

DOE/OR/22012--78

STANDARD REPORT FORM

STATIC RENEWAL TESTS USING
PIMEPHALES PROMELAS (FATHEAD MINNOWS)

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

Principal Investigator: Damien J. Simbeck

Starting Date: October 21, 1993

Ending Date: October 28, 1993

1.0 EXECUTIVE SUMMARY

Clinch River - Environmental Restoration Program (CR-ERP) personnel and Tennessee Valley Authority (TVA) personnel conducted a study during the week of October 21-28, 1993, as described in the Statement of Work (SOW) document. [1] The organisms specified for testing were larval fathead minnows, Pimephales promelas, and the daphnid, Ceriodaphnia dubia. Due to serious reproduction/embryo abortion problems with the TVA daphnid cultures, TVA conducted tests during this study period using only fathead minnows. A split sample test using daphnids only will be scheduled during 1994 as a substitute for this study period (see letter, J. Moses to T. L. Phipps, October 14, 1993). [2]

Surface water samples were collected by TVA Field Engineering personnel from Poplar Creek Mile 2.9, Mile 4.3, and Mile 5.1 on October 20, 22, and 25. 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 or growth) 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 three sites: Poplar Creek Mile 2.9, Mile 4.3 and Mile 5.1.
- 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.
- 2.3 Sample Dates and Times: Test samples were collected on October 20, 22, and 25, 1993. Collection times were between 0940 and 1200 EDT.

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- 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 four liters per minute. A 20 L composite was collected at each station and partitioned (split) according to the workplan for shipping to the TVA Toxicity Testing Laboratory (TTL) at Browns Ferry Nuclear Plant site or direct transfer to ORNL (DOE) personnel in the field.
- 2.5 Pertinent Site Conditions: Weather conditions were clear and sunny during sampling on October 20, 22, and 25.
- 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 TVA Toxicity Testing Laboratory (TTL).
- 2.7 Sample Transport: Samples collected on October 20, 22, and 25 were transported to the Browns Ferry Nuclear Plant site by overnight TVA mail courier. Personnel from TTL picked up samples from the mailroom and transported them to TTL. All chain of custody security seals were intact upon receipt of shipments.
- 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 $64\ \mu\text{m}$ nylon mesh filter into 2000 mL beakers, and appropriate dilutions were prepared where applicable.
- 2.9 Test Treatments: Samples from Poplar Creek Mile 2.9, Mile 4.3, and Mile 22.0 were tested at 100 percent (undiluted) and diluted to 50 percent using moderately hard reconstituted water.

3.0 TEST ORGANISMS/CULTURING CONDITIONS

- 3.1 Species: Pimephales promelas, Fathead minnow
- 3.1.1 Source: TTL 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: October 16, 1993
- 3.1.6 Hatch Date/Time: October 20, 1993/1000 CDT to
October 21, 1993/0825 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: 0.08 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.

4.0 TEST METHODS

- 4.1 Fathead Minnow (Pimephales promelas) Larval Survival and Growth Test, EPA Test Method 1000.0. [3]
- 4.1.1 Modifications to/Deviations from Method 1000.0:
- 4.1.1.1 The Poplar Creek Mile 4.3 sample storage temperature on Day 6 was 2.7°C which was below the prescribed range of $4^{\circ}\text{C} \pm 1^{\circ}\text{C}$. Temperatures of samples received on ice ranged from 0.4°C to 1.5°C .
- 4.1.1.2 Temperatures in 10 beakers on Day 1 and one beaker on Day 7 were below the required $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$. These deviate temperatures ranged from 23.5°C to 23.9°C . No adverse affect to test results was likely since the low temperatures were random among treatments, and the overall means for the test (24.9°C) and all individual treatments were within the EPA required limits.

- 4.1.2 Date/Time Test Initiated: October 21, 1993/0930 CDT
- 4.1.3 Date/Time Test Terminated: October 28, 1993/0945 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: $25.0^{\circ}\text{C} \pm 1^{\circ}\text{C}$
- 4.1.10 Feeding Regime During Test: Fathead minnow larvae were fed brine shrimp (Artemia) nauplii <24-h old 2 or 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 (10/21, 10/23, and 10/26).

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.

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 TTL 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 TTL 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 procedures ES-43.8 and ES-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 ES-43.6 and ES-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 ES-43.7 and ES-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 ES-43.3 and ES-42.3, respectively. [4]

5.2.7 Alkalinity was measured by titration of 100 mL samples with 0.02 N H_2SO_4 to an end point of 4.5 according to TVA procedure ES-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 ES-42.9, Rev. 0. [4]

5.3 Reference Toxicant Tests

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

5.3.2 Standard Toxicants Used:

Copper Sulfate Reference Toxicant Solution
Source/Brand: EPA

5.3.3 Dilution Water Used: Moderately hard reconstituted water

- 5.3.4 Statistics: Chronic Test, FH Survival/Growth, NOEC - Dunnett's Test or Steel's Many-one Rank Test, EPA Bootstrap Procedure - IC₂₅

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 Poplar Creek Mile 2.9, Mile 4.3, or Mile 5.1 samples during the CR-ERP Ambient Water Toxicity Study conducted from October 21-28, 1993.

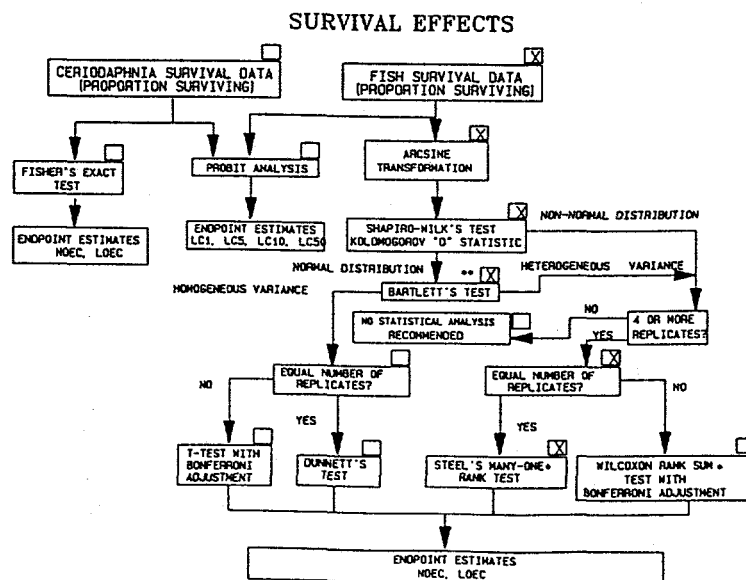
6.1.2 Results, Survival Data:

6.1.2.1 Daily Percent Survival Summary for Fathead Minnow Larval Survival Test, CR-ERP Study, October 21-28, 1993.

Treatment	Total Daily % Survival						
	Day 1	2	3	4	5	6	7
Medium	100	100	100	100	100	100	100
PCM 2.9-50%	100	100	100	98	98	98	98
PCM 2.9-100%	100	100	100	98	98	98	98
PCM 4.3-50%*	100	100	100	98	97	97	97
PCM 4.3-100%	100	100	100	98	98	98	98
PCM 5.1-50%	100	100	100	93	93	93	93
PCM 5.1-100%	100	100	100	100	100	100	100

*Replicate 4 counted as 9 organisms initially for Days 5, 6, and 7 due to accidental injury/death of 1 fish.

6.1.2.2 Statistical Decision Process for Determining Toxicity Endpoints for 7-Day Survival of Fathead Minnows, CR-ERP Study, October 21-28, 1993.



* Test requires 4 replicates/treatment

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

6.1.2.3 Analysis of Survival Data Using Steel's Many-one Rank Test for Fathead Minnow 7-Day Larval Survival Test, CR-ERP Study, October 21-28, 1993.

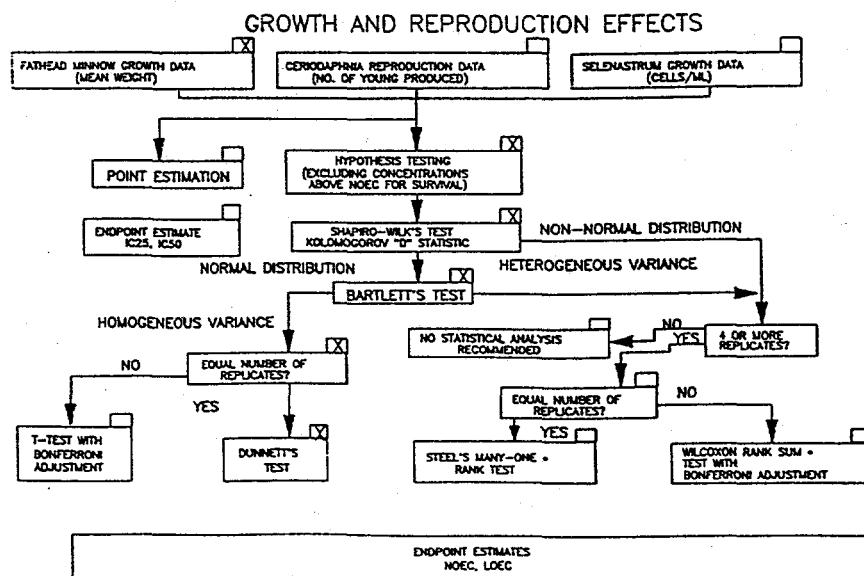
Group	Survival (%) Data										Mean	S*
	Replicate											
	1	2	3	4	5	6	7	8	9	10		
Medium	100	100	100	100							100	
PCM 2.9-50%	100	100	100	90							98	
PCM 2.9-100%	90	100	100	100							98	
PCM 4.3-50%	100	100	100	89							97	
PCM 4.3-100%	100	100	90	100							98	
PCM 5.1-50%	100	100	100	70							93	
PCM 5.1-100%	100	100	100	100							100	

Steel's Many-one Rank Test			
Treatment	Replicates	Critical Rank Sum	Rank Sum*
PCM 2.9-50%	4	10	16.0
PCM 2.9-100%	4	10	16.0
PCM 4.3-50%	4	10	16.0
PCM 4.3-100%	4	10	16.0
PCM 5.1-50%	4	10	16.0
PCM 5.1-100%	4	10	18.0

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

6.1.3 Results, Growth Data:

6.1.3.1 Statistical Decision Process for Determining Toxicity Endpoints for 7-Day Growth of Fathead Minnows, CR-ERP Study, October 21-28, 1993.



* Test requires 4 replicates/treatment

6.1.3.2 Analysis of Dry Weight (mg) Data Using Dunnett's Test for Fathead Minnow 7-Day Larval Growth Test, CR-ERP Study, October 21-28, 1993.

No transformation applied before data analysis. For this set of data, the minimum significant difference is 0.08.

This represents an 15.51% decrease in dry weight, mg.

T = 2.45 Alpha = 0.05 (one-tailed test)

Treatment	Growth Data (mg)										Mean	S*
	Replicate											
	1	2	3	4	5	6	7	8	9	10		
Medium	0.51	0.47	0.54	0.46							0.50	
PCM 2.9-50%	0.51	0.49	0.53	0.50							0.51	
PCM 2.9-100%	0.50	0.48	0.50	0.62							0.53	
PCM 4.3-50%	0.58	0.58	0.53	0.61							0.57	
PCM 4.3-100%	0.54	0.49	0.49	0.39							0.48	
PCM 5.1-50%	0.46	0.50	0.44	0.54							0.48	
PCM 5.1-100%	0.53	0.46	0.52	0.50							0.50	

*Values significantly less than the control (Medium). EMS = 0.002.

6.2 Physical/Chemical Parameters

6.2.1 Overall Test Temperature: Fathead Minnow - 24.9°C (23.5°-26.0°C)

6.2.2 Water chemistry summary for CR-ERP Study, October 21-28, 1993.

See: Appendix A Water Chemistry Mean Values and Ranges
for Fathead Minnow Test, CR-ERP Study,
October 21-28, 1993

6.3 Reference Toxicant Tests

6.3.1 Summary of Results:

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

6.3.2 Fathead Minnows

6.3.2.1 Date/Time of Most Recent Test:

September 30, 1993/0915 CDT to October 7, 1993/0830 CDT

6.3.2.2 LOEC: 0.008 mg Cu/L

NOEC: 0.003 mg Cu/L

IC₂₅: 0.006 mg Cu/L

6.3.2.3 Control Chart Information:

Number of standard tests completed by laboratory: 48

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: 0.004-0.012 mg Cu/L

7.0 CONCLUSION

Testing conducted using Poplar Creek Mile 2.9, Mile 4.3, and Mile 5.1 samples collected on October 20, 22, and 25 showed no toxicity (survival or growth) to fathead minnows.

8.0 REFERENCES

1. Phipps, T. L., and L. A. Kszos, Statement of Work, Environmental Sciences Division, Biomonitoring Group, Oak Ridge National Laboratory (April 1993, revised June 1993).
2. Letter, J. Moses, TVA, to Terry L. Phipps, ORNL, October 14, 1993, Re: Using Only Fathead Minnows for October 1993; Rescheduling Daphnid Test for 1994.
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.

PLARC501-1951

Appendix A

Water Chemistry Mean Values and Ranges for Fathead Minnow Test, CR-ERP Ambient Water Toxicity Study, October 21-28, 1993

Source	Temperature		Dissolved Oxygen		pH		Conductivity		Alk Initial Fish	Hardness		Chlorine Initial
	Final Fish	(°C)	Initial Fish	(mg/L)	Initial Fish	(S.U.)	Final Fish	(µmhos)		Initial Fish	(mg/L)	
Fish Medium	24.9 (23.5-25.9)	8.3 (8.1-8.4)	6.0 (4.6-7.1)	7.8 (7.6-7.9)	348 (338-360)	352 (344-363)	67 (65-68)	94.1 (94.1-94.1)	-	-	-	
PCM 2.9-50%	24.9 (23.9-26.0)	8.3 (8.2-8.4)	6.0 (4.5-7.0)	7.9 (7.7-8.0)	360 (353-366)	364 (356-371)	-	-	-	-	-	
PCM 2.9-100%	24.9 (23.9-25.9)	8.3 (8.0-8.4)	6.0 (4.8-7.1)	8.0 (7.8-8.1)	375 (363-382)	378 (370-384)	116 (113-119)	153.9 (153.9-153.9)	<0.1 (<0.1-<0.1)	-	-	
PCM 4.3-50%	24.8 (23.8-25.8)	8.2 (8.0-8.4)	6.0 (4.3-7.0)	7.7 (7.6-7.8)	375 (368-382)	378 (371-389)	-	-	-	-	-	
PCM 4.3-100%	24.9 (23.7-25.9)	7.6 (7.0-8.1)	5.9 (4.5-7.1)	7.5 (7.3-7.6)	406 (401-416)	410 (405-421)	122 (120-126)	160.2 (159.0-162.5)	<0.1 (<0.1-<0.1)	-	-	
PCM 5.1-50%	24.8 (23.7-25.8)	8.2 (8.0-8.4)	6.1 (4.1-7.2)	7.7 (7.6-7.8)	371 (367-375)	378 (371-385)	-	-	-	-	-	
PCM 5.1-100%	24.9 (23.5-25.9)	7.6 (6.9-8.3)	6.0 (4.7-7.2)	7.5 (7.3-7.6)	401 (397-405)	405 (401-410)	122 (120-127)	161.3 (159.0-162.5)	<0.1 (<0.1-<0.1)	-	-	

*mg/L as CaCO3

PLARC501-1952

ATTACHMENT I

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

$TVA \rightarrow TVAT$
(Bferr)

RELINQUISHED BY: <i>James E. McWhorter</i>	DATE: 10-20-93	TIME: 13:00	RECEIVED BY:	DATE:	TIME:
RELINQUISHED BY: <i>CS R. H. Hines</i>	DATE: 10-21-93	TIME: 06:30	RECEIVED BY:	DATE:	TIME:
SAMPLE DISPOSED BY:			DATE:		

TVA → Bferry

FCC: Rev. 2 21st:1993

DOCUMENT ID:

$TV_A \rightarrow B_{ferry}$

FCCOC: Rev. 2 21SI:P93

DOCUMENT ID:

ATTACHMENT II

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

ARL CHRONIC TOXICITY TEST MASTER CHECKLIST

Study: DOE Ambient Tox

Date Issued: 10-20

To: DJS

From: Jm

1. Test organism availability: FH Minnows-T.L.* Jm C.U.* TC Date 9-29
Daphnids - T.L. N/A C.U. → Date →

2. Sample Collection Coordination: Date According to SOW By Jm With →

3. Glassware availability: T.L. DJS Tech. → Date 10-20

4. Glassware prep. complete: Date 10-20 By DJS

5. Data Sheet prep. complete: Date 10-20 By DJS

6. Test organism availability verification: FH-OK? DJS Daphnids-OK? N/A

7. FH Minnow acclimation:
Day 1 2

By NA NA

8. Test Initiation: FH-Date/Time 10-21-93/0930 Daphnid-Date/Time NA

Initial Chem. DJS FH DJS Daphnid NA Log Samples DJS
SPP SPP → →

9. Test Renewal: Day #: 1 2 3 4 5 6 (7) (8)

Initial Chem. - T.L. DJS DJS DJS DJS DJS SPP NA →
T.M.* JPP JPP NA JPP JPP WR/GK NA →

Final Chem. - T.L. DJS DJS DJS DJS DJS SPP DJS →
T.M. SPP SPP OH SPP SPP WR/GK SPP →

F.H. - T.L. DJS DJS DJS DJS DJS JPP DJS →
T.M. SPP SPP OH JPP JPP WR/GK SPP →

Daphnid - T.L. NA → → → → → → →
T.M. NA → → → → → → →

10. Test Termination: FH-Date/Time 10-28-93/0945 Daphnid-Date/Time NA

Final Chem. DJS FH DJS Daphnid NA Clean-up DJS
SPP SPP NA SPP

11. Weigh Fish: Date 10-29-93 By DJS

12. Run Stats: Date 11-03-93 By CA

13. Report Prep.: Date 11-15-93 By DJS

14. Report Final: Date 11-24-93 By Jm Approved: NA

*Team Leader

†Culture Unit

#Team Member

Chronic Study Fathead Record Sheet

Study CR-ERP QA Test October 1993

Test Organism Pimephales promelas

Beginning Date/Time 10-21-93 / 0930

Ending Date/Time 10-28-93 / 0945

Personnel Simbeck, Posey, Kinard, Russel

Control/Dilution Water MHRV (F-MED)

Test Treatment Identification

1. F-MED (control)
2. PCM 2.9 50%
3. PCM 2.9 100%
4. PCM 4.3 50%
5. PCM 4.3 100%
6. PCM 5.1 50%
7. PCM 5.1 100%
8. _____

Spawn Date

10/16

Tile #

12, 13, 14

16, 19, 20

9, 11

Hatch Date

10/20 AF 1000

10/21 BF 0825

Test #

NOEC > 100% for all sites

LOEC > 100% for all sites

Notes:

10-21-93
AF 1000

10-20-93
AF 1000

10/16 #12, 13

10/16 #14, 16

10/16 #9, 11

10/16 #19, 20

FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

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Study CR-ERP Oct '93

Beginning Date/Time 10-21-93/0930

Ending Date/Time 10-28-93/0945

Personnel

Simbeck Knard
Posey Russel

-- Number Alive --

Treatment	Rep	- Day -						
		1	2	3	4	5	6	7
F-MED 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:	DJS	DJS	DJS	DJS	DJS	GKK	DJS
PCM 2.9 50%	1	10	10	10	10	10	10	10
	2	10	10	10	10	10	10	10
	3	10	10	10	10	10	10	10
	4	10	10	10	9	9	9	9
	By:	DJS	DJS	DJS	DJS	DJS	GKK	DJS
PCM 2.9 100%	1	10	10	10	9	9	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:	DJS	DJS	DJS	DJS	DJS	GKK	DJS
PCM 4.3 50%	1	10	10	10	10	10	10	10
	2	10	10	10	10	10	10	10
	3	10	10	10	10	10	10	10
	4	10	10	10	*9	8	8 ⁺	8
	By:	DJS/JPP	DJS	DH	DJS/JPP/DH/JPP	DJS/JPP	GKK/JPP	DJS
PCM 4.3 100%	1	10	10	10	10	10	10	10
	2	10	10	10	10	10	10	10
	3	10	10	10	9	9	9	9
	4	10	10	10	10	10	10	10
	By:	JPP	JPP	DH	JPP	JPP	JPP	JPP
PCM 5.1 50%	1	10	10	10	10	10	10	10
	2	10	10	10	10	10	10	10
	3	10	10	10	10	10	10	10
	4	10	10	10	7	7	7	7
	By:	JPP	JPP	DH	JPP	JPP	JPP	JPP

Notes:

* one possibly injured
+ count as 9 initially
on days 5, 6, + 7

Fed- Time/By: 0715/DJS 1145/DJS 0230/DJS 0415/DJS 700/DH 0647/DH

0935/DJS 1200/DJS 1400/DJS 0900/DH 1200/DH 1020/DJS 1020/JPP

1650/JPP 1450/DJS 1615/JPP 1530/JPP 1530/JPP

Dilution Water ID: 1503 1503 1503 1503 1504 1504 1504

(PLARC501-257) Reviewed By: DJS DJS DJS DJS DJS JPP/DH DJS

FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

Page 2 of 2

Study CR-ERP Oct. 93

11-22-93

Personnel

Simbeck Knael
Posey Russel

Beginning Date/Time 10-21-93/0930

Ending Date/Time 10-21-93/0945

— Number Alive —

Treatment	Rep	- Day -						
		1	2	3	4	5	6	7
PCM 5.1 100%	1	10	10	10	10	10	10	10
	2	10	10	10	10	10	10	10
	3	10	10	10	10	10	10	10
	4	10	10	10	10	10	10	10
	By:	JPP	JPP	DH	JPP	JPP	JPP	JPP
	1							
	2							
	3							
	4							
	By:							
	1							
	2							
	3							
	4							
	By:							
	1							
	2							
	3							
	4							
	By:							
	1							
	2							
	3							
	4							
	By:							
	1							
	2							
	3							
	4							
	By:							
	1							
	2							
	3							
	4							
	By:							

Notes:

Fed- Time/By: 0715/292 0815/292 0920/292 0935/292 1000/292 1020/292 1040/292

0935/292 1000/292 1020/292 1040/292 1060/292 1080/292 1100/292

1650/292 1450/292 1615/292 1530/292 1530/292

Dilution Water ID: 1503 1503 1503 1503 1504 1504 1504

(PLARCS01-257) Reviewed By: 0/5 0/5 0/5 0/5 0/5 0/5 0/5

11-03-93

Csk

Analysis of Survival

CR-ERP #3

Starting Date: 10/21/93

Survival (%) Data

Treatment	Replicate										Mean
	1	2	3	4	5	6	7	8	9	10	
MEDIUM	1.00	1.00	1.00	1.00	.	.	.	.	.	.	1.00
PCM 2.9 50%	1.00	1.00	1.00	0.90	.	.	.	.	.	.	0.98
PCM 2.9 100%	0.90	1.00	1.00	1.00	.	.	.	.	.	.	0.98
PCM 4.3 50%	1.00	1.00	1.00	0.89	.	.	.	.	.	.	0.97
PCM 4.3 100%	1.00	1.00	0.90	1.00	.	.	.	.	.	.	0.98
PCM 5.1 50%	1.00	1.00	1.00	0.70	.	.	.	.	.	.	0.93
PCM 5.1 100%	1.00	1.00	1.00	1.00	.	.	.	.	.	.	1.00

Steel's Many-One Rank Test

Treatment	No. of Replicates	Critical Rank Sum	Rank Sum*
PCM 2.9 50%	4	10	16
PCM 2.9 100%	4	10	16
PCM 4.3 50%	4	10	16
PCM 4.3 100%	4	10	16
PCM 5.1 50%	4	10	16
PCM 5.1 100%	4	10	18

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

Non-parametric analysis of toxicity data

2

20:37 Sunday, October 27, 1991

----- STUDY=CR-ERP #3 ST_DATE=102193 PARM=MINS TEST=STEEL -----

OBS	TREATMENT	N CONTROL	N EFFLUENT	RANK SUM	CRITICAL RANK SUM	SIGNIFICANT DIFFERENCE
1	PCM 2.9 50%	4	4	16	10	
2	PCM 2.9 100%	4	4	16	10	
3	PCM 4.3 50%	4	4	16	10	
4	PCM 4.3 100%	4	4	16	10	
5	PCM 5.1 50%	4	4	16	10	
6	PCM 5.1 100%	4	4	18	10	

—

9-

1	CR-ERP	#3	102193	MINS	2	0	10	4	4	4	4	4	6	6	STEEL	1	PCM	2.9	50%	20
2	CR-ERP	#3	102193	MINS	2	0	10	4	4	4	4	4	6	6	STEEL	2	PCM	2.9	50%	16
3	CR-ERP	#3	102193	MINS	3	0	10	4	4	4	4	4	6	6	STEEL	1	PCM	2.9	100%	20
4	CR-ERP	#3	102193	MINS	3	0	10	4	4	4	4	4	6	6	STEEL	3	PCM	2.9	100%	16
5	CR-ERP	#3	102193	MINS	4	0	10	4	4	4	4	4	6	6	STEEL	1	PCM	4.3	50%	20
6	CR-ERP	#3	102193	MINS	4	0	10	4	4	4	4	4	6	6	STEEL	4	PCM	4.3	50%	16
7	CR-ERP	#3	102193	MINS	5	0	10	4	4	4	4	4	6	6	STEEL	1	PCM	4.3	100%	20
8	CR-ERP	#3	102193	MINS	5	0	10	4	4	4	4	4	6	6	STEEL	5	PCM	4.3	100%	16
9	CR-ERP	#3	102193	MINS	6	0	10	4	4	4	4	4	6	6	STEEL	1	PCM	5.1	50%	20
10	CR-ERP	#3	102193	MINS	6	0	10	4	4	4	4	4	6	6	STEEL	6	PCM	5.1	50%	16
11	CR-ERP	#3	102193	MINS	7	0	10	4	4	4	4	4	6	6	STEEL	1	PCM	5.1	100%	18
12	CR-ERP	#3	102193	MINS	7	0	10	4	4	4	4	4	6	6	STEEL	7	PCM	5.1	100%	18

TEST FOR NORMAL DISTRIBUTION

20:32 Sunday, October 27, 1991

----- STUDY=CR-ERP #3 ST_DATE=102193 PARM=MINS -----

UNIVARIATE PROCEDURE

Variable=CENTER

Moments

N	28	Sum Wgts	28
Mean	0	Sum	0
Std Dev	0.089688	Variance	0.008044
Skewness	-1.93773	Kurtosis	4.74489
USS	0.217187	CSS	0.217187
CV	.	Std Mean	0.016949
T:Mean=0	0	Prob> T	1.0000
Sgn Rank	15	Prob> S	0.5880
Num ^= 0	20		
W:Normal	0.76776	Prob<W	0.0001

Quantiles (Def=5)

100% Max	0.105215	99%	0.105215
75% Q3	0.040743	95%	0.105215
50% Med	0.040743	90%	0.105215
25% Q1	0	10%	-0.12223
0% Min	-0.31564	5%	-0.13579
		1%	-0.31564
Range	0.42086		
Q3-Q1	0.040743		
Mode	0		

Extremes

Lowest	Obs	Highest	Obs
-0.31564 (	54)	0.045264 (	32)
-0.13579 (	34)	0.045264 (	33)
-0.12223 (	14)	0.105215 (	51)
-0.12223 (	43)	0.105215 (	52)
-0.12223 (	21)	0.105215 (	53)

Missing Value

Count	42
% Count/Nobs	60.00

TEST FOR NORMAL DISTRIBUTION

20:32 Sunday, October 27, 1991

STUDY=CR-ERP #3 ST_DATE=102193 PARM=MINS

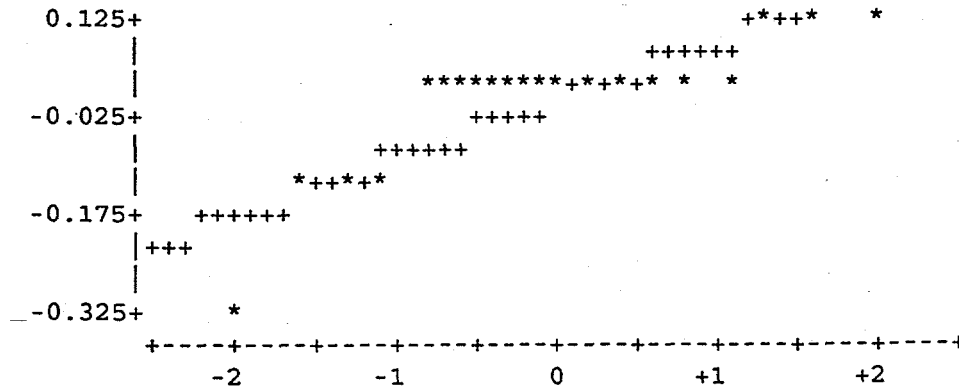
UNIVARIATE PROCEDURE

Variable=CENTER

Stem Leaf	#	Boxplot
1 111	3	0
0 555	3	
0 000000004444444444	17	+---+---+
-0		
-0		
-1 4222	4	0
-1		
-2		
-2		
-3 2	1	*

Multiply Stem.Leaf by 10**-1

Normal Probability Plot



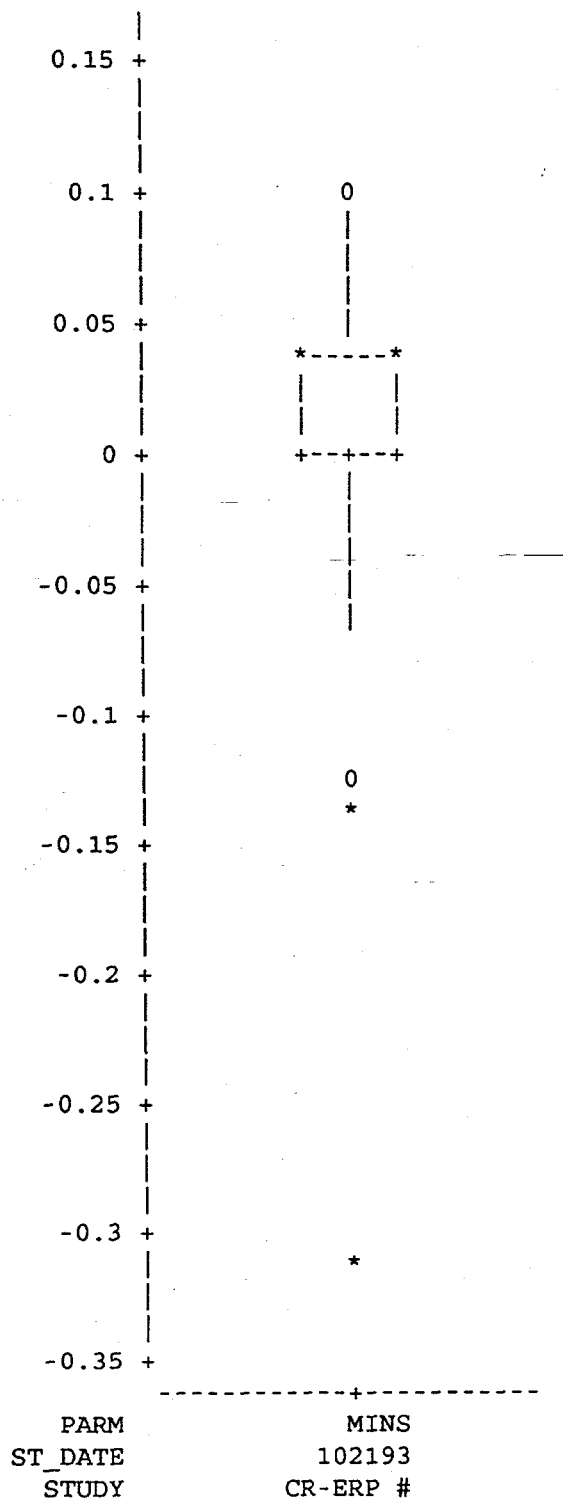
TEST FOR NORMAL DISTRIBUTION

20:32 Sunday, October 27, 1991

UNIVARIATE PROCEDURE

Schematic Plots

Variable=CENTER

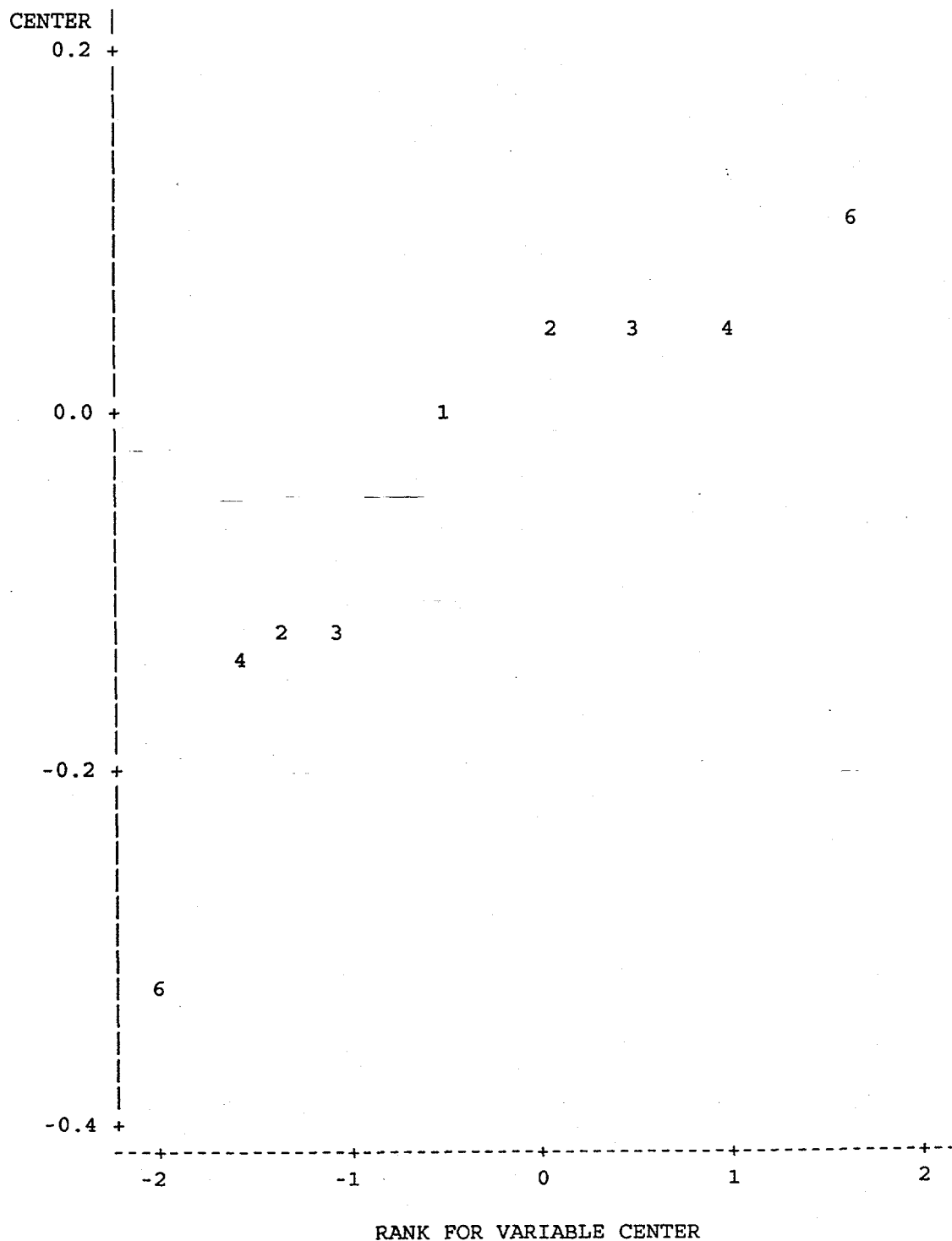


TEST FOR NORMAL DISTRIBUTION

20:32 Sunday, October 27, 1991

STUDY=CR-ERP #3 ST_DATE=102193 PARM=MINS

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



NOTE: 42 obs had missing values. 19 obs hidden.

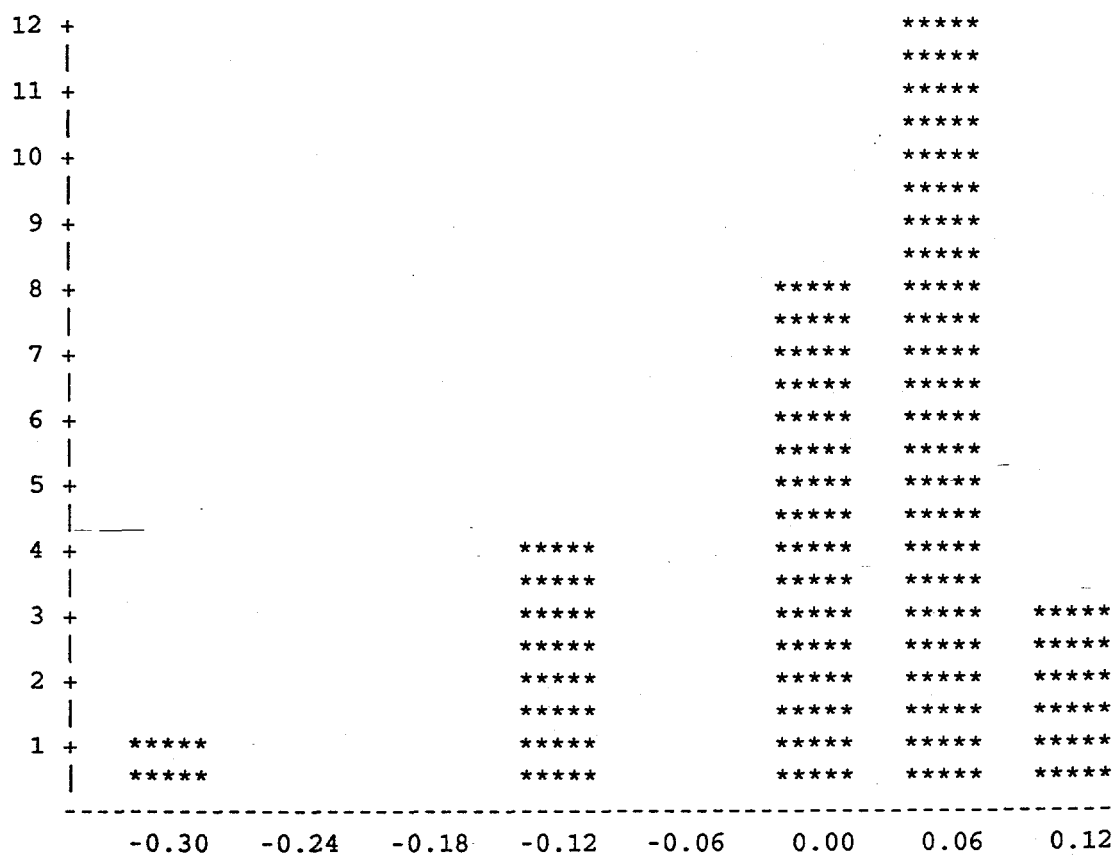
TEST FOR NORMAL DISTRIBUTION

20:32 Sunday, October 27, 1991

----- STUDY=CR-ERP #3 ST_DATE=102193 PARM=MINS -----

FREQUENCY OF CENTER

FREQUENCY



CENTER MIDPOINT

TEST FOR NORMAL DISTRIBUTION

20:32 Sunday, October 27, 1991

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) 7

LEVENE'S TEST FOR HOMOGENEITY OF VARIANCE

20:32 Sunday, October 27, 1991

(----- STUDY=CR-ERP #3 ST_DATE=102193 PARM=MINS -----)

General Linear Models Procedure
Class Level Information

Class	Levels	Values
TRT	7	MEDIUM PCM 2.9 100% PCM 2.9 50% PCM 4.3 100% PCM 4.3 50% PCM 5.1 100% PCM 5.1 50%

Number of observations in by group = 70

NOTE: Due to missing values, only 28 observations can be used in this analysis.

Tests of assumptions for survival data (arcsine transformed) 8

LEVENE'S TEST FOR HOMOGENEITY OF VARIANCE

20:32 Sunday, October 27, 1991

----- STUDY=CR-ERP #3 ST_DATE=102193 PARM=MINS -----

General Linear Models Procedure

Dependent Variable: ABS_VAL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	0.06727273	0.01121212	4.34	0.0053
Error	21	0.05429667	0.00258556		
Corrected Total	27	0.12156941			

R-Square	C.V.	Root MSE	ABS_VAL Mean
0.553369	87.01373	0.050848	0.05843717

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	6	0.06727273	0.01121212	4.34	0.0053

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	6	0.06727273	0.01121212	4.34	0.0053

FATHEAD DRY WEIGHT RECORD SHEET

Page 1 of 2Study/Date CR-ERP Oct. 93Personnel DSPans: Date/Time of Drying 10-27-93/1525-12-28-93/0815 Fish: Date/Time of Drying 10-29-93/0800-1030Pans: Date/Time of Weighing 10-28-93/1200-1312 Fish: Date/Time of Weighing 10-29-93/1215-1450

Sample ID	Tare Wt.	Tare + Fish Wt.	Fish Wt.	# Fish	Mean Wt.	Mean Wt. Difference	
Initial	1. 1.07603	1.07677	0.00074 0.0006	10			
	2. 0.99320	0.99405	0.00085	10			
	3. 1.07914	1.07993	0.00079 0.0007	10			
	4. 1.00537	1.00619	0.00082	10			
Initial Mean Wt.							
F-MED	1. 1.02634	1.03145		10			
	2. 1.03445	1.03918		10			
	3. 1.05550	1.06040		10			
	4. 1.04772	1.05228		10			
PCM 2.9 50%	1. 0.99797	1.00302		10			
	2. 1.00387	1.00876		10			
	3. 1.08221	1.08747		10			
	4. 1.04668	1.05119		9			
PCM 2.9 100%	1. 1.04298	1.04751		9			
	2. 1.03796	1.04278		10			
	3. 1.00989	1.01493		10			
	4. 1.07963	1.08584		10			
PCM 4.3 50%	1. 1.03271	1.03853		10			
	2. 1.02576	1.03160		10			
	3. 1.03828	1.04354		10			
	4. 1.02267	1.02752		8			
PCM 4.3 100%	1. 1.05977	1.06514 1.06629		10			
	2. 1.07085	1.07574		10			
	3. 1.07828	1.08263		0			
	4. 1.06242	1.06629		10			
PCM 5.1 50%	1. 0.99542	1.00004		10			
	2. 1.02162	1.02657		10			
	3. 1.11688	1.12128		10			
	4. 1.06582	1.06960		7			

Notes:

Reviewed By: CR

FATHEAD DRY WEIGHT RECORD SHEET

Page 2 of 2

Study/Date CR-ERP Oct 93

Personnel ajs

Pans: Date/Time of Drying 10-27-93/1525-10-28-93/0915 Fish: Date/Time of Drying 10-29-93/0700-1030

Pans: Date/Time of Weighing 10-29-93/1200-1312 Fish: Date/Time of Weighing 10-29-93/1215-1450

Sample ID	Tare Wt.	Tare + Fish Wt.	Fish Wt.	# Fish	Mean Wt.	Mean Wt. Difference
Initial 1.						
Initial 2.						
3.						
4.						
Initial Mean Wt.						
1.	1.03562	1.04095		10		
PCM 5.1 2.	0.98897	0.99355		10		
50% 10-20-93 3.	1.04306	1.04829		10		
100% 4.	1.08800	1.09301		10		
1.						
2.						
3.						
4.						
1.						
2.						
3.						
4.						
1.						
2.						
3.						
4.						
1.						
2.						
3.						
4.						

Notes:

Reviewed By: Car

FATHEAD DRY WEIGHT RECORD SHEET

Page 1 of 1

Study/Date WARP QA Oct 93 Review

Personnel DJS

Pans:Date/Time of Drying 11/4/93 / 073-0846

Fish:Date/Time of Drying 11/4/93 / 1100-1200

Pans:Date/Time of Weighing 11/4/93 / 1050-1100

Fish:Date/Time of Weighing 11/4/93 / 1225-1235

Sample ID	Tare Wt.	Tare + Fish Wt.	Fish Wt.	# Fish	Mean Wt.	Mean Wt. Difference	
Initial							
1.							
2.							
3.							
4.							
Initial Mean Wt.							
1.	1.05475	1.06005	0.00530	10	0.000530		0.530
PCM 4.3							
100%							
4.	1.04037	1.04409	0.00372	10	0.000372		0.372
1.							
2.							
3.							
4.							
1.							
2.							
3.							
4.							
1.							
2.							
3.							
4.							
1.							
2.							
3.							
4.							
1.							
2.							
3.							
4.							

Notes:

Reviewed By: h/s

FATHEAD DRY WEIGHT RECORD SHEET

Study/Date: DOE #3

Personnel: DJS

Pans:Date/Time of Drying: 10/27/93-1525 to
10/28/93-0815

Fish:Date/Time of Drying: 10-29-93/0800

Pans:Date/Time of Weighing: 10-28-93/1200

Fish:Date/Time of Weighing: 10-29-93/1215

Sample ID	Tare Wt.	Tare + Fish Wt.	Fish Wt.	# Fish	Mean Wt. grams	Mean Wt. Difference	Mean Wt. mg
1.	1.07603	1.07677	0.00074	10	0.000074	-	-
Initial 2.	0.99320	0.99405	0.00085	10	0.000085	-	-
3.	1.07914	1.07993	0.00079	10	0.000079	-	-
4.	1.00537	1.00619	0.00082	10	0.000082	-	-
Initial Mean Wt.						0.00008	
1.	1.02634	1.03145	0.00511	10	0.000511	0.000431	0.511
MEDIUM 2.	1.03445	1.03918	0.00473	10	0.000473	0.000393	0.473
3.	1.05550	1.06090	0.00540	10	0.000540	0.000460	0.540
4.	1.04772	1.05228	0.00456	10	0.000456	0.000376	0.456
1.	0.99797	1.00302	0.00505	10	0.000505	0.000425	0.505
PCM 2.9 50% 2.	1.00387	1.00876	0.00489	10	0.000489	0.000409	0.489
3.	1.08221	1.08747	0.00526	10	0.000526	0.000446	0.526
4.	1.04668	1.05119	0.00451	9	0.000501	0.000421	0.501
1.	1.04298	1.04751	0.00453	9	0.000503	0.000423	0.503
PCM 2.9 100% 2.	1.03796	1.04278	0.00482	10	0.000482	0.000402	0.482
3.	1.00989	1.01493	0.00504	10	0.000504	0.000424	0.504

Notes:

	4.	1.07963	1.08584	0.00621	10	0.000621	0.000541	0.621

	1.	1.03271	1.03853	0.00582	10	0.000582	0.000502	0.582

PCM 4.3 50%	2.	1.00576	1.01160	0.00584	10	0.000584	0.000504	0.584

	3.	1.03828	1.04354	0.00526	10	0.000526	0.000446	0.526

	4.	1.02267	1.02752	0.00485	8	0.000606	0.000526	0.606

	1.	1.05977	1.06514	0.00537	10	0.000537	0.000457	0.537

PCM 4.3 100%	2.	1.07085	1.07574	0.00489	10	0.000489	0.000409	0.489

	3.	1.07828	1.08268	0.00440	9	0.000489	0.000409	0.489

	4.	1.06242	1.06629	0.00387	10	0.000387	0.000307	0.387

	1.	0.99542	1.00004	0.00462	10	0.000462	0.000382	0.462

PCM 5.1 50%	2.	1.02162	1.02657	0.00495	10	0.000495	0.000415	0.495

	3.	1.11688	1.12128	0.00440	10	0.000440	0.000360	0.440

	4.	1.06582	1.06960	0.00378	7	0.000540	0.000460	0.540

	1.	1.03562	1.04095	0.00533	10	0.000533	0.000453	0.533

PCM 5.1 100%	2.	0.98897	0.99355	0.00458	10	0.000458	0.000378	0.458

	3.	1.04306	1.04829	0.00523	10	0.000523	0.000443	0.523

	4.	1.08800	1.09301	0.00501	10	0.000501	0.000421	0.501

Revised

Reviewed By: Russell

11-03-93

CR

11-04-93
CWR

Analysis of 7-day Larval Growth Test

CR-ERP #3
Starting Date: 10/21/93

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 0.08

This represents a 15.51 % reduction in Dry Weight (mg).

$$T = 2.45 \text{ ALPHA} = 0.05$$

Dry Weight (mg) Data

TREATMENT	Replicate										MEAN	S
	1	2	3	4	5	6	7	8	9	10		
1 MEDIUM	0.51	0.47	0.54	0.46	.	.	.	.	.	.	0.50	
2 PCM 2.9 50%	0.51	0.49	0.53	0.50	.	.	.	.	.	.	0.51	
3 PCM 2.9 100%	0.50	0.48	0.50	0.62	.	.	.	.	.	.	0.53	
4 PCM 4.3 50%	0.58	0.58	0.53	0.61	.	.	.	.	.	.	0.57	
5 PCM 4.3 100%	0.54	0.49	0.49	0.39	.	.	.	.	.	.	0.48	
6 PCM 5.1 50%	0.46	0.50	0.44	0.54	.	.	.	.	.	.	0.48	
7 PCM 5.1 100%	0.53	0.46	0.52	0.50	.	.	.	.	.	.	0.50	

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

Analysis of Variance

Source	DF	Sum OF Sq.	Mean Sq.	Calc F	F(0.05)
Among	6	0.026	0.004	2.180	0.0863
Within	21	0.041	0.002		
Total	27	0.000			

20:56 Sunday, October 27, 1991

STUDY=CR-ERP #3
ST_DATE=102193
PARM=MING
DUNNETT'S TEST
T = 2.45 ALPHA = 0.05

TREATMENT	N	MEAN	SIGNIFICANT DIFFERENCE
MEDIUM	4	0.50	
PCM 2.9 50%	4	0.51	
PCM 2.9 100%	4	0.53	
PCM 4.3 50%	4	0.57	
PCM 4.3 100%	4	0.48	
PCM 5.1 50%	4	0.48	
PCM 5.1 100%	4	0.50	

MINIMUM SIGNIFINANT DIFFERENCE = 0.08

THIS REPRESENTS A 15.51 % DECREASE IN SURVIVAL FROM THE CONTROL

20:56 Sunday, October 27, 1991

STUDY=CR-ERP #3

ST_DATE=102193

PARM=MING

DUNNETT'S TEST

T = 2.45 ALPHA = 0.05

TREATMENT	REPLICATE										MEAN	S
	1	2	3	4	5	6	7	8	9	10		
1 MEDIUM	0.51	0.47	0.54	0.46	.	.	.	.	.	.	0.50	
2 PCM 2.9 50%	0.51	0.49	0.53	0.50	.	.	.	.	.	.	0.51	
3 PCM 2.9 100%	0.50	0.48	0.50	0.62	.	.	.	.	.	.	0.53	
4 PCM 4.3 50%	0.58	0.58	0.53	0.61	.	.	.	.	.	.	0.57	
5 PCM 4.3 100%	0.54	0.49	0.49	0.39	.	.	.	.	.	.	0.48	
6 PCM 5.1 50%	0.46	0.50	0.44	0.54	.	.	.	.	.	.	0.48	
7 PCM 5.1 100%	0.53	0.46	0.52	0.50	.	.	.	.	.	.	0.50	

MINIMUM SIGNIFINANT DIFFERENCE = 0.08

THIS REPRESENTS A 15.51 % DECREASE IN SURVIVAL FROM THE CONTROL

20:56 Sunday, October 27, 1991

General Linear Models Procedure
Class Level Information

Class	Levels	Values
TRT	7	MEDIUM PCM 2.9 100% PCM 2.9 50% PCM 4.3 100% PCM 4.3 50% PCM 5.1 100% PCM 5.1 50%

Number of observations in data set = 70

NOTE: Due to missing values, only 28 observations can be used in this analysis.

20:56 Sunday, October 27, 1991

General Linear Models Procedure

Dependent Variable: RESP

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	0.02567143	0.00427857	2.18	0.0863
Error	21	0.04122500	0.00196310		
Corrected Total	27	0.06689643			

R-Square	C.V.	Root MSE	RESP Mean
0.383749	8.693702	0.0443068	0.50964286

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	6	0.02567143	0.00427857	2.18	0.0863

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	6	0.02567143	0.00427857	2.18	0.0863

Test for Normal Distribution

20:50 Sunday, October 27, 1991

----- STUDY=CR-ERP #3 ST_DATE=102193 PARM=MING -----

UNIVARIATE PROCEDURE

Variable=CENTER

Moments

N	28	Sum Wgts	28
Mean	0	Sum	0
Std Dev	0.039075	Variance	0.001527
Skewness	0.213347	Kurtosis	0.403796
USS	0.041225	CSS	0.041225
CV	.	Std Mean	0.007384
T:Mean=0	0	Prob> T	1.0000
Sgn Rank	-3.5	Prob> S	0.9382
Num ^= 0	28		
W:Normal	0.982811	Prob<W	0.9142

Quantiles (Def=5)

100% Max	0.095	99%	0.095
75% Q3	0.02	95%	0.0625
50% Med	0.00375	90%	0.055
25% Q1	-0.025	10%	-0.045
0% Min	-0.0875	5%	-0.045
		1%	-0.0875
Range	0.1825		
Q3-Q1	0.045		
Mode	-0.025		

Extremes

Lowest	Obs	Highest	Obs
-0.0875(	44)	0.035(	34)
-0.045(	22)	0.045(	3)
-0.045(	53)	0.055(	54)
-0.045(	33)	0.0625(	41)
-0.0425(	62)	0.095(	24)

Missing Value

Count 42

% Count/Nobs 60.00

Test for Normal Distribution

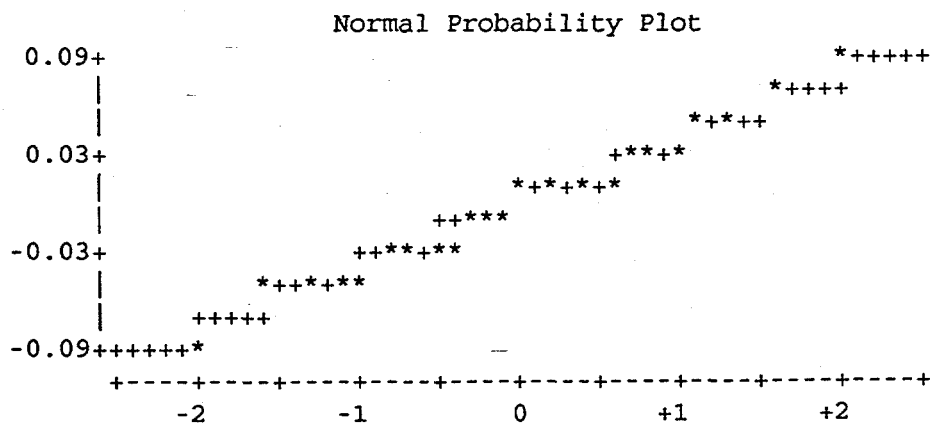
20:50 Sunday, October 27, 1991

----- STUDY=CR-ERP #3 ST_DATE=102193 PARM=MING -----

UNIVARIATE PROCEDURE

Variable=CENTER

Stem Leaf	#	Boxplot
8 5	1	0
6 2	1	
4 55	2	
2 285	3	+-----+
0 25522558	8	*---+---
-0 882	3	
-2 55555	5	+-----+
-4 5552	4	
-6		
-8 8	1	

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

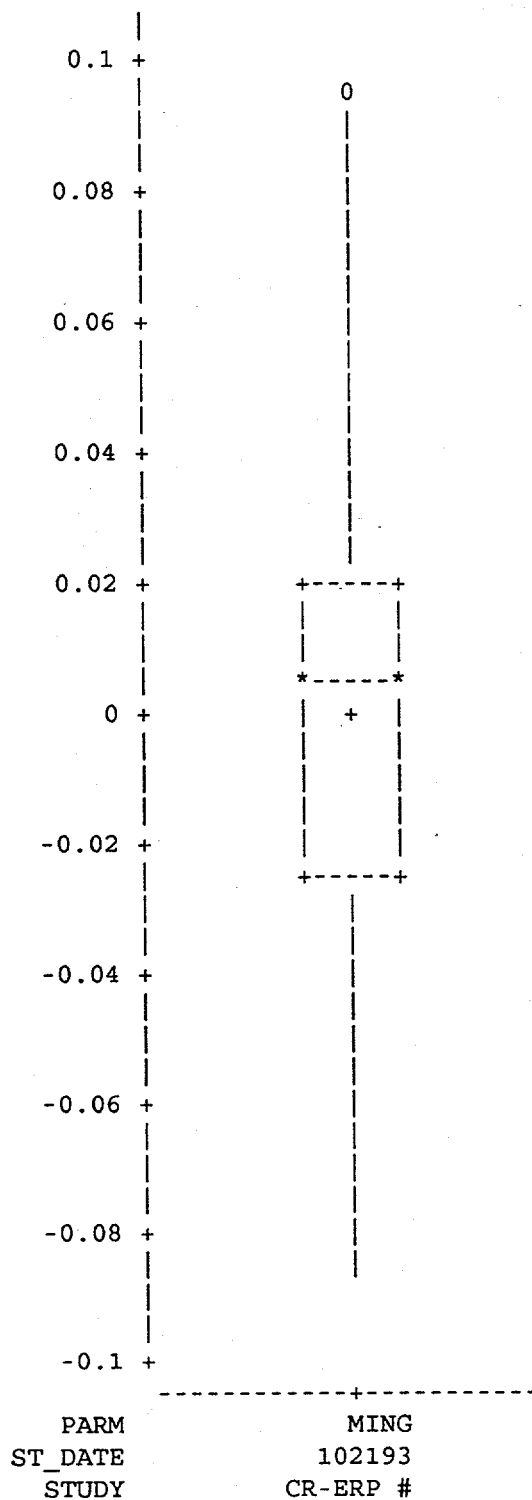
Test for Normal Distribution

20:50 Sunday, October 27, 1991

UNIVARIATE PROCEDURE

Schematic Plots

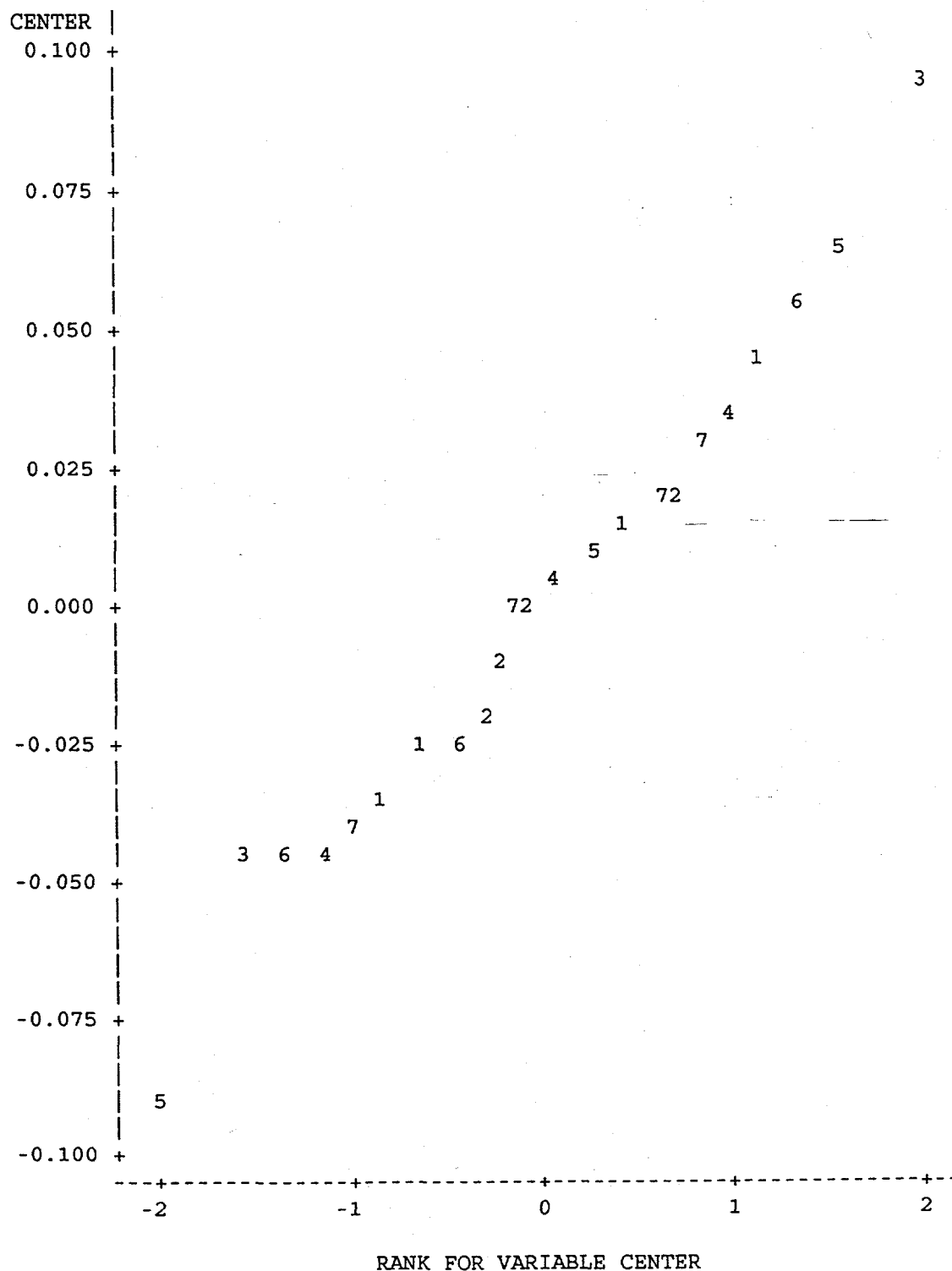
Variable=CENTER



20:50 Sunday, October 27, 1991

----- STUDY=CR-ERP #3 ST_DATE=102193 PARM=MING -----

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



NOTE: 42 obs had missing values. 5 obs hidden.

Tests of assumptions for untransformed data

5

Bartlett's Test for Homogeneous Variance

20:50 Sunday, October 27, 1991

STUDY=CR-ERP #3

ST_DATE=102193

PARM=MING

TREATMENT	N	MEAN	VARIANCE
MEDIUM	4	0.50	0.001
PCM 2.9 5	4	0.51	0.000
PCM 2.9 1	4	0.53	0.004
PCM 4.3 5	4	0.57	0.001
PCM 4.3 1	4	0.48	0.004
PCM 5.1 5	4	0.48	0.002
PCM 5.1 1	4	0.50	0.001

BARTLETT'S TEST STATISTIC = 5.658

PROB>B = 0.463

CR-ERP #3	102193 MINS	1 MEDIUM	10.00	10.00	10.00	10.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00
CR-ERP #3	102193 MINS	2 PCM 2.9 50%	10.00	10.00	10.00	9.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00
ERP #3	102193 MINS	3 PCM 2.9 100%	9.00	10.00	10.00	10.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00
CR-ERP #3	102193 MINS	4 PCM 4.3 50%	10.00	10.00	10.00	8.00
	INITIAL NUMBER		10.00	10.00	10.00	9.00
CR-ERP #3	102193 MINS	5 PCM 4.3 100%	10.00	10.00	9.00	10.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00
CR-ERP #3	102193 MINS	6 PCM 5.1 50%	10.00	10.00	10.00	7.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00
CR-ERP #3	102193 MINS	7 PCM 5.1 100%	10.00	10.00	10.00	10.00
	INITIAL NUMBER		10.00	10.00	10.00	10.00

CR-ERP #3	102193 MING	1 MEDIUM	0.51	0.47	0.54	0.46
CR-ERP #3	102193 MING	2 PCM 2.9 50%	0.51	0.49	0.53	0.50
CR-ERP #3	102193 MING	3 PCM 2.9 100%	0.50	0.48	0.50	0.62
CR-ERP #3	102193 MING	4 PCM 4.3 50%	0.58	0.58	0.53	0.61
CR-ERP #3	102193 MING	5 PCM 4.3 100%	0.54	0.49	0.49	0.39
CR-ERP #3	102193 MING	6 PCM 5.1 50%	0.46	0.50	0.44	0.54
CR-ERP #3	102193 MING	7 PCM 5.1 100%	0.53	0.46	0.52	0.50

C R - E R P - P C (Poplar Creek) -- OCTOBER 21-28, 1993 -- INITIAL AND FINAL CHEMISTRY

INITIAL CHEMISTRY

FISH MEDIUM

INITIAL WARMED							
DAY	TEMP	TEMP	DO	pH	COND	HARD	ALK CHLORINE
0	22.9	25.0	8.3	8.2	360	94.1	68
1	21.6	25.1	8.4	8.2	351		
2	22.2	25.2	8.4	8.2	351		
3	22.7	25.3	8.4	8.2	353		
4	23.3	25.0	8.3	8.2	338	94.1	65
5	23.7	25.3	8.2	8.3	339		
6	25.2	25.4	8.1	8.2	342		
MEAN	23.1	25.2	8.3	8.2	348	94.1	67
MIN	21.6	25.0	8.1	8.2	338	94.1	65
MAX	25.2	25.4	8.4	8.3	360	94.1	68

PCM 4.3 - 100%

INITIAL WARMED							
DAY	TEMP	TEMP	DO	pH	COND	HARD	ALK CHLORINE
0	1.5	25.4	7.7	7.3	416	162.5	120 <0.1
1	3.3	24.9	8.1	7.4	413		
2	0.4	25.1	7.0	7.5	403	159.0	120 <0.1
3	3.1	25.1	7.4	7.5	404		
4	3.0	24.9	7.8	7.5	404		
5	0.9	25.1	7.3	7.5	401	159.0	126 <0.1
6	2.7	25.6	7.7	7.6	403		
MEAN	2.1	25.2	7.6	7.5	406	160.2	122 <0.1
MIN	0.4	24.9	7.0	7.3	401	159.0	120 <0.1
MAX	3.3	25.6	8.1	7.6	416	162.5	126 <0.1

PCM 2.9 - 50%

INITIAL WARMED							
DAY	TEMP	TEMP	DO	pH	COND	HARD	ALK CHLORINE
0		25.0	8.4	7.9	366		
1		24.7	8.4	8.0	353		
2		25.3	8.2	8.0	364		
3		25.3	8.2	8.0	363		
4		25.0	8.4	8.0	355		
5		25.4	8.2	8.0	358		
6		25.6	8.3	7.1	361		
MEAN		25.2	8.3	7.9	360		
MIN		24.7	8.2	7.1	353		
MAX		25.6	8.4	8.0	366		

PCM 5.1 - 50%

INITIAL WARMED							
DAY	TEMP	TEMP	DO	pH	COND	HARD	ALK CHLORINE
0		24.9	8.2	7.6	375		
1		24.6	8.4	7.8	375		
2		25.3	8.1	7.7	373		
3		25.3	8.1	7.7	374		
4		25.0	8.0	7.7	367		
5		25.3	8.4	7.6	368		
6		25.4	8.4	7.6	368		
MEAN		25.1	8.2	7.7	371		
MIN		24.6	8.0	7.6	367		
MAX		25.4	8.4	7.8	375		

PCM 2.9 - 100%

INITIAL WARMED							
DAY	TEMP	TEMP	DO	pH	COND	HARD	ALK CHLORINE
0	1.3	25.1	8.4	7.5	369	153.9	113 <0.1
1	3.3	24.7	8.4	8.0	363		
2	0.5	25.3	8.0	7.7	378	153.9	117 <0.1
3	3.2	25.1	8.3	7.7	378		
4	3.5	24.9	8.4	7.9	375		
5	0.7	25.2	8.4	7.7	381	153.9	119 <0.1
6	3.0	26.0	8.4	7.6	382		
MEAN	2.2	25.2	8.3	7.7	375	153.9	116 <0.1
MIN	0.5	24.7	8.0	7.5	363	153.9	113 <0.1
MAX	3.5	26.0	8.4	8.0	382	153.9	119 <0.1

PCM 5.1 - 100%

INITIAL WARMED							
DAY	TEMP	TEMP	DO	pH	COND	HARD	ALK CHLORINE
0	1.5	25.1	7.6	7.3	405	162.5	120 <0.1
1	3.8	24.7	8.1	7.4	405		
2	0.5	25.2	6.9	7.6	398	159.0	120 <0.1
3	3.0	25.0	7.1	7.6	397		
4	3.6	24.8	7.6	7.6	398		
5	0.6	25.0	7.9	7.4	402	162.5	127 <0.1
6	3.2	25.2	8.3	7.4	403		
MEAN	2.3	25.0	7.6	7.5	401	161.3	122 <0.1
MIN	0.5	24.7	6.9	7.3	397	159.0	120 <0.1
MAX	3.8	25.2	8.3	7.6	405	162.5	127 <0.1

PCM 4.3 - 50%

INITIAL		WARMED					
DAY	TEMP	TEMP	DO	pH	COND	HARD	ALK CHLORINE
0		25.1	8.2	7.6	381		
1		24.6	8.4	7.8	382		
2		25.2	8.2	7.7	376		
3		25.2	8.2	7.7	377		
4		25.1	8.3	7.7	370		
5		25.1	8.1	7.7	368		
6		25.1	8.0	7.8	369		
MEAN		25.1	8.2	7.7	375		
MIN		24.6	8.0	7.6	368		
MAX		25.2	8.4	7.8	382		

FISH FINAL

FISH MEDIUM

PCM 2.9 - 50%

PCM 2.9 - 100%

DAY	TEMP	DO	pH	COND	DAY	TEMP	DO	pH	COND	DAY	TEMP	DO	pH	COND
1	24.2	7.1	7.9		1	24.2	6.7	8.0		1	23.9	6.9	8.1	
	23.5	7.1		363		24.1	7.0		371		24.0	6.5		370
	24.0	6.1				23.9	6.6				24.2	6.7		
	23.7	7.0				24.1	6.6				24.1	7.1		
2	24.7	6.8			2	24.5	6.5			2	24.7	6.5		
	25.3	6.3	7.9			25.1	6.7	8.0			25.2	6.6	8.0	
	25.2	6.9		354		24.8	6.6		356		25.0	6.0		370
	25.2	6.0				25.0	6.3				25.1	6.9		
3	24.7	6.8			3	25.0	6.5			3	24.6	6.7		
	25.1	6.6				25.0	6.2				25.0	7.0		
	25.0	6.7	7.9			24.9	5.6	7.8			24.8	6.8	8.0	
	24.9	6.7		354		24.8	6.3		365		24.8	6.4		380
4	25.3	6.1		356	4	25.2	6.6		366	4	25.0	6.7		380
	25.2	6.2				25.0	6.6				25.1	6.7		
	25.2	6.5				25.0	6.5				25.1	6.7		
	25.2	6.8	7.9			25.0	6.8	7.9			25.0	6.0	7.9	
5	25.5	5.5	7.7		5	25.6	4.7	7.7		5	25.5	5.2	7.9	
	25.8	4.9		344		26.0	5.5		360		25.8	4.9		381
	25.9	5.0				25.8	5.7				25.7	5.0		
	25.8	4.7				25.8	5.4				25.9	5.0		
6	25.0	5.4			6	25.2	4.5			6	25.2	5.1		
	25.1	5.0	7.6			25.2	4.8	7.7			25.4	5.0	7.8	
	25.2	4.6		345		25.2	5.3		365		25.0	5.0		384
	25.2	5.4				25.1	5.0				25.1	4.8		
7	24.4	5.7			7	24.5	5.9			7	24.6	5.7		
	24.6	5.6				24.6	5.7				24.8	5.5		
	24.6	4.9	7.6			24.2	6.2	7.9			24.8	5.8	8.0	
	24.7	5.9		345		24.8	5.1		364		24.6	5.5		383
MEAN	24.9	6.0	7.8	352	MEAN	24.9	6.0	7.9	364	MEAN	24.9	6.0	8.0	378
MIN	23.5	4.6	7.6	344	MIN	23.9	4.5	7.7	356	MIN	23.9	4.8	7.8	370
MAX	25.9	7.1	7.9	363	MAX	26.0	7.0	8.0	371	MAX	25.9	7.1	8.1	384

PCM 4.3 - 50%

DAY	TEMP	DO	pH	COND
1	23.8	6.9	8.0	
	24.1	7.0		383
	24.0	6.8		
	24.0	6.4		
2	25.1	6.2		
	25.4	6.4	7.9	
	24.3	6.4		389
	25.0	6.4		
3	24.7	6.8		
	24.7	6.3		
	24.8	6.7	8.0	
	24.5	6.8		379
4	25.2	6.5		379
	25.3	6.3		
	24.4	6.8		
	25.0	6.3	7.9	
5	25.6	5.6	7.8	
	25.4	5.8		371
	25.5	5.8		
	25.8	5.4		
6	24.9	4.3		
	25.0	4.8	7.7	
	24.7	5.4		375
	25.4	4.9		
7	24.8	5.4		
	24.8	4.6		
	24.7	4.8	7.7	
	24.6	5.2		371
MEAN	24.8	6.0	7.9	378
MIN	23.8	4.3	7.7	371
MAX	25.8	7.0	8.0	389

PCM 4.3 - 100%

DAY	TEMP	DO	pH	COND
1	24.3	6.0	7.8	
	24.3	6.9		414
	24.0	7.0		
	23.7	7.1		
2	25.1	6.1		
	25.2	6.4	7.8	
	25.0	5.7		421
	25.0	6.2		
3	24.8	6.9		
	24.9	6.9		
	24.5	7.0	7.9	
	25.1	6.9		405
4	25.0	6.3		406
	25.1	6.5		
	24.8	6.5		
	24.9	6.5	8.0	
5	25.9	5.8	7.9	
	25.9	5.0		409
	25.8	5.3		
	25.9	5.0		
6	25.2	4.8		
	25.1	4.5	7.8	
	25.2	4.8		409
	25.2	4.6		
7	24.8	4.6		
	24.3	5.2		
	24.8	5.3	7.9	
	24.7	5.0		405
MEAN	24.9	5.9	7.9	410
MIN	23.7	4.5	7.8	405
MAX	25.9	7.1	8.0	421

PCM 5.1 - 50%

DAY	TEMP	DO	pH	COND
1	24.3	7.2	8.0	
	23.7	7.2		381
	23.7	6.9		
	24.0	7.0		
2	24.8	6.5		
	24.6	6.2	7.9	
	24.8	6.6		385
	25.0	6.4		
3	24.8	7.0		
	24.8	7.1		
	25.0	6.7	8.0	
	25.0	6.6		375
4	25.2	6.5		377
	24.5	6.6		
	24.7	6.7		
	24.9	6.2	7.9	
5	25.7	5.8	7.8	
	25.7	5.7		371
	25.6	5.9		
	25.8	4.6		
6	24.7	5.0		
	25.0	5.0	7.7	
	25.1	5.7		380
	25.2	4.1		
7	24.8	5.7		
	24.6	5.3		
	23.7	6.2	7.9	
	24.5	4.6		377
MEAN	24.8	6.1	7.9	378
MIN	23.7	4.1	7.7	371
MAX	25.8	7.2	8.0	385

PCM 5.1 - 100%

DAY	TEMP	DO	pH	COND
1	24.1	6.7	8.0	
	23.8	6.8		408
	24.0	7.2		
	23.5	7.2		
2	25.0	6.6		
	25.0	6.4	7.9	
	25.2	6.2		408
	24.5	6.2		
3	24.8	6.6		
	25.0	6.5		
	24.7	6.5		
	24.9	6.5	8.0	403
4	24.8	6.5		401
	24.9	6.8		
	25.3	6.7		
	25.0	6.2	7.9	
5	25.9	5.5	7.9	
	25.7	5.4		401
	25.6	5.6		
	25.6	5.3		
6	25.0	4.7		
	25.4	4.8	7.8	
	25.2	4.9		410
	25.2	4.8		
7	24.4	5.6		
	24.4	5.8		
	24.9	5.4	7.8	
	24.8	5.7		407
MEAN	24.9	6.0	7.9	405
MIN	23.5	4.7	7.8	401
MAX	25.9	7.2	8.0	410

MEAN TEMPERATURE 24.9

MINIMUM: 23.5

MAXIMUM: 26.0

Reviewed by DJS 11/9/93 (CRERP-PC)

INITIAL CHEMISTRY

Study CR-ERP Oct '93Personnel SimbackBeginning Date 10-21-93Date 10-21PoseyEnding Date 10-28-93

By	D/S	D/S	D/S	D/S	D/S	JAP	D/S	DAS	DAS	DAS	D/S
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
F-MED #1503	22.9	25.0	8.3	8.2	360	5.5	94.1	6.8	6.8		
0836/0841 PCM 2.9 50%		25.0	8.7 8.4	7.8 7.9	366						
0836/0841 PCM 2.9 100%	1.3	25.1	8.7 8.4	7.6 7.5	369	9.0	153.9	11.3	113	<0.1	<0.1
ID # 10002											
PCM 4.3 50%		25.1	8.2	7.6	381						
PCM 4.3 100%	1.5	25.4	7.7	7.3	416	9.5	162.5	12.0	120	<0.1	<0.1
ID # 10004											
PCM 5.1 50%		24.9	8.2	7.6	375						
PCM 5.1 100%	1.5	25.1	7.6	7.3	405	9.5	162.5	12.0	120	<0.1	<0.1
ID # 10006											

NOTES:

PLARC501-252

Reviewed By: D/S

Ending Date 10-28-93

[illegible]

NOTES:

PLARC501-252

* checked twice

Reviewed By:

INITIAL CHEMISTRY

Study CR-ERP Oct '93Personnel SimbackBeginning Date 10-21-93Date 10-27-93PoseyEnding Date 10-28-93Russell

By	Cur	JPP	JPP	JPP	JPP						
Sample ID	Initial Temp.	Warmed Temp.	DO	pH	Cond.	Hard	x17.1	Alk	x10	TRC	x 1.0
F-MED #1504	23.2	25.4	8.1	8.2	342						
PCM 2.9 50%		25.6	8.5 8.3	7.9 7.7	361						
PCM 2.9 100%	3.0	26.0	8.8 8.4	7.7 7.6	382						
ID # 10062											
PCM 4.3 50%		25.1	8.0	7.8	369						
PCM 4.3 100%	2.7	25.6	7.7	7.6	403						
ID # 10064											
PCM 5.1 50%		25.4	8.4	7.6	368						
PCM 5.1 100%	3.2	25.2	8.3	7.4	403						
ID # 10066											

NOTES:

PLARC501-252

Reviewed By: MS/cue

Study CR-ERP Oct '93

Beginning Date 10-21-93

Ending Date 10-28-93

Date 10-22.

Personnel Simbeck

Posey

Sample ID	Fish				
	By	JPP	JPP	JPP	JPP
	Rep.	Temp.	DO	pH	Cond.
	1	24.2	7.1	7.9	
F-MED	2	23.5	7.1		363
Control	3	24.0	6.1		
LDH ^{OP} 10-20-93	4	23.7	7.0		
	1	24.2	6.7	8.0	
PCM 2.9	2	24.1	7.0		371
50%	3	23.9	6.6		
	4	24.1	6.6		
	1	23.9	6.9	8.1	
PCM 2.9	2	24.0	6.5		370
100%	3	24.2	6.7		
	4	24.1	7.1		
	1	23.8	6.9	8.0	
PCM 4.3	2	24.1	7.0		383
50%	3	24.0	6.8		
	4	24.0	6.4		
	1	24.3	6.0	7.8	
PCM 4.3	2	24.3	6.9		414
100%	3	24.0	7.0		
	4	23.7	7.1		
	1	24.3	7.2	8.0	
PCM 5.1	2	23.7	7.2		381
50%	3	23.7	6.9		
	4	24.0	7.0		
	1	24.1	6.7	8.0	
PCM 5.1	2	23.8	6.8		408
100%	3	24.0	7.2		
	4	23.5	7.2		

NOTES:

[illegible]

Reviewed By: DJS

Posey

[illegible]

Reviewed By: 975

Personnel Simbeck
Posey
Haraway

[illegible]

Reviewed By: dy2

Date 10-25.

Beginning Date 10-21-93

Ending Date 10-25-43

Posev

Sample ID	Fish				
	By	JPP	JPP	JPP	JPP
	Rep.	Temp.	DO	pH	Cond.
	1	25.3	6.1		356
F-MED	2	25.2	6.2		
Control	3	25.2	6.5		
100% ^{off} 10-30-93	4	25.2	6.8	7.9	
	1	25.2	6.6		366
PCM 2.9	2	25.0	6.6		
50%	3	25.0	6.5		
	4	25.0	6.3	7.9	
	1	25.0	6.7		380
PCM 2.9	2	25.1	6.7		
100%	3	25.1	6.7		
	4	25.0	6.0	7.9	
	1	25.2	6.5		379
PCM 4.3	2	25.3	6.3		
50%	3	24.4	6.8		
	4	25.0	6.3	7.9	
	1	25.0	6.3		406
PCM 4.3	2	25.1	6.5		
100%	3	24.8	6.5		
	4	24.9	6.5	8.0	
	1	25.2	6.5		377
PCM 5.1	2	24.5	6.6		
50%	3	24.7	6.7		
	4	24.9	6.2	7.9	
	1	24.8	6.5		401
PCM 5.1	2	24.9	6.8		
100%	3	25.3	6.7		
	4	25.0	6.2	7.9	

NOTES:

[illegible]

Reviewed By: 295

Date 10-26

Personnel Simbeck

Posey

[illegible]

Reviewed By: ojs

Date 10-27

Personnel Simbeck

Posey

Kinder

Sample ID	By Rep.	Fish				
		JPP	JPP	JPP	JPP	
		GKK	GKK	GKK	GKK	
		Temp.	DO	pH	Cond.	
	1		25.0	5.4		
F-MED	2		25.1	5.0	7.6	
Control	3		25.2	4.6		345
100% ²⁰⁻²⁵	4		25.2	5.4		
	1		25.2	4.5		
PCM 2.9	2		25.2	4.8	7.7	
50%	3		25.2	5.3		365
	4		25.1	5.0		
	1		25.2	5.1		
PCM 2.9	2		25.4	5.0	7.8	
100%	3		25.0	5.0		384
	4		25.1	4.8		
	1		24.9	4.3		
PCM 4.3	2		25.0	4.8	7.7	
50%	3		24.7	5.4		375
	4		25.4	4.9		
	1		25.2	4.8		
PCM 4.3	2		25.1	4.5	7.8	
100%	3		25.2	4.8		409
	4		25.2	4.6		
	1		24.7	5.0		
PCM 5.1	2		25.0	5.0	7.7	
50%	3		25.1	5.7		380
	4		25.2	4.1		
	1		25.0	4.7		
PCM 5.1	2		25.4	4.8	7.8	
100%	3		25.2	4.9		410
	4		25.2	4.8		

NOTES:

[illegible]

Reviewed By: JS / aw

Posey[illegible]

PROJECT REAGENT RECORD SHEET

Project/Study: CR-ERP Oct. '93
 Personnel: Simbeck, Passy

Beginning Date: 10-21-93
 Ending Date: 10-28-93

WINKLER TITRATION METHOD

Alkaline-Iodide-Azide:

Brand Fisher
 Lot # 910062-24
 Exp. 2-93

Manganous Sulfate:

Brand Fisher
 Lot # 910067-24
 Exp. 4-93

Sodium Thiosulfate:

Brand Ricca
 Lot # M158
 Exp. 9-94

Sulfuric Acid:

Brand Fisher
 Lot # 854507
 Exp. NA

Thyodene:

Brand Fisher
 Lot # 912254
 Exp. NA

pH BUFFER SOLUTIONS

pH 4:

Brand Mallinckrodt
 Lot # 0097 KLEA
 Exp. 9-94

pH 7:

Brand Mallinckrodt
 Lot # 0098 KLKT
 Exp. 1-95

pH 10:

Brand Mallinckrodt
 Lot # 0099 KLBB
 Exp. 1-94

pH _____:

Brand _____
 Lot # _____
 Exp. _____

CONDUCTIVITY STANDARD SOLUTIONS

200 μ hos:

Brand BIOPHARM
 Lot # 6292A
 Exp. 1-95

720 μ hos:

Brand BIOPHARM
 Lot # C303B
 Exp. 4-95

_____ μ hos:

Brand _____
 Lot # _____
 Exp. _____

ALKALINITY TITRATION

Sulfuric Acid Solution N/50:

Brand Mallinckrodt
 Lot # H366
 Exp. NA

HARDNESS TITRATION

Hardness Titrating Solution:

Brand Calgon
 Lot # R2037700
 Exp. NA

Hardness Indicator:

Brand Calgon
 Lot # 0119B
 Exp. NA

Hardness Buffer Solution:

Brand Calgon
 Lot # 26C6B
 Exp. NA

CHLORINE TITRATION

DPD Powder Pillows:

Brand Hach
 Lot # 03cm
 Exp. NA

Potassium Iodide:

Brand Fisher
 Lot # 863484A
 Exp. NA

FAS:

Brand Ricca
 Lot # H078
 Exp. 11-4-93

Project Instrument Record Sheet

Project Study CR-ERP Oct. '93

Beginning Date 10-21-93

Ending Date 10-28-93

DO Meter

Model YSI Model 57

TVA Tag 531047

Calibration Date 2-18-93

pH Meter(s)

Model Orion Research Model SA250

TVA Tag 8147 + 7413

Calibration Date 4-30-93 + 10/20/93

Model Orion Research Model 399A

TVA Tag 543347

Calibration Date 5-6-93

Conductivity Meter

Model YSI Model 32

TVA Tag 543369

Calibration Date 8-12-93

Thermometer(s)

Model ERTCO

TVA Tag M-148

Calibration Date 12-8-92

Model ERTCO

TVA Tag M-253

Calibration Date 12-8-92

ATTACHMENT III

**CR-ERP AMBIENT WATER TOXICITY 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	
44	06/01/93*	0.05	0.02	0.008	0.003	0.0074	
45	07/06/93**	0.05	0.02	0.02	0.008	0.0119	**fish were 24hrs & 53mins
46	08/04/93*	0.02	0.008	0.008	0.003	0.0054	
47	09/08/93*	0.02	0.008	0.008	0.003	0.0057	
48	09/30/93*	0.02	0.008	0.008	0.003	0.006	
49	10/28/93*	0.05	0.02	0.008	0.003	0.0049	

Chronic Study Fathead Record Sheet

Study In Ref Tox

Test Organism Fatheads

Beginning Date/Time 9/30/93 10915

Ending Date/Time 10-7-93 10830

Personnel Seiler Posey

Control/Dilution Water F-med

Test Treatment Identification

1. Control Stock Conc.
2. 0.001
3. 0.003
4. 0.008
5. 0.02
6. 0.05
7. _____
8. _____

Spawn Date

9/25/93

Tile #

12,16,15,14,
29,23,24,25

Hatch Date

9/29 AF 1100
BF 0645 9/30

Test # 48

NOEC 0.003

LOEC 0.008

Notes:

IC₂₅ = 0.0060

ARL CHRONIC TOXICITY TEST MASTER CHECKLIST Study: Cu Ref Tox

Date Issued: 9-30-93 To: Seely From: Moser

1. Test organism availability: FH Minnows-T.L.*TS C.U.†TS Date 9/23/93
Daphnids - T.L. NA C.U. — Date —
2. Sample Collection Coordination: Date NA By — With —
3. Glassware availability: T.L. TS Tech. — Date 9/29/93
4. Glassware prep. complete: Date 9/29/93 By TS
5. Data Sheet prep. complete: Date 9/29/93 By TS
6. Test organism availability verification: FH-OK? TS Daphnids-OK? —
7. FH Minnow acclimation:
Day 1 2
By 224 m. old
8. Test Initiation: FH-Date/Time 9/30/93 0915 Daphnid-Date/Time —
Initial Chem. TS FH TS Daphnid — Log Samples —
9. Test Renewal: Day #: 1 2 3 4 5 6 (7) (8)
Initial Chem. - T.L. TS TS TS TS TS TS N/A —
T.M.* — — — — — — — —
Final Chem. - T.L. TS TS TS TS TS TS JP —
T.M. JP JP JP JP JP JP DS —
F.H. - T.L. TS TS TS TS TS TS DS —
T.M. JP JP JP JP JP JP JP —
Daphnid - T.L. N/A N/A N/A N/A N/A N/A N/A —
T.M. N/A N/A N/A N/A N/A N/A N/A —
10. Test Termination: FH-Date/Time 10-7-93/0830 Daphnid-Date/Time N/A
Final Chem. JP FH JP Daphnid N/A Clean-up JP
DS DS N/A —
11. Weigh Fish: Date 10-12-93 By TCS
12. Run Stats: Date 10-21-93 By Cur
13. Report Prep.: Date N/A By —
14. Report Final: Date N/A By — Approved: N/A

*Team Leader

†Culture Unit

#Team Member

FATHEAD MINNOW LARVAL SURVIVAL AND GROWTH TEST

Study Cu Ref ToxPage 1 of 1Beginning Date/Time 9/30/93 0915Ending Date/Time 10-7-93/0830

Personnel

Sester
Possy

-- Number Alive --

Treatment	Rep	- Day -						
		1	2	3	4	5	6	7
Control	1	10	10	10	10	10	10	10
	2	10	10	10	10	10	10	10
	3	10	10	10	10	10	10	10
	4	10	10	10	10	10	10	10
	By:	TS	TS	TS	TS	TS	TS	JP
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	JP
0.003	1	10	10	10	10	10	10	10
	2	10	9	9	9	9	9	9
	3	10	10	10	10	10	10	10
	4	10	10	10	10	10	10	10
	By:	TS	TS	TS	TS	TS	TS	JP/JP
0.008	1	10	10	10	10	10	10	10
	2	10	10	10	10	10	9	9
	3	10	10	10	10	10	9	9
	4	10	10	10	10	10	10	10
	By:	TS/JP	JP	JP	JP/TS	JP/TS	JP	JP
0.02	1	10	10	10	10	10	9	8
	2	10	10	10	8	6	6	5
	3	10	10	10	8	7	6	6
	4	10	10	10	9	8	8	7
	By:	JP	JP	JP	JP	JP	JP	JP
0.05	1	10	9	9	8	6	6	6
	2	10	10	10	8	7	6	5
	3	10	10	8	6	5	3	3
	4	10	10	10	8	6	6	5
	By:	JP	JP	JP	JP	JP	JP	JP

Notes:

Fed- Time/By: 0615/TS 0630/JP 0645/TS 0650/JP 0700/TS 0705/JP 0715/TS 0720/JP

0730/TS 0740/JP 0745/TS 0750/JP 0755/TS 0800/JP 0805/TS 0810/JP

1500/TS 1510/JP 1515/TS 1520/JP 1525/TS 1530/JP 1535/TS 1540/JP

Dilution Water ID: 1484 1484 1486 1486 1489 1489 1491
 (PLARC501-257) Reviewed By: TS TS TS TS TS JP JP

1545/JP

11-21-93
CCL

Analysis of Survival

REFTOX #48
Starting Date: 09/30/93

Survival (%) Data

Treatment	Replicate										Mean
	1	2	3	4	5	6	7	8	9	10	
CONTROL	1.00	1.00	1.00	1.00	.	.	.	.	.	.	1.00
0.001	1.00	1.00	1.00	1.00	.	.	.	.	.	.	1.00
0.003	1.00	0.90	1.00	1.00	.	.	.	.	.	.	0.98
0.008	1.00	0.90	0.90	1.00	.	.	.	.	.	.	0.95
0.02	0.80	0.50	0.60	0.70	.	.	.	.	.	.	0.65
0.05	0.60	0.50	0.30	0.50	.	.	.	.	.	.	0.48

Steel's Many-One Rank Test

Treatment	No. of Replicates	Critical Rank Sum	Rank Sum*
0.001	4	10	18
0.003	4	10	16
0.008	4	10	14
0.02	4	10	10 *
0.05	4	10	10 *

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

Non-parametric analysis of toxicity data

2

4:04 Monday, October 14, 1991

----- STUDY=REFTOX #48 ST_DATE=093093 PARM=MINS TEST=STEEL -----

OBS	TREATMENT	N CONTROL	N EFFLUENT	RANK SUM	CRITICAL RANK SUM	SIGNIFICANT DIFFERENCE
1	0.001	4	4	18	10	
2	0.003	4	4	16	10	
3	0.008	4	4	14	10	
4	0.02	4	4	10	10	*
5	0.05	4	4	10	10	*

Non-parametric analysis of toxicity data

1

4:04 Monday, October 14, 1991

	S	T	S	T	P	C	Y	R	C	M	C	M	T	T	S	O	T	K
1	REFTOX	#48	093093	MINS	2	0	10	4	4	4	4	4	5	5	STEEL	1	0.001	18
2	REFTOX	#48	093093	MINS	2	0	10	4	4	4	4	4	5	5	STEEL	2	0.001	18
3	REFTOX	#48	093093	MINS	3	0	10	4	4	4	4	4	5	5	STEEL	1	0.003	20
4	REFTOX	#48	093093	MINS	3	0	10	4	4	4	4	4	5	5	STEEL	3	0.003	16
5	REFTOX	#48	093093	MINS	4	0	10	4	4	4	4	4	5	5	STEEL	1	0.008	22
6	REFTOX	#48	093093	MINS	4	0	10	4	4	4	4	4	5	5	STEEL	4	0.008	14
7	REFTOX	#48	093093	MINS	5	0	10	4	4	4	4	4	5	5	STEEL	1	0.02	26
8	REFTOX	#48	093093	MINS	5	0	10	4	4	4	4	4	5	5	STEEL	5	0.02	10
9	REFTOX	#48	093093	MINS	6	0	10	4	4	4	4	4	5	5	STEEL	1	0.05	26
10	REFTOX	#48	093093	MINS	6	0	10	4	4	4	4	4	5	5	STEEL	6	0.05	10

TEST FOR NORMAL DISTRIBUTION

4:01 Monday, October 14, 1991

----- STUDY=REFTOX #48 ST_DATE=093093 PARM=MINS -----

UNIVARIATE PROCEDURE

Variable=CENTER

Moments

N	24	Sum Wgts	24
Mean	0	Sum	0
Std Dev	0.081703	Variance	0.006675
Skewness	-0.41677	Kurtosis	0.450456
USS	0.153532	CSS	0.153532
CV	.	Std Mean	0.016677
T:Mean=0	0	Prob> T	1.0000
Sgn Rank	2	Prob> S	0.9299
Num ^= 0	16		
W:Normal	0.942557	Prob<W	0.1913

Quantiles (Def=5)

100% Max	0.164704	99%	0.164704
75% Q3	0.040743	95%	0.126949
50% Med	0	90%	0.081485
25% Q1	-0.02818	10%	-0.12223
0% Min	-0.17949	5%	-0.15705
		1%	-0.17949
Range	0.344192		
Q3-Q1	0.068927		
Mode	0		

Extremes

Lowest	Obs	Highest	Obs
-0.17949(	53)	0.048711(	44)
-0.15705(	42)	0.081485(	31)
-0.12223(	22)	0.081485(	34)
-0.08149(	33)	0.126949(	51)
-0.08149(	32)	0.164704(	41)

Missing Value

Count 36

% Count/Nobs 60.00

TEST FOR NORMAL DISTRIBUTION

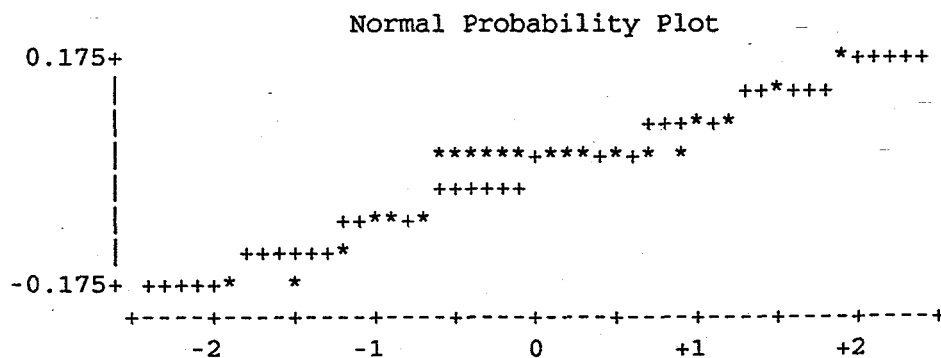
4:01 Monday, October 14, 1991

----- STUDY=REFTOX #48 ST_DATE=093093 PARM=MINS -----

UNIVARIATE PROCEDURE

Variable=CENTER

Stem Leaf	#	Boxplot
1 6	1	0
1 3	1	
0 588	3	
0 0000000033444	13	+++---+
-0		-----+
-0 886	3	
-1 2	1	
-1 86	2	0

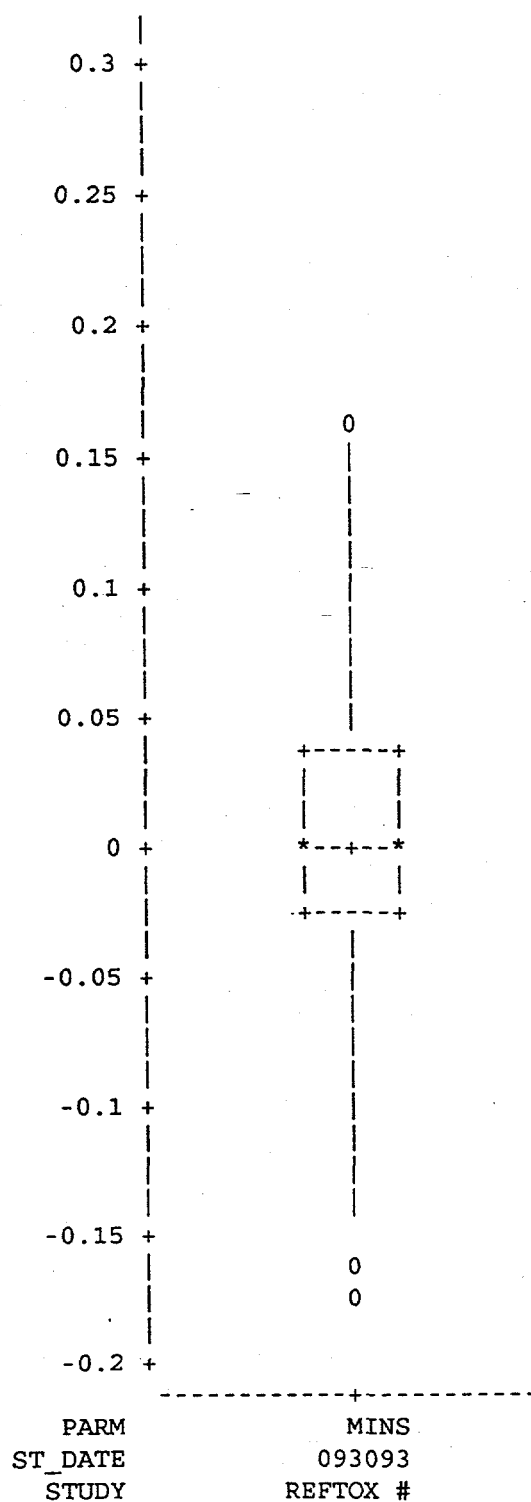
-----+-----+-----+-----+
Multiply Stem.Leaf by 10** -1

TEST FOR NORMAL DISTRIBUTION

4:01 Monday, October 14, 1991

UNIVARIATE PROCEDURE
Schematic Plots

Variable=CENTER

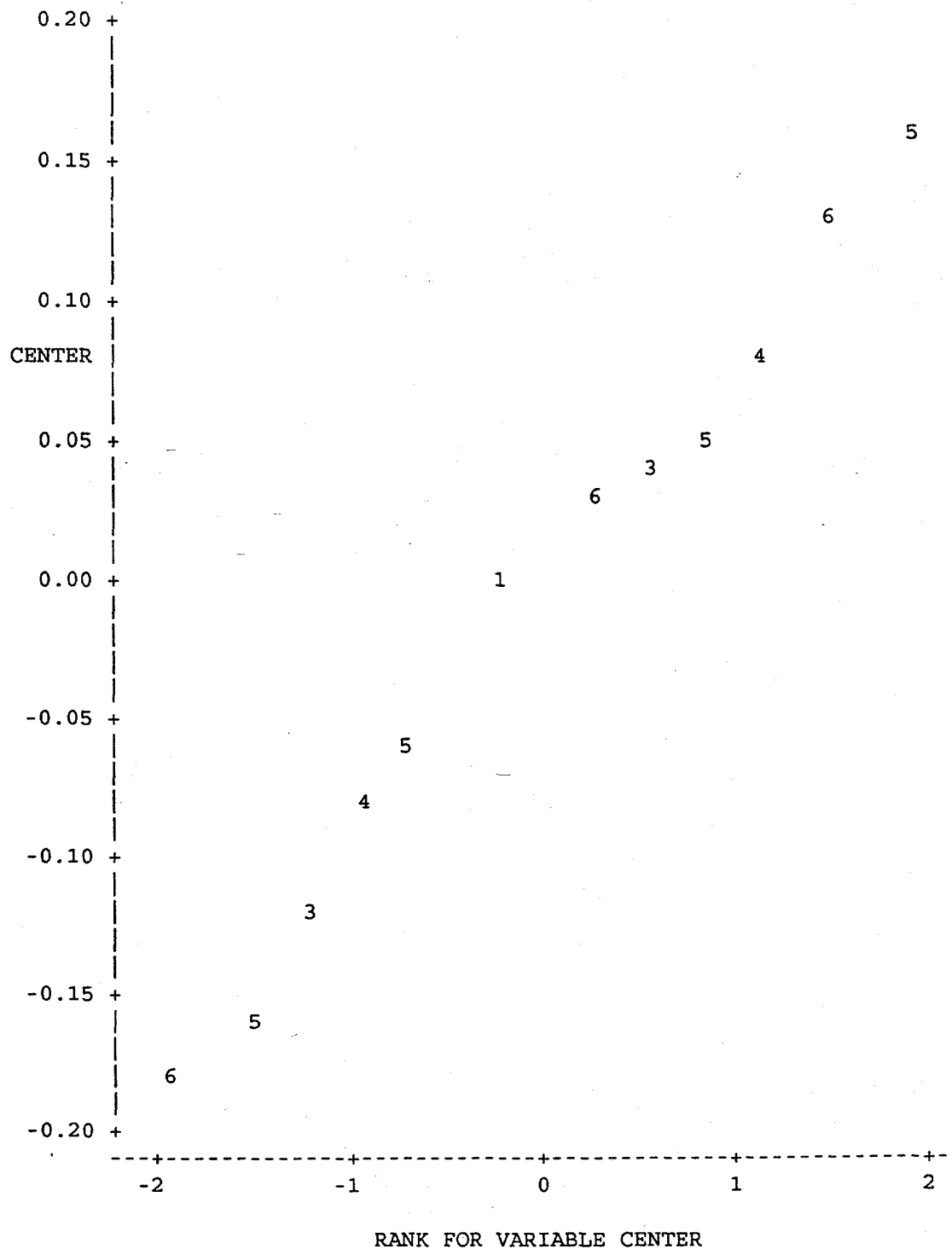


TEST FOR NORMAL DISTRIBUTION

4:01 Monday, October 14, 1991

----- STUDY=REFTOX #48 ST_DATE=093093 PARM=MINS -----

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



NOTE: 36 obs had missing values. 12 obs hidden.

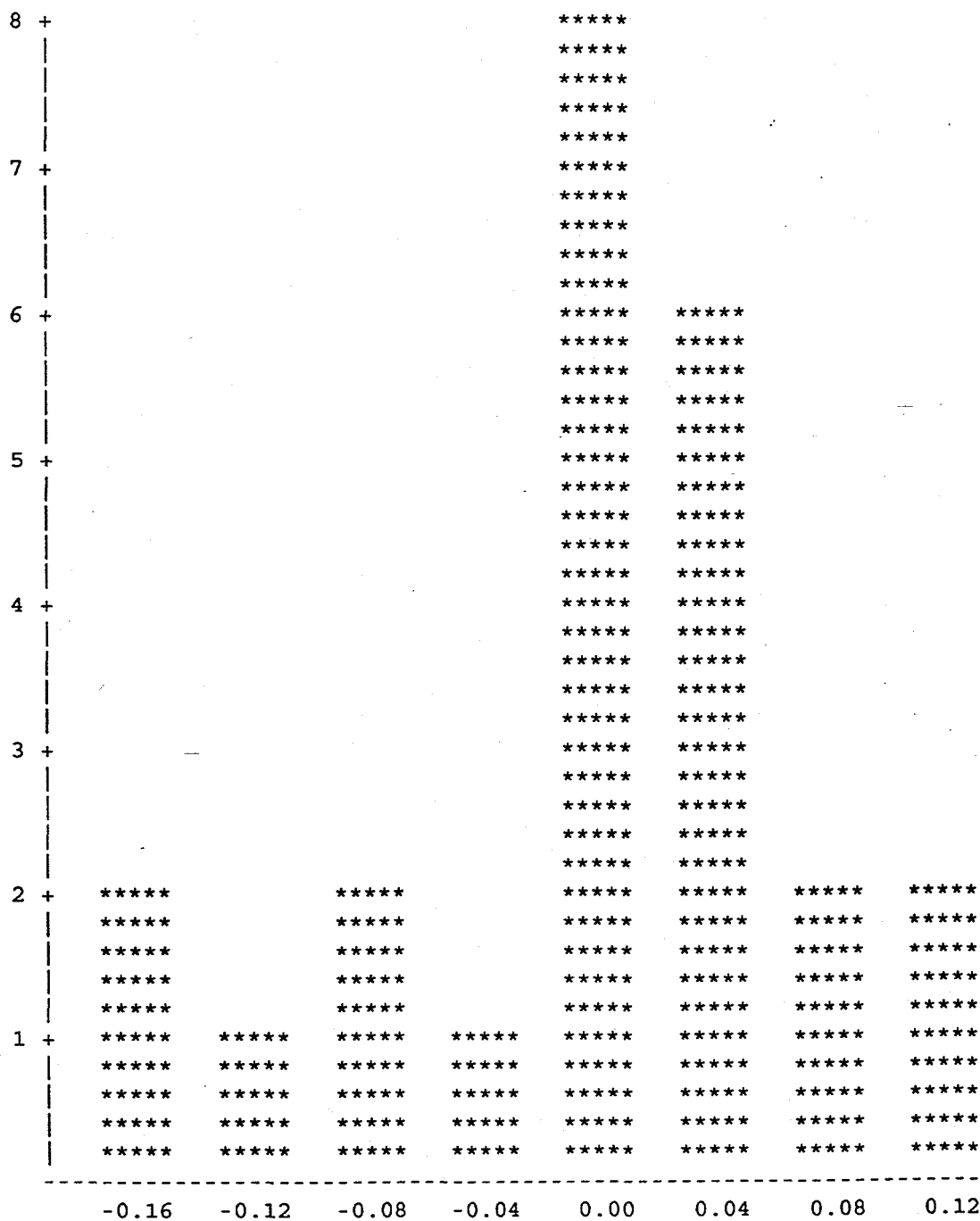
TEST FOR NORMAL DISTRIBUTION

4:01 Monday, October 14, 1991

----- STUDY=REFTOX #48 ST_DATE=093093 PARM=MINS -----

FREQUENCY OF CENTER

FREQUENCY



CENTER MIDPOINT

TEST FOR NORMAL DISTRIBUTION

4:01 Monday, October 14, 1991

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)

7

LEVENE'S TEST FOR HOMOGENEITY OF VARIANCE

4:01 Monday, October 14, 1991

----- STUDY=REFTOX #48 ST_DATE=093093 PARM=MINS -----

General Linear Models Procedure

Class Level Information

Class	Levels	Values
TRT	6	0.001 0.003 0.008 0.02 0.05 CONTROL

Number of observations in by group = 60

NOTE: Due to missing values, only 24 observations can be used in this analysis.

Tests of assumptions for survival data (arcsine transformed)

8

LEVENE'S TEST FOR HOMOGENEITY OF VARIANCE

4:01 Monday, October 14, 1991

----- STUDY=REFTOX #48 ST_DATE=093093 PARM=MINS -----

General Linear Models Procedure

Dependent Variable: ABS_VAL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	0.04262409	0.00852482	4.48	0.0079
Error	18	0.03427130	0.00190396		
Corrected Total	23	0.07689539			

R-Square	C.V.	Root MSE	ABS_VAL Mean
0.554313	77.21746	0.043634	0.05650847

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	5	0.04262409	0.00852482	4.48	0.0079

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	5	0.04262409	0.00852482	4.48	0.0079

FATHEAD DRY WEIGHT RECORD SHEET

Page 1 of 1Study/Date Cu Repto. Oct. 93Personnel TCSPans: Date/Time of Drying 10/8/93, 1045Fish: Date/Time of Drying 10/12/93, 1020Pans: Date/Time of Weighing 10/8/93, 1215Fish: Date/Time of Weighing 10/12/93, 1300

Sample ID		Tare Wt.	Tare + Fish Wt.	Fish Wt.	# Fish	Mean Wt.	Mean Wt. Difference
Initial	1.	1.07303	1.07360		10		
	2.	1.10332	1.10386		10		
	3.	1.01103	1.01161		10		
	4.	1.05113	1.05170		10		
Initial Mean Wt.							
<u>Control</u>	1.	1.08671	1.09067		10		
	2.	1.04112	1.04441		10		
	3.	1.05315	1.05761		10		
	4.	0.96406	0.96790		10		
<u>0.001</u>	1.	1.07413	1.07808		10		
	2.	1.05315	1.05746		10		
	3.	1.12868	1.13311		10		
	4.	1.07324	1.07782		10		
<u>0.003</u>	1.	1.04645	1.05066		10		
	2.	1.03103	1.03562		9		
	3.	1.02828	1.03323		10		
	4.	1.06435	1.06922		10		
<u>0.008</u>	1.	1.10625	1.10922		10		
	2.	1.09108	1.09374		9		
	3.	1.10655	1.10880		9		
	4.	1.07324	1.07529		10		
<u>0.02</u>	1.	1.07245	1.07319		8		
	2.	1.07925	1.07953		5		
	3.	1.12164	1.12215		6		
	4.	1.05652	1.05730		7		
<u>0.05</u>	1.	1.06184	1.06217		6		
	2.	1.11870	1.11885		5		
	3.	1.05764	1.05769		3		
	4.	1.04215	1.04242		5		

Notes:

Reviewed By: TCS

FATHBAD DRY WEIGHT RECORD SHEET

Page 1 of 1

Study/Date in Ref box

Personnel TCS

Pans: Date/Time of Drying 10/13/93; 0745

Fish: Date/Time of Drying 10/13/93; 1010

Pans: Date/Time of Weighing 10/13/93; 0940

Fish: Date/Time of Weighing 10/13/93; 1300

Sample ID	Tare Wt.	Tare + Fish Wt.	Fish Wt.	# Fish	Mean Wt.	Mean Wt. Difference	
Initial							
1.							
2.							
3.							
4.							
Initial Mean Wt.							
1.							
Control 2. X	1.03051	1.03370		10			.319
3. X	1.08282	1.08724		10			.442
4.							
1.							
0.008 2. X	1.04803	1.05065		9			.291
3. X							
4. X	1.03726	1.03923		10			.197
1.							
0.02 2. X	1.08208	1.08246		5			.076
3.							
4. X	1.03486	1.03565		7			.113
1. X	1.03420	1.03452		6			.053
0.05 2.							
3. X	1.03008	1.03026		3			.060
4.							
1.							
2.							
3.							
4.							
1.							
2.							
3.							
4.							

Notes:

Reviewed By: cur

Study/Date: Cu Ref Tox #48

used in analysis Cel 10-21-93

0-99 10/11/93

Pans:Date/Time of Drying: 10/8/93-1045

Fish:Date/Time of Drying: 10/12/93-1020

Pans:Date/Time of Weighing: 10/8/93-1215

Fish:Date/Time of Weighing: 10/12/93-1000

Sample ID	Tare Wt.	Tare + Fish Wt.	Fish Wt.	# Fish	Mean Wt. grams	Mean Wt. Difference	Mean Wt. mg
Initial							
1.	1.07303	1.07360	0.00057	10	0.000057	-	-
2.	1.10332	1.10386	0.00054	10	0.000054	-	-
3.	1.01103	1.01161	0.00058	10	0.000058	-	-
4.	1.05113	1.05170	0.00057	10	0.000057	-	-
Initial Mean Wt.					0.0000565		
Control							
1.	1.08671	1.09067	0.00396	10	0.000396	0.000339	0.396
2.	1.04112	1.04441	0.00329	10	0.000329	0.000272	0.329
3.	1.05315	1.05761	0.00446	10	0.000446	0.000389	0.446
4.	0.96406	0.96790	0.00384	10	0.000384	0.000327	0.384
0.001							
1.	1.07413	1.07808	0.00395	10	0.000395	0.000338	0.395
2.	1.05315	1.05746	0.00431	10	0.000431	0.000374	0.431
3.	1.12868	1.13311	0.00443	10	0.000443	0.000387	0.443
4.	1.07324	1.07781	0.00458	10	0.000458	0.000401	0.458
0.003							
1.	1.04645	1.05206	0.00561	10	0.000561	0.000504	0.561
2.	1.03103	1.03562	0.00459	9	0.000510	0.000454	0.510
3.	1.02828	1.03323	0.00495	10	0.000495	0.000438	0.495
4.	1.06435	1.06922	0.00487	10	0.000487	0.000430	0.487
0.008							
1.	1.10625	1.10922	0.00297	10	0.000297	0.000240	0.297
2.	1.09108	1.09374	0.00266	9	0.000296	0.000239	0.296
3.	1.10655	1.10980	0.00325	9	0.000250	0.000194	0.250
4.	1.07324	1.07529	0.00205	10	0.000205	0.000149	0.205
0.02							
1.	1.07245	1.07319	0.00074	8	0.000093	0.000036	0.093
2.	1.07925	1.07953	0.00028	5	0.000056	-0.000000	0.056
3.	1.12164	1.12215	0.00051	6	0.000085	0.000028	0.085
4.	1.05652	1.05730	0.00078	7	0.000111	0.000055	0.111
0.05							
1.	1.06184	1.06217	0.00033	6	0.000055	-0.000001	0.055
2.	1.11870	1.11885	0.00015	5	0.000030	-0.000000	0.030
3.	1.05764	1.05769	0.00005	5	0.000010	-0.000000	0.010
4.	1.04211	1.04241	0.00030	5	0.000060	-0.000000	0.060

Notes:

new weigh

new weigh

new weigh

new weigh

10-21-93
Cuk

Analysis of 7-day Larval Growth Test

REFTOX #48
Starting Date: 09/30/93

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 16.94 % reduction in Dry Weight (mg).

T = 2.29 ALPHA = 0.05

Dry Weight (mg) Data

TREATMENT	Replicate										MEAN	S
	1	2	3	4	5	6	7	8	9	10		
1 CONTROL	0.40	0.33	0.45	0.38	.	.	.	.	.	.	0.39	
2 0.001	0.40	0.43	0.44	0.46	.	.	.	.	.	.	0.43	
3 0.003	0.42	0.51	0.50	0.49	.	.	.	.	.	.	0.48	
4 0.008	0.30	0.30	0.25	0.21	.	.	.	.	.	.	0.27	*

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

Analysis of Variance

Source	DF	Sum OF Sq.	Mean Sq.	Calc F	F(0.05)
Among	3	0.102	0.034	20.440	0.0001
Within	12	0.020	0.002		
Total	15	0.000			

Analysis of untransformed data

1

4:17 Monday, October 14, 1991

STUDY=REFTOX #48

ST_DATE=093093

PARM=MING

DUNNETT'S TEST

T = 2.29 ALPHA = 0.05

TREATMENT	N	MEAN	SIGNIFICANT DIFFERENCE
CONTROL	4	0.39	
0.001	4	0.43	
0.003	4	0.48	
0.008	4	0.27	*

MINIMUM SIGNIFINANT DIFFERENCE = 0.07

THIS REPRESENTS A 16.94 % DECREASE IN SURVIVAL FROM THE CONTROL

Analysis of untransformed data

2

4:17 Monday, October 14, 1991

STUDY=REFTOX #48

ST_DATE=093093

PARM=MING

DUNNETT'S TEST

T = 2.29 ALPHA = 0.05

TREATMENT	REPLICATE										MEAN	S
	1	2	3	4	5	6	7	8	9	10		
1 CONTROL	0.40	0.33	0.45	0.38	.	.	.	.	.	.	0.39	
2 0.001	0.40	0.43	0.44	0.46	.	.	.	.	.	.	0.43	
3 0.003	0.42	0.51	0.50	0.49	.	.	.	.	.	.	0.48	
4 0.008	0.30	0.30	0.25	0.21	.	.	.	.	.	.	0.27	*

MINIMUM SIGNIFINANT DIFFERENCE = 0.07

THIS REPRESENTS A 16.94 % DECREASE IN SURVIVAL FROM THE CONTROL

Analysis of untransformed data

3

4:17 Monday, October 14, 1991

General Linear Models Procedure
Class Level Information

Class	Levels	Values
TRT	4	0.001 0.003 0.008 CONTROL

Number of observations in data set = 40

NOTE: Due to missing values, only 16 observations can be used in this analysis.

4:17 Monday, October 14, 1991

General Linear Models Procedure

Dependent Variable: RESP

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	0.10206875	0.03402292	20.44	0.0001
Error	12	0.01997500	0.00166458		
Corrected Total	15	0.12204375			

R-Square	C.V.	Root MSE	RESP Mean
0.836329	10.41131	0.0407993	0.39187500

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	3	0.10206875	0.03402292	20.44	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	3	0.10206875	0.03402292	20.44	0.0001

Test for Normal Distribution

4:14 Monday, October 14, 1991

----- STUDY=REFTOX #48 ST_DATE=093093 PARM=MING -----

UNIVARIATE PROCEDURE

Variable=CENTER

Moments

N	16	Sum Wgts	16
Mean	0	Sum	0
Std Dev	0.036492	Variance	0.001332
Skewness	-0.43449	Kurtosis	-0.68758
USS	0.019975	CSS	0.019975
CV	.	Std Mean	0.009123
T:Mean=0	0	Prob> T	1.0000
Sgn Rank	4	Prob> S	0.8491
Num ^= 0	16		
W:Normal	0.936459	Prob<W	0.3057

Quantiles (Def=5)

100% Max	0.06	99%	0.06
75% Q3	0.02875	95%	0.06
50% Med	0.00875	90%	0.035
25% Q1	-0.02375	10%	-0.06
0% Min	-0.06	5%	-0.06
		1%	-0.06
Range	0.12		
Q3-Q1	0.0525		
Mode	-0.06		

Extremes

Lowest	Obs	Highest	Obs
-0.06(	21)	0.0275(	14)
-0.06(	2)	0.03(	22)
-0.055(	34)	0.035(	31)
-0.0325(	11)	0.035(	32)
-0.015(	33)	0.06(	3)

Missing Value

Count 24

% Count/Nobs 60.00

Test for Normal Distribution

4:14 Monday, October 14, 1991

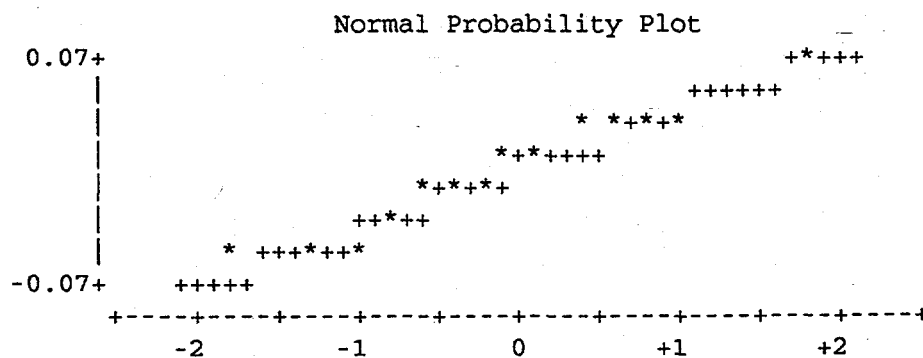
----- STUDY=REFTOX #48 ST_DATE=093093 PARM=MING -----

UNIVARIATE PROCEDURE

Variable=CENTER

Stem Leaf	#	Boxplot
6 0	1	
4		
2 08055	5	+-----+
0 800	3	*---+---
-0 502	3	
-2 2	1	+-----+
-4 5	1	
-6 00	2	

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



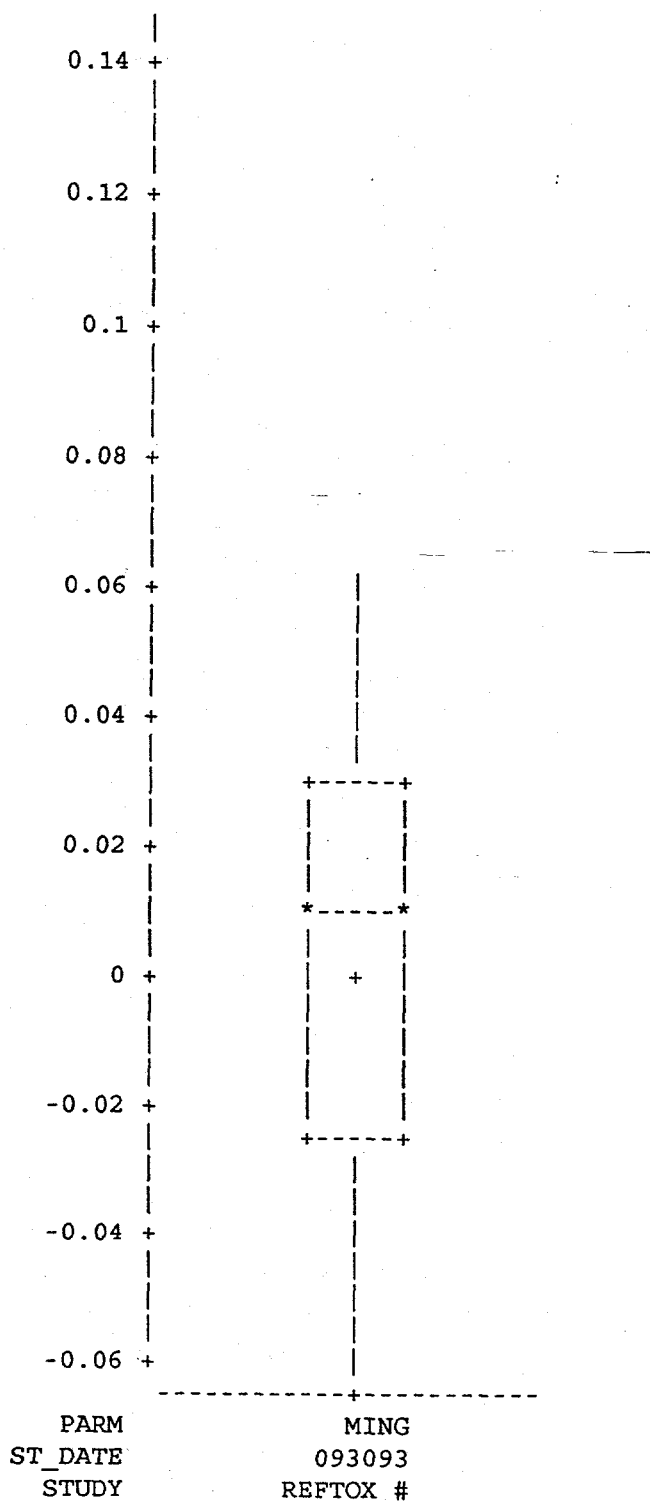
Tests of assumptions for untransformed data
Test for Normal Distribution

3

4:14 Monday, October 14, 1991

UNIVARIATE PROCEDURE
Schematic Plots

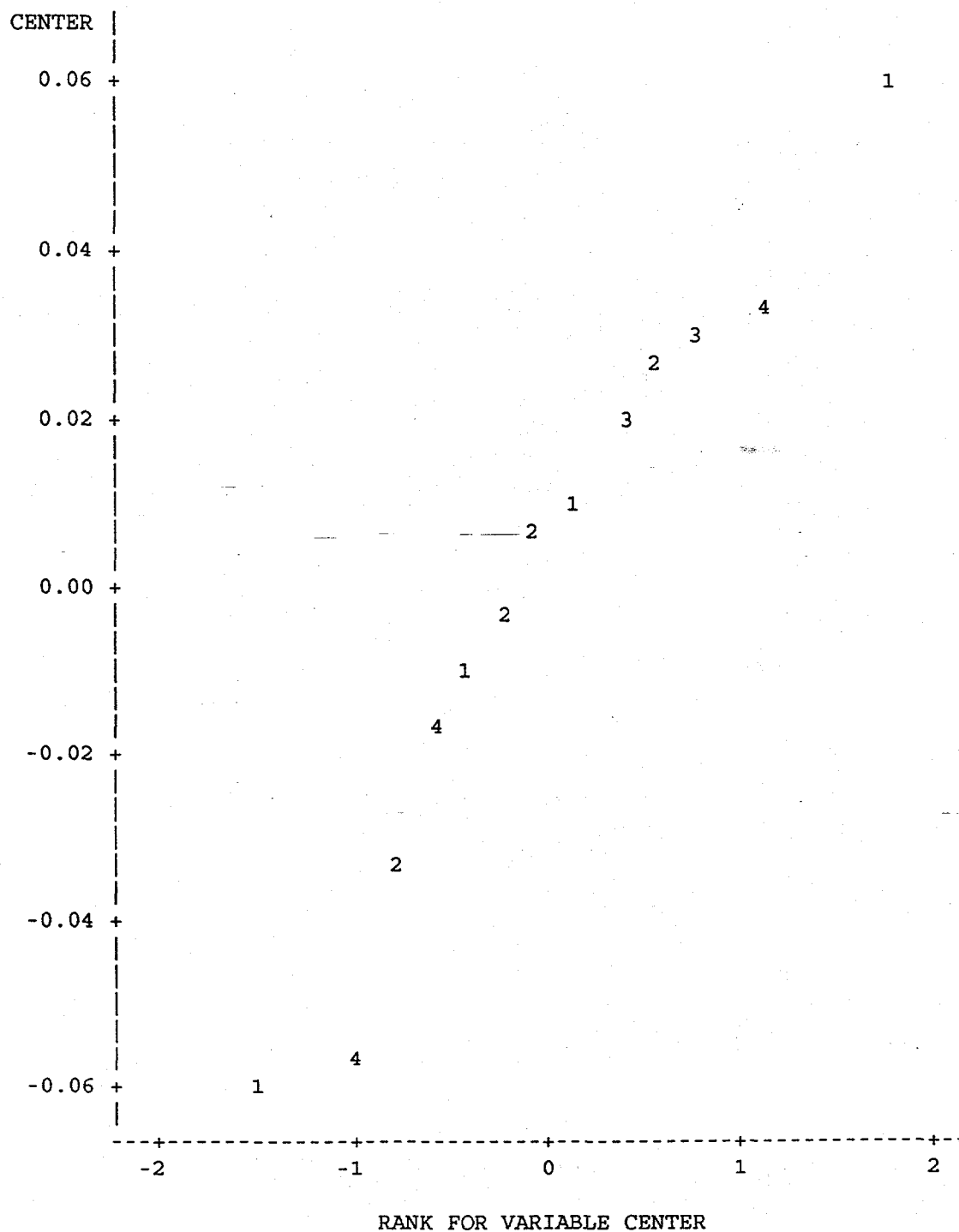
Variable=CENTER



4:14 Monday, October 14, 1991

----- STUDY=REFTOX #48 ST_DATE=093093 PARM=MING -----

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



NOTE: 24 obs had missing values. 3 obs hidden.

Bartlett's Test for Homogeneous Variance

4:14 Monday, October 14, 1991

STUDY=REFTOX #48

ST_DATE=093093

PARM=MING

TREATMENT	N	MEAN	VARIANCE
CONTROL	4	0.39	0.002
0.001	4	0.43	0.001
0.003	4	0.48	0.002
0.008	4	0.27	0.002

BARTLETT'S TEST STATISTIC = 1.193
PROB>B = 0.755

THE NUMBER OF RESAMPLES IS 80

Ref to #48 Fish
IC₂₅ 10-21-93
CVR

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

CONC. (%EFF)	RESPONSE MEAN	MEAN AFTER POOLING
.000	.389	.429
.001	.432	.429
.003	.465	.429
.008	.248	.248
.020	.058	.058
.050	.020	.020

THE LINEAR INTERPOLATION ESTIMATE OF THE TOTAL IMPACT CONCENTRATION
FROM THE INPUT SAMPLE IS .0060.

.050	.020	.020
------	------	------

THE LINEAR INTERPOLATION ESTIMATE OF THE TOTAL IMPACT CONCENTRATION
FROM THE INPUT SAMPLE IS .0060.

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

THE MEAN OF THE BOOTSTRAP ESTIMATES IS .0060.

THE STANDARD DEVIATION OF THE BOOTSTRAP ESTIMATES IS .0003.

AN EMPIRICAL 95.0% CONFIDENCE INTERVAL FOR THE
BOOTSTRAP ESTIMATE IS (.0055, .0067).

C:\BOOTSTRP>

1 0	.396
1 0	.329
1 0	.446
1 0	.384
2 .001	.395
2 .001	.431
2 .001	.443
2 .001	.458
3 .003	.421
3 .003	.459
3 .003	.495
3 .003	.487
4 .008	.297
4 .008	.266
4 .008	.225
4 .008	.205
5 .02	.074
5 .02	.028
5 .02	.051
5 .02	.078
6 .05	.033
6 .05	.015
6 .05	.005
6 .05	.027