

RESULTS OF ACUTE TOXICITY TESTS  
WITH *Daphnia magna* AND *Pimephales promelas*  
ON SAMPLES FROM CALGON CORPORATION

Prepared for:

Calgon Corporation  
Elyria, Ohio

Prepared by:

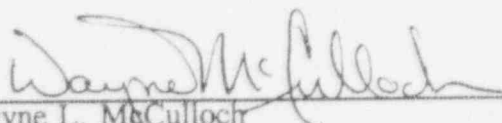
EA Mid-Atlantic  
EA Engineering, Science, and Technology, Inc.  
15 Loveton Circle  
Sparks, Maryland 21152



Virginia A. Sohn  
Project Manager

17 October 1994

Date



Wayne L. McCulloch  
Senior Scientist

17 October 1994

Date

October 1994

## 1. INTRODUCTION

At the request of Calgon Corporation, EA Engineering, Science, and Technology performed acute toxicity screening tests with *Daphnia magna* (water flea) and *Pimephales promelas* (fathead minnow) on three samples from the Perry Nuclear Power Plant. Each species was exposed to 100 percent samples of (1) influent, (2) effluent prior to zebra mussel treatment, and (3) effluent during treatment.

Sample collection and receipt data, together with initial water quality data, are reported in Table 1. Test results, test organism source and age, reference toxicant data, and water quality measurements are summarized on pages 3-6. Test protocols, copies of raw data sheets, and the Report Quality Assurance Record are included as Attachments I, II, and III, respectively.

## RESULTS

Results of the acute screening assays performed on samples from Perry Nuclear Power Plant are reported on pages 4 and 6. There was 100 percent survival of *Daphnia magna* (page 4) after 48 hours of exposure to the influent, the effluent collected prior to treatment, and the laboratory water control (page 4). There was 85 percent survival in the effluent composite collected during the zebra mussel treatment. In the *Pimephales promelas* test (page 6), there was 100 percent survival after 96 hours of exposure to the influent, the effluent collected prior to treatment and to the effluent composite collected during treatment. There was 95 percent survival of laboratory water control organisms.

## SUMMARY OF SAMPLE/TEST INFORMATION

Test: 48-hour *Daphnia magna* Static Acute Toxicity Test

Client Name: **Calgon Corporation**

Test Procedure: EA Protocol ATS-SAI-DS-04  
Acute 48-hour assay with *Daphnia*

Sample Description: **Influent; effluent prior to treatment; effluent during treatment**  
EA Accession Numbers: **AT4-773, AT4-774, AT4-775**

EA QC Test Number: **SA-09-24-94-983**

Test initiation time and date: 1350, 24 September 1994

Test completion time and date: 1350, 26 September 1994

Control Water: Dechlorinated tap water

### Organism Lot Information

Lot Number: Not Applicable

Source: EA's Culture Facility, Sparks, Maryland

Age: <24 hours

### Reference Toxicant (SDS) Test Information

Reference Toxicant: Sodium dodecyl sulfate

EA QC Test Number: RT-09-01-94-875

Dilution Water: Dechlorinated tap water

### Results:

48-hour LC50: 14.1 mg/L SDS

Laboratory control chart acceptability range for 48-hour LC50:  
4.0 - 25.0 mg/L SDS

## SUMMARY OF SAMPLE/TEST INFORMATION (Cont.)

Test Organism: *D. magna*

EA QC Test Number: SA-09-24-94-983

<u>Test Material</u> <u>(100 percent concentration)</u>	<u>Percent Survival at 48 Hours</u>
Laboratory Control	100
Influent	100
Effluent prior to treatment	100
Effluent during treatment	85

<u>Selected Water Quality</u>	<u>Range</u>
Temperature (°C):	20.3 - 20.9
pH:	6.8 - 8.4
Dissolved oxygen (mg/L):	8.1 - 8.9
Conductivity (μS°):	211 - 330

## SUMMARY OF SAMPLE/TEST INFORMATION

Test: 96-hour *Pimephales promelas* Static Acute Toxicity Test

Client Name: Calgon Corporation

Test Procedure: EA Protocol ATS-SAF-FM-04

Acute assay with fathead minnows (*Pimephales promelas*)

Sample Description: Influent; effluent prior to treatment; effluent during treatment

EA Accession Numbers: AT4-773, AT4-774, AT4-775

EA QC Test Number: SA-09-24-94-984

Test initiation time and date: 1420, 24 September 1994

Test completion time and date: 1425, 28 September 1994

Control Water: Dechlorinated tap water

### Organism Lot Information

Lot Number: FH 4-9/18-19

Source: EA's Culture Facility, Sparks, Maryland

Age: 5-6 days (hatched within a 24-hour window)

### Reference Toxicant (CdCl<sub>2</sub>) Test Information

Reference Toxicant: Cadmium chloride

EA QC Test Number: RT-09-28-94-996

Dilution Water: Dechlorinated tap water

### Results:

48-hour LC50: 31.4 µg/L Cd

Laboratory control chart acceptability range for 48-hour LC50:

13.0 - 50.7 µg/L Cd

# SUMMARY OF SAMPLE/TEST INFORMATION (Cont.)

Test Organism: *P. promelas*

EA QC Test Number: SA-09-24-94-984

Test Material  
(100 percent concentration)

Percent Survival at 96 Hours

Laboratory Control	95
Influent	100
Effluent prior to treatment	100
Effluent during treatment	100

Selected Water Quality

Range

Temperature (°C):	19.5 - 21.4 <sup>(a)</sup>
pH:	6.8 - 8.1 <sup>(b)</sup>
Dissolved oxygen (mg/L):	8.1 - 8.8
Conductivity (μS°):	223 - 343

- 
- (a) Temperature of test solutions was greater than target range of  $20 \pm 1^{\circ}\text{C}$  at 48 hours. Test chambers were relocated in laboratory to correct for the temperature deviation.
- (b) pH of test solutions was not measured at 48 hours.

TABLE 1 SAMPLE COLLECTION AND INITIAL WATER QUALITY DATA FOR SAMPLES FROM CALGON CORPORATION

<u>Sample Description</u>	<u>EA Accession Number</u>	<u>Type of Sample</u>	<u>Sample Collection</u>	<u>Sample Receipt</u>	<u>Alkalinity (mg/L CaCO<sub>3</sub>)</u>	<u>Hardness (mg/L CaCO<sub>3</sub>)</u>
Influent	AT4-774	Grab	0900, 22 Sep 94	0925, 24 Sep 94	82	128
Effluent prior to treatment	AT4-773	Grab	0900, 22 Sep 94	0925, 24 Sep 94	92	132
Effluent during treatment	AT4-775	Composite	1030, 22 Sep 94 to 2330, 22 Sep 94	0925, 24 Sep 94	90	140



**ATTACHMENT I**  
**PROTOCOLS**

## ACUTE ASSAY WITH *Daphnia* sp.

### 1. TEST OBJECTIVE

To assess the toxicity of a test material to *Daphnia* and determine the LC50 or EC50 using mortality or immobilization, respectively, as the test end points.

### 2. TEST ARTICLE

#### 2.1 Description/Identification

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

#### 2.2 Methods of Synthesis

In most cases the test article is an effluent sample. Information on the methods of synthesis, stability, and composition or other characteristics which define the test article are on file with the client.

### 3. EXPERIMENTAL DESIGN

#### 3.1 Test Organisms

A species of *Daphnia* (water fleas), as determined by project needs, is the test organism.

#### 3.2 Source

*Daphnia* used for acute toxicity tests are obtained from stock cultures maintained in EA's Aquatic Toxicology Culturing Facility.

### 3.3 Culturing and Holding Conditions

*Daphnia* cultures are maintained at  $20 \pm 2$  C and a 16-hour light, 8-hour dark photoperiod cycle in an environmentally controlled laboratory. Cultures are maintained in 18.9-L all glass aquaria or other appropriate container and are fed algae (*Selenastrum capricornutum*) and a trout chow/yeast/cereal leaves suspension in the manner described in Weber 1991. New cultures are initiated on a routine basis to ensure healthy, productive populations. Organisms from cultures producing ephippia are not used for toxicity tests. Certain regulatory or project specific objectives may require organism acclimation to the dilution water when it is different from the holding/culture water.

### 3.4 Age of Test Organisms at Test Initiation

Neonates of known age (i.e., less than 24-hours old) are obtained for testing by segregating adult females from the mass cultures on the day before a test is initiated. On the day of the test, neonates are segregated from the parent organisms.

### 3.5 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 and other possible contaminants such as 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* and *Pimephales promelas* cultures, with no evident loss of fecundity. If requested, reconstituted fresh water or an appropriate receiving water can be used as the dilution water.

### 3.6 Test Concentration Series

The test concentration series consists of a minimum of five dilutions and may be determined from a prior screening of the test material (e.g., 1, 3, 10, 30, and 100 percent effluent; or 6.25, 12.5, 25, 50, and 100 percent effluent plus a control).

### 3.7 Test Concentration Preparation

Test concentrations are prepared with Class A glassware.

### 3.8 Test Vessels and Test Volume

Test vessels are 400-ml glass beakers or 200-ml culture bowls; the final test volume of each replicate is 200 ml. Depending on the study requirements, other test vessels and test volumes may be used.

### 3.9 Test Organism Number

Tests are conducted using two replicates per concentration, with ten organisms per container. Neonates are randomly assigned to each replicate test container. More replicates can be added, if appropriate.

### 3.10 Test Environment

The test vessels are maintained at  $20 \pm 1$  C or  $25 \pm 1$  C in an environmentally controlled laboratory with a 16-hour light, 8-hour dark photoperiod.

### 3.11 Analysis of Test Concentrations for Test Article

If required, test solutions may be analyzed for verification of chemical concentrations. The analytical method and number of analyses are determined after consultation with the client. When chemical analyses are necessary, both nominal and actual measured test solution concentrations are reported.

### 3.12 Test Observations

Each test day, test organisms are observed to record the number of surviving organisms. The study terminates after completion of the 2-day observation period. The study may be extended, however, at the request of the client.

Each sample received is analyzed for temperature, conductivity, alkalinity, and hardness. Measurements of water quality taken daily include dissolved oxygen, pH, temperature and conductivity from a minimum of one replicate of every concentration. Aliquots of effluent and receiving water may be gently aerated (100 bubbles/min) if dissolved oxygen is less than 4 mg/L or greater than 105% saturation. After test initiation, if the dissolved oxygen in any test chamber is less than 4 mg/L, all test chambers are gently aerated or other corrective action is taken. Analytical determinations are conducted according to APHA et al. (1992) and EPA (1979).

### 3.13 Solution Renewal (When Applicable)

When static-renewal testing is required, the test solutions are renewed at 24-hours. New test solutions are prepared on the day of renewal and dispensed according to Section 3.7. After the new solutions have reached test temperature, the test organisms are transferred from the old test vessels to the new test vessels using a wide bore pipet or glass tube. The number of live organisms is recorded. Caution is given not to stress the test organisms during transfer. After water quality measurements (temperature, pH, dissolved oxygen, and conductivity) are completed, the old solution is discarded.

### 3.14 Data Analysis

The LC50 or EC50 values and associated statistics are calculated using the probit, moving average, and binomial methods as described by Stephan (1977). Depending on the nature of the data, other methods may be used, including the Trimmed Spearman-Kärber method, the probit approximation method of Litchfield and Wilcoxon (1949), SAS probit analysis (SAS Institute 1985) or graphical interpolation using the log concentration vs. percent mortality as described by APHA et al. (1989). The methods used are specified in the final report.

### 3.15 Test Acceptability

An individual test may be conditionally acceptable if temperature, DO, and other specified conditions fall outside specifications, depending on the degree of the departure and the objectives of the tests.

#### 4. FINAL REPORT

The final report is prepared to contain at a minimum the following information:

- . Objectives and procedures stated in the approved protocol, including any changes made to the original protocol
- . Identity of the test article(s) by name or code number and the 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
- . Water quality characteristics of dilution water and selected test concentrations during testing (pH, dissolved oxygen, temperature, etc.)
- . Any unforeseen circumstances that may have affected the quality or integrity of the study
- . Signature of the project manager, senior technical reviewer, and quality control officer, authorizing release 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 (if applicable); morbidity and mortality; presentation of water quality characteristics; and survival data.

## 5. QUALITY ASSURANCE

### 5.1 Amendments to Protocol

Amendments to the authorized protocol established by EA or by the client are made only after proper authorization. Such authorization is achieved by completion of the Amendment to Protocol Form by EA after consultation with the client.

### 5.2 Standard Operating Procedures

Unless otherwise specified, all procedures specified 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 generally follow the types of requirements as outlined in the U.S. EPA's Good Laboratory Practice Standards (GLPs) (EPA 1989).

### 5.3 Reference Toxicant

A reference toxicant test, utilizing sodium dodecyl sulfate (SDS), cadmium chloride, or another appropriate chemical is used as an internal quality check of the sensitivity of the test organisms. Testing is conducted at least once monthly on organisms which are cultured in-house. The results of each test are compared with historical, species-specific toxicological information from reference toxicant tests performed at EA, to determine if the results are within acceptable limits. Limits are established using the control charts outlined in Weber (1991).

### 5.4 Quality Assurance Evaluation

Studies conducted under this protocol may be subject to internal audit by EA's Quality Assurance Unit. A quality control officer is 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 QC program and, if applicable, 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 whose study is being inspected will be consulted before examiners 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. Original primary data are retained at EA for 5 years. Primary data include chain-of-custody records, 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

Studies are conducted at the Aquatic Toxicology Laboratory of EA Engineering, Science, and Technology, Inc. at the Loveton Office in Sparks, Maryland.

## 6. SPECIFICATIONS OF THE *Daphnia* ACUTE TOXICITY TEST

### 6.1 Basic References

American Public Health Association (APHA), American Waterworks Association, Water Environment Federation. 1992. Standard Methods for Examination of Water and Wastewater, 18th edition or most recent version. APHA, Washington, D.C.

EA Manual ATS-102. 1992. Aquatic Toxicology Studies, Quality Control and Standard Operating Procedures Manual. Fourth Revision. Internal document prepared by Aquatic Toxicology Services, EA Engineering, Science, and Technology, Inc.

Litchfield, J.T., Jr. and F. Wilcoxon. 1949. A simplified method of evaluating dose-effect experiments. J. Pharm. Exp. Ther. 96:99-113.



SAS Institute Inc. 1985. SAS® User's Guide: Basics, Version 5 Edition. Cary, NC: SAS Institute Inc. 1290 pp.

Stephan, C.E. 1977. Methods for calculating an LC50, in *Aquatic Toxicology and Hazard Evaluation* (F.L. Mayer and J.I. Hamelink, eds.), pp. 65-84. ASTM STP 634. American Society for Testing and Materials, Philadelphia.

U.S. Environmental Protection Agency. 1979. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020. U.S. EPA, Washington.

Weber, C.I. 1991. Editor. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Fourth Edition. EPA/600/4-90/027. U.S. Environmental Protection Agency. Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

U.S. EPA. 1989. Toxic Substances Control Act (TSCA); Good Laboratory Practice Standards. Title 40 CFR Part 792. *Fed. Regist.* 54(158):34034-34074.

## 6.2 Test Specifications

Test organism:	<i>Daphnia magna</i> or <i>D. pulex</i> ; species to be specified in the study plan and final report
Age:	Less than 24 hours old
Temperature:	20±1 C or 25±1 C
Light quality:	Wide-spectrum fluorescent light
Light intensity:	50-100 f.c.
Photoperiod:	16-hour light, 8-hour dark
Aeration:	None, unless dissolved oxygen falls below 4 mg/L

Dilution water:	Dechlorinated municipal water, reconstituted water, or appropriate receiving water
Test container:	400-ml beaker or 200 ml culture bowl
Test volume:	200 ml per replicate
No. of concentrations:	Minimum of five test concentrations and a control
No. of replicates:	Two
No. of animals per replicate:	Ten
Feeding regime:	Animals will not be fed during test
Test type and duration:	Rangefinding--24 to 48 hours Definitive--48 hours
Endpoints:	Mortality or immobilization  Immobilization--defined as cessation of movement except for minor activity of appendages  Mortality--defined as cessation of all movement for a period of at least 5 seconds even when the test container is tapped or rotated, or the organism is gently prodded with glass rod
Test acceptability:	90% or greater survival in the control solution.

ACUTE ASSAY WITH FATHEAD MINNOWS  
(*Pimephales promelas*)

1. TEST OBJECTIVE

To assess the toxicity of a test material to *Pimephales promelas* and determine the LC50 or EC50 using mortality and/or immobilization, respectively, as the test endpoint(s).

2. TEST ARTICLE

2.1 Description/Identification

Unless otherwise specified, the test material is supplied by the client. Adequate chemical specifications with special reference to hazardous properties and storage conditions are also supplied by the client.

2.2 Methods of Synthesis

In most cases the test article is an effluent sample. Information on the methods of synthesis, stability, and composition or other characteristics which define the test article are on file with the client.

3. EXPERIMENTAL DESIGN

3.1 Test Organisms

The test species is the fathead minnow, *Pimephales promelas*.

3.2 Source

*P. promelas* used for toxicity tests are usually obtained from stock cultures maintained at EA's Aquatic Toxicology Culturing Facility. However, organisms may be obtained from a scientific organism vendor, if necessary.

### 3.3 Culturing and Holding Conditions

*P. promelas* stock are maintained at  $20 \pm 2$  C and a 16-hour light, 8-hour dark photoperiod cycle in an environmentally controlled laboratory. Test organisms are maintained in 18.9-L or 30-L all glass aquaria in a recirculating system of dechlorinated municipal tap water. If organisms are obtained from a scientific vendor, the fish, upon receipt, are transferred to static recirculating holding tanks of an appropriate size containing dechlorinated tap water at the temperature ( $\pm 2$  C) of the water in which the organisms were shipped. All fish stocks are examined regularly. 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 or *Artemia* nauplii a minimum of once daily. Certain regulatory or project specific objectives may require organism acclimation to the dilution water when it is different from the holding/culture water.

### 3.4 Age of Test Organisms at Test Initiation

The age of the test organisms is dependent on the objectives of the study and the specific guidelines being followed, but in general, fathead minnows used for acute toxicity testing are 1-14 days old (with a 24-hour range in age) upon test initiation.

### 3.5 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 and other possible contaminants such as 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* and fathead minnow cultures, with no evident loss of fecundity. If requested, reconstituted fresh water or other dilution water may be used.

### 3.6 Test Concentration Series

The test concentration series consists of a minimum of five dilutions and may be determined from a prior screening of the test material (e.g., 1, 3, 10, 30, and 100 percent effluent; or 6.25, 12.5, 25, 50, and 100 percent effluent plus a control).

### 3.7 Test Concentration Preparation

Test concentrations are prepared with Class A glassware.

### 3.8 Test Vessels and Test Volume

Test vessels are 2 L glass culture bowls; the final test volume is 1 L. Other test vessels may be used depending on the study's requirements.

### 3.9 Test Organism Number

Tests are conducted using 2 replicates per concentration, with 10 organisms per container. Fish are randomly assigned to each replicate test container. More replicates can be added, if appropriate.

### 3.10 Test Environment

The test vessels are maintained at  $20 \pm 1$  C or  $25 \pm 1$  C (unless a different project-specific temperature is required) in an environmentally controlled laboratory with a 16-hour light, 8-hour dark photoperiod. Temperature within the environmental room is monitored continuously using temperature recorders.

### 3.11 Analysis of Test Concentrations for Test Article

If required, test solutions may be analyzed for verification of chemical concentrations. The analytical method and number of analyses are determined after consultation with the client.

When chemical analyses are necessary, both nominal and actual measured test concentrations are reported.

### 3.12 Test Observations

Each test day, test organisms are observed to record the number of surviving organisms. Dead organisms are removed when observed. The study terminates after completion of the observation period (24 to 96 hours). The study may be extended, however, at the request of the client.

Each sample received is analyzed for temperature, conductivity, alkalinity, and hardness. Measurements of water quality taken daily include dissolved oxygen, pH, temperature, and conductivity from a minimum of one replicate of every concentration. Aliquots of effluent and receiving water may be gently aerated (100 bubbles/min) if dissolved oxygen is less than 4 mg/L or greater than 105% saturation. After test initiation, if the dissolved oxygen in any test chamber is less than 4 mg/L, all test chambers are gently aerated or other corrective action is taken. Analytical determinations are conducted according to APHA et al. (1992) and EPA (1979).

At the end of the test period, a minimum of 30 surviving fish are removed from the test vessels, placed in labeled containers, and frozen for later measurements. 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. For fish between 1-14 days old and within a 24-hour age range, weights and lengths usually will not be measured.

### 3.13 Solution Renewal (When Applicable)

When static-renewal testing is required, the test solution is renewed daily. New solutions are prepared on the day of renewal and dispensed according to Section 3.8. After the new solutions have reached test temperature and water quality measurements (temperature, pH, dissolved oxygen, and conductivity) are completed, the solution renewal may be performed by transferring the organisms from one test chamber to another or by replacing the test

solution. If the test solution replacement method is used, caution must be given not to stress the test organisms while the test chamber is siphoned. Usually 75 percent of the old solution is removed and replaced; however, the amount is dependent on the size of the test organisms.

### 3.14 Data Analysis

The LC50 and/or EC50 values and associated statistics are calculated using the probit, moving average, and binomial methods as described by Stephan (1977). Depending on the nature of the data, other methods may be used including the Trimmed Spearman-Kärber Method, the probit approximation method of Litchfield and Wilcoxon (1949), SAS probit analysis (SAS Institute 1985), or graphical interpolation using the log concentration vs. percent mortality and/or percent affected as described by APHA et al. (1992). The methods used are specified in the final report.

### 3.15 Test Applicability

An individual test may be conditionally acceptable if temperature, DO, and other specified conditions fall outside specifications, depending on the degree of the departure and the objectives of the tests.

## 4. FINAL REPORT

The final report is prepared to contain, at a minimum, the following information:

- Objectives and procedures stated in the approved protocol, including any changes made to the original protocol
- Identity of the test article(s) 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 wet weights of test fish, the respective standard deviations, and approximate biomass loadings (g fish/L of test solution), if applicable
- Water quality characteristics (pH, dissolved oxygen, temperature, etc.) of dilution water and selected test concentrations during testing
- Any unforeseen circumstances that may have affected the quality or integrity of the study
- Signature of the project manager, senior technical reviewer, and quality control officer authorizing release 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 (if applicable); morbidity and mortality; presentation of water quality characteristics, and survival data.

## 5. QUALITY ASSURANCE

### 5.1 Amendments to Protocol

Amendments to the authorized protocol established by EA or by the client are made only after proper authorization. Such authorization is achieved by completion of the Amendment to Protocol Form by EA after consultation with the client.



## 5.2 Standard Operating Procedures

Unless otherwise specified, all procedures given 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 generally follow the types of requirements outlined in the U.S. EPA's Good Laboratory Practice Standards (GLPs) (EPA 1989).

## 5.3 Reference Toxicant

A reference toxicant test, utilizing sodium dodecyl sulfate (SDS), cadmium chloride, or another appropriate chemical is used as an internal quality check of the sensitivity of the test organisms. Testing is conducted at least once monthly on organisms that are cultured in-house. The results of each test are compared with historical, species-specific toxicological information from reference toxicant tests performed at EA, to determine if the results are within acceptable limits. Limits are established using the control charts outlined in Weber (1991).

## 5.4 Quality Assurance Evaluation

Studies conducted under this protocol may be subject to internal audit by EA's Quality Assurance Unit. A quality control officer is 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 QC program and, if applicable, 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 whose study is being inspected will be consulted before examiners 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. Original primary data are retained at EA for 5 years. Primary data include chain-of-custody records, 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

Studies are conducted at the Aquatic Toxicology Laboratory of EA Engineering, Science, and Technology, Inc. at the Loveton Office in Sparks, Maryland.

# 6. SPECIFICATIONS OF THE FATHEAD MINNOW ACUTE TOXICITY TEST

## 6.1 Basic References

American Public Health Association (APHA) American Water Works Association, Water Environment Federation. 1992. Standard Methods for Examination of Water and Wastewater, 18th or most recent version. APHA, Washington, D.C.

American Society for Testing and Materials (ASTM). 1991. Standard Practice for Conducting Acute Tests with Fishes, Macroinvertebrates, and Amphibians. ASTM Designation: E729-80, Philadelphia, Pa.

EA Manual ATS-102. 1992. Aquatic Toxicology Studies, Quality Control and Standard Operating Procedures Manual. Fourth Revision. Internal document prepared by Aquatic Toxicology Services, EA Engineering, Science, and Technology, Inc.

Litchfield, J.T., Jr. and F. Wilcoxon. 1949. A simplified method of evaluating dose-effect experiments. J. Pharm. Exp. Ther. 96:99-113.

ATS-102

EA Engineering, Science,  
and Technology, Inc.

Effective May 1981

Revision 4, April 1992

SAS Institute Inc. 1985. SAS® User's Guide: Basics, Version 5 Edition. Cary, NC: SAS Institute Inc. 1290 pp.

Stephan, C.E. 1977. Methods for calculating an LC50, in Aquatic Toxicology and Hazard Evaluation (F.L. Mayer and J.L. Hamelink, eds.), pp. 65-84. ASTM STP 634. American Society for Testing and Materials, Philadelphia.

U.S. Environmental Protection Agency. 1979. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020. U.S. EPA, Washington.

U.S. EPA. 1989. Toxic Substances Control Act (TSCA); Good Laboratory Practice Standards. Title 40 CFR Part 792. Fed. Regist. 54.

Weber, C.I. 1991. Editor. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Fourth Edition. EPA/600/4-90/027. U.S. Environmental Protection Agency. Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

## 6.2 Test Specifications

Test organism:	Fathead minnow ( <i>Pimephales promelas</i> )
Temperature:	20±1 C or 25±1 C
Fish age:	Dependent on test guidelines being followed, but in general, 1-14 days with a 24-hour range in age
Fish length:	The largest fish is not more than 50 percent longer than the smallest fish
Loading ratio:	In general, test containers may not contain greater than 0.65 g/L biomass

Aeration:	None, unless dissolved oxygen falls below 4 mg/L
Light quality:	Wide-spectrum fluorescent light
Light intensity:	50-100 f.c.
Photoperiod:	16-hour light, 8-hour dark
Dilution water:	Dechlorinated municipal tap water, reconstituted fresh water, or appropriate receiving water
Test containers:	2 L glass culture bowl
Test volume:	1 L/replicate
No. of concentrations:	Minimum of five test concentrations and a control
No. of replicates:	2
Test animals per container:	10 (if loading is exceeded, more replicates or larger test containers may be used)
Feeding regime:	Animals are not fed during tests unless fish are too small to survive 96 hours without feeding.
Test type and duration:	Rangefinding--24-96 hours Definitive--24-96 hours

Endpoints:

Mortality and/or Immobilization

Immobilization--defined as cessation of movement except for minor activity of appendages

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

Test acceptability:

90 percent or greater survival in the control solution

**ATTACHMENT II**

**DATA SHEETS**



## AQUATIC ORGANISMS ACUTE TOXICITY TEST DATA SHEET

Project No.: 70003 10 TEST: Static, Flow-through, Renewal  
Test Article: Water Test Container: 4" bowl  
Client: Calgon Perry Nuclear Test Volume: 2 L  
QC Test No.: SA-092494983 Test Duration: 4 hrs  
Sample No.: AT4-7737475 Temp: 20±1  
Dilution No.: dechlor

TEST ORGANISM:  
Common Name: water flea  
Scientific Name: D. magna  
Lot No.: NA  
Source: EA

Beginning (Time, Date): 9-24-94 1350  
Ending (Time, Date): 9-26-94 1350  
Adults Isolated (Time, Date): 9-23-94 2051  
Organisms Pulled (Time, Date): 9-24-94 1010  
Acclimation: N/A or Age 24 hrs  
Culture Water T/S. @ Transfer (±2) 20°C

		ALL TESTS																				OTHER				
Con. or %	Test Container No.	Number of Live Organisms					Temperature (C)					pH					Dissolved Oxygen (mg/liter)					Conductivity (µS°) - Salinity (ppt)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
inlet	A	10	10	10			20.4		20.7			6.8	8.1				8.8	8.9				230	211			
	B	10	10	10			20.5					6.9					8.5					231				
influent AT4-774	A	10	10	10			20.3		20.8			6.9	8.4				8.2	8.9				304	268			
	B	10	10	10			20.4					6.9					8.5					272				
effluent AT4-773	A	10	10	10			20.7		20.7			7.0	8.4				8.3	8.9				312	279			
	B	10	10	10			20.5					6.9					8.5					304				
effluent during treatment AT4-775	A	10	10	7			20.7		20.9			7.1	8.4				8.1	8.9				330	297			
	B	10	10	10			20.8					7.9					8.4					319				
Instrument Number		1/5 1/5 250					1/5 1/5 250					55 55 1					1/5 1/5 1/5									
Correction Factor		1.5 1.5 1.5					1.5 1.5 1.5					8.7 8.7 8.5					1/8 1/8 1/8									
Time		140 134 130					135 133 134					135 136 136					134 135 135									
Investigator		GB 15 15					CH 15 15					CH ET 15					CH ET 15									

# AQUATIC TOXICOLOGY BENCH SHEET - SET UP (SMALL VOLUMES)

Project No.: 70003.10  
 Client: Wagon/Kayle Nuclear  
 QC Test No.: SA-092494-983

Date/Time	Activity	Investigator
9-24-94 1325	Dilutions Made	CH
↓ 1325	Test Vessels Filled	CH
1350	Transferred Organisms	CH
1400	Head Counts	JB

Sample No.: AT4-773,774,775  
 Dilution No.: alcohol

Test Concentration	Volume Test Material (ml)	Final Volume
Control	0ml	400ml
100% influent	400ml	↓
100% effluent prior to treatment	400ml	↓
100% effluent during treatment	400ml	↓





## AQUATIC TOXICOLOGY BENCH SHEET

Project No.: 70083.10  
Client: Calgon/Perry Nuclear  
QC Test No.: SA 092494-483

Date/Time	Activity	Investigator
-----------	----------	--------------

9/26/94 Floating organisms (alive):

- 3 in Control A
- 4 in Control B
- 2 in influent 100% A
- 3 in influent 100% B
- 2 in effluent (prior) 100% A
- 4 in effluent (prior) 100% B



## AQUATIC ORGANISMS ACUTE TOXICITY TEST DATA SHEET

Project No.: 76003 10 TEST: Static; Flow-through, Renewal  
Test Article: 1,1,1-trichloroethane Test Container: 20 L beaker  
Client: Calgon/Perry Nuclear Test Volume: 250 ml  
QC Test No.: SA 092494 984 Test Duration: 96 hrs  
Sample No.: ATL-715/714, 715 Temp: 20 ± 1  
Dilution No.: dechlor

TEST ORGANISM:  
Common Name: fathead  
Scientific Name: C. promelas  
Lot No.: FH4-7/8-19  
Source: EA

Beginning (Time, Date): 9/24/94 1420  
Ending (Time, Date): 9/29/94 1425  
Adults Isolated (Time, Date): N/A  
Organisms Pulled (Time, Date): N/A  
Acclimation: N/A or Age 14 days  
Culture Water T/S. @ Transfer (±2): 19.3 C

						ALL TESTS																				OTHER						
Con. or %	Test Container No.	Number of Live Organisms					Temperature (C)					pH					Dissolved Oxygen (mg/liter)					Conductivity (µS) Salinity (ppt)										
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	
100%	A	10	9	9	9	9	20.4		21.4		20.6	6.8				8.1	8.8		8.4		8.3	230		223		252						
	B	10	10	10	10	10	19.5		20.7				7.7	7.9			8.2	8.1				233		247								
100%	A	10	10	10	10	10	20.3		21.3		20.5	6.9				8.0	8.7		8.5		8.3	304		279		312						
100%	B	10	10	10	10	10	20.5		20.9				7.6	7.7			8.1	8.1				300		308								
100% ATB-14 bacteria	A	10	10	10	10	10	20.7		21.1		20.3	7.0				8.0	8.3		8.5		8.1	312		283		320						
	B	10	10	10	10	10	20.5		20.8				7.7	7.7			8.2	8.1				306		325								
100% ATB-14 bacteria	A	10	10	10	10	10	20.7		21.2		20.2	7.1				8.0	8.1		8.5		8.1	330		296		336						
	B	10	10	10	10	10	20.4		20.4				7.7	7.7			8.2	8.2				322		343								
Instrument Number							115	115	250	115	115	115	115	250	115	115	55	1	1	1	1	115	115	115	115	115	115	115	115	115	115	115
Correction Factor							1.5	1.5	6.1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	8.7	8.5	8.5	8.5	8.6	1.413	1.413	1.413	1.413	1.413	1.413	1.413	1.413	1.413	1.413	
Time		1420	1410	1405	1400	1405	1335	1412	1407	1443	1440	1335	1410	1407	1407	1410	1335	1415	1404	1415	1435	1340	1412	1403	1444	1425						
Investigator		AK	LS	LS	AK	AK	CH	AK	LS	AK	CH	AK	LS	AK	CH	AK	CH	AK	LS	AK	CH	AK	LS	AK	CH	AK	LS	AK	CH	AK	CH	AK

# AQUATIC TOXICOLOGY BENCH SHEET - SET UP (SMALL VOLUMES)

Project No.: 762310  
 Client: MTA/MTA/MTA  
 QC Test No.: 2000094-994

Date/Time	Activity	Investigator
9-24-94 1325	Dilutions Made	CH
1325	Test Vessels Filled	CH
1420	Transferred Organisms	CH
1430	Head Counts	jm

Sample No.: AT4-773774,775  
 Dilution No.: decide

Test Concentration	Volume Test Material (ml)	Final Volume
Control	Control	Stand
100% influent	500 ml	
100% effluent prior to treatment		
100% effluent during treatment		



## AQUATIC TOXICOLOGY BENCH SHEET

Project No.: 7508310  
Client: Wichita / Petco / Nuclear  
QC Test No.: 15A024094-984

Date/Time

Activity

Investigator

9/26/94 Test temperatures  $> 21^{\circ}\text{C}$  at 48hrs. Test was relocated. -CS

Freshwater Aquatic Toxicology Laboratories  
Pavilion Circle  
Sparks (Baltimore), Maryland 21152  
Telephone: (410) 771-4950  
Fax: (410) 771-4204

EA Aquatic  
Toxicology  
Laboratories

Species to be tested:

_____ <i>D. magna</i>	_____ <i>Menidia</i> sp.
_____ <i>D. pulex</i>	_____ <i>P. pugio</i>
_____ <i>C. dubia</i>	_____ <i>C. variegatus</i>
_____ <i>P. promelas</i>	_____ <i>M. bahia</i>
_____ Other	_____ Other

A = Acute      C = Chronic      B = Bioaccumulation

Fax: (410) 771-4204  
Client: Perry Nuclear Project No.: \_\_\_\_\_

NPDES Number: \_\_\_\_\_ Client Purchase Order Number: \_\_\_\_\_

State/City/County Collected: OH / Perry / Clark

[illegible]

Sampled By: <i>Perry</i>	Date/Time 9/22/94	Received By:	Date/Time
Sampler's Printed Name:	Title:	Relinquished By:	Date/Time
Relinquished By: <i>Jim S. Moore</i>	Date/Time 9/23/94 1900	Received By: Laboratory: <i>Walt Ballinger</i>	Date/Time 9/24/94 0925
Was Sample Chilled During Collection? <input checked="" type="checkbox"/> Yes/ <input type="checkbox"/> No		Sample Shipped By: (circle) Fed. Ex.      Puro. <u>UPS</u> Airborne	
Comments:		Other: _____ Air Bill Number: _____	
		Sample Temperature at Receipt: <u>7</u> C	

AT4-773-40C  
AT4-774-30C  
AT4-775-45C

**ATTACHMENT III**  
**REPORT QUALITY ASSURANCE RECORD**



## REPORT QUALITY ASSURANCE RECORD

Client: Calgon CorporationEA Report No.: 1755Project Number: 20003.10Type Analysis: AcuteAuthor: Virginia A. SohnTest Organisms: D. magna & P. promelas

## REPORT CHECKLIST

QA/QC ITEM	REVIEWER	DATE
1. Samples collected, transported, and received according to study plan requirements	<u>Virginia A. Sohn</u>	<u>10/1/94</u>
2. Samples prepared and processed according to study plan requirements.	<u>Virginia A. Sohn</u>	<u>10/1/94</u>
3. Data collected using calibrated equipment.	<u>Virginia A. Sohn</u>	<u>10/1/94</u>
4. Calculations checked: - Hand calculations checked	<u>Not applicable</u>	<u>          </u>
- Documented and verified statistical procedure used.	<u>Not applicable</u>	<u>          </u>
5. Data input/statistical analyses complete and correct.	<u>Richard A. Connolly</u>	<u>10/14/94</u>
6. Reported results and facts checked against original sources.	<u>Richard A. Connolly</u>	<u>10/14/94</u>
7. Data presented in figures and tables correct and in agreement with text.	<u>Richard A. Connolly</u>	<u>10/14/94</u>
8. Results reviewed for compliance with study plan requirements.	<u>Virginia A. Sohn</u>	<u>10/1/94</u>

	AUTHOR	DATE
9. Commentary reviewed and resolved.	<u>Virginia A. Sohn</u>	<u>10/17/94</u>
10. All study plan and quality assurance/control requirements have been met and the report is approved:		

<u>Virginia A. Sohn</u>	<u>10/17/94</u>
PROJECT MANAGER	DATE

<u>Richard A. Connolly</u>	<u>10/14/94</u>
QUALITY CONTROL OFFICER	DATE

<u>Wayne McCulloch</u>	<u>10/17/94</u>
SENIOR TECHNICAL REVIEWER	DATE