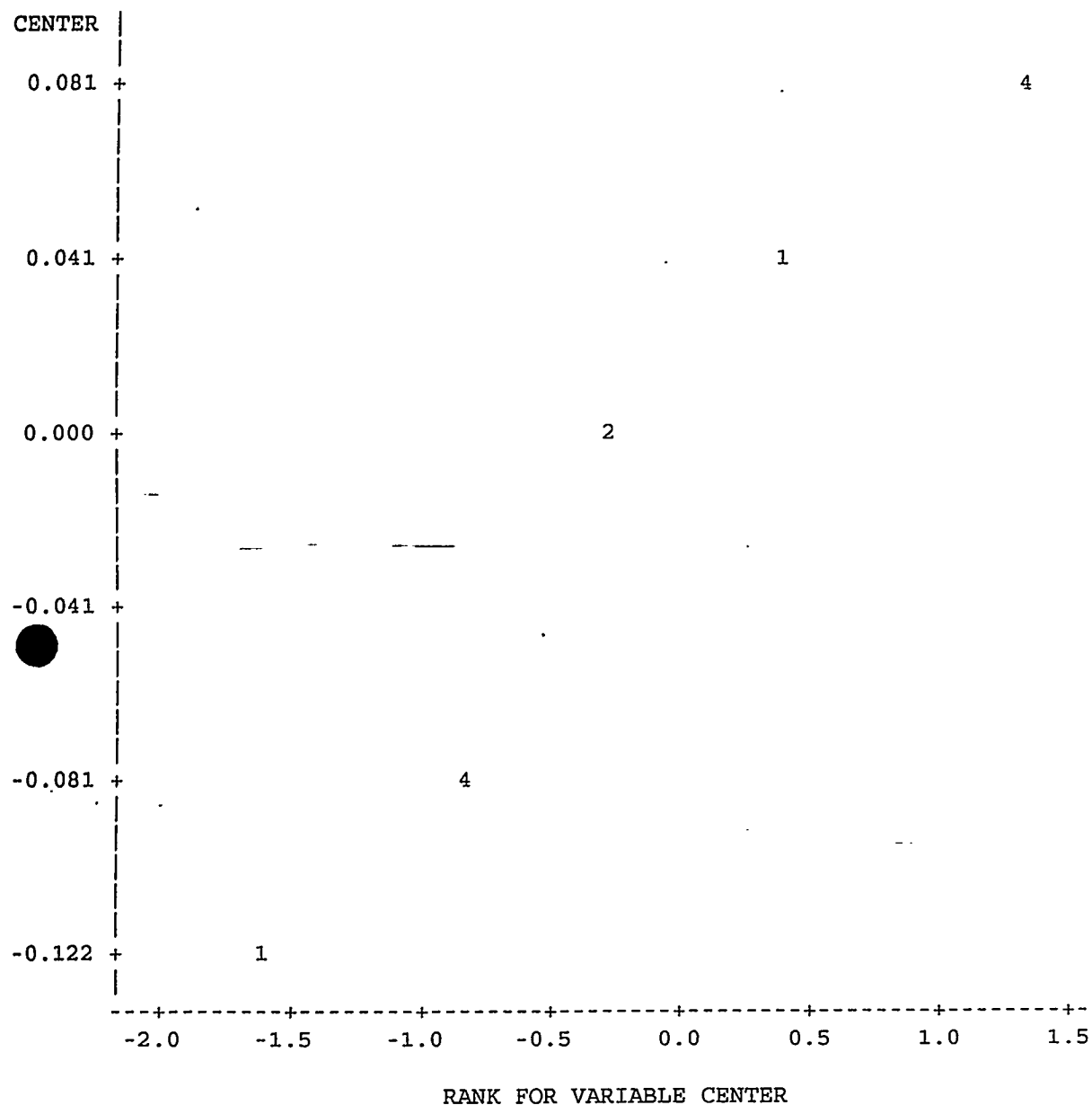


TEST FOR NORMAL DISTRIBUTION

12:22 Thursday, July 2, 1992

----- STUDY=DOE #1 ST_DATE=042293 PARM=MINS -----

Plot of CENTER*RANKIT. Symbol is value of TRT_NO.



NOTE: 30 obs had missing values. 15 obs hidden.

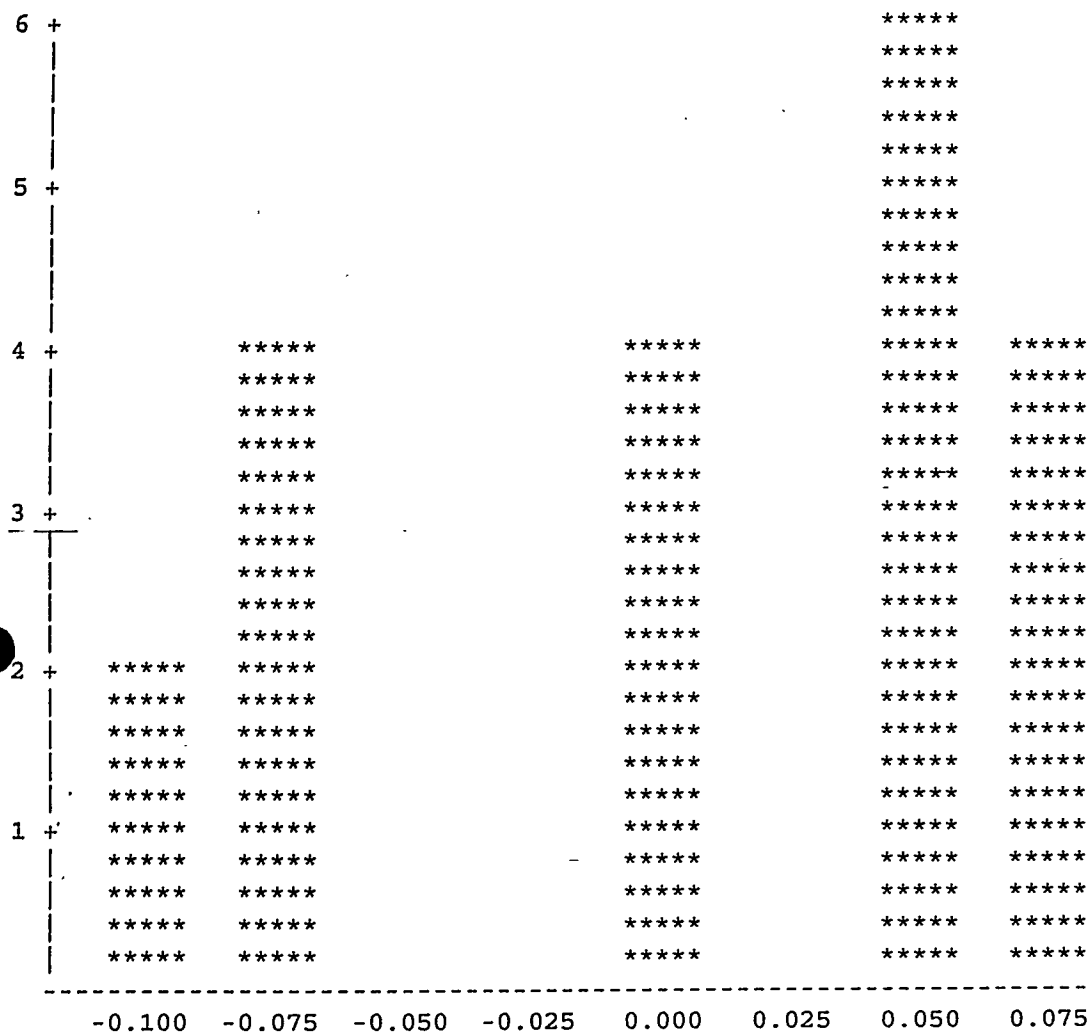
TEST FOR NORMAL DISTRIBUTION

12:22 Thursday, July 2, 1992

----- STUDY=DOE #1 ST_DATE=042293 PARM=MINS -----

FREQUENCY OF CENTER

FREQUENCY



CENTER MIDPOINT

TEST FOR NORMAL DISTRIBUTION

12:22 Thursday, July 2, 1992

VARIANCE EQUAL TO ZERO FOR ONE OR MORE TREATMENTS
BARTLETT'S TEST CAN NOT BE CALCULATED

LEVENE'S TEST WILL BE USED

Tests of assumptions for survival data (arcsine transformed)
LEVENE'S TEST FOR HOMOGENEITY OF VARIANCE

7

12:22 Thursday, July 2, 1992

----- STUDY=DOE #1 ST_DATE=042293 PARM=MINS -----

General Linear Models Procedure
Class Level Information

Class	Levels	Values
TRT	5	CRM9 100% CRM9.0 50% MEDIUM PCK1.6 100% PCK1.6 50%

Number of observations in by group = 50

NOTE: Due to missing values, only 20 observations can be used in this analysis.

LEVENE'S TEST FOR HOMOGENEITY OF VARIANCE

12:22 Thursday, July 2, 1992

----- STUDY=DOE #1 ST_DATE=042293 PARM=MINS -----

General Linear Models Procedure

Dependent Variable: ABS_VAL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	0.01792755	0.00448189	6.75	0.0026
Error	15	0.00995975	0.00066398		
Corrected Total	19	0.02788730			

R-Square	C.V.	Root MSE	ABS_VAL Mean
0.642857	45.17540	0.025768	0.05703962

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	4	0.01792755	0.00448189	6.75	0.0026

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	4	0.01792755	0.00448189	6.75	0.0026

FATHEAD DRY WEIGHT RECORD SHEET

Page 1 of 1

Study/Date DOE Study I (CRER Plot Study)

Personnel CH

Pans: Date/Time of Drying 4/29/93 10:20-11:00 Fish: Date/Time of Drying 4/30/93 7:30-9:30

Pans: Date/Time of Weighing 4/29/93 1:30-3:00 Fish: Date/Time of Weighing 4/30/93 10:00-12:00

Sample ID	Tare Wt.	Tare + Fish Wt.	Fish Wt.	# Fish	Mean Wt.	Mean Wt. Difference	
Initial	1.	1.09707	1.09271	10			
	2.	1.07658	1.02725	10			
	3.	1.04235	1.07300	10			
	4.	1.03951	1.04023	10			
Initial Mean Wt.							
F-1000	1.	1.05356	1.05778	9			
	2.	1.03615	1.03207	10			
	3.	1.05522	1.06045	10			
	4.	1.05762	1.05760	10			
CRM 50	1.	1.07498	1.08067	10			
	2.	1.10342	1.10910	10			
	3.	1.12963	1.13429	10			
	4.	0.98488	0.98485	10			
CRM 70	1.	1.02230	1.02759	10			
	2.	1.05123	1.05626	9			
	3.	1.08410	1.08928	10			
	4.	1.08981	1.09505	10			
PER 16	1.	1.03557	1.04093	10			
	2.	1.08163	1.08693	10			
	3.	0.97829	0.98298	9			
	4.	1.05432	1.05932	9			
PER 16	1.	1.04275	1.04795	10			
	2.	1.07275	1.07671	9			
	3.	1.05678	1.06180	9			
	4.	1.08747	1.09257	10			
1.							
2.							
3.							
4.							

Notes:

Reviewed By: CH

FATHHEAD DRY WEIGHT RECORD SHEET

Page 1 of 2
C.R. 6563 43

Study/Date: DOE #1

Personnel: DRH

Pans:Date/Time of Drying: 04-29-93/1000

Fish:Date/Time of Drying: 04-30-93/0730

Pans:Date/Time of Weighing: 04-29-93/1330

Fish:Date/Time of Weighing: 04-30-93/1000

Sample ID	Tare Wt.	Tare + Fish Wt.	Fish Wt.	# Fish	Mean Wt. grams	Mean Wt. Difference	Mean Wt. mg
1.	1.09207	1.09271	0.00064	10	0.000064	-	-
Initial 2.	1.02658	1.02725	0.00067	10	0.000067	-	-
3.	1.04235	1.04300	0.00065	10	0.000065	-	-
4.	1.03951	1.04023	0.00072	10	0.000072	-	-

Notes:

Initial 0.000067
Mean Wt.

1.	1.05356	1.05778	0.00422	9	0.000469	0.000402	0.469
MEDIUM 2.	1.02615	1.03207	0.00592	10	0.000592	0.000525	0.592
3.	1.05522	1.06045	0.00523	10	0.000523	0.000456	0.523

4.	1.05162	1.05760	0.00598	10	0.000598	0.000531	0.598
----	---------	---------	---------	----	----------	----------	-------

1.	1.07498	1.08067	0.00569	10	0.000569	0.000502	0.569
CRM 9.0 50% 2.	1.10342	1.10910	0.00568	10	0.000568	0.000501	0.568
3.	1.12963	1.13429	0.00466	10	0.000466	0.000399	0.466
4.	0.98488	0.98985	0.00497	10	0.000497	0.000430	0.497

1.	1.02230	1.02759	0.00529	10	0.000529	0.000462	0.529
CRM 9.0 100% 2.	1.05123	1.05626	0.00503	9	0.000559	0.000492	0.559

	3.	1.08410	1.08928	0.00518	10	0.000518	0.000451	0.518
	4.	1.08981	1.09505	0.00524	10	0.000524	0.000457	0.524
	1.	1.03557	1.04093	0.00536	10	0.000536	0.000469	0.536
PCK 1.6	2.	1.08163	1.08693	0.00530	10	0.000530	0.000463	0.530
50%	3.	0.97829	0.98298	0.00469	9	0.000521	0.000454	0.521
	4.	1.05432	1.05932	0.00500	9	0.000556	0.000489	0.556
	1.	1.04275	1.04795	0.00520	10	0.000520	0.000453	0.520
PCK 1.6	2.	1.07245	1.07671	0.00426	9	0.000473	0.000406	0.473
100%	3.	1.05678	1.06180	0.00502	9	0.000558	0.000491	0.558
	4.	1.08747	1.09257	0.00510	10	0.000510	0.000443	0.510

Reviewed By: Russell

Analysis of 7-day Larval Growth Test

DOE #1
Starting Date: 04/22/93

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 0.07

This represents a 12.51 % reduction in Dry Weight (mg).

$$T = 2.36 \text{ ALPHA} = 0.05$$

Dry Weight (mg) Data

TREATMENT	Replicate										MEAN	S
	1	2	3	4	5	6	7	8	9	10		
1 MEDIUM	0.47	0.59	0.52	0.60	.	.	.	.	.	.	0.54	
2 CRM9 50%	0.57	0.57	0.47	0.50	.	.	.	.	.	.	0.53	
3 CRM9 100%	0.53	0.56	0.52	0.52	.	.	.	.	.	.	0.53	
4 PCK1.6 50%	0.54	0.53	0.52	0.56	.	.	.	.	.	.	0.54	
5 PCK1.6 100%	0.52	0.47	0.56	0.51	.	.	.	.	.	.	0.52	

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	0.002	0.001	0.300	0.8706
Within	15	0.025	0.002		
Total	19	0.000			

15:09 Sunday, July 5, 1992

STUDY=DOE #1
ST_DATE=042293
PARM=MING
DUNNETT'S TEST
T = 2.36 ALPHA = 0.05

TREATMENT	N	MEAN	SIGNIFICANT DIFFERENCE
MEDIUM	4	0.54	
CRM9 50%	4	0.53	
CRM9 100%	4	0.53	
PCK1.6 50%	4	0.54	
PCK1.6 100%	4	0.52	

MINIMUM SIGNIFINANT DIFFERENCE = 0.07

THIS REPRESENTS A 12.51 % DECREASE IN SURVIVAL FROM THE CONTROL

15:09 Sunday, July 5, 1992

STUDY=DOE #1
ST_DATE=042293
PARM=MING
DUNNETT'S TEST
T = 2.36 ALPHA = 0.05

TREATMENT	REPLICATE										MEAN	S
	1	2	3	4	5	6	7	8	9	10		
1 MEDIUM	0.47	0.59	0.52	0.60	.	.	.	.	.	.	0.54	
2 CRM9 50%	0.57	0.57	0.47	0.50	.	.	.	.	.	.	0.53	
3 CRM9 100%	0.53	0.56	0.52	0.52	.	.	.	.	.	.	0.53	
4 PCK1.6 50%	0.54	0.53	0.52	0.56	.	.	.	.	.	.	0.54	
5 PCK1.6 100%	0.52	0.47	0.56	0.51	.	.	.	.	.	.	0.52	

MINIMUM SIGNIFINANT DIFFERENCE = 0.07

THIS REPRESENTS A 12.51 % DECREASE IN SURVIVAL FROM THE CONTROL

15:09 Sunday, July 5, 1992

General Linear Models Procedure
Class Level Information

Class	Levels	Values
TRT	5	CRM9 100% CRM9 50% MEDIUM PCK1.6 100% PCK1.6 50%

Number of observations in data set = 50

NOTE: Due to missing values, only 20 observations can be used in this analysis.

15:09 Sunday, July 5, 1992

General Linear Models Procedure

Dependent Variable: RESP

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	0.00203000	0.00050750	0.30	0.8706
Error	15	0.02502500	0.00166833		
Corrected Total	19	0.02705500			

R-Square	C.V.	Root MSE	RESP Mean
0.075032	7.684899	0.0408452	0.53150000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	4	0.00203000	0.00050750	0.30	0.8706

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	4	0.00203000	0.00050750	0.30	0.8706

Test for Normal Distribution

15:07 Sunday, July 5, 1992

----- STUDY=DOE #1 ST_DATE=042293 PARM=MING -----

UNIVARIATE PROCEDURE

Variable=CENTER

Moments

N	20	Sum Wgts	20
Mean	0	Sum	0
Std Dev	0.036292	Variance	0.001317
Skewness	-0.26288	Kurtosis	-0.52069
USS	0.025025	CSS	0.025025
CV	.	Std Mean	0.008115
T:Mean=0	0	Prob> T	1.0000
Sgn Rank	-2.5	Prob> S	0.9344
Num ^= 0	20		
W:Normal	0.956374	Prob<W	0.4825

Quantiles (Def=5)

100% Max	0.055	99%	0.055
75% Q3	0.035	95%	0.05
50% Med	-0.00375	90%	0.045
25% Q1	-0.02125	10%	-0.05125
0% Min	-0.075	5%	-0.06625
		1%	-0.075
Range	0.13		
Q3-Q1	0.05625		
Mode	-0.0125		

Extremes

Lowest	Obs	Highest	Obs
-0.075 (	1)	0.0425 (	11)
-0.0575 (	13)	0.0425 (	12)
-0.045 (	42)	0.045 (	2)
-0.0275 (	14)	0.045 (	43)
-0.025 (	3)	0.055 (	4)

Missing Value

Count 30

% Count/Nobs 60.00

Test for Normal Distribution

15:07 Sunday, July 5, 1992

----- STUDY=DOE #1 ST_DATE=042293 PARM=MING -----

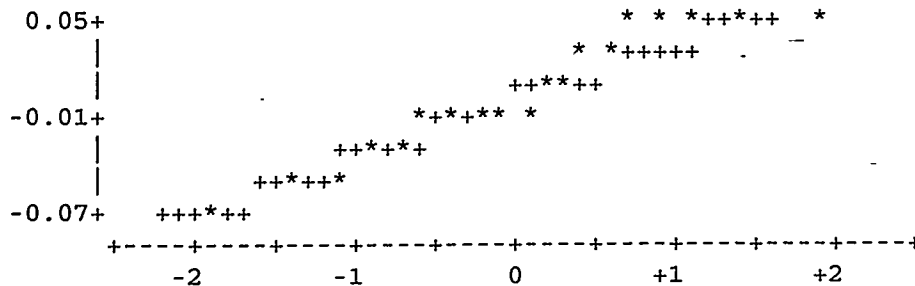
UNIVARIATE PROCEDURE

Variable=CENTER

Stem Leaf	#	Boxplot
4 22555	5	
2 28	2	+-----+
0 25	2	+
-0 822852	6	*-----*
-2 85	2	+-----+
-4 85	2	
-6 5	1	

-----+-----+-----+-----+
 Multiply Stem.Leaf by 10** -2

Normal Probability Plot



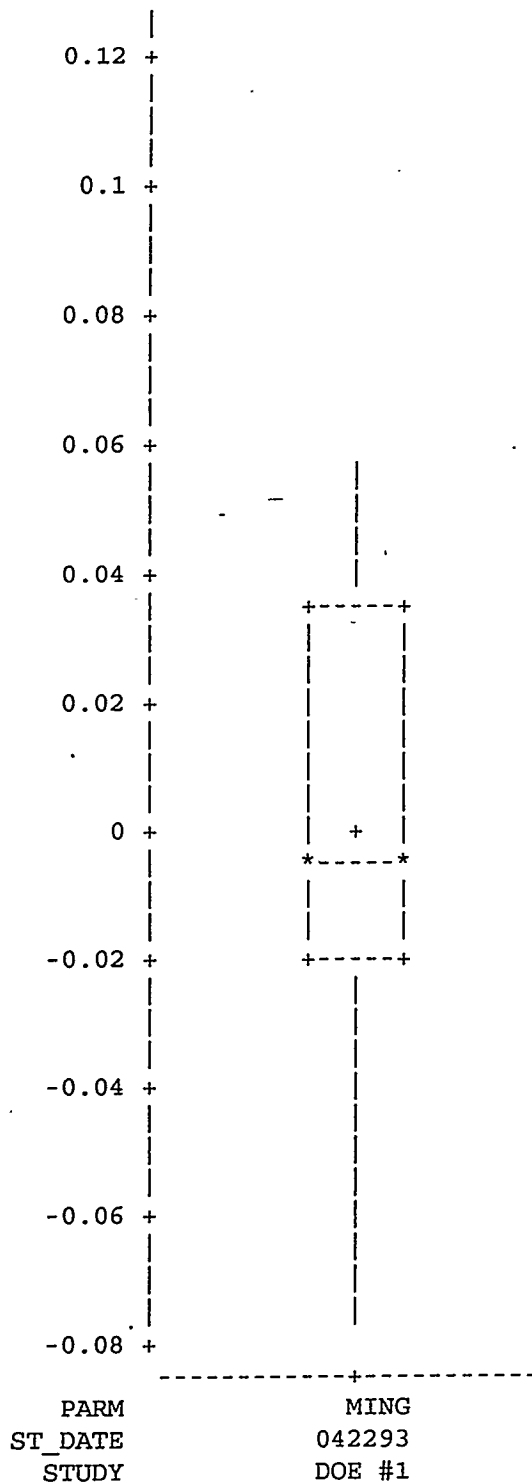
Test for Normal Distribution

15:07 Sunday, July 5, 1992

UNIVARIATE PROCEDURE

Schematic Plots

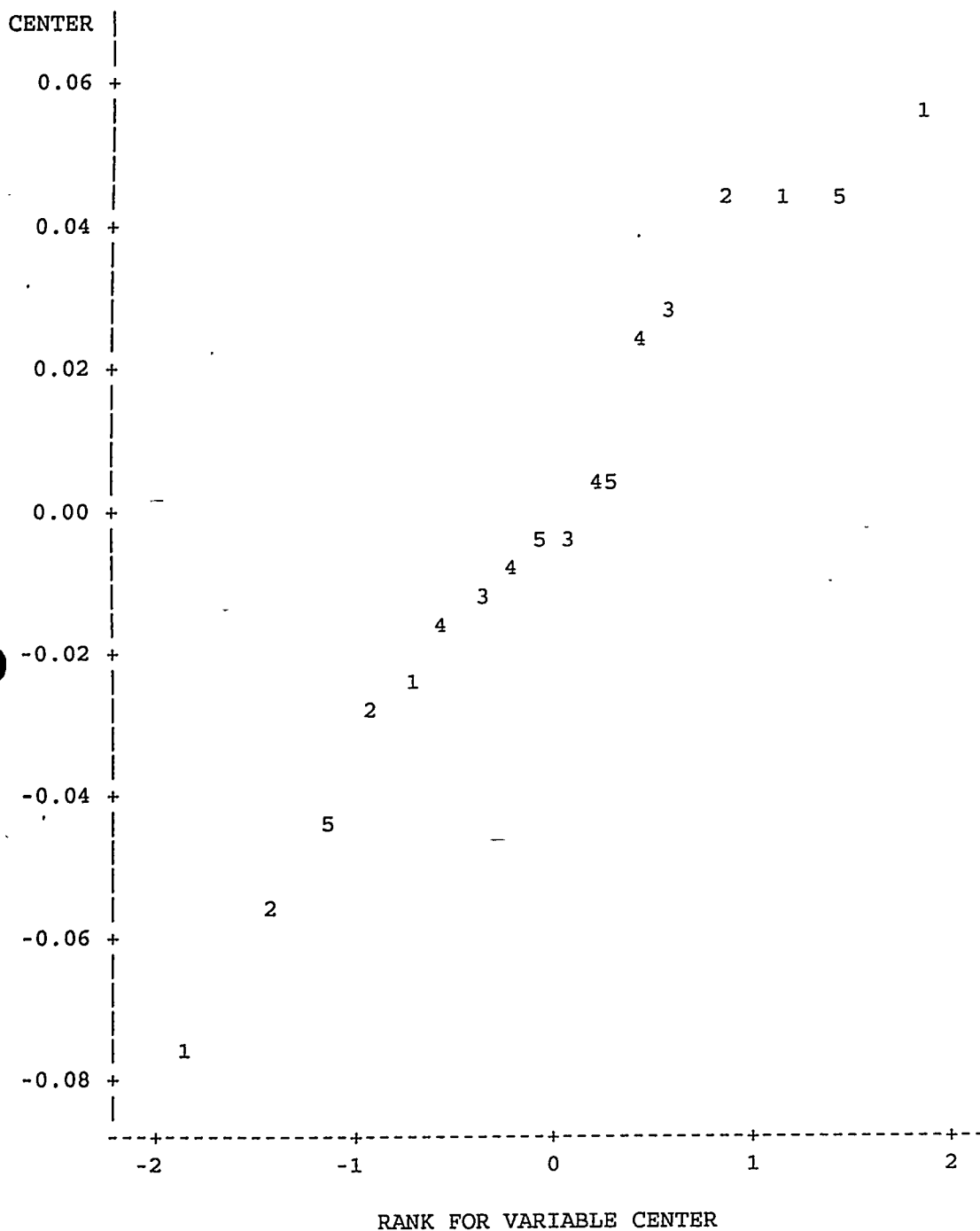
Variable=CENTER



15:07 Sunday, July 5, 1992

----- STUDY=DOE #1 ST_DATE=042293 PARM=MING -----

Plot of CENTER*RANKIT. Symbol is value of TRT_NO.



NOTE: 30 obs had missing values. 2 obs hidden.

Tests of assumptions for untransformed data

5

Bartlett's Test for Homogeneous Variance

15:07 Sunday, July 5, 1992

STUDY=DOE #1
ST_DATE=042293
PARM=MING

TREATMENT	N	MEAN	VARIANCE
MEDIUM	4	0.55	0.004
CRM9 50%	4	0.53	0.003
CRM9 100%	4	0.53	0.000
PCK1.6 50	4	0.54	0.000
PCK1.6 10	4	0.52	0.001

BARTLETT'S TEST STATISTIC = 5.928
PROB>B = 0.205

DOE #1	042293 MINS	1 MEDIUM	9.00	10.00	10.00	10.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00
DOE #1	042293 MINS	2 CRM9.0 50%	10.00	10.00	10.00	10.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00
DOE #1	042293 MINS	3 CRM9 100%	10.00	9.00	10.00	10.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00
DOE #1	042293 MINS	4 PCK1.6 50%	10.00	10.00	9.00	9.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00
DOE #1	042293 MINS	5 PCK1.6 100%	10.00	9.00	9.00	10.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00

DOE, #1	042293	MING	1	MEDIUM	0.47	0.59	0.52	0.60
DOE #1	042293	MING	2	CRM9 50%	0.57	0.57	0.47	0.50
DOE #1	042293	MING	3	CRM9 100%	0.53	0.56	0.52	0.52
DC, #1	042293	MING	4	PCK1.6 50%	0.54	0.53	0.52	0.56
DOE #1	042293	MING	5	PCK1.6 100%	0.52	0.47	0.56	0.51

Chronic Study Zooplankton Record Sheet

Study DOE Study I (CRERP Pilot Study)

Test Organism Ceriodaphnia dubia

Beginning Date/Time 4-22-93 / 11:15

Ending Date/Time 04-23-93 / 11:15

Personnel DN

Control/Dilution Water C-MED (#'s on chem + count sheets)

Test Treatment Identification

1. C-MED (Control)
2. CRM 9.0 50%
3. CRM 9.0 100%
4. PEK 1.6 50%
5. PEK 1.6 100%
6. _____
7. _____
8. _____

Released From

Date

4-21-93

Time

12:00 noon

To

Date

4-21-93

Time

8:00 pm

Test # 1 (Pilot Study)

NOEC > 100%

LOEC > 100%

Notes:

STATION

CRM 9.0

SAMPLE #

1. 1284 Q

2. 1290 Q

3. 1296 Q

DATES USED

4/22, 04/23

04/24, 04/15, 04/16

04/27

PEK 1.6

1. 1279 Q

2. 1283 Q

3. 1291 Q

4/22, 04/23

04/24, 04/15, 04/16

04/27

CERIODAPHNIA SURVIVAL AND REPRODUCTION TEST

Page 1 of 2Study: DOE Study T
Beginning Date: 4-22-93
Ending Date: 4-28-93Time: 11:15
Time: 11:15Personnel: JH

--- Number of Young/Day ---

Treatment	By Rep.	Number of Young/Day								Total Young
		1	2	3	4	5	6	7	8	
(1) CMED	1	0	0	3	0	7	9			17
	2			0	3	6	8			17
	3			0	4	7	11			22
	4			3	0	5	11			19
	5			4	7	0	11			22
	6			0	3	6	10			19
	7			3	0	6	9			18
	8			0	3	7	10			20
	9			4	8	0	11			23
	10			0	3	7	12			22
(2) CRM 9.0 50%	1	0	0	3	0	7	10			20
	2			0	4	8	11			23
	3			0	4	7	11			22
	4			4	7	0	11			22
	5			4	7	0	10			21
	6			4	0	7	10			21
	7			4	0	6	12			22
	8			3	0	7	10			20
	9			3	8	0	12			23
	10			2	0	8	12			22
(3) CRM 9.0 100%	1	0	0	3	0	9	9			21
	2			3	0	10	14			27
	3			4	0	8	15			27
	4			4	8	0	15			27
	5			2	10	0	17			29
	6			4	0	8	12			24
	7			4	0	8	11			23
	8			3	0	8	14			25
	9			4	8	0	16			28
	10			4	0	9	16			29
(4) PCK 1:1 50%	1	0	0	4	0	7	12			23
	2			4	0	8	12			24
	3			0	3	6	11			20
	4			4	9	0	13			26
	5			4	8	0	12			24
	6			4	0	8	12			24
	7			4	0	8	11			23
	8			3	0	9	12			24
	9			2	7	0	11			20
	10			4	0	7	14			25

Chow ID#: E11-17 E11-17 E11-17 E11-17 E11-17 E11-17Algae ID#: A0428 A0428 A0429 A0429 A0429 A0431Dilution Water ID#: 13010 1301 1307 1307 1307 1307Reviewed By: EH EH EH EH EH EH

Notes:

PLARC501-310

CERIODAPHNIA SURVIVAL AND REPRODUCTION TEST

Page 2 of 2

Study: Dose Study I
Beginning Date: 4-22-83
Ending Date: 4-28-83

Time: 11:15
Time: 11:15

Personnel: Oct.

Number of Young/Day

Treatment	By Rep.	1	2	3	4	5	6	7	8	Total Young
	1	0	0	2	0	6	12			20
	2			3	0	8	15			26
B. PK. 1.6	3			0	4	9	14			27
10.0%	4			4	9	0	15			28
	5			5	8	0	17			30
	6			3	0	8	14			25
	7			3	0	9	12			24
	8			0	5	6	13			24
	9			3	10	0	15			28
	10			3	8	0	14			25
	1									
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
	1									
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	10									
	1									
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									

Chow ID#: E11-17 E11-17 E11-17 E11-17 E11-17 E11-18

Algae ID#: A0428 A0428 A0429 A0429 A0429 A0431

Dilution Water ID#: 1306 1307 1307 1307 1307 1309

Reviewed By: Oct EH EH EH OH CC

10/1/83

Notes:

PLARC501-310

Analysis of 6-day Reproduction Test

DOE #1
Starting Date: 04/22/93

Analysis of Reproduction (# young/female/6 days) Data Dunnett's Test

No transformation applied before data analysis.

For this set of data, the minimum significant difference is 2.17

This represents a 10.81 % reduction in Reproduction (# young/female/6 days).

T = 2.22 ALPHA = 0.05

Reproduction (# young/female/6 days) Data

TREATMENT	Replicate										MEAN	S
	1	2	3	4	5	6	7	8	9	10		
MEDIUM	19	17	22	19	22	19	18	20	23	22	20.10	
2 CRM9.0 50%	20	23	22	22	21	21	22	20	23	22	21.60	
3 CRM9.0 100%	21	27	27	27	29	24	23	25	28	29	26.00	
4 PCK1.6 50%	23	24	20	26	24	24	23	24	20	25	23.30	
5 PCK1.6 100%	20	26	27	28	30	25	24	24	28	25	25.70	

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	61.720	65.430	13.660	0.0001
Within	45	5.500	4.789		
Total	49	0.000			

12:40 Thursday, July 2, 1992

STUDY=DOE #1
ST_DATE=042293
PARM=CERR
DUNNETT'S TEST
T = 2.22 ALPHA = 0.05

TREATMENT	N	MEAN	SIGNIFICANT DIFFERENCE
MEDIUM	10	20.10	
CRM9.0 50%	10	21.60	
CRM9.0 100%	10	26.00	
PCK1.6 50%	10	23.30	
PCK1.6 100%	10	25.70	

MINIMUM SIGNIFINANT DIFFERENCE = 2.17

THIS REPRESENTS A 10.81 % DECREASE IN SURVIVAL FROM THE CONTROL

12:40 Thursday, July 2, 1992

STUDY=DOE #1
ST_DATE=042293
PARM=CERR
DUNNETT'S TEST
T = 2.22 ALPHA = 0.05

TREATMENT	REPLICATE										MEAN	S
	1	2	3	4	5	6	7	8	9	10		
1 MEDIUM	19	17	22	19	22	19	18	20	23	22	20.10	
2 CRM9.0 50%	20	23	22	22	21	21	22	20	23	22	21.60	
3 CRM9.0 100%	21	27	27	27	29	24	23	25	28	29	26.00	
4 PCK1.6 50%	23	24	20	26	24	24	23	24	20	25	23.30	
5 PCK1.6 100%	20	26	27	28	30	25	24	24	28	25	25.70	

MINIMUM SIGNIFINANT DIFFERENCE = 2.17

THIS REPRESENTS A 10.81 % DECREASE IN SURVIVAL FROM THE CONTROL

General Linear Models Procedure
Class Level Information

Class	Levels	Values
TRT	5	CRM9.0 100% CRM9.0 50% MEDIUM PCK1.6 100% PCK1.6 50%

Number of observations in data set = 50

12:40 Thursday, July 2, 1992

General Linear Models Procedure

Dependent Variable: RESP

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	261.72000000	65.43000000	13.66	0.0001
Error	45	215.50000000	4.78888889		
Corrected Total	49	477.22000000			

R-Square	C.V.	Root MSE	RESP Mean
0.548426	9.375977	2.1883530	23.34000000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	4	261.72000000	65.43000000	13.66	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	4	261.72000000	65.43000000	13.66	0.0001

12:33 Thursday, July 2, 1992

----- STUDY=DOE #1 ST_DATE=042293 PARM=CERR -----

UNIVARIATE PROCEDURE

Variable=CENTER

Moments

N	50	Sum Wgts	50
Mean	0	Sum	0
Std Dev	2.097131	Variance	4.397959
Skewness	-0.53603	Kurtosis	0.294791
USS	215.5	CSS	215.5
CV	.	Std Mean	0.296579
T:Mean=0	0	Prob> T	1.0000
Sgn Rank	32.5	Prob> S	0.7572
Num ^= 0	50		
W:Normal	0.974081	Prob<W	0.5102

Quantiles (Def=5)

100% Max	4.3	99%	4.3
75% Q3	1.4	95%	3
50% Med	0.4	90%	2.5
25% Q1	-1.1	10%	-3.05
0% Min	-5.7	5%	-3.3
		1%	-5.7
Range	10		
Q3-Q1	2.5		
Mode	0.4		

Extremes

Lowest	Obs	Highest	Obs
-5.7 (	41)	2.7 (	34)
-5 (	21)	2.9 (	9)
-3.3 (	39)	3 (	25)
-3.3 (	33)	3 (	30)
-3.1 (	2)	4.3 (	45)

Test for Normal Distribution

12:33 Thursday, July 2, 1992

----- STUDY=DOE #1 ST_DATE=042293 PARM=CERR -----

UNIVARIATE PROCEDURE

Variable=CENTER

Stem Leaf	#	Boxplot
4 3	1	
3		
3 00	2	
2 79	2	
2 033	3	
1 7999	4	
1 000344	6	
0 7777	4	
0 34444	5	
-0 331	3	
-0 7766	4	
-1 1110	4	
-1 7766	4	
-2 10	2	
-2		
-3 3310	4	
-3		
-4		
-4		
-5 0	1	
-5 7	1	
-----+-----+-----+-----+		

Test for Normal Distribution

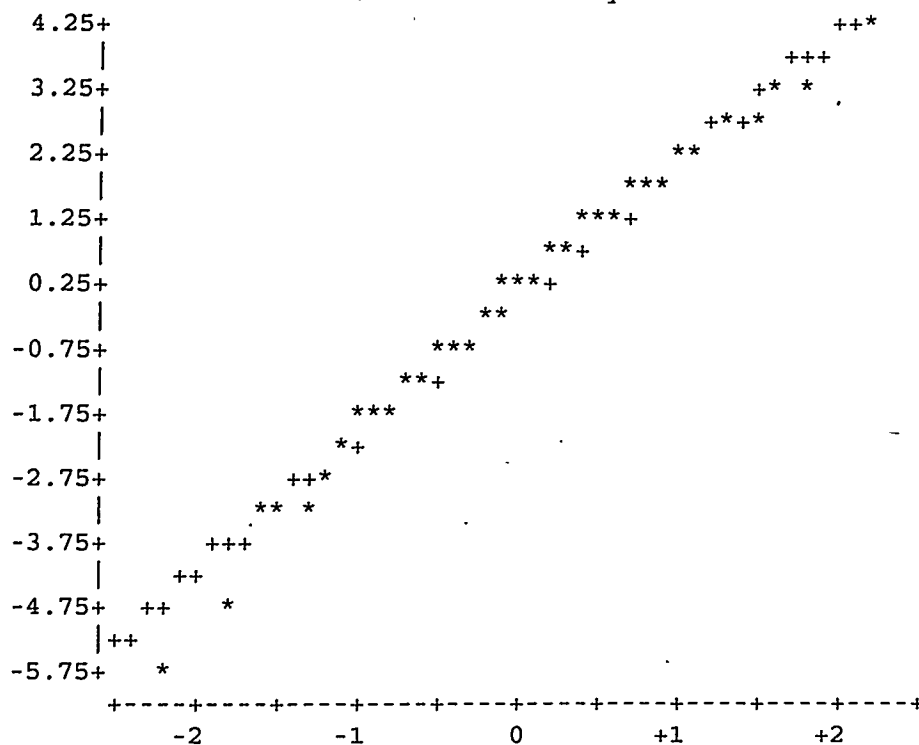
12:33 Thursday, July 2, 1992

----- STUDY=DOE #1 ST_DATE=042293 PARM=CERR -----

UNIVARIATE PROCEDURE

Variable=CENTER

Normal Probability Plot



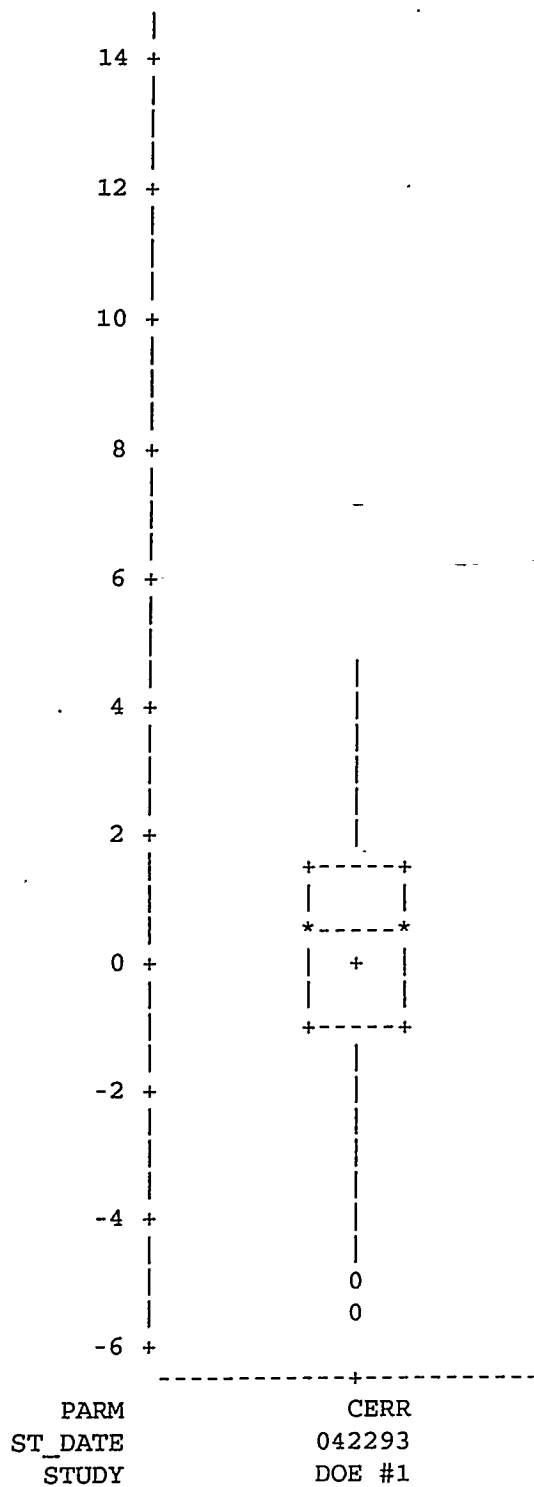
Test for Normal Distribution

12:33 Thursday, July 2, 1992

UNIVARIATE PROCEDURE

Schematic Plots

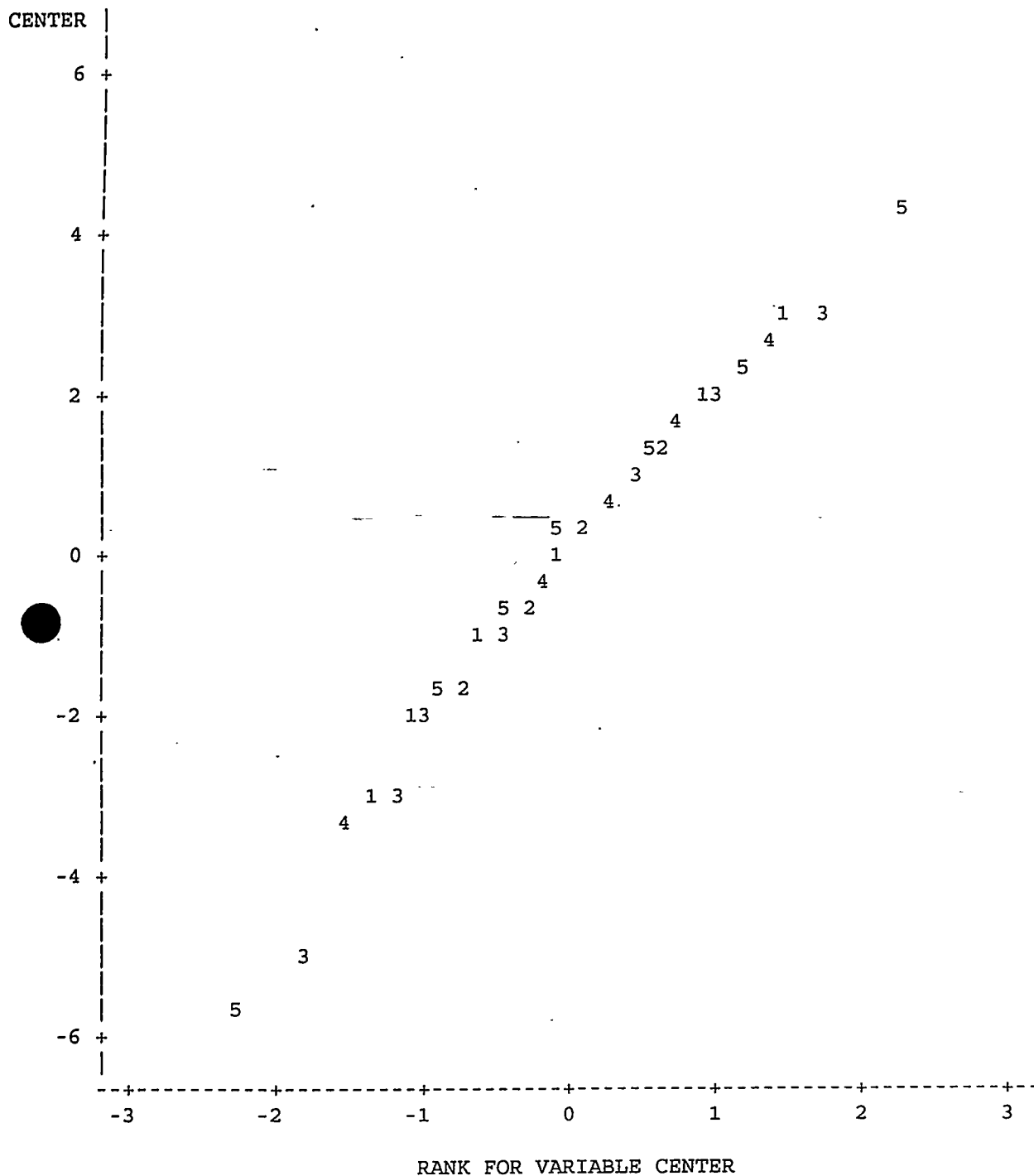
Variable=CENTER



12:33 Thursday, July 2, 1992

----- STUDY=DOE #1 ST_DATE=042293 PARM=CERR -----

Plot of CENTER*RANKIT. Symbol is value of TRT_NO.



NOTE: 21 obs hidden.

Tests of assumptions for untransformed data
Bartlett's Test for Homogeneous Variance

6

12:33 Thursday, July 2, 1992

STUDY=DOE #1
ST_DATE=042293
PARM=CERR

TREATMENT	N	MEAN	VARIANCE
MEDIUM	10	20.10	4.100
CRM9.0 50	10	21.60	1.156
CRM9.0 10	10	26.00	7.111
PCK1.6 50	10	23.30	3.789
PCK1.6 10	10	25.70	7.789

BARTLETT'S TEST STATISTIC = 8.009
PROB>B = 0.091

042293	CEKR	1	MEDIUM	19.00	17.00	22.00	19.00	22.00	19.00	18.00	20.00	23.00	22.00
042293	CEKR	2	CMH9.0 50%	20.00	23.00	22.00	22.00	21.00	21.00	22.00	20.00	23.00	22.00
042293	CEKR	3	CMH9.0 100%	21.00	27.00	27.00	27.00	29.00	24.00	23.00	25.00	28.00	29.00
042293	CEKR	4	PCK1.6 50%	23.00	24.00	20.00	26.00	24.00	24.00	23.00	24.00	20.00	25.00
042293	CEKR	5	PCK1.6 100%	20.00	26.00	27.00	28.00	30.00	25.00	24.00	24.00	28.00	25.00

CERIODAPHNIA RANDOMIZATION

Study DOE Study IPersonnel C:HLBeginning Date 4-22-93Ending Date 4-28-93

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

Treatment Identification:

Notes:

1. CMEP (Control)
2. CRM 9.0 50%
3. CRM 9.0 100%
4. PEK 1.6 50%
5. PEK 1.6 100%
6. Temperature
7. _____
8. _____
9. _____
10. _____

Batch ID: 1110
 O Date: 4-11-93
 Tray: _____

GERIODAPHNIA BROOD RECORD SHEET

Page No. 1 of 1
 Personnel: DRH/JDT
 Reviewed By: DM

Brood Box

1098
 B-10
 1474
 1098
 4711
 1474

Row	A (Brood/Number Young)									
10	0	1	0	5	7	0	4	1		
9	3	4	0	9	12	15	0	13-8		
8	4	1	0	6	10	11	0	12-8-15	-2	
7	4	1	0	6	12	10	0	12-8-10		
6	4	1	0	17-4				12-8-14	-1	
5	4	1	0	9	12	10	0	3		
4	5	1	0	7	11	18	0	11		
3	4	1	0	8	14	15	0	12-8-10		
2	4	5	0	10	14	15	0	5		
1	0	5	4	0	6	9	0	3		
Day	4/11	5/11	6/11	7/11	8/11	9/11	10/11	11/11		

Row	B (Brood/Number Young)									
10	4	6	0	5	10	14	0	0		
9	3	3	0	5	6	0	6	0		
8	4	5	0	7	10	17	0	5		
7	3	5	0	6	9	16	0	4		
6	3	1	0	9	9	16	0	12-8-10		
5	4	5	0	6	10	12	0	1		
4	4	5	0	6	9	16	0	12-8-1		
3	4	1	0	6	10	14	0	10		
2	3	4	0	8	10	13	0	0		
1	3	5	0	4	8	13	0	12-8-14	-3	
Day	4/11	5/11	6/11	7/11	8/11	9/11	10/11	11/11		

Row	C (Brood/Number Young)									
10	3	4	0	0	11	15	0	6		
9	4	6	5	0	5	15	0	12-8-10		
8	4	5	5	0	9	13	0	12-8-13	-7	
7	4	1	0	5	11	17	0	12-8-10		
6	5	4	0	5	10	13	0	12-8-15	-6	
5	4	3	0	0	9	14	0	12-8-18	-5	
4	4	6	4	0	9	15	0	12-8-1		
3	3	4	0	0	11-2	16	0	12-8-1		
2	4	1	5	0	11	15	0	12-8-16	-4	
1	4	4	0	5	9	13	0	12-8-10		
Day	4/11	5/11	6/11	7/11	8/11	9/11	10/11	11/11		

Day-Date--Time--Temp--Hed--Food--Algae	Day-Date--Time--Temp--Hed--Food--Algae	Day-Date--Time--Temp--Hed--Food--Algae	Day-Date--Time--Temp--Hed--Food--Algae
0 4-11-93			
1 4-12			
2 4-13			
3 4-14 1230 75.3 1302 CH-14 A0425	8 4-19 1725 75.3 1305 CH-16 A0421		
4 4-15 1600 75.3 1362 CH-15 A0425	9 4-20 1816 74.4 13.6 CH-16 A0421		
5 4-16 600 75.3 1302 CH-15 A-176	10 4-21 1000 75.3 1306 CH-16 A0421		
6 4-17 740 75.3 1305 CH-15 A0426	11 4-22 0716 102.4 102.5		
7 4-18 1010 76.3 1305 CH-15 A0426	12		
	13		
	14		

NOTES:

4-11-93

1291/E11-13/A423

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

CERIODAPHNIA BROOD RECORD SHEET

Batch ID: 1111
 Date: 4-11-93
 Tray: _____

Page No.: 1 of 1
 Personnel: DRH/JDT
 Reviewed By: sm

Brood So:
 =====

Row 5 (Brood/Number Young)

10	2	3	0	4	3	3	0	0			
9	0	3	0	0	3	14	1	0			
8	3	4	4	0	0	12	0	0			
7	3	1	11	0	0	11	0	0	15	+8	
6	0	6	4	0	0	12	0	0	0		
5	4	1	6	0	3	11	0	0	30		
4	1	1	0	2	3	10	0	0	135		
3	1	4	4	0	0	11	0	0	0	I. Rel. & 11	
2	3	3	4	0	4	10	0	0	0		
1	5	1	4	0	1	11	0	0	0		
Day	4/11	5/11	6/11	7/11	8/11	9/11	10/11	11/11			

Row 6 (Brood/Number Young)

10	1	1	0	4	1/2	0	0	0			
9	1	1	0	2	5	10	0	0			
8	2	1	0	3	4	10	0	0			
7	1	1	0	5	4	0	0	0			
6	1	1	0	5	3	10	0	0			
5	1	1	0	5	1/3	9	0	0	2		
4	1	1	0	0	0	8	0	0	0		
3	1	1	0	5	1/6	0	0	0	0		
2	1	3	0	2	1/6	0	0	0	0		
1	3	5	0	4	3	10	0	0	0		
Day	4/11	5/11	6/11	7/11	8/11	9/11	10/11	11/11			

Row 7 (Brood/Number Young)

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

Day	Date	Time	Temp	Med	Food	Algae	Day	Date	Time	Temp	Med	Food	Algae
0	4-11-93						8	4-11	1325	36.3	1325	0116	A14
1	4-11						9	4-11	1145	35.4	1325	0116	A14
2	4-13						10	4-11	1000	36.3	1301	0116	A14
3	4-14	1230	25.3	1302	0114	A126	11	4-13	1015	36.3	1301	0116	A14
4	4-15	1000	25.3	1302	0115	10425	12						
5	4-16	910	25.3	1302	0115	10425	13						
6	4-17	941	25.3	1305	0115	10426	14						
7	4-18	1010	25.3	1305	0115	10426							

NOTES:

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

INITIAL CHEMISTRY

Study DDC Study I (CAERP Pilot Study)Personnel HarsanyiDate 4-22-93Beginning Date 4-22-9304-18-93 CecilRussellEnding Date 04-29-93 FishSimbeck

By	D/S/OH	DRY/OJS	DRY/OJS	DRY/OJS	DRY/OJS	DRY/OJS	Cur	Cur	Cur	Cur	Cur
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
F-MED H1308	22.8	24.8	8.4	8.1	339	5.6	95.8	6.3	63		
CRM 9.0 50% F		24.9	8.3	8.1	300						
Aeration 1001-1007 CRM 9.0 15.5% F	2.4+ 3.4	24.8	9.6° 8.4	7.7° 8.0	262	7.2	123.1	10.0	100	40.1	40.1
ID # 1284Q											
PK 1.6 50% F		25.0	8.3	8.0	283						
Aeration 1001-1006 PK 1.6 100% F	2.9+ 3.3	25.1	9.4° 8.4	7.6° 7.8	226	6.0	102.6	7.3	73	40.1	40.1
ID # 1279Q											
C-MED H1307	22.2	24.8	8.34	8.1	323	5.5	94.1	6.3	63		
CRM 9.0 50% C		25.1	8.2	8.0	285						
PK 1.6 50% C		25.0	8.3	7.9	269						

NOTES: *Before aeration

PLARC501-252

Reviewed By: O.H./cur

INITIAL CHEMISTRY

Study DOE Study I (CRERP Pilot Study)

Personnel Hawkey

Date 4-23-93

Beginning Date 4-22-93

Russell

Ending Date 04-29-93 FIVE

Simbeck

By	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
<u>AS</u>											
F-MED #1310	23.4	24.9	8.4	8.2	346						
CRM 9.0 50% F		25.1	8.2	8.1	303						
variation 0739-0747 CRM 9.0 100% F	4.8°	25.1	9.9° 8.3	7.6° 8.1	262						
ID # 1284Q											
PEK 1.6 50% F		25.2	8.2	8.0	286						
variation 0739-0750 PEK 1.6 100% F	4.8°	25.1	9.9° 8.3	7.4° 7.8	226						
ID # 1279Q											
C-MED #1307	23.0	25.1	8.4	8.1	322						
CRM 9.0 50% C		25.0	8.2	8.1	287						
PEK 1.6 50% C		25.0	8.2	8.0	268						

NOTES: A Before aeration

PLARC501-252

Reviewed By: BA

INITIAL CHEMISTRY

Page 1 of 1Study DDC Study I (CRER Pilot Study)Personnel HawkeyBeginning Date 4-22-93Date 4-24-93RussellEnding Date 04-29-93Simbeck

By	DH	DH	DH	DH	DH	Cur		Cur	GLK	UR	Cur
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
1310 F-MED H 1319 DH	23.8	25.4	8.2	8.3	347	5.7	97.5	6.1	61		
CRM 9.0 50% F		25.1	8.2	8.2	308						
1130-1137 CRM 9.0 100% F	6.6 ^c	25.3	9.9[*] 8.5	8.0[*] 8.2	275	7.7 ^A	131.7	10.8 ^A	108	20.1	20.1
ID # 1290 Q											
PEK 1.6 50% F		25.0	8.2	8.1	267						
1130-1135 PEK 1.6 100% F	6.2 ^c	25.3	9.3[*] 8.3	7.6[*] 7.8	188	4.9 ^A	83.8	5.6 ^A	56	20.1	20.1
ID # 1285 Q											
C-MED H 1307	23.3	25.0	8.2	8.2	322						
CRM 9.0 50% C		25.4	8.1	8.2	293						
PEK 1.6 50% C		25.3	8.1	8.0	252						

NOTES: * Before Aeration

PLARC501-252

Δ repeated

Reviewed By: OH/ae

INITIAL CHEMISTRY

Page 1 of 1Study DOC Study I (CERP Pilot Study)Personnel HawkeyBeginning Date 4-22-93Date 4-25-93RussellEnding Date 04-29-93 F.W.Simbeck

By	DH	DH	DH	DH	DH	N/A		n/A		n/n	
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
F-MED H/1310	23.6	25.4	8.3	8.3	348						
CRM 9.0 50% F		25.1	8.2	8.3	310						
0830-0837 CRM 9.0 100% F	4.0	25.1	10.0* 8.3	8.1* 8.2	274						
ID # 12909											
PK 1.6 50% F		25.3	8.2	8.1	268						
0830-0835 PK 1.6 100% F	4.5	25.2	9.2* 8.3	7.6* 7.8	187						
ID # 12859											
C-MED H/1307	23.3	25.2	8.2	8.3	328						
CRM 9.0 50% C		25.2	8.1	8.3	296						
PK 1.6 50% C		25.2	8.1	8.1	255						

NOTES: X Before Aeration

PLARC501-252

Reviewed By: DM/ae

INITIAL CHEMISTRY

Page 1 of 1Study IDE Study I (CRERP Pilot Study)Personnel HawkingDate 04-26-93Beginning Date 4-22-93
04-28-93 CensorRussellEnding Date 04-29-93 FISHSimbeck

By	DH	DH	DH	DH	DH	CUR		CUR	CUR	n/a	n/a
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
F-MED H 1310	23.0	25.5	8.3	8.3	350						
CRM 9.0 50% F		25.3	8.2	8.2	310						
0812-0820 CRM 9.0 100% F	3.2	25.4	10.0 8.3	8.0 8.2	274	7.7	131.7	10.3	103		
ID # 12900											
PK 1.6 50% F		25.3	8.2	8.1	268						
0812-0819 PK 1.1 100% F	3.5	25.4	9.8 8.3	7.6 7.9	187	4.9	83.8	5.6	56		
ID # 12850											
C-MED H 1307	22.2	25.4	8.3	8.2	334						
CRM 9.0 50% C		25.1	8.1	8.2	301						
PK 1.6 50% C		25.4	8.1	8.0	256						

NOTES:

* Balance Reaction

PLARC501-252

Reviewed By: Witt/Care

INITIAL CHEMISTRY

Study IBC Study I (CRERP Pilot Study)Personnel HawesburyBeginning Date 4-22-93Date 4-27-93RussellEnding Date 04-24-9304-28-93 Center04-24-93 FigsSimbeck

By	DH	DH	DH	DH	DH	⁰⁴⁻²⁷⁻⁹³ Cue bCue		Cue	bCue	Cue	Cue
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
F-MED H 1316	26.4	25.0	7.9	8.3	340 298	5.5	94.1	6.5	65		
					GE 042791						
CRM 4.0 50% F		24.9	8.1	8.3	298						
0921-0929 CRM 4.0 100% F	2.4	25.1	9.6 8.3	8.2 8.3	261	7.4 ^A	126.5	10.2 ^A	102 102	20.1	20.1
									GE 042791		
ID # 1296Q											
PK 1.1 50% F		25.0	8.1	8.2	271						
0921-0929 PK 1.1 100% F	2.0	25.4	9.2 8.3	7.8 8.0	205	5.3 ^A	90.6	6.4 ^A	64	20.1	20.1
ID # 1291Q											
C MED H 1309	24.3	25.0	8.2	8.3	320	5.5	94.1	6.3	63		
CRM 4.0 50% C		25.1	8.1	8.3	286						
PK 1.1 50% C		25.0	8.1	8.1	255						

NOTES: & Define Hierarchy

PLARC501-252

^A repeatedReviewed By: PH/cuz

INITIAL CHEMISTRY

Study IDE Study I (KERP Pilot Study)Personnel HarcourtBeginning Date 4-22-93
04 28 93 CondDate 4-28-93RussellEnding Date 04 24 93 TestSimbeck

By	DH	DH	DH	DH	DH	Cap		Cur	Cur		
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
F-MED #1317	26.2	25.1	8.0	8.3	337	5.6	95.8	16.3	6.3		
CRM 9.0 50% F		25.0	8.1	8.3	298						
0700-0708											
CRM 9.0 100% F	4.3	25.4	10.0* 8.3	8.2* 8.3	263						
ID # 12964											
PKK 1.6 50% F		24.9	8.1	8.2	272						
0700-0706											
PKK 1.6 100% F	3.3	25.4	9.7* 8.3	7.8* 8.1	203						
ID # 12919											
C-MED #1369	23.3	25.0	8.3	8.3	320						
CRM 9.0 50% C		25.3	8.2	8.3	290						
PKK 1.1 50% C		25.3	8.3	8.2	261						

NOTES: * Below Attention

PLARC501-252

Reviewed By: 8246 / C. H.

Study DOE Study I (CRP-Pilot Study)

Beginning Date 4-22-93

Date 4-23-93

Ending Date 04-28-93 Control
04-29-93 Fish

Personnel Hawaway

Russell

Simbeck

Sample ID	By Rep.	Fish			
		DRH	DRH	DRH	DRH
		Temp.	DO	pH	Cond.
	1	25.1	6.9	7.9	
F.MED	2	25.1	6.8		310
Control	3	25.1	6.8		
	4	25.1	6.7		
	1	24.9	6.4	7.9	
CRM 9.0	2	25.0	6.4		303
50%	3	25.0	6.3		
	4	25.2	6.4		
	1	24.9	6.5	8.0	
CRM 9.0	2	24.9	6.6		267
100%	3	25.2	6.4		
	4	25.1	6.2		
	1	25.0	6.3	7.8	
PCR 1.6	2	25.1	6.0		285
50%	3	25.1	6.2		
	4	25.1	6.2		
	1	25.2	6.3	7.8	
PCR 1.6	2	25.0	6.3		232
100%	3	25.0	6.4		
	4	25.0	6.2		
	1				
	2				
	3				
	4				
	1				
	2				
	3				
	4				

Ceriodaphnia			
Temp.	Sample ID	DO	pH
25.6	1) MED	7.5	8.0
25.5	2) CRM 9.0 50%	7.6	8.1
25.4	3) CRM 9.0 100%	7.6	8.2
25.4	4) PCR 1.6 50%	7.6	8.0
25.4	5) PCR 1.6 100%	7.6	8.0
25.3			
25.3			
25.3			
25.3			
25.4			

NOTES:

Reviewed By: CHC
PLARC501-255

FINAL CHEMISTRY

Page 1 of 1

Study DOE Study I (CRERP Pilot Study)

Date 04-24-93

Beginning Date 4-22-93

Ending Date 04-28-93 Cont.
04-29-93 Fish

Personnel Haranay

Russell

Simbeck

Sample ID	By Rep.	Fish			
		DI/Cu	DI/Ku	DI/Cu	DI/Ku
		Temp.	DO	pH	Cond.
	1	25.2	6.4		
F. MED	2	25.1	6.0	7.8	
Control	3	25.3	5.7		347
	4	25.3	6.3		
	1	25.1	4.9		
CRM 9.0	2	25.3	5.2	7.7	
50%	3	25.2	5.9		304
	4	25.1	5.5		
	1	25.2	5.5		
CRM 9.0	2	25.2	5.7	7.9	
100%	3	25.2	5.6		CR 04/24/93 2267
	4	25.3	5.5		
	1	24.8	6.0		
PK 1.6	2	25.1	6.0	7.7	
50%	3	25.2	5.6		240
	4	25.2	5.6		
	1	25.1	5.3		
PK 1.6	2	24.1 04-24-93	6.0	7.8	
100%	3	25.1	6.5		229
	4	25.2	5.5		
	1				
	2				
	3				
	4				
	1				
	2				
	3				
	4				

Ceriodaphnia			
OH		OH	OH
Temp.	Sample ID	DO	pH
25.5	7.1 MED	7.2	8.1
25.5	1.0 CRM 9.0 50%	7.2	8.2
25.6	3.0 CRM 9.0 100%	7.2	8.3
25.5	7.1 PK 1.6 50%	7.2	8.1
25.5	5.0 PK 1.6 100%	7.3	8.1
25.5			
25.4			
25.5			
25.5			
25.6			

NOTES:

Reviewed By: CR / OH
PLARC501-255

Study DOE Study I (CERD Pilot Study)Date 04-25-93Beginning Date 4-22-9304-28-93 ContoEnding Date 04-29-93 FinPersonnel HarawayRussellSimbeck

Sample ID	By Rep.	Fish			
		DH	DH	DH	DH
		Temp.	DO	pH	Cond.
	1	25.1	6.6		
F MED	2	25.1	6.4		
Control	3	24.9	6.4	7.9	
	4	25.1	6.2		348
	1	25.0	6.1		
CRM 9.0	2	24.9	6.2		
50%	3	24.9	6.5	8.1	
	4	24.9	6.5		313
	1	24.9	6.2		
CRM 9.0	2	24.8	6.4		
100%	3	24.9	6.2	8.1	
	4	25.1	5.7		278
	1	24.6	6.5		
PCR 1.6	2	25.1	6.5		
50%	3	24.8	6.5	7.9	
	4	25.1	5.5		270
	1	25.0	5.8		
PCR 1.6	2	25.2	5.9		
100%	3	25.1	6.2	7.8	
	4	25.2	6.2		189
	1				
	2				
	3				
	4				
	1				
	2				
	3				
	4				

NOTES:

Ceriodaphnia			
DH		DH	DH
Temp.	Sample ID	DO	pH
25.6	7 F MED	7.4	8.1
25.4	10 CRM 9.0 50%	7.4	8.2
25.5	3 CRM 9.0 100%	7.3	8.4
25.4	7 PCR 1.6 50%	7.7	8.1
25.4	5 PCR 1.6 100%	7.4	8.1
25.5			
25.5			
25.3			
25.5			
25.4			

Study DOE Study I (CRERP Pilot Study)Beginning Date 4-22-93Date 04-26-93

Ending Date

04-28-93 Cont.04-29-93 FishPersonnel WanwayRussellSimbeck

Sample ID	By Rep.	Fish			
		D11	D11	D11	D11
		Temp.	DO	pH	Cond.
	1	25.4	5.4		350
F. MEN	2	25.3	5.8		
Control	3	25.4	5.9		
	4	25.3	5.9	7.8	
	1	25.2	5.6		312
CRM 9.0	2	25.2	5.5		
50%	3	25.1	5.7		
	4	25.1	5.9	7.9	
	1	25.3	5.6		277
CRM 9.0	2	25.2	5.7		
100%	3	25.3	5.0		
	4	25.3	5.1	7.9	
	1	25.0	5.2		770
PK 1.6	2	25.2	5.3		
50%	3	25.2	5.4		
	4	25.1	6.0	7.7	
	1	25.1	5.5		190
PK 1.6	2	25.2	5.2		
100%	3	25.3	5.9		
	4	25.3	5.9	7.6	
	1				
	2				
	3				
	4				
	1				
	2				
	3				
	4				

NOTES:

Ceriodaphnia			
OH		OH	OH
Temp.	Sample ID	DO	pH
25.7	7.1 MED	7.4	8.1
25.7	1.0 CRM 9.0 50%	7.4	8.2
25.6	3.0 CRM 9.0 100%	7.4	8.2
25.6	4.0 PK 1.6 50%	7.4	8.1
25.5	5.0 PK 1.6 100%	7.4	8.0
25.4			
25.5			
25.4			
25.5			
25.4			

Study DOE Study I (NERP Pilot Study)Beginning Date 4-22-93Date 04-27-93Ending Date 04-29-93 FishPersonnel HarawayRussellSimbeck

Sample ID	By Rep.	Fish			
		DH	DH	DH	LH
		Temp.	DO	pH	Cond.
	1	25.2	5.1	7.7	
F. MED	2	25.2	5.3		354
Control	3	25.3	5.0		
	4	25.1	5.8		
	1	25.2	5.1	7.7	
CRM 9.0	2	25.4	4.5		316
50%	3	25.2	5.4		
	4	25.0	5.2		
	1	25.2	5.3	7.9	
CRM 9.0	2	25.2	5.1		279
100%	3	25.3	4.8		
	4	25.3	4.6		
	1	25.0	5.4	7.6	
PK 1.6	2	25.2	4.1		272
50%	3	25.1	5.3		
	4	25.4	4.7		
	1	25.1	4.8	7.6	
PK 1.6	2	25.3	4.7		190
100%	3	25.2	5.2		
	4	25.2	5.2		
	1				
	2				
	3				
	4				
	1				
	2				
	3				
	4				

NOTES:

Ceriodaphnia			
OH		DH	SH
Temp.	Sample ID	DO	pH
25.6	7. MED	7.6	8.1
25.5	10. CRM 9.0 50%	7.5	8.2
25.4	3. CRM 9.0 100%	7.6	8.3
25.4	4. PK 1.6 50%	7.5	8.1
25.3	5. PK 1.6 100%	7.6	8.0
25.3			
25.3			
25.3			
25.4			
25.4			

FINAL CHEMISTRY

Page 1 of 1

Study DOE Study I (CLEAR Pilot Study)
Beginning Date 4-22-93 Date 04-28-93
04-28-93 Conto
Ending Date 04-29-93 Filt

Personnel Haranay
Russell
Simbeck

Sample ID	By	Fish			
		Temp.	DO	pH	Cond.
	Rep.				
	1	25.1	5.2		
F MARD	2	25.1	5.6	7.7	
Control	3	25.1	5.1		341
	4	25.2	5.2		
	1	24.9	5.7		
CRM 9.0	2	25.2	4.7	7.7	
50%	3	25.1	5.2		303
	4	25.2	5.2		
	1	24.8	5.0		
CRM 9.0	2	25.1	5.0	7.8	
100%	3	25.2	5.4		265
	4	25.1	4.8		
	1	24.7	5.8		
PCR 1.6	2	25.1	5.1	7.7	
50%	3	25.0	5.6		272
	4	25.1	4.6		
	1	24.9	5.0		
PCR 1.6	2	25.1	5.1	7.6	
100%	3	24.9	5.7		205
	4	24.9	5.4		
	1				
	2				
	3				
	4				
	1				
	2				
	3				
	4				

Ceriodaphnia			
Temp.	Sample ID	DO	pH
25.5	7X MED	7.5	8.0
25.5	100% CRM 9.0 50%	7.5	8.2
25.5	300% CRM 9.0 100%	7.5	8.2
25.4	300% PCR 1.6 50%	7.5	8.1
25.4	500% PCR 1.6 100%	7.5	8.0
25.3			
25.4			
25.4			
25.3			
25.3			

NOTES:

Reviewed By: WTK/ave
PLARC501-255

Study DOE Study I (CLRP Pilot Study)

Beginning Date 4-22-93

Date 04-29-93

Ending Date 04-28-93 - Cont.
04-29-93 Fish

Personnel Hawman

Russell

Simbeck

Sample ID	By Rep.	Fish			
		Temp.	DO	pH	Cond.
	1	25.1	6.2		
FMED	2	25.1	5.8		
Control	3	25.2	6.1	7.8	
	4	25.0	6.1		344
	1	25.1	5.7		
CRM 9.0	2	25.2	5.7		
50%	3	25.1	5.8	7.8	
	4	25.2	5.9		303
	1	25.3	5.5		
CRM 9.0	2	25.3	5.3		
100%	3	25.3	5.7	7.9	
	4	25.3	5.4		268
	1	24.8	6.0		
PCR 1.6	2	25.2	5.3		
50%	3	25.2	6.0	7.3	
	4	25.2	5.6		271
	1	25.2	5.6		
PCR 1.6	2	25.3	5.4		
100%	3	25.2	5.0	7.6	
	4	25.2	6.1		205
	1				
	2				
	3				
	4				
	1				
	2				
	3				
	4				

Ceriodaphnia			
Temp.	Sample ID	DO	pH
	FMED		
	CRM 9.0 50%		
	CRM 9.0 100%		
	PCR 1.6 50%		
	PCR 1.6 100%		

NOTES:

INITIAL CHEMISTRY

MEDIUM (FISH) ✓

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	22.0	24.0	8.4	8.1	339	95.8	63	---
1	23.4	24.9	8.4	8.2	346	---	---	---
2	23.8	25.1	8.2	8.3	347	97.5	61	---
3	23.6	25.4	8.3	8.3	348	---	---	---
4	23.0	25.5	8.3	8.3	350	---	---	---
5	26.4	25.0	7.9	8.3	340	94.1	65	---
6	26.2	25.1	8.0	8.3	337	95.0	63	---
MEAN	24.2	25.2	8.2	8.3	344	95.8	63	---
MIN	22.0	24.0	7.9	8.1	337	94.1	61	---
MAX	26.4	25.5	8.4	8.3	350	97.5	65	---

CRM 2.0 50% W/F-MEDIUM ✓

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	---	24.9	8.3	8.1	300	---	---	---
1	---	25.1	8.2	8.1	303	---	---	---
2	---	25.1	8.2	8.2	308	---	---	---
3	---	25.1	8.2	8.3	310	---	---	---
4	---	25.3	8.2	8.2	310	---	---	---
5	---	24.9	8.1	8.3	298	---	---	---
6	---	25.0	8.1	8.3	298	---	---	---
MEAN	0.0	25.1	8.2	8.2	304	0.0	0	---
MIN	0.0	24.9	8.1	8.1	298	0.0	0	---
MAX	0.0	25.3	8.3	8.3	310	0.0	0	---

CRM 4.0 100% W/F-MEDIUM ✓

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	---	3.4	24.0	8.4	8.0	262	123.1	100
1	---	4.8	25.1	8.3	8.1	262	---	---
2	---	6.6	25.3	8.3	8.2	275	131.7	108
3	---	4.0	25.1	8.3	8.2	274	---	---
4	---	3.2	25.4	8.3	8.2	274	131.7	108
5	---	2.4	25.1	8.3	8.3	261	126.5	102
6	---	4.3	25.4	8.3	8.3	263	---	---
MEAN	4.1	25.2	8.3	8.2	267	128.3	105	<0.1
MIN	2.4	24.0	8.3	8.0	261	123.1	100	<0.1
MAX	6.6	25.4	8.4	8.3	275	131.7	108	<0.1

CRM 1.6 50% W/F-MEDIUM ✓

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	---	25.0	8.3	8.0	283	---	---	---
1	---	25.2	8.2	8.0	286	---	---	---
2	---	25.0	8.2	8.1	267	---	---	---
3	---	25.3	8.2	8.1	268	---	---	---
4	---	25.1	8.2	8.1	268	---	---	---
5	---	25.0	8.1	8.2	271	---	---	---
6	---	24.0	8.1	8.2	272	---	---	---
MEAN	0.0	25.1	8.2	8.1	274	0.0	0	---
MIN	0.0	24.0	8.1	8.0	267	0.0	0	---
MAX	0.0	25.3	8.2	8.2	286	0.0	0	---

CRM 1.6 100% W/F-MEDIUM ✓

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	---	25.1	8.4	7.8	226	---	---	---
1	---	25.1	8.3	7.8	226	---	---	---
2	---	25.1	8.3	7.8	226	---	---	---
3	---	25.1	8.3	7.8	226	---	---	---
4	---	25.1	8.3	7.8	226	---	---	---
5	---	25.1	8.3	7.8	226	---	---	---
6	---	25.1	8.3	7.8	226	---	---	---
MEAN	0.0	25.1	8.3	7.8	226	---	---	---
MIN	0.0	25.1	8.3	7.8	226	---	---	---
MAX	0.0	25.1	8.3	7.8	226	---	---	---

MEDIUM (CRUD) ✓

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	22.2	24.9	8.4	8.1	122	---	---	---
1	23.0	25.1	8.4	8.1	122	---	---	---
2	23.3	25.0	8.2	8.2	122	---	---	---
3	23.3	25.2	8.2	8.3	122	---	---	---
4	22.2	25.1	8.3	8.2	122	---	---	---
5	24.1	25.2	8.2	8.3	122	---	---	---
6	23.3	25.0	8.3	8.1	122	---	---	---
MEAN	23.1	25.1	8.3	8.2	122	---	---	---
MIN	22.2	24.9	8.2	8.1	122	---	---	---
MAX	24.1	25.2	8.4	8.3	122	---	---	---

CRM 0.0 50% W/F-MEDIUM ✓

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	---	25.1	8.2	8.0	275	---	---	---
1	---	25.2	8.2	8.1	275	---	---	---
2	---	25.2	8.1	8.2	271	---	---	---
3	---	25.2	8.1	8.3	276	---	---	---
4	---	25.1	8.1	8.2	261	---	---	---
5	---	25.1	8.1	8.3	286	---	---	---
6	---	25.2	8.2	8.3	288	---	---	---
MEAN	0.0	25.2	8.1	8.2	271	0.0	0	---
MIN	0.0	25.0	8.1	8.0	261	0.0	0	---
MAX	0.0	25.2	8.2	8.3	288	0.0	0	---

CRM 1.6 50% W/F-MEDIUM ✓

DAY	INITIAL TEMP	WARMED TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	---	25.0	8.3	7.9	269	---	---	---
1	---	25.0	8.2	8.0	269	---	---	---
2	---	25.1	8.1	8.0	272	---	---	---
3	---	25.2	8.1	8.1	275	---	---	---
4	---	25.2	8.1	8.0	276	---	---	---
5	---	25.0	8.1	8.1	275	---	---	---
6	---	25.1	8.3	8.2	261	---	---	---
MEAN	0.0	25.1	8.2	8.0	271	0.0	0	---
MIN	0.0	25.0	8.1	7.9	269	0.0	0	---
MAX	0.0	25.2	8.3	8.2	276	0.0	0	---

WATER (1991)

DAY	TEMP	DW	pH	COND
1	25.1	6.3	7.8	340
2	25.1	6.4	7.8	347
3	25.1	6.4	7.9	348
4	25.1	6.4	7.8	350
5	25.1	6.4	7.7	354
6	25.1	6.4	7.7	341
7	25.1	6.4	7.8	344
MEAN	25.2	6.4	7.8	346
MIN	24.9	6.0	7.7	340
MAX	25.4	6.9	7.9	354

PCW 1.6 50% W/P-MEDIUM

DAY	TEMP	DW	pH	COND
1	25.1	6.3	7.8	308
2	25.1	6.4	7.7	309
3	25.1	6.4	7.7	310
4	25.1	6.4	7.7	311
5	25.1	6.4	7.7	312
6	25.1	6.4	7.7	313
7	25.1	6.4	7.8	314
MEAN	25.1	6.4	7.8	310
MIN	24.9	6.0	7.7	308
MAX	25.4	6.9	7.9	316

PCW 1.6 100%

DAY	TEMP	DW	pH	COND
1	25.1	6.3	7.8	285
2	25.1	6.4	7.8	290
3	25.1	6.4	7.9	270
4	25.1	6.4	7.7	270
5	25.1	6.4	7.6	272
6	25.1	6.4	7.7	272
7	25.1	6.4	7.8	274
MEAN	25.1	6.4	7.7	276
MIN	24.9	6.0	7.6	270
MAX	25.4	6.9	7.9	290

PCW 1.6 50% W/P-MEDIUM

DAY	TEMP	DW	pH	COND
1	25.1	6.3	7.8	285
2	25.1	6.4	7.8	290
3	25.1	6.4	7.9	270
4	25.1	6.4	7.7	270
5	25.1	6.4	7.6	272
6	25.1	6.4	7.7	272
7	25.1	6.4	7.8	274
MEAN	25.1	6.4	7.7	276
MIN	24.9	6.0	7.6	270
MAX	25.4	6.9	7.9	290

PCW 1.6 100%

DAY	TEMP	DW	pH	COND
1	25.1	6.3	7.8	212
2	25.1	6.4	7.8	229
3	25.1	6.4	7.8	189
4	25.1	6.4	7.6	190
5	25.1	6.4	7.6	190
6	25.1	6.4	7.6	205
7	25.1	6.4	7.6	205
MEAN	25.1	6.4	7.7	206
MIN	24.9	6.0	7.6	189
MAX	25.3	6.9	7.8	232

MEAN TEMPERATURE 25.1

MINIMUM: 24.6
MAXIMUM: 25.4

PERIOD 1

PERIOD 1 (PERIOD)

DAY	DO	PH
1	7.5	8.0
2	7.2	8.1
3	7.4	8.1
4	7.4	8.1
5	7.6	8.1
6	7.5	8.0
7	-	-

MEAN 7.4 8.1

MIN 7.2 8.0
MAX 7.6 8.1

PERIOD 2 (PERIOD)

DAY	DO	PH
1	7.6	8.2
2	7.2	8.2
3	7.4	8.2
4	7.4	8.2
5	7.6	8.2
6	7.5	8.2
7	-	-

MEAN 7.4 8.2

MIN 7.2 8.1
MAX 7.6 8.2

PERIOD 3 (PERIOD)

DAY	DO	PH
1	7.6	8.2
2	7.2	8.2
3	7.4	8.2
4	7.4	8.2
5	7.6	8.2
6	7.5	8.2
7	-	-

MEAN 7.4 8.2

MIN 7.2 8.1
MAX 7.6 8.2

PERIOD 4 (PERIOD)

DAY	DO	PH
1	7.6	8.2
2	7.2	8.2
3	7.4	8.2
4	7.4	8.2
5	7.6	8.2
6	7.5	8.2
7	-	-

MEAN 7.4 8.2

MIN 7.2 8.1
MAX 7.6 8.2

PERIOD 5 (PERIOD)

DAY	DO	PH
1	7.6	8.0
2	7.3	8.1
3	7.4	8.1
4	7.4	8.0
5	7.6	8.0
6	7.5	8.0
7	-	-

MEAN 7.5 8.0

MIN 7.3 8.0
MAX 7.6 8.1

PERIOD 6 (PERIOD)

DAY	DO	PH
1	25.6	25.5
2	25.5	25.4
3	25.4	25.5
4	25.4	25.5
5	25.4	25.5
6	25.4	25.5
7	25.4	25.5

MEAN: 25.4

MIN: 25.4

MAX: 25.7

Reviewed by TS

2011

Project Instrument Record Sheet

Project Study Dee Study I

Beginning Date 4-22-93

Ending Date 04-28-93 - COV
4-27-93 - Fish

DO Meter

Model YSI Model 57

TVA Tag 543347

Calibration Date 7-27-92

pH Meter(s)

Model Orion 511250

TVA Tag 510 8147

Calibration Date 11-10-92

Model Model 39514

TVA Tag 543347

Calibration Date 5-10-92

Conductivity Meter

Model Model 32

TVA Tag 543389

Calibration Date SN 8-5-93 2893

Thermometer(s)

Model Extek Stim CT-40

TVA Tag 11-204 SN-3117

Calibration Date 6-5-92

Model Extek Stim CT-40

TVA Tag 11-205

Calibration Date 6-5-92

PROJECT REAGENT RECORD SHEET

Project/Study: Dye Study I
 Personnel: DRH

Beginning Date: 4-22-93
 Ending Date: 4-25-93 cerum
4-29-93 fish

WINKLER TITRATION METHOD

Alkaline-Iodide-Azide:

Brand Riccat
 Lot # C-075
 Exp. Indef.

Manganous Sulfate:

Brand Riccat
 Lot # B295
 Exp. Indef.

Sodium Thiosulfate:

Brand Riccat
 Lot # J137
 Exp. July 93

Sulfuric Acid:

Brand Fisher
 Lot # 854507
 Exp. Indef.

Thyodene:

Brand Fisher
 Lot # 912254
 Exp. Indef.

pH BUFFER SOLUTIONS

pH 4:

Brand N/KCM
 Lot # F267
 Exp. 6-94

pH 7:

Brand Spectrum
 Lot # 116207
 Exp. July 93

pH 10:

Brand Riccat
 Lot # 11037
 Exp. Oct 93

pH _____:

Brand N/A
 Lot # _____
 Exp. _____

CONDUCTIVITY STANDARD SOLUTIONS

200 μ mhos:

Brand Biochrom
 Lot # A2721D
 Exp. 2-94

720 μ mhos:

Brand Biochrom
 Lot # 1-322C
 Exp. 12-94

_____ μ mhos:

Brand N/A
 Lot # _____
 Exp. _____

ALKALINITY TITRATION

Sulfuric Acid Solution N/50:

Brand Mt/Mac-Krodt
 Lot # H36612JEE
 Exp. Indef.

HARDNESS TITRATION

Hardness Titrating Solution:

Brand Citric Acid
 Lot # 1-1037700
 Exp. Indef.

Hardness Indicator:

Brand Citric Acid
 Lot # 1-1037700
 Exp. Indef.

Hardness Buffer Solution:

Brand Citric Acid
 Lot # 2-1037700
 Exp. Indef.

CHLORINE TITRATION

DPD Powder Pillows:

Brand HMPK
 Lot # 1-1037700
 Exp. Indef.

Potassium Iodide:

Brand Fisher
 Lot # 912254
 Exp. Indef.

FAS:

Brand Riccat
 Lot # 1-1037700
 Exp. 5-13-93

DO METER STANDARDIZATION

12

METER ID: 572

DATE: 2-18-93 TIME: 0715 BY: JRP
INITIAL READING: 7.9
WATER TEMP: 22.2°C
WINKLER #1: 7.9 #2: 8.0
X: 7.95
CORRECTED READING: 8.0

DATE: 4-18-93 TIME: 1040 BY: JRP
INITIAL READING: 8.0
WATER TEMP: 22.8°C
WINKLER #1: 8.0 #2: 8.0
X: 8.0
CORRECTED READING: 8.0

NOTES: _____

DATE: 04-19-93 TIME: 0722 BY: Cue
INITIAL READING: 22.7°C
WATER TEMP: 8.6
WINKLER #1: 8.6 #2: 8.7
X: 8.65
CORRECTED READING: 8.6

DATE: 04-19-93 TIME: 1225 BY: JRP
INITIAL READING: 23.1°C 8.6
WATER TEMP: 23.1°C
WINKLER #1: 8.5 #2: 8.5
X: 8.5
CORRECTED READING: 8.5

NOTES: _____

DATE: 04-20-93 TIME: 0630 BY: Cue
INITIAL READING: 8.3
WATER TEMP: 22.7°C
WINKLER #1: 8.3 #2: 8.5
X: 8.4
CORRECTED READING: 8.4

DATE: 04-20-93 TIME: 1030 BY: JRP
INITIAL READING: 8.5
WATER TEMP: 22.8°C
WINKLER #1: 8.3 #2: 8.3
X: 8.3
CORRECTED READING: 8.3

NOTES: _____

DATE: 04-21-93 TIME: 0121 BY: Cue
INITIAL READING: 8.6
WATER TEMP: 22.1°C
WINKLER #1: 8.7 #2: 8.5
X: 8.6
CORRECTED READING: 8.6

DATE: 04-20-93 TIME: 1211 BY: Cue
INITIAL READING: 8.5
WATER TEMP: 22.5°C
WINKLER #1: 8.6 #2: 8.5
X: 8.55
CORRECTED READING: 8.5

NOTES: _____

DATE: 04-22-93 TIME: 0643 BY: Cue
INITIAL READING: 8.6
WATER TEMP: 21.8°C
WINKLER #1: 8.7 #2: 8.6
X: 8.65
CORRECTED READING: 8.6

DATE: 4-22-93 TIME: 1211 BY: JRP
INITIAL READING: 8.6
WATER TEMP: 21.3
WINKLER #1: 8.1 #2: 8.6
X: 8.1
CORRECTED READING: 8.1

NOTES: _____

DO METER STANDARDIZATION

13

METER ID: #7

DATE: 4-23-93 TIME: 7:01 BY: DH
INITIAL READING: 8.5
WATER TEMP: 22.4
WINKLER #1: 8.5 #2: 8.4
X: 8.45
CORRECTED READING: 8.5

NOTES: _____

DATE: 4-23 TIME: 1:55 BY: 111
INITIAL READING: 8.4
WATER TEMP: 23.0
WINKLER #1: 8.4 #2: 8.2
X: 8.4
CORRECTED READING: 8.4

DATE: 4-24 TIME: 10:38 BY: DH
INITIAL READING: 7.7
WATER TEMP: 22.7
WINKLER #1: 7.9 #2: 7.9
X: 7.9
CORRECTED READING: 7.7

NOTES: _____

DATE: 4-24 TIME: 1:01 BY: 111
INITIAL READING: 7.8
WATER TEMP: 23.2
WINKLER #1: 7.8 #2: 7.7
X: 7.8
CORRECTED READING: 7.8

DATE: 4-25 TIME: 7:58 BY: DH
INITIAL READING: 7.8
WATER TEMP: 23.0°C
WINKLER #1: 7.7 #2: 7.7
X: 7.7
CORRECTED READING: 7.7

NOTES: _____

DATE: 04-25-93 TIME: 10:35 BY: 111
INITIAL READING: 23.0°C
WATER TEMP: 23.0°C
WINKLER #1: 7.8 #2: 7.7
X: 7.75
CORRECTED READING: 7.7

DATE: 4-26-93 TIME: 7:02 BY: DH
INITIAL READING: 8.3
WATER TEMP: 22.9
WINKLER #1: 8.3 #2: 8.4
X: 8.35
CORRECTED READING: 8.3

NOTES: _____

DATE: 4-26 TIME: 11 BY: 111
INITIAL READING: 7.5
WATER TEMP: 23.1
WINKLER #1: 7.5 #2: 7.5
X: 7.5
CORRECTED READING: 7.5

DATE: 4-27-93 TIME: 7:00 BY: DH
INITIAL READING: 8.1
WATER TEMP: 23.0°C
WINKLER #1: 8.2 #2: 8.1
X: 8.15
CORRECTED READING: 8.1

NOTES: _____

DATE: 4-27-93 TIME: 12:12 BY: DH
INITIAL READING: 8.0
WATER TEMP: 23.1
WINKLER #1: 8.0 #2: 7.1
X: 7.75
CORRECTED READING: 7.75

DO METER STANDARDIZATION

METER ID: # 2

DATE: 4-28 TIME: 6:23 BY: DH
 INITIAL READING: 8.0
 WATER TEMP: 22.9
 WINKLER #1: 8.1 #2: 8.2
 X: 8.15
 CORRECTED READING: 8.1

DATE: 4-28 TIME: 12:15 BY: DH
 INITIAL READING: 8.1
 WATER TEMP: 23.3
 WINKLER #1: 8.1 #2: 8.0
 X: 8.05
 CORRECTED READING: 8.1

NOTES: _____

DATE: 4-28 TIME: 9:08 BY: DH
 INITIAL READING: 8.1
 WATER TEMP: 22.8
 WINKLER #1: 8.1 #2: 8.0
 X: 8.05
 CORRECTED READING: 8.1

DATE: 05-03-93 TIME: 0558 BY: Cue
 INITIAL READING: 7.9
 WATER TEMP: 23.1 °C
 WINKLER #1: 8.1 #2: 8.0
 X: 8.05
 CORRECTED READING: 8.0

NOTES: _____

used winker on hr of standardization → *same as 05-03-93*

DATE: 05-04-93 TIME: 0600 BY: Cue
 INITIAL READING: 8.0
 WATER TEMP: 23.3 °C
 WINKLER #1: 8.0 #2: 7.9
 X: 7.95
 CORRECTED READING: 8.0

DATE: 05-04-93 TIME: 1458 BY: Cue
 INITIAL READING: 7.8
 WATER TEMP: 23.1 °C
 WINKLER #1: 7.7 #2: 7.9
 X: 7.8
 CORRECTED READING: 7.8

NOTES: _____

DATE: 5-5-93 TIME: 7:23 BY: DH
 INITIAL READING: 7.7
 WATER TEMP: 22.7
 WINKLER #1: 7.4 #2: 7.5
 X: 7.45
 CORRECTED READING: 7.5

DATE: 5-5-93 TIME: 12:30 BY: DH
 INITIAL READING: 7.5
 WATER TEMP: 23.1
 WINKLER #1: 7.4 #2: 7.5
 X: 7.45
 CORRECTED READING: 7.5

NOTES: _____

DATE: 5-6-93 TIME: 7:12 BY: DH
 INITIAL READING: 7.7
 WATER TEMP: 22.7
 WINKLER #1: 7.6 #2: 7.6
 X: 7.6
 CORRECTED READING: 7.6

DATE: 5-6 TIME: 1:37 BY: DH
 INITIAL READING: 7.7
 WATER TEMP: 22.8
 WINKLER #1: 7.8 #2: 7.7
 X: 7.75
 CORRECTED READING: 7.7

NOTES: _____

pH METER STANDARDIZATION

24

METER ID: # 7

DATE: <u>4-21-93</u> TIME: <u>0731</u> BY: <u>GKK</u> Buffer Temp: <u>23°C</u> pH 7.0 BUFFER Initial Reading: <u>7.03</u> Corrected Reading: <u>7.00</u> pH 4.0/10.0 BUFFER Initial Reading: <u>10.00</u> Corrected Reading: <u>10.00</u> % Slope: <u>99.8%</u> ADDITIONAL Reading -15 Sec: <u>7.46</u> STANDARD Reading - 1 Min: <u>7.58</u>	DATE: <u>4-21-93</u> TIME: <u>1025</u> BY: <u>J</u> Buffer Temp: <u>22.5°C</u> pH 7.0 BUFFER Initial Reading: <u>7.00</u> Corrected Reading: <u>7.00</u> pH 4.0/10.0 BUFFER Initial Reading: <u>9.99</u> Corrected Reading: <u>10.00</u> % Slope: <u>99.6%</u> ADDITIONAL Reading -15 Sec: <u>7.77</u> STANDARD Reading - 1 Min: <u>7.79</u>
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NOTES: Check at p.p.m. 04-21-93 CDR

DATE: <u>4-22-93</u> TIME: <u>0653</u> BY: <u>CW</u> Buffer Temp: <u>22.5°C</u> pH 7.0 BUFFER Initial Reading: <u>7.03</u> Corrected Reading: <u>7.00</u> pH 4.0/10.0 BUFFER Initial Reading: <u>10.00</u> Corrected Reading: <u>10.00</u> % Slope: <u>99.5%</u> ADDITIONAL Reading -15 Sec: <u>7.62</u> STANDARD Reading - 1 Min: <u>7.67</u>	DATE: <u>4-22-93</u> TIME: <u>1013</u> BY: <u>N</u> Buffer Temp: <u>22.6°C</u> pH 7.0 BUFFER Initial Reading: <u>6.97</u> Corrected Reading: <u>7.00</u> pH 4.0/10.0 BUFFER Initial Reading: <u>9.99</u> Corrected Reading: <u>10.00</u> % Slope: <u>99.7%</u> ADDITIONAL Reading -15 Sec: <u>7.71</u> STANDARD Reading - 1 Min: <u>7.70</u>
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NOTES:

DATE: <u>4-23-93</u> TIME: <u>7:07</u> BY: <u>DN</u> Buffer Temp: <u>22.6</u> pH 7.0 BUFFER Initial Reading: <u>6.96</u> Corrected Reading: <u>7.00</u> pH 4.0/10.0 BUFFER Initial Reading: <u>10.00</u> Corrected Reading: <u>10.00</u> % Slope: <u>99.9%</u> ADDITIONAL Reading -15 Sec: <u>7.75</u> STANDARD Reading - 1 Min: <u>7.78</u>	DATE: <u>4-23</u> TIME: <u>1202</u> BY: <u>OH</u> Buffer Temp: <u>23.1</u> pH 7.0 BUFFER Initial Reading: <u>7.01</u> Corrected Reading: <u>7.00</u> pH 4.0/10.0 BUFFER Initial Reading: <u>10.01</u> Corrected Reading: <u>10.00</u> % Slope: <u>99.9%</u> ADDITIONAL Reading -15 Sec: <u>7.74</u> STANDARD Reading - 1 Min: <u>7.75</u>
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NOTES:

DATE: <u>4-24-93</u> TIME: <u>6:45</u> BY: <u>DN</u> Buffer Temp: <u>23.5</u> pH 7.0 BUFFER Initial Reading: <u>7.01</u> Corrected Reading: <u>7.00</u> pH 4.0/10.0 BUFFER Initial Reading: <u>10.01</u> Corrected Reading: <u>10.00</u> % Slope: <u>99.9</u> ADDITIONAL Reading -15 Sec: <u>7.77</u> STANDARD Reading - 1 Min: <u>7.79</u>	DATE: <u>4-24</u> TIME: <u>1:07</u> BY: <u>DN</u> Buffer Temp: <u>23.7</u> pH 7.0 BUFFER Initial Reading: <u>7.01</u> Corrected Reading: <u>7.00</u> pH 4.0/10.0 BUFFER Initial Reading: <u>9.98</u> Corrected Reading: <u>10.00</u> % Slope: <u>99.5</u> ADDITIONAL Reading -15 Sec: <u>7.75</u> STANDARD Reading - 1 Min: <u>7.77</u>
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NOTES:

DATE: <u>4-25-93</u> TIME: <u>8:04</u> BY: <u>DN</u> Buffer Temp: <u>23.5</u> pH 7.0 BUFFER Initial Reading: <u>7.01</u> Corrected Reading: <u>7.00</u> pH 4.0/10.0 BUFFER Initial Reading: <u>10.01</u> Corrected Reading: <u>10.00</u> % Slope: <u>100.1</u> ADDITIONAL Reading -15 Sec: <u>7.71</u> STANDARD Reading - 1 Min: <u>7.74</u>	DATE: <u>04-25-93</u> TIME: <u>1030</u> BY: <u>CW</u> Buffer Temp: <u>24.6</u> pH 7.0 BUFFER Initial Reading: <u>7.00</u> Corrected Reading: <u>7.00</u> pH 4.0/10.0 BUFFER Initial Reading: <u>9.98</u> Corrected Reading: <u>10.00</u> % Slope: <u>99.8%</u> ADDITIONAL Reading -15 Sec: <u>7.51</u> STANDARD Reading - 1 Min: <u>7.60</u>
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NOTES:

pH METER STANDARDIZATION

25

METER ID: #7

DATE: 4-26-93 TIME: 7:08 BY: DM DATE: 4-26-93 TIME: 10:10 BY: yls

Buffer Temp: 23.2 Buffer Temp: 23.3

pH 7.0 BUFFER Initial Reading: 7.02 pH 7.0 BUFFER Initial Reading: 6.95

Corrected Reading: 7.00 Corrected Reading: 7.00

pH 4.0/10.0 Initial Reading: 9.99 pH 4.0/10.0 Initial Reading: 9.95

BUFFER Corrected Reading: 10.00 BUFFER Corrected Reading: 10.00

% Slope: 100.2% % Slope: 99.7%

ADDITIONAL Reading -15 Sec: 7.74 ADDITIONAL Reading -15 Sec: _____

STANDARD Reading - 1 Min: 7.74 STANDARD Reading - 1 Min: _____

NOTES: _____

DATE: 4-27-93 TIME: 7:06 BY: DM DATE: 4-27-93 TIME: 10:38 BY: JI

Buffer Temp: 23.1 Buffer Temp: 23.2

pH 7.0 BUFFER Initial Reading: 6.97 pH 7.0 BUFFER Initial Reading: 7.07

Corrected Reading: 7.00 Corrected Reading: 7.00

pH 4.0/10.0 Initial Reading: 10.00 pH 4.0/10.0 Initial Reading: 9.99

BUFFER Corrected Reading: 10.00 BUFFER Corrected Reading: 10.00

% Slope: 100.1% % Slope: 100.0%

ADDITIONAL Reading -15 Sec: 7.77 ADDITIONAL Reading -15 Sec: 7.73

STANDARD Reading - 1 Min: 7.78 STANDARD Reading - 1 Min: 7.71

NOTES: _____

DATE: 4-28-93 TIME: 06:18 BY: Cuz DATE: 4-28-93 TIME: 10:25 BY: JI

Buffer Temp: 23.3°C Buffer Temp: 24.0°C

pH 7.0 BUFFER Initial Reading: 6.98 pH 7.0 BUFFER Initial Reading: 7.00

Corrected Reading: 7.00 Corrected Reading: 7.00

pH 4.0/10.0 Initial Reading: 10.00 pH 4.0/10.0 Initial Reading: 9.99

BUFFER Corrected Reading: 10.00 BUFFER Corrected Reading: 10.00

% Slope: 100.2% % Slope: 100.0%

ADDITIONAL Reading -15 Sec: 7.54 ADDITIONAL Reading -15 Sec: 7.51

STANDARD Reading - 1 Min: 7.62 STANDARD Reading - 1 Min: 7.62

NOTES: _____

DATE: 4-29 TIME: 9:20 BY: DM DATE: 4-29-93 TIME: 10:32 BY: JI

Buffer Temp: 23.8 Buffer Temp: 23.9

pH 7.0 BUFFER Initial Reading: 7.01 pH 7.0 BUFFER Initial Reading: 7.01

Corrected Reading: 7.00 Corrected Reading: 7.00

pH 4.0/10.0 Initial Reading: 9.99 pH 4.0/10.0 Initial Reading: 9.99

BUFFER Corrected Reading: 10.00 BUFFER Corrected Reading: 10.00

% Slope: 100.0% % Slope: 99.6%

ADDITIONAL Reading -15 Sec: 7.77 ADDITIONAL Reading -15 Sec: 7.77

STANDARD Reading - 1 Min: 7.78 STANDARD Reading - 1 Min: 7.16

NOTES: _____

DATE: 4-30-93 TIME: 06:11 BY: CR DATE: 5-3-93 TIME: 10:20 BY: JI

Buffer Temp: 23.7°C Buffer Temp: 24.1°C

pH 7.0 BUFFER Initial Reading: 7.06 pH 7.0 BUFFER Initial Reading: 6.97

Corrected Reading: 7.00 Corrected Reading: 7.00

pH 4.0/10.0 Initial Reading: 10.02 pH 4.0/10.0 Initial Reading: 9.93

BUFFER Corrected Reading: 10.00 BUFFER Corrected Reading: 10.00

% Slope: 100.1% % Slope: 100.0%

ADDITIONAL Reading -15 Sec: 7.11 ADDITIONAL Reading -15 Sec: 7.55

STANDARD Reading - 1 Min: 7.28 STANDARD Reading - 1 Min: 7.56

NOTES: _____

pH METER STANDARDIZATION

17

METER ID: 113

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DATE: <u>04-18-93</u> TIME: <u>9:50</u> BY: <u>JPP</u>	DATE: <u>04-20-93</u> TIME: <u>10:56</u> BY: <u>CAR</u>
Buffer Temp: <u>24.0°C</u>	Buffer Temp: <u>24°C</u>
pH 7.0 BUFFER Initial Reading: <u>7.0</u>	pH 7.0 BUFFER Initial Reading: <u>7.0</u>
Corrected Reading: <u>7.0</u>	Corrected Reading: <u>7.0</u>
pH 4.0/10.0 BUFFER Initial Reading: <u>4.0</u>	pH 4.0/10.0 BUFFER Initial Reading: <u>4.0</u>
Corrected Reading: <u>4.0</u>	Corrected Reading: <u>4.0</u>
% Slope: <u>98.5%</u>	% Slope: <u>99%</u>
ADDITIONAL Reading -15 Sec: <u>7.7</u>	ADDITIONAL Reading -15 Sec: <u>7.2</u>
STANDARD Reading - 1 Min: <u>7.4</u>	STANDARD Reading - 1 Min: <u>7.4</u>
NOTES: <u>Cleaned probe 04-17-93 standardized within an hour. C.E. meter was standardized on 04-1</u>	

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DATE: <u>4/21/93</u> TIME: <u>0920</u> BY: <u>TCS</u>	DATE: <u>04-22-93</u> TIME: <u>1138</u> BY: <u>CAR</u>
Buffer Temp: <u>24°C</u>	Buffer Temp: <u>22°C</u>
pH 7.0 BUFFER Initial Reading: <u>7.0</u>	pH 7.0 BUFFER Initial Reading: <u>7.0</u>
Corrected Reading: <u>7.0</u>	Corrected Reading: <u>7.0</u>
pH 4.0/10.0 BUFFER Initial Reading: <u>4.0</u>	pH 4.0/10.0 BUFFER Initial Reading: <u>4.0</u>
Corrected Reading: <u>4.0</u>	Corrected Reading: <u>4.0</u>
% Slope: <u>98.5%</u>	% Slope: <u>98.5%</u>
ADDITIONAL Reading -15 Sec: <u>7.3</u>	ADDITIONAL Reading -15 Sec: <u>7.0</u>
STANDARD Reading - 1 Min: <u>7.45</u>	STANDARD Reading - 1 Min: <u>7.3</u>
NOTES: <u>Used within one hour of standardization same on 04-22-93 C.E.</u>	

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DATE: <u>04-24-93</u> TIME: <u>1320</u> BY: <u>CAR</u>	DATE: <u>04-26-93</u> TIME: <u>0845</u> BY: <u>CAR</u>
Buffer Temp: <u>23°C</u>	Buffer Temp: <u>23°C</u>
pH 7.0 BUFFER Initial Reading: <u>7.0</u>	pH 7.0 BUFFER Initial Reading: <u>7.0</u>
Corrected Reading: <u>7.0</u>	Corrected Reading: <u>7.0</u>
pH 4.0/10.0 BUFFER Initial Reading: <u>4.0</u>	pH 4.0/10.0 BUFFER Initial Reading: <u>4.0</u>
Corrected Reading: <u>4.0</u>	Corrected Reading: <u>4.0</u>
% Slope: <u>98.5%</u>	% Slope: <u>99%</u>
ADDITIONAL Reading -15 Sec: <u>7.1</u>	ADDITIONAL Reading -15 Sec: <u>7.0</u>
STANDARD Reading - 1 Min: <u>7.3</u>	STANDARD Reading - 1 Min: <u>7.2</u>
NOTES: <u>Used within a hour of standardization same on 04-26-93 C.E.</u>	

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DATE: <u>04-27-93</u> TIME: <u>1153</u> BY: <u>CAR</u>	DATE: <u>04-28-93</u> TIME: <u>0755</u> BY: <u>CAR</u>
Buffer Temp: <u>23°C</u>	Buffer Temp: <u>23°C</u>
pH 7.0 BUFFER Initial Reading: <u>7.0</u>	pH 7.0 BUFFER Initial Reading: <u>7.0</u>
Corrected Reading: <u>7.0</u>	Corrected Reading: <u>7.0</u>
pH 4.0/10.0 BUFFER Initial Reading: <u>4.0</u>	pH 4.0/10.0 BUFFER Initial Reading: <u>4.0</u>
Corrected Reading: <u>4.0</u>	Corrected Reading: <u>4.0</u>
% Slope: <u>99%</u>	% Slope: <u>99%</u>
ADDITIONAL Reading -15 Sec: <u>7.2</u>	ADDITIONAL Reading -15 Sec: <u>7.2</u>
STANDARD Reading - 1 Min: <u>7.3</u>	STANDARD Reading - 1 Min: <u>7.4</u>
NOTES: <u>Used within 1 hour of standardization same on 04-28-93 C.E.</u>	

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DATE: _____ TIME: _____ BY: _____	DATE: _____ TIME: _____ BY: _____
Buffer Temp: _____	Buffer Temp: _____
pH 7.0 BUFFER Initial Reading: _____	pH 7.0 BUFFER Initial Reading: _____
Corrected Reading: _____	Corrected Reading: _____
pH 4.0/10.0 BUFFER Initial Reading: _____	pH 4.0/10.0 BUFFER Initial Reading: _____
Corrected Reading: _____	Corrected Reading: _____
% Slope: _____	% Slope: _____
ADDITIONAL Reading -15 Sec: _____	ADDITIONAL Reading -15 Sec: _____
STANDARD Reading - 1 Min: _____	STANDARD Reading - 1 Min: _____
NOTES: _____	

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CONDUCTIVITY METER STANDARDIZATION

METER ID: #1DATE: 04-19-93 TIME: 0734 BY: CAR DATE: 04-19-93 TIME: 1220 BY: CAR

75 μ MHo STD. TEMP
 METER READING
 200 μ MHo STD. TEMP 23.4°C
 METER READING 195 μ hos
 720 μ MHo STD. TEMP 23.4°C
 METER READING 726 μ hos

75 μ MHo STD. TEMP
 METER READING
 200 μ MHo STD. TEMP 23.2°C
 METER READING 199 μ hos
 720 μ MHo STD. TEMP 23.2°C
 METER READING 724 μ hos

NOTES: DATE: 04-19-93 TIME: 0646 BY: CAR DATE: 04-20-93 TIME: 1045 BY: JPP
04-20-93

75 μ MHo STD. TEMP
 METER READING
 200 μ MHo STD. TEMP 23.4°C
 METER READING 200 μ hos
 720 μ MHo STD. TEMP 23.4°C
 METER READING 724 μ hos

75 μ MHo STD. TEMP
 METER READING
 200 μ MHo STD. TEMP 24.0°C
 METER READING 198
 720 μ MHo STD. TEMP 24.0°C
 METER READING 722

NOTES: DATE: 4-21-93 TIME: 0725 BY: GKK DATE: 4-21-93 TIME: 1025 BY: GKK

75 μ MHo STD. TEMP
 METER READING
 200 μ MHo STD. TEMP 23.4°C
 METER READING 199
 720 μ MHo STD. TEMP 23.9
 METER READING 724

75 μ MHo STD. TEMP
 METER READING
 200 μ MHo STD. TEMP 23.7
 METER READING 198
 720 μ MHo STD. TEMP 23.7
 METER READING 722

NOTES: DATE: 04-22-93 TIME: 0655 BY: CAR DATE: 4-22-93 TIME: 1205 BY: DAI

75 μ MHo STD. TEMP
 METER READING
 200 μ MHo STD. TEMP 22.7°C
 METER READING 198 μ hos
 720 μ MHo STD. TEMP 22.7°C
 METER READING 722 μ hos

75 μ MHo STD. TEMP
 METER READING
 200 μ MHo STD. TEMP 22.6
 METER READING 178
 720 μ MHo STD. TEMP 22.7
 METER READING 723

NOTES: DATE: 4-23 TIME: 716 BY: DAI DATE: 4-23 TIME: 1207 BY: DAI

75 μ MHo STD. TEMP
 METER READING
 200 μ MHo STD. TEMP 23.2
 METER READING 197
 720 μ MHo STD. TEMP 23.3
 METER READING 722

75 μ MHo STD. TEMP
 METER READING
 200 μ MHo STD. TEMP 23.6
 METER READING 198
 720 μ MHo STD. TEMP 23.5
 METER READING 724

NOTES:

CONDUCTIVITY METER STANDARDIZATION

METER ID: #71 Jm
5-20-93

DATE: 4-24 TIME: 6:52 BY: DN DATE: 4-24 TIME: 1:13 BY: DN

75 μ MHo STD. TEMP. _____
 METER READING _____
 200 μ MHo STD. TEMP. 23.7
 METER READING 198
 720 μ MHo STD. TEMP. 23.8
 METER READING 724

75 μ MHo STD. TEMP. _____
 METER READING _____
 200 μ MHo STD. TEMP. 23.8
 METER READING 197
 720 μ MHo STD. TEMP. 23.8
 METER READING 725

NOTES: _____

DATE: 4-25-93 TIME: 8:12 BY: DN DATE: 4-25-93 TIME: 10:28 BY: CAC

75 μ MHo STD. TEMP. _____
 METER READING _____
 200 μ MHo STD. TEMP. 24.1
 METER READING 199
 720 μ MHo STD. TEMP. 24.0
 METER READING 724

75 μ MHo STD. TEMP. _____
 METER READING _____
 200 μ MHo STD. TEMP. 24.0
 METER READING 199 mhos
 720 μ MHo STD. TEMP. 24.0
 METER READING 725 mhos

NOTES: _____

DATE: 4-26 TIME: 7:17 BY: DN DATE: 4-26-93 TIME: 12:05 BY: DN

75 μ MHo STD. TEMP. _____
 METER READING _____
 200 μ MHo STD. TEMP. 23.5
 METER READING 198
 720 μ MHo STD. TEMP. 23.6
 METER READING 722

75 μ MHo STD. TEMP. _____
 METER READING _____
 200 μ MHo STD. TEMP. 23.7
 METER READING 198
 720 μ MHo STD. TEMP. 23.8
 METER READING 724

NOTES: _____

DATE: 4-27 TIME: 7:11 BY: DN DATE: 4-27 TIME: 12:39 BY: DN

75 μ MHo STD. TEMP. _____
 METER READING _____
 200 μ MHo STD. TEMP. 24.4
 METER READING 198
 720 μ MHo STD. TEMP. 24.6
 METER READING 718

75 μ MHo STD. TEMP. _____
 METER READING _____
 200 μ MHo STD. TEMP. 23.5
 METER READING 197
 720 μ MHo STD. TEMP. 23.6
 METER READING 721

NOTES: _____

DATE: 4-28-93 TIME: 06:16 BY: CAC DATE: 4-28 TIME: 12:17 BY: DN

75 μ MHo STD. TEMP. _____
 METER READING _____
 200 μ MHo STD. TEMP. 24.0
 METER READING 199 mhos
 720 μ MHo STD. TEMP. 24.0
 METER READING 723 mhos

75 μ MHo STD. TEMP. _____
 METER READING _____
 200 μ MHo STD. TEMP. 23.5
 METER READING 199
 720 μ MHo STD. TEMP. 23.5
 METER READING 725

NOTES: _____

CONDUCTIVITY METER STANDARDIZATION

METER ID: 527 # 1

DATE: 4-29 TIME: 5:24 BY: BID DATE: 05-03-93 TIME: 0616 BY: Cue

75 μ MHo STD. TEMP _____
METER READING _____
200 μ MHo STD. TEMP 24.1
METER READING 200
720 μ MHo STD. TEMP 24.1
METER READING 724

75 μ MHo STD. TEMP _____
METER READING _____
200 μ MHo STD. TEMP 24.0
METER READING 199 mhos
720 μ MHo STD. TEMP 24.0
METER READING 723 mhos

NOTES: same as 05-03-93 as $\rightarrow$ used with one hr. of Standardization

DATE: 05-04-93 TIME: 0616 BY: Cue DATE: 05-04-93 TIME: 1502 BY: Cue

75 μ MHo STD. TEMP _____
METER READING _____
200 μ MHo STD. TEMP 24.0
METER READING 199 mhos
720 μ MHo STD. TEMP 24.0
METER READING 720 mhos

75 μ MHo STD. TEMP _____
METER READING _____
200 μ MHo STD. TEMP 23.4.0
METER READING 700 mhos
720 μ MHo STD. TEMP 23.4.0
METER READING 723 mhos

NOTES: _____

DATE: 5-5-93 TIME: 7:34 BY: Dfb DATE: 5-5-93 TIME: 1050 BY: GKK

75 μ MHo STD. TEMP _____
METER READING _____
200 μ MHo STD. TEMP 23.8
METER READING 199
720 μ MHo STD. TEMP 23.6
METER READING 721

75 μ MHo STD. TEMP _____
METER READING _____
200 μ MHo STD. TEMP 24.6
METER READING 199
720 μ MHo STD. TEMP 24.5
METER READING 722

NOTES: _____

DATE: 5-6-93 TIME: 7:27 BY: DH DATE: 5-6-93 TIME: 1040 BY: GKK

75 μ MHo STD. TEMP _____
METER READING _____
200 μ MHo STD. TEMP 23.6
METER READING 199
720 μ MHo STD. TEMP 23.6
METER READING 723

75 μ MHo STD. TEMP _____
METER READING _____
200 μ MHo STD. TEMP 24.0
METER READING 198
720 μ MHo STD. TEMP 23.9
METER READING 721

NOTES: _____

DATE: 5-7 TIME: 7:17 BY: DH DATE: 5-7 TIME: 12:05 BY: DH

75 μ MHo STD. TEMP _____
METER READING _____
200 μ MHo STD. TEMP 198
METER READING 23.5
720 μ MHo STD. TEMP 23.6
METER READING 718

75 μ MHo STD. TEMP _____
METER READING _____
200 μ MHo STD. TEMP 22.0
METER READING 197
720 μ MHo STD. TEMP 22.1
METER READING 722

NOTES: _____

SITE: Ch. 33, 34, 16

SHIPPED BY: 10/10/68

DATE/TIME: JUL 2, 55 . 15

PROJECT: CECOP 2000 Study

SHIPPED VIA: T-14 MAIL 1-11-54

1000

PROJECT LEADER: D. S. Subick

RECEIVED BY: J. Edgar Hoover

DATE/TIME: 06/25/58 - 06:00

SAMPLE COLLECTION

[illegible]

NOTES:

CLINCH RIVER RPT FIELD CHAIN-OF-CUSTODY / FORM FOR SURFACE WATER SAMPLES

Field Custodian: J. Kennedy

Sampling Team Signatures:

Page 1 of 1

Return to: C. J. Ford
P.O. Box 2008, M.S. 6036
Oak Ridge, TN 37831-6036

Time 11:55 (military)
hh mm[illegible]

2) Sample custody transfer DATE: _____ TIME : _____
Relinquished by: _____ dd ____ mm ____ yy hh ____ min
of _____ (org.)
Received by: _____ of _____ (org.)

Are security seals intact - 0806 copy

FCN: COCFW-1044 28OCT92

2/1/5

Field Custodian:

[Signature]

C-Of-C Form No.: 0423933

Sampling Team Signatures:

Page 1 of 1

Date: 23 Apr 93

Return to: C. J. Ford
P.O. Box 2008, M.S. 6036
Oak Ridge, TN 37831-6036

Time : (military)
hh mm[illegible]

1) Sample custody transfer DATE: 03 04 93 TIME 13:20
Relinquished by: [Signature] dd mm yy hh mm of TNAK52.org.)
Received by: S. Hecimoglu / ic: 50 of TVM (org.)

2) Sample custody transfer DATE: _____ TIME _____
 Relinquished by: _____ of _____ (org.)
 Received by: _____ of _____ (org.)

V.3.4. 2/24/92

There were no secondary seals and ice cores on calibration.

ECN:COCEFV-1047 28 OCT 92



QUESTIONS? CALL 800-238-5355 TOLL FREE.

AIRBILL
PACKAGE
TRACKING NUMBER

565558274

RECIPIENT'S COPY

From (Your Name) Please Print Date 23-03-93		To (Recipient's Name) Please Print Date 23-03-93	
Your Phone Number (Very Important) 23-03-93		Recipient's Phone Number (Very Important) 23-03-93	
Company Department/Floor No.		Company Department/Floor No.	
Street Address City State ZIP Required 37502		Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes) City State ZIP Required 37502	
YOUR INTERNAL BILLING REFERENCE INFORMATION (optional) (First 24 characters will appear on invoice)			
PAYMENT 1 ☐ Bill Sender 2 ☐ Bill Recipient's Fedex Acct. No. 3 ☐ Bill and Party Fedex Acct. No. 4 ☐ Bill Credit Card			
SERVICES (Check only one box) Priority Overnight (Delivery by next business morning) 11 ☐ YOUR PACKAGING 16 ☐ FEDEX LETTER 12 ☐ FEDEX PAK* 13 ☐ FEDEX BOX 14 ☐ FEDEX TUBE 30 ☐ ECONOMY 41 ☐ GOVT 46 ☐ GOVT LETTER 47 ☐ GOVT PACKAGE			
DELIVERY AND SPECIAL HANDLING (Check services required) 1 ☐ HOLD FOR PICK-UP (Fill in Box H) 2 ☐ DELIVER WEEKDAY 3 ☐ DELIVER SATURDAY (Extra charge) 4 ☐ DANGEROUS GOODS (Extra charge) 5 ☐ DRY ICE 6 ☐ OTHER SPECIAL SERVICE 7 ☐ SATURDAY PICK-UP 8 ☐ SATURDAY DELIVERY 9 ☐ SATURDAY DELIVERY (Extra charge) 10 ☐ SATURDAY DELIVERY (Extra charge) 11 ☐ SATURDAY DELIVERY (Extra charge) 12 ☐ SATURDAY DELIVERY (Extra charge)			
Total Total Total		Total Total Total	
GMA SHIPMENT Chargeable Weight		GMA SHIPMENT Chargeable Weight	
Received By: X		Received By: X	
Date/Time Received		Date/Time Received	
Fedex Employee Number		Fedex Employee Number	
Signature		Signature	
Release		Release	
Revision Date 292		Revision Date 292	
Format 1126		Format 1126	

Field Custodian: W. A. C. 2

Sampling Team Signatures:

Page 1 of 1

Return to: C. J. Ford
P.O. Box 2008, M.S. 6036
Oak Ridge, TN 37831-6036

Time : _____ (military)
hh mm

1) Sample custody transfer	DATE: 26 4 93	TIME 13:15
	dd mm yy	hh mm
Relinquished by: <u>Marc C. L...</u>	of	TVA (org.)
Received by: <u>C. H...</u>	4-27-93	of TVA (org.)
	dd mm yy	hh mm
2) Sample custody transfer	DATE:	TIME
	dd mm yy	hh mm
Relinquished by: _____	of	(org.)
Received by: _____	of	(org.)

4-127-23 ¹ signals
Society in the
sketch as condition of existence

ATTACHMENT III

CR-ERP AMBIENT WATER TOXICITY PILOT STUDY
Reference Toxicant Test Information

Chronic Reference Toxicant Test

Fathead Minnows - ARL

Test #	Date	Survival		Growth		IC25	Corrective Action Taken
		LOEC	NOEC	LOEC	NOEC		
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	
Mean=		0.043	0.018	Mean=	0.011	0.004	0.0068

Chronic Reference Toxicant Record Sheet

Study Cu Ref tox
Test Organism Fatheads
Beginning Date/Time 3/23/93; 10:10
Ending Date/Time 3/30/93; 0930
Personnel Seiler, Posey

Toxicant Cu
Source EPA
Lot # 188
Concentration 50mg/ml

Stock Concentration(s) _____
Test Concentrations 0.001, 0.003, 0.008, 0.02, 0.05
Dilution Water F-mcd

Spawn Date	Tile #	Hatch Date
<u>3/18</u>	<u>9, 10, 12, 13, 20,</u>	<u>3/22 11:15 AM</u>
_____	<u>24, 27, 28</u>	<u>BF 0630 3/23</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Test # 42
NOEC 0.003
LOEC 0.008

Notes: IC₂₅ = 0.0056

FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

Page 1 of 1

Study Cu Ref 10x
Beginning Date/Time 3/23/93; 1010
Ending Date/Time 3/30/93; 0930

Personnel Seaborn
1000
Simonek

Treatment	Rep	— Number Alive —						
		— 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:	TS	TS	TS	TS	TS	TS	TS
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:	TS	TS	TS	TS	TS	TS	TS
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:	TS	TS	TS	TS	TS	TS	TS
0.008	1	10	10	10	10	9	9	8
	2	10	10	10	10	10	10	10
	3	10	10	10	10	10	10	9
	4	10	10	10	10	10	10	10
	By:	JPP	JPP	QAS	QAS	QAS	GKK	JPP
0.02	1	10	10	10	9	9	9	9
	2	10	10	9	9	9	9	9
	3	10	10	10	10	10	10	10
	4	10	10	9	9	9	7	7
	By:	JPP	JPP	QAS	QAS	QAS	GKK	JPP
0.05	1	10	10	4	4	4	4	4
	2	10	8	6	3	3	3	3
	3	10	10	7	5	5	3	2
	4	10	10	8	5	5	5	3
	By:	JAP	JPP	QAS	QAS	QAS	GKK	JPP

Notes:

(PLARC501-257) Reviewed By: TCS TCS TCS TCS TCS TCS TS

Analysis of Survival

APR#12-011 Fox
Starting Date: 03-23-93

Survival Data

Treatment	Replicate									
	1	2	3	4	5	6	7	8	9	10
CONTROL	1.00	1.00	1.00	1.00	.	.	.	.	.	1.00
.001	1.00	1.00	1.00	1.00	.	.	.	.	.	1.00
.003	1.00	1.00	1.00	1.00	.	.	.	.	.	1.00
.008	0.80	1.00	0.90	1.00	.	.	.	.	.	0.80
.02	0.90	0.90	1.00	0.70	.	.	.	.	.	0.80
.05	0.40	0.30	0.20	0.30	—	.	.	.	.	0.30

Steel's Many One Rank Test

Treatment	No. of Replicates	Critical Rank Sum	Observed Rank Sum
0.001	4	18	18
0.003	4	12	12
0.008	4	11	10
0.02	4	12	10
0.05	4	10	10

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

Analysis of 7-day larval growth test

APR#12 DEETOX

Starting Date: 03/02/39

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 0.0001.

This represents a 15.50 % reduction in Dry Weight (mg).

T = 2.36 ALPHA = 0.05

Dry Weight (mg) Data

TREATMENT	Replicate									
	1	2	3	4	5	6	7	8	9	10
1 CONTROL	0.33	0.31	0.35	0.39	.	.	.	.	.	0.33
2 0.001	0.31	0.36	0.40	0.38	.	.	.	.	.	0.36
3 0.003	0.36	0.38	0.37	0.34	.	.	.	.	.	0.37
4 0.008	0.21	0.18	0.16	0.26	.	.	.	.	.	0.20
5 0.02	0.10	0.09	0.08	0.12	.	.	.	.	.	0.10

Asterisk (*) indicates values significantly less than control (0.0001).

Analysis of Variance

Source	DF	Sum OF Sq.	Mean Sq.	Calc F	P-Value
Among	4	0.228	0.057	73.190	0.0001
Within	15	0.015	0.001		
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	.346	.355
.001	.362	.355
.003	.358	.355
.008	.187	.187
.020	.085	.085
.050	.007	.007

THE LINEAR INTERPOLATION ESTIMATE OF THE TOTAL IMPACT CONCENTRATION
FROM THE INPUT SAMPLE IS .0056.

.050	.007	.007
------	------	------

THE LINEAR INTERPOLATION ESTIMATE OF THE TOTAL IMPACT CONCENTRATION
FROM THE INPUT SAMPLE IS .0056.

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

THE MEAN OF THE BOOTSTRAP ESTIMATES IS .0056.

THE STANDARD DEVIATION OF THE BOOTSTRAP ESTIMATES IS .0004.

AN EMPIRICAL 95.0% CONFIDENCE INTERVAL FOR THE
BOOTSTRAP ESTIMATE IS (.0050, .0067).

C:\BOOTSTRP>

Chronic Reference Toxicant Test

Cerio - ARL

Test #	Date	Survival		Reproduction		IC25	Corrective Action Taken
		LOEC	NOEC	LOEC	NOEC		
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	
Mean=		0.05	0.02	Mean=	0.03	0.01	0.0195

Chronic Study Zooplankton Record Sheet

Study Cu Ref tox

Test Organism Cerio

Beginning Date/Time 3/23/93 ; 0930

Ending Date/Time 3/30/93 ; 0830

Personnel Pasey, Siskin

Control/Dilution Water C-med

Test Treatment Identification

1. Control
2. 0.001
3. 0.003
4. 0.008
5. 0.02
6. 0.05
7. Control with new food
8. _____

Released From

Date	Time
<u>3/22/93</u>	<u>1300</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

To

Date	Time
<u>3/22/93</u>	<u>2200</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Test # 40

NOEC 0.008

LOEC 0.02

Notes: IC₂₅

CERIODAPHRINA SURVIVAL AND REPRODUCTION TEST

Study Co. Ref. 748Time 0930Personnel PeserBeginning Date 3-23-73Time 0830SimmonsEnding Date 3/30/73

-- Number Young --

Reviewed By T. J.

Treatment	Rep	- Day -								Total Young
		1	2	3	4	5	6	7	8	
Control	1	0	0	0	0	8	13	11		32
	2			0	0	8	13	14		35
	3			0	0	8	16	12		42
	4			3	0	9	14	16		42
	5			4	0	10	18	15		47
	6			1	0	8	13	13		35
	7			1	0	9	16	16		42
	8			0	3	7	10	0		20
	9			0	0	4	12	15		31
	10			0	0	10	15	9		34
0.001	1	0	0	0	0	8	14	14		36
	2			3	0	7	11	4		25
	3			1	0	8	11	12		32
	4			3	0	8	15	17		43
	5			0	4	7	10	16		31
	6			0	0	5	12	12		29
	7			1	0	8	15	10		34
	8			0	4	8	6	0		18
	9			0	0	8	14	12		34
	10			1	0	9	13	12		35
0.003	1	0	0	0	0	6	12	16		34
	2			0	0	7	15	17		39
	3			0	0	0/7			-?	7
	4			3	0	9	16	13		41
	5			1	0	8	17	5		31
	6			0	0	7	14	17		38
	7			0	1	8	10	0		19
	8			0	4	8	9	0		21
	9			0	0	7	13	15		35
	10			0	0	9	10	13		31
0.008	1	0	0	0	0	8	11	14		33
	2			0	0	7	11	17		35
	3				0	8	15	8		31
	4				0	9	15	14		38
	5				1	8	13	0		22
	6				1	8	12	0		21
	7				1	8	13	0		22
	8				3	8	14	0		25
	9			2	0	7	11	15		35
	10			0	0	8	10	14		32

Notes:

CERIODAPHNIA SURVIVAL AND REPRODUCTION TEST

Study C. RET. TokTime 0930Personnel J. DSEYBeginning Date 8-23-73

Time _____

SLIMBECK

Ending Date _____

-- Number Young --

Reviewed By _____

Treatment	Rep	- Day -								Total Young
		1	2	3	4	5	6	7	8	
0.02	1	0	0	0	2	7	8	0		17
	2			1	0	8	12	12		33
	3			0	0	4	10	10		24
	4				0	8	15	0		23
	5				1	8	12	0		21
	6				2	8	9	0		19
	7				0	7	8	0		15
	8				3	7	8	0		18
	9				3	8	9	0		20
	10				0	8	14	15		37
0.05	1	0	0	0	3	5	8	0		16
	2		0	D/O						0
	3		0	0	D/O					1
	4		D/O							0
	5		D/O							0
	6		D/O							0
	7		0	0	0	0	0			0
	8		0	0	1	D/O				1
	9		D/O							0
	10		D/O							0
Control NEW FOOD	1	0	0	0	0	7	10	7		24
	2				4	3	0	9		16
	3				0	6	13	15		34
	4					8	7	12		27
	5					8	13	0		21
	6					8	13	13		34
	7			3		9	11	0		22
	8			0	4	6	3	0		13
	9			0	0	8	6	7		23
	10			0	0	8	14	16		38
	1									
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									

Notes:

Analysis of 7-day Reproduction Test

APR#40 REFTOX

Starting Date: 03/23/93

Analysis of Reproduction (# young/female/7 days) Data Dunnett's Test

No transformation applied before data analysis.

For this set of data, the minimum significant difference is 8.00

This represents a 22.48 % reduction in Reproduction (# young/female/7 days)

$$T = 2.29 \text{ ALPHA} = 0.05$$

----- --Reproduction (# young/female/7 days) Data -----

TREATMENT	Replicate										MEAN
	1	2	3	4	5	6	7	8	9	10	
1 CONTROL	32	35	42	42	47	35	42	20	31	31	36.00
2 0.001	36	25	32	43	31	29	34	18	24	25	31.70
3 0.003	34	39	7	41	31	38	19	21	35	31	29.60
4 0.008	33	35	31	38	22	21	22	25	25	32	29.40
5 0.02	17	33	24	23	21	19	15	18	20	37	22.70
6 C/NEW FOOD	24	16	34	27	21	34	23	13	23	38	25.30

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

----- Analysis of Variance -----

Source	DF	Sum OF Sq.	Mean Sq.	Calc F	F (0.05)
Among	5	2101.083	220.216	3.530	0.0028
Within	54	71.100	62.428		
Total	59	0.000			

THE NUMBER OF RESAMPLES IS 80

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

CONC. (%EFF)	RESPONSE MEAN	MEAN AFTER POOLING
.000	36.000	36.000
.001	31.700	31.700
.003	29.600	29.600
.008	29.400	29.400
.020	22.700	22.700
.050	1.800	1.800

THE LINEAR INTERPOLATION ESTIMATE OF THE TOTAL IMPACT CONCENTRATION
FROM THE INPUT SAMPLE IS .0123.

.050	1.800	1.800
------	-------	-------

THE LINEAR INTERPOLATION ESTIMATE OF THE TOTAL IMPACT CONCENTRATION
FROM THE INPUT SAMPLE IS .0123.

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

THE MEAN OF THE BOOTSTRAP ESTIMATES IS .0098.

THE STANDARD DEVIATION OF THE BOOTSTRAP ESTIMATES IS .0044.

AN EMPIRICAL 95.0% CONFIDENCE INTERVAL FOR THE
BOOTSTRAP ESTIMATE IS (.0013, .0170).

C:\BOOTSTRP>

INITIAL CHEMISTRY

Page 1 of 1Study Cu Ref toxBeginning Date 3/23/93

Ending Date _____

Date 3/23/93Personnel SealerPoser

Sample ID	Temp.	DO	pH	Cond	Hard	x17.1	Alk	x10	Cl	x 1.0
Control	25.1	8.5	7.2	355	⁴ 5.8	92.3	5.4	54.0		
0.001	25.6		7.1	355						
0.003	25.1		7.1	354						
0.008	25.2		7.1	356						
0.02	25.6		7.1	356						
0.05	25.5	✓	7.0	356	5.4	92.3	5.4	54.0		
F-Med #1278										
Control	24.5	8.4	7.1	334						
0.001				334	5.4	92.3	^A 5.0	50		
0.003				334						
0.008				335						
0.02				335						
0.05	↓	✓	↓	337	5.4	92.3	^A 5.4	50		
C-Med #1279										

NOTES:

+ checked twice
 Δ checked 1/2 sample (50-ml) 2.5 reading

Reviewed By: JCS

INITIAL CHEMISTRY

Page 1 of 1

Study Cu Ref tox

Date 3/24/93

Personnel Sesler

Beginning Date 3/23/93

Posey

Ending Date _____

Sample ID	Temp.	DO	pH	Cond	Hard	x17.1	Alk	x10	Cl	x1.0
Control	25.2	8.3	7.2	351						
0.001	25.3		7.2	352						
0.003	25.5		7.2	352						
0.008	25.4		7.2	352						
0.02	25.3		7.2	352						
0.05	25.3	✓	7.1	352						
F-Med #1281										
Control	25.0	8.3	7.2	322						
0.001			7.2	322						
0.003			7.2	322						
0.008			7.2	324						
0.02			7.2	325						
0.05	✓	✓	7.1	325						
C-Med #1282										

NOTES:

Reviewed By: TCS

INITIAL CHEMISTRY

Page 1 of 1

Study On Ref toxBeginning Date 3/23/93

Ending Date _____

Date 3/25/93Personnel S. S. S.P. S. S.

Sample ID	Temp.	DO	pH	Cond	Hard	x17.1	Alk	x10	Cl	x 1.0
Control	25.3	8.4	7.2	352						
0.001	25.3		7.2	352						
0.003	25.2		7.2	353						
0.008	25.2		7.1	353						
0.02	25.3		7.1	353						
0.05	25.6	✓	7.1	354						
F-Med #1281										
Control	25.0	8.3	7.2	322						
0.001			7.2	323						
0.003			7.2	324						
0.008			7.1	324						
0.02			7.1	325						
0.05	✓		7.1	325						
C-Med #1282										

NOTES:

Reviewed By: T. C. S.

INITIAL CHEMISTRY

Page 1 of 1

Study Cu Ref toxBeginning Date 3/23/93

Ending Date _____

Date 3/26/93Personnel Seaton
Sinkov

Sample ID	Temp.	DO	pH	Cond	Hard	x17.1	Alk	x10	Cl	x1.0
Control	25.2	8.3	7.2	347						
0.001	25.1	↓	7.2	349						
0.003	25.1	↓	7.2	↓						
0.008	25.1	↓	7.2	↓						
0.02	24.9	↓	7.2	↓						
0.05	25.1	↓	7.1	↓						
F-Med #1295										
Control	24.6	8.3	7.2	328						
0.001	↓	↓	↓	328						
0.003	↓	↓	↓	328						
0.008	↓	↓	↓	328						
0.02	↓	↓	↓	329						
0.05	↓	↓	↓	329						
C-Med #1282										

NOTES:

Reviewed By: T. S.

INITIAL CHEMISTRY

Page 1 of 1

Study Cu Ref toxBeginning Date 3/23/93

Ending Date _____

Date 3/27/93Personnel Sesler
Seibert

Sample ID	Temp.	DO	pH	Cond	Hard	x17.1	Alk	x10	Cl	x1.0
Control	25.4	8.4	7.2	351*						
0.001	25.3			349						
0.003	25.3			349						
0.008	25.1			349						
0.02	25.4			351*						
0.05	25.2	✓	✓	349						
F-Med #1285										
F-Med #1284										
Control	25.5	8.3	7.4	332						
0.001	25.8		7.3	330						
0.003	25.8		7.2	329						
0.008	25.8		7.2	326						
0.02	25.7		7.2	331						
0.05	25.7	✓	7.2	331						
C-Med #1283										

NOTES:

* Used F-Med #1284 on Control + 0.02

Reviewed By: TCS

INITIAL CHEMISTRY

Page 1 of 1Study On Ref toxBeginning Date 3/23/93

Ending Date _____

Date 3/28Personnel SealerWinkler

Sample ID	Temp.	DO	pH	Cond	Hard	x17.1	Alk	x10	Cl	x1.0
Control	25.2	8.3	7.2	351						
0.001	25.2			351						
0.003	25.2			352						
0.008	25.2			351						
0.02	25.3			352						
0.05	25.2	↓	↓	351						
F-Med # 1284	-	-								
Control	24.5	8.1	7.3	332						
0.001	25.1		7.2	331						
0.003	25.1			328						
0.008	25.0			329						
0.02	25.0			330						
0.05	25.1	↓	↓	333						
C-Med # 1283										

NOTES:

Reviewed By: TS

INITIAL CHEMISTRY

Page 1 of 1

Study Cu Ref toxBeginning Date 3/23/93

Ending Date _____

Date 3/29Personnel Leslie
Simbeck

Sample ID	Temp.	DO	pH	Cond	Hard	x17.1	Alk	x10	Cl	x 1.0
Control	25.3	8.0	7.3	348						
0.001	25.3		7.3	350						
0.003	25.3		7.3	350						
0.008	25.3		7.3	349						
0.02	25.3		7.2	350						
0.05	25.3	✓	7.2	349						
F-Med #1288										
Control	25.5	8.4	7.4	337						
0.001	25.3		7.3	337						
0.003	25.2		7.3	337						
0.008	25.3		7.3	338						
0.02	25.2		7.3	338						
0.05	25.4	✓	7.3	338						
C-Med #1283										

NOTES:

Reviewed By: TCS

FINAL CHEMISTRY

Page 1 of 1

Study Cu Re/tox
 Beginning Date 3/23/93
 Ending Date _____

Date 3/24/93

Personnel Selen

Sample ID	Rep.	Fish				Ceriodaphnia			
		Temp.	DO	pH	Cond.	Temp.	Sample ID	DO	pH
Control	1	24.9	7.3	7.9		25.1	Control ①	7.8	7.9
	2	25.4	7.2		358	25.5	0.001 ②	7.8	7.9
	3	24.9	7.3			25.5	0.003 ③	7.9	7.9
	4	25.0	7.3			25.7	0.008 ④	7.7	7.9
0.001	1	24.8	7.1	7.8		25.7	0.02 ⑤	7.8	7.9
	2	25.9	6.9		357	25.5	0.05 ⑥	7.8	7.9
	3	25.0	7.3			25.2	Food w/ Control	7.7	7.9
	4	25.2	7.2			25.7			
0.003	1	24.9	7.1	7.8		25.6			
	2	24.8	7.2		358	25.0			
	3	24.8	7.2						
	4	24.8	7.3						
0.008	1	25.0	7.3	7.8					
	2	25.4	7.4		358				
	3	25.3	7.5						
	4	25.2	7.3						
0.02	1	25.0	7.4	7.9					
	2	25.2	7.3		358				
	3	24.8	7.5						
	4	25.1	7.3						
0.05	1	24.8	7.6	7.9					
	2	25.0	7.5		358				
	3	25.0	7.4						
	4	24.8	7.6						

* D.O. meter + pH meter used from Watt's Bar #9 test.

NOTES:

Reviewed By: TCS

FINAL CHEMISTRY

Page 1 of 1

Study P.L. Re/tox
 Beginning Date 3/23/93
 Ending Date _____

Date 3/25/93

Personnel Seelen
Rosey

Sample ID	Rep.	Fish				Ceriodaphnia			
		Temp.	DO	pH	Cond.	Temp.	Sample ID	DO	pH
Control	1	25.5	6.0			25.1	Control ①	7.5	7.9
	2	25.1	6.4	7.6		25.5	0.001 ②	7.5	7.9
	3	25.2	6.6		355	25.5	0.003 ③	7.6	7.9
	4	25.0	6.4			25.6	0.008 ④	7.5	7.9
0.001	1	25.3	6.6			25.7	0.02 ⑤	7.5	7.9
	2	25.0	6.4	7.6		25.5	0.05 ⑥	7.6	7.9
-	3	25.0	6.2		356	25.3	Food w/ Control	7.6	7.9
	4	25.2	6.9			25.7			
0.003	1	25.1	5.6			25.6			
	2	25.1	6.4	7.6		24.8			
	3	25.1	5.8		356				
	4	25.3	6.2						
0.008	1	24.8	7.0						
	2	25.0	6.7	7.6					
	3	25.1	6.6		357				
	4	25.2	6.0						
0.02	1	25.1	6.5						
	2	25.3	6.9	7.7					
	3	25.2	6.7		356				
	4	24.8	6.9						
0.05	1	24.9	7.0						
	2	25.0	7.1	7.7					
	3	25.0	6.9		358				
	4	24.8	6.9						

NOTES:

Reviewed By: TCS

FINAL CHEMISTRY

Page 1 of 1Study Cu Re/toxDate 3/26/93Personnel SeslerBeginning Date 3/23/93Semick

Ending Date _____

Sample ID	Rep.	Fish				Ceriodaphnia			
		Temp.	DO	pH	Cond.	Temp.	Sample ID	DO	pH
Control	1	25.2	4.3			25.0	Control ①	7.7	8.0
	2	24.9	4.0			25.5	0.001 ②	7.7	8.0
	3	25.2	4.4	7.7		25.5	0.003 ③	7.7	8.0
	4	25.3	6.2		356	25.7	0.008 ④	7.7	7.9
0.001	1	24.7	4.6			25.7	0.02 ⑤	7.7	7.9
	2	24.8	4.1			25.5	0.05 ⑥	7.7	7.9
	3	25.0	5.3	7.7		25.2	Food w/ Control	7.7	7.9
	4	25.0	3.9		358	25.7			
0.003	1	24.8	4.2			25.8			
	2	25.2	5.4			24.8			
	3	25.0	5.1	7.6					
	4	24.8	4.6		360				
0.008	1	24.8	4.3						
	2	24.9	3.6						
	3	24.8	4.5	7.6					
	4	25.0	4.6		361				
0.02	1	25.1	5.3						
	2	25.1	5.4						
	3	24.7	5.5	7.1					
	4	25.0	4.7		364				
0.05	1	24.9	5.6						
	2	24.7	6.4						
	3	24.5	6.6	7.7					
	4	24.6	6.5		365				

NOTES:

Reviewed By: TCS

FINAL CHEMISTRY

Page 1 of 1Study Cu Re/toxBeginning Date 3/23/93Date 3/27/93Personnel SeatonSimbeck

Ending Date _____

Sample ID	Rep.	Fish				Ceriodaphnia			
		Temp.	DO	pH	Cond.	Temp.	Sample ID	DO	pH
Control	1	25.0	6.0		352	25.1	Control ①	7.7	8.1
	2	24.9	6.6			25.4	0.001 ②	7.7	8.1
	3	25.0	6.0			25.4	0.003 ③	7.7	8.1
	4	25.0	6.7	7.8		25.5	0.008 ④	7.7	8.1
0.001	1	25.3	6.3		353	25.5	0.02 ⑤	7.7	8.1
	2	25.0	6.7			25.3	0.05 ⑥	7.6	8.1
	3	25.1	6.4			25.0	Food w/ Control	7.7	8.1
	4	25.2	5.6	7.7		25.5			
0.003	1	24.5	6.2		355	25.3			
	2	25.0	5.9			24.8			
	3	24.9	6.0						
	4	24.5	5.9	7.7					
0.008	1	25.4	6.5		353				
	2	25.1	6.1						
	3	24.5	6.1						
	4	24.5	6.5	7.7					
0.02	1	24.9	6.5		353				
	2	25.5	6.2						
	3	25.3	6.4						
	4	24.9	6.5	7.7					
0.05	1	24.8	6.7		352				
	2	25.1	6.8						
	3	24.5	6.7						
	4	24.5	6.8	7.7					

NOTES:

Reviewed By: TCS

FINAL CHEMISTRY

Page 1 of 1Study C. R. / toxBeginning Date 3/23/93Date 3/28Personnel S. L. / S. Beck

Ending Date _____

Sample ID	Rep.	Fish				Ceriodaphnia			
		Temp.	DO	pH	Cond.	Temp.	Sample ID	DO	pH
Control	1	25.2	6.9			25.5	Control ①	7.8	8.2
	2	25.3	6.8	7.7		25.5	0.001 ②	7.8	8.1
	3	25.2	6.8		350	25.5	0.003 ③	7.8	8.1
	4	25.3	6.8			25.5	0.008 ④	7.8	8.1
0.001	1	25.4	6.6			25.4	0.02 ⑤	7.8	8.1
	2	25.1	6.8	7.8		25.2	0.05 ⑥	7.8	8.1
	3	25.2	6.7		352	25.0	Food w/ Control	7.8	8.1
	4	25.3	6.6			25.2			
0.003	1	25.2	6.9			25.5			
	2	25.3	6.5	7.8		25.7			
	3	25.2	6.7		351				
	4	25.3	6.6						
0.008	1	25.0	7.0						
	2	25.0	7.0	7.8					
	3	25.1	7.1		352				
	4	25.2	7.0						
0.02	1	25.1	7.2						
	2	25.0	7.1	7.8					
	3	25.2	7.2		353				
	4	25.4	7.2						
0.05	1	25.2	7.3						
	2	25.2	7.3	7.8					
	3	25.2	7.4		352				
	4	25.0	7.4						

NOTES:

Reviewed By: TS

FINAL CHEMISTRY

Page 1 of 1Study Cu Re/toxDate 3/29/93Personnel SelenBeginning Date 3/23/93

Ending Date _____

Sample ID	Rep.	Fish				Ceriodaphnia			
		Temp.	DO	pH	Cond.	Temp.	Sample ID	DO	pH
Control	1	25.2	6.7	7.9		25.3	Control ①	7.7	8.1
	2	25.2	6.8		34.8	25.4	0.001 ②	7.7	8.1
	3	25.4	6.5			25.4	0.003 ③	7.7	8.0
	4	25.4	6.3			25.4	0.008 ④	7.7	8.1
0.001	1	25.2	6.6	7.8		25.3	0.02 ⑤	7.7	8.0
	2	25.2	6.7		35.4	25.4	0.05 ⑥	7.7	8.0
	3	25.2	6.2			24.6	Food w/ Control	7.7	8.0
	4	25.0	6.5			25.3			
0.003	1	25.6	6.6	7.8		25.4			
	2	25.1	6.5		35.8	25.0			
	3	25.0	6.7						
	4	25.2	6.2						
0.008	1	24.8	7.0	7.8					
	2	24.8	7.2		35.8				
	3	25.2	7.2						
	4	25.1	7.0						
0.02	1	25.0	6.9	7.8					
	2	25.1	7.2		35.9				
	3	25.0	6.8						
	4	25.0	7.0						
0.05	1	24.8	7.3	7.9					
	2	25.0	7.3		35.9				
	3	25.2	7.1						
	4	25.0	7.2						

NOTES:

Reviewed By: TCS

FINAL CHEMISTRY

Page 1 of 1Study Cl. Re/toxBeginning Date 3/23/93Date 3-30-93Personnel Sealer

Ending Date _____

Posay

Sample ID	Rep.	Fish				Ceriodaphnia			
		Temp.	DO	pH	Cond.	Temp.	Sample ID	DO	pH
Control	1	25.0	6.3			25.7	Control ①	7.8	8.1
	2	25.2	6.6	7.8		25.7	0.001 ②	7.8	8.0
	3	25.1	6.7		350	25.5	0.003 ③	7.8	8.0
	4	25.2	6.5			25.5	0.008 ④	7.8	7.9
0.001	1	25.5	6.6			25.3	0.02 ⑤	7.8	7.9
	2	25.3	6.3	7.7		25.4	0.05 ⑥	7.8	8.0
	3	25.0	6.7		351	25.6	Food w/ Control	7.8	7.9
	4	24.9	6.6			25.4			
0.003	1	24.9	6.6			25.4			
	2	25.0	6.4	7.7		25.6			
	3	25.1	6.6		353				
	4	24.7	6.8						
0.008	1	24.7	6.7						
	2	25.0	7.0	7.7					
	3	24.9	6.9		353				
	4	24.7	7.0						
0.02	1	24.9	6.8						
	2	24.7	7.1	7.8					
	3	25.0	7.1		356				
	4	25.0	6.7						
0.05	1	25.0	7.1						
	2	24.9	7.1	7.8					
	3	25.2	7.1		354				
	4	24.5	7.3						

NOTES:

Reviewed By: TCS

ATTACHMENT IV

CR-ERP AMBIENT WATER TOXICITY PILOT STUDY
Personnel Training Documentation

Training Record for:

Jennifer Meza

Position:

Unit Supervisor

I, Jennifer Meza, have read the "Referenced Chapters" of the ARL Toxicology Laboratory Quality Assurance Program and Standard Operating Procedures Manual.

The trainee will initial the READ column and will sign and date the TRAINEE SIGNATURE AND DATE column after each referenced chapter.

CHAPTER	READ	TRAINEE SIGNATURE AND DATE
CHAPTER 1 Introduction	JM	Jennifer Meza, 12-2-92
CHAPTER 2 Facility	JM	Jennifer Meza, 12-2-92
CHAPTER 3 Personnel	JM	Jennifer Meza, 12-2-92
CHAPTER 4 Health and Safety	JM	Jennifer Meza, 12-2-92
CHAPTER 5 Quality Assurance	JM	Jennifer Meza, 12-2-92

PLARCS01-975

1. Jennifer M. Moore, have read the ARL Toxicology Laboratory Quality Assurance Program and Standard Operating Procedures Manual. The trainee will initial the READ and TRAINED columns for the referenced SOP after (1) each applicable Standard Operating Procedure has been read, and (2) after training has been received by the Unit Supervisor or approved trainer.

The Unit Supervisor or approved trainer will initial the PROFICIENT column after the calibrations, procedures, and calculations (if applicable) have been satisfactorily performed by the trainee.

After the READ, TRAINED, and PROFICIENT columns have been initialed, the trainee will sign and date the TRAINEE SIGNATURE AND DATE column.

SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-1 Sample Collection and Handling	JM	JM	✓		Jennifer Moore, 12-2-92
SOP-2 Preparation of Reagent Water	JM	JM	✓		Jennifer Moore (10-1-92)
SOP-3 Glassware Preparation	JM	JM	✓		Jennifer Moore, 12-2-92
SOP-4 Fathead Minnow Culture Methods	JM	JM	✓		Jennifer Moore, 12-8-92
SOP-5 Hatching and Preparation of Live Brine Shrimp (Artemia)	JM	JM	✓		Jennifer Moore, 12-8-92
SOP-6 Preparation of Laboratory Reconstituted Water	JM	JM	✓		Jennifer Moore, 12-8-92
SOP-7 Ceriodaphnia dubia Culture Methods	JM	JM	✓		Jennifer Moore, 4-21-93

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SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-8 <u>Daphnia pulex</u> Culture Methods	SM	SM	✓		James Moea (03-31-92)
SOP-9 Algal, <u>Selenastrum capricornutum</u> , Culture, Methods	SM	SM			James Moea (10-01-92)
SOP-10 Algal Cell Enumeration	SM	SM	✓		James Moea (03-31-92)
SOP-11 Fathead Minnow, <u>Pimephales</u> <u>promelas</u> , Acute Toxicity Test	SM	SM	✓		James Moea (10-01-92)
SOP-12 Fathead Minnow, <u>Pimephales</u> <u>promelas</u> , Chronic Toxicity Test	✓	✓	✓		James Moea 4-21-93
SOP-13 Fathead Minnow, <u>Pimephales</u> <u>promelas</u> , Embryo Larval Survival and Teratogenicity Test	SM	SM	✓		James Moea (03-31-92)
SOP-14 Daphnid, <u>Daphnia pulex</u> or <u>Ceriodaphnia dubia</u> , Acute Toxicity Test	SM	SM	✓		James Moea (10-01-90)
SOP-15 Cladoceran, <u>Ceriodaphnia dubia</u> , Survival and Reproduction Test	✓	✓	✓		James Moea 4-21-93
SOP-16 Algal, <u>Selenastrum capricornutum</u> , Growth Test	SM	SM	✓		James Moea (10-01-92)
SOP-17 Reference Toxicant Testing	SM	SM	✓		James Moea (3-31-92)

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SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-18 Physical/Chemical Analyses	✓	✓	✓		<i>[Signature]</i> 10-31-92
SOP-19 Statistics					
SOP-20 Report Preparation	✓	✓	✓		<i>[Signature]</i> 10-31-92
SOP-21 Freshwater Mussel Culture Methods					
SOP-22 Freshwater Mussel Test Methods					
SOP-23 Rotox●					
SOP-24 Microtox (Microbics Corporation)					
SOP-25 Duckweed Toxicity Test (ASTM)					

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Training Record for: John J. Farnsworth Position: Triclist

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ARL Toxicology Laboratory
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I, Joseph L. B. Brown, have read the "Referenced Chapters" of the ARL Toxicology Laboratory Quality Assurance Program and Standard Operating Procedures Manual.

The trainee will initial the READ column and will sign and date the TRAINEE SIGNATURE AND DATE column after each referenced chapter.

CHAPTER	READ	TRAINEE SIGNATURE AND DATE
CHAPTER 1 Introduction	<u>MR</u>	<u>Joseph L. B. Brown</u> 12-02-92
CHAPTER 2 Facility	<u>MR</u>	<u>Joseph L. B. Brown</u> 12-02-92
CHAPTER 3 Personnel	<u>MR</u>	<u>Joseph L. B. Brown</u> 12-02-92
CHAPTER 4 Health and Safety	<u>MR</u>	<u>Joseph L. B. Brown</u> 12-02-92
CHAPTER 5 Quality Assurance	<u>MR</u>	<u>Joseph L. B. Brown</u> 12-02-92

PLARC501-975

1, Arthur L. Russell, have read the ARL Toxicology Laboratory Quality Assurance Program and Standard Operating Procedures Manual. The trainee will initial the READ and TRAINED columns for the referenced SOP after (1) each applicable Standard Operating Procedure has been read, and (2) after training has been received by the Unit Supervisor or approved trainer.

The Unit Supervisor or approved trainer will initial the PROFICIENT column after the calibrations, procedures, and calculations (if applicable) have been satisfactorily performed by the trainee.

After the READ, TRAINED, and PROFICIENT columns have been initialed, the trainee will sign and date the TRAINEE SIGNATURE AND DATE column.

SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-1 Sample Collection and Handling	CR	CR	CR	JM	<u>Arthur L. Russell</u> 12-12-92
SOP-2 Preparation of Reagent Water					
SOP-3 Glassware Preparation	CR	CR	CR	JM	<u>Arthur L. Russell</u> 12-12-92
SOP-4 Fathead Minnow Culture Methods	CR	CR	CR	RH HCS	<u>Arthur L. Russell</u> 12-18-92
SOP-5 Hatching and Preparation of Live Brine Shrimp (Artemia)	CR	CR	CR	DH	<u>Arthur L. Russell</u> 12-18-92
SOP-6 Preparation of Laboratory Reconstituted Water	CR	CR	CR	DH	<u>Arthur L. Russell</u> 12-18-92
SOP-7 <u>Ceriodaphnia dubia</u> Culture Methods	CR	CR	CR	DH	<u>Arthur L. Russell</u> 12-18-92

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SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-8 <u>Daphnia pulex</u> Culture Methods	Cut	Cut	Cut	JM	Complete & Reviewed 12-11-92
SOP-9 Algal, <u>Selenastrum capricornutum</u> , Culture, Methods	Cut	Cut	Cut	JM	Complete & Reviewed 12-11-92
SOP-10 Algal Cell Enumeration	Cut				
SOP-11 Fathead Minnow, <u>Pimephales promelas</u> , Acute Toxicity Test					
SOP-12 Fathead Minnow, <u>Pimephales promelas</u> , Chronic Toxicity Test	Cut	Cut	Cut	JM	Complete & Reviewed 04-21-93
SOP-13 Fathead Minnow, <u>Pimephales promelas</u> , Embryo Larval Survival and Teratogenicity Test					
SOP-14 Daphnid, <u>Daphnia pulex</u> or <u>Ceriodaphnia dubia</u> , Acute Toxicity Test					
SOP-15 Cladoceran, <u>Ceriodaphnia dubia</u> , Survival and Reproduction Test	Cut	Cut	Cut	JM	Complete & Reviewed 04-21-93
SOP-16 Algal, <u>Selenastrum capricornutum</u> , Growth Test					
SOP-17 Reference Toxicant Testing					

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SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-18 Physical/Chemical Analyses	CUE	CUE	CUE	JM	Signature of Trainee 10/30/92
SOP-19 Statistics	CUE	CUE	CUE	JM	Signature of Trainee 10/30/92
SOP-20 Report Preparation	CUE	CUE	CUE	JM	Signature of Trainee 10/30/92
SOP-21 Freshwater Mussel Culture Methods					
SOP-22 Freshwater Mussel Test Methods					
SOP-23 Rotox●					
SOP-24 Microtox (Microbics Corporation)					
SOP-25 Duckweed Toxicity Test (ASTM)					

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Training Record for: James J. Sullivan

Position: Trainee

I, James J. Sullivan, have read the "Referenced Chapters" of the ARL Toxicology Laboratory Quality Assurance Program and Standard Operating Procedures Manual.

The trainee will initial the READ column and will sign and date the TRAINEE SIGNATURE AND DATE column after each referenced chapter.

CHAPTER	READ	TRAINEE SIGNATURE AND DATE
CHAPTER 1 Introduction	<i>JS</i>	<i>James J. Sullivan</i> 12-2-92
CHAPTER 2 Facility	<i>JS</i>	<i>James J. Sullivan</i> 12-2-92
CHAPTER 3 Personnel	<i>JS</i>	<i>James J. Sullivan</i> 12-2-92
CHAPTER 4 Health and Safety	<i>JS</i>	<i>James J. Sullivan</i> 12-2-92
CHAPTER 5 Quality Assurance	<i>JS</i>	<i>James J. Sullivan</i> 12-2-92

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1, Donald J. Smith, have read the ARL Toxicology Laboratory Quality Assurance Program and Standard Operating Procedures Manual. The trainee will initial the READ and TRAINED columns for the referenced SOP after (1) each applicable Standard Operating Procedure has been read, and (2) after training has been received by the Unit Supervisor or approved trainer.

The Unit Supervisor or approved trainer will initial the PROFICIENT column after the calibrations, procedures, and calculations (if applicable) have been satisfactorily performed by the trainee.

After the READ, TRAINED, and PROFICIENT columns have been initialed, the trainee will sign and date the TRAINEE SIGNATURE AND DATE column.

SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-1 Sample Collection and Handling	<i>DS</i>	<i>DS</i>	<i>DS</i>	<i>DM</i>	<i>Donald J. Smith</i> 12-2-92
SOP-2 Preparation of Reagent Water					
SOP-3 Glassware Preparation	<i>DS</i>	<i>DS</i>	<i>DS</i>	<i>DM</i>	<i>Donald J. Smith</i> 12-2-92
SOP-4 Fathead Minnow Culture Methods	<i>DS</i>	<i>DS</i>	<i>DS</i>	<i>TC/DM</i>	<i>Donald J. Smith</i> 12-8-92
SOP-5 Hatching and Preparation of Live Brine Shrimp (Artemia)	<i>DS</i>	<i>DS</i>	<i>DS</i>	<i>TC</i>	<i>Donald J. Smith</i> 12-8-92
SOP-6 Preparation of Laboratory Reconstituted Water	<i>DS</i>				
SOP-7 <u>Ceriodaphnia dubia</u> Culture Methods	<i>DS</i>	<i>DS</i>	<i>DS</i>	<i>DM/DM</i>	<i>Donald J. Smith</i> 12-18-92

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SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-8 <u>Daphnia pulex</u> Culture Methods					
SOP-9 Algal, <u>Selenastrum capricornutum</u> , Culture, Methods					
SOP-10 Algal Cell Enumeration					
SOP-11 Fathead Minnow, <u>Pimephales promelas</u> , Acute Toxicity Test					
SOP-12 Fathead Minnow, <u>Pimephales promelas</u> , Chronic Toxicity Test	MS	MS	MS	LM	<i>[Signature]</i> 4-21-93
SOP-13 Fathead Minnow, <u>Pimephales promelas</u> , Embryo Larval Survival and Teratogenicity Test					
SOP-14 Daphnid, <u>Daphnia pulex</u> or <u>Ceriodaphnia dubia</u> , Acute Toxicity Test					
SOP-15 Cladoceran, <u>Ceriodaphnia dubia</u> , Survival and Reproduction Test	MS	MS	MS	LM	<i>[Signature]</i> 4-21-93
SOP-16 Algal, <u>Selenastrum capricornutum</u> , Growth Test					
SOP-17 Reference Toxicant Testing					

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SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-18 Physical/Chemical Analyses		<i>WJS</i>	<i>WJS</i>	<i>WJS</i>	<i>Daryl Smith</i> 4-21-93
SOP-19 Statistics					
SOP-20 Report Preparation		<i>WJS</i>	<i>WJS</i>	<i>WJS</i>	<i>Daryl Smith</i> 4-21-93
SOP-21 Freshwater Mussel Culture Methods	<i>WJS</i>	<i>WJS</i>	<i>WJS</i>	<i>WJS</i>	<i>Daryl Smith</i> 4-21-93
SOP-22 Freshwater Mussel Test Methods	<i>WJS</i>	<i>WJS</i>	<i>WJS</i>	<i>WJS</i>	<i>Daryl Smith</i> 4-21-93
SOP-23 Rotox®					
SOP-24 Microtox (Microbics Corporation)					
SOP-25 Duckweed Toxicity Test (ASTM)					

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Training Record for: Daniel R. Harsanyi Position: Res. Assoc.

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I, Daniel R. Harsanyi, have read the "Referenced Chapters" of the ARL Toxicology Laboratory Quality Assurance Program and Standard Operating Procedures Manual.

The trainee will initial the READ column and will sign and date the TRAINEE SIGNATURE AND DATE column after each referenced chapter.

CHAPTER	READ	TRAINEE SIGNATURE AND DATE
CHAPTER 1 Introduction	<u>DRH</u>	<u>Daniel R. Harsanyi</u> 12-2-92
CHAPTER 2 Facility	<u>DRH</u>	<u>Daniel R. Harsanyi</u> 12-2-92
CHAPTER 3 Personnel	<u>DRH</u>	<u>Daniel R. Harsanyi</u> 12-2-92
CHAPTER 4 Health and Safety	<u>DRH</u>	<u>Daniel R. Harsanyi</u> 12-2-92
CHAPTER 5 Quality Assurance	<u>DRH</u>	<u>Daniel R. Harsanyi</u> 12-2-92

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1, Daniel R. Hershman, have read the ARL Toxicology Laboratory Quality Assurance Program and Standard Operating Procedures Manual. The trainee will initial the READ and TRAINED columns for the referenced SOP after (1) each applicable Standard Operating Procedure has been read, and (2) after training has been received by the Unit Supervisor or approved trainer.

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After the READ, TRAINED, and PROFICIENT columns have been initialed, the trainee will sign and date the TRAINEE SIGNATURE AND DATE column.

SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-1 Sample Collection and Handling	OK	OK	OK	J. Moser	D. R. Hershman 12-2-92
SOP-2 Preparation of Reagent Water	OK	OK	✓	J. Moser	D. R. Hershman 12-2-93
SOP-3 Glassware Preparation	OK	OK	OK	J. Moser	D. R. Hershman 12-2-92
SOP-4 Fathead Minnow Culture Methods	OK				
SOP-5 Hatching and Preparation of Live Brine Shrimp (Artemia)	OK	OK	OK	J. Moser	D. R. Hershman 12-2-92
SOP-6 Preparation of Laboratory Reconstituted Water	OK	OK	OK	J. Moser	D. R. Hershman 12-2-92
SOP-7 <u>Ceriodaphnia dubia</u> Culture Methods	OK	OK	✓	J. Moser	D. R. Hershman 12-1-93

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SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-8 <u>Daphnia pulex</u> Culture Methods	OK	OK	✓	J. Moses	D. Henderson
SOP-9 Algal, <u>Selenastrum capricornutum</u> , Culture, Methods					
SOP-10 Algal Cell Enumeration					
SOP-11 Fathead Minnow, <u>Pimephales promelas</u> , Acute Toxicity Test					
SOP-12 Fathead Minnow, <u>Pimephales promelas</u> , Chronic Toxicity Test	OK	OK	✓	J. Moses	D. Henderson 4-21-93
SOP-13 Fathead Minnow, <u>Pimephales promelas</u> , Embryo Larval Survival and Teratogenicity Test					
SOP-14 Daphnid, <u>Daphnia pulex</u> or <u>Ceriodaphnia dubia</u> , Acute Toxicity Test					
SOP-15 Cladoceran, <u>Ceriodaphnia dubia</u> , Survival and Reproduction Test	OK	OK	✓	J. Moses	D. Henderson 4-21-93
SOP-16 Algal, <u>Selenastrum capricornutum</u> , Growth Test					
SOP-17 Reference Toxicant Testing					

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SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-18 Physical/Chemical Analyses	OK	OK	✓	T. Warr	O. R. Housensmy 4.21.93
SOP-19 Statistics					
SOP-20 Report Preparation					
SOP-21 Freshwater Mussel Culture Methods					
SOP-22 Freshwater Mussel Test Methods					
SOP-23 ROTOX●					
SOP-24 Microtox (Microbics Corporation)					
SOP-25 Duckweed Toxicity Test (ASTM)					

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Training Record for: Teresa C. Sessler

Position: Biologist

I, Teresa C. Sessler have read the "Referenced Chapters" of the ARL Toxicology Laboratory Quality Assurance Program and Standard Operating Procedures Manual.

The trainee will initial the READ column and will sign and date the TRAINEE SIGNATURE AND DATE column after each referenced chapter.

CHAPTER	READ	TRAINEE SIGNATURE AND DATE
CHAPTER 1 Introduction	<u>TS</u>	<u>Teresa C. Sessler 12/2/92</u>
CHAPTER 2 Facility	<u>TS</u>	<u>Teresa C. Sessler 12/2/92</u>
CHAPTER 3 Personnel	<u>TS</u>	<u>Teresa C. Sessler 12/2/92</u>
CHAPTER 4 Health and Safety	<u>TS</u>	<u>Teresa C. Sessler 12/2/92</u>
CHAPTER 5 Quality Assurance	<u>TS</u>	<u>Teresa C. Sessler 12/2/92</u>

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I, Sharon C. Seiber, have read the ARL Toxicology Laboratory Quality Assurance Program and Standard Operating Procedures Manual. The trainee will initial the READ and TRAINED columns for the referenced SOP after (1) each applicable Standard Operating Procedure has been read, and (2) after training has been received by the Unit Supervisor or approved trainer.

The Unit Supervisor or approved trainer will initial the PROFICIENT column after the calibrations, procedures, and calculations (if applicable) have been satisfactorily performed by the trainee.

After the READ, TRAINED, and PROFICIENT columns have been initialed, the trainee will sign and date the TRAINEE SIGNATURE AND DATE column.

SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-1 Sample Collection and Handling	<i>SCS</i>	<i>SCS</i>	<i>SCS</i>	<i>Sharon C. Seiber</i>	<i>Sharon C. Seiber 10/22/92</i>
SOP-2 Preparation of Reagent Water					
SOP-3 Glassware Preparation	<i>SCS</i>	<i>SCS</i>	<i>SCS</i>	<i>Sharon C. Seiber</i>	<i>Sharon C. Seiber 10/22/92</i>
SOP-4 Fathead Minnow Culture Methods	<i>SCS</i>	<i>SCS</i>	<i>SCS</i>	<i>Sharon C. Seiber</i>	<i>Sharon C. Seiber 10/28/92</i>
SOP-5 Hatching and Preparation of Live Brine Shrimp (Artemia)	<i>SCS</i>	<i>SCS</i>	<i>SCS</i>	<i>Sharon C. Seiber</i>	<i>Sharon C. Seiber 10/28/92</i>
SOP-6 Preparation of Laboratory Reconstituted Water					
SOP-7 <i>Ceriodaphnia dubia</i> Culture Methods					

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SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-8 <u>Daphnia pulex</u> Culture Methods					
SOP-9 Algal, <u>Selenastrum capricornutum</u> , Culture, Methods					
SOP-10 Algal Cell Enumeration					
SOP-11 Fathead Minnow, <u>Pimephales promelas</u> , Acute Toxicity Test	yes	yes	✓	JM	Jean Decker 5/25/93
SOP-12 Fathead Minnow, <u>Pimephales promelas</u> , Chronic Toxicity Test	yes	yes	✓	JM	Jean Decker 5/25/93
SOP-13 Fathead Minnow, <u>Pimephales promelas</u> , Embryo Larval Survival and Teratogenicity Test					
SOP-14 Daphnid, <u>Daphnia pulex</u> or <u>Ceriodaphnia dubia</u> , Acute Toxicity Test	yes	yes	✓	JM	Jean Decker 5/25/93
SOP-15 Cladoceran, <u>Ceriodaphnia dubia</u> , Survival and Reproduction Test	yes	yes	✓	JM	Jean Decker 5/25/93
SOP-16 Algal, <u>Selenastrum capricornutum</u> , Growth Test					
SOP-17 Reference Toxicant Testing	yes	yes	✓	JM	Jean Decker 5/25/93

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SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-18 Physical/Chemical Analyses	yes	TCB	✓	JM	Jean Leelan 5/25/93
SOP-19 Statistics	yes	TCB	✓	JM	Jean Leelan 5/25/93
SOP-20 Report Preparation					
SOP-21 Freshwater Mussel Culture Methods	yes				
SOP-22 Freshwater Mussel Test Methods	yes	TCB	✓	JP DS	Jean Leelan 5/25/93
SOP-23 Rotox	yes	TCB	✓	JP	Jean Leelan 5/25/93
SOP-24 Microtox (Microbics Corporation)					
SOP-25 Duckweed Toxicity Test (ASTM)					

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Training Record for: Janet Foley Position: Section Chief

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Page 1 of 4

I, Janet Foley, have read the "Referenced Chapters" of the ARL Toxicology Laboratory Quality Assurance Program and Standard Operating Procedures Manual.

The trainee will initial the READ column and will sign and date the TRAINEE SIGNATURE AND DATE column after each referenced chapter.

CHAPTER	READ	TRAINEE SIGNATURE AND DATE
CHAPTER 1 Introduction	JPF	Janet Foley 12-2-92
CHAPTER 2 Facility	JPF	Janet Foley 12-2-92
CHAPTER 3 Personnel	JPF	Janet Foley 12-2-92
CHAPTER 4 Health and Safety	JPF	Janet Foley 12-2-92
CHAPTER 5 Quality Assurance	JPF	Janet Foley 12-2-92

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1. Unit Supervisor, have read the ARL Toxicology Laboratory Quality Assurance Program and Standard Operating Procedures Manual. The trainee will initial the READ and TRAINED columns for the referenced SOP after (1) each applicable Standard Operating Procedure has been read, and (2) after training has been received by the Unit Supervisor or approved trainer.

The Unit Supervisor or approved trainer will initial the PROFICIENT column after the calibrations, procedures, and calculations (if applicable) have been satisfactorily performed by the trainee.

After the READ, TRAINED, and PROFICIENT columns have been initialed, the trainee will sign and date the TRAINEE SIGNATURE AND DATE column.

SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-1 Sample Collection and Handling	JPP	JPP	JPP	JM	<i>Unit Supervisor</i> 12-2-92
SOP-2 Preparation of Reagent Water	JPP	JPP	JPP	JM	<i>Unit Supervisor</i>
SOP-3 Glassware Preparation	JPP	JPP	JPP	JM	<i>Unit Supervisor</i> 12-2-92
SOP-4 Fathead Minnow Culture Methods	JPP	JPP	JPP	TCS	<i>Unit Supervisor</i> 12-5-92
SOP-5 Hatching and Preparation of Live Brine Shrimp (Artemia)	JPP	JPP	JPP	RIS	<i>Unit Supervisor</i> 12-4-92
SOP-6 Preparation of Laboratory Reconstituted Water			JPP	JM	
SOP-7 Ceriodaphnia dubia Culture Methods					

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SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-18 Physical/Chemical Analyses	YES	SOP	✓	SM	Garret Peters 5-25-93
SOP-19 Statistics					
SOP-20 Report Preparation					
SOP-21 Freshwater Mussel Culture Methods	YES	SOP	✓	SM	Garret Peters 5-25-93
SOP-22 Freshwater Mussel Test Methods	YES	SOP	✓	SM	Garret Peters 5-25-93
SOP-23 ROTOX●	YES	SOP	✓	Don Wade SM	Garret Peters 5-25-93
SOP-24 Microtox (Microbics Corporation)					
SOP-25 Duckweed Toxicity Test (ASTM)					

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SOP Section	READ	TRAINED	PROFICIENT	TRAINER (Name)	TRAINEE SIGNATURE AND DATE
SOP-8 <u>Daphnia pulex</u> Culture Methods					
SOP-9 Algal, <u>Selenastrum capricornutum</u> , Culture, Methods					
SOP-10 Algal Cell Enumeration					
SOP-11 Fathead Minnow, <u>Pimephales promelas</u> , Acute Toxicity Test	YES	SPP	✓	SM	Donat Pacey 5-25-93
SOP-12 Fathead Minnow, <u>Pimephales promelas</u> , Chronic Toxicity Test	YES	SPP	✓	SM	Donat Pacey 5-25-93
SOP-13 Fathead Minnow, <u>Pimephales promelas</u> , Embryo Larval Survival and Teratogenicity Test	YES	SPP	✓	SM	Donat Pacey 5-25-93
SOP-14 Daphnid, <u>Daphnia pulex</u> or <u>Ceriodaphnia dubia</u> , Acute Toxicity Test	YES	SPP	✓	SM	Donat Pacey 5-25-93
SOP-15 Cladoceran, <u>Ceriodaphnia dubia</u> , Survival and Reproduction Test	YES	SPP	✓	SM	Donat Pacey 5-25-93
SOP-16 Algal, <u>Selenastrum capricornutum</u> , Growth Test					
SOP-17 Reference Toxicant Testing	YES	SPP	✓	SM	Donat Pacey 5-25-93

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