



**North
Atlantic**

North Atlantic Energy Service Corporation
P.O. Box 300
Seabrook, NH 03874
(603) 474-9521

The Northeast Utilities System
August 14, 2000

NPDES Permit NH0020338
NYE-00025

Mr. Carl DeLoi
U.S Environmental Protection Agency
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Seabrook Station
Discharge of Steam Generator Scale Conditioning Agent

North Atlantic Energy Service Corporation (North Atlantic), the operator of Seabrook Station, encloses information in support of our plans to discharge a steam generator scale conditioning agent (SCA) on a one-time basis this year. The planned discharge will occur during Seabrook Station's upcoming refueling outage scheduled for October through November 2000.

The SCA chemical solution will be applied to the secondary-side of two steam generators to assist in the subsequent mechanical removal of scale on the steam generator tubes. The removal of scale will increase the long-term integrity and longevity of Seabrook Station's steam generators. The chemical solution will be discharged to the ocean through the plant's cooling water system discharge (NPDES Outfall 001) following the SCA application.

North Atlantic plans to discharge the SCA in accordance with paragraph I.A.1.i. (2) of Seabrook Station's NPDES Permit which pertains to discharges of less than 0.5 mg/l that occur on a non-routine or infrequent basis. We notified Mr. Damien Houlihan (EPA) of our plans to discharge the SCA earlier this year¹. Enclosed is the following information regarding the SCA discharge as requested by Mr. Houlihan.

- Discharge flow path
- Discharge concentrations and amounts
- Duration and frequency of use
- Aquatic toxicity information
- Material Safety Data Sheets (MSDS's)

¹ Notification of Seabrook Station's plans to use scale conditioning agent, telecon by A. Legendre (North Atlantic) to D. Houlihan (EPA) on January 7, 2000

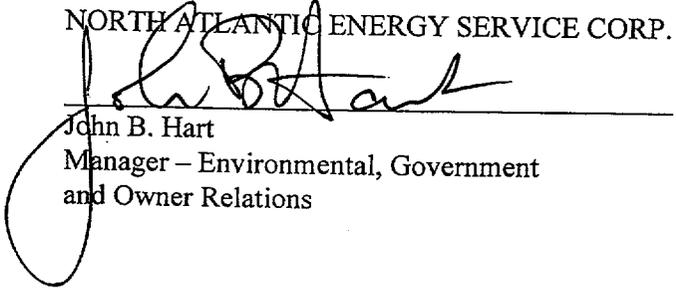
IE23

In the near future, we also plan to submit a supplement to Seabrook Station's NPDES Permit renewal application addressing future discharges of the SCA during refueling outages.

If you have additional questions, please contact me at (603) 773-7762.

Very truly yours,

NORTH ATLANTIC ENERGY SERVICE CORP.



John B. Hart

Manager - Environmental, Government
and Owner Relations

cc:

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Mr. Robert M. Pulsifer, Project Manager
Mail Stop 08B1
Project Directorate I-2
Division of Licensing
Project Management
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Mr. Hubert J. Miller
Regional Administrator - Region 1
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406-1415

Mr. George C. Berlandi, P.E.
Sanitary Engineer
Surface Water Quality Bureau
NH Department of Environmental Services
Water Supply and Pollution Control Div.
64 North Main Street, 3rd Floor
Concord NH 03301

Mr. Damien Houlihan
U.S. Environmental Protection Agency
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Mr. Jeffrey Andrews
NH Dept. Of Environmental Services
Water Division
6 Hazen Drive
Concord, NH 03302

ENCLOSURE 1 TO NYE-00025

DISCHARGE OF STEAM GENERATOR SCALE CONDITIONING AGENT

North Atlantic plans to apply a scale conditioning agent (SCA) to its steam generators during the plant's seventh refueling outage scheduled to begin in October 2000. The scale conditioning agent or SCA is a solution of organic amines, hydrogen peroxide and cyclic imines. This chemical solution will be applied to the secondary-side of two steam generators in order to change the density and morphology of accumulated scale to assist in its subsequent mechanical removal. The scale is a combination of aluminum, iron, magnesium, calcium, silicates, carbonates and oxides. This SCA application will increase the long-term integrity and longevity of Seabrook Station's steam generators.

Westinghouse Electric Company, the manufacturer of Seabrook Station's steam generators, developed the SCA chemical solution. The SCA is specific to Seabrook Station and is based on its effectiveness at softening a sample of scale removed from the plant's steam generators during the last refueling outage in the spring of 1999. The SCA concentrations within the steam generators are as follows:

<u>Chemical Name</u>	<u>Concentration</u>
N-methyl pyrrolidone	600 µg/l
Dimethylamine	100 µg/l
2,2' Bipyridyl	100 µg/l
Hydrogen peroxide	10 µg/l

During each scale conditioning agent application about 200 gallons of an SCA concentrate will be injected into each of the two steam generators – which each contain about 17,000 gallons of water – to achieve the above concentrations. The scale conditioning agent will be allowed to soak the scale on the steam generator tubes for up to 48 hours in order to soften the scale. Following this soak, the SCA will be discharged to Outfall 001 (ocean outfall) at a rate of up to 150 gallons per minute (gpm). The duration of this discharge will be less than four hours.

After each soak, a high pressure water spray will be used to remove the scale which will then be collected by filters and disposed of as solid waste.

During the SCA discharge at least one Circulating Water System Pump (150,000 gpm) and one Service Water system Pump (10,500 gpm) will be in operation providing significant dilution of the SCA solution. The concentration of the SCA will be ≤ 0.35 mg/l at the Discharge Transition Structure, which is below the notification requirements (0.5 mg/l) established for discharges which occur on a non-routine or infrequent basis in accordance with paragraph I.A.1.i. (2) of the NPDES Permit.

Toxicity Testing

Specific toxicity tests were conducted on the SCA solution using marine test species specified by the EPA. The toxicity tests and test species were:

- Chronic and Modified Acute Toxicity of Effluents to Mysid Shrimp, *Americamysis bahia*
- Chronic Toxicity of Effluents to Tidewater Silverside Minnow, *Menidia berillina*
- Chronic Toxicity of Effluents to Sea Urchin, *Arbacia punctulata* (fertilization tests)

Testing was performed by EnviroSystems (ESI) of Hampton, New Hampshire. The ESI toxicity evaluation report is attached (Attachment 1).

Toxicity testing concentrations of the SCA mixture were 0.0 mg/l (laboratory control), 0.01 mg/l, 0.05 mg/l, 0.1 mg/l, 1.0 mg/l and 2.0 mg/l. The toxicity evaluation results are summarized in the tables below.

Acute Toxicity Evaluation

<u>Species</u>	<u>Exposure</u>	<u>LC-50</u>	<u>A-NOEC</u>
<i>A. bahia</i> (mysid shrimp)	48 hours	>2.0 mg/L	2.0 mg/L
<i>M. beryllina</i> (silverside minnow)	48 hours	>2.0 mg/L	2.0 mg/L

Chronic Toxicity Evaluation

<u>Species</u>	<u>Exposure</u>	<u>C-NOEL</u>	<u>C-LOEC</u>	<u>Chronic Value</u>	
<i>A. bahia</i>	7 days	Survival	2.0 mg/L	>2.0 mg/L	>2.0 mg/L
		Growth	2.0 mg/L	>2.0 mg/L	>2.0 mg/L
<i>M. beryllina</i>	7 days	Survival	2.0 mg/L	>2.0 mg/L	>2.0 mg/L
		Growth	2.0 mg/L	>2.0 mg/L	>2.0 mg/L
<i>A. punctulata</i> (sea urchin)	60 minutes	0.1 mg/L	1.0 mg/L	0.32 mg/L	

Toxicity Testing Term

Definition

LC-50	Median lethal concentration is the effluent concentration that kills half of the test animals.
A-NOEC	Acute No Observed Effect Concentration is the highest tested concentration which causes no significant mortality.
C-LOEC	Lowest concentration that had an effect.
C-NOEL	Highest concentration where no effect was observed.

Discussion of SCA Aquatic Toxicity in Seabrook Station's Discharge

The concentration of SCA in Seabrook Station's discharge (0.35 mg/l) is below the acute and chronic toxicity values for mysid shrimp and silverside minnow.

With respect to sea urchin egg fertilization, the discharge concentration of SCA (0.35 mg/l) is between the C-NOEL or highest (test) concentration where no effect was observed (0.1 mg/l) and the C-LOEC or lowest concentration (tested) that had an effect (1.0 mg/l). An estimate of the lowest concentration that would have an effect on sea urchin egg fertilization (chronic value based on geometric mean of C-NOEL and C-LOEC) is 0.32 mg/l or about the concentration of SCA in Seabrook Station's cooling water discharge. The toxicity values were determined during a 60 minute evaluation. Seabrook Station's ocean cooling water discharge passes through eleven diffuser nozzles that are located about one mile offshore and result in the cooling water being diluted 10:1 in a very short period of time. When this dilution factor is considered, the concentration of SCA in Seabrook Station's discharge plume is about 0.035 mg/l or about ten times less than the lowest concentration that would have an effect on sea urchin egg fertilization.

In summary, the discharge of the SCA mixture for less than a four hour period in early November 2000 will not have an effect on marine species in the vicinity of Seabrook Station's ocean cooling water discharge for the following reasons.

- Relatively low toxicity of the SCA mixture.
- Low concentration of the SCA mixture in the ocean discharge.
- Short duration of discharge.
- Rapid dilution of cooling water discharge in ocean water.

Fate and Transport in the Environment

The following information about the environmental fate and transport of the individual SCA chemicals (if available) are taken from the Material Safety Data Sheets (MSDSs) provided in Attachment 2.

- **N-methyl pyrrolidone** - This material is not expected to significantly bioaccumulate.
- **Dimethylamine** - When released into the water, this material is expected to readily degrade. When released into the water this material is expected to have a half-life between 1 and 10 days. This material has an estimated bioconcentration factor (BCF) of less than 100. This material is not expected to significantly bioaccumulate.
- **2,2' Bipyridyl** - No information provided.
- **Hydrogen peroxide** – Rapid and considerable aerobic biodegradation was determined with a half-life of 0.3 to 2 days (fresh water). Hydrogen peroxide is non-bioaccumulable.

ATTACHMENT 1 TO NYE-00025

**TOXICOLOGICAL EVALUATION
OF A SCALE CONDITIONING AGENT**

JULY 2000

Prepared For

North Atlantic Energy Service Corporation
Seabrook Station
Route 1
PO Box 300
Seabrook, New Hampshire 03874

By

EnviroSystems, Incorporated
One Lafayette Road
Hampton, New Hampshire 03842

July 2000
Reference Number SEASTAT8878-00-07

EXECUTIVE SUMMARY 8878

The following summarizes the results of acute and chronic exposure bioassays conducted during the July of 2000 to evaluate the effects of Scale Conditioning Agent on the marine species *Americamysis bahia*, *Menidia beryllina* and *Arbacia punctulata*. The sample was provided by Dominion Engineering, Washington, DC.

Acute Toxicity Evaluation

Species	Exposure	LC-50	A-NOEC
<i>A. bahia</i>	48 Hours	>2.0 mg/L	2.0 mg/L
<i>M. beryllina</i>	48 Hours	>2.0 mg/L	2.0 mg/L

Chronic Toxicity Evaluation

Species	Exposure	C-NOEL	C-LOEC	Chronic Value	
<i>A. bahia</i>	7 Days	Survival	2.0 mg/L	>2.0 mg/L	>2.0 mg/L
		Growth	2.0 mg/L	>2.0 mg/L	>2.0 mg/L
<i>M. beryllina</i>	7 Days	Survival	2.0 mg/L	>2.0 mg/L	>2.0 mg/L
		Growth	2.0 mg/L	>2.0 mg/L	>2.0 mg/L
<i>A. punctulata</i>	60 Minutes	0.1 mg/L	1.0 mg/L	0.32 mg/L	

COMMENTS:

All concentrations are nominal values expressed as the N-methyl pyrrolidone portion of the Scale Conditioning Agent.

Authorized Signature: _____

EnviroSystems, Incorporated

8/1/2000
Date

**TOXICOLOGICAL EVALUATION
OF A SCALE CONDITIONING AGENT
DOMINION ENGINEERING:
JULY 2000**

**North Atlantic Energy Service Corporation
Seabrook Station**

1.0 INTRODUCTION

The US Environmental Protection Agency is currently using national water quality criteria in evaluating the effects of direct discharges on representative, sensitive species while allowing for the establishment of discharge limits that will protect aquatic environments. Data in support of this process can be generated from a review of existing literature or a series of bioassays.

Acute toxicity tests involve preparing a series of concentrations by diluting effluent with control water. Groups of test animals are exposed to each effluent concentration and a control for a specified period. In acute tests, mortality data for each concentration are used to calculate (by regression) the median lethal concentration, or LC-50, defined as the effluent concentration which kills half of the test animals. Samples with high LC-50 values are less likely to cause significant environmental impact. The no-effect concentration is also determined to provide information about the level of effluent which would have minimal acute effects in the environment. This Acute No Observed Effect Concentration (A-NOEC) is defined as the highest tested concentration which causes no significant mortality.

Chronic tests evaluate toxicity based on sublethal effects. Fertilization of *Arbacia punctulata* eggs or growth (weight) of *Menidia beryllina* are measured to determine effluent concentrations that have a significant impact on the organisms. Using Analysis of Variance techniques to evaluate the data, it is possible to determine the lowest concentration that had an effect (C-LOEC) and the highest concentration where no effect was observed (C-NOEL). The geometric mean of these points is the chronic value, or maximum allowable toxicant concentration (MATC). *A. punctulata* fertilization data are also evaluated to determine the effluent concentration where a 25% reduction in fertilization rates occurs. This is known as the Inhibition Concentration (IC-25).

This report presents the results of chronic toxicity tests conducted on the N-methyl pyrrolidone portion of a scale conditioning agent (SCA) provided by Dominion Engineering, Washington, DC. Testing was based on programs and protocols developed by the US EPA (1993, 1994). Seven day chronic toxicity tests were conducted with the inland silverside, *M. beryllina*, and the mysid shrimp, *Americamysis bahia*, and a 60 minute chronic fertilization assay was conducted with the purple sea urchin, *A. punctulata*. All bioassays were performed at EnviroSystems, Incorporated (ESI) in Hampton, New Hampshire.

2.0 MATERIALS AND METHODS

2.1 General Methods

Toxicological and analytical protocols used in this program follow procedures outlined in *Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms* (EPA 1993), *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms* (EPA 1994), *Attachment G: NPDES Toxicity Testing, Monitoring and Reporting Tips and Common Pitfalls* (EPA 1999), and *Standard Methods for the Examination of Water and Wastewater* (APHA 1995). These programs provide standard approaches for evaluation of acute and chronic toxicological effects of wastewater on aquatic organisms and analysis of water samples.

2.2 Test Species

A. bahia, 7 days old, were from cultures which are maintained by Aquatic Research Organisms, Hampton, New Hampshire. Test organisms were transferred to test chambers using a large bore pipet, minimizing the amount of water added to test solutions.

M. beryllina, 10 days old, were also obtained from cultures maintained by Aquatic Research Organisms, Hampton, New Hampshire. Fish were acclimated to approximate test conditions prior to use in the assay. The fish were transferred to test chambers with a large bore glass pipet, minimizing the amount of water added to test solutions.

A. punctulata were from cultures maintained by ESI. Original stock was obtained from commercial supply. Male and female urchins are maintained in separate chambers as recommended by protocol (EPA 1994).

2.3 Scale Conditioning Agent and Dilution Water

A one liter sample of the Dominion Engineering Scale Conditioning Agent was received on July 7, 2000. The sample was stored at room temperature under a fume hood until used. Test solutions were prepared fresh on a daily basis. A stock solution of the N-methyl pyrrolidone portion of the test compound was prepared by adding a known amount, product was weighed to the nearest 0.01 mg, and adding the material to the dilution water. Stock solution concentration was equal to the highest test concentration. Test concentrations for all assays were; 0.0 mg/L (laboratory control), 0.01 mg/L, 0.05 mg/L, 0.1 mg/L, 1.0 mg/L, and 2.0 mg/L. All concentrations are nominal values expressed as the N-methyl pyrrolidone portion of the scale conditioning agent. Hydrogen peroxide was also added to the stock solution prior to making dilutions. Highest concentrations of N-methyl pyrrolidone and hydrogen peroxide used in the assays were specified by the client. Data associated with preparation of stock solutions and dilutions are included in Appendix A.

Dilution water used for the assays was collected from the Hampton/Seabrook Estuary. This diluent is classified as SA-1 and has been used to culture marine test organisms since 1991. Dilution water used in the assays was maintained at a salinity of 30±2 ppt.

2.4 Bioassays

2.4.1 *Americamysis bahia* and *Menidia beryllina* Chronic Exposure Bioassays

The 7 day static renewal chronic exposure assays were conducted at $25 \pm 1^\circ\text{C}$ with a photoperiod of 16:8 hours light:dark. Mysid shrimp were maintained in 250 mL glass beakers containing 150 mL of test solution in each of 8 replicates with 5 organisms/replicate. Fish were maintained in 600 mL beakers containing 500 mL of test solution in each of 4 replicates containing 10 organisms/replicate. Test concentrations were mixed up fresh each day prior to test renewal.

Prior to daily renewals, survival and dissolved oxygen in all replicates were recorded and pH and salinity were measured in one replicate of each test treatment. Dissolved oxygen, salinity, pH, and specific conductivity were measured in one replicate of each new test treatment. Dissolved oxygen was measured using two YSI model 57 units. Specific conductivity was measured using a YSI 30 meter. Values for pH were recorded using an Accumet model 50 unit and an Accumet Basic model. Salinity values were read using an ATAGO S/Mill-E refractometer. Daily samples were weighed out using an American Scientific S/P 182 digital scale. Survival data were analyzed to assess acute toxicity after the initial 48 hours of exposure.

During the test, organisms were fed ≤ 24 hour old *Artemia* nauplii. On Day 7 of the assay, surviving organisms were removed from test solutions, rinsed to remove any surface detritus and salts, and tranquilized using Finquel®. Organisms were placed on tared containers and dried for 24 hours at 104°C in order to obtain dry weight to the nearest 0.01 mg. To obtain the final dry weight/organisms used in the statistical comparisons, the net dry weight was divided by the number of organisms introduced at the initiation of the assay.

2.4.2 *Arbacia punctulata* Chronic Fertilization Bioassay

Test chambers were 20 mL glass vials with 5 mL of test solution in each of 4 replicates. Gametes were obtained by potassium chloride injection to induce spawning. Sperm were collected dry, diluted to 4.48×10^7 sperm/mL, and exposed to effluent solutions for 60 minutes. Eggs were introduced to sperm/effluent solutions and exposed for 20 minutes prior to the addition of preservative. Aliquots of preserved solution were counted to determine fertilized and unfertilized eggs.

2.5 Data Analysis

When applicable, 48 hour survival data were analyzed to assess acute toxicity using a program developed by Stephan (1982) which computes LC-50 values using the Spearman-Kärber, Binomial and Probit methods. If survival in the highest test concentration was $>50\%$, LC-50 values were determined by direct observation of the raw data. The Acute No Observed Effect Concentration (A-NOEC) is defined as the highest tested concentration which causes no significant mortality.

A. bahia growth, *M. beryllina* survival and *M. beryllina* growth data were normal and homogenous. All three data sets were analyzed using Dunnett's Test. *A. punctulata* fertilization data, also normal and homogenous, were analyzed using Bonferroni t-Test (EPA 1994). Replicate data were combined to determine the statistical significance of differences existing between test treatments and the control. Statistical significance was accepted at $\alpha < 0.05$.

2.6 Quality Control

As part of the laboratory quality control program, reference toxicant evaluations are conducted on a regular basis for each test species. These results provide relative health and response data while allowing for comparison with historic data sets. The sodium dodecyl sulfate reference toxicant tests conducted on July 6, 2000 resulted in 48 hour LC-50 values of 19.4 mg/L (Binomial Method) for *A. bahia* and 7.53 mg/L (Spearman-Karber Method) for *M. beryllina*, respectively. These results were within one standard deviation of the historic mean for the species. The copper reference toxicant test conducted on April 20, 2000 using *A. punctulata* resulted in a C-NOEC of 20.0 $\mu\text{g/L}$ copper with an associated IC-25 of 38.8 $\mu\text{g/L}$. Both values were within two standard deviations of the historic mean.

3.0 RESULTS AND DISCUSSION

Results of the chronic exposure assays conducted using *A. bahia* and *M. beryllina* are provided in Tables 1 and 2. General water quality data collected during the mysid and minnow assays are presented in Table 3. Data from the *A. punctulata* fertilization assay are summarized in Tables 4 and 5. Table 6 contains a summary of reference toxicant data for each test species. Sample receipt information is included in Table 7. Analytical chemistry results are included in Table 8. Support data, including laboratory bench sheets, can be found in Appendix A.

3.1 *Americamysis bahia* Chronic Exposure Bioassay

Survival on Day 7 was 95% in the laboratory diluent control with a mean dry weight of 0.306 mg/shrimp, based on Day 7 survival, in the laboratory diluent control. Minimum test acceptability criteria require 80% survival with a mean dry weight of 0.200 mg/shrimp, based on Day 7 survival (EPA 1994). Mean dry weight based on Day 0 survival was 0.293 mg/shrimp. Values based on Day 0 survival were used in the statistical analysis of the growth data. These results are an indication of healthy test organisms and that the dilution water had no significant adverse impact on the outcome of the assay.

After 48 hours exposure, survival was $\geq 98\%$ in all treatments. The 48 hour LC-50 value was observed to be > 2.0 mg/L N-methyl pyrrolidone with an associated A-NOEC value of 2.0 mg/L N-methyl pyrrolidone.

After 7 days exposure, survival was $\geq 95\%$ in all test concentrations. Review of the data indicated that survival in all treatments was not significantly different from the laboratory diluent control. The C-NOEL for survival was 2.0 mg/L N-methyl pyrrolidone. The LOEC and chronic values were each > 2.0 mg/L N-methyl pyrrolidone.

At the end of the 7 day exposure period, mean dry weight of surviving mysid shrimp ranged from 0.218 mg/shrimp in 0.05 mg/L N-methyl pyrrolidone to 0.292 mg/fish in 1.0 mg/L N-methyl pyrrolidone. Analysis of the data showed that the mean dry weight in 0.05 mg/L N-methyl pyrrolidone was significantly less than that observed in the laboratory diluent control. The C-NOEL for growth was 2.0 mg/L N-methyl pyrrolidone. The LOEC and chronic values were each >2.0 mg/L N-methyl pyrrolidone

3.2 *Menidia beryllina* Chronic Exposure Bioassay

Survival on Day 7 was 92.5% in the laboratory diluent control with a mean dry weight of 0.778 mg/fish based on Day 7 survival. Minimum test acceptability criteria require 80% survival with a mean dry weight of 0.500 mg/fish, based on Day 7 survival (EPA 1994). Based on Day 0 survival, minnows had a mean dry weight of 0.720 mg/fish in the laboratory diluent control. These results were used in the statistical comparisons of growth data. These results are an indication of healthy test organisms and that the dilution water had no significant adverse impact on the outcome of the assay.

After 48 hours exposure, survival was $\geq 85\%$ in all remaining treatments. The 48 hour LC-50 value was observed to be >2.0 mg/L N-methyl pyrrolidone with an associated A-NOEC value of 2.0 mg/L N-methyl pyrrolidone.

After 7 days exposure, survival was $\geq 80\%$ in all remaining concentrations. Review of the data indicated that survival in all treatments was not significantly different from the laboratory diluent control. The C-NOEL for survival was 2.0 mg/L N-methyl pyrrolidone. The LOEC and chronic values were each >2.0 mg/L N-methyl pyrrolidone.

At the end of the 7 day exposure period, mean dry weight of surviving fish ranged from 0.835 mg/fish in 0.1 mg/L N-methyl pyrrolidone to 1.092 mg/fish in 1.0 mg/L N-methyl pyrrolidone. Analysis of the data showed that the mean dry weight in all remaining concentrations was not significantly less than that observed in the laboratory diluent control. The C-NOEL for growth was 2.0 mg/L N-methyl pyrrolidone. The LOEC and chronic values were each >2.0 mg/L N-methyl pyrrolidone.

3.3 *Arbacia punctulata* Chronic Fertilization Bioassay

Review of the data showed a mean fertilization rate of 84.4% in the laboratory diluent control after 60 minutes exposure. This value meets the 70% to 90% fertilization rate recommended by the protocol (EPA 1994).

Mean fertilization rates ranged from 74.1% in 1.0 mg/L N-methyl pyrrolidone to 79.5% in 0.05 mg/L N-methyl pyrrolidone. Analysis of the data showed that the mean fertilization rates in 2.0 mg/L N-methyl pyrrolidone and 1.0 mg/L N-methyl pyrrolidone were significantly less than that observed in the laboratory diluent control. The C-NOEL for fertilization was 0.1 mg/L N-methyl pyrrolidone with an LOEC value of 1.0 mg/L N-methyl pyrrolidone. The chronic value was determined to be 0.32 mg/L N-methyl pyrrolidone. The IC-25 value could not be calculated.

3.4 Summary

The Scale Conditioning Agent sample provided by Dominion Engineering did not exhibit signs of acute toxicity to the mysid, *Americamysis bahia*, or the inland silverside, *Menidia beryllina*, after 48 hours exposure. Results of the chronic exposure assays indicate that the Dominion Engineering Scale Conditioning Agent had significant chronic impacts on mysid growth, silverside growth, and the fertilization success of the purple sea urchin, *Arbacia punctulata*, during their respective exposure periods.

4.0 LITERATURE CITED

- APHA. 1995. *Standard Methods for the Examination of Water and Wastewater*, 19th edition. Washington D.C.
- Stephan, C. 1982. Documentation for Computing LC-50 Values with a Mini Computer. Unpublished.
- US EPA. 1993. *Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms*. Fourth Edition. EPA/600/4-90/027F.
- US EPA. 1994. *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Estuarine and Marine Organisms*. EPA
- US EPA. 1999. *Attachment G: NPDES Toxicity Testing, Monitoring and Reporting Tips and Common Pitfalls*. Dated October 1999. US EPA Region I Offices, Boston, Massachusetts

**TABLE 1. Summary of Chronic Bioassay Results: *A. bahia*.
 Dominion Engineering Scale Conditioning Agent Toxicity Evaluation.
 July 2000.**

SURVIVAL (expressed as actual values)

Treatment	Exposure Period (Days)								Survival (%)
	0	1	2	3	4	5	6	7	
Lab	40	40	39	39	39	38	38	38	95.0
0.01 mg/L	40	40	39	39	38	38	38	38	95.0
0.05 mg/L	40	40	39	39	39	39	39	39	97.5
0.1 mg/L	40	39	39	39	39	39	39	39	97.5
1.0 mg/L	40	40	40	40	40	40	40	40	100.0
2.0 mg/L	40	40	40	40	40	40	40	40	100.0

GROWTH (mg/shrimp)*

Treatment	Replicate								Mean
	A	B	C	D	E	F	G	H	
Lab	0.268	0.276	0.164	0.312	0.360	0.360	0.374	0.228	0.293
0.01 mg/L	0.232	0.330	0.220	0.294	0.236	0.248	0.280	0.290	0.266
0.05 mg/L	0.148	0.204	0.222	0.208	0.200	0.380	0.188	0.198	0.218
0.1 mg/L	0.384	0.240	0.122	0.214	0.290	0.210	0.372	0.186	0.252
1.0 mg/L	0.336	0.322	0.272	0.260	0.294	0.206	0.368	0.274	0.292
2.0 mg/L	0.102	0.292	0.364	0.258	0.316	0.298	0.344	0.348	0.290

	Survival	Growth
Chronic No Observed Effect Concentration-	2.0 mg/L	2.0 mg/L
Lowest Observed Effect Concentration -	>2.0 mg/L	>2.0 mg/L
Chronic Value -	>2.0 mg/L	>2.0 mg/L

COMMENTS

Treatment concentrations are nominal values expressed as the N-methyl pyrrolidone portion of the Scale Conditioning Agent.

* - Growth calculations and statistics based on number of organisms added at test initiation (Day 0).

**TABLE 2. Summary of Chronic Bioassay Results: *M. beryllina*.
Dominion Engineering Scale Conditioning Agent Toxicity Evaluation.
July 2000.**

CONCENTRATIONS EXPRESSED AS ACTUAL VALUES

Treatment	SURVIVAL								GROWTH (mg/fish)*				
	Exposure Period (Days)								Replicate				
	0	1	2	3	4	5	6	7	A	B	C	D	Mean
Lab	40	39	38	37	37	37	37	37	0.622	0.706	0.842	0.708	0.720
0.01 mg/L	40	40	39	37	37	37	37	37	0.881	0.881	0.784	0.794	0.835
0.05 mg/L	40	35	34	34	34	33	33	32	0.537	0.829	1.069	0.918	0.838
0.1 mg/L	40	39	35	34	34	34	34	34	0.909	1.058	0.974	0.978	0.980
1.0 mg/L	40	40	39	39	39	39	38	38	0.979	1.144	1.179	1.064	1.092
2.0 mg/L	40	38	36	36	35	35	35	35	1.070	1.017	0.952	0.981	1.005

	Lab	0.01 mg/L	0.05 mg/L	0.1 mg/L	1.0 mg/L	2.0 mg/L
Survival (%)	92.5	92.5	80.0	85.0	95.0	87.5
Growth (mg/fish)*	0.720	0.835	0.838	0.980	1.092	1.005

	Survival	Growth
Chronic No Observed Effect Concentration -	2.0 mg/L	2.0 mg/L
Lowest Observed Effect Concentration -	>2.0 mg/L	>2.0 mg/L
Chronic Value -	>2.0 mg/L	>2.0 mg/L

COMMENTS

Treatment concentrations are nominal values expressed as the N-methyl pyrrolidone portion of the Scale Conditioning Agent.

* Growth calculations and statistics based on number of organisms added on Day 0.

**TABLE 3. Summary of Water Quality Data: *M. beryllina* and *A. bahia*.
Dominion Engineering Scale Conditioning Agent Toxicity Evaluation.
July 2000.**

PARAMETER	UNITS	2.0 mg/L N-methyl pyrrolidone	LAB CONTROL
Specific Conductivity	μmhos/cm	43900	43200
pH	SU	7.71	7.63
Salinity	ppt	28	28
TRC	mg/L	<0.05	<0.05
Ammonia	mg/L as N	0.26	<0.10
Total Solids	mg/L	31764	33520
Total Suspended Solids	mg/L	80	42
Hardness	mg/L	4898	4896
Total Organic Carbon	mg/L	‡	‡

**TABLE 4. Summary of Chronic Bioassay Results: *A. punctulata*.
Dominion Engineering Scale Conditioning Agent Toxicity Evaluation.
July 2000.**

	TREATMENTS					
	Lab	0.01 mg/L	0.05 mg/L	0.1 mg/L	1.0 mg/L	2.0 mg/L
Mean %	84.4	79.5	79.4	77.7	74.1	75.5

Chronic No Observed Effect Concentration	-	0.1 mg/L
Lowest Observed Effect Concentration	-	1.0 mg/L
Chronic Value	-	0.32 mg/L
IC-25	-	Could not be calculated

COMMENTS

Treatment concentrations are nominal values expressed as the N-methyl pyrrolidone portion of the Scale Conditioning Agent.

‡ - Results to be provided as soon as they are available.

**TABLE 5. Summary of Water Quality Data: *A. punctulata*.
 Dominion Engineering Scale Conditioning Agent Toxicity Evaluation.
 July 2000.**

PARAMETER	UNITS	2.0mg/L N-methyl pyrrolidone	LAB CONTROL
Specific Conductivity	μ mhos/cm	44460	43530
pH	SU	7.87	7.60
Salinity	ppt	28	28

**TABLE 6. Summary of Reference Toxicant Data.*
 Dominion Engineering Scale Conditioning Agent Toxicity Evaluation.
 July 2000.**

Species	LC-50	Historic Mean	Number of Tests	± 1 STD Deviation	± 2 STD Deviations
<i>A. bahia</i>	19.4	19.8	114	4.05	8.09
<i>M. beryllina</i>	7.53	6.64	99	1.42	2.83

Species	NOEC	Historic Mean	Number of Tests	± 1 STD Deviation	± 2 STD Deviations
<i>A. bahia</i>	20.0	8.39	31	6.45	12.9

Species	IC-25	Historic Mean	Number of Tests	± 1 STD Deviation	± 2 STD Deviations
<i>A. bahia</i>	38.8	20.9	16	14.3	28.6

COMMENTS:

* - Concentrations are expressed as mg/L sodium dodecyl sulfate for *A. bahia* and *M. beryllina*, and as μ g/L Copper for *A. punctulata*.

**TABLE 7. Summary of Sample Receipt Information.
 Dominion Engineering Scale Conditioning Agent Toxicity Evaluation.
 July 2000.**

Sample Description	Receipt Date	Volume Received (mL)	Initial Weight of Jar(g)	Final Weight of Jar (g)
Dominion Engineering Scale Conditioning Agent	07/07/00	approx. 1L	1097.6	1096.4

**TABLE 8. Summary of Analytical Chemistry Results.
 Dominion Engineering Scale Conditioning Agent Toxicity Evaluation.
 July 2000.**

PARAMETER	UNIT	2.0 mg/L N-methyl pyrrolidone	LAB CONTROL
Aluminum, total	mg/L	‡	‡
Zinc, total	mg/L	‡	‡
Lead, total	mg/L	‡	‡
Cadmium, total	mg/L	‡	-
Nickel, total	mg/L	‡	-
Copper, total	mg/L	‡	‡
Chromium, total	mg/L	‡	-

COMMENTS:

‡ - Results to be provided as soon as they are available.

APPENDIX A
DATA SHEETS
STATISTICAL SUPPORT

Contents

- A. bahia* 7 Day Chronic Assay New Water Qualities - 1 page
- A. bahia* Chronic Assay - 2 pages
- A. bahia* Organism Dry Weights - 2 pages
- A. bahia* Growth Statistics - 3 pages
- A. bahia* Organism Culture Data - 1 page
- M. beryllina* 7 Day Chronic Assay New Water Qualities - 1 page
- M. beryllina* Chronic Assay - 1 page
- M. beryllina* Survival Statistics - 3 pages
- M. beryllina* Larval Fish Dry Weights - 1 page
- M. beryllina* Growth Statistics - 3 pages
- M. beryllina* Organism Culture Data - 1 page
- A. punctulata* Water Qualities -1 page
- A. punctulata* Fertilization Counts - 1 page
- A. punctulata* Fertilization Summary - 1 page
- A. punctulata* Fertilization Statistics -3 pages
- Hardness By Calculation - 1 page
- Chemical Analysis Inventory - 1 page
- Mixing Instructions - 1 page
- Sample Receipt Record - 1 page

New WQ

Americamysis bahia 7 DAY CHRONIC ASSAY

STUDY:		CLIENT: Seabrook Station							SAMPLE: Dominion			DILUENT: Lab Salt			
8278															
NEW DISSOLVED OXYGEN (mg/L)									NEW SALINITY (ppt)						
CONC**	REP	0	1	2	3	4	5	6	0	1	2	3	4	5	6
LAB	A	6.7	6.4	6.8	7.1	6.8	7.0	7.2	28	28	28	30	28	28	28
0.01 mg/L	A	6.7	6.6	6.8	6.9	6.8	6.7	7.1	28	29	28	30	29	29	29
0.05 mg/L	A	6.9	6.6	6.8	6.7	6.8	6.6	7.0	28	29	28	30	29	28	29
0.1 mg/L	A	6.9	6.1	6.8	6.5	6.7	6.5	7.0	28	29	29	30	29	28	29
1.0 mg/L	A	6.9	6.3	6.8	6.7	6.7	6.8	7.0	28	29	29	30	29	28	29
2.0 mg/L	A	7.1	6.7	6.8	6.9	6.7	6.9	7.0	28	28	29	30	29	29	29
NEW pH (SU)									NEW SPECIFIC CONDUCTIVITY (µmhos/cm)						
CONC**	REP	0	1	2	3	4	5	6	0	1	2	3	4	5	6
LAB	A	7.63	7.43	7.58	7.77	7.60	7.59	7.71	43.2	44.1	43.4	39.4	43.8	44.0	40.8
0.01 mg/L	A	7.66	7.57	7.61	7.68	7.64	7.57	7.74	43.7	44.5	44.1	40.4	44.3	44.3	41.5
0.05 mg/L	A	7.68	7.62	7.60	7.61	7.51	7.52	7.53	43.9	44.4	44.0	40.5	44.3	43.8	41.4
0.1 mg/L	A	7.68	7.62	7.56	7.55	7.44	7.58	7.53	43.9	44.2	44.3	40.5	44.5	44.1	41.4
1.0 mg/L	A	7.71	7.61	7.59	7.56	7.54	7.73	7.54	44.0	44.2	44.5	40.2	44.7	44.0	45.1
2.0 mg/L	A	7.71	7.62	7.64	7.45	7.68	7.80	7.59	43.9	44.3	44.5	40.7	44.7	44.4	41.0
INC TEMP:		25	25	24	24	24	24	25	25	25	24	24	24	24	25
DATE:		7/21/05	7/21	7/22	7/23	7/24	7/25	7/26	7/21/05	7/21	7/22	7/23	7/24	7/25	7/26
TIME:		1217	1309	1157	1225	1642	1217	1617	1217	1309	1157	1225	1642	1217	1615
INIT:		CS	CS	CS	CS	CS	CS	KCL	CS	CS	CS	CS	CS	CS	KCL

** Concentrations given as the N-methyl pyrrolidone portion of the Dominion Engineering sample.

Americamysis bahia 7 DAY CHRONIC ASSAY

STUDY 2878		CLIENT Seabrook Station			SAMPLE Dominion Engineering					DILUENT Lab Salt			FISH/BATCH ARC			
		NUMBER OF SURVIVORS								OLD DISSOLVED OXYGEN (mg/L)						
CONC**	REP	0	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Lab Control	A	5	5	5	5	5	4	4	4	3.3	5.6	6.0	7.0	6.3	6.5	6.7
	B	5	5	5	5	5	5	5	5	3.9	5.7	6.0	7.4	6.0	6.2	6.5
	C	5	5	4	4	4	4	4	4	5.1	5.8	5.9	7.5	5.9	6.3	6.5
	D	5	5	5	5	5	5	5	5	5.2	5.8	5.9	7.4	5.7	6.3	6.5
	E	5	5	5	5	5	5	5	5	5.4	5.9	6.0	7.2	5.9	6.4	6.4
	F	5	5	5	5	5	5	5	5	4.4	5.9	6.0	7.3	5.8	6.5	6.5
	G	5	5	5	5	5	5	5	5	4.7	5.9	6.0	7.4	5.6	6.5	6.4
	H	5	5	5	5	5	5	5	5	5.2	5.9	6.0	7.4	5.8	6.7	6.4
0.01 mg/L	A	5	5	5	5	5	5	5	5	5.4	6.0	6.0	7.2	6.0	6.6	6.0
	B	5	5	5	5	5	5	5	5	5.6	5.9	6.0	7.1	5.7	6.3	5.8
	C	5	5	4	4	4	4	4	4	5.6	5.9	6.0	7.0	5.8	6.3	5.8
	D	5	5	5	5	5	5	5	5	4.8	5.8	5.9	7.4	5.6	6.0	6.0
	E	5	5	5	5	5	5	5	5	5.4	5.9	5.8	7.0	5.9	6.0	6.1
	F	5	5	5	5	5	5	5	5	5.4	5.9	5.8	7.2	5.4	6.1	6.2
	G	5	5	5	5	5	5	5	5	5.4	5.9	6.1	7.4	5.6	6.2	6.0
	H	5	5	5	5	4	4	4	4	5.4	5.9	6.0	7.2	5.5	6.3	6.3
0.05 mg/L	A	5	5	5	5	5	5	6	5	5.9	5.9	5.1	7.1	5.0	6.3	6.4
	B	5	5	5	5	5	5	6	5	5.5	6.0	5.0	7.2	5.0	6.1	6.3
	C	5	5	5	5	5	5	6	5	5.2	5.3	5.3	7.1	5.0	6.0	6.3
	D	5	5	5	5	5	5	5	5	5.4	5.3	5.7	7.4	5.0	6.0	6.2
	E	5	5	5	5	5	5	5	5	5.6	5.6	5.8	7.6	4.5	5.9	6.4
	F	5	5	5	5	5	5	5	5	5.8	5.6	5.6	7.5	4.5	5.8	6.3
	G	5	5	4	4	4	4	4	4	5.9	5.6	5.6	7.4	4.6	6.0	6.5
	H	5	5	5	5	5	5	5	5	5.9	5.7	5.7	7.5	4.8	6.0	6.4
OLD SALINITY (ppt)										OLD pH (SU)						
Conc**	Rep	0	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Lab	A		29	29	30	30	29	30	29	7.32	7.69	7.71	7.95	7.86	7.91	7.86
0.01mg/L	A		29	29	30	30	30	30	29	7.59	7.75	7.83	8.02	7.79	7.96	7.85
0.05 mg/L	A		30	30	30	30	30	30	29	7.75	7.77	7.71	7.97	7.75	7.93	7.93
INC TEMP:		25	25	24	24	25	24	25	25	25	24	24	25	24	25	25
DATE:		7/20/07	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/21	7/22	7/23	7/24	7/25	7/26	7/27
TIME:		1000	1002	1022	1035	1545	1034	1609	1200	1002	1023	1035	1545	1034	1609	1200
INIT:		OS	OS	OS	OR	KOK	OS	KOK	KOK	OS	OS	OS	KOK	OR	KOK	KOK

** Concentrations given as the N-methyl pyrrolidone portion of the Dominion Engineering sample.

Americamysis bahia 7 DAY CHRONIC ASSAY

STUDY 8878		CLIENT Seabrook Station			SAMPLE Dominion Engineering					DILUENT Lab Salt		FISH/BATCH				
		NUMBER OF SURVIVORS								OLD DISSOLVED OXYGEN (mg/L)						
CONC**	REP	0	1	2	3	4	5	6	7	1	2	3	4	5	6	7
0.1 mg/L	A	5	5	5	5	5	5	5	5	5.3	5.7	5.2	7.0	4.4	5.9	6.1
	B	5	5	5	5	5	5	5	5	5.0	5.4	5.4	7.2	4.3	6.0	6.3
	C	5	5	5	5	5	5	5	5	5.0	5.6	5.4	7.5	4.5	5.9	6.3
	D	5	5	5	5	5	5	5	5	5.0	5.7	5.5	7.4	5.0	5.8	6.3
	E	5	5	5	5	5	5	5	5	4.4	5.9	5.6	7.6	4.9	6.0	6.3
	F	5	5	5	5	5	5	5	5	4.6	5.8	5.7	7.7	4.5	6.1	6.2
	G	5	5	5	5	5	5	5	5	4.8	5.8	5.6	7.6	4.6	6.1	6.2
	H	5	4	4	4	4	4	4	4	4.7	5.9	5.6	7.7	5.0	6.1	6.5
1.0 mg/L	A	5	5	5	5	5	5	5	5	5.0	5.9	5.5	6.7	5.2	6.4	6.5
	B	5	5	5	5	5	5	5	5	4.3	5.8	5.5	6.9	5.0	6.3	6.4
	C	5	5	5	5	5	5	5	5	4.5	5.8	5.6	6.8	5.0	6.1	6.3
	D	5	5	5	5	5	5	5	5	5.6	5.8	5.6	7.4	5.3	6.1	6.5
	E	5	5	5	5	5	5	5	5	5.4	5.9	5.5	7.3	5.2	6.3	6.5
	F	5	5	5	5	5	5	5	5	5.0	5.8	5.3	7.5	5.3	6.3	6.5
	G	5	5	5	5	5	5	5	5	5.0	5.8	5.4	7.3	5.2	6.2	6.4
	H	5	5	5	5	5	5	5	5	5.5	5.7	5.4	7.5	5.4	6.2	6.3
2.0 mg/L	A	5	5	5	5	5	5	5	5	5.8	5.8	5.2	6.1	5.5	6.3	6.6
	B	5	5	5	5	5	5	5	5	5.9	5.7	5.3	6.3	5.5	6.2	6.7
	C	5	5	5	5	5	5	5	5	6.0	5.7	5.5	7.3	5.3	6.1	6.7
	D	5	5	5	5	5	5	5	5	5.3	5.7	5.5	7.4	5.5	6.2	6.8
	E	5	5	5	5	5	5	5	5	5.9	5.8	5.7	7.6	5.7	6.2	6.6
	F	5	5	5	5	5	5	5	5	6.2	5.7	5.8	7.8	5.8	6.3	6.7
	G	5	5	5	5	5	5	5	5	6.2	5.7	5.7	7.8	5.8	6.3	6.7
	H	5	5	5	5	5	5	5	5	6.1	5.6	6.0	7.7	5.7	6.3	6.7
OLD SALINITY (ppt)										OLD pH (SU)						
Conc**	Rep	0	1	2	3	4	5	6	7	1	2	3	4	5	6	7
0.1 mg/L	A		29	29	30	29	30	31	30	7.59	7.78	7.77	7.96	7.70	7.86	7.86
1.0 mg/L	A		30	30	30	30	30	31	30	7.56	7.77	7.82	7.97	7.77	7.90	7.98
2.0 mg/L	A		29	30	30	29	30	30	30	7.69	7.76	7.81	7.88	7.82	7.89	7.97
INC TEMP:		25	25	24	24	25	24	25	25	25	24	24	25	24	25	25
DATE:		7/20/07	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/21	7/22	7/23	7/24	7/25	7/26	7/27
TIME:		1550	1025	1027	1035	1545	1034	1600	1150	1025	1027	1035	1545	1034	1526	1200
INIT:		OK	OK	OK	OK	KCK	OK	KCK	KCK	OK	OK	OK	KCK	OK	KCK	KCK

7/27
KCK

7/20/07
1550

** Concentrations given as the N-methyl pyrrolidone portion of the Dominion Engineering sample.

ORGANISM DRY WEIGHTS

CLIENT: Seabrook Station (Dominion Engineering sample)				TEST DATES:			Mean Wt (mg)
STUDY #: 8878				SPECIES: A. bahia			
CONC**	REP	TARE WT (G)	SHRIMP + FOIL (G)	NET WT (MG)	# SHRIMP	MEAN WT (MG) ^{of 2017}	
Lab Control	A	0.00678	0.00872	1.340	4	0.335	.268
	B	0.00728	0.00866	1.380	5	0.276	→
	C	0.00700	0.00782	0.820	4	0.205	.164
	D	0.00740	0.00896	1.500	5	0.312	→
	E	0.00635	0.00815	1.800	5	0.360	→
	F	0.00668	0.00848	1.800	5	0.360	→
	G	0.00652	0.00839	1.870	5	0.374	→
	H	0.00737	0.00851	1.140	5	0.228	→
0.01 mg/L	A	0.00506	0.00622	1.100	5	0.232	→
	B	0.00538	0.00703	1.650	5	0.330	→
	C	0.00668	0.00778	1.100	4	0.275	0.220
	D	0.00640	0.00787	1.470	5	0.294	→
	E	0.00616	0.00734	1.180	5	0.236	→
	F	0.00540	0.00664	1.240	5	0.248	→
	G	0.00652	0.00792	1.400	5	0.280	→
	H	0.00577	0.00722	1.450	4	0.362	.290
0.05 mg/L	A	0.00502	0.00576	0.740	5	0.148	→
	B	0.00613	0.00715	1.020	5	0.204	→
	C	0.00543	0.00654	1.110	5	0.222	→
	D	0.00705	0.00809	1.040	5	0.208	→
	E	0.00636	0.00736	1.000	5	0.200	→
	F	0.00569	0.00759	1.900	5	0.380	→
	G	0.00706	0.00800	0.940	4	0.235	.189
	H	0.00768	0.00867	0.990	5	0.198	→
DATE:		7/27/00	7/28/00	7/28/00	7/28/00	7/28/00	
TIME:		1000	1025	1130	1100	1130	
INITIALS:		KC	KC	KC	KC	KE	

Based on 7

→ indicates same value as to the left

** Concentrations given as the N-methyl pyrrolidone portion of the Dominion Engineering sample.

ORGANISM DRY WEIGHTS

CLIENT: Seabrook Station (Dominion Engineering sample)			TEST DATES:			
STUDY #: 2278			SPECIES: A. bahia			
CONC**	REP	TARE WT (G)	SHRIMP + FOIL (G)	NET WT (MG)	# SHRIMP	MEAN WT (MG)
0.1 mg/L	A	0.00695	0.00887	1.920	5	0.384
	B	0.00756	0.00876	1.200	5	0.240
	C	0.00709	0.00770	0.610	5	0.122
	D	0.00809	0.00916	1.070	5	0.214
	E	0.00659	0.00804	1.450	5	0.290
	F	0.00750	0.00855	1.050	5	0.210
	G	0.00663	0.00849	1.860	5	0.372
	H	0.00799	0.00892	0.930	4	0.232
1.0 mg/L	A	0.00750	0.00918	* 1.610 ^{1.610} _{1.72}	5	0.336
	B	0.00627	0.00788	1.610	5	0.322
	C	0.00761	0.00897	1.360	5	0.272
	D	0.00741	0.00871	1.300	5	0.260
	E	0.00753	0.00900	1.470	5	0.294
	F	0.00670	0.00773	1.030	5	0.206
	G	0.00650	0.00834	1.840	5	0.368
	H	0.00718	0.00855	1.370	5	0.274
2.0 mg/L	A	0.00779	0.00830	0.510	5	0.102
	B	0.00680	0.00826	1.460	5	0.292
	C	0.00688	0.00870	1.820	5	0.364
	D	0.00713	0.00842	1.290	5	0.258
	E	0.00671	0.00829	1.580	5	0.316
	F	0.00688	0.00837	1.490	5	0.298
	G	0.00710	0.00882	1.720	5	0.344
	H	0.00685	0.00859	1.740	5	0.348
DATE:		7/27/00	7/28/00	7/28/00	7/28/00	7/28/00
TIME:		10:12	10:40	11:40	10:40	11:40
INITIALS:		KC	KC	KC	KC	KC

Based on Jay

Mean wt(mg)

1.186

above

same

1.680

KC

** Concentrations given as the N-methyl pyrrolidone portion of the Dominion Engineering sample.

Title: 8878 Seabrook A. bahia Chronic Growth
File: 8878ab Transform:

NO TRANSFORMATION

Summary Statistics on Data

TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Lab	8	0.1640	0.3740	0.2928
2	0.01	8	0.2200	0.3300	0.2663
3	0.05	8	0.1480	0.3800	0.2185
4	0.1	8	0.1220	0.3840	0.2523
5	1.0	8	0.2060	0.3680	0.2915
6	2.0	8	0.1020	0.3640	0.2903

Title: 8878 Seabrook A. bahia Chronic Growth
File: 8878ab Transform:

NO TRANSFORMATION

Summary Statistics on Data

TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Lab	0.0054	0.0734	0.0259	25.0615
2	0.01	0.0014	0.0381	0.0135	14.3002
3	0.05	0.0047	0.0687	0.0243	31.4608
4	0.1	0.0083	0.0909	0.0321	36.0468
5	1.0	0.0025	0.0504	0.0178	17.2786
6	2.0	0.0070	0.0836	0.0295	28.7865

Title: 8878 Seabrook A. bahia Chronic Growth
File: 8878ab Transform:

NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

D = 0.2054
W = 0.9780

Critical W = 0.9290 (alpha = 0.01 ; N = 48)
W = 0.9470 (alpha = 0.05 ; N = 48)

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: 8878 Seabrook A. bahia Chronic Growth
File: 8878ab Transform:

NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 6.1668 (p-value = 0.2903)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 15.0863 (alpha = 0.01, df = 5)
= 11.0705 (alpha = 0.05, df = 5)

Title: 8878 Seabrook A. bahia Chronic Growth
 File: 8878ab Transform:

NO TRANSFORMATION

ANOVA Table

SOURCE	DF	SS	MS	F
Between	5	0.0349	0.0070	1.4261
Within (Error)	42	0.2054	0.0049	
Total	47	0.2403		

(p-value = 0.2347)

Critical F = 3.4882 (alpha = 0.01, df = 5,42)
 = 2.4377 (alpha = 0.05, df = 5,42)

Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)

Title: 8878 Seabrook A. bahia Chronic Growth
 File: 8878ab Transform:

NO TRANSFORMATION

Dunnett's Test - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG 0.05
1	Lab	0.2928	0.2928		
2	0.01	0.2663	0.2663	0.7579	
3	0.05	0.2185	0.2185	2.1235	
4	0.1	0.2523	0.2523	1.1583	
5	1.0	0.2915	0.2915	0.0357	
6	2.0	0.2903	0.2903	0.0715	

Dunnett critical value = 2.3100 (1 Tailed, alpha = 0.05, df [used] = 5,40)
 (Actual df = 5,42)

Title: 8878 Seabrook A. bahia Chronic Growth
 File: 8878ab Transform:

NO TRANSFORMATION

Dunnett's Test - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	Lab	8			
2	0.01	8	0.0808	27.6	0.0265
3	0.05	8	0.0808	27.6	0.0742
4	0.1	8	0.0808	27.6	0.0405
5	1.0	8	0.0808	27.6	0.0012
6	2.0	8	0.0808	27.6	0.0025



Aquatic Research Organisms

DATA SHEET

I. Organism History

Species: Amerimysis bahia

Source: Lab reared Hatchery reared _____ Field collected _____

Hatch date 7/13/60 Receipt date _____

Lot number 071300MS Strain ARO

Brood Origination FL

II. Water Quality

Temperature 25 °C Salinity 28 ppt DO Sat

pH 7.9 Hardness _____ ppm

III. Culture Conditions

System: SW heat recirc

Diet: Flake Food _____ Phytoplankton _____ Trout Chow _____

Brine Shrimp Rotifers _____ Other _____

Prophylactic Treatments: _____

Comments: _____

IV. Shipping Information

Client: EST # of Organisms: 240+

Carrier: PICK UP Date Shipped: 7/20/60

Biologist: Steve Jantski

1 - 800 - 927 - 1650

PO Box 1271 • One Lafayette Road • Hampton, NH 03842 • (603) 926-1650

Menidia beryllina 7 DAY CHRONIC ASSAY

STUDY:		CLIENT:							SAMPLE:			DILUENT:			
2078		Seabrook Station							Dominion Engineering			Lab Salt			
NEW DISSOLVED OXYGEN (mg/L)									NEW SALINITY (ppt)						
CONC**	REP	0	1	2	3	4	5	6	0	1	2	3	4	5	6
LAB	A	6.7	6.7	6.7	6.9	6.6	6.6	6.7	28	28	28	30	28	28	28
0.01 mg/L	A	6.7	6.8	6.7	6.7	6.7	6.6	6.6	28	29	28	30	29	29	28
0.05 mg/L	A	6.9	6.8	6.8	6.7	6.8	6.7	6.4	28	28	28	30	29	29	29
0.1 mg/L	A	6.9	6.8	6.7	6.5	6.7	6.9	6.6	28	28	29	30	29	28	29
1.0 mg/L	A	6.9	6.8	6.7	6.5	6.6	6.8	6.8	28	29	29	30	29	28	29
2.0 mg/L	A	7.1	6.9	6.7	6.5	6.5	6.9	6.9	28	28	29	30	29	29	29
NEW pH (SU)									NEW SPECIFIC CONDUCTIVITY (μmhos/cm) x1000						
CONC**	REP	0	1	2	3	4	5	6	0	1	2	3	4	5	6
LAB	A	7.63	7.62	7.47	7.38	7.43	7.43	7.87	43.2	43.8	43.0	40.0	43.9	43.9	40.7
0.01 mg/L	A	7.63	7.65	7.56	7.61	7.59	7.46	7.82	43.7	44.1	43.7	40.6	44.2	44.2	41.7
0.05 mg/L	A	7.68	7.65	7.56	7.58	7.48	7.48	7.80	43.9	44.1	44.0	40.3	44.3	44.2	41.8
0.1 mg/L	A	7.68	7.62	7.50	7.48	7.39	7.45	7.79	43.9	44.2	44.2	40.6	44.3	43.7	41.7
1.0 mg/L	A	7.71	7.63	7.53	7.39	7.49	7.56	7.85	44.0	44.2	44.3	40.4	44.5	43.8	41.2
2.0 mg/L	A	7.71	7.63	7.54	7.31	7.55	7.60	7.91	43.9	44.2	44.4	40.7	44.6	44.4	41.0
INC TEMP (°C:)		25	25	24	24	24	24	26							
DATE:		7/21	7/21	7/22	7/23	7/24	7/25	7/26							
TIME:		1217	1245	1145	1235	1134	1305	1505							
INITIALS:		CS	CS	CS	CS	CS	CS	KCK							

KCK
7/26

** Concentrations given as the N-methyl pyrrolidone portion of the Dominion Engineering sample.

Menidia beryllina 7 Day Chronic Assay

STUDY 8878		CLIENT Seabrook Station			SAMPLE Dominion Engineering					DILUENT: Lab Salt		FISH/BATCH				
NUMBER OF SURVIVORS										OLD DISSOLVED OXYGEN (mg/L)						
CONC**	REP	0	1	2	3	4	5	6	7	1	2	3	4	5*	6	7
LAB CONTROL	A	10	9	8	8	8	8	8	8	6.2	6.1	6.6	5.9	6.3	7.5	8.2
	B	10	10	10	9	9	9	9	9	6.1	6.1	6.5	5.7	6.2	7.4	8.1
	C	10	10	10	10	10	10	10	10	6.0	6.0	6.1	5.7	6.1	7.3	8.2
	D	10	10	10	10	10	10	10	10	6.1	5.9	6.0	5.8	6.1	7.3	8.2
0.01 mg/L	A	10	10	10	10	10	10	10	10	6.1	6.1	6.1	5.6	6.1	7.4	8.1
	B	10	10	10	10	10	10	10	10	6.0	6.0	6.2	5.8	5.8	7.4	8.1
	C	10	10	10	9	9	9	9	9	6.0	5.9	6.0	5.7	5.7	7.4	7.9
	D	10	10	9	8	8	8	8	8	6.1	5.9	6.0	5.7	5.7	7.3	8.1
0.05 mg/L	A	10	7	6	6	6	6	6	6	6.0	5.8	5.9	5.7	4.7	7.3	8.2
	B	10	9	9	9	9	9	9	8	5.9	5.9	5.8	6.0	4.5	7.3	8.1
	C	10	10	10	10	10	9	9	9	6.0	5.8	5.5	5.6	4.5	7.3	8.1
	D	10	9	9	9	9	9	9	9	6.0	5.5	5.6	5.8	3.7	7.2	8.1
0.1 mg/L	A	10	9	8	8	8	8	8	8	5.8	5.4	5.1	5.3	3.7	7.3	8.2
	B	10	10	9	9	9	9	9	9	5.7	5.2	5.1	5.1	3.9	7.2	8.0
	C	10	10	9	9	9	9	9	9	5.7	5.1	4.7	5.0	4.2	7.3	8.1
	D	10	10	9	8	8	8	8	8	5.7	5.1	4.7	5.1	4.2	7.2	8.0
1.0 mg/L	A	10	10	10	10	10	10	10	10	5.9	5.2	4.3	5.0	4.4	7.2	8.1
	B	10	10	10	10	10	10	9	9	5.9	5.0	4.6	4.8	4.4	7.2	8.0
	C	10	10	10	10	10	10	10	10	5.9	4.7	4.5	4.8	4.4	7.2	8.0
	D	10	10	9	9	9	9	9	9	5.8	4.6	5.0	4.7	4.4	7.2	8.0
2.0 mg/L	A	10	10	9	9	9	9	9	9	5.8	5.0	4.9	4.7	5.0	7.3	8.1
	B	10	9	9	9	9	9	9	9	5.8	5.3	4.8	4.6	5.2	7.3	8.0
	C	10	9	8	8	8	8	8	8	5.9	5.2	4.9	4.8	5.2	7.3	8.0
	D	10	10	10	10	9	9	9	9	6.0	5.1	5.0	4.9	5.3	7.2	8.0
OLD SALINITY (ppt)										OLD PH (SU)						
Conc**	Rep	0	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Lab	A		29	28	30	28	28	28	28	7.64	7.65	7.75	7.57	7.78	8.14	8.02
0.01	A		29	29	30	29	29	29	28	7.75	7.68	7.78	7.71	7.76	8.12	8.02
0.05	A		29	29	30	29	29	29	29	7.77	7.73	7.79	7.74	7.55	8.14	8.06
0.1 mg/L	A		29	29	30	29	29	29	29	7.74	7.63	7.67	7.59	7.54	8.10	8.06
1.0 mg/L	A		29	29	30	29	29	29	29	7.72	7.59	7.63	7.59	7.56	8.09	8.03
2.0 mg/L	A		29	30	30	29	29	29	29	7.73	7.59	7.69	7.58	7.56	8.12	8.04
INC TEMP (°C):		25	25	24	24	24	24	26	25							
DATE:		7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27							
TIME:		1430	1136	1054	1110	1530	1233	1337	1005							
INITIALS:		CS	CS	CS	CA	KL	CS	KCL	KCK							

* Puroxin
 < 60% saturation

** Concentrations given as the N-methyl pyrrolidone portion of the Dominion Engineering sample.

Title: 8878 Seabrokk Station M. beryllina Survival
 File: 8878mb Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Lab	4	1.1071	1.4120	1.2951
2	0.01	4	1.1071	1.4120	1.2951
3	0.05	4	0.8861	1.2490	1.1228
4	0.1	4	1.1071	1.2490	1.1781
5	1.0	4	1.2490	1.4120	1.3305
6	2.0	4	1.1071	1.2490	1.2136

Title: 8878 Seabrokk Station M. beryllina Survival
 File: 8878mb Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Lab	0.0216	0.1470	0.0735	11.3473
2	0.01	0.0216	0.1470	0.0735	11.3473
3	0.05	0.0294	0.1714	0.0857	15.2672
4	0.1	0.0067	0.0819	0.0410	6.9540
5	1.0	0.0089	0.0941	0.0470	7.0718
6	2.0	0.0050	0.0709	0.0355	5.8463

Title: 8878 Seabrokk Station M. beryllina Survival
File: 8878mb Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

D = 0.2795
W = 0.9055

Critical W = 0.8840 (alpha = 0.01 , N = 24)
W = 0.9160 (alpha = 0.05 , N = 24)

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: 8878 Seabrokk Station M. beryllina Survival
File: 8878mb Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 3.2668 (p-value = 0.6589)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 15.0863 (alpha = 0.01, df = 5)
= 11.0705 (alpha = 0.05, df = 5)

Title: 8878 Seabrokk Station M. beryllina Survival
 File: 8878mb Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA Table

SOURCE	DF	SS	MS	F
Between	5	0.1301	0.0260	1.6750
Within (Error)	18	0.2795	0.0155	
Total	23	0.4096		

(p-value = 0.1916)

Critical F = 4.2479 (alpha = 0.01, df = 5,18)
 = 2.7729 (alpha = 0.05, df = 5,18)

Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)

Title: 8878 Seabrokk Station M. beryllina Survival
 File: 8878mb Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	TRANS T STAT	SIG 0.05
1	Lab	1.2951	0.9250		
2	0.01	1.2951	0.9250	0.0000	
3	0.05	1.1228	0.8000	1.9545	
4	0.1	1.1781	0.8500	1.3273	
5	1.0	1.3305	0.9500	-0.4026	
6	2.0	1.2136	0.8750	0.9248	

Dunnett critical value = 2.4100 (1 Tailed, alpha = 0.05, df = 5,18)

Title: 8878 Seabrokk Station M. beryllina Survival
 File: 8878mb Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	Lab	4			
2	0.01	4	0.1458	15.7	0.0000
3	0.05	4	0.1458	15.7	0.1250
4	0.1	4	0.1458	15.7	0.0750
5	1.0	4	0.1458	15.7	-0.0250
6	2.0	4	0.1458	15.7	0.0500

LARVAL FISH DRY WEIGHTS

CLIENT: <i>Saba</i>		TEST DATES: <i>7/20-27/00</i>						
STUDY #:		SPECIES: <i>M. bergyllina</i>						
CONC	REP	TARE WT (g)	FISH + FOIL (g)	NET WT (mg)	# FISH DAY 0	# FISH DAY 7	MEAN WT DAY 0 (mg)	MEAN WT DAY 7 (mg)
Lab	A	0.00642	0.01264	6.220	10	8	0.622	0.777
	B	0.00625	0.01331	7.060	10	9	0.706	0.784
	C	0.00610	0.01452	8.420	10	10	0.842	0.842
	D	0.00630	0.01338	7.080	10	10	0.708	0.708
.01	A	0.00640	0.01521	8.810	10		0.881	
	B	0.00569	0.01635	8.810	10		0.881	
	C	0.00621	0.01405	7.840	10		0.784	
	D	0.00613	0.01407	7.940	10		0.794	
.05	A	0.00691	0.01228	5.370	10		0.537	
	B	0.00701	0.01530	8.290	10		0.829	
	C	0.00587	0.01656	10.690	10		0.0 ¹⁰⁰⁰ / ₁₀₀₀	
	D	0.00606	0.01524	9.180	10		0.918	
.1	A	0.00636	0.01545	9.090	10		0.909	
	B	0.00706	0.01764	10.580	10		1.058	
	C	0.00710	0.011084	9.740	10		0.974	
	D	0.00698	0.01676	9.780	10		0.978	
1.0	A	0.00688	0.01667	9.790	10		0.979	
	B	0.00679	0.01823	11.440	10		1.144	
	C	0.00664	0.01843	11.790	10		1.179	
	D	0.00587	0.01651	10.640	10		1.064	
2.0	A	0.00580	0.01650	10.700	10		1.070	
	B	0.00695	0.01712	10.170	10		1.017	
	C	0.00657	0.01609	9.520	10		0.952	
	D	0.00679	0.01660	9.810	10		0.981	
L	A							
	B							
	C							
	D							
	A							
	B							
	C							
	D							
DATE:		7/27/00	7/28/00	7/28/00	7/28/00	7/28/00	7/28/00	7/28/00
TIME:		10:00	10:50	11:10	10:50	10:50	11:10	11:10
INIT:		KC	KC	KC	KC	KC	KC	KC

x Day 7 = 0.778

* 1.069

Title: 8878 Seabrook M. beryllina Growth
 File: 8878mbwt Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Lab	4	0.6220	0.8420	0.7195
2	0.01	4	0.7840	0.8810	0.8350
3	0.05	4	0.5370	1.0690	0.8383
4	0.1	4	0.9090	1.0580	0.9798
5	1.0	4	0.9790	1.1790	1.0915
6	2.0	4	0.9520	1.0700	1.0050

Title: 8878 Seabrook M. beryllina Growth
 File: 8878mbwt Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Lab	0.0083	0.0910	0.0455	12.6436
2	0.01	0.0028	0.0533	0.0266	6.3800
3	0.05	0.0501	0.2239	0.1120	26.7148
4	0.1	0.0037	0.0610	0.0305	6.2266
5	1.0	0.0079	0.0891	0.0446	8.1645
6	2.0	0.0026	0.0508	0.0254	5.0587

Title: 8878 Seabrook M. beryllina Growth
 File: 8878mbwt Transform: NO TRANSFORMATION

ANOVA Table

SOURCE	DF	SS	MS	F
Between	5	0.3755	0.0751	5.9679
Within (Error)	18	0.2265	0.0126	
Total	23	0.6021		

(p-value = 0.0020)

Critical F = 4.2479 (alpha = 0.01, df = 5,18)
 = 2.7729 (alpha = 0.05, df = 5,18)

Since F > Critical F REJECT Ho: All equal (alpha = 0.05)

Title: 8878 Seabrook M. beryllina Growth
 File: 8878mbwt Transform: NO TRANSFORMATION

Dunnett's Test - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG 0.05
1	Lab	0.7195	0.7195		
2	0.01	0.8350	0.8350	-1.4560	
3	0.05	0.8383	0.8383	-1.4970	
4	0.1	0.9798	0.9798	-3.2808	
5	1.0	1.0915	1.0915	-4.6896	
6	2.0	1.0050	1.0050	-3.5991	

Dunnett critical value = 2.4100 (1 Tailed, alpha = 0.05, df = 5,18)

Title: 8878 Seabrook M. beryllina Growth
 File: 8878mbwt Transform: NO TRANSFORMATION

Dunnett's Test - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	Lab	4			
2	0.01	4	0.1912	26.6	-0.1155
3	0.05	4	0.1912	26.6	-0.1188
4	0.1	4	0.1912	26.6	-0.2603
5	1.0	4	0.1912	26.6	-0.3720
6	2.0	4	0.1912	26.6	-0.2855

Title: 8878 Seabrook M. beryllina Growth
File: 8878mbwt Transform: NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

D = 0.2265
W = 0.9287

Critical W = 0.8840 (alpha = 0.01 , N = 24)
W = 0.9160 (alpha = 0.05 , N = 24)

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: 8878 Seabrook M. beryllina Growth
File: 8878mbwt Transform: NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 10.0592 (p-value = 0.0736)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 15.0863 (alpha = 0.01, df = 5)
= 11.0705 (alpha = 0.05, df = 5)

Arbacia punctulata Chronic Fertilization Assay

STUDY	CLIENT	SAMPLE	DATE		
8878	Seabrook Station	Dominion Engineering product	7/25/00		
SAMPLE CONCENTRATION**	D.O. (mg/L)	pH (SU)	SPEC COND (µmhos/cm)	SALINITY (ppt)	TRC (mg/L)
LAB CONTROL	7.4	7.60	43530 39240 ^{BB}	28	<0.05
0.01 mg/L	7.4	7.73	43460	28	
0.05 mg/L	7.4	7.77	43620	28	
0.1 mg/L	7.5	7.79	43450	28	
1.0 mg/L	7.5	7.83	43160	28	
2.0 mg/L	7.4	7.87	44460	28	
INITIALS	BB	BB	BB	BB	

INCUBATION TEMPERATURE (°C) 20

SPERM DILUTIONS:

HEMACYTOMETER COUNT, E: 112 × 10⁴ = SPM SOLUTION E = 1.12 × 10⁶

SPERM CONCENTRATIONS: SOLUTION E X 40 = SOLUTION A = 4.48 × 10⁷ SPM
 SOLUTION E X 20 = SOLUTION B = 2.24 × 10⁷ SPM
 SOLUTION E X 5 = SOLUTION C = 5.60 × 10⁶ SPM

FINAL COUNTS:

FINAL SPERM COUNT: 4.48 × 10⁷
 FINAL EGG COUNT: 2100

TEST TIMES:

SPERM COLLECTED: 1350
 EGGS COLLECTED: 1345
 SPERM ADDED: 1430
 EGGS ADDED: 1530
 FIXATIVE ADDED: 1530

Meters Used

DO meter # _____ DO probe # _____ pH meter # _____ pH probe # _____ S/C meter # _____ S/C probe # _____
 Salinity meter # _____ Scale # _____ Thermometer # _____

** Concentrations given as the N-methyl pyrrolidone portion of the Dominion Engineering sample.

Arbacia punctulata Chronic Fertilization Assay

STUDY	CLIENT	SAMPLE			DATE COUNTED
8878	Seabrook Station	Dominion Engineering product			07/26/00
SAMPLE CONCENTRATION**	REPLICATE VIAL				
	<u>1</u> UNFERT/TOTAL	<u>2</u> UNFERT/TOTAL	<u>3</u> UNFERT/TOTAL	<u>4</u> UNFERT/TOTAL	
LAB CONTROL	29/110	17/102	14/106	14/112	
0.01 mg/L	95/100 *	17/116	24/111	29/115	
0.05 mg/L	17/106	22/103	17/101	25/107	
0.1 mg/L	25/111	25/105	34/134	19/108	
1.0 mg/L	23/103	22/107	28/107	40/116	
2.0 mg/L	22/101	26/115	24/102	32/106	
INITIALS	Ⓟ	Ⓟ	Ⓟ	Ⓟ	

** Concentrations given as the N-methyl pyrrolidone portion of the Dominion Engineering sample.

* Replicate contaminated. Not included in statistics. Ⓟ

Arbacia punctulata Fertilization Data

CLIENT: Seabrook Station
 ESI#: 8878
 DATE: 07/25/00

CONC	REPLICATE			UNFERTILIZED	
	A	B	C	D	MEAN
Lab	20.0%	16.7%	13.2%	12.5%	15.6%
0.01 mg/L	*	14.7%	21.6%	25.2%	20.5%
0.05 mg/L	17.9%	21.4%	25.4%	17.6%	20.6%
0.1 mg/L	22.5%	23.8%	25.4%	17.6%	22.3%
1.0 mg/L	22.3%	20.6%	26.2%	34.5%	25.9%
2.0 mg/L	21.8%	22.6%	23.5%	30.2%	24.5%

CALCULATIONS FOR IC-25

	REPLICATE			FERTILIZED	
	A	B	C	D	MEAN
Lab	80.0%	83.3%	86.8%	87.5%	84.4%
0.01 mg/L	*	85.3%	78.4%	74.8%	79.5%
0.05 mg/L	82.1%	78.6%	74.6%	82.4%	79.4%
0.1 mg/L	77.5%	76.2%	74.6%	82.4%	77.7%
1.0 mg/L	77.7%	79.4%	73.8%	65.5%	74.1%
2.0 mg/L	78.2%	77.4%	76.5%	69.8%	75.5%

* Replicate contaminated. Not included in statistics.

Title: 8878 Seabrook Station A. punctulata Fertilization
 File: 8878ap Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Lab	4	1.1071	1.2094	1.1663
2	0.01	3	1.0449	1.1773	1.1032
3	0.05	4	1.0426	1.1379	1.1011
4	0.1	4	1.0426	1.1379	1.0796
5	1.0	4	0.9430	1.0997	1.0388
6	2.0	4	0.9890	1.0850	1.0535

Title: 8878 Seabrook Station A. punctulata Fertilization
 File: 8878ap Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Lab	0.0022	0.0473	0.0236	4.0512
2	0.01	0.0046	0.0676	0.0390	6.1282
3	0.05	0.0020	0.0447	0.0223	4.0552
4	0.1	0.0017	0.0413	0.0206	3.8247
5	1.0	0.0048	0.0696	0.0348	6.6994
6	2.0	0.0019	0.0438	0.0219	4.1593

Title: 8878 Seabrook Station A. punctulata Fertilization
File: 8878ap Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

D = 0.0472
W = 0.9581

Critical W = 0.8810 (alpha = 0.01 , N = 23)
W = 0.9140 (alpha = 0.05 , N = 23)

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: 8878 Seabrook Station A. punctulata Fertilization
File: 8878ap Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 1.3676 (p-value = 0.9278)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 15.0863 (alpha = 0.01, df = 5)
= 11.0705 (alpha = 0.05, df = 5)

Using Average Degrees of Freedom
(Based on average replicate size of 3.83)

Calculated B2 statistic = 0.9466 (p-value = 0.9668)

Data PASS B2 homogeneity test at 0.01 level. Continue analysis.

Title: 8878 Seabrook Station A. punctulata Fertilization
 File: 8878ap Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA Table

SOURCE	DF	SS	MS	F
Between	5	0.0406	0.0081	2.9216
Within (Error)	17	0.0472	0.0028	
Total	22	0.0878		

(p-value = 0.0441)

Critical F = 4.3359 (alpha = 0.01, df = 5,17)
 = 2.8100 (alpha = 0.05, df = 5,17)

Since F > Critical F REJECT Ho: All equal (alpha = 0.05)

Title: 8878 Seabrook Station A. punctulata Fertilization
 File: 8878ap Transform: ARC SINE(SQUARE ROOT(Y))

Bonferroni t-Test - TABLE 1 OF 2 Ho: Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	TRANS t STAT	SIG 0.05
1	Lab	1.1663	0.8440		
2	0.01	1.1032	0.7950	1.5682	
3	0.05	1.1011	0.7942	1.7513	
4	0.1	1.0796	0.7767	2.3287	
5	1.0	1.0388	0.7410	3.4228	*
6	2.0	1.0535	0.7548	3.0273	*

Bonferroni t critical value = 2.5669 (1 Tailed, alpha = 0.05, df = 5,17)

Title: 8878 Seabrook Station A. punctulata Fertilization
 File: 8878ap Transform: ARC SINE(SQUARE ROOT(Y))

Bonferroni t-Test - TABLE 2 OF 2 Ho: Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	Lab	4			
2	0.01	3	0.0816	9.7	0.0490
3	0.05	4	0.0751	8.9	0.0498
4	0.1	4	0.0751	8.9	0.0673
5	1.0	4	0.0751	8.9	0.1030
6	2.0	4	0.0751	8.9	0.0892

HARDNESS BY CALCULATION

STUDY NUMBER: 8878
CLIENT: Seabrook
SAMPLE DESCRIPTION: Effluent & Site Diluent
ANALYSIS DATE: 07/31/00

SAMPLE DESCRIPTION	SAMPLE DAY	MAGNESIUM (mg/L)	CALCIUM (mg/L)	HARDNESS (mg/L)
EFFLUENT	0	1008.00	299.00	4897.5
SITE DILUENT	0	1004.00	304.90	4895.8

7 Day Chronic Assays
Chemical Analysis Inventory

STUDY: 2878	CLIENT: Seabrook Station	SAMPLE: Dominion Engineering	Diluent: Lab Salt
----------------	-----------------------------	---------------------------------	----------------------

	DAY 0 (START)	DATE: 7/24/00
CHEMISTRY	Dominion Stock Sol'n (2 mg/L)	LAB CONTROL
AMM	☺	☺
TS/TSS	☺	☺
HARDNESS	☺	☺
TOC	☺	☺
METALS	☺	☺
TRC (mg/L)	6.05	6.05

*Initial Weight of Sample Bottle (g)	Initials	Amount of Dominion Eng. Product Removed From Sample Container (mg)	Amount of Lab Salt Used to Mix 2.0 mg/L Solution	Used in What Assays?
Start (Day 0) 1097.6g	☺	0.0233 ^{23.3mg}	7L	MB/AB7DCR
Day 1	☺	0.0200g ^{20.0mg}	6L	MB/AB7DCR
Day 2	☺	0.02007g ^{20.1mg}	6L	MB/AB7DCR
Day 3	CE	0.02009g	6L	MB/AB7DCR
Day 4	☺	0.01999g	6L	MB/AB7DCR
Day 5	☺	0.02005g	6L	MB/AB7DCR APDCR
Day 6	☺	0.02005g	6L	MB/AB7DCR
Final weight of Sample Bottle (g)	CE	1096.4		

NOTES: * weight w/ cap on bottle

ENVIROSYSTEMS, INCORPORATED

STUDY NUMBER: 8878

CLIENT: Seabrook Station

TEST TYPE: 7 DAY CHRONIC RENEWAL

TEST SUBSTANCE: Dominion Engineering product

STUDY INITIATION DATE: 7/29/00 TEST SPECIES: Americamysis bahia & Menidia beryllina

Use 2.0 mg/L as the highest tested concentration and as a stock solution to dilute other test concentrations.

For Day 0 (need about 4L per concentration to mix both species together):

23.3mg of Dominion sample is mixed into 7 L of Hampton Estuary Lab Salt at 30 ppt plus 0.070mg H₂O₂

$23.3\text{mg} = 0.0233\text{g}$

$0.070\text{mg} = 7 \times 10^{-5}\text{g} = 0.00007\text{g}$

- 4L of this is used as **2.0 mg/L**
- 3L of this is mixed with 3L of Lab Salt
 - 4L of this is used as **1.0 mg/L**
 - 800mL of this is mixed with 7.2L of Lab Salt
 - 1.2L is discarded
 - 4L of this is used as **0.1 mg/L**
 - 4L of this is mixed with 4L Lab Salt
 - 4L of this is used as **0.05 mg/L**
 - 1L is mixed with 4L Lab Salt
 - 3L is discarded
 - 4L of this solution is used as **0.01 mg/L**
 - 1L is discarded

700µ to 100ml
then
1ml to 100ml
= 0.00007g
1ml into 7L
bucket

For Renewal Days (need about 3L per concentration to mix both species together):

20 mg of Dominion sample is mixed into 6L of Hampton Estuary Lab Salt at 30 ppt plus 0.060mg H₂O₂

0.0200g

- 3L is used as **2.0 mg/L** solution
- 3L is mixed with 3L of Lab Salt
 - 3L of this is used as **1.0 mg/L**
 - 600mL of this is mixed with 5400mL of Lab Salt
 - 2.4L is discarded
 - 3L of this is used as **0.1 mg/L**
 - 3L of this is mixed with 3L of Lab Salt
 - 3L of this is used as **0.05 mg/L**
 - 1L of this is mixed with 4L Lab Salt
 - 3L of this is used as **0.01 mg/L**
 - 2L is discarded

600µ to 100ml
= 0.006
1ml 0.006 to 100ml
= 0.00006
1ml 0.00006 to 6L

Please Initial if samples were mixed as described above. If not, attach documentation describing process.		
	Initials	Notes
Day 0	<u>TS</u>	Lab Salt at 28ppt 7/29/00
Day 1	<u>TS</u>	lab salt at 28ppt 7/21/00
Day 2	<u>TS</u>	lab salt @ 28ppt 7/22/00
Day 3	<u>TS</u>	lab salt @ 30ppt 7/23/00
Day 4	<u>TS</u>	lab salt @ 28ppt 7/24/00
Day 5	<u>TS</u>	lab salt @ 28ppt 7/25/00
Day 6	<u>TS</u>	lab salt @ 28ppt 7/26/00

LABORATORY SAMPLE RECEIVING LOG

1. ESI Sample Number 8878
2. Sponsor Name and Address Seabrook Station
Route 1, PO Box 300
Seabrook, NH 03874
3. Sponsor Sample Identification Scale Conditioning Agent (SCA)
4. Sample Container Label Data see below
5. Date Received 7/7/00 6. Data Photographed N/A
7. Method of Shipment Shipped from Dominion Engineering, Washington, DC 20064
Via FedEx
8. Description of Shipping Containers(s) 1 small cardboard box
(Number, Type, Size)
9. Description of Sample Container(s) 1 liter plastic jar
(Number, Type, Size)
10. Sample Storage Location and Required Storage Conditions room temperature
11. Signature Christine Emery Date 7/7/00
12. Notes

Sample container info:

100 ppm 2,2' bipyridyl
100 ppm dimethylamine
600 ppm N-methyl pyrrolidone

ATTACHMENT 2 TO NYE-00025

Please reduce your browser font size for better viewing and printing.

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-493-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

DIMETHYLAMINE (25-40% AQUEOUS SOLUTIONS)

MSDS Number: D5793 --- Effective Date: 06/16/97

1. Product Identification

Synonyms: methanamine, N-methyl
CAS No.: 124-40-3
Molecular Weight: 45.09
Chemical Formula: (CH₃)₂NH
Product Codes: J.T. Baker: J407 Mallinckrodt: 2393

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Dimethylamine	124-40-3	25 - 40%	No
Water	7732-18-5	60 - 75%	No

3. Hazards Identification

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES BURNS TO ANY AREA OF CONTACT.

Potential Health Effects
-----**Inhalation:**

Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. May cause lung edema, a medical emergency.

Ingestion:

Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach. Can cause sore throat, vomiting, diarrhea.

Skin Contact:

Corrosive. Symptoms of redness, pain, and severe burn can occur. May be absorbed through the skin causing nausea, headache and general discomfort.

Eye Contact:

Vapors are highly irritating and can cause corneal damage. Contact with liquid can cause severe burns and blindness.

Chronic Exposure:

Chronic exposure may cause dermatitis, conjunctivitis, and lung problems.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician immediately.

Ingestion:

DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician immediately.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician, immediately. Wash clothing before reuse.

Eye Contact:

Immediately flush eyes with gentle but large stream of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Call a physician immediately.

5. Fire Fighting Measures

Fire:

Flash point: -18C (0F) Autoignition temperature: 430C (806F) Flammable limits in air % by volume: lel: 2.8; uel: 14.4 Extremely Flammable Liquid.

Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back. Sensitive to static discharge.

Fire Extinguishing Media:

Stop flow before extinguishing fire. Dry chemical, alcohol foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. ~~Do not flush to sewer!~~
~~Use water spray to reduce vapors and dilute spills to nonflammable mixtures.~~

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL): 10 ppm (TWA) -ACGIH Threshold Limit Value (TLV): 5 ppm (TWA), 15 ppm (STEL)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a half-face respirator with an ammonia/methylamine cartridge may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece respirator with an ammonia/methylamine cartridge may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. The recommended cartridge is not specifically approved for this substance. Organic vapor cartridges have a service life of less than 30 minutes with this material.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:

There is insufficient data in the published literature to assign complete numerical SAF-T-DATA* ratings and laboratory protective equipment for this product. Special precautions must be used in storage, use and handling. Protective equipment for laboratory bench use should be chosen using professional judgment based on the size and type of reaction or test to be conducted and the available ventilation, with overriding consideration to minimize contact with the chemical.

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Ammonia odor.

Solubility:

Very soluble in water.

Specific Gravity:

0.83 - 0.93

pH:

Highly alkaline.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

No information found.

Melting Point:

No information found.

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

No information found.

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Burning may produce carbon monoxide, carbon dioxide, nitrogen oxides.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Oxidizing agents, acids, acrylaldehyde, fluorine, chlorine, mercury, and maleic anhydride. It will attack some forms of plastics, rubber, and coating.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 698 mg/kg; inhalation rat LC50: 4540 ppm/6H; investigated as a mutagen.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Dimethylamine (124-40-3)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

When released into the soil, this material is expected to quickly evaporate. When released into the soil, this material may leach into groundwater. ~~When released into the soil, this material may biodegrade to a moderate extent. When released into water, this material is expected to readily biodegrade. When released into the water, this material is expected to have a half-life between 1 and 10 days. This material has an estimated bioconcentration factor (BCF) of less than 100. This material is not expected to significantly bioaccumulate.~~ When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of less than 1 day. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.

Environmental Toxicity:

~~No information found.~~

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

 Proper Shipping Name: DIMETHYLAMINE SOLUTION
 Hazard Class: 3, 8

UN/NA: UN1160
 Packing Group: II
 Information reported for product/size: 3KG

International (Water, I.M.O.)

 Proper Shipping Name: DIMETHYLAMINE, SOLUTION
 Hazard Class: 3.2, 8
 UN/NA: UN1160
 Packing Group: II
 Information reported for product/size: 3KG

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----

Ingredient	TSCA	EC	Japan	Australia
Dimethylamine (124-40-3)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----

Ingredient	Korea	--Canada--		Phil.
		DSL	NDSL	
Dimethylamine (124-40-3)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----

Ingredient	-SARA 302-		-SARA 313-	
	RQ	TPQ	List	Chemical Catg.
Dimethylamine (124-40-3)	No	No	Yes	No
Water (7732-18-5)	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----

Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8 (d)
Dimethylamine (124-40-3)	1000	U092	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: Yes TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
 Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2PE
Poison Schedule: No information found.

WHMIS:
 This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 3 Reactivity: 0

Label Hazard Warning:

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES BURNS TO ANY AREA OF CONTACT.

Label Precautions:

No SAF-T-DATA Ratings have been developed for this product. Read and follow all warnings, precautions, instructions and other safety and handling information on the label and MSDS. Do not breathe vapor. Do not get in eyes, on skin, or on clothing. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Keep away from heat, sparks and flame.

Label First Aid:

In all cases call a physician immediately. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Product Use:

Laboratory Reagent.

Revision Information:

Mixture. New 16 section MSDS format, all sections have been revised.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

Please reduce your browser font size for better viewing and printing.

MSDS

Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7515

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

1-METHYL-2-PYRROLIDINONE

MSDS Number: M7114 --- Effective Date: 11/17/99

1. Product Identification

Synonyms: N-methylpyrrolidinone; N-methyl-2-pyrrolidone; NMP; M-Pyrol

CAS No.: 872-50-4

Molecular Weight: 99.13

Chemical Formula: C₅H₉NO

Product Codes:

J.T. Baker: 6337, 6347, 6397, 639R, 6407, 9261, R053, R056

Mallinckrodt: 2575, 6392

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
1-Methyl-2-pyrrolidinone	872-50-4	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. HARMFUL IF SWALLOWED OR INHALED. COMBUSTIBLE LIQUID AND VAPOR.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight

Flammability Rating: 2 - Moderate

Reactivity Rating: 1 - Slight

Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES; LAB COAT; CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:

Mild irritant if vapor or mist from heated solvent is inhaled. Coughing, possible breathing difficulties may be observed.

Ingestion:

Causes irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea.

Skin Contact:

Mild irritant, may cause some discomfort if in contact with the skin for several hours.

Eye Contact:

Causes irritation, redness, and pain. May possibly cause corneal clouding.

Chronic Exposure:

Minor skin irritation on repeated contact.

Aggravation of Pre-existing Conditions:

No information found.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Flash point: 93C (199F) CC

Autoignition temperature: 346C (655F)

Flammable limits in air % by volume:

l_{el}: 0.99; u_{el}: 3.9

Combustible.

Explosion:

Above the flash point, explosive vapor-air mixtures may be formed.

Fire Extinguishing Media:

Dry chemical, foam or carbon dioxide.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust.

Do not flush to sewer!

J. T. Baker SOLUSORB(R) solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Keep in a tightly closed container. Store in a cool, dry, ventilated area away from sources of heat or ignition. Protect against physical damage. Store separately from reactive or combustible materials, and out of direct sunlight. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

AIHA Workplace Environmental Exposure Level (WEEL):10 ppm, 8-hour, TWA

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

For conditions of use where exposure to the substance is apparent, consult an industrial hygienist. For emergencies, or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Slight amine odor.

Solubility:

Miscible in water.

Specific Gravity:

1.03

pH:

7.7

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

202C (396F)

Melting Point:

-24C (-11F)

Vapor Density (Air=1):

3.4

Vapor Pressure (mm Hg):

0.5 @ 25C (77F)

Evaporation Rate (BuAc=1):
0.06

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Hygroscopic and basic.

Hazardous Decomposition Products:

Burning may produce carbon monoxide, carbon dioxide, nitrogen oxides.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Strong oxidants and acids. Reacts with chlorinating agents to form the amide. Reacts with sulfur or carbon disulfide at high temperatures and pressures.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

1-Methyl-2-pyrrolidinone:

Oral rat LD50: 3914 mg/kg;

Skin rabbit LD50: 8 gm/kg;

Investigated as a mutagen, reproductive effector.

-----\Cancer Lists\-----

Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
1-Methyl-2-pyrrolidinone (872-50-4)	No	No	None

12. Ecological Information

Environmental Fate:

When released into the soil, this material may biodegrade to a moderate extent. When released into the soil, this material may evaporate to a moderate extent. When released into water, this material is not expected to evaporate significantly. This material is not expected to significantly bioaccumulate.

When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.

Environmental Toxicity:

The LC50/96-hour values for fish are over 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: COMBUSTIBLE LIQUID, N.O.S. (1-METHYL-2-PYRROLIDINONE)

Hazard Class: COMB

UN/NA: NA1993

Packing Group: III

Information reported for product/size: 460LB

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----
Ingredient TSCA EC Japan Australia

1-Methyl-2-pyrrolidinone (872-50-4) Yes Yes Yes Yes

-----\Chemical Inventory Status - Part 2\-----
Ingredient Korea DSL NDSL Phil.

1-Methyl-2-pyrrolidinone (872-50-4) Yes Yes No Yes

-----\Federal, State & International Regulations - Part 1\-----
Ingredient -SARA 302- -SARA 313-
RQ TPQ List Chemical Catg.

1-Methyl-2-pyrrolidinone (872-50-4) No No Yes No

-----\Federal, State & International Regulations - Part 2\-----
Ingredient CERCLA -RCRA- -TSCA-
261.33 8(d)

1-Methyl-2-pyrrolidinone (872-50-4) No No No

Chemical Weapons Convention: No TSCA 12(b): Yes CDTA: No
SARA 311/312: Acute: Yes Chronic: No Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

Australian Hazchem Code: No information found.

Poison Schedule: No information found.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 2 Flammability: 1 Reactivity: 0

Label Hazard Warning:

WARNING! CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. HARMFUL IF SWALLOWED OR INHALED. COMBUSTIBLE LIQUID AND VAPOR.

Label Precautions:

Avoid contact with eyes, skin and clothing.

Avoid breathing vapor or mist.

Keep container closed.

Use only with adequate ventilation.

Keep away from heat and flame.

Wash thoroughly after handling.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

No changes.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

MATERIAL SAFETY DATA SHEET

1 5 5 8

Avecia Inc.

1405 Foulk Rd., P.O. Box 15457
Wilmington, Delaware 19850-5457
Phone: (800) 435-8679
10/25/93
Medical Emergency: (800) 286-7850

Issue Date:

Rev: C
PROD CODE: 29305

For a transport accident or leak, fire or major spill, call
CHEMICAL EMERGENCY RESPONSE CENTER, (800) 424-2466

SECTION 1 NAME & HAZARD SUMMARY

Material name: ~~2,2'-BIPYRIDYL~~

Hazard summary (as defined by OSHA Hazard Comm. Std., 29 CFR 1910.1200):

Physical hazards: None

Health hazards: ~~Harmful (skin, eye, respiratory passages), toxic (oral),
harmful (dermal)~~

Read the entire MSDS for a more thorough evaluation of the hazards.

SECTION 2 INGREDIENTS

2,2'-Bipyridyl (CAS 366-18-7)

%	OSHA PEL
	Not listed

Ingredients not precisely identified are proprietary or nonhazardous.
Values are not product specifications.

SECTION 3 PHYSICAL DATA

*** Appearance and odor: Pink crystals
Melting point: 156.2°F, 69°C
Vapor pressure (mm Hg at 20°C): No data
Vapor density (air = 1): No data
Solubility in water: About 0.5%
*** pH: 8 (5 g/l water)
Specific gravity: No data
% Volatile by volume: Negligible

SECTION 4 FIRE AND EXPLOSION HAZARD DATA

~~Flash point: 21°C, 249.8°F~~
Autoignition temperature: No data
Flammable limits (STP): Not applicable

Extinguishing media:

Water fog, foam, carbon dioxide, dry chemical, halogenated agents.

Special fire fighting protective equipment:

Self-contained breathing apparatus with full facepiece and protective clothing.

Unusual fire and explosion hazards:

This product may form explosive dust clouds in air. Possible toxic smoke, vapors, fallout and runoff water can result from fires depending on extent of combustion and presence of other combustible materials.

Contaminated buildings, areas, and equipment must be properly decontaminated before reuse.

SECTION 5 REACTIVITY DATA

Stability:

Stable under normal conditions.

Incompatibility:

Oxidizing agents.

Hazardous decomposition products:

Combustion products: Carbon dioxide, carbon monoxide. Nitrogen oxides, ammonia.

Hazardous polymerization:

Not known to occur.

SECTION 6 HEALTH HAZARD ASSESSMENT

General:

Limited toxicity data are available on this specific product; this health hazard assessment is based on the results of screening tests and information from the scientific literature.

Ingestion:

The acute oral LD50 in rat is 100 mg/kg. Relative to other materials, this material is classified as "moderately toxic" by ingestion. The animals which survived the single oral doses had slight tremors which persisted for up to 48 hours. If swallowed, symptoms of exposure may include tremors and muscular incoordination. The appearance of orange-colored urine may indicate significant absorption regardless of route of exposure.

Eye contact:

This material is mildly irritating in rabbit eye irritation studies. A similar degree of irritation will probably occur after human eye contact.

Skin contact:

This material is slightly irritating in rabbit dermal irritation studies. Short contact periods with human skin will probably not produce irritation. Irritation can develop following repeated and/or prolonged contact with human skin. This material was not a skin sensitizer in animal testing. The potential is low for developing sensitization following contact with human skin.

Skin absorption:

~~This material is absorbed through skin. The dermal LD50 in animals is reported to be between 625 and 1,250 mg/kg. Relative to other materials,~~

~~this material is classified as "slightly toxic" by skin absorption.~~

Inhalation:

Particulates of this material can irritate respiratory passages.

Other effects of overexposure:

Rats orally administered this material at ~~50 mg/kg for 14 consecutive days developed anemia, no other adverse effects occurred.~~

Intraperitoneal injections to pregnant rats induced birth defects, primarily affecting the limbs. This indicates this material has some teratogenic potential. However, this route of administration has little relevance to potential industrial exposures.

---continued---

(Continued) 2,2'-BIPYRIDYL

Page 3

SECTION 6 HEALTH HAZARD ASSESSMENT (continued)

Other effects of overexposure (continued):

Because exposure potential is a critical element in the expression of a potential health hazard, this product, if handled in accordance with good industrial hygiene practice, will not present an actual hazard in the workplace.

First aid procedures:

Skin: Wash material off of the skin with plenty of soap and water. If redness, itching, or a burning sensation develops, get medical attention. Wash contaminated clothing and decontaminate footwear before reuse.

Eyes: Immediately flush with plenty of water for at least 15 minutes. If redness, itching, or a burning sensation develops, have eyes examined and treated by medical personnel.

Ingestion: Give 1 or 2 glasses of water to drink and induce vomiting by sticking finger down throat. Repeat until vomitus is clear. Refer person to medical personnel. (Never give anything by mouth to an unconscious person.)

Inhalation: Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is labored, give oxygen. Consult medical personnel.

~~SECTION 7 SPILL OR LEAK PROCEDURES~~

Steps to be taken in case material is released or spilled:

Wear skin, eye, and respiratory protection during cleanup. Sweep up and recover or mix material with a moist absorbent and shovel into a chemical waste container. Cover container and remove from work area. ~~Wash residue from spill area with water containing detergent and flush to a sewer served by a wastewater treatment facility.~~

~~Disposal method:~~

~~classified as "slightly toxic" by skin absorption.~~

this material can irritate respiratory passages.

overexposure:

Administered this material at ~~50 mg/kg for 14 consecutive~~
~~injections, no other adverse effects occurred.~~

Injections to pregnant rats induced birth defects,
including the limbs. This indicates this material has some
potential. However, this route of administration has little
potential industrial exposures.

TRIDYL

Page 3

HAZARD ASSESSMENT (continued)

overexposure (continued):

Health hazard potential is a critical element in the expression of a
health hazard, this product, if handled in accordance with good
hygiene practice, will not present an actual hazard in the

Measures:

Remove material off of the skin with plenty of soap and water. If
burning, or a burning sensation develops, get medical attention.
Remove contaminated clothing and decontaminate footwear before reuse.
Immediately flush with plenty of water for at least 15 minutes. If
burning, or a burning sensation develops, have eyes examined and
treated by medical personnel.

Give 1 or 2 glasses of water to drink and induce vomiting by
gagging down throat. Repeat until vomitus is clear. Refer
victim to medical personnel. (Never give anything by mouth to an
unconscious person.)

Remove victim to fresh air. If not breathing, give
artificial respiration, preferably mouth-to-mouth. If breathing is
difficult, give oxygen. Consult medical personnel.

~~SPILLAGE PROCEDURES~~

Actions to be taken in case material is released or spilled:

Use appropriate personal protective equipment, and respiratory protection during cleanup. Sweep up and
contain spilled material with a moist absorbent and shovel into a chemical
resistant container. Cover container and remove from work area. ~~Wash residue~~
~~with water containing detergent and flush to a sewer~~
~~with wastewater treatment facility.~~

This product is toxic by inhalation and skin absorption and must be handled with caution. ~~Discarded product is not a hazardous waste under RCRA, 40 CFR 261~~

~~Container disposal:~~

~~Empty container retains product residue. Observe all hazard precautions. Do not distribute, make available, furnish or reuse empty container except for storage and shipment of original product. Remove all product residue from container and puncture or otherwise destroy empty container before disposal.~~

SECTION 8 SPECIAL PROTECTION INFORMATION

TLV® or suggested control value:

No ACGIH TLV or OSHA PEL assigned. Minimize exposure in accordance with good hygiene practice. Avecia INC. operates its facility such that exposures

to 4,4'-bipyridyl are kept below 0.028 mg/m³. A similar exposure limit is appropriate for 2,2'-bipyridyl.

Ventilation:

Use ventilation adequate to maintain safe levels.

Respiratory protection:

Use MSHA-NIOSH approved respirator for organic vapors, dusts and mists whose TLV is greater than 0.05 mg/m³.

(Continued) 2,2'-BIPYRIDYL

Page 4

SECTION 8 SPECIAL PROTECTION INFORMATION (continued)

Protective clothing:

Gloves determined to be impervious under the conditions of use. Depending on conditions of use, additional protection may be required such as apron, arm covers, or full body suit. Wash contaminated clothing before rewearing. Use adequate clothing to prevent skin contact. Clean clothing on a routine basis.

Eye protection:

Chemical tight goggles.

Other protective equipment:

Eyewash station and safety shower in work area.

SECTION 9 SPECIAL PRECAUTIONS OR OTHER COMMENTS

Special precautions or other comments:

Follow procedures specified in the National Fire Protection Association

Codes and Standards for handling combustible dusts. Maintain good housekeeping to avoid dust buildup. Prevent skin and eye contact. Avoid breathing particulates. Thorough showering at the end of the work shift is strongly recommended. Work clothes should be disposable or be laundered daily.

SECTION 10 REGULATORY INFORMATION

TSCA (Toxic Substances Control Act) Regulations, 40 CFR 710:

All ingredients are on the TSCA Chemical Substance Inventory.

CERCLA and SARA Regulations (40 CFR 355, 370, and 372):

This product does not contain any chemicals subject to the reporting requirements of SARA Section 313.

The information herein is given in good faith
but no warranty, expressed or implied, is made.

Prepared/Reviewed: 10/25/93

CCDB: C11419

***This line or section contains revisions or new statements since the last issue date.

Hydrogen Peroxide, 50 wt% Solution in Water
ACROS97775

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Hydrogen Peroxide, 50 wt% Solution in Water

Catalog Numbers:

AC302860000, AC302865000

Synonyms:

Carbamide peroxide; Hydrogen dioxide; Peroxide; Hydroperoxide; Urea peroxide; Hydrogen peroxide 100 volumes;

Company Identification (Europe): Acros Organics N.V.
Janssen Pharmaceuticalaan 3a
2440 Geel, Belgium

Company Identification (USA): Acros Organics
One Reagent Lane
Fairlawn, NJ 07410

For information in North America, call: 800-ACROS-01

For information in Europe, call: 0032(0) 14575211

For emergencies in the US, call CHEMTREC: 800-424-9300

For emergencies in Europe, call: 0032(0) 14575299

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
7722-84-1	Hydrogen peroxide	30-50	231-765-0
7732-18-5	Water	Balance	231-791-2

Hazard Symbols: O C

Risk Phrases: 34 8

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: clear, colorless.

Danger! Strong oxidizer. Contact with other material may cause a fire. Corrosive. Light sensitive. Mutagen. May be harmful if swallowed. May cause central nervous system effects. Eye contact may result in permanent eye damage. May cause blood abnormalities. May cause severe respiratory tract irritation with possible burns. Causes eye and skin irritation and possible burns. May cause severe digestive tract irritation with possible burns.
Target Organs: Blood, central nervous system.

Potential Health Effects

Eye:

Contact with liquid is corrosive to the eyes and causes severe burns. Contact with the eyes may cause corneal damage.

Skin:

Causes severe skin irritation and possible burns. May cause discoloration, erythema, swelling, and the formation of papules and vesicles.

Ingestion:

Causes gastrointestinal irritation with nausea, vomiting and diarrhea. Causes gastrointestinal tract burns. May cause vascular collapse and damage. May cause damage to the red blood cells. May cause difficulty in swallowing, stomach distension, possible cerebral swelling and death. Ingestion may result in irritation of the esophagus, bleeding of the stomach and ulcer formation.

Inhalation:

Causes chemical burns to the respiratory tract. May cause ulceration of nasal tissue, insomnia, nervous tremors with numb extremities, chemical pneumonia, unconsciousness, and death. At high concentrations, respiratory effects may include acute lung damage and delayed pulmonary edema.

Chronic:

Prolonged or repeated skin contact may cause dermatitis. Laboratory experiments have resulted in mutagenic effects. Repeated contact may cause corneal damage.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:

Get medical aid immediately. Do NOT allow victim to rub or keep eyes closed. Extensive irrigation is required (at least 30 minutes).

Skin:

Get medical aid immediately. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Destroy contaminated shoes.

Ingestion:

Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately. Wash mouth out with water. Vomiting may occur spontaneously. If vomiting occurs and the victim is conscious, give water to further dilute the chemical.

Inhalation:

Get medical aid immediately. Remove from exposure to fresh air immediately. If breathing is difficult, give oxygen. DO NOT use mouth-to-mouth respiration. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask.

Notes to Physician:

Treat symptomatically and supportively. Attempts at evacuating the stomach via emesis induction or gastric lavage should be avoided. In the event of severe distension of the stomach or esophagus due to gas formation, insertion of a gastric tube may be required. To treat corneal damage, careful ophthalmologic evaluation is recommended and the possibility of local corticosteroid therapy should be considered.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. Strong oxidizer. Contact with combustible materials may cause a fire. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Substance is noncombustible. Use water with caution and in flooding amounts. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Some oxidizers may react explosively with hydrocarbons(fuel). May decompose explosively when heated or involved in a fire. May accelerate burning if involved in a fire.

Extinguishing Media:

Use water only! Do NOT use carbon dioxide. Do NOT use dry chemical. Do NOT get water inside containers. Contact professional fire-fighters immediately. Cool containers with flooding quantities of water until well after fire is out. For large fires, flood fire area with large quantities of water, while knocking down vapors with water fog.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Use water spray to disperse the gas/vapor. Remove all sources of ignition. Absorb spill using an absorbent, non-combustible material such as earth, sand, or vermiculite. Flush spill area with water. Provide ventilation. Do not get water inside containers. Keep combustibles (wood, paper, oil, etc.,) away from spilled material.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:

Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well ventilated area. Contents may develop pressure upon prolonged storage. Do not get in eyes, on skin, or on clothing. Keep container tightly closed. Avoid contact with clothing and other combustible materials. Do not ingest or inhale. Store protected from light. Discard contaminated shoes. Unused chemicals should not be returned to the container. Rinse empty drums and containers thoroughly with water before discarding.

Storage:

Keep away from heat, sparks, and flame. Do not store near combustible materials. Keep container closed when not in use. Store in a cool, dry, well-ventilated area away from incompatible substances. Store protected from light. Keep away from alkalis, oxidizable materials, finely divided metals, alcohols, and permanganates. Store below 35°C. Store only in light-resistant containers fitted with a safety vent.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:

Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Hydrogen peroxide	1 ppm ; 1.4 mg/m3	1 ppm TWA; 1.4 mg/m3 TWA 75 ppm IDLH	1 ppm TWA; 1.4 mg/m3 TWA
Water	none listed	none listed	none listed

OSHA Vacated PELs:

Hydrogen peroxide:
1 ppm TWA; 1.4 mg/m3 TWA

Water:

No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:

Wear appropriate protective gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Liquid
Appearance:	clear, colorless
Odor:	slight acid odor
pH:	3.3 (30% solution)
Vapor Pressure:	23 mm Hg @ 30C
Vapor Density:	1.10
Evaporation Rate:	>1.0 (Butyl acetate=1)
Viscosity:	1.25 cP
Boiling Point:	108 deg C @ 760 mmHg
Freezing/Melting Point:	-33 deg C
Autoignition Temperature:	Noncombustible
Flash Point:	Noncombustible
NFPA Rating:	Not published.
Explosion Limits, Lower:	40 vol %
Upper:	100 vol %
Decomposition Temperature:	Not available.
Solubility:	Miscible in water.
Specific Gravity/Density:	1.1-1.2 (30-50%)
Molecular Formula:	H2O2
Molecular Weight:	34.0128

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:

Decomposes slowly to release oxygen. Unstable when heated or contaminated with heavy metals, reducing agents, rust, dirt or organic materials. Stability is reduced when pH is above 4.0.

Conditions to Avoid:

Mechanical shock, incompatible materials, light, ignition sources, dust generation, excess heat, combustible materials, reducing agents, alkaline materials, strong oxidants, rust, dust, pH > 4.0.

Incompatibilities with Other Materials:

Strong oxidizing agents, strong reducing agents, acetic acid, acetic anhydride, alcohols, brass, copper, copper alloys, finely powdered metals, galvanized iron, hydrazine, iron, magnesium, nitric acid, sodium carbonate, potassium permanganate, cyanides (e.g. potassium cyanide, sodium cyanide), ethers (e.g. dioxane, furfuran, tetrahydrofuran (THF)), urea, chlorosulfonic acid, alkalies, lead, nitrogen compounds, triethylamine, silver, nickel, palladium, organic matter, charcoal, sodium borate, aniline, platinum, formic acid, cyclopentadiene, activated carbon, tert-butyl alcohol, hydrogen selenide, manganese dioxide, mercurous chloride, rust, ketones, carboxylic acids, glycerine, sodium fluoride, sodium pyrophosphate, soluble fuels (acetone, ethanol, glycerol), wood, wood, asbestos, hexavalent chromium compounds, salts of iron, copper, chromium, vanadium, tungsten, molybdenum, and platinum.

Hazardous Decomposition Products:

Oxygen, hydrogen gas, water, heat, steam.

Hazardous Polymerization: Will not occur.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:

CAS# 7722-84-1: MX0899000 MX0900000

CAS# 7732-18-5: ZC0110000

LD50/LC50:

CAS# 7722-84-1: Inhalation, rat: LC50 = 2 gm/m³/4H; Oral, mouse: LD50 = 2 gm/kg; Skin, rat: LD50 = 4060 mg/kg.

CAS# 7732-18-5: Oral, rat: LD50 = >90 mL/kg.

Carcinogenicity:

Hydrogen peroxide -

ACGIH: A3 - Animal Carcinogen

IARC: Group 3 carcinogen

Water -

Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.

Epidemiology:

No information available.

Teratogenicity:

No information available.

Reproductive Effects:

No information available.

Neurotoxicity:

No information available.

Mutagenicity:

CAS#: 7722-84-1 Mutation in Microorganisms: Salmonella typhimurium = 100 ug/plate.; Hyman, embryo = 50 umol/L.; Cytogenetic Analysis:

Human, embryo = 20 umol/L. Mutation in Mammalian Somatic Cells:

Hamster, lung = 1mmol/L.

Other Studies:

No data available.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:

Not available.

Fish: Carp: LC50 = 42 mg/L; 48 Hr; Unspecified

Fish: Fathead Minnow: LC50 = 16.4 mg/L; 96 Hr; Fresh water

Fish: Fathead Minnow: NOEC = 5 mg/L; 96 Hr; Fresh water

Water flea Daphnia: EC50 = 2.4 mg/L; 48 Hr; Fresh water

Fish: Channel catfish: LC50 = 37.4 mg/L; 96 Hr; Fresh water

Environmental Fate:

Rain washout is expected due to condensation of hydrogen peroxide on contact with water droplets. In the atmosphere, indirect photooxidation is predicted with a half-life of 10 to 20 hours.

Non-significant evaporation and adsorption from water surfaces and soil/sediments is expected. Rapid and considerable aerobic

biodegradation was determined with a half-life < 1 minute

(biological treatment sludge) and 0.3 to 2 days (fresh water).

Hydrogen peroxide is non-bioaccumulable.

Physical/Chemical:

Not available.

Other:

Not available.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT

Shipping Name: HYDROGEN PEROXIDE, AQUEOUS SOLUTION

Hazard Class: 5.1

UN Number: UN2014

Packing Group: II

Canadian TDG

No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA

CAS# 7722-84-1 is listed on the TSCA inventory.

CAS# 7732-18-5 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA

Section 302 (RQ)

None of the chemicals in this material have an RQ.

Section 302 (TPQ)

CAS# 7722-84-1: concentration > 52%: TPQ = 1000 pounds; RQ = 1000 pounds

SARA Codes

CAS # 7722-84-1: acute, flammable.

Section 313

No chemicals are reportable under Section 313.

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

CAS# 7722-84-1 is considered highly hazardous by OSHA.

STATE

Hydrogen peroxide can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

Water is not present on state lists from CA, PA, MN, MA, FL, or NJ.

California No Significant Risk Level:

None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: O C

Risk Phrases:

R 34 Causes burns.

R 8 Contact with combustible material may cause fire.

Safety Phrases:

S 28 After contact with skin, wash immediately with plenty of ... (to be specified by the manufacturer).

S 3 Keep in a cool place.
 S 36/39 Wear suitable protective clothing and eye/face protection.
 S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)

CAS# 7722-84-1: 0

CAS# 7732-18-5: No information available.

Canada

CAS# 7722-84-1 is listed on Canada's DSL/NDSL List.

CAS# 7732-18-5 is listed on Canada's DSL/NDSL List.

This product has a WHMIS classification of C, E, D2A.

CAS# 7722-84-1 is not listed on Canada's Ingredient Disclosure List.

CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 7722-84-1: OEL-AUSTRALIA:TWA 1 ppm (1.5 mg/m3)

OEL-BELGIUM:TWA 1 ppm (1.4 mg/m3)

OEL-DENMARK:TWA 1 ppm (1.4 mg/m3)

OEL-FINLAND:TWA 1 ppm (1.4 mg/m3);STEL 3 ppm (4.2 mg/m3)

OEL-FRANCE:TWA 1 ppm (1.5 mg/m3)

OEL-GERMANY:TWA 1 ppm (1.4 mg/m3)

OEL-THE NETHERLANDS:TWA 1 ppm (1.4 mg/m3)

OEL-THE PHILIPPINES:TWA 1 ppm (1.4 mg/m3)

OEL-SWITZERLAND:TWA 1 ppm (1.4 mg/m3);STEL 2 ppm (2.8 mg/m3)

OEL-TURKEY:TWA 1 ppm (1.4 mg/m3)

OEL-UNITED KINGDOM:TWA 1 ppm (1.5 mg/m3);STEL 2 ppm (3 mg/m3)

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 7/08/1999 Revision #0 Date: Original.

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.
