



**RESULTS OF FLOW-THROUGH
ACUTE TOXICITY TESTS ON
TEST MATERIALS FROM PYROCAP INC.**

Prepared for:

Pyrocap Inc.

Prepared by:

**EA Mid-Atlantic Regional Operations
EA Engineering, Science, and Technology, Inc.**

July 1989

EA Project 70003.10-294

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EA Engineering, Science, and Technology, Inc.
15 Loveton Circle
Sparks, Maryland 21152



Wayne L. McCulloch
Project Manager

25 June 1988

Date



Richard K. Peddicord, Ph.D.
Manager, Environmental Assessment

11 July 89

Date

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1. INTRODUCTION

At the request of Pyrocap, EA Engineering, Science, and Technology, Inc. performed a flow-through acute toxicity test on one formulation of fire fighting foam from Pyrocap, Inc. in Springfield, Va. The objective of the test was to determine the 96-hour median lethal concentration (LC50) of the test materials to Fundulus heteroclitus (mummichogs).

2. METHODS AND MATERIALS

2.1 SAMPLE DESCRIPTION

The test sample, contained in a 5-gal carboy provided by Pyrocap, was shipped via overnight courier to the EA laboratory in Sparks, Maryland on 2 May 1989. Upon receipt, the sample was logged in and assigned EA Aquatic Toxicology Laboratory Accession Number AT9-287. The sample was stored at 20 C until used for testing.

2.2 TEST ORGANISMS

Fundulus heteroclitus (mummichogs) which constituted the test species were acquired from Chesapeake Cultures in Hayes, Virginia.

The mummichogs were assigned lot number FU-003, and were received on 16 May 1989. The F. heteroclitus were held in 50-gal holding tanks in 20 ppt artificial sea water (described below), under a 16-hour light/ 8-hour dark photoperiod. The juveniles were fed flaked food a minimum of twice daily during acclimation but were not fed 24 hours before or during testing. The mean acclimation temperature and salinity values for lot FU-003 were 21.6 C and 20.3 ppt, respectively. There was no mortality during the holding period.

2.3 DILUTION WATER

The dilution water for the flow-through acute toxicity tests, as well as the water used for holding the organisms prior to testing, was 20 ppt artificial sea water. Dry sea salts (Forty Fathoms, Marine Enterprises, Towson, Maryland) were added to dechlorinated tap water, and allowed to age before use. The source of the dechlorinated tap water was the Baltimore municipal water supply. A summary of the chemical characteristics associated with Forty Fathoms is presented in Table 1.

2.4 TOXICITY TEST OPERATIONS AND PERFORMANCE

2.4.1 Range Finder Test

Prior to the flowthrough test, a static acute range finder test was conducted to determine an appropriate concentration range. The range finder test concentrations included 1 ppm, 10 ppm, 100 ppm, 1000 ppm, 10,000 ppm and a dilution water control. The 96-hour test was conducted at 20 ppt salinity and 20 C, with one replicate of five animals per concentration. Head counts and water quality measurements were taken daily.

2.4.2 Acute Flow-through Test

Toxicity test methods were performed in conformance with standard U.S. EPA (Peltier and Weber, 1985) and APHA (1985) procedures, and are described in the protocol ATS-FAF-GT-01 found in EA's (1986) Aquatic Toxicology Laboratory Quality Control and Standard Operating Procedures Manual (Attachment 1).

Acute flow-through testing was conducted using an Ace Glass proportional diluter. This diluter system is a modified version of the proportional diluter described by Mount and Brungs (1967). The diluter consists of individual graduated cells connected with interlocking joints and 316 Grade B stainless steel standpipes which control the amount of liquid that is delivered. When the solenoid valves of the diluent and test material stock cells are opened, liquid enters the mixing chambers and is split equally into the replicate test chambers. The diluter system is made of polypropylene solenoid valves, glass-lined polypropylene fittings, stainless steel, research-grade tygon tubing, and lead-free glass. All functions of the diluter system are controlled by an individual control console, which displays elapsed time and dilution cycles.

A stock solution equal to the highest test concentration was delivered through the lower tier of diluter cells. This stock was diluted to the desired test concentrations with 20 ppt artificial sea water delivered through the upper tier of cells. The volume delivered by each cell was calibrated prior to initiation of the test and approximately 3 times daily during testing by means of Class A glassware. Performance of the diluter during testing including calculated effluent concentrations based on volume to volume calibrations, are presented in Table 4.

During the start-up procedure for the diluter, the individual test vessels were filled with dilution water and spiked with the appropriate amount of sample to achieve the desired concentrations for each test. The diluter was started immediately after spiking the test chambers and fresh aliquots of correct concentrations were delivered to the tanks approximately every 15 minutes.

The test chambers in these tests were aquaria constructed of lead-free glass bonded with clear silicone sealant. The vessels used were 10-L chambers containing 7 L of test solution. The diluter controls were set to provide more than five 90 percent replacement volumes during a 24-hour period to each test chamber. The volume flow per cycle to each test chamber was 500 ml. The aquaria were placed in a thermally controlled water bath maintained at 20 ± 2 C. Each effluent treatment concentration and control consisted of two replicates of 10 organisms each.

Mortality observations and water quality determinations were made daily throughout the exposure periods and recorded on the data sheets. Temperature, pH, dissolved oxygen (DO), and salinity were measured in each replicate of each concentration and control at test initiation, and in at least one replicate of each concentration and control at 24, 48, and 72 hours and at test termination. Copies of the original data sheets are presented in Attachment II:

Using the total number of dead organisms per replicate and concentration at the end of the exposure period, the 96-hour median lethal concentration (LC50 value) was calculated by the binomial, moving average, and probit analysis methods as described by Stephan (1977). Copies of the statistical analysis are included in Attachment III.

2.5 REFERENCE TOXICANT TESTS

The reference toxicant used was sodium dodecyl sulfate (SDS). The test species were exposed to the appropriate graded concentration series to determine if the lots of organisms were within the acceptable limits of EA's Aquatic Toxicology Laboratory. The test duration was 24 hours and treatments were not replicated.

2.6 ARCHIVES

Original data sheets, records, memoranda, notes, and computer printouts are archived at EA's laboratory facilities in Sparks, Maryland. Primary data and associated information will be retained for a period of 5 years unless a longer period of time is requested by Pyrocap, Inc.

3. RESULTS

The range finder test resulted in 100 percent mortality for the 10,000 ppm, 1,000 ppm, and 100 ppm concentrations and no mortality at 10 ppm. Therefore a concentration series of 80 ppm, 40 ppm, 24 ppm, 15 ppm, 5 ppm and a dilution water control was chosen for the acute flow through test.

Results of the acute flowthrough toxicity test are summarized in Table 5. Water quality parameters (temperature, DO, pH, and salinity) were within acceptable ranges during the test. The 96-hour LC50 of this fire fighting foam concentrate sample to F. heteroclitus was 45.2 mg/L.

During daily counts and water quality measurements, the glass covers were removed from the test chambers. During the time the tanks were uncovered, an organism jumped from the 24 ppm replicate B test chamber. The "missing" organism was not considered dead, rather the original number of organisms exposed in that chamber was corrected to account for the fish that left the tank. The mean length of lot FH-0013 was 21.42 mm with a range of 15.80-28.45 mm. The mean weight was 0.1533 g with a range of 0.0489-0.3763 g.

The 24-hour LC50 value for the sodium reference toxicant test on lot FH-003 was 11.7 mg/L, with an acceptable range of 7.0-20.0 mg/L.

4. REFERENCES

- American Public Health Association, American Water Work Association, Water Pollution Control Federation. 1985. Standard Methods for the Examination of Water and Wastewater. 16th edition. APHA, Washington, D.C.
- EA Engineering, Science, and Technology, Inc. (EA). 1986. Aquatic Toxicological Studies Quality Control and Standard Operating Procedures Manual. Revision of 1981 and 1984 publications. EA, Sparks, Maryland.
- Mount, D.I. and W.A. Brungs. 1967. A simplified dosing apparatus for fish toxicological studies. *Water Res.* 1:21-29.
- Peltier, W.H. and C.I. Weber. 1985. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms. Report No. 600/4-85-013. U.S. EPA, Office of Research and Development, Cincinnati, Ohio.
- Stephan, C.E. 1977. Methods for calculating an LC50, in *Aquatic Toxicology and Hazard Evaluation*. ASTM STP 634. American Society for Testing and Materials, Philadelphia, Pennsylvania.

TABLE 1. SUMMARY OF WATER QUALITY CHARACTERISTICS ASSOCIATED WITH FORTY FATHOMS MARINE MIX HYDRATED TO A DENSITY OF 1.025 USING DISTILLED WATER

<u>Parameter</u>	<u>Molecular Weight</u>	<u>Forty Fathoms (ppm)</u>
Aluminum	27.0	0.06
Antimony	121.7	0.0005
Arsenic	74.9	0.01
Barium	137.3	0.12
Bicarbonate	61.0	174.0
Beryllium	9.0	0.0002
Boron	10.8	2.1
Bromide	79.9	62.0
Cadmium	112.4	0.009
Calcium	40.0	410.0
Carbonate	60.0	10.0
Cerium	140.0	0.0007
Chromium	52.0	0.02
Chloride	35.4	18,600
Cobalt	58.9	0.0025
Copper	63.5	0.007
Fluorine	19.0	1.9
Gallium	69.7	0.0004
Germanium	72.6	0.00005
Iodine	126.9	0.03
Iron	55.8	0.03
Lithium	6.9	0.24
Magnesium	24.3	1,290
Manganese	54.9	0.008
Mercury	200.6	0.0007
Molybdenum	95.9	0.005
Nickel	58.7	0.009
Nitrogen	14.0	0.85
Phosphorus	31.0	0.04
Potassium	39.1	380
Silicon	28.1	4.5
Sodium	23.0	10,400
Strontium	87.6	12.4
Sulfur (SO ₄)	96.1	2,600
Thallium	204.4	0.000007
Tin	118.7	0.006
Titanium	47.9	0.004
Tungsten	183.9	0.004
Vanadium	50.9	0.0009
Zinc	65.4	0.24

TABLE 2 SUMMARY OF WATER QUALITY RANGES FOR 96-HOUR FLOW-THROUGH
ACUTE TOXICITY TESTS FOR PYROCAP, INC.

<u>Test Number</u>	<u>EA Accession Number</u>	<u>Temperature (C)</u>	<u>pH</u>	<u>DO (mg/L)</u>	<u>Salinity (ppt)</u>
FT-05-24-89-427	AT9-287	19.2-22.0	8.0-8.2	5.6-7.4	19.0-21.8

TABLE 3 RESULTS OF PROPORTIONAL DILUTER CALIBRATION DETERMINATIONS FOR THE ACUTE TOXICITY TEST
 FT-05-24-89-427

Calibration		Day	Calculated Concentration (as ppm-mg/L)					
Date	Time		Cell A	Cell B	Cell C	Cell D	Cell E	Cell F
24 MAY 1989	1720	0	0	5.5	15.4	25.1	39.2	80
25 MAY 1989	0912	1	0	5.3	16.3	25.3	44.1	80
25 MAY 1989	1250	1	0	5.6	16.3	25.4	44.1	80
25 MAY 1989	1620	1	0	5.7	15.9	24.5	44.4	--
26 MAY 1989	0910	2	0	6.1	15.8	25.1	44.9	--
26 MAY 1989	1204	2	0	5.9	16.1	25.3	45.2	--
26 MAY 1989	1719	2	0	5.9	15.4	25.0	45.8	--
28 MAY 1989	1240	4	0	5.6	16.4	24.9	44.6	--
28 MAY 1989	1540	4	0	5.6	15.5	24.7	42.9	--
Mean (S.D.)			0.0 (0.0)	5.7 (0.24)	15.9 (0.4)	25.03 (0.3)	43.9 (1.9)	80.0 (0.0)
C.V. (%)				4.2	2.5	1.2	4.3	

TABLE 4 RESULTS OF THE 96-HOUR FLOW THROUGH ACUTE TOXICITY TESTS USING *Fundulus heteroclitus*

Pyrocap Fire Fighting Foam

QC Number: FT-05-24-89-427
Sample Number: AT9-287
Dilution Water: 20±2 ppt Forty Fathoms Artificial Seawater
Species Tested: Fundulus heteroclitus (mummichog)
Exposure Period: 96 hours

<u>Test Concentration</u> (ppm)	<u>Percent Survival</u>
Control	100
5	100
15	100
24	100
40	65
80	0

96-hour LC50 = 45.2 ppm (Binomial method)

ATTACHMENT I
PROTOCOLS

24. FLOW-THROUGH ACUTE 96-HOUR LC50 ASSAY WITH A FISH

1. TEST OBJECTIVE

To assess the toxicity of a test article to a fish species under flow-through conditions and determine the 96-hour LC50 using lethality as the test end point.

2. TEST ARTICLE

2.1 Description/Identification

Unless otherwise specified, the test article will be supplied by the client. Adequate chemical specifications with special reference to hazardous properties and storage conditions also will be supplied by the client.

2.2 Methods of Synthesis

Information on the methods of synthesis, stability, and data on composition or other characteristics which define the test article are on file with the client.

3. EXPERIMENTAL DESIGN

3.1 Test Organisms

A fish will constitute the test species as defined by project needs.

3.2 Source

Stocks are laboratory reared, obtained from a scientific organism vendor, or field collected using techniques that will be specified in the report.

3.3 Holding Conditions

Upon receipt, fish are transferred to holding tanks which are continuously replenished with dechlorinated municipal tap water, synthetic seawater, or other appropriate dilution water. The fish are acclimated to laboratory conditions for a minimum of 7 days prior to testing. The laboratory is maintained on a 16-hour light, 8-hour dark photoperiod cycle by a programmable electrical timer. All fish stocks are examined regularly throughout the work week. Dead fish, or those displaying abnormal swimming behavior, discoloration, or pronounced lethargy are removed as observed, and recorded on appropriate log sheets. Fish

stocks are fed a commercial fish food a minimum of once daily throughout the work week. They are not fed for 48 hours prior to initiating a test.

3.4 Dilution Water

The source of dilution water is the City of Baltimore Municipal Water System. Upon entry to the laboratory, the water is passed through a high-capacity, activated-carbon filtration system to remove chlorine, detergents, and hexane-soluble organic materials. This water source has proven safe for aquatic organism toxicity testing, as evidenced by maintenance of the multigeneration Daphnia cultures, with no evident loss of fecundity. If requested, reconstituted fresh water, synthetic sea water, or other dilution water may be used.

3.5 Test Concentration Series

The test concentration series to be used for definitive toxicity tests will be selected following preliminary tests to bracket appropriate concentration ranges. A minimum of five concentrations and diluent water controls will be used. If it proves necessary to use a carrier solvent to disperse the test article in aqueous solution, an additional set of solvent controls will be used. All test concentrations and controls will normally be conducted with two replicates. Additional replicates may be used at the client's request.

3.6 Toxicant Delivery System

A solenoid-activated proportional diluter system similar to that described by Peltier and Weber (1985) will constitute the toxicant delivery system. The proportional diluter will be calibrated prior to test initiation and at test termination. Each test concentration should be at least 50 percent of the next highest concentration in the series. Test vessel calibrations, cycle times, flow rates, and other pertinent data will be reported.

3.7 Test Vessels and Test Volume

Test vessels will be of sufficient volume as to not exceed the organism loading ratio and minimum number of daily tank volume replacements.

3.8 Test Organism Number

A minimum of 10 test organisms will be used in each test replicate, constituting a minimum number of 20 fish per treatment group. Fish will be randomly assigned to each test replicate.

3.9 Test Environment

The test vessels will be maintained at a temperature similar to that at which the fish have been acclimated, but within the recommended test range for that species. Test temperature will not vary more than ± 2 C from specified acclimation temperature. The tests will be conducted on a 16-hour light, 8-hour dark photoperiod cycle.

3.10 Analysis of Test Concentrations for Test Article

If required, test solution replicates may be analyzed for chemical analytical verification of achieved test concentrations. The analytical method and number of determinations will be formulated after consultation with the client. Where chemical analyses are necessary, both nominal and actual measured test solution concentrations will be reported.

3.11 Test Observations

Test organisms will be observed at a minimum of 24, 48, 72, and 96 hours after test initiation to determine number of animals killed by test article concentrations. The study will terminate after completion of the 4-day observation period. The study may be extended, however, at the request of the client.

Routine water quality measurements are performed on the test solutions and diluent water controls according to the following schedule: temperature is measured daily from all test chambers; dissolved oxygen, salinity (when applicable), and pH are measured initially from all test chambers as well as at test termination, and from the control, low, medium, and high concentration at 24-, 48-, and 72-hour intervals. Specific conductance, total alkalinity, and total hardness are measured from the diluent water and sample (when applicable). Specific conductance may also be used for concentration monitoring at the request of the client. Test solutions will not be aerated unless dissolved oxygen concentrations fall below 40 percent of saturation. Analytical methods will be conducted according to APHA et al. (1985) and EPA (1979).

Dead fish are removed when observed. At the end of the 96-hour test period, a minimum of 30 surviving fish are removed from the test containers, placed in labeled specimen bags, and frozen. The fish are subsequently thawed, measured to the nearest mm (standard length), patted dry, and weighed to the nearest 0.01 g. The average length and weight of the test fish are reported, along with their respective ranges and standard deviations.

3.12 Data Analysis

The LC50 values and associated statistics will be derived by the probit analysis, moving average, and binomial test methods as described by Stephan (1977). Depending on the nature of the data, other methods may be used including the probit approximation method of Litchfield and Wilcoxon (1949), SAS probit analysis (SAS Institute 1979), or graphical interpolation using the log concentration vs. percent lethality as described by APHA et al. (1985). The methods used will be specified in the report.

4. FINAL REPORT

The final report will be prepared to contain the following information:

- . Objectives and procedures stated in the approved protocol, including any changes made to the original protocol
- . Identity of the test articles by name or code number and their strength (i.e., quality/purity) and a description of any pretreatment
- . Source of the dilution water, its chemical characteristics, and a description of any pretreatment
- . Test concentration series used and duration of the assay
- . Mean standard lengths and weights of test fish, the respective ranges, and approximate loadings of fish to test volume (g/L)
- . Routine water quality characteristics of dilution water and selected test concentrations
- . Any unforeseen circumstances that may have affected the quality or integrity of the study
- . Signature of the project coordinator, program manager, and quality control officer as authorization of the report.
- . Location of all archived data and the original copy of the final report at EA

Items of data to be included in the report consist of: experimental design and test performance; effects on general appearance of test organisms; morbidity and mortality; tabular presentation and appropriate

statistical evaluation of water quality characteristics; and survival data where necessary.

5. QUALITY ASSURANCE

5.1 Amendments to Protocol

Amendments to the authorized protocol instigated by EA or by the client will be made only after proper authorization. Such authorization is achieved by completion of the Amendment to Protocol form by EA and the client.

5.2 Standard Operating Procedures

Unless otherwise specified, all procedures mentioned in the protocol are subject to detailed Standard Operating Procedures (SOPs) which are contained in the SOP manuals of the participating departments. These SOPs and protocols follow the U.S. EPA's Good Laboratory Practice Standards (GLPs) (EPA 1983).

5.3 Reference Toxicant

A reference toxicant bioassay, utilizing sodium dodecylsulfate (SDS) or other appropriate reference toxicant, will be used as an internal quality check of the sensitivity of each batch of test organisms. Testing will be prior to or concurrent with the test or following the acclimation period for newly acquired organisms. The results of each test will be compared with historical toxicological information of reference toxicant tests performed at EA on the species, to determine if the results are within acceptable limits using the control charts outlined in Peltier and Weber (1985).

5.4 Quality Assurance Evaluation

The study described in this protocol may be subject to internal audit by the Quality Assurance Unit. A quality control officer will be responsible for monitoring each study to assure the client that the facilities, equipment, personnel, methods, practices, records, and controls are in conformance with EA's OC program and EPA's GLPs.

5.5 Inspection by Regulatory Authorities

In the event of an inspection of EA by an outside authority during the course of the study, the client will be consulted before inspectors are permitted access to any of the project records or the experimental areas.

5.6 Archives

Copies of project-specific records shall be transferred to the client promptly after the project is completed or as negotiated and budgeted with each client. Original primary data will be retained by EA for 5 years. Primary data include laboratory data sheets, records, memoranda, notes, photographs, microfilm, and computer printouts that are a result of the original observations and activities of the study and which are necessary for the reconstruction and evaluation of the study report.

5.7 Location

This study will be conducted by the Aquatic Toxicology Services Department of the Scientific Operations Division of EA Engineering, Science, and Technology, Inc. at the Mid-Atlantic Regional Offices, Sparks, Maryland.

6. SPECIFICATIONS FOR FLOW-THROUGH ACUTE TOXICITY TEST WITH FISH

6.1 Basic References

American Public Health Association et al. 1985. Standard Methods for Examination of Water and Wastewater, 16th edition. APHA, Washington, D.C. 1,268 pp.

American Society for Testing and Materials (ASTM). 1980. Standard Practice for Conducting Acute Tests with Fishes, Macroinvertebrates, and Amphibians. ASTM Designation: E729-80, Philadelphia, Pa. pp. 285-309.

EA Manual T-101. 1981. Aquatic Toxicology Studies, Quality Control and Standard Operating Procedures Manual. Revised, August 1986. (Internal document prepared by Aquatic Toxicology Services, EA Engineering, Science, and Technology, Inc.)

Peltier, W.H. and C.I. Weber. 1985. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms. EPA-600/4-85-013. U.S. Environmental Protection Agency, Cincinnati, Ohio.

U.S. EPA. 1983. Toxic Substances Control: Good Laboratory Practice Standards, Title 40 CFR Part 792. Fed. Regist. 28(230):53922-53944.

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6.2 Test Specifications

Test organism:	A fish species to be specified in final report
Fish age:	All fish for any one test will be selected from the same age-class
Fish length:	The largest fish will not be more than 50 percent longer than the smallest fish
Temperature:	To be specified
Light quality:	Wide-spectrum fluorescent lights
Light intensity:	50-100 f.c.
Photoperiod:	16-hour light, 8-hour dark
Diluter and test chamber flow rate:	Continuous flow--a minimum of five volume replacements per test chamber during a 24-hour period
Aeration:	None, unless dissolved oxygen falls below 60 percent saturation in first 48 hours of the test or below 40 percent saturation thereafter
Loading ratio:	In general, test chambers may not contain greater than 0.8 g/L biomass
Dilution water:	Dechlorinated tap water, reconstituted fresh water, synthetic seawater, or appropriate receiving water
Test container:	19- or 38-L all glass aquaria
No. of concentrations:	Minimum of five concentrations and a control in duplicate series
Test animals per container:	10 (if loading is exceeded, more replicates or larger aquaria may be used)

Feeding regime: Animals are not fed during the test unless fish are too small to survive 96 hours without feeding. Feeding is terminated 48 hours before test initiation in the lot from which organisms are obtained

Test type and duration: Rangefinding--24-96 hours
Definitive--96 hours
Reference toxicant--24 hours

End point: Lethality--defined as cessation of opercular movement and inability to respond to external stimuli (gentle prodding with glass rod)

ATTACHMENT II

DATA SHEETS

Aquatic Organism Acute Toxicity Test Data Sheet

Project No.: 7000 3 10 TEST: Static, Flow through, Renewal TEST ORGANISM: TEST ORGANISM Beginning Date: 5/24/87 Time: 1523
 Test Article: Fine (light) sand Test Container: 10 L Common Name: Fl. m. c. chry Ending Date: 5/28/87 Time: 1524
 Client: Pyroscap Test Volume: 7 L Scientific Name: Salicidactylus haubei (Lac) Sample Effluent
 OC Test No.: FT-053485427 Lot No: 700005 Alkalinity: _____
 Sample No.: A79-287 Source: Chrysalis Hardness: _____
 Dilution No.: 20% S.H.H.O Acclimation: 8 d. ps. or Age < 10 days Conductivity: _____

Conc. of %	Test Con. talier No.	All Tests												Salt or Brackish Water Tests												
		Temperature (C)				Dissolved Oxygen (mg/liter)				pH				Salinity (ppt)												
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96					
		17.5	17.0	17.5	17.5	17.5	7.4	7.1	7.1	7.1	7.3	8.2	8.1	8.1	8.1	8.2	21.1	20.0	20.0	19.7	20.1					
	A	19.5	19.0	19.5	19.5	19.5	7.4	7.0	7.1	7.1	7.3	8.2	8.2	8.2	8.1	8.2	21.1	20.1	20.0	19.7	20.1					
	B	19.5	19.0	19.5	19.5	19.5	7.2	6.6	6.6	6.7	7.1	8.2	8.1	8.1	8.0	8.2	21.1	20.1	20.0	19.7	20.1					
	A'	17.5	17.0	17.5	17.5	17.5	7.2	6.5	6.6	6.7	6.9	8.2	8.1	8.1	8.0	8.2	21.1	20.1	20.0	19.7	20.1					
	B	17.5	17.0	17.5	17.5	17.5	7.2	6.5	6.6	6.7	6.9	8.2	8.1	8.1	8.0	8.2	21.1	20.1	20.0	19.7	20.1					
	A	17.5	17.0	17.5	17.5	17.5	7.0	6.1	6.3	6.2	6.8	8.2	8.1	8.1	8.0	8.2	20.5	20.5	20.0	19.7	20.2					
	B	17.5	17.0	17.5	17.5	17.5	7.0	6.1	6.3	6.2	6.8	8.2	8.1	8.1	8.0	8.2	20.5	20.5	20.0	19.7	20.2					
	A	15.2	15.1	15.1	15.1	15.1	7.1	6.2	6.3	6.3	6.5	8.2	8.1	8.1	8.0	8.2	20.0	20.0	20.0	19.3	20.1					
	B	15.2	15.1	15.1	15.1	15.1	7.1	6.2	6.3	6.3	6.5	8.2	8.1	8.1	8.0	8.2	20.0	20.0	20.0	19.3	20.1					
	A	19.2	19.2	19.2	19.2	19.2	7.0	6.1	6.3	6.2	6.9	8.2	8.1	8.1	8.0	8.2	20.8	20.8	20.0	19.7	20.2					
	B	19.2	19.2	19.2	19.2	19.2	7.0	6.1	6.3	6.2	6.9	8.2	8.1	8.1	8.0	8.2	20.8	20.8	20.0	19.7	20.2					
	A	19.5	19.5	19.5	19.5	19.5	7.1	6.0	5.6	6.1	6.7	8.2	8.1	8.1	8.0	8.2	21.1	21.1	20.0	19.0	20.4					
	B	19.5	19.5	19.5	19.5	19.5	7.1	6.0	5.6	6.1	6.7	8.2	8.1	8.1	8.0	8.2	21.1	21.1	20.0	19.0	20.4					
	A	14.6	14.6	14.6	14.6	14.6	7.0	5.9				8.2	8.0	8.0	8.0	8.2	21.5	21.5	20.0							
	B	14.6	14.6	14.6	14.6	14.6	7.0	5.9				8.2	8.0	8.0	8.0	8.2	21.5	21.5	20.0							
	A	17.7	17.7	17.7	17.7	17.7	7.1	6.0				8.2	8.1	8.1	8.0	8.2	21.7	21.7	20.0							
	B	17.7	17.7	17.7	17.7	17.7	7.1	6.0				8.2	8.1	8.1	8.0	8.2	21.7	21.7	20.0							
Instrument Number		3	3	3	3	3	0.5	0.5	0.5	0.5	0.5	5	5	5	5	5	2	2	2	2	2					
Correction Factor		AL	AL	AL	AL	AL	8.8	8.9	8.9	8.9	8.8	7/10	7/10	7/10	7/10	7/10	1.8	1.8	1.8	1.8	1.8					
Time		1535	1541	1548	1545	1545	1545	1548	1548	1548	1548	1545	1548	1548	1548	1548	1548	1548	1548	1548	1548					
Investigators		BSH	CB	PS	PS	PS	BSH	CB	PS	PS	BSH	BSH	CB	PS	PS	BSH	BSH	CB	PS	PS	BSH					

AQUATIC TOXICOLOGY BENCH SHEET

Project No.: 7000310

Client: P. nocua

QC Test No.: FT-052489427

Date/Time Activity Investigator

5/24/89 1245 Organisms difficult to head count
due to rapid movement & location of
test.

5/24/89 1720 80ppm organisms dead/severely stressed WJ
80ppm A - 1 dead - rest stressed
80ppm B - 2 dead - rest stressed

5/25/89 0937 SFC check of D.O. JB/RS
control 8.4
5ppm 8.4
24ppm 8.2
40ppm 7.8
80ppm 7.4

5/25/89 (A) 15HL 2UB 1 ORGANISM NOT ACCOUNTED FOR VF/ETS
(B) 2-A-B ~~NOT~~ SHOWING UNUSUAL BEHAVIOR VF/ETS,
SLURPING, KILLING ETC.

5/25/89 Made up new 80ppm stock barrel - only made up 100L
because 80ppm test concentration all dead - not
delivering 80ppm solution any longer WJ

5/26/89 new 80ppm stock - 100L. salinity = 18.9 Temp 23°C D.O. 6.6
5/27 " " " " salinity = 19.8 Temp 23°C D.O. = 7.0
Dilution " = 200 Temp 22°C D.O. = 7.0

ATTACHMENT III

STATISTICS

ATTACHMENT IV
REPORT/ANALYSIS REVIEW RECORD

REPORT/ANALYSIS REVIEW RECORD
LEVEL NO. _____

CLIENT Alameda County DATE SUBMITTED 7/10/89
 PROJECT NUMBER 700-101 DATE DUE TO CLIENT _____
 PROGRAM _____ QC TEST NO. 700-101-001
 AUTHOR _____ TYPE ANALYSIS FT

REPORT/ANALYSIS CHECKLIST

<u>QA/QC ITEM</u>	<u>REVIEWER</u>	<u>DATE</u>
1. Samples/data collected, transported, and received according to study plan requirements.	<u>MEH</u>	<u>7/1/89</u>
2. Samples prepared and processed according to study plan requirements.	<u>MEH</u>	<u>7/1/89</u>
3. Samples and data collected and analyzed using calibrated equipment.	<u>MEH</u>	<u>7/1/89</u>
4. Quality control activities completed.	<u>J. B. White</u>	<u>7/1/89</u>
5. Data checked for correctness, source identification, and data confirmation.	<u>J. B. White</u>	<u>7/1/89</u>
6. Calculations checked: - Hand calculations checked by reviewer	<u>MEH</u>	<u>7/1/89</u>
- Documented and verified computer programs used.	<u>MEH</u>	<u>7/1/89</u>
7. Results reviewed for compliance with study plan requirements.	<u>MEH</u>	<u>7/1/89</u>
8. Reported results and facts checked against original sources.	<u>J. B. White</u>	<u>7/1/89</u>
9. Figures and tables checked for correct presentation of data.	<u>J. B. White</u>	<u>7/10/89</u>

	<u>AUTHOR</u>	<u>DATE</u>
10. Commentary reviewed and resolved.	<u>MEH</u>	<u>7/1/89</u>
11. All study plan and quality assurance/control requirements have been met and the Report/Analysis is approved:		
	<u>William G. [Signature]</u>	<u>7/10/89</u>
	PROJECT MANAGER	DATE
	<u>[Signature]</u>	<u>11 July 89</u>
	PROGRAM MANAGER	DATE
	<u>J. B. White</u>	<u>7/10/89</u>
	Q.C. OFFICER	DATE