

12

DOE/OR/22007--T12

August 16, 1993

Ms. Lynn A. Kszos, Aquatic Toxicologist
Environmental Sciences Division
Oak Ridge National Laboratory
P. O. Box 2008, MS-6351
Oak Ridge, Tennessee 37831-6351

Dear Lynn:

Enclosed is a copy of the report presenting results of TVA copper sulfate reference toxicant testing using juvenile freshwater mussels (Anodonta imbecillis) following the liquid media protocol and comparing the two feeding regimes (bloomed indigenous phytoplankton versus YCT-S). The test was conducted from July 6-15 and resulted in 9-day LC₅₀'s of 0.97 mg Cu/L and 0.84 mg Cu/L for phytoplankton and YCT-S, respectively. Analysis of growth data (μ m) indicated all test treatments, including the YCT-S control, showed significant reduction from the phytoplankton control. Results of this study indicate that phytoplankton concentrate was the better food, although the YCT-S test met survival test acceptability criteria (no criteria have been established for growth). Please send a letter to document your decision to perform future tests using YCT-S. Attachments to the report include Toxicity Test Bench Sheets and Statistical Analyses (I), and Copper Analysis Request and Results (II).

Please call Damien Simbeck (205-729-4543) or me (205-729-3340) if you have questions or comments regarding the report or conductance of the study.

Sincerely,

MASTER

Jennifer Moses, Unit Supervisor
Aquatic Research Laboratory

JM:DTH
Enclosures

cc: J. D. Milligan, HB 2C-C
D. C. Wade, OSA 1B-M (w/enclosures)
Files, WR, HB 2C-C (w/enclosures)

Prepared by Jennifer Moses

PLARC501-1743

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

APPROVED FOR RELEASE OR
PUBLICATION. INTEL. PROP. GP.,
OFC. OF CHIEF COUNSEL, DOE/ORO
By SP Dillon Date 11/21/97

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible electronic image products. Images are produced from the best available original document.

STANDARD REPORT FORM

STATIC RENEWAL TESTS USING ANODONTA IMBECILLIS (FRESHWATER MUSSELS)

Test Title: Anodonta imbecillis Copper Sulfate Reference Toxicant/Food Test,
Clinch River - Environmental Restoration Program (CR-ERP)

Principle Investigator: Damien J. Simbeck

Starting Date: July 6, 1993

Ending Date: July 15, 1993

1.0 EXECUTIVE SUMMARY

Reference toxicant testing using juvenile freshwater mussels was conducted as part of the CR-ERP biomonitoring study of Clinch River sediments to assess the sensitivity of test organisms and the overall performance of the test. [1] Tests were conducted using moderately hard synthetic water spiked with known concentrations of copper as copper sulfate. Two different foods, phytoplankton and YCT-Selenastrum (YCT-S), were tested in side by side tests to compare food quality.

Toxicity testing of copper sulfate reference toxicant was conducted from July 6-15, 1993. The organisms used for testing were juvenile fresh-water mussels (Anodonta imbecillis). Results from this test showed LC₅₀ values of 0.97 and 0.84 mg Cu/L for phytoplankton and YCT-S, respectively. Previously obtained values for phytoplankton tests are 2.02 and 1.12 mg Cu/L. Too few tests have been conducted with copper as the toxicant to determine a normal range of values. Although significant reduction in growth, compared to the phytoplankton control, was seen in all treatments, including the YCT-S Control, the consequence of this observation has not been established. Ninety-day testing of juvenile mussels exhibited large variations in growth within treatment and replicate groups. [2]

2.0 SAMPLE COLLECTION/TREATMENTS

2.1 Test Sample Identification (Chemical/Effluent/Elutriate, etc.):
The samples used were serial dilutions of preserved copper stock solutions diluted in moderately hard synthetic water. Stock solutions were prepared on June 28, 1993, from EPA Reference Toxicant copper sulfate (50 mg Cu/mL), lot #188, and were used daily during the test.

- 2.2 Control and/or Dilution Water: Moderately hard synthetic water.
- 2.3 Sample Dates and Times: Not applicable.
- 2.4 Sampling Method: Not applicable
- 2.5 Sample Storage/Handling: All samples were renewed daily. Moderately hard synthetic water was prepared as needed and stored in 20-L carboys under aeration until used. Copper stock solutions were preserved using 1:1 HNO₃ following procedures for preservation of metals samples. [3]
- 2.6 Sample Transport: Not applicable
- 2.7 Sample Pretreatment: Sample temperature was raised to 24°C in a warm water bath. Food (phytoplankton or YCT-S) and non-toxic, filtered (100 µm Nytex® screen) sediment were added daily prior to initial chemical measurements.
- 2.8 Test Treatments: Nominal test concentrations were Control (0 mg Cu/L), 0.31 mg Cu/L, 0.63 mg Cu/L, 1.25 mg Cu/L, 2.5 mg Cu/L, and 5.0 mg Cu/L. Actual total copper concentrations verified by laboratory analysis of the prepared test series were Control (0 mg Cu/L), 0.30 mg Cu/L, 0.60 mg Cu/L, 1.40 mg Cu/L, 2.70 mg Cu/L, and 5.40 mg Cu/L for the phytoplankton series and Control (0 mg Cu/L), 0.30 mg Cu/L, 0.62 mg Cu/L, 1.30 mg Cu/L, 2.50 mg Cu/L, and 5.10 mg Cu/L for the YCT-S series.

3.0 TEST ORGANISMS/CULTURING CONDITIONS

- 3.1 Species: Anodonta imbecillis, freshwater mussel
- 3.2 Source: In vitro culture, June 21-June 28, 1993, TVA Aquatic Research Laboratory. The gravid adult from which glochidia were extracted was obtained from Taylor's Catfish ponds, Town Creek, Alabama, on April 13, 1993. Adults were maintained in a 40-L aquarium with approximately 5 L non-toxic sediment from Taylor's ponds and 20 L Tennessee River water. Water was changed at least once per week with bloomed phytoplankton water and sediment was changed monthly.
- 3.3 Culture medium: Mussel culture medium used to transform larvae (glochidia) into juveniles consisted of a 2:1 mixture of cell culture medium (MEM) and 0.22 µm filtered catfish plasma. Antibiotics and antimycotics were added in small concentrations to prevent bacterial and fungal contamination. [4]
- 3.4 Temperature of Culture: 24°C ± 1°C

- 3.5 Culture water: After transformation of larval mussels, the free-living juveniles were placed in 100 μ m filtered TR water with bloomed indigenous algae (phytoplankton). Non-toxic sediment (100 μ m filtered) was added to provide additional food and substrate for healthy growth of the juvenile mussels. [5]
- 3.6 Temperature of Culture: $24^{\circ}\text{C} \pm 1^{\circ}\text{C}$
- 3.7 General Maintenance: Cultures were maintained in 1000-mL Nalgene® trays in 24-h dark incubators for 6-10 days after transformation. Cultures were fed bloomed phytoplankton daily. Water and sediment were changed a minimum of once every two days. Health and survival of the cultures were checked by microscopic examination of animals when culture water was changed.
- 3.8 Food Preparation:
- 3.8.1 Phytoplankton preparation: Phytoplankton was bloomed in 20-L glass aquaria 4-7 days (until dark green). Blooms were initiated by adding concentrated solids from ARL channel water to filtered (100 μ m) TR water. Algal nutrients used for Selenastrum cultures were added (1 mL/L) to boost algal blooms. [6] Blooms were centrifuged to concentrate the algal cells into a dark green suspension, obtaining about 0.5 L per aquarium. Prepared phytoplankton concentrate was refrigerated until used.
- 3.8.2 YCT and Selenastrum preparation: YCT was made according to methods modified from EPA/600/4-89/001 with tropical fish food substituted for trout chow and alfalfa substituted for Cerophyll. [7] The alga Selenastrum capricornutum concentrated to 30×10^6 cells/mL was also fed as part of the test diet.
- 3.9 Sediment preparation: Whole, non-toxic sediment from Taylor's Catfish ponds, Town Creek, Alabama, was filtered through a 100- μ m nylon mesh filter. Filtered sediment was stored at 4°C until used.

4.0 TEST METHODS

- 4.1 Mussels, Anodonta imbecillis, Survival Test, TVA Test Method, SOP-22, liquid media protocol. [6]
- 4.2 Modification/Deviations to SOP-22: None
- 4.3 Date/Time Test Initiated: July 6, 1993/0930 CDT
- 4.4 Date/Time Test Terminated: July 15, 1993/0930 CDT
- 4.5 Age of test organisms: 8 days old

- 4.6 Test Chamber: 50 mm-diameter glass cylinder (75 mm tall) with 100- μ m nylon mesh bottom, placed in 250-mL crystallizing dish
- 4.7 Volume per Chamber: 150 mL
- 4.8 Number of organisms per replicate: 10
- 4.9 Number of Replicates per Treatment: 4
- 4.10 Dilution Water: Moderately hard synthetic water
- 4.11 Test Controls: Moderately hard synthetic water was spiked with pH adjusted reagent water to exclude pH as a variable since copper stock solutions were acid preserved. This water augmented with either phytoplankton or YCT-S served as controls for respective food-source comparisons.
- 4.12 Food and Feeding: One series was fed 6 mL/L phytoplankton and the other was fed 3 mL/L YCT and 3 mL/L Selenastrum, added to test water daily.
- 4.13 Test Temperature: 24°C $\pm$ 1
- 4.14 Photoperiod: 24-h dark
- 4.15 Renewal Period: 24-h
- 4.16 Physical and Chemical Parameters Measured: Parameters measured daily ("initial") on fresh test solutions and control waters (following addition of silt and algae) were temperature (temperature adjusted to equal "final" temperature before renewal), DO, pH, and conductivity. Alkalinity, and hardness were measured daily on the control and highest concentration.
- "Final" measurements of temperature, DO, and pH were measured daily in one replicate per treatment before renewal. Conductivity was measured in a combination of two or more replicates per treatment following renewal. Mean values and ranges are reported in Section 6.3.2. One day during the study samples were collected for total copper determination by combining test water from the replicates for each treatment (following renewal) in 500 mL bottles and adding 1:1 HNO₃ for preservation. The test copper series were sent to TVA's Environmental Chemistry Laboratory in Chattanooga, Tennessee, for analysis using inductively coupled plasma (ICP) methodology.
- 4.17 Test Endpoint Determination:
- 4.17.1 Survival: Test animals were counted as dead when microscopic examination revealed valves gaped open and no observable internal movement or an empty shell.

- 4.17.2 Growth: Reported growth was the length along the longest axis measured at $\approx$ mid-shell using an ocular micrometer. Results are reported in microns.
- 4.18 Statistics: Revised statistical procedures contained in the fourth edition of EPA's acute toxicity methods require a decision process for testing statistical assumptions before selecting a specific program to determine LC₅₀ values. [8] Decision processes followed for testing mussel survival response are shown in Sections 6.2.1.1 and 6.2.2.1. The program used for LC₅₀ determination for this test was the Spearman-Kärber Method for the phytoplankton series and the Probit Analysis for the YCT-S series. Statistical analysis of growth data was conducted using the phytoplankton control and included only those treatments which did not show significant survival effects based on hypothesis testing of treatments within each food test. The decision process used for selection of the appropriate test for mussel growth is shown in Section 6.3.1. Dunnett's Test was used for endpoint determination.

5.0 QUALITY ASSURANCE

- 5.1 Toxicity Test Methods: All phases of the study including, but not limited to, sample preparation, 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, the ARL Quality Assurance Plan and SOP Manual, and EPA/600/4-89/001. [6][8] 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, and calibration information pertaining to ARL laboratory instruments is contained in bound Laboratory Instrument Logbooks and specific instruments used were documented on an instrument record sheet, along with daily calibration record sheets, contained in the study notebook.

- 5.2.3 Temperature was measured using mercury thermometers. The instrument was standardized and inspected with readings made according to TVA procedure DS-42.11. [3]
- 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 DS-43.6 and DS-42.4, respectively. [3]
- 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. [3]
- 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. [3]
- 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. [3]
- 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 was determined using the DPD Titrimetric Method according to TVA procedure DS-42.9, Rev. 0. [3]

6.0 RESULTS

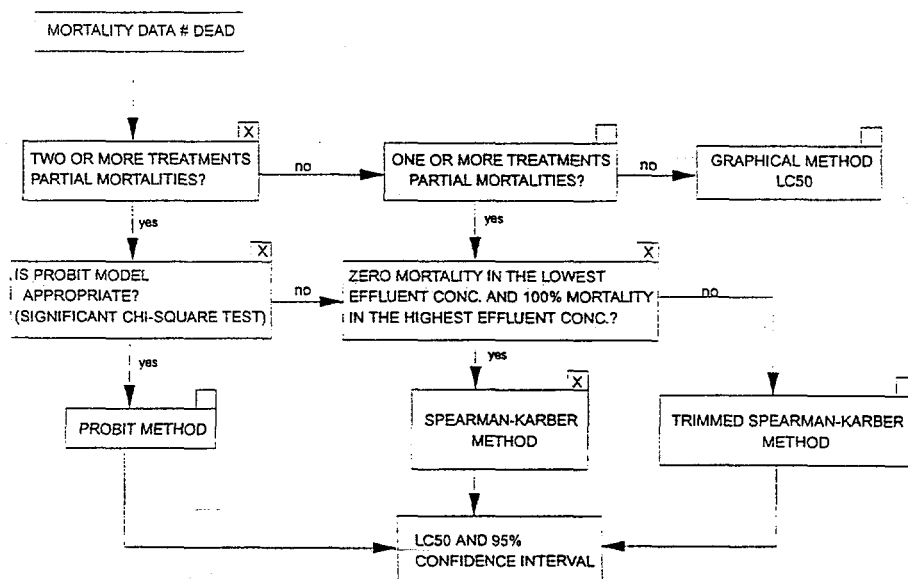
- 6.1 Summary of Results: Nine day exposure of juvenile freshwater mussels, Anodonta imbecillis, to copper reference toxicant resulted in LC₅₀ values of 0.97 and 0.84 mg Cu/L for phytoplankton and YCT-S, respectively, based on the measured copper concentrations. A significant reduction in growth, compared to the phytoplankton control, was seen in all treatments, including the YCT-S Control.

6.2 Results, Survival Data:

6.2.1 Phytoplankton Study:

6.2.1.1 Statistical Decision Process for Determining Toxicity Endpoints for 9-Day Exposure of the Juvenile Mussel-Phytoplankton Series, Anodonta imbecillis, to Copper, July 6-15, 1993.

DETERMINATION OF THE LC50 FROM A MULTI-EFFLUENT/ CONCENTRATION ACUTE TOXICITY TEST



6.2.1.2 Daily Percent Survival Summary for Anodonta imbecillis, Copper Sulfate Reference Toxicant-Phytoplankton Study, CR-ERP, July 6-15, 1993.

Treatment	Total Daily % Survival								
	1	2	3	4	5	6	7	8	9
Control	95	95	95	95	95	93	93	93	93
0.30 mg Cu/L	100	100	100	100	100	100	100	100	100
0.60 mg Cu/L	100	100	100	100	100	100	100	100	98
1.40 mg Cu/L	100	100	100	95	90	85	58	35	10
2.70 mg Cu/L	95	83	75	65	60	33	23	0	0
5.40 mg Cu/L	50	18	0	0	0	0	0	0	0

6.2.1.3

Nine-day Percent Survival Summary for Anodonta imbecillis,
Copper Sulfate Reference Toxicant-Phytoplankton Study, CR-ERP,
July 6-15, 1993.

Mussel Survival Data (% Survival)												
Treatment	Replicate										Mean	S*
	1	2	3	4	5	6	7	8	9	10		
Control	90	90	90	100							93	
0.30 mg Cu/L	100	100	100	100							100	
0.60 mg Cu/L	100	100	90	100							98	
1.40 mg Cu/L	0	10	20	10							10	*
2.70 mg Cu/L	0	0	0	0							0	*
5.40 mg Cu/L	0	0	0	0							0	*

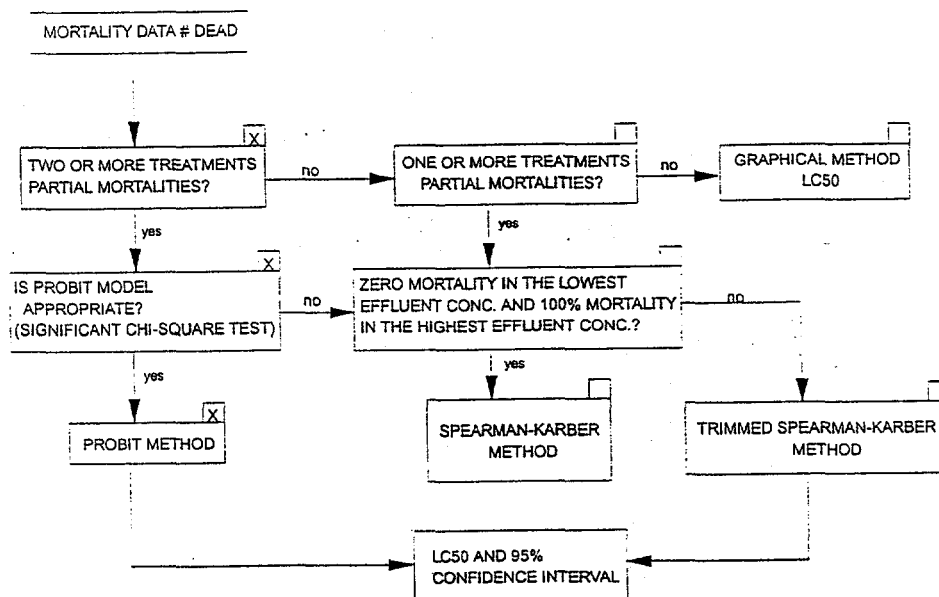
*Significantly less than control based on Steel's Many-one Rank Test.

6.2.1.4 Test Endpoint: 9-day $LC_{50} = 0.97$ (0.92-1.01, 95% C L) mg Cu/L.

6.2.2 YCT-S Study:

6.2.2.1 Statistical Decision Process for Determining Toxicity Endpoints for 9-Day Exposure of the Juvenile Mussel-YCT-S Series, Anodonta imbecillis, to Copper, July 6-15, 1993.

DETERMINATION OF THE LC_{50} FROM A MULTI-EFFLUENT/ CONCENTRATION ACUTE TOXICITY TEST



6.2.2.2 Daily Percent Survival Summary for Anodonta imbecillis, Copper Sulfate Reference Toxicant-YCT-S Study, CR-ERP, July 6-15, 1993.

Treatment	Total Daily % Survival								
	1	2	3	4	5	6	7	8	9
Control	100	100	100	100	100	100	100	100	100
0.30 mg Cu/L	100	98	98	98	98	98	98	98	98
0.62 mg Cu/L	100	100	93	93	90	90	90	88	80
1.30 mg Cu/L	98	98	95	85	75	63	43	23	15
2.50 mg Cu/L	88	70	68	68	43	30	13	13	0
5.10 mg Cu/L	43	18	0	0	0	0	0	0	0

6.2.2.3 Nine-day Percent Survival Summary for Anodonta imbecillis, Copper Sulfate Reference Toxicant-YCT-S Study, CR-ERP, July 6-15, 1993.

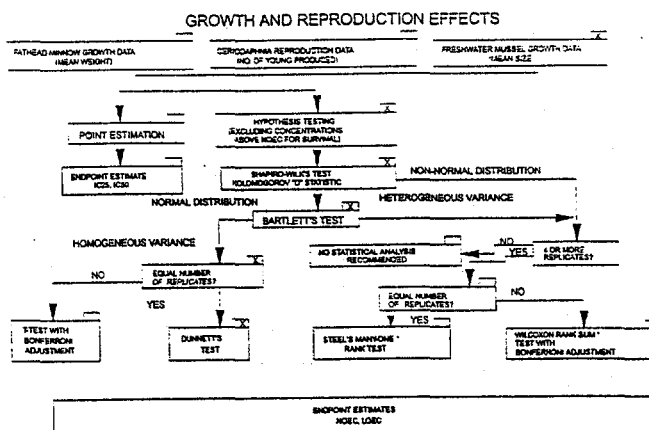
Mussel Survival Data (% Survival)											
Treatment	Replicate										Mean S*
	1	2	3	4	5	6	7	8	9	10	
Control	100	100	100	100							100
0.30 mg Cu/L	100	100	100	90							98
0.62 mg Cu/L	80	100	70	70							80
1.30 mg Cu/L	50	10	0	0							15 *
2.50 mg Cu/L	0	0	0	0							0 *
5.10 mg Cu/L	0	0	0	0							0 *

*Significantly less than control based on Steel's Many-one Rank Test.

6.2.2.4 Test Endpoint: 9-day LC₅₀ = 0.84 (0.73-0.96, 95% C L) mg Cu/L.

6.3 Results, Growth Data:

6.3.1 Statistical Decision Process for Determining Toxicity Endpoints for 9-Day Exposure of the Juvenile Mussel Anodonta imbecillis, to Copper, July 6-15, 1993.



* Test requires 4 replicates/treatment

6.3.2 Analysis of Growth (length, μm) Data Using Dunnett's Test for Juvenile Mussels 9-Day Test,

No transformation applied before data analysis. For this set of data, the minimum significant difference is 34.76.

This represents a 5.18% reduction in Growth (length, μm).
 $T = 2.41$ $\text{Alpha} = 0.05$ (one-tailed test)

Group	Growth (length, μm) Data										Mean	S*
	Replicate											
	1	2	3	4	5	6	7	8	9	10		
Control-Phyto	696.9	670.8	683.8	631.1							670.65	
0.30 mg/L-P	411.6	446.9	439.0	435.1							433.15	*
0.60 mg/L-P	439.0	446.9	435.6	439.0							440.12	*
Control-YCT-S	635.0	654.6	642.9	576.2							627.17	*
0.30 mg/L-Y	462.6	446.9	466.5	453.0							457.25	*
0.62 mg/L-Y	431.2	443.0	459.2	448.0							445.35	*

*Indicates values significantly less than control (Control-Phyto).
 EMS = 416.1.

6.4 Results: Water chemistry summary for Anodonta imbecillis, Copper Sulfate Reference Toxicant/Food Study, CR-ERP, July 6-15, 1993.

6.4.1 Overall Test Temperature:

6.4.1.1 Phytoplankton Study: 23.9°C (23.3°-24.4°C)

6.4.1.2 YCT-S Study: 23.8°C (23.0°-24.4°C)

6.4.2 See: Appendix A Water Chemistry Mean Values and Ranges for Anodonta imbecillis, Copper Sulfate Reference Toxicant/Phytoplankton Study, CR-ERP, July 6-15, 1993.

Appendix B Water Chemistry Mean Values and Ranges for Anodonta imbecillis, Copper Sulfate Reference Toxicant/YCT-Selenastrum Study, CR-ERP, July 6-15, 1993.

7.0 CONCLUSION

Toxicity testing of copper sulfate reference toxicant was conducted from July 6-15, 1993. The organisms used for testing were juvenile fresh-water mussels (Anodonta imbecillis). Results from this test showed LC₅₀ values of 0.97 and 0.84 mg Cu/L for phytoplankton and YCT-S, respectively. Previously obtained values for phytoplankton tests are 2.02 and 1.12 mg Cu/L. Too few tests have been conducted with copper as the

toxicant to determine a normal range of values. Although significant reduction in growth, compared to the phytoplankton control, was seen in all treatments, including the YCT-S Control, the consequence of this observation has not been established. Ninety-day testing of juvenile mussels exhibited large variations in growth within treatment and replicate groups. [2]

8.0 REFERENCES

1. Phipps, T. L., and L. A. Kszos, Statement of Work to Provide Assistance to Staff of the Clinch River-Environmental Restoration Program (CR-ERP) and to Evaluate Toxicity Tests of Water and Sediment Conducted by CR-ERP Staff, Environmental Sciences Division, Biomonitoring Group, Oak Ridge National Laboratory (April 1993).
2. Schweinforth, R. L., and D. C. Wade, Effects from Subchronic 90-Day Exposure of In Vitro Transformed Juvenile Freshwater Mussels (Anodonta imbecillis) to Manganese, Abstract, 11th Annual Meeting, SETAC, Arlington, VA, 11-15 November, 1990.
3. Field Operations Natural Resource Engineering Procedures Manual, Vol. 1, Division of Natural Resource Operations, Tennessee Valley Authority.
4. Isom, B. G., and R. G. Hudson, "In Vitro Culture of Parasitic Freshwater Mussel Glochidia," The Nautilus, Vol. 96, No. 4, 1982, pp. 147-151.
5. Hudson, R. G., and B. G. Isom, "Rearing Juveniles of the Freshwater Mussels (Unionidae) in a Laboratory Setting," The Nautilus, Vol. 98, No. 4, 1984, pp. 129-135.
6. Aquatic Research Laboratory Quality Assurance Program and Standard Operating Procedures Manual, Division of Water Resources, Tennessee Valley Authority (October 1992).
7. 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).
8. Weber, C. I. (ed.), Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, EPA/600/4-90/027 (September 1991).

PLARC501-1709

Appendix A

Water Chemistry Mean Values and Ranges for Anadonta imbecillis,
Copper Sulfate Reference Toxicant-Phytoplankton Study, CR-ERP, July 6-15, 1993

Source	Temperature		Dissolved Oxygen		pH		Conductivity		Alk		Hardness	
	Final	(°C)	Initial	(mg/L)	Initial	(S.U.)	Final	(µmhos)	Initial	(µmhos)	Initial	(mg/L)
CONTROL	23.7	(23.4-24.2)	7.7	(7.4-8.1)	6.8	(6.7-6.9)	7.8	(7.7-7.9)	356	(346-369)	373	(359-384)
0.312 mg/L	23.9	(23.6-24.4)	7.7	(7.4-8.1)	6.8	(6.7-6.9)	7.8	(7.7-7.9)	357	(345-373)	376	(360-403)
0.625 mg/L	24.0	(23.3-24.2)	7.8	(7.5-8.1)	6.8	(6.7-6.9)	7.8	(7.7-7.9)	356	(346-371)	371	(355-392)
1.250 mg/L	24.0	(23.5-24.3)	7.9	(7.6-8.1)	6.8	(6.7-6.9)	7.8	(7.7-8.0)	357	(348-372)	373	(356-397)
2.500 mg/L	23.9	(23.3-24.2)	7.9	(7.5-8.2)	6.6	(6.5-6.8)	7.8	(7.7-7.9)	360	(351-375)	371	(358-386)
5.000 mg/L	24.0	(23.9-24.1)	7.8	(7.6-8.0)	6.5	(6.4-6.5)	7.7	(7.6-7.8)	358	(355-360)	372	(368-375)

* mg/L as CaCO₃

PLARC501-1710(1)

Appendix B

Water Chemistry Mean Values and Ranges for Anadonta imbecillis,
Copper Sulfate Reference Toxicant-YCT-Selenastrum Study, CR-ERP, July 6-15, 1993

Source	Temperature Final (°C)	Dissolved Oxygen		pH		Conductivity		Alk		Hardness	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
		(mg/L)	(mg/L)	(S.U.)	(S.U.)	(µmhos)	(µmhos)	*	*	*	*
CONTROL	23.6 (23.0-24.2)	7.7 (7.3-8.1)	7.9 (7.7-8.1)	6.7 (6.2-7.2)	7.7 (7.3-7.9)	357 (345-380)	374 (359-391)	37 (11-48)		95.0 (92.3-102.6)	
0.312 mg/L	23.9 (23.0-24.4)	7.7 (7.3-8.1)	8.0 (7.8-8.2)	6.8 (6.7-7.1)	7.8 (7.5-7.9)	355 (343-370)	370 (360-381)	-		-	
0.625 mg/L	23.9 (23.4-24.4)	7.7 (7.4-8.1)	8.0 (7.8-8.3)	6.7 (6.7-7.0)	7.8 (7.5-7.9)	355 (345-370)	370 (354-385)	-		-	
1.250 mg/L	23.9 (23.5-24.4)	7.8 (7.5-8.1)	8.0 (7.8-8.3)	6.7 (6.7-7.0)	7.8 (7.7-7.9)	356 (347-371)	371 (352-385)	-		-	
2.500 mg/L	23.9 (23.5-24.4)	7.8 (7.5-8.1)	8.0 (7.8-8.3)	6.6 (6.6-6.8)	7.8 (7.7-7.9)	359 (350-374)	372 (357-394)	41 (37-48)		95.4 (94.1-100.9)	
5.000 mg/L	23.7 (23.4-23.9)	7.7 (7.5-7.9)	8.1 (7.9-8.3)	6.4 (6.4-6.5)	7.7 (7.6-7.8)	357 (354-360)	374 (363-384)	33 (32-33)		96.2 (95.8-97.5)	

* mg/L as CaCO₃

PLARC501-1710(2)

ATTACHMENT I

TOXICITY TEST BENCH SHEETS AND STATISTICAL ANALYSES

ARL ACUTE TOXICITY TEST (MUSSEL) MASTER CHECKLIST Study: CR-ERP Mussel Ret. Toy

Date Issued: _____ To: DJS From: Jm

July 1993

1. Test organism availability: T.L.* O/S C.U.* O/S Date 6-27-93
2. Sample Collection Coordination: Date NA By NA With NA
3. Glassware availability: T.L. O/S Tech _____ Date 6-30-93
4. Silt/Phytoplankton availability: Silt- By O/S Date 6-28-93
Phytoplankton- By O/S Date 6-26-93
5. Glassware prep. complete: Date 7-2-93 By JPP
6. Data Sheet prep. complete: Date 7-5-93 By O/S
7. Test organism availability verification: T.L. O/S
8. Test Initiation: Date/Time 7/6/93; 0930

9. Test Renewal:	Day#:	0	1	2	3	4	5	6	7	8	9
Meter Calib.	T.L.	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>
	T.M.#	<u>NA</u>	<u>JPP</u>	<u>JPP</u>	<u>NA</u>	<u>NA</u>	<u>JPP</u>	<u>NA</u>	<u>JPP</u>		
Log Samples	T.L.	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
	T.M.	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
Initial Chem.	T.L.	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>JPP</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>NA</u>
	T.M.	<u>NA</u>	<u>JPP</u>	<u>JPP</u>	<u>O/S</u>	<u>JPP</u>	<u>JPP</u>	<u>JPP</u>	<u>JPP</u>		<u>NA</u>
Renewal/Counts	T.L.	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>
	T.M.	<u>JPP</u>	<u>JPP</u>	<u>JPP</u>	<u>JPP</u>	<u>JPP</u>	<u>JPP</u>	<u>JPP</u>	<u>JPP</u>		
Final Chem.	T.L.	<u>NA</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>
	T.M.	<u>NA</u>	<u>JPP</u>	<u>JPP</u>	<u>JPP</u>	<u>JPP</u>	<u>JPP</u>	<u>JPP</u>	<u>JPP</u>		
Meter Recal.	T.L.	<u>O/S</u>	<u>JPP</u>	<u>JPP</u>	<u>JPP</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>
	T.M.	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>JPP</u>	<u>JPP</u>				
Paperwork reviewed	T.L.	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>	<u>O/S</u>
	T.M.	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>JPP</u>	<u>JPP</u>	<u>NA</u>	<u>NA</u>			

10. Test Termination: Date/Time 7/15/93; 0930

12. Run Stats: Date 7/22/93 By O/S

13. Report Prep.: Date 7/22/93 By DJS

14. Report Final: Date 8-16-93 By Jm Approved: DCW

*Team Leader

†Culture Unit

#Team Member

Date: 06-28-93

Copper stocks prepared as follows by D. Simbeck using EPA Copper Sulfate reference toxicant, Lot #188, Ampules #2025, Ampules #2026, 50 mg/mL Cu:

1. Combine contents of 2 ampules (7.0 mL) in 100 mL beaker.
2. Add 5 mL CuSO_4 to a 100 mL vol. flask and fill to line to obtain Stock #I = 2,500 mg/L. Pour into 100 mL beaker to mix.

NOTE: Steps 1 and 2 completed on 05-06-93 by DJS.

3. Add 2.5 mL CuSO_4 (ampule #2144) to a 100 mL vol. flask and fill to line to obtain Stock #II = 1,250 mg/L. Pour into 100 mL beaker to mix.

4. Prepare diluted stock series:

<u>Cu Conc. Stock</u>	<u>mL Stock #</u>	<u>mL 50:50 HNO_3</u>	<u>Dilute to 100 mL</u>
Control	0.00	1	100
46.75 mg/L	1.87 I	1	100
93.75 mg/L	3.75 I	1	100
187.50 mg/L	7.50 I	1	100
375.00 mg/L	30.00 II	1	100
750.00 mg/L	60.00 II	1	100

5. Prepare test solutions:

<u>Cu Conc. Stock</u>	<u>mL</u>	<u>Dilute to 1000 mL</u>	<u>Cu Conc. Test</u>
Control	6.67	993.33	0.000
46.75 mg/L	6.67	993.33	0.312
93.75 mg/L	6.67	993.33	0.625
187.50 mg/L	6.67	993.33	1.250
375.00 mg/L	6.67	993.33	2.500
750.00 mg/L	6.67	993.33	5.000

Damien J. Simbeck

PLARC501-1504

MUSSEL TEST RECORD SHEET
Anodonta imbecillis

Project CR-ERP Reference Toxicant

Beginning

Date/Time 7-6-93 10930

Ending

Date/Time /

Personnel Simbeck, Posey

Mussels placed in test vessels: Date 07-05-93 Time 0930-1100

Mussels per test vessel: 10

Test Treatments:

1	<u>Control (phyto)</u>	11	<u>2.500 mg/L Cu (YCT-S)</u>
2	<u>0.312 mg/L Cu (phyto)</u>	12	<u>5.000 mg/L Cu (YCT-S)</u>
3	<u>0.625 mg/L Cu (phyto)</u>	13	<u> </u>
4	<u>1.250 mg/L Cu (phyto)</u>	14	<u> </u>
5	<u>2.500 mg/L Cu (phyto)</u>	15	<u> </u>
6	<u>5.000 mg/L Cu (phyto)</u>	16	<u> </u>
7	<u>Control (YCT-S)</u>	17	<u> </u>
8	<u>0.312 mg/L Cu (YCT-S)</u>	18	<u> </u>
9	<u>0.625 mg/L Cu (YCT-S)</u>	19	<u> </u>
10	<u>1.250 mg/L Cu (YCT-S)</u>	20	<u> </u>

Control/Dilution Water: Moderately Hard Syntetic Water (F-Med)

Source

Date Collected/Prepared

CULTURE HISTORY:

Culture ID	Date Started	Date Transformed
<u>93-Q</u>	<u>06/21/93</u>	<u>06/28/93</u>
<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>

FOOD/SUBSTRATE PREPARATION:

Phytoplankton Started

06/21/93
06/25/93

Phytoplankton Concentrated

06/26/93
06/29/93

Silt Collected: Date/Location 06/23/93 / Taylor's Lower Pond

Silt Filtered (Date) 06/24/93 Silt Weighed (Date) 06/30/93

Volume Weighed 5 mL

	<u>Wt. of pan</u>	<u>Wt. of pan and silt</u>	<u>Wt. of silt</u>
Replicate 1	<u>1.03836 mg</u>	<u>1.78540 mg</u>	<u>0.74704 mg</u>
Replicate 2	<u>1.00166 mg</u>	<u>1.74436 mg</u>	<u>0.74270 mg</u>
Replicate 3	<u>1.03139 mg</u>	<u>1.79344 mg</u>	<u>0.76205 mg</u>
Average dry weight	<u>1.02380 mg</u>	<u>1.77440 mg</u>	<u>0.75060 mg</u>
	<u>5.33 mL = 800 mg dry weight</u>		

PLARC501-130(5)

TREATMENT: Control Phytoplankton

[illegible]

TREATMENT: 0.312 mg/L Cu phytoplankton

[illegible]

TREATMENT: 0.625 mg/L CU Phytoplankton

DAY:	0	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9
DATE:	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Rep 1: # Alive	10	*10	10	10	10	10	10	10	10	8
# Stressed	0	0	0	0	0	0	0	0	0	2
# Dead	0	0	0	0	0	0	0	0	0	0
Rep 2: # Alive	10	*10	10	10	10	10	10	10	10	10
# Stressed	0	0	0	0	0	0	0	0	0	0
# Dead	0	0	0	0	0	0	0	0	0	0
Rep 3: # Alive	10	*10	10 ^{2 active}	10	10	10	10	10	10	9
# Stressed	0	0	0	0	0	0	0	0	0	0
# Dead	0	0	0	0	0	0	0	0	0	1
Rep 4: # Alive	10	*10	10	10	10	9	10	10	10	9
# Stressed	0	0	0	0	0	1	0	0	0	1
# Dead	0	0	0	0	0	0	0	0	0	0

* very slow moving, inactive by day 2

TREATMENT: 1.250 mg/L Cu Phytoplankton

DAY:	0	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th
DATE:	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Rep 1: # Alive	10	10	10	10	9	9	7	2	1	0
# Stressed	0	0	0	0	0	0	2	3	0	0
# Dead	0	0	0	0	1	1	1	5	9	10
Rep 2: # Alive	10	10	10	10	9	9	9	4	1	1
# Stressed	0	0	0	0	1	0	0	3	3	0
# Dead	0	0	0	0	0	1	1	3	6	9
Rep 3: # Alive	10	10	10	10	9	7	6	4	3	2
# Stressed	0	0	0	0	0	2	1	3	2	0
# Dead	0	0	0	0	1	1	3	3	5	8
Rep 4: # Alive	10	10	10	10	10	9	7	3	3	1
# Stressed	0	0	0	0	0	0	2	1	1	0
# Dead	0	0	0	0	0	1	1	6	6	9

inactive on Day 2

TREATMENT: 2.500 mg/L CU Phytoplankton

DAY:		0	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9
DATE:		7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Rep 1:	# Alive	10	10 ⁷	7	7	4	3 rd	2	1	0	X
	# Stressed	0	1	0	0	2	1	1	0	0	
	# Dead	0	2	3	3	4	5	7	9	10	
Rep 2:	# Alive	10	10	8	8	6	2	0	0	0	X
	# Stressed	0	0	2	0	2	6	4	3 rd 4	0	
	# Dead	0	0	0	2	2	2	6	6	10	
Rep 3:	# Alive	10	10	7	6	4	5	0	3 rd 6	0	X
	# Stressed	0	0	0	0	2	1	3	3	0	
	# Dead	0	0	3	4	4	4	7	7	10	
Rep 4:	# Alive	10	10	8	8	4	3	3	1	0	X
	# Stressed	0	0	1	1	2	2	0	0	0	
	# Dead	0	0	1	1	4	5	7	9	10	

7 animals are allowed out to collect at waste traps
** only food - 9

TREATMENT: 5.000 mg/L Cu Phytoplankton

DAY:		0	1 st	2 nd	3 rd	4 th	5	6	7	8	9
DATE:		7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Rep 1:	# Alive	10	5	0	0						
	# Stressed	0	1	3	0						
	# Dead	0	4	7	10						
Rep 2:	# Alive	10	0	0	-						
	# Stressed	0	1	0	-						
	# Dead	0	9	10	-						
Rep 3:	# Alive	10	4	1	0						
	# Stressed	0	4	3	0						
	# Dead	0	2	6	10						
Rep 4:	# Alive	10	2	0	-						
	# Stressed	0	3	0	-						
	# Dead	0	5	10	-						

SPEARMAN-KARBER METHOD LC50 ESTIMATION

TEST: Mussel Ref Tox July 1993 (phyto)

DATE: 15 July 1993

TREATMENT	log10 CONC.	# DEAD	ADJ. PROP DEAD	# EXPOSED
0.300	-0.52288 [1]	0	-0.081 A	40
0.600	-0.22185 [2]	1	-0.054 B	40
1.400	0.14613 [3]	36	0.892 C	40
2.700	0.43136 [4]	40	1.000 D	40
5.400	0.73239 [5]	40	1.000 E	40

Control 3 0

M=Log(Estimated LC50)

$$\begin{aligned}
 & (B-A)(\log[1]+\log[2])/2 + -0.01005 + \\
 & (C-B)(\log[2]+\log[3])/2 + -0.03581 + \\
 & (D-C)(\log[3]+\log[4])/2 + 0.031184 + \\
 & (E-D)(\log[4]+\log[5])/2 = M \quad 0 = M \\
 & -0.01468 = M
 \end{aligned}$$

Estimated LC50 = antilog M

V(m)=Estimated Variance in M

$$\begin{aligned}
 & B(1-B)(\log[3]-\log[1])e^{2/4(n-1)} + -0.00016 + \\
 & C(1-C)(\log[4]-\log[2])e^{2/4(n-1)} + 0.000263 + \\
 & D(1-D)(\log[5]-\log[3])e^{2/4(n-1)} + 0 = V(m) \\
 & 0.000100 = V(m)
 \end{aligned}$$

$$CL = M \pm 2\sqrt{V(m)}$$

LCL= antilog-0.03470

UCL= antilog0.005334

Est. LC50 = 0.966751

95% LCL = 0.923197

95% UCL = 1.012359

Reviewed By: DJS *[Signature]*

Non-parametric analysis of toxicity data

2

10:02 Friday, August 9, 1991

----- STUDY=JULY#03 REFTOX ST_DATE=070693 PARM=MINS TEST=STEEL -----

OBS	TREATMENT	N CONTROL	N EFFLUENT	RANK SUM	CRITICAL RANK SUM	SIGNIFICANT DIFFERENCE
1	0.30	4	4	24	10	
2	0.60	4	4	22	10	
3	1.4	4	4	10	10	*
4	2.7	4	4	10	10	*
5	5.4	4	4	10	10	*

TREATMENT: Control YCT-S

DAY:		0	1	2	3	4	5	6	7	8	9
DATE:		7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Rep 1:	# Alive	10	10	10	10	10	10	10	10	10	10
	# Stressed	0	0	0	0	0	0	0	0	0	0
	# Dead	0	0	0	0	0	0	0	0	0	0
Rep 2:	# Alive	10	10	10	10	10	10	10	10	10	10
	# Stressed	0	0	0	0	0	0	0	0	0	0
	# Dead	0	0	0	0	0	0	0	0	0	0
Rep 3:	# Alive	10	10	10	10	10	10	10	10	10	10
	# Stressed	0	0	0	0	0	0	0	0	0	0
	# Dead	0	0	0	0	0	0	0	0	0	0
Rep 4:	# Alive	10	10	10	10	10	10	10	10	10	10
	# Stressed	0	0	0	0	0	0	0	0	0	0
	# Dead	0	0	0	0	0	0	0	0	0	0
			0/5	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0

TREATMENT: 0.312 mg/L Cu YCT-S

DAY:		0	1	2	3	4	5	6	7	8	9
DATE:		7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Rep 1:	# Alive	10	10*	10	10	10	10	10	10	10	10
	# Stressed	0	0	0	0	0	0	0	0	0	0
	# Dead	0	0	0	0	0	0	0	0	0	0
Rep 2:	# Alive	10	10*	10	10	10	10	10	10	10	9
	# Stressed	0	0	0	0	0	0	0	0	0	0
	# Dead	0	0	0	0	0	0	0	0	0	0
Rep 3:	# Alive	10	10*	10	10	10	10	10	10	10	10
	# Stressed	0	0	0	0	0	0	0	0	0	0
	# Dead	0	0	0	0	0	0	0	0	0	0
Rep 4:	# Alive	10	10*	9	9	9	9	9	9	9	9
	# Stressed	0	0	0	0	0	0	0	0	0	0
	# Dead	0	0	1	1	1	1	1	1	1	1
			0/5	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0

* Day 1: Slow but active

TREATMENT: 0.625 mg/L CU YCT-S

DAY:		0	1	2	3	4	5	6	7	8	9
DATE:		7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Rep 1:	# Alive	10	10*	10*	10	10	10	10	10	10	87
	# Stressed	0	0	0	0	0	0	0	0	0	01
	# Dead	0	0	0	0	0	0	0	0	0	2
Rep 2:	# Alive	10	10*	10*	10	10	10	10	10	10	10
	# Stressed	0	0	0	0	0	0	0	0	0	0
	# Dead	0	0	0	0	0	0	0	0	0	0
Rep 3:	# Alive	10	10*	10*	9	9	8	8	8	*7	7
	# Stressed	0	0	0	0	0	0	0	0	0	0
	# Dead	0	0	0	1	1	2	2	2	2	3
Rep 4:	# Alive	10	10*	10*	8	8	8	8	8	7	7
	# Stressed	0	0	0	0	0	0	0	0	0	0
	# Dead	0	0	0	2	2	2	2	2	3	3
*Extremely slow but active			075	5PP	075	3PP	075	3PP	075	3PP	3PP

TREATMENT: 1.250 mg/L Cu YCT-S

DAY:		0	1	2	3	4	5	6	7	8	9
DATE:		7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Rep 1:	# Alive	10	10*	10*	10	9	9	8	7	5	3
	# Stressed	0	0	0	0	0	0	1	0	2	2
	# Dead	0	0	0	0	1	1	1	3	3	5
Rep 2:	# Alive	10	10*	10*	9	6	6	3	2	1	0
	# Stressed	0	0	0	0	2	1	2	1	1	1
	# Dead	0	0	0	1	1	3	5	7	8	9
Rep 3:	# Alive	10	9*	9*	9	7	3	15	0	0	X
	# Stressed	0	0	0	0	0	2	0 ³	1	0	
	# Dead	0	1	1	1	3	5	6	9	10	
Rep 4:	# Alive	10	10*	10*	10	9	8	6	1	0	X
	# Stressed	0	0	0	0	0	1	1	0 ⁵	0	
	# Dead	0	0	0	0	1	1	3	0 ¹² 4	10	

* Periodically, inactive
very little movement
of water in soil

TREATMENT: 2.500 mg/L CU YCT-S

DAY:	0	1	2	3	4	5	6	7	8	9
DATE:	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Rep 1: # Alive	10	10*	10 ¹	8	4	4	3	0	0	0
# Stressed	0	0	0	1	5	1	2	3	3	0
# Dead	0	0	0	1	1	5	5	7	7	10
Rep 2: # Alive	10	6*	6	5	5	2	2	0		
# Stressed	0	3	0	1	1	3	0	0		
# Dead	0	1	4	4	4	5	8	10		
Rep 3: # Alive	10	6*	5	5	5	1	2	1	2	0
# Stressed	0	1	0	0	0	2	1	1	0	0
# Dead	0	3	5	5	5	7	7	8	8	10
Rep 4: # Alive	10	8*	7	5	4	4	1	0		
# Stressed	0	1	0	2	3	0	1	0		
# Dead	0	1	3	3	3	6	8	10		
* inactive, closed										
		0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2

TREATMENT: 5.000 mg/L Cu YCT-S

DAY:	0	1	2	3	4	5	6	7	8	9
DATE:	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Rep 1: # Alive	10	2*	0	0						
# Stressed	0	1	3	0						
# Dead	0	7	7	10						
Rep 2: # Alive	10	2*	0	0						
# Stressed	0	2	2	0						
# Dead	0	6	8	10						
Rep 3: # Alive	10	0	0							
# Stressed	0	4	0							
# Dead	0	6	10							
Rep 4: # Alive	10	2*	2*	0						
# Stressed	0	4	0	0						
# Dead	0	4	8	10						
* inactive, closed										
		0/6	0/2	0/2						

EPA PROBIT ANALYSIS PROGRAM
 USED FOR CALCULATING EC VALUES
 Version 1.4

Y-Death

Conc.	Number Exposed	Number Resp.	Observed Proportion Responding	Adjusted Proportion Responding	Predicted Proportion Responding
0.3000	40	1	0.0250	0.0250	0.0088
0.6200	40	8	0.2000	0.2000	0.2426
1.3000	40	34	0.8500	0.8500	0.8437
2.5000	40	40	1.0000	1.0000	0.9941
5.1000	40	40	1.0000	1.0000	1.0000

Chi - Square Heterogeneity = 1.840

Mu = -0.076189
 Sigma = 0.188271

Parameter	Estimate	Std. Err.	95% Confidence Limits	
Intercept	5.404674	0.160099	(5.090879,	5.718469)
Slope	5.311483	0.715271	(3.909553,	6.713413)

Theoretical Spontaneous Response Rate = 0.0000

Death

Y. 1. 4. 3.

Estimated EC Values and Confidence Limits

Dint	Conc.	95% Confidence Limits	
		Lower	Upper
0 1.00	0.3061	0.2060	0.3903
0 5.00	0.4113	0.3045	0.4981
0 10.00	0.4814	0.3739	0.5691
0 15.00	0.5354	0.4286	0.6239
0 50.00	0.8391	0.7331	0.9584
0 85.00	1.3150	1.1323	1.6300
0 90.00	1.4625	1.2422	1.8673
0 95.00	1.7120	1.4201	2.2916
0 99.00	2.3003	1.8135	3.3863

Non-parametric analysis of toxicity data

2

10:25 Friday, August 9, 1991

STUDY=JULY#03 musref ST_DATE=070693 PARM=MINS TEST=STEEL

OBS	TREATMENT	N CONTROL	N EFFLUENT	RANK SUM	CRITICAL RANK SUM	SIGNIFICANT DIFFERENCE
1	0.30	4	4	16	10	
2	0.62	4	4	12	10	
3	1.3	4	4	10	10	*
4	2.5	4	4	10	10	*
5	5.1	4	4	10	10	*

Mussel Reference Toxicant: Growth 07/15/93

Treatment:	Control P			
Replicate	1	2	3	4
1	1.8	2.0	1.8	1.4
2	2.1	2.6	1.5	1.6
3	1.2	2.0	1.8	2.1
4	1.3	1.5	1.6	1.4
5	2.0	1.8	1.8	1.3
6	2.0	1.7	1.5	1.8
7	1.3	1.7	2.0	1.3
8	1.8	1.2	1.9	2.1
9	2.5	1.5	1.8	1.7
10	D	D	D	1.4

Treatment:	Control Y			
Replicate	1	2	3	4
1	1.8	1.9	1.6	1.3
2	1.8	1.6	1.6	1.8
3	1.0	1.3	1.6	1.5
4	1.3	1.8	1.9	1.7
5	1.8	2.0	1.5	1.4
6	1.9	1.6	1.9	1.6
7	1.6	1.8	2.1	1.8
8	1.7	1.5	1.2	1.3
9	1.8	1.5	1.1	1.3
10	1.5	1.7	1.9	1.1

Treatment:	0.312 P			
Replicate	1	2	3	4
1	1.2	1.1	1.1	1.0
2	0.9	1.1	1.1	1.1
3	0.8	1.1	1.0	1.0
4	1.2	1.2	1.1	1.1
5	1.1	1.2	1.2	1.3
6	1.1	1.1	1.1	1.1
7	1.0	1.1	1.2	1.1
8	1.0	1.2	1.3	1.2
9	1.1	1.3	1.0	1.0
10	1.1	1.0	1.1	1.2

Treatment:	0.312 Y			
Replicate	1	2	3	4
1	1.0	1.2	1.0	1.0
2	1.1	1.2	1.1	1.1
3	1.2	1.2	1.2	1.2
4	1.3	1.1	1.3	1.2
5	1.3	1.3	1.1	1.1
6	1.2	1.2	1.3	1.3
7	1.2	1.1	1.1	1.0
8	1.3	1.1	1.3	1.3
9	1.1	0.9	1.2	1.2
10	1.1	1.1	1.3	D

Treatment:	0.625 P			
Replicate	1	2	3	4
1	1.2	1.2	1.0	1.1
2	1.2	1.1	1.3	1.1
3	1.0	1.1	1.2	1.3
4	1.1	1.1	1.1	1.2
5	1.1	1.1	1.2	1.0
6	1.1	1.2	1.2	1.1
7	1.2	1.2	0.9	1.0
8	1.1	1.2	1.0	1.1
9	1.2	1.1	1.1	1.1
10	1.0	1.1	D	1.2

Treatment:	0.625 Y			
Replicate	1	2	3	4
1	1.0	1.1	1.3	1.1
2	1.1	1.2	1.1	1.1
3	1.4	1.3	1.0	1.3
4	1.2	1.1	1.1	1.2
5	1.1	1.2	1.2	1.1
6	0.9	1.0	1.3	1.2
7	1.0	1.2	1.3	1.0
8	1.1	0.9	D	D
9	D	1.2	D	D
10	D	1.1	D	D

1 unit= 392 microns

Mussel Reference Toxicant: Growth 07/15/93

Treatment: 1.250 P

Replicate	1	2	3	4
1	P	1.5	1.2	1.2
2	D	D	1.1	D
3	D	D	D	D
4	D	D	D	D
5	D	D	D	D
6	D	D	D	D
7	D	D	D	D
8	D	D	D	D
9	D	D	D	D
10	D	D	D	D

Treatment: 1.250 Y

Replicate	1	2	3	4
1	1.3	1.2	D	D
2	1.1	D	D	D
3	1.2	D	D	D
4	1.1	D	D	D
5	1.2	D	D	D
6	D	D	D	D
7	D	D	D	D
8	D	D	D	D
9	D	D	D	D
10	D	D	D	D

Treatment: 2.500 P

Replicate	1	2	3	4
1	D	D	D	D
2	D	D	D	D
3	D	D	D	D
4	D	D	D	D
5	D	D	D	D
6	D	D	D	D
7	D	D	D	D
8	D	D	D	D
9	D	D	D	D
10	D	D	D	D

Treatment: 2.500 Y

Replicate	1	2	3	4
1	D	D	D	D
2	D	D	D	D
3	D	D	D	D
4	D	D	D	D
5	D	D	D	D
6	D	D	D	D
7	D	D	D	D
8	D	D	D	D
9	D	D	D	D
10	D	D	D	D

Mussel Reference Toxicant: Growth 07/15/93

Treatment: Control P				
Micrometer units				
Replicate	1	2	3	4
1	1.8	2.0	1.8	1.4
2	2.1	2.0	1.5	1.6
3	1.2	2.0	1.8	2.1
4	1.3	1.5	1.6	1.4
5	2.0	1.8	1.8	1.3
6	2.0	1.7	1.5	1.8
7	1.3	1.7	2.0	1.3
8	1.8	1.2	1.9	2.1
9	2.5	1.5	1.8	1.7
10	DEAD	DEAD	DEAD	1.4

Treatment: Control P				
Micrometers				
Replicate	1	2	3	4
1	705.6	784.0	705.6	548.8
2	823.2	784.0	588.0	627.2
3	470.4	784.0	705.6	823.2
4	509.6	588.0	627.2	548.8
5	784.0	705.6	705.6	509.6
6	784.0	666.4	588.0	705.6
7	509.6	666.4	784.0	509.6
8	705.6	470.4	744.8	823.2
9	980.0	588.0	705.6	666.4
10	0.0	0.0	0.0	548.8

AVERAGE 696.9 670.8 683.8 631.1
AVERAGE= 669.6

Treatment: 0.312 P				
Micrometer units				
Replicate	1	2	3	4
1	1.2	1.1	1.1	1.0
2	0.9	1.1	1.1	1.1
3	0.8	1.1	1.0	1.0
4	1.2	1.2	1.1	1.1
5	1.1	1.2	1.2	1.3
6	1.1	1.1	1.1	1.1
7	1.0	1.1	1.2	1.1
8	1.0	1.2	1.3	1.2
9	1.1	1.3	1.0	1.0
10	1.1	1.0	1.1	1.2

Treatment: 0.312 P				
Micrometers				
Replicate	1	2	3	4
1	470.4	431.2	431.2	392.0
2	352.8	431.2	431.2	431.2
3	313.6	431.2	392.0	392.0
4	470.4	470.4	431.2	431.2
5	431.2	470.4	470.4	509.6
6	431.2	431.2	431.2	431.2
7	392.0	431.2	470.4	431.2
8	392.0	470.4	509.6	470.4
9	431.2	509.6	392.0	392.0
10	431.2	392.0	431.2	470.4

AVERAGE 411.6 446.9 439.0 435.1
AVERAGE= 433.2

Treatment: 0.625 P				
Micrometer units				
Replicate	1	2	3	4
1	1.2	1.2	1.0	1.1
2	1.2	1.1	1.3	1.1
3	1.0	1.1	1.2	1.3
4	1.1	1.1	1.1	1.2
5	1.1	1.1	1.2	1.0
6	1.1	1.2	1.2	1.1
7	1.2	1.2	0.9	1.0
8	1.1	1.2	1.0	1.1
9	1.2	1.1	1.1	1.1
10	1.0	1.1	DEAD	1.2

Treatment: 0.625 P				
Micrometers				
Replicate	1	2	3	4
1	470.4	470.4	392.0	431.2
2	470.4	431.2	509.6	431.2
3	392.0	431.2	470.4	509.6
4	431.2	431.2	431.2	470.4
5	431.2	431.2	470.4	392.0
6	431.2	470.4	470.4	431.2
7	470.4	470.4	352.8	392.0
8	431.2	470.4	392.0	431.2
9	470.4	431.2	431.2	431.2
10	392.0	431.2	0.0	470.4

AVERAGE 439.0 446.9 435.6 439.0
AVERAGE= 440.2

Mussel Reference Toxicant: Growth 07/15/93

Treatment: 1.250 P				
Micrometer units				
Replicate	1	2	3	4
1	DEAD	1.5	1.2	1.2
2	DEAD	DEAD	1.1	DEAD
3	DEAD	DEAD	DEAD	DEAD
4	DEAD	DEAD	DEAD	DEAD
5	DEAD	DEAD	DEAD	DEAD
6	DEAD	DEAD	DEAD	DEAD
7	DEAD	DEAD	DEAD	DEAD
8	DEAD	DEAD	DEAD	DEAD
9	DEAD	DEAD	DEAD	DEAD
10	DEAD	DEAD	DEAD	DEAD

Treatment: 1.250 P				
Micrometers				
Replicate	1	2	3	4
1	0.0	588.0	470.4	470.4
2	0.0	0.0	431.2	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0

AVERAGE 0.0 588.0 450.8 470.4
AVERAGE= 490.0

Treatment: 2.500 P				
Micrometer units				
Replicate	1	2	3	4
1	DEAD	DEAD	DEAD	DEAD
2	DEAD	DEAD	DEAD	DEAD
3	DEAD	DEAD	DEAD	DEAD
4	DEAD	DEAD	DEAD	DEAD
5	DEAD	DEAD	DEAD	DEAD
6	DEAD	DEAD	DEAD	DEAD
7	DEAD	DEAD	DEAD	DEAD
8	DEAD	DEAD	DEAD	DEAD
9	DEAD	DEAD	DEAD	DEAD
10	DEAD	DEAD	DEAD	DEAD

Treatment: 2.500 P				
Micrometers				
Replicate	1	2	3	4
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0

AVERAGE 0.0 0.0 0.0 0.0
AVERAGE= 0.0

Treatment: 5.000 P				
Micrometer units				
Replicate	1	2	3	4
1	DEAD	DEAD	DEAD	DEAD
2	DEAD	DEAD	DEAD	DEAD
3	DEAD	DEAD	DEAD	DEAD
4	DEAD	DEAD	DEAD	DEAD
5	DEAD	DEAD	DEAD	DEAD
6	DEAD	DEAD	DEAD	DEAD
7	DEAD	DEAD	DEAD	DEAD
8	DEAD	DEAD	DEAD	DEAD
9	DEAD	DEAD	DEAD	DEAD
10	DEAD	DEAD	DEAD	DEAD

Treatment: 5.000 P				
Micrometers				
Replicate	1	2	3	4
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0

AVERAGE 0.0 0.0 0.0 0.0
AVERAGE= 0.0

Mussel Reference Toxicant: Growth 07/15/93

Treatment:	Control Y			
	Micrometer units			
Replicate	1	2	3	4
1	1.8	1.9	1.6	1.3
2	1.8	1.6	1.6	1.8
3	1.0	1.3	1.6	1.5
4	1.3	1.8	1.9	1.7
5	1.8	2.0	1.5	1.4
6	1.9	1.6	1.9	1.6
7	1.6	1.8	2.1	1.8
8	1.7	1.5	1.2	1.3
9	1.8	1.5	1.1	1.2
10	1.5	1.7	1.9	1.1

Treatment:	Control Y			
	Micrometers			
Replicate	1	2	3	4
1	705.6	744.8	627.2	509.6
2	705.6	627.2	627.2	705.6
3	392.0	509.6	627.2	588.0
4	509.6	705.6	744.8	666.4
5	705.6	784.0	588.0	548.8
6	744.8	627.2	744.8	627.2
7	627.2	705.6	823.2	705.6
8	666.4	588.0	470.4	509.6
9	705.6	588.0	431.2	470.4
10	588.0	666.4	744.8	431.2

AVERAGE 635.0 654.6 642.9 576.2
AVERAGE= 627.2

Treatment:	0.312 Y			
	Micrometer units			
Replicate	1	2	3	4
1	1.0	1.2	1.0	1.0
2	1.1	1.2	1.1	1.1
3	1.2	1.2	1.2	1.2
4	1.3	1.1	1.3	1.2
5	1.3	1.3	1.1	1.1
6	1.2	1.2	1.3	1.3
7	1.2	1.1	1.1	1.0
8	1.3	1.1	1.3	1.3
9	1.1	0.9	1.2	1.2
10	1.1	1.1	1.3	DEAD

Treatment:	0.312 Y			
	Micrometers			
Replicate	1	2	3	4
1	392.0	470.4	392.0	392.0
2	431.2	470.4	431.2	431.2
3	470.4	470.4	470.4	470.4
4	509.6	431.2	509.6	470.4
5	509.6	509.6	431.2	431.2
6	470.4	470.4	509.6	509.6
7	470.4	431.2	431.2	392.0
8	509.6	431.2	509.6	509.6
9	431.2	352.8	470.4	470.4
10	431.2	431.2	509.6	0.0

AVERAGE 462.6 446.9 466.5 453.0
AVERAGE= 457.3

Treatment:	0.625 Y			
	Micrometer units			
Replicate	1	2	3	4
1	1.0	1.1	1.2	1.1
2	1.1	1.2	1.1	1.1
3	1.4	1.3	1.0	1.3
4	1.2	1.1	1.1	1.2
5	1.1	1.2	1.2	1.1
6	0.9	1.0	1.3	1.2
7	1.0	1.2	1.3	1.0
8	1.1	0.9	DEAD	DEAD
9	DEAD	1.2	DEAD	DEAD
10	DEAD	1.1	DEAD	DEAD

Treatment:	0.625 Y			
	Micrometers			
Replicate	1	2	3	4
1	392.0	431.2	470.4	431.2
2	431.2	470.4	431.2	431.2
3	548.8	509.6	392.0	509.6
4	470.4	431.2	431.2	470.4
5	431.2	470.4	470.4	431.2
6	352.8	392.0	509.6	470.4
7	392.0	470.4	509.6	392.0
8	431.2	352.8	0.0	0.0
9	0.0	470.4	0.0	0.0
10	0.0	431.2	0.0	0.0

AVERAGE 431.2 443.0 459.2 448.0
AVERAGE= 444.7

Mussel Reference Toxicant: Growth 07/15/93

Treatment: 1.250 Y
Micrometer units

Replicate	1	2	3	4
1	1.2	1.2	DEAD	DEAD
2	1.1	DEAD	DEAD	DEAD
3	1.2	DEAD	DEAD	DEAD
4	1.1	DEAD	DEAD	DEAD
5	1.2	DEAD	DEAD	DEAD
6	DEAD	DEAD	DEAD	DEAD
7	DEAD	DEAD	DEAD	DEAD
8	DEAD	DEAD	DEAD	DEAD
9	DEAD	DEAD	DEAD	DEAD
10	DEAD	DEAD	DEAD	DEAD

Treatment: 1.250 Y
Micrometers

Replicate	1	2	3	4
1	470.4	470.4	0.0	0.0
2	431.2	0.0	0.0	0.0
3	470.4	0.0	0.0	0.0
4	431.2	0.0	0.0	0.0
5	470.4	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0

AVERAGE 454.7 470.4 0.0 0.0
AVERAGE= 457.3

Treatment: 2.500 Y
Micrometer units

Replicate	1	2	3	4
1	DEAD	DEAD	DEAD	DEAD
2	DEAD	DEAD	DEAD	DEAD
3	DEAD	DEAD	DEAD	DEAD
4	DEAD	DEAD	DEAD	DEAD
5	DEAD	DEAD	DEAD	DEAD
6	DEAD	DEAD	DEAD	DEAD
7	DEAD	DEAD	DEAD	DEAD
8	DEAD	DEAD	DEAD	DEAD
9	DEAD	DEAD	DEAD	DEAD
10	DEAD	DEAD	DEAD	DEAD

Treatment: 2.500 Y
Micrometers

Replicate	1	2	3	4
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0

AVERAGE 0.0 0.0 0.0 0.0
AVERAGE= 0.0

Treatment: 5.000 Y
Micrometer units

Replicate	1	2	3	4
1	DEAD	DEAD	DEAD	DEAD
2	DEAD	DEAD	DEAD	DEAD
3	DEAD	DEAD	DEAD	DEAD
4	DEAD	DEAD	DEAD	DEAD
5	DEAD	DEAD	DEAD	DEAD
6	DEAD	DEAD	DEAD	DEAD
7	DEAD	DEAD	DEAD	DEAD
8	DEAD	DEAD	DEAD	DEAD
9	DEAD	DEAD	DEAD	DEAD
10	DEAD	DEAD	DEAD	DEAD

Treatment: 5.000 Y
Micrometers

Replicate	1	2	3	4
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0

AVERAGE 0.0 0.0 0.0 0.0
AVERAGE= 0.0

COULTER COUNTER DATA SHEET

MUSSEL FOOD FOR
DSStudy: PULEX FOODStudy Dates: Beginning: 7-2 End: 7-2Analysis Date: 7-2-93Counter Calibration Date: 6-29-93Personnel: COOPERCalibration Constant: 7.82.3

SAMPLE ID	REP.	ml SAMPLE	ml ISOTON	HANOH.	TL	CORRECTED COUNT	CELLS/ ml
RD STILL		1	19	100	1103	204	
						144	$\bar{x} = 1161$
						137	
ALGAE	1					3285	
	29					3223	$\bar{x} = 3166.3 - 161$
						3179	$\sqrt{200 \times 50} =$
						3097	30053000
	26					3158	$\bar{x} = 3183.3 - 161$
						3192	$\sqrt{200 \times 50} =$
						3200	30223000
	2a					3127	$\bar{x} = 3120 - 161$
						3171	$\sqrt{200 \times 50} =$
						3062	29590000

Comments: $\bar{x} = 29955.333$

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-6-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S							
Temperature	24.1	24.4	24.4	24.4	24.3	24.3		
D.O. (before air)								
(after air)								
(w/silt/algae)	7.8	7.8	7.8	7.8	7.9	7.9		
pH (before air)								
(after air)								
(w/silt/algae)	7.2	7.1	7.0	7.0	6.8	6.5		
(Aeration time)								
Conductivity	380	356	352	353	355	360		
Hardness	5.6					5.7		
x 17.1	95.8					97.5		
Alkalinity	3.7					3.2		
x 10	37					32		
Chlorine								
Ammonia								

NOTES: F-Med #1372

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-6-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	24.1	24.4	24.4	24.5	24.4	24.5		
D.O. (before air)								
(after air)								
(w/silt/algae)	7.8	7.9	7.9	8.0	8.0	8.0		
pH (before air)								
(after air)								
(w/silt/algae)	6.9	6.9	6.9	6.8	6.7	6.5		
(Aeration time)								
Conductivity	362	356	353	354	356	360		
Hardness	5.7					5.7		
x 17.1	97.5					97.5		
Alkalinity	3.7					3.1		
x 10	37					31		
Chlorine								
Ammonia								

NOTES: F-MED #1372

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-7-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000	
	YCT-S						
Temperature	23.4	23.7	23.9	24.0	24.1	23.8	
D.O. (before air)							
(after air)							
(w/silt/algae)	7.4	7.5	7.5	7.7	7.7	7.7	
pH (before air)							
(after air)							
(w/silt/algae)	6.7	6.7	6.7	6.7	6.6	6.4	
(Aeration time)							
Conductivity	352	353	353	354	358	358	
Hardness	5.4					5.6	
x 17.1	92.3					95.8	
Alkalinity	3.7					3.3	
x 10	37					33	
Chlorine							
Ammonia							

NOTES: F-MED A1376

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-7-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	23.7	23.9	24.0	23.9	23.9	23.8		
D.O. (before air)								
(after air)								
(w/silt/algae)	7.4	7.4	7.6	7.7	7.7	7.7		
pH (before air)								
(after air)								
(w/silt/algae)	6.7	6.7	6.7	6.7	6.5	6.4		
(Aeration time)								
Conductivity	352	352	353	353	357	360		
Hardness	55					56		
x 17.1	94.1					95.8		
Alkalinity	3.8					3.3		
x 10	38					33		
Chlorine								
Ammonia								

NOTES: F MED # 1376

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-8-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S							
Temperature	24.3	24.4	24.4	24.5	24.6	24.5		
D.O. (before air)								
(after air)								
(w/silt/algae)	7.5	7.6	7.6	7.7	7.8	7.8		
pH (before air)								
(after air)								
(w/silt/algae)	6.8	6.8	6.7	6.7	6.6	6.4		
(Aeration time)								
Conductivity	345	346	347	348	351	354		
Hardness	⁵⁰ 65.6					5.6		
x 17.1	95.8					95.8		
Alkalinity	3.6					3.2		
x 10	36					32		
Chlorine								
Ammonia								

NOTES: 1 May H

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-8-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	24.4	24.4	24.4	24.4	24.4	24.4		
D.O. (before air)								
(after air)								
(w/silt/algae)	7.4	7.5	7.5	7.6	7.7	7.8		
pH (before air)								
(after air)								
(w/silt/algae)	6.8	6.7	6.7	6.7	6.6	6.5		
(Aeration time)								
Conductivity	346	346	348	348	351	355		
Hardness	6.0					5.5		
x 17.1	102.6					94.1		
Alkalinity	3.7					3.3		
x 10	37					33		
Chlorine								
Ammonia								

NOTES: F-med H

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-9-93

TREATMENT	Cntrl	0.312	0.625	1.250	2,500	5,000		
	YCT-S							
Temperature	24.6	23.9	23.8	23.8	23.9	24.0		
D.O. (before air)								
(after air)								
(w/silt/algae)	7.3	7.3	7.4	7.5	7.5	7.5		
pH (before air)								
(after air)								
(w/silt/algae)	6.7	6.7	6.7	6.7	6.6	6.4		
(Aeration time)								
Conductivity	346	343	345	347	350	354		
Hardness	5.4					5.6		
x 17.1	92.3					95.8		
Alkalinity	1.1					3.3		
x 10	11					33		
Chlorine								
Ammonia								

NOTES: * may be low due to excessive silt / checked twice JA
 * dropped original sample. Had to make new and added too much
 spike sample (13.33 ml in one liter) pH=6.2, DO and Conductivity unchanged

F-mey H1381

(PLARC501-130)

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-9-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	24.6	23.8	23.8	23.8	23.8	24.0		
D.O. (before air)								
(after air)								
(w/silt/algae)	7.4	7.4	7.5	7.6	7.5	7.6		
pH (before air)								
(after air)								
(w/silt/algae)	6.8	6.8	6.8	6.7	6.6	6.5		
(Aeration time)								
Conductivity	347	345	346	348	352	355		
Hardness	5.3					5.6		
x 17.1	90.6					95.8		
Alkalinity	3.7					3.3		
x 10	37					33		
Chlorine								
Ammonia								

NOTES: 1 mgd #1381

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-10-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S							
Temperature	23.4	23.5	23.6	23.5	23.8			
D.O. (before air)								
(after air)								
(w/silt/algae)	7.6	7.7	7.6	7.7	7.7			
pH (before air)								
(after air)								
(w/silt/algae)	6.8	6.7 ^{yp}	6.7	6.7	6.6			
(Aeration time)								
Conductivity	356	357	358	358	361			
Hardness	5.7				5.5 5.9			
x 17.1	97.5				94.1 92.5			
Alkalinity	4.0				4.0			
x 10	40				40			
Chlorine								
Ammonia								

NOTES: 1 med H 1393

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-10-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	23.5	23.5	23.5	23.5	23.5			
D.O. (before air)								
(after air)								
(w/silt/algae)	7.7	7.7	7.8	7.8	7.8			
pH (before air)								
(after air)								
(w/silt/algae)	6.8	6.7	6.7	6.7	6.6			
(Aeration time)								
Conductivity	358	357	359	360	362			
Hardness	5.9				5.5			
x 17.1	100.9				94.1			
Alkalinity	4.0				3.8			
x 10	40				38			
Chlorine								
Ammonia								

NOTES: f map #1383

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: Simbeck

Beginning Date: _____

Posey

Ending Date: _____

Date: 7-11-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S							
Temperature	23.1	23.2	23.2	23.2	23.4	—		
D.O. (before air)								
(after air)								
(w/silt/algae)	8.1	8.1	8.1	8.1	8.1	—		
pH (before air)								
(after air)								
(w/silt/algae)	6.7	6.7	6.7	6.7	6.6	—		
(Aeration time)								
Conductivity	351	352	352	353	356	—		
Hardness	5.4				5.5			
x 17.1	92.3				94.1			
Alkalinity	4.0				3.8			
x 10	40				38			
Chlorine								
Ammonia								

NOTES: F-men # 1384

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-11-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	23.2	23.2	23.2	23.2	23.4	—		
D.O. (before air)								
(after air)								
(w/silt/algae)	8.1	8.1	8.1	8.1	8.1	—		
pH (before air)								
(after air)								
(w/silt/algae)	6.9	6.8	6.8	6.7	6.6	—		
(Aeration time)								
Conductivity	351	352	353	354	357	—		
Hardness	5.5				5.6			
x 17.1	94.1				95.8			
Alkalinity	4.0				4.0			
x 10	40				40			
Chlorine								
Ammonia								

NOTES: F- MEO 1384

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-12-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S							
Temperature	23.7	23.4	23.4	23.6	23.4			
D.O. (before air)								
(after air)								
(w/silt/algae)	7.9	8.0	8.0	8.1	8.0			
pH (before air)								
(after air)								
(w/silt/algae)	6.7	6.7	6.7	6.7	6.6			
(Aeration time)								
Conductivity	354	356	356	357	359			
Hardness	6.0				5.9			
x 17.1	102.6				100.9			
Alkalinity	4.0				3.7			
x 10	40				37			
Chlorine								
Ammonia								

NOTES: END

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-12-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	23.6	23.5	23.6	23.5	23.5			
D.O. (before air)								
(after air)								
(w/silt/algae)	8.0	8.0	8.0	8.1	8.2			
pH (before air)								
(after air)								
(w/silt/algae)	6.9	6.8	6.8	6.8	6.7			
(Aeration time)								
Conductivity	355	373	356	358	361			
Hardness	5.5				5.8			
x 17.1	94.1				99.2			
Alkalinity	3.8				3.6			
x 10	38				36			
Chlorine								
Ammonia								

NOTES: E-MED #

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-13-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S							
Temperature	23.9	23.8	23.8	23.9	23.9			
D.O. (before air)								
(after air)								
(w/silt/algae)	7.9	7.8	7.9	7.9	7.9			
pH (before air)								
(after air)								
(w/silt/algae)	6.8	6.8	6.8	6.8	6.7			
(Aeration time)								
Conductivity	369	370	³⁷⁰ 369	371	374			
Hardness	5.4		^{5.8}		5.5			
x 17.1	92.3				94.1			
Alkalinity	4.8				4.8			
x 10	48				48			
Chlorine								
Ammonia								

NOTES: FHEO H1388

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-13-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	23.7	23.7	23.7	23.9	24.0			
D.O. (before air)								
(after air)								
(w/silt/algae)	7.8	7.8	7.8	8.0	7.9			
pH (before air)								
(after air)								
(w/silt/algae)	6.9	6.9	6.9	6.9	6.8			
(Aeration time)								
Conductivity	369	370	371 372	372 375	375 369			
Hardness	5.5		3 ^p	3 ^p	3 ^p 5.5			
x 17.1	94.1				94.1			
Alkalinity	4.8				4.7			
x 10	48				47			
Chlorine								
Ammonia								

NOTES: F-MED #1388

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-14-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	23.8	23.9	24.1	24.1	24.1			
D.O. (before air)								
(after air)								
(w/silt/algae)	7.8	7.8	7.8	7.8	7.8			
pH (before air)								
(after air)								
(w/silt/algae)	6.8	6.8	6.8	6.8	6.7			
(Aeration time)								
Conductivity	364	364	365	366	368			
Hardness	5.5				5.5			
x 17.1	94.1				94.1			
Alkalinity	4.0				4.0			
x 10	40				40			
Chlorine								
Ammonia								

NOTES: F-MED #11391

INITIAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-14-93

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S							
Temperature	24.1	24.1	24.1	24.2	24.1			
D.O. (before air)								
(after air)								
(w/silt/algae)	7.8	7.8	7.8	7.8	7.8			
pH (before air)								
(after air)								
(w/silt/algae)	6.7	6.7	6.7	6.7	6.6			
(Aeration time)								
Conductivity	364	364	364	365	368			
Hardness	5.5				5.5			
x 17.1	94.1				94.1			
Alkalinity	4.0				4.0			
x 10	40				40			
Chlorine								
Ammonia								

NOTES: F-Med #1591

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-7-93Replicate: 1

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
		YCT-S						
Temperature	24.1	24.2 ^{1.2}	24.2	23.6	24.0	23.9		
D.O.	8.1	8.1	8.0	8.3	8.3	8.3		
pH	7.2 ^{6.0}	7.5	7.5	7.7	7.7	7.6		
Conductivity	391	369	370	375	368	375 ^{7.5}		
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-7-93Replicate: 1

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	23.5	23.7	23.8	23.8	24.0	23.7		
D.O.	8.0	8.1	8.2	8.1	8.2	8.1		
pH	7.7	7.7	7.7	7.7	7.7	7.6		
Conductivity	376	380	368	363	365	374		
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

(PLARC501-130)

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-8-93Replicate: 2

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S							
Temperature	24.2	24.4	24.0	24.2	23.7	23.1		
D.O.	7.9	8.0	8.0	7.9	8.0	8.2		
pH	7.8	7.8	7.8	7.8	7.8	7.8		
Conductivity	368	363	368	368	365	384		
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-8-93Replicate: 2

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	24.2	24.2	24.1	24.1	23.3	24.1		
D.O.	8.0	8.0	8.0	8.0	8.2	8.0		
pH	7.8	7.8	7.8	7.8	7.9	7.8		
Conductivity	359	363	362	371	379	375		
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

(PLARC501-130)

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-9-93Replicate: 3

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S					2.4		
Temperature	23.0	23.0	23.8	23.8	23.5	23.9		
D.O.	8.0	8.1	8.0	7.8	8.0	7.7		
pH	7.8	7.8	7.8	7.8	7.8	7.8		
Conductivity	362	372	359	356	363	363		
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-9-93Replicate: 3

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON						224	
Temperature	23.7	23.9	24.1	24.0	24.2	24.1		
D.O.	7.7	7.8	7.8	8.0	7.9	8.0		
pH	7.8	7.8	7.8	7.8	7.8	7.9		
Conductivity	360	360	370	358	358	368		
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-10-93Replicate: 4

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S							
Temperature	23.5	24.0	24.2	24.4	24.4			
D.O.	7.8	7.9	7.9	7.8	7.8			
pH	7.3	7.6	7.7	7.7	7.7			
Conductivity	385	360	354	352	357			
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

(PLARC501-130)

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-10-93Replicate: 4

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	23.8	24.0	24.2	24.3	24.2			
D.O.	7.8	7.8	7.8	7.9	7.9			
pH	7.8	7.8	7.7	7.7	7.7			
Conductivity	384	364	355	356	359			
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

(PLARC501-130)

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-11-93Replicate: 1

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S							
Temperature	23.6	23.7	23.6	23.5	23.8			
D.O.	8.1	8.2	8.3	8.3	8.3			
pH	7.8	7.8	7.9	7.9	7.8			
Conductivity	371	370	373	374	380			
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

(PLARC501-130)

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-11-93Replicate: 1

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	23.4	24.0	24.2	24.0	24.0			
D.O.	8.3	8.3	8.3	8.2	8.3			
pH	7.9	7.8	7.8	7.8	7.8			
Conductivity	378	368	370	394	377			
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

(PLARC501-130)

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-12-93Replicate: 2

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S							
Temperature	24.0	24.0	23.4	24.0	23.9			
D.O.	7.8	7.8	8.0	8.0	8.0			
pH	7.8	7.8	7.9	7.8	7.8			
Conductivity	359	365	373	369	367			
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

(PLARC501-130)

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-12-93Replicate: 2

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	24.0	24.4	23.3	23.5	24.1			
D.O.	7.9	7.8	8.0	8.0	8.0			
pH	7.9	7.9	7.9	7.9	7.9			
Conductivity	366	364	375	370	366			
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-13-93Replicate: 3

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S							
Temperature	23.6	23.8	24.0	24.0	23.8			
D.O.	7.8 7.8	7.8	8.0 7.8	7.8	7.8			
pH	7.8	7.8	7.8	7.8	7.8			
Conductivity	364	370	371	379	375			
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

(PLARC501-130)

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-13-93Replicate: 3

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	23.8	23.6	24.0	24.0	24.0			
D.O.	7.8	7.9	8.0	7.9	7.9			
pH	7.9	7.8	7.9	7.9	7.8			
Conductivity	379	403	370	368	376			
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

(PLARC501-130)

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-14-93Replicate: 4

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S							
Temperature	23.2	23.6	23.8	23.5	23.7			
D.O.	8.0	7.9	7.9	8.0	8.0			
pH	7.9	7.9	7.9	7.9	7.9			
Conductivity	384	381	385	385	383			
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-14-93Date: 7-14-93Replicate: 4

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	23.7	23.8	24.1	23.6	23.7			
D.O.	7.8	7.9	7.9	8.0	7.9			
pH	7.8	7.9	7.9	8.0	7.9			
Conductivity	380	382	392	397	386			
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-15-93Replicate: 1

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	YCT-S							
Temperature	23.6	24.2	24.4	24.2	24.0	-		
D.O.	7.8	7.9	7.8	7.8	7.9	-		
pH	7.8	7.8	7.8	7.9	7.9	-		
Conductivity	378	379	379	380	394	-		
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: _____

(PLARC501-130)

FINAL CHEMISTRYProject: Mussel Ref Tox July 1993Personnel: SimbeckBeginning Date: 7-6-93PoseyEnding Date: 7-15-93Date: 7-15-93Replicate: 1

TREATMENT	Cntrl	0.312	0.625	1.250	2.500	5.000		
	PHYTOPLANKTON							
Temperature	23.5	23.6	24.1	24.3	-	-		
D.O.	7.9	8.0	8.0	8.0	-	-		
pH	7.8	8.0	7.9	7.9	-	-		
Conductivity	378	401	375	382	-	-		
Hardness								
x 17.1								
Alkalinity								
x 10								
Chlorine								
Ammonia								

NOTES: ⁴ checked twice

CR-ERP 2 -- July 06-15, 1993 -- INITIAL AND FINAL CHEMISTRY

INITIAL CHEMISTRY

CONTROL-PHYTO

DAY	TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	24.1	7.8	6.9	362	97.5	37	--
1	23.7	7.4	6.7	352	94.1	38	--
2	24.4	7.4	6.8	346	102.6	37	--
3	24.6	7.4	6.8	347	90.6	37	--
4	23.5	7.7	6.8	358	100.9	40	--
5	23.2	8.1	6.9	351	94.1	40	--
6	23.6	8.0	6.9	355	94.1	38	--
7	23.7	7.8	6.9	369	94.1	48	--
8	23.8	7.8	6.8	364	94.1	40	--

MEAN 23.8 7.7 6.8 356 95.8 39 --

MIN 23.2 7.4 6.7 346 90.6 37 --

MAX 24.6 8.1 6.9 369 102.6 48 --

1.250 mg/L-PHYTO

DAY	TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	24.5	8.0	6.8	354	-	-	-
1	23.9	7.7	6.7	353	-	-	-
2	24.4	7.6	6.7	348	-	-	-
3	23.8	7.6	6.7	348	-	-	-
4	23.5	7.8	6.7	360	-	-	-
5	23.2	8.1	6.7	354	-	-	-
6	23.5	8.1	6.8	358	-	-	-
7	23.9	8.0	6.9	372	-	-	-
8	24.1	7.8	6.8	366	-	-	-

MEAN 23.9 7.9 6.8 357 0.0 0 --

MIN 23.2 7.6 6.7 348 0.0 0 --

MAX 24.5 8.1 6.9 372 0.0 0 --

0.312 mg/L-PHYTO

DAY	TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	24.4	7.9	6.9	356	-	-	-
1	23.9	7.4	6.7	352	-	-	-
2	24.4	7.5	6.7	346	-	-	-
3	23.8	7.4	6.8	345	-	-	-
4	23.5	7.7	6.7	357	-	-	-
5	23.2	8.1	6.8	352	-	-	-
6	23.5	8.0	6.8	373	-	-	-
7	23.7	7.8	6.9	370	-	-	-
8	23.9	7.8	6.8	364	-	-	-

MEAN 23.8 7.7 6.8 357 0.0 0 --

MIN 23.2 7.4 6.7 345 0.0 0 --

MAX 24.4 8.1 6.9 373 0.0 0 --

2.500 mg/L-PHYTO

DAY	TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	24.4	8.0	6.7	356	-	-	-
1	23.9	7.7	6.5	357	-	-	-
2	24.4	7.7	6.6	351	-	-	-
3	23.8	7.5	6.6	352	-	-	-
4	23.5	7.8	6.6	362	94.1	38	-
5	23.4	8.1	6.6	357	95.8	40	-
6	23.5	8.2	6.7	361	99.2	36	-
7	24.0	7.9	6.8	375	94.1	47	-
8	24.1	7.8	6.7	368	94.1	40	-

MEAN 23.9 7.9 6.6 360 95.4 40 --

MIN 23.4 7.5 6.5 351 94.1 36 --

MAX 24.4 8.2 6.8 375 99.2 47 --

0.625 mg/L-PHYTO

DAY	TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	24.4	7.9	6.9	353	-	-	-
1	24.0	7.6	6.7	353	-	-	-
2	24.4	7.5	6.7	348	-	-	-
3	23.8	7.5	6.8	346	-	-	-
4	23.5	7.8	6.7	359	-	-	-
5	23.2	8.1	6.8	353	-	-	-
6	23.6	8.0	6.8	356	-	-	-
7	23.7	7.8	6.9	371	-	-	-
8	24.1	7.8	6.8	365	-	-	-

MEAN 23.9 7.8 6.8 356 0.0 0 --

MIN 23.2 7.5 6.7 346 0.0 0 --

MAX 24.4 8.1 6.9 371 0.0 0 --

5.000 mg/L-PHYTO

DAY	TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	24.5	8.0	6.5	360	97.5	31	-
1	23.8	7.7	6.4	360	95.8	33	-
2	24.4	7.8	6.5	355	94.1	33	-
3	24.0	7.6	6.5	355	95.8	33	-
4	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-

MEAN 24.2 7.8 6.5 358 95.8 33 -

MIN 23.8 7.6 6.4 355 94.1 31 -

MAX 24.5 8.0 6.5 360 97.5 33 -

FINAL CHEMISTRY

CONTROL-PHYTO

DAY	TEMP	DO	pH	COND
1	23.5	8.0	7.7	376
2	24.2	8.0	7.8	359
3	23.7	7.7	7.8	360
4	23.8	7.8	7.8	384
5	23.4	8.3	7.9	378
6	24.0	7.9	7.9	366
7	23.8	7.8	7.9	379
8	23.7	7.9	7.8	380
9	23.5	7.9	7.8	378

MEAN 23.7 7.9 7.8 373

MIN 23.4 7.7 7.7 359

MAX 24.2 8.3 7.9 384

0.312 mg/L-PHYTO

DAY	TEMP	DO	pH	COND
1	23.7	8.1	7.7	380
2	24.2	8.0	7.8	363
3	23.9	7.8	7.8	360
4	24.0	7.8	7.8	364
5	24.0	8.3	7.8	368
6	24.4	7.8	7.9	364
7	23.6	7.9	7.8	403
8	23.8	7.9	7.9	382
9	23.6	8.0	8.0	401

MEAN 23.9 8.0 7.8 376

MIN 23.6 7.8 7.7 360

MAX 24.4 8.3 8.0 403

0.625 mg/L-PHYTO

DAY	TEMP	DO	pH	COND
1	23.8	8.2	7.7	368
2	24.1	8.0	7.8	362
3	24.1	7.8	7.8	370
4	24.2	7.8	7.7	355
5	24.2	8.3	7.8	370
6	23.3	8.0	7.9	375
7	24.0	8.0	7.9	370
8	24.1	7.9	7.9	392
9	24.1	8.0	7.9	375

MEAN 24.0 8.0 7.8 371

MIN 23.3 7.8 7.7 355

MAX 24.2 8.3 7.9 392

1.250 mg/L-PHYTO

DAY	TEMP	DO	pH	COND
1	23.8	8.1	7.7	363
2	24.1	8.0	7.8	371
3	24.0	8.0	7.8	358
4	24.3	7.9	7.7	356
5	24.0	8.2	7.8	394
6	23.5	8.0	7.9	370
7	24.0	7.9	7.9	368
8	23.6	8.0	8.0	397
9	24.3	8.0	7.9	382

MEAN 24.0 8.0 7.8 373

MIN 23.5 7.9 7.7 356

MAX 24.3 8.2 8.0 397

2.500 mg/L-PHYTO

DAY	TEMP	DO	pH	COND
1	24.0	8.2	7.7	365
2	23.3	8.2	7.9	379
3	24.2	7.9	7.8	358
4	24.2	7.9	7.7	359
5	24.0	8.3	7.8	379
6	24.1	8.0	7.9	366
7	24.0	7.9	7.8	376
8	23.7	7.9	7.9	386
9	-	-	-	-

MEAN 23.9 8.0 7.8 371

MIN 23.3 7.9 7.7 358

MAX 24.2 8.3 7.9 386

5.000 mg/L-PHYTO

DAY	TEMP	DO	pH	COND
1	23.9	8.1	7.6	374
2	24.1	8.0	7.8	375
3	24.1	8.0	7.8	368
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-
7	-	-	-	-
8	-	-	-	-
9	-	-	-	-

MEAN 24.0 8.0 7.7 372

MIN 23.9 8.0 7.6 368

MAX 24.1 8.1 7.8 375

TEMPERATURE:MEAN: 23.9

MIN: 23.3

MAX: 24.4

Reviewed By/Date:

DJS

8/2/97

(CR-ERP-2)

INITIAL CHEMISTRY

CONTROL-YCT-5

DAY	TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	24.1	7.8	7.2	380	95.8	37	--
1	23.4	7.4	6.7	352	92.3	37	--
2	24.3	7.5	6.8	345	95.8	36	--
3	24.6	7.3	6.2	346	92.3	11	--
4	23.4	7.6	6.8	356	97.5	40	--
5	23.1	8.1	6.7	351	92.3	40	--
6	23.7	7.9	6.7	354	102.6	40	--
7	23.9	7.9	6.8	369	92.3	48	--
8	24.1	7.8	6.7	364	94.1	40	--
MEAN	23.8	7.7	6.7	357	95.0	37	--
MIN	23.1	7.3	6.2	345	92.3	11	--
MAX	24.6	8.1	7.2	380	102.6	48	--

0.312 mg/L-YCT-5

DAY	TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	24.4	7.8	7.1	356	-	-	-
1	23.7	7.5	6.7	353	-	-	-
2	24.4	7.6	6.8	346	-	-	-
3	23.9	7.3	6.7	343	-	-	-
4	23.5	7.7	6.7	357	-	-	-
5	23.2	8.1	6.7	352	-	-	-
6	23.4	8.0	6.7	356	-	-	-
7	23.8	7.8	6.8	370	-	-	-
8	24.1	7.8	6.7	364	-	-	-
MEAN	23.8	7.7	6.8	355	0.0	0	--
MIN	23.2	7.3	6.7	343	0.0	0	--
MAX	24.4	8.1	7.1	370	0.0	0	--

0.625 mg/L-YCT-5

DAY	TEMP	DO	pH	COND	HARD	ALK	CHLORINE
0	24.4	7.8	7.0	352	-	-	-
1	23.9	7.5	6.7	353	-	-	-
2	24.4	7.6	6.7	347	-	-	-
3	23.8	7.4	6.7	345	-	-	-
4	23.6	7.6	6.7	358	-	-	-
5	23.2	8.1	6.7	352	-	-	-
6	23.4	8.0	6.7	356	-	-	-
7	23.8	7.9	6.8	370	-	-	-
8	24.1	7.8	6.7	364	-	-	-
MEAN	23.8	7.7	6.7	355	0.0	0	--
MIN	23.2	7.4	6.7	345	0.0	0	--
MAX	24.4	8.1	7.0	370	0.0	0	--

1.250 mg/L-YCY-5

DAY	TEMP	DO	pH	COND	HARD	ALK	CHLORI
0	24.4	7.8	7.0	353	-	-	-
1	24.0	7.7	6.7	354	-	-	-
2	24.5	7.7	6.7	348	-	-	-
3	23.8	7.5	6.7	347	-	-	-
4	23.5	7.7	6.7	358	-	-	-
5	23.2	8.1	6.7	353	-	-	-
6	23.6	8.1	6.7	357	-	-	-
7	23.9	7.9	6.8	371	-	-	-
8	24.2	7.8	6.7	365	-	-	-
MEAN	23.9	7.8	6.7	356	0.0	0	--
MIN	23.2	7.5	6.7	347	0.0	0	--
MAX	24.5	8.1	7.0	371	0.0	0	--

2.500 mg/L-YCT-5

DAY	TEMP	DO	pH	COND	HARD	ALK	CHLORI
0	24.3	7.9	6.8	355	-	-	-
1	24.1	7.7	6.6	358	-	-	-
2	24.6	7.8	6.6	351	-	-	-
3	23.9	7.5	6.6	350	-	-	-
4	23.8	7.7	6.6	361	94.1	40	-
5	23.4	8.1	6.6	356	94.1	38	-
6	23.4	8.0	6.6	359	100.9	37	-
7	23.9	7.9	6.7	374	94.1	48	-
8	24.1	7.8	6.6	368	94.1	40	-
MEAN	23.9	7.8	6.6	359	95.4	41	--
MIN	23.4	7.5	6.6	350	94.1	37	--
MAX	24.6	8.1	6.8	374	100.9	48	--

5.000 mg/L-YCT-5

DAY	TEMP	DO	pH	COND	HARD	ALK	CHLORI
0	24.3	7.9	6.5	360	97.5	32	-
1	23.8	7.7	6.4	358	95.8	33	-
2	24.5	7.8	6.4	354	95.8	32	-
3	24.0	7.5	6.4	354	95.8	33	-
4	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
MEAN	24.2	7.7	6.4	357	96.2	33	-
MIN	23.8	7.5	6.4	354	95.8	32	-
MAX	24.5	7.9	6.5	360	97.5	33	-

===== FINAL CHEMISTRY =====

CONTROL-YCT-S

DAY	TEMP	DO	pH	COND
1	24.1	8.1	7.6	391
2	24.2	7.9	7.8	368
3	23.0	8.0	7.8	362
4	23.5	7.8	7.3	385
5	23.6	8.1	7.8	371
6	24.0	7.8	7.8	359
7	23.6	7.7	7.8	364
8	23.2	8.0	7.9	384
9	23.6	7.8	7.8	378

MEAN 23.6 7.9 7.7 374

MIN 23.0 7.7 7.3 359

MAX 24.2 8.1 7.9 391

0.312 mg/L-YCT-S

DAY	TEMP	DO	pH	COND
1	24.1	8.1	7.5	369
2	24.4	8.0	7.8	363
3	23.0	8.1	7.8	372
4	24.0	7.9	7.6	360
5	23.7	8.2	7.8	370
6	24.0	7.9	7.8	365
7	23.8	7.8	7.8	370
8	23.6	7.9	7.9	381
9	24.2	7.9	7.8	379

MEAN 23.9 8.0 7.8 370

MIN 23.0 7.8 7.5 360

MAX 24.4 8.2 7.9 381

0.625 mg/L-YCT-S

DAY	TEMP	DO	pH	COND
1	24.2	8.0	7.5	370
2	24.0	8.0	7.8	368
3	23.8	8.0	7.8	359
4	24.2	7.9	7.7	354
5	23.6	8.3	7.9	373
6	23.4	8.0	7.9	373
7	24.0	7.8	7.8	371
8	23.8	7.9	7.9	385
9	24.4	7.8	7.8	379

MEAN 23.9 8.0 7.8 370

MIN 23.4 7.8 7.5 354

MAX 24.4 8.3 7.9 385

1.250 mg/L-YCT-S

DAY	TEMP	DO	pH	COND
1	23.6	8.3	7.7	375
2	24.2	7.9	7.8	368
3	23.8	7.8	7.8	356
4	24.4	7.8	7.7	352
5	23.5	8.3	7.9	374
6	24.0	8.0	7.8	369
7	24.0	7.8	7.8	379
8	23.5	8.0	7.9	385
9	24.2	7.8	7.9	380

MEAN 23.9 8.0 7.8 371

MIN 23.5 7.8 7.7 352

MAX 24.4 8.3 7.9 385

2.500 mg/L-YCT-S

DAY	TEMP	DO	pH	COND
1	24.0	8.3	7.7	368
2	23.7	8.0	7.8	365
3	23.5	8.0	7.8	363
4	24.4	7.8	7.7	357
5	23.8	8.3	7.8	380
6	23.9	8.0	7.8	367
7	23.8	7.8	7.8	375
8	23.7	8.0	7.9	383
9	24.0	7.9	7.9	394

MEAN 23.9 8.0 7.8 372

MIN 23.5 7.8 7.7 357

MAX 24.4 8.3 7.9 394

5.000 mg/L-YCT-S

DAY	TEMP	DO	pH	COND
1	23.9	8.3	7.6	375
2	23.4	8.2	7.8	384
3	23.9	7.9	7.8	363
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-
7	-	-	-	-
8	-	-	-	-
9	-	-	-	-

MEAN 23.7 8.1 7.7 374

MIN 23.4 7.9 7.6 363

MAX 23.9 8.3 7.8 384

TEMPERATURE:MEAN: 23.8

MIN: 23.0

MAX: 24.4

Reviewed By/Date:

0/5 8/2/93

(CR-ERP-2)

Project Instrument Record Sheet

Project Study CR-ERP Mussel Ref Tow July 93

Beginning Date 7-6-93

Ending Date 7-15-93

DO Meter

Model YSI Model 57

TVA Tag 557673

Calibration Date 4-28-93

pH Meter(s)

Model SA 250 Orion Research

TVA Tag SW-8147

Calibration Date 4-30-93

Model Orion Model 407A

TVA Tag 557674

Calibration Date 4-14-93

Conductivity Meter

Model YSI Model 32

TVA Tag 543389

Calibration Date 2-8-93

Thermometer(s)

Model SAMA CT-40

TVA Tag A-20

Calibration Date _____

Model _____

TVA Tag _____

Calibration Date _____

PROJECT REAGENT RECORD SHEET

Project/Study: CR-ERP Mussel Rept 93 Beginning Date: 7-9-93
 Personnel: Smbeck, Posey Ending Date: 7-16-93

WINKLER TITRATION METHOD

Alkaline-Iodide-Azide:

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

Manganous Sulfate:

Brand Fisher
 Lot # 910067-26
 Exp. 4-93

Sodium Thiosulfate:

Brand Ricca
 Lot # 11267
 Exp. 4-94

Sulfuric Acid:

Brand Fisher
 Lot # 854507
 Exp. NA

Thyodene:

Brand Fisher
 Lot # 912254
 Exp. NA

pH BUFFER SOLUTIONS

pH 4:

Brand Ricca
 Lot # F267
 Exp. 3-94

pH 7:

Brand Mallinckrodt
 Lot # 0049K10
 Exp. 9-94

pH 10:

Brand Mallinckrodt
 Lot # 0049KJ VJ
 Exp. 12-93

pH _____:

Brand _____
 Lot # _____
 Exp. _____

CONDUCTIVITY STANDARD SOLUTIONS

200 μ mhos:

Brand Biochem
 Lot # 1302C
 Exp. 11-94

720 μ mhos:

Brand Biochem
 Lot # E052A
 Exp. 5-94

_____ μ mhos:

Brand _____
 Lot # _____
 Exp. _____

ALKALINITY TITRATION

Sulfuric Acid Solution N/50:

Brand Mallinckrodt
 Lot # H364
 Exp. NA

HARDNESS TITRATION

Hardness Titrating Solution:

Brand Calgon
 Lot # R2037700
 Exp. NA

Hardness Indicator:

Brand Calgon
 Lot # 01E9B
 Exp. NA

Hardness Buffer Solution:

Brand Calgon
 Lot # 26668
 Exp. NA

CHLORINE TITRATION

DPD Powder Pillows:

Brand Hach
 Lot # 030m
 Exp. NA

Potassium Iodide:

Brand Fisher
 Lot # 863484A
 Exp. NA

FAS:

Brand Ricca
 Lot # C275
 Exp. 7-27-93

ATTACHMENT II

COPPER ANALYSIS REQUEST AND RESULTS

ACCT. # 4210-DK 200-85555

SURVEY Mussel Ref Tox

DATE 7-12-93

SHIPPED FROM ARL-1A BFW

VIA TVA Ma: |

SHIPPED BY Danien Simback

AT 0800

RECEIVED BY _____ AT _____ ON _____
TIME DATE

BOTTLE REQUIREMENT*

CHECK AS INDICATED:

SHIPPING ☒RECEIVING ☒

TAG NO.

[illegible]

NO. OF ICE CHESTS SHIPPED _____

RECEIVED _____

NO. OF SHIPPING CHESTS SHIPPED 1

RECEIVED _____

NO. OF RACKS SHIPPED _____

RECEIVED _____

NO. OF FIELD SHEETS SHIPPED 3

RECEIVED _____

SIGNATURE OF SHIPPER A. L. Smith DATE 7-12-93

***IF THE NUMBER OF SAMPLES OF EACH TYPE RECEIVED IS DIFFERENT FROM THE NUMBER SHIPPED, NOTIFY THE WATER QUALITY AND ECOLOGY BRANCH IMMEDIATELY.**

REQUEST FOR AND REPORT OF ANALYSIS

Date submitted 7-12-93

Laboratory No. _____

Date wanted 7-26-93

Date reported _____

Charge to account No. 4210-011200-85555

GENERAL DESCRIPTION: _____

Consignor's Number	Specific Description for Each Sample
1	Blank
2	Con-P (Control-P)
3	0.312-P (0.312 mg/L Cu-P)
4	0.625-P (0.625 mg/L Cu-P)
5	1.250-P (1.250 mg/L Cu-P)
6	2.50-P (2.50 mg/L Cu-P)
7	5.0-P (5.0 mg/L Cu-P)
8	Con-Y (Control-Y)
Remarks, method, etc.: <u>Total Copper & in well before analysis</u>	

ANALYZE FOR

Lab. No.	Consignor's Number										

Requested by Danien Simbeck

Notebook page _____

Address ARL-1A BEN

Analyzed by _____

Request approved by [Signature]

Laboratory _____

DISTRIBUTION OF COPIES:

3 1 } To Laboratory
2 } --- 2 Returned to Originating Office
3 } Retained by Originating Office

REQUEST FOR AND REPORT OF ANALYSIS

Date submitted 7-12-93

Laboratory No. _____

Date wanted 7-26-93

Date reported _____

Charge to account No. 4210-011200-85555

GENERAL DESCRIPTION:

Consignor's Number	Specific Description for Each Sample
9	0.312-Y (0.312 mg/L Cu-Y)
10	0.625-Y (0.625 mg/L Cu-Y)
11	1.250-Y (1.250 mg/L Cu-Y)
12	2.50-Y (2.50 mg/L Cu-Y)
13	5.0-Y (5.0 mg/L Cu-Y)

Remarks, method, etc.: Total Copper & mix well before analysis

ANALYZE FOR

Lab. No.	Consignor's Number									

Requested by Danien Simbeck

Notebook page _____

Address ARI LA BEN

Analyzed by _____

Request approved by D. Simbeck

Laboratory _____

DISTRIBUTION OF COPIES:

3

1- To Laboratory
 2- --- 2 Returned to Originating Office
 3- Retained by Originating Office

STANDARD SAMPLE LOGIN SHEET FOR LABSAN

Labels :

1073

LABSAN SAMPLE KEY NO. : 93/ 6781 (Filled in at sample login.)

Requesting Organization : STD (Enter for standard sample login.)

Sample ID/Location : BLANK (A. Biology) ICP (25)Sample Comments : MUSSEL Reference toxicity study (25)Sample Type/Matrix : Water (25)Date Sample Collected : 930712 YYMMDD format (6)

Time Sample Collected : _____ 24 Hour Time format (4)

Date Sample Received by Lab : 930713 YYMMDD format (6)Sample was collected by : Damien Simbeck (30)Send sample results to : Damien Simbeck (30)Address for results - 1 : ARL 1A-BFN (30)

Address for results - 2 : _____ (30)

Sample Account Number : 4210-011200-85555, F, WRS (50)

Sample Project Leader : LHH LOH DMV CVS CFP BWS (WRS) ALP RIG GO CLK JAT

Days until sample results are due : 14 default is 0 (3)

Method of Analysis : _____ (46)

Laboratory comments : _____ (25)

Test or Group IDC entry : 01042

LABSAM SAMPLE KEY NO. : 93/ <u>6782</u> (Filled in at sample login.)		
Sample ID/Location :	<u>CON - P</u> (ICP)	(25)
Sample Comments :		(25)
Date Sample Collected :	YYMMDD format	(6)
LABSAM SAMPLE KEY NO. : 93/ <u>6783</u> (Filled in at sample login.)		
Sample ID/Location :	<u>0.312 - P</u> (ICP)	(25)
Sample Comments :		(25)
Date Sample Collected :	YYMMDD format	(6)
LABSAM SAMPLE KEY NO. : 93/ <u>6784</u> (Filled in at sample login.)		
Sample ID/Location :	<u>0.625 - P</u> (ICP)	(25)
Sample Comments :		(25)
Date Sample Collected :	YYMMDD format	(6)
LABSAM SAMPLE KEY NO. : 93/ <u>6785</u> (Filled in at sample login.)		
Sample ID/Location :	<u>1.250 - P</u> (ICP)	(25)
Sample Comments :		(25)
Date Sample Collected :	YYMMDD format	(6)
LABSAM SAMPLE KEY NO. : 93/ <u>6786</u> (Filled in at sample login.)		
Sample ID/Location :	<u>2.50 - P</u> (ICP)	(25)
Sample Comments :		(25)
Date Sample Collected :	YYMMDD format	(6)
LABSAM SAMPLE KEY NO. : 93/ <u>6787</u> (Filled in at sample login.)		
Sample ID/Location :	<u>5.0 - P</u> (ICP)	(25)
Sample Comments :		(25)
Date Sample Collected :	YYMMDD format	(6)
LABSAM SAMPLE KEY NO. : 93/ <u>6788</u> (Filled in at sample login.)		
Sample ID/Location :	<u>CON - Y</u> (ICP)	(25)
Sample Comments :		(25)
Date Sample Collected :	YYMMDD format	(6)
LABSAM SAMPLE KEY NO. : 93/ <u>6789</u> (Filled in at sample login.)		
Sample ID/Location :	<u>0.312 - Y</u> (ICP)	(25)
Sample Comments :		(25)
Date Sample Collected :	YYMMDD format	(6)
LABSAM SAMPLE KEY NO. : 93/ <u>6790</u> (Filled in at sample login.)		
Sample ID/Location :	<u>0.625 - Y</u> (ICP)	(25)
Sample Comments :		(25)
Date Sample Collected :	YYMMDD format	(6)
LABSAM SAMPLE KEY NO. : 93/ <u>6791</u> (Filled in at sample login.)		
Sample ID/Location :	<u>1.250 - Y</u> (ICP)	(25)
Sample Comments :		(25)
Date Sample Collected :	YYMMDD format	(6)

LABSAM SAMPLE KEY NO. : 93/ <u>6792</u> (Filled in at sample login.)	
Sample ID/Location : <u>1.250-Y (ICP) Precision</u>	(25)
Sample Comments : _____	(25)
Date Sample Collected : _____	YYMMDD format (6)
LABSAM SAMPLE KEY NO. : 93/ <u>6793</u> (Filled in at sample login.)	
Sample ID/Location : <u>2.50-Y (ICP)</u>	(25)
Sample Comments : _____	(25)
Date Sample Collected : _____	YYMMDD format (6)
LABSAM SAMPLE KEY NO. : 93/ <u>6794</u> (Filled in at sample login.)	
Sample ID/Location : <u>5.0-Y (ICP)</u>	(25)
Sample Comments : _____	(25)
Date Sample Collected : _____	YYMMDD format (6)
LABSAM SAMPLE KEY NO. : 93/ _____ (Filled in at sample login.)	
Sample ID/Location : _____	(25)
Sample Comments : _____	(25)
Date Sample Collected : _____	YYMMDD format (6)
LABSAM SAMPLE KEY NO. : 93/ _____ (Filled in at sample login.)	
Sample ID/Location : _____	(25)
Sample Comments : _____	(25)
Date Sample Collected : _____	YYMMDD format (6)
LABSAM SAMPLE KEY NO. : 93/ _____ (Filled in at sample login.)	
Sample ID/Location : _____	(25)
Sample Comments : _____	(25)
Date Sample Collected : _____	YYMMDD format (6)
LABSAM SAMPLE KEY NO. : 93/ _____ (Filled in at sample login.)	
Sample ID/Location : _____	(25)
Sample Comments : _____	(25)
Date Sample Collected : _____	YYMMDD format (6)
LABSAM SAMPLE KEY NO. : 93/ _____ (Filled in at sample login.)	
Sample ID/Location : _____	(25)
Sample Comments : _____	(25)
Date Sample Collected : _____	YYMMDD format (6)
LABSAM SAMPLE KEY NO. : 93/ _____ (Filled in at sample login.)	
Sample ID/Location : _____	(25)
Sample Comments : _____	(25)
Date Sample Collected : _____	YYMMDD format (6)

SURVEY Mussel Ref Tox

DATE 7-12-93

SHIPPED FROM ARL-1A BFN

VIA IVA Ma: |

SHIPPED BY Damien Simbeck

AT 0800

RECEIVED BY _____ AT _____ ON _____
TIME DATE

CHECK AS INDICATED:

SHIPPING ☒RECEIVING ☒

TAG NO.

[illegible]

NO. OF ICE CHESTS SHIPPED _____

RECEIVED _____

NO. OF SHIPPING CHESTS SHIPPED 1

RECEIVED _____

NO. OF RACKS SHIPPED 1

RECEIVED _____

NO. OF FIELD SHEETS SHIPPED 3

RECEIVED _____

SIGNATURE OF SHIPPER *[Signature]* DATE 7-12-93

***IF THE NUMBER OF SAMPLES OF EACH TYPE RECEIVED IS DIFFERENT FROM THE NUMBER SHIPPED, NOTIFY THE WATER QUALITY AND ECOLOGY BRANCH IMMEDIATELY.**

Laboratory No. _____

© 2006 The Authors
Journal compilation © 2006 Blackwell Publishing Ltd

Charge to account No. 4210-011200-85555, =

Consignor's Number	Specific Description for Each Sample
1	Blank
2	Con-P (Control-P)
3	0.312-P (0.312 mg/L Cu-P)
4	0.625-P (0.625 mg/L Cu-P)
5	1.250-P (1.250 mg/L Cu-P)
6	2.50-P (2.50 mg/L Cu-P)
7	5.0-P (5.0 mg/L Cu-P)
8	Con-Y (Control-Y)
Remarks, method, etc.: Total Copper * mix well before analysis	

[illegible]

Notebook page _____

Analyzed by _____

Laboratory

1
1-- } To Laboratory
2-- } -- 2 Returned to Originating Office
3-- Retained by Originating Office

REQUEST FOR AND REPORT OF ANALYSIS

Date submitted 7-12-93

Laboratory No. _____

Date wanted 7-26-93

Date reported _____

Charge to account No. 4210-011200-85555

GENERAL DESCRIPTION:

Consignor's Number	Specific Description for Each Sample
9	0.312-Y (0.312 mg/L Cu-Y)
10	0.625-Y (0.625 mg/L Cu-Y)
11	1.250-Y (1.250 mg/L Cu-Y)
12	2.50-Y (2.50 mg/L Cu-Y)
13	5.0-Y (5.0 mg/L Cu-Y)

Remarks, method, etc.: Total Copper * mix well before analysis

ANALYZE FOR

Lab. No.	Consignor's Number									

LABORATORY BRANCH

02 JUL 13 AM 1:03

RECEIVED

Requested by Rebecca Simbeck

Notebook page _____

Address ARI 1A BFN

Analyzed by _____

Request approved by [Signature]

Laboratory _____

DISTRIBUTION OF COPIES:

1. 1 } To Laboratory
 2. }
 3. } --- 2 Returned to Originating Office
 Retained by Originating Office

```

=====
| TVA Environmental Chemistry      Chattanooga, Tennessee |
| 07/21/93                      FINAL DATA REPORT          07:39 |
===== Page 1 =====

```

```

S'INFO      BLANK (A.BIOLOGY) ICP      SAMPLE      : 93/06781
S'CMT       MUSSEL REFERENCE TOXICITY  LOGDATE      : 930713
S'TYPE      WATER                      DUEDATE      : 07/27/93
ACT'NUMB    4210-011200-85555,F,WRS  P'LEAD       : @WRS

```

Lab Sample Number : 93/06781 Project Leader : William R. Scott

```

Sample ID information : BLANK (A.BIOLOGY) ICP
Sample comments      : MUSSEL REFERENCE TOXICITY
Sample type/matrix   : WATER
Sample collected by  : DAMIEN SIMBECK
Sample collection date : 930712
Sample login date    : 930713      Sample received by lab : 930713
Sample account number : 4210-011200-85555,F,WRS

```

```

-----
| Alt. ID# | Analysis Performed | result | units |
-----
| 01042 | Copper, Total in Water | < 10. | ug/L |

```

```

=====
| TVA Environmental Chemistry          Chattanooga, Tennessee |
| 07/21/93                          FINAL DATA REPORT        07:39 |
===== Page 1 =====

```

```

S'INFO   : CON-P (ICP)          SAMPLE   : 93/06782
S'CMT    : MUSSEL REFERENCE TOXICITY LOGDATE  : 930712
S'TYPE   : WATER                DUE DATE  : 07/27/93
ACT'NUMB : 4210-011200-85555,F,WRS P'LEAD   : @WRS

```

Lab Sample Number : 93/06782 Project Leader : William R. Scott

```

Sample ID Information : CON-P (ICP)
Sample comments       : MUSSEL REFERENCE TOXICITY
Sample type/matrix    : WATER
Sample collected by   : DAMIEN SIMBECK
Sample collection date : 930712
Sample login date     : 930713      Sample received by lab : 930713
Sample account number : 4210-011200-85555,F,WRS

```

Alt. IDC	Analysis Performed	result	units
01042	Copper, Total in Water	< 10.	ug/L

```

=====
| TVA Environmental Chemistry          Chattanooga, Tennessee |
| 07/21/93                          FINAL DATA REPORT        07:39 |
===== Page 1 =====

```

```

S'INFO      : 0.312-P (ICP)          SAMPLE      : 93/06783
S'CMT       : MUSSEL REFERENCE TOXICITY LOGDATE     : 930713
S'TYPE      : WATER                  DUE DATE    : 07/27/93
ACT'NUMB    : 4210-011200-85555,F,WRS P'LEAD      : @WRS

```

Lab Sample Number : 93/06783 Project Leader : William R. Scott

```

Sample ID Information : 0.312-P (ICP)
Sample comments       : MUSSEL REFERENCE TOXICITY
Sample type/matrix    : WATER
Sample collected by   : DAMIEN SIMBECK
Sample collection date : 930712
Sample login date     : 930713      Sample received by lab : 930713
Sample account number : 4210-011200-85555,F,WRS

```

```

-----
| Alt. ID | Analysis Performed | result | units |
-----
| 01042   | Copper, Total in Water | 300.   | ug/L  |

```

```

=====
| TVA Environmental Chemistry          Chattanooga, Tennessee |
| 07/21/93                          FINAL DATA REPORT        07:39 |
===== Page 1 =====

```

```

S'INFO      : 00.625-P(ICP)          SAMPLE      : 93/06784
S'CMT       : MUSSEL REFERENCE TOXICITY LOGDATE     : 930713
S'TYPE      : WATER                  DUE DATE    : 07/27/93
ACT'NUMB    : 4210-011200-85555,F,URS P'LEAD      : @URS

```

Lab Sample Number : 93/06784 Project Leader : William R. Scott

```

Sample ID Information : 00.625-P(ICP)
Sample comments       : MUSSEL REFERENCE TOXICITY
Sample type/matrix    : WATER
Sample collected by   : DAMIEN SIMBECK
Sample collection date : 930712
Sample login date     : 930713      Sample received by lab : 930713
Sample account number : 4210-011200-85555,F,URS

```

```

-----
| Alt. ID# | Analysis Performed | result | units |
-----
| 01042   | Copper, Total in Water | 600.   | ug/L  |

```

```

=====
| TVA Environmental Chemistry          Chattanooga, Tennessee |
| 07/21/93                          FINAL DATA REPORT        07:39 |
===== Page 1 =====

```

```

S'INFO      : 1.250-P (ICP)          SAMPLE      : 93/06785
S'CMT       : MUSSEL REFERENCE TOXICITY LOGDATE     : 930713
S'TYPE      : WATER                  DUE DATE    : 07/27/93
ACT'NUMB    : 4210-011200-85555,F,WRS P'LEAD      : @WRS

```

Lab Sample Number : 93/06785 Project Leader : William R. Scott

```

Sample ID Information : 1.250-P (ICP)
Sample comments       : MUSSEL REFERENCE TOXICITY
Sample type/matrix    : WATER
Sample collected by   : DAMIEN SIMBECK
Sample collection date : 930712
Sample login date     : 930713      Sample received by lab : 930713
Sample account number : 4210-011200-85555,F,WRS

```

Alt. ID	Analysis Performed	result	units
01042	Copper, Total in Water	1400.	ug/L

```

=====
| TVA Environmental Chemistry          Chattanooga, Tennessee |
| 07/21/93                          FINAL DATA REPORT        07:39 |
===== Page 1 =====

```

```

S'INFO : 2.50-P (ICP)          SAMPLE : 93/06786
S'CMT : MUSSEL REFERENCE TOXICITY LOGDATE : 930713
S'TYPE : WATER                DUE DATE : 07/27/93
ACT'NUMB : 4210-011200-85555,F,WRS P'LEAD : @WRS

```

Lab Sample Number : 93/06786 Project Leader : William R. Scott

```

Sample ID Information : 2.50-P (ICP)
Sample comments      : MUSSEL REFERENCE TOXICITY
Sample type/matrix   : WATER
Sample collected by  : DAMIEN SIMBECK
Sample collection date : 930712
Sample login date    : 930713      Sample received by lab : 930713
Sample account number : 4210-011200-85555,F,WRS

```

```

-----
| Alt. IDC | Analysis Performed | result | units |
-----
01042      Copper, Total in Water 2700.    ug/L

```



```

=====
| TVA Environmental Chemistry                      Chattanooga, Tennessee |
| 07/21/93                      FINAL DATA REPORT                      07:39 |
===== Page 1 =====

```

```

S'INFO      : 5.0-P (ICP)                      SAMPLE      : 93/06787
S'CMNT      : MUSSEL REFERENCE TOXICITY          LOGDATE       : 930713
S'TYPE      : WATER                              DUE DATE      : 07/27/93
ACT'NUMB    : 4210-011200-85555,F,WRS          P'LEAD        : @WRS

```

Lab Sample Number : 93/06787 Project Leader : William R. Scott

```

Sample ID Information : 5.0-P (ICP)
Sample comments       : MUSSEL REFERENCE TOXICITY
Sample type/matrix    : WATER
Sample collected by   : DAMIEN SIMBECK
Sample collection date : 930712
Sample login date     : 930713      Sample received by lab : 930713
Sample account number : 4210-011200-85555,F,WRS

```

```

-----
| Alt. ID# | Analysis Performed | result | units |
-----
01042      Copper, Total in Water    5400.   ug/L

```

```

=====
| TVA Environmental Chemistry          Chattanooga, Tennessee |
| 07/21/93                          FINAL DATA REPORT        07:39 |
===== Page 1 =====

```

```

S'INFO      CON-Y      (ICP)          SAMPLE      : 93/06788
S'CHT       MUSSEL REFERENCE TOXICITY LOGDATE     : 930713
S'TYPE      WATER      DUE DATE      : 07/27/93
ACT'NUMB    4210-011200-85555,F,WRS P'LEAD      : @WRS

```

Lab Sample Number : 93/06788 Project Leader : William R. Scott

```

Sample ID Information : CON-Y      (ICP)
Sample comments       : MUSSEL REFERENCE TOXICITY
Sample type/matrix    : WATER
Sample collected by   : DAMIEN SIMBECK
Sample collection date : 930712
Sample login date     : 930713      Sample received by lab : 930713
Sample account number : 4210-011200-85555,F,WRS

```

```

-----
| Alt. ID# | Analysis Performed | result | units |
-----
| 01042   | Copper, Total in Water | < 10. | ug/L |

```

```

=====
| TVA Environmental Chemistry          Chattanooga, Tennessee |
| 07/21/93                          FINAL DATA REPORT        07:39 |
===== Page 1 =====

```

```

S'INFO      : 0.312-Y (ICP)          SAMPLE      : 93/06789
S'CMT       : MUSSEL REFERENCE TOXICITY LOGDATE     : 930713
S'TYPE      : WATER                  DUE DATE    : 07/27/93
ACT'NUMB    : 4210-011200-85555,F,WRS P'LEAD      : @WRS

```

Lab Sample Number : 93/06789

Project Leader : William R. Scott

```

Sample ID Information : 0.312-Y (ICP)
Sample comments      : MUSSEL REFERENCE TOXICITY
Sample type/matrix   : WATER
Sample collected by   : DAMIEN SIMBECK
Sample collection date : 930712
Sample login date     : 930713      Sample received by lab : 930713
Sample account number : 4210-011200-85555,F,WRS

```

```

-----
| Alt. ID | Analysis Performed | result | units |
-----
| 01042 | Copper, Total in Water | 300. | ug/L |

```

```

=====
| TVA Environmental Chemistry                      Chattanooga, Tennessee |
| 07/21/93                      FINAL DATA REPORT                      07:39 |
===== Page 1 =====

```

```

S'INFO      : 0.625-Y (ICP)                      SAMPLE      : 93/06790
S'CN1       : MUSSEL REFERENCE TOXICITY           LOGDATE     : 930713
S'TYPE      : WATER                               DUE DATE    : 07/27/93
ACT'NUMB    : 4210-011200-85555,F,WRS           P'LEAD      : @WRS

```

Lab Sample Number : 93/06790 Project Leader : William R. Scott

```

Sample ID Information : 0.625-Y (ICP)
Sample comments       : MUSSEL REFERENCE TOXICITY
Sample type/matrix    : WATER
Sample collected by   : DAMIEN SIMBECK
Sample collection date : 930712
Sample login date     : 930713      Sample received by lab : 930713
Sample account number : 4210-011200-85555,F,WRS

```

Alt	IDC	Analysis Performed	result	units
01042		Copper, Total in Water	620.	ug/L

```

=====
| TVA Environmental Chemistry          Chattanooga, Tennessee |
| 07/21/93                          FINAL DATA REPORT        07:39 |
===== Page 1 =====

```

```

S'INFO      : 1.250-Y (ICP)          SAMPLE      : 93/06791
S'CNT       : MUSSEL REFERENCE TOXICITY LOGDATE     : 930713
S'TYPE      : WATER                  DUE DATE    : 07/27/93
ACT'NRB     : 4210-011200-85555,F,WRS P'LEAD      : @WRS

```

Lab Sample Number : 93/06791 Project Leader : William R. Scott

```

Sample ID Information : 1.250-Y (ICP)
Sample comments       : MUSSEL REFERENCE TOXICITY
Sample type/matrix    : WATER
Sample collected by   : DAMIEN SIMBECK
Sample collection date : 930712
Sample login date     : 930713      Sample received by lab : 930713
Sample account number : 4210-011200-85555,F,WRS

```

Alt. IDC	Analysis Performed	result	units
01042	Copper, Total in Water	1300.	ug/L

```

=====
| TVA Environmental Chemistry          Chattanooga, Tennessee |
| 07/21/93                          FINAL DATA REPORT        07:39 |
===== Page 1 =====

```

```

S'INFO      : 1.250-Y (ICP) PRECISION      SAMPLE      : 93/06792
S'CNT       : MUSSEL REFERENCE TOXICITY    LOGDATE     : 930713
S'TYPE      : WATER                       DUE DATE    : 07/27/93
ACT'NUMB    : 4210-011200-85555,F,WRS    P'LEAD      : @WRS

```

Lab Sample Number : 93/06792 Project Leader : William R. Scott

```

Sample ID Information : 1.250-Y (ICP) PRECISION
Sample comments       : MUSSEL REFERENCE TOXICITY
Sample type/matrix    : WATER
Sample collected by   : DAMIEN SIMBECK
Sample collection date : 930712
Sample login date     : 930713      Sample received by lab : 930713
Sample account number : 4210-011200-85555,F,WRS

```

```

-----
| Alt. IDC | Analysis Performed | result | units |
-----
01042      Copper, Total in Water 1300.    ug/L

```

```

=====
| TVA Environmental Chemistry          Chattanooga, Tennessee |
| 07/21/93                          FINAL DATA REPORT         07:39 |
===== Page 1 =====

```

```

S'INFO      : 2.50-Y (ICP)          SAMPLE      : 93/06793
S'CHT       : MUSSEL REFERENCE TOXICITY LOGDATE     : 930713
S'TYPE      : WATER                DUE DATE      : 07/27/93
ACT'NOHB    : 4210-011200-85555,F,WRS P'LEAD      : @WRS

```

Lab Sample Number : 93/06793 Project Leader : William R. Scott

```

Sample ID Information : 2.50-Y (ICP)
Sample comments       : MUSSEL REFERENCE TOXICITY
Sample type/matrix    : WATER
Sample collected by   : DAMIEN SIMBECK
Sample collection date : 930712
Sample login date     : 930713      Sample received by lab : 930713
Sample account number : 4210-011200-85555,F,WRS

```

```

-----
| Alt. IDC | Analysis Performed | result | units |
-----
| 01042    | Copper, Total in Water    | 2500.  | ug/L  |

```

```

=====
| TVA Environmental Chemistry                      Chattanooga, Tennessee |
| 07/21/93                      FINAL DATA REPORT                      07:39 |
===== Page 1 =====

```

```

S'INFO      : 5.0-Y (ICP)                      SAMPLE      : 93/06794
S'CMT       : MUSSEL REFERENCE TOXICITY          LOGDATE     : 930713
S'TYPE      : WATER                             DUEDATE     : 07/27/93
ACT'NUMB    : 4210-011200-85555,F,URS          P'LEAD      : @WRS

```

Lab Sample Number :93/06794 Project Leader :William R. Scott

```

Sample ID Information :5.0-Y (ICP)
Sample comments       :MUSSEL REFERENCE TOXICITY
Sample type/matrix    :WATER
Sample collected by   :DAMIEN SIMBECK
Sample collection date :930712
Sample login date     :930713                      Sample received by lab :930713
Sample account number :4210-011200-85555,F,URS

```

```

-----
| Alt. IDC | Analysis Performed | result | units |
-----
| 01042    | Copper, Total in Water      | 5100.  | ug/L  |

```