North Atlantic

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

The Northeast Utilities System

October 5, 2001

NPDES Permit NH0020338
NYE-01021
AR 01-07858-02

Ref: NYE-99017, NYE-98012
NYE-98021, NYE-98031
NYE-99017, NYE-00009
NYE-01009

United States Environmental Protection Agency
Region I
Attn: Robert W. Varney, Regional Administrator
c/o Shelley B. Puleo, Environmental Protection Specialist
Municipal Assistance Unit
Office of EcoSystem Protection
John F. Kennedy Federal Building
Boston, Massachusetts 02203-0001

Seabrook Station
Sixth Supplement to NPDES Permit Renewal Application

North Atlantic Energy Service Corporation (NAESCO) hereby submits, pursuant to 40 CFR 122.21(d), a sixth supplement to its April 23, 1998[1] application to renew National Pollutant Discharge Elimination System (NPDES) Permit No. NH0020338 for Seabrook Station, a nuclear electric generating facility located in Seabrook, NH.

At Seabrook Station, plant discharges to the ocean environment are through the cooling water system discharge transition structure (NPDES Outfall 001). A number of internal water streams that flow to Outfall 001 are also identified and controlled in the permit. The purpose of this supplement is to request changes to the Outfall 001 requirements as well as the internal water streams.

[1] North Atlantic Energy Service Corporation letter NYE-98012, dated April 23, 1998, "NPDES Permit Renewal Application" Mr. Ted C. Feigenbaum (North Atlantic) to Mr. John P. DeVillars (EPA)

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Supplement 6 provides the following supplemental information to that submitted in the April 23, 1998 NPDES Permit Renewal Application:

1. Updated description of Makeup Water Treatment System and its discharges to Outfall 001 (Circulating Water System).

2. Description of new product acid and caustic discharges from the Steam Generator Blowdown Acid and Caustic Storage Tanks as an input chemical in the discharge from Outfall 025C (Waste Holdup Sump).

3. Toxicity test results of Methoxypropylamine (5.0 ppm) on sea urchin egg fertilization.

4. Inspection and Cleaning of Offshore Intake Structures

Enclosure 1 contains a description of the changes in the NPDES permit application being submitted in Supplement 6. Enclosure 2 provides revised pages for insertion into the original Seabrook Station NPDES Permit Renewal Application.

If you have any questions, please call John Hart, Manager of Environmental, Government and Owner Relations at (603) 773-7762.

Very truly yours,

NORTH ATLANTIC ENERGY SERVICE CORP.

Ted C. Feigenbaum
Executive Vice President and
Chief Nuclear Officer

Certification pursuant to 40 CFR 122.22(d)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Ted C. Feigenbaum
Executive Vice President and Chief Nuclear Officer

10/5/01
Date

STATE OF NEW HAMPSHIRE

Rockingham, ss.

Then personally appeared before me, the above-named Ted C. Feigenbaum, North Atlantic Energy Service Corporation, that he is duly authorized to execute and file the foregoing information in the name and on the behalf of North Atlantic Energy Service Corporation and that the statements therein are true to the best of his knowledge and belief.

Marilyn Sullivan, Notary Public
My Commission Expires: March 19, 2002

10/5/01
Date

cc:

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

Mr. George F. Wunder, Project Manager
Project Directorate I-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation
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.
NH Dept. of Environmental Services
Water Division
6 Hazen Drive
Concord, NH 03302

Mr. Brian Mazerski
Federal Consistency Coordinator
NH Coastal Program
Office of State Planning
State of New Hampshire
2 1/2 Beacon Street
Concord, NH 03301-4497

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

ENCLOSURE 1 TO NYE-01021

Description and Discussion of Changes Requested in Seabrook Station's
NPDES Permit in Supplement 6 to the Renewal Application

Description and Discussion of Changes Requested in Seabrook Station's NPDES Permit in Supplement 6 to the Renewal Application

This supplement makes the following changes to the April 23, 1998 NPDES Permit Renewal Application and the NPDES Permit Renewal Application Supplements referred to below:

1. **Updated description of Makeup Water Treatment System and its discharges to Outfall 001 (Circulating Water System).**

Seabrook Station replaced the Makeup Water Treatment System in 1994 – following issuance of the NPDES Permit in 1993 – with a leased Makeup Water Treatment System (MWTS) owned and operated by Ionics Inc. The April 1998 NPDES Permit Renewal Application (Page 129) stated that the MWTS discharges are described in the current NPDES Permit Appendix A. This description was developed in 1993 before the MWTS began operation and does not reflect actual operating conditions. The updated detailed description of the MWTS and its discharges, as provided in Enclosure 3, reflect actual operating conditions.

2. **Description of new product acid and caustic discharges from the Steam Generator Blowdown Acid and Caustic Storage Tanks as an input chemical in the discharge from Outfall 025C (Waste Holdup Sump).**

Seabrook Station has determined that it is necessary to conduct inspection and repairs on the Steam Generator Blowdown System Acid and Caustic Storage Tanks. This is expected to be a very infrequent evolution. This work will require that acid or caustic be removed from the tank before work can be safely performed. The new product sulfuric acid (96%) or sodium hydroxide (50%) would be drained from the tank into the Waste Holdup Sump (Outfall 025) where it would be neutralized prior to discharging the neutralized solution to the ocean discharge (Outfall 001). The only alternative for draining the acid or caustic storage tanks is to manually pump the acid or caustic to drums. This option involves a significant safety hazard associated with pumping highly concentrated acid or caustic. The preferred option, described here, involves no safety hazard and no impact to the environment since the acid or caustic will be neutralized.

Sulfuric acid and sodium hydroxide in these storage tanks are used for the regeneration of the Steam Generator Blowdown System demineralizer resin beds. The quantity of sulfuric acid or sodium hydroxide to be neutralized would be minimized by not replenishing the acid or caustic supply in the tanks after the last demineralizer regeneration. The remaining sulfuric acid or sodium hydroxide – estimated to be up to 150 gallons for the acid tank or 225 gallons for the caustic tank – would be drained to the Waste Holdup Sump, where it would be neutralized. Neutralization of the Waste Holdup Sump contents is performed in accordance with the New Hampshire Department of Environmental Service Hazardous Waste Limited Permit (DES-HW-LP98-008). The contents of the Waste Holdup Sump would be sampled to ensure that the acid or caustic is neutralized and then discharged to the ocean discharge (Outfall 001).

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[2] North Atlantic Letters NYE-98031, dated September 18, 1998, "Second Supplement to NPDES Permit Renewal Application" and NYE-99017, dated August 11, 1999, Third Supplement to NPDES Permit Renewal Application," T. Feigenbaum (North Atlantic) to J. DeVillars (EPA)

Neutralization of acidic or caustic solutions is currently performed in the Waste Holdup Sump to protect the sump and connected equipment from degradation. The second and third NPDES Permit Renewal Supplements[2] describe Waste Holdup Sump neutralization. Supplement 6 proposes the discharge of neutralized new product acid or caustic.

3. Toxicity test results of Methoxypropylamine (5.0 ppm) on sea urchin egg fertilization.

The Fifth NPDES Permit Supplement[3] requested an increase in the current discharge limit for Methoxypropylamine (MPA) from 0.5 ppm to 5.0 ppm when the proposed Condensate Polisher System (CPS) is in operation. Aquatic toxicity information was provided that demonstrates that an MPA concentration of 5.0 ppm would not impact the aquatic environment. In the Fifth Supplement, North Atlantic committed to provide additional marine toxicity data on MPA for invertebrate reproduction, specifically on purple urchin (*Arbacia punctultata*) fertilization. This toxicity test was conducted by EnviroSystems, Inc, of Hampton, New Hampshire. The full toxicity report is provided as Enclosure 4.

It is important to note that mean egg fertilization was 86.6 percent in lab water (control) and that fertilization in all concentrations of MPA up to 50.0 ppm were not significantly different. A table of the test results is provided below.

MPA Concentration	Mean Fertilization
0.0 ppm	86.6%
0.5 ppm	85.4%
1.0 ppm	86.7%
5.0 ppm	86.6%
10.0 ppm	86.3%
20.0 ppm	86.7%
50.0 ppm	86.2%

The lowest concentration of MPA that had an effect (C-LOEC) was determined to be > 50.0 ppm and the highest concentration where no effect was observed (C-NOEL) was 50.0 ppm. This additional aquatic toxicity information further demonstrates that an MPA concentration of 5.0 ppm at Outfall 001, during operation of the Condensate Polisher System, would not impact the aquatic environment.

3 North Atlantic Energy Service Corporation letter NYE-01009, dated June 6, 2001, "Fifth Supplement to NPDES Permit Renewal Application" Mr. Ted C. Feigenbaum (North Atlantic) to Mr. Ira Leighton (EPA)

4. Inspection and Cleaning of Offshore Intake Structure

Seabrook Station has established a routine inspection frequency for the three offshore intake structures. This semiannual inspection is intended to ascertain the presence of fouling organisms on the intake structures that might attract browsing organisms which would then be susceptible to entrapment. Seabrook Station will inspect the intake structures during the late spring or early summer and fall of each year and remove the fouling organisms as necessary.

A description of an inspection and cleaning protocol was provided in the initial NPDES Permit Renewal Application in April 1998. The April 1998 description was submitted prior to the installation of the Seal Deterrent Barrier in 1999 and is now out-of-date. The original description contemplated the possibility that some future barrier might have been constructed using material not containing an anti-fouling protective coating. The Seal Deterrent Barrier is constructed from copper-nickel, the same anti-fouling coating as the outer surface of the intake structures.

During the first year following the installation of the Seal Deterrent Barrier Seabrook Station conducted inspections of the intake structures about every three months. Based on this inspection frequency it was determined that the inspection and cleaning frequency described above will adequately maintain control of fouling organisms on the intake structures.

ENCLOSURE 2 TO NYE-01021

Supplement 6 Revised Pages for Insertion into the Seabrook Station NPDES Renewal Application

List of Revised Pages

Remove	Insert
Page 129	Page 129 (supplement 6)
Page 133 (supplement 4)	Page 133 (supplement 6)
Page 133A (supplement 3)	Page 133A (supplement 6)
Page 174 (supplement 3)	Page 174 (supplement 6)
Page 235	Page 235 (supplement 6)

Discharge Information for Outfall 001
(Circulating Water System)

EPA Form 2C
Section II, Flows, Sources of Pollution and Treatment Technologies
Part B, Description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater.
Section V, Intake and Effluent Characteristics
Part V.D, List of Pollutants from Form 2C, Tables 2C-3 and 2C-4

Discharge includes wastewater from the following sources:

All permitted outfalls from this facility ultimately combine with the Circulating Water System and are discharged to the Atlantic Ocean. These oufalls are sampled at representative sample points prior to introduction to the Circulating Water System to ensure compliance with NPDES Permit effluent limitations and monitoring requirements.

In addition to the identified permitted outfalls which discharge to the Circulating Water System, the sources below may also be introduced:

- Cooling water drawn from three intake velocity caps and discharged through eleven double discharge diffuser nozzles in the Atlantic Ocean
- Closed loop cooling system leakage into the Service Water System.
- Residual chlorine. Chlorine is injected into the Circulating and/or Service Water Systems to prevent biofouling.
- Water Treatment System Neutralization Tank discharge ~~(Water Treatment System discharges are described in current NPDES Permit Appendix A)~~ (See description in Supplement 6, Enclosure 3). Supp. 6
- Water Treatment System waste mineral concentrates and regenerant chemicals (see description in Supplement 6, Enclosure 3).
- System drainage from systems which are not directed to another outfall
- Various seawater containing sumps that collect seawater leakage and return it to the Circulating Water System.
- Condensate hotwell discharges performed to control chemistry parameters, lower hotwell level, or drain for system maintenance.
- Brine discharge, system rinses, and in-place cleaning discharges from the future Steam Generator Blowdown ElectroDeIonization System (see description below).
- Rinses of the future Condensate Polishing System in support of start-up and periodically during standby conditions, rinses of the resin vessels following regenerations, regeneration wastewater, sampling system and grab sample waste, system leakage, and system drainage for maintenance (see description below).
- Steam Generator drainage
- Circulating Water System and Service Water System Forebay Water. Periodically sediment is removed from the forebays by a pumping process. The sediment is typically collected in lined dumpsters and the ocean water is returned to the forebay or may be directed to the Storm Drain System (Outfall 002B) which ultimately discharges to Outfall 001.

Discharge description:

The Circulating Water System provides Atlantic Ocean cooling water to the main condensers where the steam exhausted from the low pressure sections of the turbine is condensed and subsequently returned to the Condensate System and Feedwater System. The Circulating Water System also supplies cooling to several mechanical vacuum pump heat exchangers in the Condenser Vacuum System. The Service Water System provides Atlantic Ocean cooling water to various subsystem heat exchangers which are required to support normal operating conditions, shutdown conditions and emergency conditions.

- Hydrogen peroxide - Makeup Water Treatment System cleaning agent (Supp. 6)
- Sodium hypochlorite - Makeup water Treatment System sanitizing agent
- Diisopropylamine - trace quantities from sodium analyzer drains (Supp. 6)
- Sodium Chloride - Water treatment plant chemical additive, SGBD EDI cleaning agent.
- Sodium Hydroxide - Water treatment plant cleaning agent, CPS regenerant chemical.
- Suspended solids - all potential inputs to the discharge
- Citric Acid - trace quantities from silica analyzer drains
- Silica standard (500ppb) - trace quantities from calibration of silica analyzers
- Ammonium molybdate - trace quantities from silica analyzer drains
- Amino Acid - trace quantities from silica analyzers
- Hydrochloric acid - SGBD EDI cleaning agent and Makeup Water Treatment System
- Chlorhexidine Di-Gluconate (Hydrosep) - emergency eyewash station biological growth inhibitor
- Sulfuric Acid - CPS regenerant chemical.
- Bulab 9328 - Corrosion inhibitor for freshwater systems (used on auxilliary cooling tower previously)
- Bulab 6002 - Biocide for fresh water systems (used on auxilliary cooling tower previously)
- Acetaldehyde - potential breakdown product of ethanolamine, all sources of ethanolamine
- Acetic acid - potential breakdown product of ethanolamine, all sources of ethanolamine
- Diethylamine - potential breakdown product of ethanolamine, all sources of ethanoiamine
- Dimethylamine - potential breakdown product of ethanolamine, all sources of ethanolamine
- Monoethylamine - potential breakdown product of ethanolamine, all sources of ethanolamine
- Monomethylamine - potential breakdown product of ethanolamine, all sources of ethanolamine
- Triethanolamine - potential breakdown product of ethanolamine, all sources of ethanolamine
- Trimethylamine - potential breakdown product of ethanolamine, all sources of ethanolamine
- Acryionitrile - potential breakdown product of methoxypropylamine, all sources of methoxypropylamine
- Cresol-trace quantities front cleaning products, petroleum containing products
- Phenol - trace quantities from cleaning products
- ~~Flocon flocculent used in the Water Treatment System for removal of particles~~ (Stet (leave Flocon on list)) (~~Supp. 3~~ Supp. 6)
- Morpholine - Secondary chemical additive, Steam Generator soak agent, hotwell discharges
- Sodium thiosulfate - Water Treatment System additive for chlorine removal
- ~~Hypersperse – Antiscalant used in the Makeup Waste Treatment System~~ (~~Supp. 3~~ Supp. 6)
- Grease used to lubricate cooling water system traveling screen chains (Supp. 4)

/antiscalant

Proposed chemicals for future discharge:

- Chemicals identified in all other outfalls.

Note: Some of the chemicals listed below are also listed in other outfalls. They are listed below because they are also discharged directly into this outfall.

- Pyrolidine - Secondary chemical additive
- Carbohydrazide - Secondary and closed cooling loop additive
- Dimethylamine - Secondary chemical additive
- 5-aminopentanol - Secondary chemical additive
- 1,2 diaminoethane - Secondary chemical additive
- 3-hydroxyquinuclidine - Secondary chemical additive
- 2-amino,2-methylpropanol - Secondary chemical additive
- EDTA - Steam Generator and Generator Stator Coolant System cleaning agent
- EVAC Biocide - Under consideration for mollusk control in the Circulating Water System
- H-130M Biocide - Under consideration for mollusk control in the Circulating Water System
- Thruguard 300 - Under consideration to be used as an additive to the sodium hypochlorite injection line to reduce calcium carbonate scale formation.
- Diethylhydroxylamine - Secondary chemical additive

- Steam Generator scale conditioning agents containing one, or more, lower alkyl amines and/or lower alkanol amines, combined with one, or more cyclic imines. These Steam Generator scale conditioning agents may be used during outages. The scale removal process employs the use of a vendor demineralizer skid which is expected to remove all but trace quantities of these chemicals.

The following chemicals are proposed to be used in the Makeup Water Treatment System:

▪ Hypersperse - flocculent/antiscalant used in Makeup Water Treatment System	Supp. 6
▪ BetzDearborn Biomate - MBC2881Reverse osmosis biocide	Supp. 6
▪ Permacare Permatreat 191 - Inorganic antiscalant for RO	Supp. 6
▪ Minncare Cold Sterilant - Reverse osmosis biocide	Supp. 6
▪ Sodium Sulfite Anhydrous - Chlorine removal in feedwater to reverse osmosis unit	Supp. 6
▪ Sodium Metabisulfite - Chlorine removal in feedwater to reverse osmosis unit	Supp. 6

The following description is for 025C Steam Generator Blowdown Waste Holdup Sump only. Because portions of the other 025 outfalls interface with 025C, they are also briefly discussed.

Support equipment is needed to regenerate the resins in the Steam Generator Blowdown System recovery subsystem demineralizers. The basic regeneration equipment consists of an Acid Skid, a Caustic Skid and the Waste Holdup Sump.

Sulfuric acid is used to reactivate the Cation (positive ion) resin beads within the mixed-bed demineralizers and the lead cation bed demineralizer. Sodium hydroxide is used to reactivate the Anion (negative ion) resin beads within the mixed-bed demineralizers. ***Following a cation bed regeneration, the contents of the sump may be acidic with pH less than 2.*** To protect equipment in the Waste Holdup Sump, neutralization may be performed pursuant to Hazardous Waste Limited Permit DES-HW-LP-98-008 issued December 30, 1998. The Waste Holdup Sump transfers liquids to the Waste Liquid System for direct discharge to the Circulating Water System (Outfall 001) or to either of the Chemical Drain Treatment Tanks which are directed to the Waste Test Tanks (Outfall 025D). Manual startup of this process is needed to initiate the regeneration cycle. After the process is started the remainder is automatically sequenced. The entire regeneration process can be manually controlled. Interlocks ensure that only one mixed-bed demineralizer is regenerated at a time. Interlocks will also stop the regeneration cycle if there is not enough acid or caustic available to complete a cycle, or if the level in the Waste Holdup Sump is above a setpoint level

or greater than 12.5.

or caustic

Supp. 2 5 x pp. 6

Supp. 3

The Steam Generator Waste Holdup Sump is a 30,000 gallon sump designed to contain fluids from the regeneration of the demineralizer beds. It is a concrete sump lined with Plasite™ liner. The sump also captures some of the floor drains from the demineralizer room. The sump is normally directed to the Waste Liquid System for direct discharge to the Circulating Water System. ***It is sampled once prior to or during batch discharge for oil and grease and total suspended solids. The relatively low flow volume of the discharge and the buffering action of the seawater ensures that all pH limits at Outfall 001 are met.*** The sump may also be discharged to the Chemical Drain Treatment Tanks which are directed to the Waste Test Tanks. There is a recirculation system on the sump which allows for mixing and sampling prior to discharge. This recirculation system also contains components which remove larger suspended solids. The maximum discharge rate for the Waste Holdup Sump is 75 gpm.

Supp. 2

Alternate paths for this discharge:

- Waste Test Tank(s) (025D)
- Turbine Building Sump
- Storm Drains (if no beta/gamma radioactivity detected)
- Turbine Building Auxiliary Sump - (holding only - no discharge)

Potential chemicals in discharge:

- Any chemicals listed in outfalls Steam Generator Blowdown (025A) and Steam Generator Blowdown demineralizer Rinses (025B)

Note: Some of the chemicals listed below are also listed in outfalls 025A and 025B. They are listed below because they are also directly discharged into this outfall.

- Ammonia/Ammonium hydroxide - Secondary chemical additive (from thermal decomposition of hydrazine), Primary Component Cooling water drainage, Steam Generator drainage, sample system waste, trace quantities from silica analyzer cleaning
- Methoxypropylamine - Secondary chemical additive, Steam Generator drainage, sample system waste

k. The design, construction and capacity of all components of the cooling water System seaward of the inlets to the main condensers or other heat exchangers, as appropriate, of the Seabrook Station (the "Cooling Water Intake Structures") shall in all respects be in accordance with NPDES Permit Application No. NH0020338, as submitted on August 1, 1974, and the permittee's Application for a Permit to Discharge or Work in Navigable Waters and their Tributaries, submitted to the Corps of Engineers by letter of October 25, 1974 except as Specifically modified below:

(1) The Cooling Water Intake Structure shall have three intake ports.

(2) The permittee shall use an anti-fouling protective coating on the Cooling Water Intake Structures ~~The multiport diffuser shall be maintained free of marine fouling organisms. (The objective of this paragraph is to discourage the growth of organisms which might attract browsing fish which then would be susceptible to entrapment, Par. I.A.1.j.7 above).~~ that would discourage the growth of marine organisms on the intakes which might attract browsing fish which would then be susceptible to entrapment. ~~As an alternative to an anti-fouling protective coating, the permittee may establish a monitoring and cleaning program for any additional barriers or structures that are added to the intake structure for the purpose of deterring entrapment of marine mammals.~~

The permittee shall inspect the offshore intake structures during the late spring or early summer and fall of each year and remove the fouling organisms as necessary.

(3) The velocity of water as it enters the Cooling Water Intake Structures shall at no time exceed 1.0 foot per second.

(4) The Cooling Water Intake Structures shall incorporate such behavioral or other non-structural deterrents and barriers as the Regional Administrator and/or the Director determines to be appropriate under Section 316(b) of the Clean Water Act after reviewing the results of any permittee conducted studies and any other information available.

(5) NPDES Permits issued from time to time in regard to the Cooling Water Intake Structures for the Seabrook Station will contain such further limitations and requirements or be

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ENCLOSURE 3 TO NYE-01021

Makeup Water Treatment System Description

The Ionics Makeup Water Treatment System (MWTS) produces on average 150 gallons per minute (gpm) of treated water with an approximate 90 gpm waste mineral concentrate stream. The waste mineral concentrate stream is discharged to the Circulating Water System ocean discharge (Outfall 001).

In addition to the waste mineral concentrate stream, the chemicals listed below will be used for cleaning and maintaining the operation of the MWTS. Sodium hydroxide and hydrochloric acid used for batch chemical cleaning will be neutralized prior to discharge to Outfall 001. The MWTS waste mineral concentrate stream constituents and cleaning chemicals are identified below. Included are the expected discharge concentrations using conservatively low Circulating Water System flow assumptions. North Atlantic requests that the waste mineral concentrate stream constituents and cleaning chemicals be specified in the NPDES permit renewal to allow continued operation of the MWTS. The Catalytic Oxygen Removal System (CORS) identified below removes oxygen from the system by injecting hydrogen into the influent stream.

It should be noted that in the Third NPDES Permit Renewal Supplement, North Atlantic stated that the flocculent/antiscalant, Flocon, would be replaced by Hypersperse. North Atlantic now plans to continue to use Flocon and also plans to use Hypersperse in the future.

A. Discharge concentrations are based on a 240 gpm input where:

- 32 gpm waste stream is rejected from the ultrafilter filtration (UF) unit,
- 32 gpm waste stream is rejected from the reverse osmosis (RO) unit,
- 13 gpm waste stream from the EDI (electro-deionization) unit,
- 8 gpm from electrode flowstream reject, and
- 5 gpm from process analyzer sample flow.

The following table provides average and maximum observed discharge concentrations from the Makeup Water Treatment System in parts per million (ppm) prior to discharge into Outfall 001:

Parameter	Average Concentration	Maximum Concentration
Sodium	77	200
Calcium	108	250
Magnesium	36	80
Bicarbonate	376	548
Sulfate	156	365
Nitrate	2.5	11.4
Silica	39	84
Chloride	72	250
Chlorine	0	0
Flocon (sequestering agent)	10	10
TDS (sum of ions)	828	1497
Specific Conductivity	1098	1920
pH	7.7	7.9

B. Current required chemicals for operation and cleaning of the Makeup Water Treatment System. Provided below are the expected operation and cleaning frequencies, expected volume and concentration for each chemical as well as the expected discharge concentration at Outfall 001:

1) Hydrogen Peroxide

a) Purpose: Ultrafine Filtration (UF) membrane cleaning.
b) Expected Frequency: 2 times per year
c) Volume: 500 gallons (two-unit total)
d) Concentration: 10,000 ppm
e) Discharge pH:6-9
f) Discharge concentration with two circulating water pumps running = 0.40 ppm . (Note 4)

2) Hydrochloric Acid

a) Purpose: EDI/UF/RO/CORS (catalytic oxygen removal system) regeneration
b) Expected Frequency: 4 times per year
c) Volume: 65 gallons per CORS regeneration neutralization and 10 gallons per UF/RO cleaning.
d) Concentration: Not applicable
e) Discharge pH:pH = 3 in system but will be 6-8 pH in CW effluent upon discharge when performing EDI CIP.
f) Discharge concentration with one circulating water pump running is not applicable for UF, RO, and CORS bed cleaning (neutralized at Ionics RO feedtank prior to discharge to Neutralization Tank). System pH = 3 when performing EDI Clean-In-Place Procedure.

3) Sodium Hypochlorite

a) Purpose: EDI membrane sanitizing
b) Expected Frequency: 6 times per year
c) Volume: 10 gallons (two-unit total)
d) Concentration: 0.2 ppm FAC at discharge of EDI brine reject.
e) Discharge pH:6-8
f) Discharge concentration with one circulating water pump running = 0.000119 ppm during EDI Clean-In-Place (CIP) procedure.

4) Sodium Chloride

a) Purpose: EDI Cleaning
b) Expected Frequency: two times per year
c) Volume: 500 gallons (two-unit total)
d) Concentration: 36,000 ppm
e) Discharge pH:6-8
f) Discharge concentration with one circulating water pump running = 21.4 ppm

5) Sodium Hydroxide

a) Purpose: UF/RO/CORS regeneration
b) Expected Frequency: two times per year
c) Volume: 55 gallons for CORS bed regeneration / 10-14gal for UF/RO regeneration.
d) Concentration: N/A
e) Discharge pH: 6-8
f) Discharge concentration: Not applicable, neutralized at Ionics RO feedtank prior to discharge to Neutralization Tank.

6) Flocon

a) Purpose: Flocculent / Antiscalant
b) Frequency: Continuous
c) Injection rate: 1.00gph (two-unit total)
d) Concentration: 20 ppm
e) Discharge pH: 6-8
f) Discharge concentration with one circulating water pump running = 0.00990 ppm. (Note 8)

The following chemicals are proposed to be used in the MWTS:

7) Hypersperse Antiscalant

a) Purpose: Flocculent / Antiscalant
b) Frequency: continuous
c) Injection rate: 1.00 (two-unit total)
d) Concentration: 20 ppm
e) Discharge pH: 6-8
f) Discharge concentration with one circulating water pump running = 0.00990 ppm (Note 8).

8) BetzDearborn Biomate MBC2881

a) Purpose: RO biocide
b) Expected Frequency: Once per month.
c) Volume: 1.6 gal (two-unit total)
d) Concentration: 20 ppm
e) Discharge pH: 6-8 (Note 5)
f) Discharge concentration with one circulating water pump running = 0.0119 ppm

9) Permacare Permatreat 191

a) Purpose: inorganic antiscalant for RO
b) Frequency: continuous
c) Injection rate: 1.62 gph (two-unit total)
d) Concentration: 20 ppm
e) Discharge pH: 6-8
f) Discharge concentration with one circulating water pump running = 0.0119 ppm

10) Minncare Cold Sterilant

a) Purpose: RO biocide
b) Expected Frequency: Once per month.
c) Volume: 6 gallons (two-unit total)
d) Concentration: 20 ppm
e) Discharge pH:pH = 3.5 in the system (Note 6)
f) Discharge concentration with one circulating water pump running = 0.0119 ppm

11) Sodium Sulfite Anhydrous

a) Purpose: Chlorine removal in feedwater to RO unit.
b) Frequency: Not used under normal plant conditions.
c) Volume: 30 gpd (Note 7)
d) Concentration: 20 ppm
e) Discharge pH:6-8
f) Discharge concentration with one circulating water pump running = 0.0119 ppm

12) Sodium Metabisulfite

a) Purpose: Chlorine removal in feedwater to RO unit.
b) Frequency: Not used under normal plant conditions.
c) Injection rate: 30 gpd (Note 7)
d) Concentration: 20 ppm
e) Discharge pH:6-8
f) Discharge concentration with one circulating water pump running = 0.0119 ppm

General Notes:

1) Approximately 1-20 ppm of the sodium hydroxide and/or hydrochloric acid will be flushed at 130 gpm for approximately one hour during initial MWTS startup after chemical cleaning of the UF, RO, or CORS units. Expected pH is 5-9 with total volume of 7200 gallons. This may be sequestered in the Neutralization Tank until the tank is full.

2) Ionics total waste stream of 100 gpm and one circulating water pump flow = 168,300 gpm used in discharge calculations.

3) During plant outages, it is possible to have a dilution flow as low as 11,000 gpm (one Service Water pump) due to Circulating Water System outages. Chemical cleanings, injection of antiscalants, and injection of biocides shall not be performed during these periods. Seabrook Station's Chemistry Procedure for Non-radiological Effluent Releases (CP 9.3) ensures that NPDES limits for Outfall 001 will not be exceeded during Circulating Water System outages.

4) Although Ionics anticipates that 60-70% of the hydrogen peroxide will be consumed during the cleaning process, 10,000 ppm is used for calculating final concentration at Outfall 001. 500 gal of 10,000 ppm H2O2 discharged to neutralization tank. Neutralization tank level must be >65% for discharge: (10,000 ppm)(500gal)/20792 gal @ 65% level = 241 ppm H2O2 due to dilution. Discharge of neutralization tank to Outfall 001 results in (241 ppm)(600 gpm)/365,000 gpm = 0.40 ppm H2O2. (maximum volume of neutralization tank = 31,988 gal. Two CW pump flow = 365,000 gpm, two neutralization tank pumps flow = 600 gpm)

5) If hydrochloric acid were used with BetzDearborn Biomate MBC2881, the resulting pH would be 1.5 to 2.0 pH. This will be neutralized at Ionics RO feedtank prior to discharge to the Neutralization Tank.

6) Minncare Cold Sterilant can be neutralized to a discharge pH of 6-8 at Ionics RO feedtank prior to discharge.

7) Sodium metabisulfite and Sodium sulfite anhydrous injection rate based on 2:1 ratio of chemical concentration to free available chlorine concentration (Fire Tank TRO of 3 ppm used) and a 240 gpm feed rate to both RO units (calculation provided by Ionics). This would be necessary if the Activated Carbon beds were unable to successfully remove the hypochlorite from the feed water into the RO/EDI unit.

8) Flocon / Hypersperse calculation for 1 CW pump flow and bulk chemical concentration of 10%: Injection flow x Injection concentration = Discharge flow x Discharge concentration. Discharge concentration = [(1.00gph ÷ 60min/hour)(100,000ppm)] ÷ 168,300 gpm 1 CW pump flow = 0.00990ppm at the DTS. MWST Flocon and Hypersperse injection shall be limited to 1.00gph maximum for both trains combined.

ENCLOSURE 4 TO NYE-01021

TOXICOLOGICAL EVALUATION
OF COOLING WATER
ADDITIVE 3-METHOXYPROPYLAMINE (3-MPA)

North Atlantic Energy Service Corp.
Seabrook, New Hampshire

Prepared For

North Atlantic Energy Services Corp.
Seabrook Station
Rt. 1, P.O. Box 300
Seabrook, New Hampshire 03874

By

EnviroSystems, Incorporated
One Lafayette Road
Hampton, New Hampshire 03842

August 2001
Reference Number 9754-01-08

STUDY NUMBER 9756

EXECUTIVE SUMMARY

The following summarizes the results of bioassays conducted during August 2001 to assess chronic toxicity of the cooling water additive 3-Methoxypropylamine. A 60 minute chronic fertilization assay was conducted using the sea urchin, *Arbacia punctulata.*

Chronic Evaluation of Toxicity

Species	Exposure	C-NOEL	C-LOEC	IC-25
Arbacia punctulata	60 Minutes	50.0 ppm	>50.0 ppm	> 50.0 ppm

Authorized Signature: _____ 9/17/01

President~EnviroSystems, Incorporated Date

TOXICOLOGICAL EVALUATION OF COOLING WATER ADDITIVE: 3-METHOXYPROPYLAMINE (3-MPA)

North Atlantic Energy Services Corp.
Seabrook, New Hampshire

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.

Chronic tests evaluate toxicity based on sublethal effects. Fertilization of *Arbacia punctulata* eggs is measured to determine cooling water 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). *A. punctulata* fertilization data are also evaluated to determine the cooling water concentration where a 25% reduction in fertilization rates occurs. This is known as the Inhibition Concentration (IC-25).

This report presents the results of a toxicity test conducted on an cooling water additive, 3-Methoxypropylamine (3-MPA), provided by North Atlantic Energy Services Corp., Seabrook, NH . Testing was based on programs and protocols developed by the US EPA (1993) and involved a 60 minute chronic fertilization assay with the purple sea urchin, *A. punctulata.* Testing was performed at EnviroSystems, Incorporated (ESI), Hampton, New Hampshire.

2.0 MATERIALS AND METHODS

2.1 General Methods

Toxicological and analytical protocols used in this program follow procedures outlined in *Short-Term Methods for Estimating the Chronic Toxicity of Cooling waters and Receiving Waters to Marine and Estuarine Organisms* (EPA 1994), 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. 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 Cooling Water Additive and Dilution Water

The cooling water additive, 3-MPA, provided by Seabrook Station was received during August of 2001 and stored according to MSDS specifications.

Water for the laboratory control diluent was obtained from the Hampton Estuary. Total residual chlorine (TRC) was measured by amperometric titration (MDL 0.05 mg/L) in the diluent sample. The sample contained $\leq$0.05 mg/L TRC therefore dechlorination using sodium thiosulfate was not required (EPA 1993).

Test concentrations for the assay were 50.0 ppm, 20.0 ppm, 10.0 ppm, 5.0 ppm, 1.0 ppm, and 0.5 ppm 3-MPA, on a volume to volume basis, in laboratory water with a laboratory water control.

2.4 *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 4.88×10^7 sperm/mL, and exposed to cooling water solutions for 60 minutes. Eggs were introduced to sperm/cooling water 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

A. punctulata fertilization data, normal and homogenous, were analyzed using Dunnet's 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 $\propto$ <0.05.

2.6 Quality Control

As part of the laboratory quality control program, standard reference toxicant assays 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 copper reference toxicant test conducted with *A. punctulata* on July 19, 2001 resulted in an IC-25 of 24.9 μg/L copper and a C-NOEC of 20.0 μg/L copper. These values were within one standard deviation of the laboratory mean for the species.

3.0 RESULTS AND DISCUSSION

Results of the chronic exposure sea urchin fertilization assay are summarized in Table 1. A summary of reference toxicant data for the test species is presented in Table 2. Dilution water characteristics are provided in Table 3. Support data, including copies of bench sheets, are included in Appendix A.

3.1 *Arbacia punctulata* Chronic Fertilization Bioassay

Review of the data showed a mean fertilization rate of 86.6% in the laboratory water diluent control after 60 minutes exposure. Protocol requires a fertilization rate of 70% to 90% (EPA 1994). These data are an indication of healthy gametes and that dilution water had no significant adverse impact on the outcome of the assay.

Mean egg fertilization was 86.2% in 50.0 ppm 3-MPA, 86.7 in 20.0 ppm 3-MPA, 86.3% in 10.0 ppm 3-MPA, 86.6% in 5 ppm 3-MPA, 86.7% in 1 ppm 3-MPA, and 85.4% in 0.5 ppm 3-MPA. Statistical analysis of the data showed that the fertilization rates in all concentrations were not significantly different than that in laboratory water diluent control (EPA 1994). The fertilization rate is within the protocol range of 70% to 90%. The C-NOEC was determined to be 50.0 ppm 3-MPA with a LOEC of >50.0 ppm 3-MPA. The IC-25 value was calculated to be >50.0 ppm 3-MPA.

3.2 Summary

The 3-Methoxypropylamine sample provided by North Atlantic Energy Services Corp. did not have an observed sublethal effect on the fertilization success of the purple sea urchin, *Arbacia punctulata*, at the concentrations tested.

4.0 LITERATURE CITED

APHA. 1995. *Standard Methods for the Examination of Water and Wastewater*, 18th edition. Washington D.C.

Stephan, C. 1982. Documentation for Computing LC-50 Values with a Mini Computer. Unpublished.

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.

US EPA. 1994. *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Estuarine and Marine Organisms.* EPA/600/4-91/003.

TABLE 1. Summary of Chronic Results - *A. punctulata.*
Seabrook Station Cooling water Additive Evaluation. October 2000.

	TREATMENTS (ppm 3-Methoxypropylamine)						
	Lab	0.5	1.0	5.0	10.0	20.0	50.0
Mean % Fertilization	86.6	85.4	86.7	86.6	86.3	86.7	86.2

Chronic No Observed Effect Concentration	-	50.0 ppm
Lowest Observed Effect Concentration	-	> 50.0 ppm
IC-25	-	> 50.0 ppm

TABLE 2. Summary of Reference Toxicant Data.
Seabrook Station Cooling water Additive Evaluation. August 2001.

	Expressed as µg/L Copper				
Species	NOEC	Historic Mean	Number of Tests	±1 STD Deviation	±2 STD Deviations
A. punctulata	20.0	9.30	40	8.2	16.4
Species	IC-25	Historic Mean	Number of Tests	±1 STD Deviation	±2 STD Deviations
A. punctulata	24.9	23.5	25	14.0	28.0

TABLE 3. Summary Diluent Characteristics.
Seabrook Station Cooling water Additive Evaluation. August 2001.

PARAMETER	UNIT	DILUENT
pH	SU	7.51
Salinity	ppt	29
Total Residual Chlorine	mg/L	<0.05
Specific Conductance	µmhos/cm	42310

APPENDIX A

DATA SHEETS

STATISTICAL SUPPORT

METHODS USED IN NPDES PERMIT BIOMONITORING TESTING

Parameter	Method
Acute Exposure Bioassays:	
Ceriodaphnia dubia, Daphnia pulex	EPA 600/4-90/027
Pimephales promelas	EPA 600/4-90/027
Americamysis bahia	EPA 600/4-90/027
Menidia beryllina, Cyprinodon variegatus	EPA 600/4-90/027
Chronic Exposure Bioassays:	
Ceriodaphnia dubia	EPA 600/4-91/002, 1002.0
Pimephales promelas	EPA 600/4-91/002, 1000.0
Cyprinodon variegatus	EPA 600/4-91/003, 1004.0
Menidia beryllina	EPA 600/4-91/003, 1006.0
Arbacia punctulata	EPA 600/4-91/003, 1008.0
Champia parvula	EPA 600/4-91/003, 1009.0
Trace Metals:	
ICP Metals	EPA 200.7/SW 6010
Hardness	Standard Methods 20th Edition - Method 2340 B
Wet Chemistries:	
Alkalinity	Standard Methods 20th Edition - Method 310.1
Chlorine, Residual	Standard Methods 20th Edition - Method 4500CLD
Total Organic Carbon	Standard Methods 20th Edition - Method 5310.6
Specific Conductance	Standard Methods 20th Edition - Method 2510B
Nitrogen - Ammonia	Standard Methods 20th Edition - Method 4500NH3G
pH	Standard Methods 20th Edition - Method 4500H+B
Solids, Total (TS)	Standard Methods 20th Edition - Method 2540.B
Solids, Total Suspended (TSS)	Standard Methods 20th Edition - Method 2540D
Dissolved Oxygen	Standard Methods 20th Edition - Method 4500-O G

Arbacia punctulata Chronic Fertilization Assay

STUDY	CLIENT	SAMPLE/DILUENT	DATE
9754	Seabrook Station	3-Methoxypropyamine (3-MPA) Effluent Additive/Lab Salt	8/21/01

SALINITY ADJUSTMENT RECORD: N/A mL EFFLUENT + ___ g SALT

Initials BB

EFFLUENT ADDITIVE CONCENTRATION	D.O. (mg/L)	pH (SU)	SPEC COND (µmhos/cm)	SALINITY (ppt)	TRC (mg/L)
LAB CONTROL	7.5	7.51	42310	29	
0.5 ppm	7.5	7.66	42740	29	
1 ppm	7.4	7.68	42710	29	
5 ppm	7.4	7.76	42780	29	
10 ppm	7.4	7.83	42520	29	
20 ppm	7.4	8.09	42740	29	
50 ppm	7.4	8.44	42620	29	

SPERM DILUTIONS:

HEMACYTOMETER COUNT, E: 122 X 10^4 = SPM SOLUTION E = 1.22×10^6

SPERM CONCENTRATIONS:
SOLUTION E X 40 = SOLUTION A = 4.88×10^7 SPM
SOLUTION E X 20 = SOLUTION B = 2.44×10^7 SPM
SOLUTION E X 5 = SOLUTION C = 6.10×10^6 SPM

FINAL COUNTS:

FINAL SPERM COUNT: 4.88×10^7
FINAL EGG COUNT: 2200

Sample Receipt Date _____

Bottles Pulled:	EFFLUENT	DILUENT
TOC	☐	☐
METALS	☐	☐
AMM	☐	☐
TS/S	☐	☐

TEST TIMES:

SPERM COLLECTED: 1150
EGGS COLLECTED: 1150
SPERM ADDED: 1225
EGGS ADDED: 1325
FIXATIVE ADDED: 1345

Meters Used

DO meter # 21 DO probe # 3 pH meter # 1097 pH probe # 25 S/C meter # YSI30 S/C probe # 1

SALINITY meter # YSI30

Initials BB

Arbacia punctulata Chronic Fertilization Assay

STUDY # 9754	CLIENT	SAMPLE/DILUENT	DATE 8/21/01
	Seabrook Station	Effluent Additive (3-MPA)/Lab Salt	Initial BB

EFFLUENT ADDITIVE CONC.	REPLICATE 1 UNFERT/TOTAL	2 UNFERT/TOTAL	3 UNFERT/TOTAL	4 UNFERT/TOTAL
LAB	13/102	13/101	15/106	14/103
0.5 ppm	14/103	17/105	14/102	15/101
1 ppm	16/101	14/101	12/103	12/100
5 ppm	15/103	13/102	12/101	15/104
10 ppm	13/101	18/114	15/103	12/102
20 ppm	15/105	12/103	14/101	14/103
50 ppm	14/104	15/103	13/104	16/109

A 1000 ppm 3-MPA stock solution was made by bringing 1 ml 3-MPA up to 1000 ml with 30 ppt lab salt.
Stock solution ID# C-519

Dilution Information

Effluent: 3-MPA additive		
Diluent: Lab Salt 30 ppt		
Concentration	Stock Solution Volume (ml)	Total Volume (ml)
lab control	0	200
0.5ppm	0.1	200
1 ppm	0.2	200
5 ppm	1	200
10 ppm	2	200
20 ppm	4	200
50 ppm	10	200

INITIALS:	BB
TIME:	1040
DATE:	8/21/01

Arbacia punctulata Fertilization

CLIENT: Seabrook Station
ESI#: 9754
DATE: 08/21/01

CONC %	REPLICATE A	B	C	D	UNFERTILIZED MEAN
Lab	12.7%	12.9%	14.2%	13.7%	13.4%
0.5 ppm	13.6%	16.2%	13.7%	14.9%	14.6%
1 ppm	15.8%	13.9%	11.7%	12.0%	13.3%
5 ppm	14.6%	12.7%	11.9%	14.4%	13.4%
10 ppm	12.9%	15.8%	14.6%	11.8%	13.7%
20 ppm	14.3%	11.7%	13.9%	13.6%	13.3%
50 ppm	13.5%	14.6%	12.5%	14.7%	13.8%

CALCULATIONS FOR IC-25

CONC %	REPLICATE A	B	C	D	FERTILIZED MEAN
Lab	87.3%	87.1%	85.8%	86.3%	86.6%
0.5 ppm	86.4%	83.8%	86.3%	85.1%	85.4%
1 ppm	84.2%	86.1%	88.3%	88.0%	86.7%
5 ppm	85.4%	87.3%	88.1%	85.6%	86.6%
10 ppm	87.1%	84.2%	85.4%	88.2%	86.3%
20 ppm	85.7%	88.3%	86.1%	86.4%	86.7%
50 ppm	86.5%	85.4%	87.5%	85.3%	86.2%

Title: 9754 Seabrook Station A. punctulata fertilization
File: 9754apft Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

D = 0.0082
W = 0.9590

Critical W = 0.8960 (alpha = 0.01 , N = 28)
W = 0.9240 (alpha = 0.05 , N = 28)

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

Title: 9754 Seabrook Station A. punctulata fertilization
File: 9754apft Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 3.2858 (p-value = 0.7722)

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

Critical B = 16.8119 (alpha = 0.01, df = 6)
= 12.5916 (alpha = 0.05, df = 6)

Title: 9754 Seabrook Station A. punctulata fertilization
File: 9754apft Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	control	4	1.1844	1.2064	1.1965
2	0.5	4	1.1566	1.1931	1.1789
3	1.0	4	1.1620	1.2217	1.1974
4	5.0	4	1.1787	1.2186	1.1963
5	10.0	4	1.1620	1.2201	1.1911
6	20.0	4	1.1830	1.2217	1.1966
7	50.0	4	1.1773	1.2094	1.1900

Title: 9754 Seabrook Station A. punctulata fertilization
File: 9754apft Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	control	0.0001	0.0103	0.0051	0.8573
2	0.5	0.0003	0.0172	0.0086	1.4547
3	1.0	0.0008	0.0277	0.0139	2.3143
4	5.0	0.0004	0.0194	0.0097	1.6188
5	10.0	0.0007	0.0258	0.0129	2.1647
6	20.0	0.0003	0.0172	0.0086	1.4385
7	50.0	0.0002	0.0151	0.0076	1.2709

Title: 9754 Seabrook Station A. punctulata fertilization
File: 9754apft Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA Table

SOURCE	DF	SS	MS	F
Between	6	0.0011	0.0002	0.4494
Within (Error)	21	0.0082	0.0004	
Total	27	0.0092		

(p-value = 0.8372)

Critical F = 3.8117 (alpha = 0.01, df = 6,21)
= 2.5727 (alpha = 0.05, df = 6,21)

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

Title: 9754 Seabrook Station A. punctulata fertilization
File: 9754apft 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	control	1.1965	0.8663		
2	0.5	1.1789	0.8540	1.2546	
3	1.0	1.1974	0.8665	-0.0644	
4	5.0	1.1963	0.8660	0.0107	
5	10.0	1.1911	0.8623	0.3865	

6	20.0	1.1966	0.8663	-0.0112
7	50.0	1.1900	0.8618	0.4630

Dunnett critical value = 2.4600 (1 Tailed, alpha = 0.05, df [used] = 6,20)
(Actual df = 6,21)

Title: 9754 Seabrook Station A. punctulata fertilization
File: 9754apft 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	control	4			
2	0.5	4	0.0242	2.8	0.0123
3	1.0	4	0.0242	2.8	-0.0002
4	5.0	4	0.0242	2.8	0.0003
5	10.0	4	0.0242	2.8	0.0040
6	20.0	4	0.0242	2.8	0.0000
7	50.0	4	0.0242	2.8	0.0045

Title: 9754 Seabrook Station A. punctulata fertilization
File: 9754apft Transform: ARC SINE(SQUARE ROOT(Y))

GRP	IDENTIFICATION	MEAN	SMOOTHED MEAN	CONCENTRATION
1	control	1.1965	1.1965	0.0000
2	0.5	1.1789	1.1921	0.5000
3	1.0	1.1974	1.1921	1.0000
4	5.0	1.1963	1.1921	5.0000
5	10.0	1.1911	1.1921	10.0000
6	20.0	1.1966	1.1921	20.0000
7	50.0	1.1900	1.1900	50.0000

ICp estimate with p = 25 is > 50.0000

State of New Hampshire
Environmental Laboratory Accreditation Program

Awards Primary Accreditation to

EnviroSystems, Inc.
of
Hampton, NH

For the analyses listed on the attached page(s) in accordance with the provisions of the NELAC Standards and Env-C 300.

Certificate Number: 151300-B

Date of Issue: January 24, 2001

Expiration Date: December 20, 2001

Program Manager

Continuing accreditation status is dependent on successful ongoing participation in the program.
Customers may verify the laboratory's current status by calling (603) 271-2991 or (603) 271-2998

NEW HAMPSHIRE ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

Laboratory: Envirosystems, Inc. Address: Hampton Fall, NH
Certificate Number: 151300-B Date of Issue: January 24, 2001

Expiration Date: December 20, 2001

ACCREDITS THE ABOVED MENTIONED LABORATORY FOR THE FOLLOWING ANALYSES:

(ANALYSES IN **UNDERLINED BOLD** ARE NOT EPA APPROVED FOR COMPLIANCE TESTING)

WASTEWATER METALS

Aluminum:	EPA 200.7
Arsenic:	EPA 200.7
Cadmium:	EPA 200.7
Chromium:	EPA 200.7
Copper:	EPA 200.7
Iron:	EPA 200.7
Lead:	EPA 200.7
Manganese:	EPA 200.7
Nickel:	EPA 200.7
Selenium:	EPA 200.7
Silver:	EPA 200.7
Vanadium:	EPA 200.7
Zinc:	EPA 200.7

WASTEWATER INORGANIC CONTAMINANTS

Alkalinity:	EPA 310.1
Ammonia-N:	SM 4500-NH_3 F
Calcium:	EPA 200.7
Hardness:	EPA 200.7
Magnesium:	EPA 200.7
pH:	SM 4500 H^+ B
Residual Chlorine, Total:	SM 4500 Cl D
Residue, Total:	SM 2540 B
Conductivity	SM 2510 B
TOC	SM 5310 C

This certificate supercedes all previously issued certificates.

David M. Lee

Program Manager