North Atlantic

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The Northeast Utilities System

March 13, 2002

Docket No. 50-443

NYN-02027

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

Seabrook Station
Renewal of NPDES Permit No. 0020338

Enclosed please find a copy of the renewed Seabrook Station National Pollutant Discharge Elimination System (NPDES) Permit issued by the U.S. Environmental Protection Agency on February 12, 2002. The NPDES Permit shall become effective on April 1, 2002. This submittal is made pursuant to Appendix B, Environmental Protection Plan (Nonradiological), Section 3.2 of Seabrook Station's Facility Operating License.

Should you have any questions please contact Mr. John B. Hart, Manager-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

cc: H. J. Miller, NRC Region I Administrator
R.D. Starkey, NRC Project Manager, Project Directorate I-2
G.T. Dentel, NRC Senior Resident Inspector

IE23

**ENCLOSURE 1 TO NYN-02027**

# AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Clean Water Act, as amended, (33 U.S.C. Sections 1251 et seq.; the "CWA"),

**North Atlantic Energy Service Corporation**
**P.O. Box 300**
**Seabrook, NH 03874**

is authorized to discharge from a facility located at

**North Atlantic Energy Service Corporation**
**Seabrook Station**
**Route 1**
**Seabrook, NH**

to receiving water named

**Atlantic Ocean**

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on April 1, 2002.

This permit and the authorization to discharge expire at midnight, five years from the effective date.

This permit supersedes the permit issued on September 30, 1993.

This permit consists of 30 pages in Part I including effluent limitations, monitoring requirements, etc., 19 pages in Part II including General Conditions and Definitions, 5 pages in Attachment A, 1 page in Attachment B, 11 pages in Attachment C, and 18 pages in Attachment D.

Signed this 12 day of February, 2002

Director, Office of Ecosystem Protection
U.S. Environmental Protection Agency
Region I

# PART I

## A. Effluent Limitations and Monitoring Requirements

1. This permit shall be modified, revoked or reissued to comply with any applicable effluent standard or limitation issued or approved under Sections 301(b)(2)(C) and (D), 304(b) (2), and 307(a) (2) of the CWA, if the effluent standard or limitation so issued or approved:

   a. contains different conditions or is otherwise more stringent than any effluent limitation in this permit; or

   b. controls any pollutant not limited by this permit.

   If the permit is modified or reissued, it shall be revised to reflect all currently applicable requirements of the CWA.

2. 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 ("Cooling Water System") of Seabrook Station shall comply with the following:

   a. The permittee shall use and maintain an anti-fouling protective coating on all appropriate components of the intake structures. The permittee shall perform manual cleaning of the intake structures twice per year.

   b. The velocity of water as it enters the intake structures shall at no time exceed 1.0 foot per second.

   c. The intake structures shall incorporate such behavioral or other deterrents or barriers as the Regional Administrator determines to be appropriate. This determination will be made under Section 316(b) of the Clean Water Act after reviewing the results of any studies or other information provided by the permittee.

   d. The Regional Administrator has determined that the Cooling Water Intake System, as presently designed, employs the best technology available for minimizing adverse environmental impact. Therefore, no change in the location, design or capacity of the present system can be made without prior approval of the Regional Administrator and the Director. The present design shall be reviewed for conformity to regulations pursuant to Section 316(b) when such are promulgated.

3. Should the intake tunnel and/or discharge tunnel require dewatering during an emergency condition, the permittee shall submit to the Regional Administrator and the Director an Emergency Dewatering Plan for their approvals as required in Paragraphs II.B.4 and II.B.5 of this permit which define "Bypass" and "Upset" operating conditions.

4. All material shall be removed from the traveling screens and disposed of in accordance with all existing Federal, State, and/or Local laws and regulations that apply to waste disposal. Such material shall not be returned to the receiving waters.

5. Chlorine and/or EVAC™ may be used as a biocide. No other biocide shall be used without explicit approval from the Regional Administrator and the Director.

6. The permittee shall submit an annual Chlorine Minimization Report to the Regional Administrator and the Director. The objective of this chlorination report is to document the amount of chlorine used to maintain suitable biofouling control of the intake cooling water system and thereby maintaining a high condenser efficiency. The Chlorine Minimization Report should include, at a minimum:

   a. The seasonal chlorination cycle employed during the reporting period: the months the system was chlorinated, the sodium hypochlorite dosage level, the TRO reported in the Discharge Monitoring Reports, an evaluation of the chlorine demand of the marine water, and the results of any inspections of the intake structures by divers or robots.

   b. The permittee shall report on the likelihood that the thermal backflushing operation will be needed to compliment the continuous chlorination program in the ensuing year (frequency and reason for the backflushing).

   The data developed for this report shall be incorporated into the statistical hydrological and biological data base for future operational data comparison.

7. The discharge shall not jeopardize any Class B use of the nearshore Atlantic Ocean and shall not violate State Water Quality Standards of the receiving water.

8. The permittee shall not at any time, either alone or in conjunction with any person or persons, cause directly or indirectly, the discharge of any waste into the receiving waters except waste that has been treated in such a manner as will not lower the Class B quality or interfere with the uses assigned to said waters by the New Hampshire Legislature (Chapter 311, Laws of 1967).

9. There shall be no discharge of polychlorinated biphenyl compounds such as commonly used for transformer fluid.

10. The discharge of radioactive materials shall be in accordance with the Nuclear Regulatory Commission requirements (10 CFR 20 and the Seabrook Station Operating License, Appendix A, Technical Specifications).

# PART I

## A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

11. During the period beginning the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial number **001**, Circulating Water System Discharge.

a. Such discharge shall be limited and monitored by the permittee as specified below:

| Effluent Characteristic | Discharge Limitations | | Monitoring Requirements | |
|---|---|---|---|---|
| | Avg. Monthly | Max. Daily | Measurement Frequency | Sample Type |
| Flow, MGD | 720 | 720 | Continuous[1] | Estimate |
| Temperature Rise, (Delta-T), °F[2] | 39 | 41 | Continuous [2] | Recorder |
| Temperature Rise, (Delta-T), °F[2,3] | 45 | 47 | Continuous [2] | Recorder |
| Temperature (Maximum), °F | Report | Report | Continuous | Recorder |
| Total Residual Oxidants (TRO), mg/l | 0.15 | 0.20 | 1/day[4] | Grab |
| pH, s.u.[5] | 6.5 to | 8.0 | 1/week | Grab |
| Whole Effluent Toxicity[6] | Report | Report | 1/Quarter | 24-Hour Composite |
| EVAC, mg/l | -------- | 3.0[7] | When in Use | Grab |
| EVAC, mg/l | -------- | 4.3[8] | When in Use | Calculation |

[1]The flow rate may be estimated from pump capacity curves.

[2]Temperature Rise is the difference between the discharge temperature (Discharge Transition Structure) and intake temperature (Intake Transition Structure). The intake and discharge temperatures will recorded by instruments or computers. The Temperature Rise and Maximum Temperature shall be calculated as a hourly average based upon at least twelve readings per hour (12 times per hour). These hourly average values will then be reported in the monthly DMRs.

[3]These average monthly and maximum daily temperature values are allowed up to a maximum of 15 days per year and only when one circulating water pump has been taken out-of-service for corrective or preventative maintenance. The Delta-T limits of 39 °F and 41 °F (average monthly and maximum daily, respectively) shall remain in effect at all other times of the year.

[4]Samples to be taken once per day at approximately the same time period. See Subparagraph "b" below for additional TRO requirements.

[5]See Part I.D.1 of this permit for State pH requirements.

[6]See Part I.A.22 of this permit for WET testing requirements.

[7]See Part I.A.11.f of this permit for EVAC use requirements.

[8]This limit may apply after the permittee has demonstrated that 4.3 ppm at the DTS is equivalent to 3.0 ppm or lower EVAC concentration at the Diffuser Nozzles. See Part I.A.11.f of this permit.

b. Total Residual Oxidants shall be tested using the Amperometric Titration Method, Method 4500-CL D in Standard Methods for the Examination of Water and Wastewater, 18th or subsequent edition(s), as approved in 40 CFR Part 136, or Method 330.1 in the EPA Manual of Methods of Analysis of Water and Wastes.

c. Samples taken for compliance with the monitoring requirements as specified in I.A.11.a above shall be taken at the Discharge Transition Structure, except for the intake water temperature, prior to the cooling water entering the discharge tunnel. See Part I.A.11.f of this permit for EVAC sampling requirements.

d. The discharge plume from the Seabrook Station shall:

(1) not block zones of fish passage,

(2) not interfere with spawning of indigenous populations,

(3) not change the balanced indigenous population of the receiving water,

(4) not contact surrounding shorelines, and,

(5) not violate Section 1707 of the State of New Hampshire Surface Water Quality Regulations.

e. The thermal component of the discharge shall in all aspects be in accordance with the discharge described in the permittee's NPDES Permit Application No. NH0020338, dated August 1, 1974, as modified in the reapplication dated April 1998, except as specifically modified below.

(1) The thermal component of the discharge from the Seabrook Station shall not cause a monthly mean temperature rise of more than 5 °F in the "near-field jet mixing region." The 5 °F monthly limit shall apply only at the surface of the receiving waters. For the purposes of this paragraph the "near-field jet mixing region" means that portion of the receiving waters within 300 feet of the submerged diffuser in the direction of discharge.

Permit compliance with this requirement shall be demonstrated by comparing the temperature difference between sampling point DS, (inside the mixing region) and sampling point T7 (reference sampling station). The locations of sampling points DS and T7 are shown in Attachment B. No change in the location of the sampling point is allowed without prior approval from the Regional Administrator and the Director. Temperature measurements shall be taken and recorded every fifteen minutes. The daily temperature shall be the arithmetic average of these measurements. The monthly mean temperature shall be determined by the arithmetic average of the daily temperature. Delta T shall be determined by taking the difference of the monthly mean temperature between DS and T7.

This paragraph shall apply only to temperature rises caused by the addition of heat to the receiving waters by the permittee. This temperature requirement does not apply during the cooling water flow reversal (thermal backflushing) used for biological control.

This monthly temperature limit constitutes the need for a CWA 316(a) thermal variance. See Attachment A.

(2) During operation of Seabrook Station, the permittee shall conduct additional thermal plume prediction studies as determined by the Regional Administrator and/or the Director. Such studies will be for the purpose of evaluating the accuracy of the thermal plume predictions the permittee has submitted to EPA in support of the

NPDES Permit Application No. NH0020338. Any such studies may apply to both the normal operation and thermal back-flushing operation at Seabrook Station.

(3) During operation of Seabrook Station, the permittee shall conduct biological/environmental studies as determined by the Regional Administrator and/or the Director. The purpose of any such studies shall be to evaluate the effects of Seabrook Station's discharge on the balanced, indigenous population of shellfish, fish and wildlife in and on the Atlantic Ocean.

(4) This NPDES permit may be modified to contain additional or different thermal limitations if the above studies and/or other available information indicates such modifications are necessary to assure the protection and propagation of a balanced indigenous population of shellfish, fish and wildlife in and on the receiving waters.

(5) The effluent limitations of this permit shall apply to all thermal components of the discharge from the Seabrook Station including, but not limited to, discharge during normal station operation and discharge during cooling water flow reversal for bio-fouling control.

(6) The permittee is allowed to discontinue temperature monitoring, for a period of up to 48 hours, during non-power operations and when the nuclear reactor is shutdown. The permittee may perform maintenance on the temperature monitoring equipment and/or other equipment sharing common power supplies during these non-monitoring periods.

f. The molluscicide EVAC may be applied twice per year, in late spring and late summer. Each application shall occur over a period not to exceed 48 hours. The discharge concentration shall not exceed 3.0 mg/l, at the Diffuser Nozzles. The discharge concentration shall be determined by grab sample at the Diffuser Nozzles after the concentration has reached a steady state condition throughout the plant. This steady state application concentration is expected to be approximately 4.3 ppm. Seabrook shall also sample and analyze for EVAC at the Discharge Transition Structure concurrently with the grab sample at the Diffuser Nozzles.

At least 3 months prior to the first application, the permittee shall submit the result of hydrological modeling which demonstrates the dissipation of EVAC. This model shall show the expected dissipation of EVAC concentration, until its concentration is undetectable (include EVAC half-life). Results of the modeling shall be submitted to the Regional Administrator and the Director.

At least 30 days prior to each planned use of EVAC, the permittee shall notify the EPA and the NH DES. Such notification shall include the dates over which the application is expected to occur, the amount (in pounds) of the molluscicide to be used, and the calculated discharge concentration. After the initial dosing with EVAC, the permittee shall also include, in the notification, an estimate of the effectiveness of EVAC.

The permittee may request that compliance be determined at the DTS, by calculation, after demonstration that a calculated 4.3 ppm DTS EVAC concentration results in a 3.0 ppm or lower discharge EVAC concentration at the Diffuser Nozzles. At least 4 consecutive EVAC applications and sampling events must occur prior to the permittee requesting such a change in compliance sampling point.

# PART I

## A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

12. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial numbers: **022**, **023**, and **024**. These outfalls are Secondary Plant Leakage and Drainage, Vault #1; Secondary Plant Leakage and Drainage, Vault #2; and Plant System Leakage and Drainage, Vault #3; respectively.

a. Such discharges shall be limited and monitored by the permittee as specified below:

| Effluent Characteristic | Discharge Limitations | | Monitoring Requirements | |
|---|---|---|---|---|
| | Avg. Monthly | Max Daily | Measurement Frequency | Sample Type |
| Flow, gpd | Report | 122,400 | Monthly | Estimate |
| Oil and Grease, mg/l | 15 | 20 | Weekly | Grab |
| Total Suspended Solids(TSS), mg/l | 30 | 100 | Weekly | Grab |

b. The samples taken in compliance with the monitoring requirements specified above shall be taken at a representative point prior to mixing with any other waste stream.

# PART I

## A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

13. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial number **025A**, Steam Generator Blowdown.

a. Such discharges shall be limited and monitored by the permittee as specified below:

| Effluent Characteristic | Discharge Limitations | | Monitoring Requirements | |
|---|---|---|---|---|
| | Avg. Monthly | Max. Daily | Measurement Frequency | Sample Type |
| Flow, gpd | Report | 425,000 | Continuous[1] | Estimate |
| Oil and Grease, mg/l | 15 | 20 | 1/Quarter[1] | Grab |
| Total Suspended Solids, mg/l | 30 | 100 | 1/Week[1] | Grab |

[1]This discharge is considered continuous, although the frequency and duration may vary depending on plant operation. Therefore the frequency of measurement for flow is continuous when in use. The measurement frequency for TSS is once per discharge, and weekly if the discharge continues for more than seven days. The discharge may be interrupted and restarted but will still be considered continuous, as long as the discharge is reinitiated within four hours of interruption.

b. Samples taken in compliance with the monitoring requirements specified above shall be taken at a representative point prior to mixing with any other waste stream.

# PART I

## A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

14. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial number **025B**, Steam Generator Blowdown Demineralizer Rinse.

a. Such discharges shall be limited and monitored by the permittee as specified below:

| Effluent Characteristic | Discharge Limitations | | Monitoring Requirements | |
|---|---|---|---|---|
| | Avg. Monthly | Max. Daily | Measurement Frequency | Sample Type |
| Flow, gpd | Report | 210,000 | Continuous[1] | Estimate |
| Oil and Grease, mg/l | 15 | 20 | 1/Quarter[1] | Grab |
| Total Suspended Solids, mg/l | 30 | 100 | 1/Week[1] | Grab |

[1]This discharge is considered continuous, although the frequency and duration may vary depending on plant operation. Therefore the frequency of measurement for flow is continuous when in use. The measurement frequency for TSS is once per discharge, and weekly if the discharge continues for more than seven days. The discharge may be interrupted and restarted but will still be considered continuous, as long as the discharge is reinitiated within four hours of interruption.

b. Samples taken in compliance with the monitoring requirements specified above shall be taken at a representative point prior to mixing with any other waste stream.

# PART I

## A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

15. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial number **025C**, Waste Holdup Sump.

a. Such discharges shall be limited and monitored by the permittee as specified below:

| Effluent Characteristic | Discharge Limitations | | Monitoring Requirements | |
|---|---|---|---|---|
| | Avg. Monthly | Max. Daily | Measurement Frequency | Sample Type |
| Flow, gpd | Report | 60,000 | 1/Batch | Estimate |
| Oil and Grease, mg/l | 15 | 20 | 1/Batch | Grab |
| Total Suspended Solids, mg/l | 30 | 100 | 1/Batch | Grab |

b. Samples taken in compliance with the monitoring requirements specified above shall be taken at a representative point prior to mixing with any other stream.

# PART I

## A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

16. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall number serial **025D**, Waste Test or Recovery Test Tanks.

a. Such discharges shall be limited and monitored by the permittee as specified below:

| Effluent Characteristic | Discharge Limitations | | Monitoring Requirements | |
|---|---|---|---|---|
| | Avg. Monthly | Max. Daily | Measurement Frequency | Sample Type |
| Flow, gpd | Report | 100,000 | 1/Batch | Estimate |
| Oil and Grease, mg/l | 15 | 20 | 1/Batch | Grab |
| Total Suspended Solids, mg/l | 30 | 100 | 1/Batch | Grab |

b. Samples taken in compliance with the monitoring requirements specified above shall be taken at a representative point prior to mixing with any other waste stream.

# PART I

## A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

17. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial number **026**, Metal Cleaning Wastes from stationary or portable treatment equipment.

a. Such discharges shall be limited and monitored by the permittee as specified below:

| Effluent Characteristic | Discharge Limitations | | Monitoring Requirements | |
|---|---|---|---|---|
| | Avg. Monthly | Max. Daily | Measurement Frequency[1] | Sample Type |
| Flow, gpd | Report | 450,000 | 1/Batch | Estimate |
| Oil and Grease, mg/l | 15 | 20 | 1/Batch | Grab |
| Copper, mg/l | 1.0 | 1.0 | 1/Batch | Grab |
| Iron, mg/l | 1.0 | 1.0 | 1/Batch | Grab |
| Total Suspended Solids, mg/l | 30 | 100 | 1/Batch | Grab |
| pH, s.u. | 6.0 to 9.0 | | 1/Batch | Grab |

[1]Sample frequency is once per batch prior to release when treated chemical cleaning waste is being discharged from either stationary or portable holding tanks.

b. A minimum of one Circulating Water System pump shall be in operation when the Treated Chemical Cleaning Wastes are discharged.

c. The samples taken in compliance with the monitoring requirements specified above shall be taken at a representative point from stationary or portable holding tanks and prior to mixing with any other stream. The ultimate discharge shall be through the Circulating Water System, Outfall 001.

d. The permittee shall notify the Regional Administrator and the Director in writing, at least 72 hours prior to the discharge from any chemical cleaning operations and provide an estimate of the duration of the operation, the chemicals to be used, and the point or location of wastewater release into the discharge tunnel.

PART I

**A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)**

18. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial number **027**, Cooling Tower Blowdown.

a. Such discharges shall be limited and monitored by the permittee as specified below:

| Effluent Characteristic | Discharge Limitations | | | Monitoring Requirements | |
|---|---|---|---|---|---|
| | Daily Max. | Avg. Concentration | Max. Concentration | Measurement Frequency | Sample Type |
| Flow, gpd | ----- | Report | Report | Daily[1] | Estimate |
| Total Residual Oxidants | ----- | ----- | 0.5[2] mg/l | Daily[1] | Grab |
| Total Residual Oxidants | 2.6[3] pounds | Report | ----- | Daily[1] | Calculation[3] |
| pH, s.u. | 6.0 to 9.0 | | | Daily[1] | Grab |

[1]Sample frequency is once daily when the Cooling Tower has a discharge.
[2] This limit is an instantaneous maximum concentration, mg/l.
[3] This is calculated over a single period of chlorine release, not to exceed two hours per day. The following equation shall be used: Mass TRO (pounds/event) = [Flow of outfall 027 (gallons per minute)] x [average TRO concentration (mg/l)] x [3.78 liters/gallon] x [120 minutes/event] ÷ [454,000 mg/pound].

b. None of the 126 priority pollutants shall be used for cooling tower maintenance chemicals.

c. The samples taken in compliance with the monitoring requirements specified above shall be taken at a representative point prior to mixing with any other stream.

d. See Section I.A.11.b for Total Residual Oxidants analytical requirements.

# PART I

## A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

19. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial number **003**, Thermal Back-flushing Operation.[1]

a. Such discharges shall be limited and monitored by the permittee as specified below:

| Effluent Characteristic | Discharge Limitations | | Monitoring Requirements | |
|---|---|---|---|---|
| | Avg. Monthly | Max. Daily | Measurement Frequency | Sample Type |
| Flow, gpm | Report | 500,000 | When in use | Estimate[2] |
| Temperature, Maximum ($T_{MAX}$)°F | Report | 120 | Continuous when in use | Recording Max. Temp. |

[1]During the back-flushing operation, the diffuser serves as the intake and the intake structure is the discharge point.
[2]Flow rate may be estimated from pump curves.

b. The permittee shall perform back-flushing (cooling water flow reversal for bio-fouling control) only during times when hydrological and meteorological conditions are such that the plume flows off-shore and/or temperature increases are minimized at the Outer Sunk Rocks.

c. The multiport diffuser shall be maintained free of marine fouling organisms. The permittee has coated the external surfaces of the diffuser with a material approved by the Regional Administrator and the Director. The permittee may propose alternate chemicals or methods for minimizing biological growth on the diffuser nozzles to the Regional Administrator and the Director for approval.

d. The pH shall not be less than 6.5 standard units nor greater than 8.0 standard units or as naturally occurs in the receiving water, Par. I.D.1.a (Sampling not required.)

e. There shall be no visible discharge of oil sheen, foam, or floating solids in the vicinity of the discharge (the intake structures). Naturally occurring sea foam in the intake transition structure is allowed.

f. The continuous back-flushing flow shall not exceed 120 °F maximum and the duration at the maximum temperature shall not exceed 2 hours. The total back-flushing cycle shall not exceed 6 hours.

g. The permittee shall not conduct more than 4 back-flushing cycles per calendar year unless prior approval is obtained from the Regional Administrator and the Director.

h. There shall be no chlorination operations during the thermal backflushing process except for safety related functions, i.e.: Service Water System Chlorination.

i. The permittee shall notify the Regional Administrator and the Director, in writing, 15 days before each back-flushing operation is initiated.

j. The permittee shall include the date, maximum temperature, and duration in the monthly submittal of the Discharge Monitoring Report each time Discharge 003 is used.

k. Should the permittee propose to use thermal backflushing, then the December 16, 1994, thermal backflushing report entitled "Alternatives to Thermal Backflushing", shall be expanded to include the environmental impact and technical feasibility of each alternative, including EVAC. The report shall describe seasonal impacts on fish migration and spawning, endangered species, initial dilution, and plume dispersion. This report shall define the hydrological and meteorological conditions that would minimize the thermal impact on the biologically rich Sunk Rocks. Data shall be collected for a period of at least one year prior to submittal to EPA.

The updated study shall be submitted to the EPA and the NH DES at least 6 months before thermal backflushing is used.

20. The chemicals listed in Attachment C are approved, with limits, for water discharge. The permittee may propose to conduct feasibility studies involving new chemicals not currently approved for water discharge. The permittee shall gain approval from the Regional Administrator and the Director before any such studies take place. A report summarizing the results of any such studies shall be submittted to the Regional Administrator and the Director regarding discharge frequency, concentration, and the impact, if any, on the indigenous populations of the receiving water. The Regional Administrator or the Director may require Whole Effluent Toxicity testing as part of feasibility studies.

The permittee may substitute or add laboratory chemicals that are discharged in de minimis amounts without conducting feasibility studies. The permittee shall submit, to the Regional Administrator and the Director, relevant information on the proposed addition/substitution regarding toxicity, frequency of discharge, concentration, and anticipated impacts. This submittal shall include a certification that the proposed chemical(s) is not carcinogenic, mutagenic, teratogenic or will bioaccumulate..

Prior approval from the Regional Administrator and the Director is not necessary before any such addition/substitution of laboratory chemicals takes place. The permittee will continue to employ its Best Management Practice procedures entitled "Disposal of Laboratory Chemicals and Reagents" for laboratory chemicals. The permittee may not use any laboratory chemicals that are carcinogenic, mutagenic, teratogenic or that will bioaccumulate.

No increase in chemical discharge concentrations, chemical substitution, or the use of additional chemicals is allowed without written approval by the Regional Administrator and the Director or their designees. Laboratory chemical use is excluded from this requirement.

No use of chemicals that bioaccumulate is allowed.

21. There shall be no visible discharge of oil sheen, foam, or floating solids in the vicinity of the diffuser ports. Naturally occurring sea foam in the discharge transition structure is allowed. Except in cases of condenser leak seeking and sealing, use of a reasonable amount of biodegradable and non-toxic material may be used to the extent necessary to locate and/or seal any condenser leak. The permittee shall report in the appropriate monthly DMR the occasions wherein this material was used giving the date(s) of the incident, the type of materials used and the amount of materials discharged.

22. The permittee is required to report the results of chronic (and modified acute) WET tests using Inland Silverside (Menidia beryllina), acute WET tests using Mysid Shrimp (Mysidopsis bahia) and chronic Sea Urchin (Arbacia punctulata) WET tests on a quarterly basis. A 24-Hour composite sample is the required "sample type" for WET testing. If after eight consecutive sampling periods (two

years), no toxicity is found, the permittee may request a reduction in toxicity testing to twice per year. The permittee shall use the procedures and protocols contained in Attachement D to this permit when conducting the WET testing.

The toxicity tests shall be performed at times when various chemicals and waste tanks are discharged at the facility. The permittee shall document and submit to EPA the various scenarios under which the toxicity test has been performed. The permittee shall conduct quarterly toxicity testing as outlined below:

Administrative controls shall be in-place to control these discharges according to the following restrictions:

(a) NPDES Permit Outfalls 025 (A, B, C & D) will not be discharged during EVAC, mollusicide applications (expected frequency to be twice per year with a duration of up to about two days).

(b) When Outfall 025B (Steam Generator Blowdown rinses) is being discharged, none of the other Outfall 025 can be discharged.

**Quarter #1 WET Testing (January - March)**

| **Day 1** | **Day 3** | **Day 5** |
|---|---|---|
| **(Acute and sample #1 for chronic)** | **(sample #2 for chronic)** | **(sample #3 for chronic)** |
| Outfalls 025A and 025C and 025D<br>or<br>EVAC | Outfalls 025A and 025B<br>or<br>Outfalls 025C and 025D | Outfalls 025A and 025B<br>or<br>Outfalls 025C and 025D |

Note: If EVAC is not applied during the quarter, then 025A, 025C, and 025D shall be discharged and sampled. Day 3 and Day 5 cover both "or" conditions. For example: if Day 3 samples were obtained with 025A and 025B being discharged, then Day 5 samples should be obtained with 025C and 025D being discharged.

**Quarter #2 WET Testing (April - June)**

| **Day 1** | **Day 3** | **Day 5** |
|---|---|---|
| **(Acute and sample #1 for chronic)** | **(sample #2 for chronic)** | **(sample #3 for chronic)** |
| Outfalls 025A and 025B<br>(These discharges shall not be concurrent)<br>or<br>EVAC | Outfalls 025C or 025D | Outfalls 025C or 025D |

Note: If EVAC is not applied during the quarter, then 025A and 025B shall be discharged and sampled. Day 3 and Day 5 cover both "or" conditions. For example: if Day 3 samples were obtained with 025C being discharged, then Day 5 samples shall be obtained with 025D being discharged.

**Quarter #3 WET Testing (July - September)**

| Day 1 (Acute and sample #1 for chronic) | Day 3 (sample #2 for chronic) | Day 5 (sample #3 for chronic) |
|---|---|---|
| Outfalls 025A and 025C and 025D or EVAC | Outfalls 025A and 025B or Outfalls 025C and 025D | Outfalls 025A and 025B or Outfalls 025C and 025D |

Note: If EVAC is not applied during the quarter, then 025A, 025C, and 025D shall be discharged and sampled. Day 3 and Day 5 cover both "or" conditions. For example: if Day 3 samples were obtained with 025A and 025B being discharged, then Day 5 samples should be obtained with 025C and 025D being discharged.

**Quarter #4 WET Testing (October - December)**

| Day 1 (Acute and sample #1 for chronic) | Day 3 (sample #2 for chronic) | Day 5 (sample #3 for chronic) |
|---|---|---|
| Outfalls 025A and 025C and 025D or EVAC | Outfalls 025B and 025C or Outfalls 025B and 025D (These discharges shall not be concurrent) | Outfalls 025C and 025D |

Note: * If EVAC is not applied during the quarter, then 025A, 025C, and 025D shall be discharged and sampled.

23. Chlorine Transit Study. The permittee shall conduct a "chlorine transit study" a minimum of twice per year for the first three years of the permit. This study shall be based on the 1993 Chlorine Transit Study performed at Seabrook Station. The study(s) shall measure the TRO concentration at the Discharge Transition Structure and the corresponding (taking into account the transit time) TRO at the Discharge Diffuser Nozzles (DDN). The study shall be conducted during periods of low chlorine demand of the cooling water. At least one of these studies shall be conducted when the plant is shut down and the effluent is not heated.

The permittee shall submit a study proposal to the Regional Administrator and the Director 30 days after the effective date of this permit and yearly thereafter. The study shall, to the maximum extent possible, represent "worst case" situations. That is, the facility shall be discharging TRO, as measured at the Discharge Transition Structure (DTS), as close to the permitted daily maximum as possible and the cooling water shall be exerting its lowest chlorine demand. Upon approval from the Regional Administrator and the Director, the permittee shall implement the study and submit the results to the Regional Administrator and the Director.

Should any of the Chlorine Transit Study results indicate that the permitted TRO concentration, as measured at the DTS, is not sufficiently stringent to ensure that the chronic and acute water-quality standards for chlorine are met at the DDN, this permit may be reopened to incorporate stricter limits.

24. Biological and Water Quality Monitoring Program

a. The Biological and Water Quality Monitoring Program (BP) shall be submitted to EPA for approval within 30 days of the effective date of this permit. Upon approval from EPA, the BP is an enforceable element of this permit. This BP shall be based on the 1996 Biological and Water Quality Monitoring Program, except for the following alternative regimes which will replace those previously employed:

(1) Intertidal Monitoring only will be implemented if Seabrook Station decides to employ back flushing of the Cooling Water System to control macrofouling. Any such Intertidal Monitoring Program will begin at least one year prior to back flushing.

(2) The Impingement Monitoring Program will be enhanced to include: collecting two 24-hour impingement samples each week, the evaluation of screen wash efficiencies using dead fish, and a sampling protocol for high impingement events.

(3) Ichthyoplankton Entrainment Sampling Program will allow greater understanding of diel variability in ichthyoplankton densities and will include more definitive day-night sampling (4 x 2-hour samplings/week: morning, day, evening, night), increased sample volume, and decreased net mesh size.

(4) The previous reviews by EPA and NH DES and Fish & Game of the long-term studies of coastal New Hampshire have concluded that the kelp communities in the study area should not be adversely influenced by plant operation. Therefore, monitoring of kelp communities is no longer required.

b. The Contingency Plan

This Contingency Plan identifies actions that Seabrook Station may undertake when improvements to the BP are necessary. The Contingency Plan authorizes the evaluation, annually at a minimum, of the BP and associated data, and, if necessary, requires recommendations for improvements in the BP and the development of a Management Plan (See Management Plan, below).

1. BP Evaluation

At a minimum, the BP is evaluated through the following:

i. An annual review of the environmental/biological sampling and analysis plan and data,

ii. The identification of change in the aquatic or biological system,

iii. The determination of statistically significant change,

iv. The determination of biological importance,

v. The determination of the likelihood that Seabrook Station contributed to the change,

vi. A review and analysis of BP data variability and power analysis update,

vii. The identification of improved sampling and/or analysis technologies, including, but not limited to: statistical methods, sampling equipment, and modeling technologies.

2. BP Evaluation Schedule

The BP will undergo an annual review according to the following schedule:

i. Sept. 1: Permittee submits the results from the previous year's BP to the Permitting Authority.

ii. Nov. 1: Permitting Authority submits comments and questions to the Permittee.

iii. Dec. 1: Permittee schedules meeting to present data and review proposed BP for the following year.

iv. Feb. 1: Improvements reviewed and approved by the Permitting Authority.

v. Mar. 1: Permittee continues BP and implements improvements, if applicable.

3. Management Plan

The BP requires the Permittee to determine whether any adverse environmental impacts are occurring due to facility operations. If they are, then the Permittee must, in a timely manner, develop and implement a Management Plan, approved by the Permitting Authority, to prevent such impacts. A report on these efforts must be submitted to EPA and NH DES every thirty days until the issue has been resolved.

c. BP Improvements

This permit authorizes improvements, as approved by the Permitting Authority, to the BP when indicated by results and analysis of BP data (acceptable data from other sources may also be considered). Analysis of data from measured parameters such as temperature, delta T, and rates of impingement, and entrainment indicate the need for monitoring program enhancements or improvements.

The Permitting Authority will require a review, at least annually, of sampling data and protocols and an evaluation of the need for more frequent sampling. Additional sampling locations and any other justified analytical or biological program improvements may be authorized. Prior to authorization, the permittee must seek input from biologists from NHDES, NHF&G, U.S. Fish and Wildlife, and EPA. This review will be chaired by the EPA with input from NHDES, NHF&G, U.S. Fish and Wildlife, and other agencies or experts as appropriate.

Within 30 days of authorization of biological program improvements, the permittee shall update and resubmit the Biological and Water Quality Monitoring Program to include any such improvements.

Examples of BP improvements include, but are not limited to:

1. Additional sampling stations,

2. Increased sampling frequency,

3. Changes demonstrated to reduce data variability or increased analysis sensitivity,

4. Changes demonstrated to increase the power to detect statistical significance,

5. Collection of additional data demonstrated to more definitively determine Seabrook Station impacts,

6. Additional predictive models such as species-specific population, community, and/or trophic level risk.

d. Biological, hydrological, and chlorination study reports shall be submitted on a semi-annual basis with the annual report summarizing the previous year's information and conclusions. The report is due in February.

The semi-annual mid-year report shall be a letter report providing the status of the on-going programs, the expected effort in the ensuing six months, and a synopsis of the data and information obtained since the last annual report. This report shall be submitted in July.

e. Fish Mortality Monitoring and Reporting.

Any incidence of fish mortality associated with the discharge plume or of unusual number of fish impinged on the Intake Traveling Screens shall be reported to the Regional Administrator and the Director within 24-Hours by telephone report as required in Paragraph II.D.1.e of this permit. A written confirmation report is to be provided within five (5) days. This report should include the following:

1. The species, sizes, and approximate number of fish involved in the incident.

2. The time, date, and duration of the occurrence.

3. The operating mode of the station at the time of the occurrence.

4. The opinion of the permittee as to the cause of the incident.

5. The remedial action that the permittee will undertake to prevent a recurrence of the incident.

25. Requirements for Seabrook Station Discharge Diffuser Nozzles

a. The 22 submerged offshore diffuser nozzles shall be maintained when necessary to ensure proper operation. Proper operation means that the plumes from each nozzle will be balanced relative to each other and that they all have unobstructed flow. maintenance may include dredging in the vicinity of the diffuser nozzles, removal of marine growth or other solids on the interior surfaces of the diffuser nozzles or repair/replacement of the nozzle structure.

b. Any necessary maintenance dredging must be performed only during the marine construction season authorized by the New Hampshire Fish and Game Department and only after receiving all necessary permits from the DES Wetlands Bureau, U.S. Coast Guard, U.S. Army Corps of Engineers, etc.

c. To determine if maintenance will be required the diffuser nozzles will be inspected by a licensed diver or licensed marine contractor at least every 36 months. The as-found or pre-maintenance condition of the nozzles will be documented on videotape. The maintenance performed on any nozzle and the as-left or post maintenance conditions will be documented in a written report prepared by the diver or marine contractor.

d. Copies of the videotape and written report of the maintenance provided on any nozzle will be submitted to EPA and NHDES WD within 60 days of each inspection. Where it is determined that additional maintenance will be necessary, the permittee shall provide the proposed scope and schedule for the maintenance.

## B. MONITORING AND REPORTING

Monitoring results obtained during the previous month shall be summarized and reported on Discharge Monitoring Report Form(s) postmarked no later than the 15th day of the month following the completed reporting period.

Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Regional Administrator and one signed copy to the State at the following addresses:

Environmental Protection Agency
NPDES Program Operation Section
P. O. Box 8127
Boston, MA 02114

The State Agency is:

New Hampshire DES
Water Division
Permits and Compliance Section
6 Hazen Drive, P.O. Box 95
Concord, New Hampshire 03302-0095

## C. NOTIFICATION

1. All existing manufacturing, commercial, mining, and silvicultural dischargers must notify the Director as soon as they know or have reason to believe (40 CFR §122.42):

   a. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels:"

      (1) One hundred micrograms per liter (100 $\mu$g/l);

      (2) Two hundred micrograms per liter (200 $\mu$g/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 $\mu$g/l) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (mg/l) for antimony;

      (3) Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR §122.21(g)(7); or

      (4) Any other notification level established by the Director in accordance with 40 CFR §122.44(f) and New Hampshire regulations.

b. That any activity has occurred or will occur which would result in the discharge, on a non-routine or infrequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels:"

(1) Five hundred micrograms per liter (500 $\mu$g/l);

(2) One milligram per liter (1 mg/l) for antimony;

(3) Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR §122.21(g)(7); or

(4) Any other notification level established by the Director in accordance with 40 CFR §122.44(f) and New Hampshire regulations.

c. That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the permit application.

## D. State Permit Conditions

1. The permittee shall comply with the following conditions which are included as State Certification requirements:

a. "The pH for Class B waters is 6.5 to 8.0 s.u. or as naturally occurs in the receiving water. The 6.5 to 8.0 s.u. range must be achieved in the final effluent, outfall 001, unless the permittee can demonstrate to the Division: (1) that the range should be widened due to naturally occurring conditions in the receiving water or (2) that the naturally occurring source water pH is unaltered by the permittee's operations. The scope of any demonstration project must receive prior approval from the Division. In no case shall the above procedure result in pH limits less restrictive than any applicable federal effluent limitation guidelines."

b. "The permittee shall submit the Executive Summary and Section D (Surface Water) of the Seabrook Station Annual Radiological Environmental Operating Report to NH DES at the address in Par. I.B as well as to EPA, NH Fish and Game, and NMFS within 30 days of preparation."

2. This NPDES Discharge Permit is issued by the U.S. Environmental Protection Agency (EPA) under Federal and State law. Upon final issuance by the federal EPA, the New Hampshire Department of Environmental Services, Water Division, may adopt this permit, including all terms and conditions, as a State discharge permit pursuant to RSA 485-A:13.

Each agency shall have the independent right to enforce the terms and conditions of this Permit. Any modification, suspension or revocation of this Permit shall be effective only with respect to the Agency taking such action, and shall not effect the validity or status of this Permit as issued by the other Agency, unless and until each Agency has concurred in writing with such modification, suspension or revocation. In the event any portion of this Permit is declared invalid, illegal or otherwise issued in violation of State law, such permit shall remain in full force and effect under Federal law as an NPDES permit issued by the U.S. Environmental Protection Agency. In the event this permit is declared invalid, illegal or otherwise issued in violation of Federal law, this Permit, if adopted as a state permit, shall remain in full force and effect under State law as a Permit issued by the State of New Hampshire.

## E. Special Conditions

1. Whole Effluent Toxicity Test Frequency Adjustment

The permittee may submit a written request to the EPA requesting a reduction in the frequency (to not less than twice per year) of required toxicity testing, after completion of a minimum of eight (8) successive toxicity tests of effluent all of which must be valid tests and must demonstrate acceptable toxicity. Until written notice is received by certified mail from the EPA indicating that the Whole Effluent Testing requirement has been changed, the permittee is required to continue testing at the frequency specified in the respective permit.

2. pH Range Adjustment

The permittee may submit a written request to the EPA requesting a change in the permitted pH limit range to no more than 6.0 to 9.0 Standard Units. The permittee's written request must include the State's approval letter containing an original signature (no copies). The State's letter shall state that the permittee has demonstrated to the State's satisfaction that as long as discharges to the receiving water from a specific outfall are within a specific numeric pH range the naturally occurring receiving water pH will be unaltered. That letter must specify for each outfall the associated numeric pH limit range.

Until written notice is received by certified mail from the EPA indicating the pH limit range has been changed, the permittee is required to meet the permitted pH limit range in the respective permit.

**F. Re-opener Clause**

1. This permit shall be modified, or alternatively, revoked and reissued, to comply with any applicable standard or limitation promulgated or approved under sections 301(b)(2)(C) and (d), 304 (b)(2), and 307(a)(2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:

   (a) Contains different conditions or is otherwise more stringent than any effluent limitation in the permit; or

   (b) Controls any pollutants not limited in the permit.

2. This permit may be modified to incorporate necessary Total Residual Oxidant (TRO) adjustments should the results of any of the "Chlorine Transit Study(s)", as required in Part I.A.23 of this permit, indicate potential violation(s) of the water-quality standards for chlorine at the diffuser nozzles. Results of the "Chlorine Transit Study(s)" are considered "New Information" and the permit can be modified as provided in 40 CFR Section 122.62(a)(2).

**ATTACHMENT A - NH0020338**
**316(a) variance document, Seabrook Station**

I. Introduction

Section 316(a) of the Clean Water Act (CWA) addresses the thermal component of any effluent. EPA has not promulgated Best Practicable Control Technology currently available (BPT) for the thermal component of a facility's discharge. However, EPA assumes that if thermal limits satisfying BPT were developed in accordance with Section 301(b)(1)(A) of the CWA, they would be more stringent than what would be proposed by the NPDES permit applicant. This is based upon the premise that water quality criteria developed by EPA or by individual water quality standards, developed by the states, would be the limiting factor in the development of the NPDES permit. It should be noted that thermal discharges (heat content) are not subject to the technology standards required by best conventional pollutant control technology economically achievable (BCT) since heat is not identified as a toxic pollutant or a conventional pollutant as defined by the CWA and outlined at 40 CFR Section 401.15 or Section 401.16. Rather, thermal discharges (heat) are treated as a separate type of pollutant under Section 316 of the CWA.

Section 316(a ) gives the Administrator of EPA the authority to impose alternative effluent limitations (i.e., a "thermal variance") for the control of the thermal component of any discharge. However, the owner or operator of the point source must demonstrate to the satisfaction of the Administrator that existing effluent limitations are more stringent than necessary to assure the protection and propagation of a balanced indigenous community of shellfish, fish and wildlife in and on the receiving water. This authority has been delegated to the Regional Administrators or their designees.

New Hampshire Water Pollution Control Law addresses thermal waste discharged in RSA485-A:8 Section VIII which states, in pertinent part, that the "division shall adhere to the water quality requirements and recommendations of the New Hampshire Fish and Game Department, the New England Interstate Water Pollution Control Commission, or the United States Environmental Protection Agency, whichever requirements and recommendations provide the most effective level of thermal pollution control."

EPA, in the "Quality Criteria for Water, 1986," (i.e., the Gold Book), has set a maximum acceptable increase in the weekly average temperature at 1.8 °F during all seasons of the year. Seabrook Station's 1993 NPDES permit allows a maximum 5 °F temperature rise at the surface in the near field jet mixing region (on a daily basis). At the time of the 1993 permit issuance, the Regional Administrator tentatively determined that this temperature limit would ensure the protection and propagation of a balanced indigenous community of fish, shellfish, and wildlife in and on the nearshore Atlantic Ocean waters. Therefore, the limits proposed in the 1993 permit constituted a Section 316(a) thermal discharge variance. The facility has sought to continue this variance in the next permit.

II. Criteria for Determining Alternative Effluent Limitations Under Section 316(a)

40 CFR Part 125, Subpart H specifies the criteria and information necessary for EPA to make a Section 316(a) thermal variance. For existing discharges, Section 125.73(c)(1) allows the demonstration to be based on the absence of prior appreciable harm in lieu of predictive studies.

Seabrook Station began commercial operation in 1990, and, therefore, is considered an existing discharger. Pursuant to 40 CFR Section 125.73(c), the determination shall be based upon the absence of prior appreciable harm in lieu of predictive studies and shall show: (i) that no appreciable harm has resulted from the normal component of the discharge (taking into account the interaction of such thermal component with other pollutants and the additive effect of other thermal sources to a balanced, indigenous community of shellfish, fish and wildlife in and on the body of water into which the discharge has been made; or (ii) that despite the occurrence of such previous harm, the desired alternative effluent limitations (or appropriate modifications thereof) will nevertheless assure the protection and propagation of a balanced, indigenous community of shellfish, fish and wildlife in and on the body of water into which the discharge is made. In determining whether or not prior appreciable harm has occurred, the director shall consider the length of time in which the applicant has been discharging and the nature of the discharge.

III. Environmental Monitoring Program

Seabrook Station environmental monitoring programs began as early as 1969. These early programs focused on plant design and siting. Later, monitoring programs were designed to assess the temporal and spatial variability during the preoperational period as a baseline. The preoperational data focused on fisheries from 1976 - 1989 and plankton and benthic from 1978 - 1989. During these years, consistent sampling regimes were developed that included data from nearfield and farfield stations to provide background information in order to address the question of operational effects. Commercial operation of Seabrook Station began in 1990 and August 1990 is considered the beginning of the operation period for the purposes of environmental assessment.

In 1975, EPA and the State jointly formed a committee of biologists from regulatory agencies which were responsible for the aquatic community in the Hampton Harbor and Seabrook area. The agencies included the EPA, the National Marine Fisheries Service (NMFS), the NH DES-Water Division, and NH Fish and Game. The committee has been responsible for assisting the permittee in developing study programs, evaluating the resulting data, reviewing program conclusions, and approving/rejecting proposed program modifications and/or remediation by the permittee. In the past , the committee has also provided EPA with recommendations for the NPDES permit that would ensure the protection of the ecological community in and on the receiving water.

In the 1993 permit renewal, the biological committee was formalized into the Technical Advisory Committee (TAC) to ensure that its effort was an official part of the permit. The TAC

was empowered to accept, reject, or modify the facility's biological monitoring program and/or schedules.

As previously noted, Seabrook Station began commercial operation in 1990 and has operated to-date with only routine outages due to refueling and maintenance needs. A review of the entire biological monitoring program was undertaken in 1996. A number of program elements were revised, with the approval of the Technical Advisory Committee (TAC). The entrainment and impingement programs were enhanced to improve the quality of the data. Programs that monitored nutrients, phytoplankton, microzooplankton, pelagic fish (gill net sampling program), surface fouling panels, and macrobenthos at the deep stations were eliminated because the TAC felt sufficient data existed to eliminate concerns for potential impacts. Data collection at Station P5 was also ended because it was determined that is was too far from the discharge to reflect potential effects and was essentially the same as data collected from the Intake Station, P2.

IV. Previous 316(a) determinations

A series of decisions and legal actions on the design and impact of the cooling system on aquatic resources led to a Decision on Remand on August 4, 1978, by the EPA Administrator. Considered in the Decision on Remand were the potential for impact from: thermal discharge, thermal backflushing, cold shock, discharge plume scouring of the ocean bottom, entrainment of plankton through the cooling system, attraction of fish to the intake structures, entrapment of fish and subsequent impingement on the traveling screens, thermal plume barriers to migrating fish, increase in nuisance species populations, and gas bubble disease of fish. The Decision on Remand concluded that: 1) the requirements of Section 316(a) and (b) of the CWA had been met, and 2) the once-through cooling system would ensure the protection and propagation of a balanced indigenous population of fish, shellfish, and wildlife in and on the receiving waters with respect to the thermal discharge.

In the July 1993 Fact Sheet for the renewal of the permit, the Regional Administrator tentatively determined that a favorable 316(a) determination could be made. The proposed permit was consistent with the Administrator's previous 316(a) determinations.

This tentative determination was made after consultation with the biological committee and was based on a review of the biological and hydrological monitoring data which showed that a once-through cooling system satisfied the State of New Hampshire thermal requirements and, as required by section 316(a) of the CWA, ensured the protection and propagation of a balanced indigenous community of fish, shellfish, and wildlife in and on Hampton Harbor and the nearshore Atlantic Ocean.

The permit specified that the operational phase biological monitoring program would continue in order to assure EPA and the State that the continued operation of Seabrook Station did not significantly impact the local biological community.

The July 1993 Fact Sheet also noted that the 316 tentative determinations were made on the data as presented by the permittee and consultants during the plant construction (17 years) and upon post-operational data since 1990.

V. Current 316(a) determination

Seabrook Station has certified that the thermal component of the discharge has not changed since last permit issuance (see April 1998 renewal application). A thermal plume comparative evaluation was submitted to the EPA in June 1991 which concluded that there was agreement between plume model predictions and field data in terms of surface temperature rise isotherms, thermocline depths and plume pattern.

As previously noted in this document, the impact of the thermal component of the discharge is assessed on an ongoing basis through the biological monitoring program. Seabrook Station's 1998 Environmental Monitoring Report (received by EPA November 1999) demonstrates that the operation of the facility has not caused "appreciable harm" to the balanced, indigenous community of shellfish, fish and wildlife in the Hampton-Seabrook area. Seabrook Station has submitted information to support the continuation of the variance based on actual operating experience.

Therefore, in accordance with 40 CFR Part 125, Section 125.73, and after consultation with members of the Technical Advisory Committee, the Regional Administrator has determined that the current biological and hydrological monitoring data shows that a once-through cooling system for Seabrook Station satisfies the thermal requirements and will ensure the protection and propagation of a balanced indigenous community of fish, shellfish, and wildlife in and on Hampton Harbor and the nearshore Atlantic Ocean. In making this determination, the Regional Administrator has taken into account the length of time and the nature of the discharge (approximately ten years and about 560 Million Gallons per Day of heated effluent).

The thermal limits proposed in the draft permit constitute a Section 316(a) thermal discharge variance. The post-operational phase of the biological monitoring program will continue in order to assure EPA and the State that the continued operations of Seabrook Station does not significantly impact the local biological community.

## BIBLIOGRAPHY TO 316(a) VARIANCE DOCUMENT


1. New Hampshire Water Pollution Control Law, Chapter 485-A

2. Quality Criteria for Water, 1986, EPA 440/5-86-001, "Gold Book Criteria"

3. 40 CFR Part 125, Subpart H

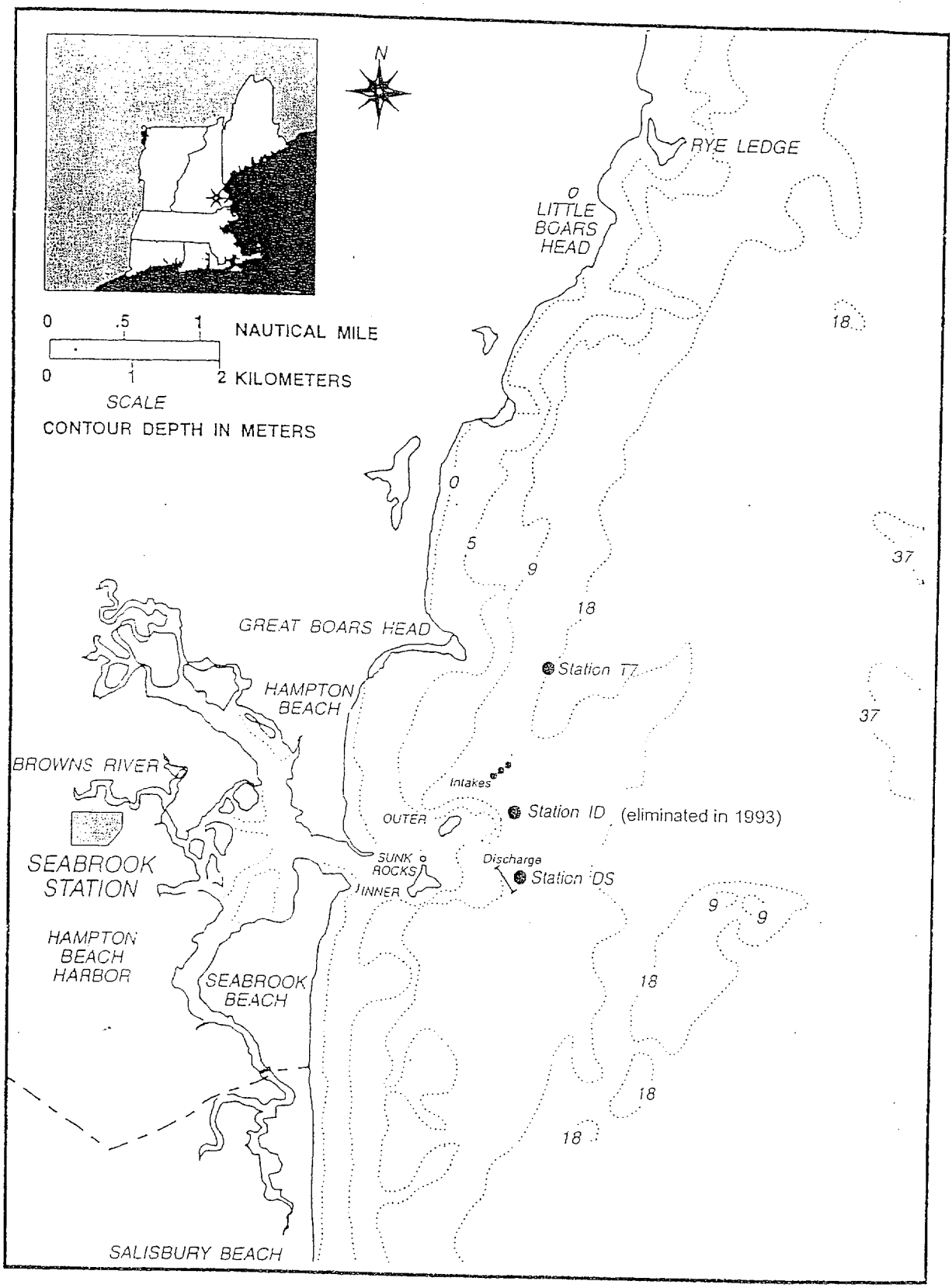
4. North Atlantic Energy Service Corporation's National Pollutant Discharge Elimination System (NPDES) Permit and Fact Sheet, 1993

5. Seabrook Station 1999 Environmental Monitoring Report, December 2000

6. Seabrook Station NPDES Permit NH0020338 Renewal Application, April 1998

ATTACHMENT: B

NH0020338




Seabrook Station Temperature Monitoring Station Locations

ATTACHMENT C
NH0020388
CHEMICAL USE

# BULK CHEMICALS

| CHEMICAL NAME | CHEMICAL FORMULA | LIMIT at 001 in mg/L | INTERNAL OUTFALL | INTERNAL CONCENTRATION | DISCHARGE FREQUENCY | TOTAL YEARLY DISCHARGE (Lbs) |
|---|---|---|---|---|---|---|
| Total Residual Chlorine | OCl- | See section I.A.11.a | | | | 41300 |
| | | | 2 | < 0.18 | Batch(Q) | negligible |
| | | | 22 | <0.18 | Batch(M) | negligible |
| | | | 23 | < 0.18 | Batch(M) | negligible |
| | | | 24 | <0.18 | Batch(M) | negligible |
| | | | 25C | < 0.18 | Batch(M) | negligible |
| | | | 27 | | Batch(Y) | 10 |
| Ammonia | NH4OH | 0.5 | | | | |
| | | | 2 | <1 mg/l | Cont. | ~2 |
| | | | 22 | <2 mg/l | Cont. | 5368 |
| | | | 23 | <1 mg/l | Cont. | ~200 |
| | | | 25A | ~1 mg/l | Batch(M) | 55.1 |
| | | | 25B | <.1 mg/l | Batch(M) | ~2 |
| | | | 25C | 1146 mg/l | Batch(2/M) | 398.8 |
| | | | 25D | <.1 mg/l | Batch(3/W) | ~1 |
| CIL | Na2SiO3 | 5 | | | | |
| | | | 27 | 5-7 mg/l | Batch(M) | 10 |
| Boric Acid | H3BO3 | 5.0 (as boron) | | | | |
| | | | 25D | <1500 mg/l | Batch(3/W) | 5201 |
| | | | 25A | <10 ppm | Infrequent | |
| Hypersperse | Proprietary | 0.02 | | | | |
| | | | WT Reject | 0.02 mg/l | Batch(W) | 363 |
| Ethanolamine (ETA) | C2H7NO | 0.5 | | | | |
| | | | 2 | < 0.01 mg/l | Cont. | negligible |
| | | | 22 | ~0.1 mg/l | Cont. | negligible |
| | | | 23 | ~0.01 mg/l | Cont. | negligible |
| | | | 25A | 2 mg/l | Batch(2/M) | 110 |
| | | | 25B | <0.01 mg/l | Batch(M) | negligible |
| | | | 25C | ~400 mg/l | Batch(2/M) | 1868 |
| | | | 25D | <0.01 mg/l | Batch(3/W) | negligible |
| Ethylene Glycol | C2H6O2 | 50 | | | | |
| | | | 2 | N/A | Accidental | negligible |
| | | | 22 | N/A | Accidental | negligible |
| | | | 23 | N/A | Accidental | negligible |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | 25D | N/A | Accidental | negligible |
| Hydrazine | N2H4 | 0.5 | | | | |
| | | | 2 | 5 mg/l | Batch | negligible |
| | | | 2 | <0.05 mg/l | Cont. | negligible |
| | | | 22 | ~0.1 mg/l | Cont. | negligible |
| | | | 23 | ~0.1mg/l | Cont. | negligible |
| | | | 25A | <0.05 mg/l | Batch(2/M) | 1.87 |
| | | | 25B | <0.05 mg/l | Batch(M) | negligible |
| | | | 25C | 5-100 mg/l | Batch(2/M) | 48.1 |
| | | | 25D | <0.05 mg/l | Batch(3/W) | negligible |
| Methoxypropylamine (MPA) | C4H11NO | 0.5, 5 | | | | |
| | | | 2 | <0.05 mg/l | Cont. | negligible |
| | | | 22 | <1 mg/l | Cont. | negligible |
| | | | 23 | <0.01 mg/l | Cont. | negligible |
| | | | 25A | ~ 5 mg/l | Batch(2/M) | 163 |
| | | | 25B | <0.01 mg/l | Batch(M) | negligible |
| | | | 25C | ~1500 mg/l | Batch(2/M) | 2774 |
| | | | 25D | <0.05 mg/l | Batch(3/W) | negligible |
| Sodium Hydroxide | NaOH | pH, See.I.A.11.a | | | | |
| | | | 25C | see comment sheet | Batch(2/M) | 6255 |
| Sulfuric Acid | H2SO4 | pH, See I.A.11.a | | | | |
| | | | 25C | see comment Sheet | Batch(2/M) | 14572 |
| Nalcolyte | Proprietary | 0.1 mg/l | | | | |
| | | | 25D | ~0.11 mg/l | Batch(3/W) | 15.2 |
| Muriatic Acid | HCl | pH, See I.A.11.a | | | | |
| | | | WT Reject | 12 mg/l | Batch(W) | 202 |
| DC-13 (Floor Cleaner) | NonylPhenyl -Ethoxylate(15%) | 0.1 | 022 | 2.1 mg/l | cont. | 95.4 |
| EVAC (as proposed) | C26H49NO4 | 3 mg/l | 001 | 4-5 mg/l | Semi-Annual/24 hrs | 2.50E+004 |
| BetzDearborn DA6801 | poly acrylic acid and ethanolamine | 0.007ppb | 001 | 1-10 ppb | Continuous | |
| Dynacool 1385 (Thruguard 300) | proprietary phosphonate | 0.05 | 001 | ~20 mg/l (chlorination) | Continuous | 18,000 |

**Bulk Chemicals Used in the past but Currently not in Use**

| | | | | | |
|---|---|---|---|---|---|
| Morpholine | C4H9NO | 0.1 | 025D | <0.1 | <1 |
| Bulab 6002 | | 0.1 | 001 | <0.1 | ~20 |
| Bulab 9328 | | 0.1 | 001 | <0.1 | ~21 |
| Cat Floc L | | 0.1 | 25D | <0.1 | ~20 |
| Cat Floc TL | | 0.1 | 25D | <0.1 | ~20 |

# Bulk Chemicals Proposed for Future Use

| CHEMICAL NAME | CHEMICAL FORMULA | LIMIT at 001 in mg/L | OUTFALL | INTERNAL CONCENTRATION | FREQUENCY OF DISCHARGE | TOTAL YEARLY DISCHARGE |
|---|---|---|---|---|---|---|
| 1,2-Diamino ethane(or ethylene diamine) | C2H8N2 | 5<br>5 | 025A<br>025D | 1-10 mg/l<br>1000-5000 mg/l | | 3000-5000 |
| 1,2-diaminoethane 3-Hydroxyquinuclide | C11H24N3 | 5<br>5 | 025A<br>025D | 1-10 mg/l<br>1000-5000 mg/l | | 4100 |
| 2-Amino, 2-methylpropanol | C4H11NO | 5<br>5 | 025A<br>025D | 1-10 mg/l<br>1000-5000 mg/l | | 3000 |
| 2-METHYL-2-AMINO-1-PROPANE | C4H11N | 5<br>5 | 025A<br>025D | 1-10 mg/l<br>1000-5000 mg/l | | 3000-5000 |
| 2,2'-Dipyridyl | C10H8N2 | 5<br>5 | 025A<br>025D | 1-10 mg/l<br>1000-5000 mg/l | | 3000-5000 |
| 2,9-Dimethyl-1,10-Phenanthroline | C14H12N2 | 5<br>5 | 025A<br>025D | 1-10 mg/l<br>1000-5000 mg/l | | 3000-5000 |
| 4,4'-Dipyridyl | C10H8N2 | 5<br>5 | 025A<br>025D | 1-10 mg/l<br>1000-5000 mg/l | | 3000-5000 |
| 4,7-Dimethyl-1,10-phenanthroline | C14H12N2 | 5<br>5 | 025A<br>025D | 1-10 mg/l<br>1000-5000 mg/l | | 3000-5000 |
| 5-AMINOPENTANOL | C5H13NO | 5<br>5 | 025A<br>025D | 1-10 mg/l<br>1000-5000 mg/l | | 3361 |
| Terpyridine | C10H8N2 | 5<br>5 | 025A<br>025D | 1-10 mg/l<br>1000-5000 mg/l | | 3000-5000 |
| Pyrolidine | C4H9N | 5<br>5 | 025A<br>025D | 1-10 mg/l<br>1000-5000 mg/l | | 2350 |
| Pyrolidone | C4H7NO | 5<br>5 | 025A<br>025D | 1-10 mg/l<br>1000-5000 mg/l | | 3000-5000 |

| | | | | | |
|---|---|---|---|---|---|
| Carbohydrazide | CH6N4O | 5 | 025A | 50-500 mg/l | 200 |
| Sulfuric Acid (note already in use at outfall 025C) | H2SO4 | pH | 001 | | ~16000 |
| Sodium Hydroxide (note already in use at outfall 25C) | NaOH | pH | 001 | | ~32000 |

# PROCESS CHEMICALS

| CHEMICAL NAME | CHEMICAL FORMULA | PROPOSED LIMIT at 001 | OUTFALL | INTERNAL CONCENTRATION | FREQUENCY OF DISCHARGE | TOTAL USE LBS/YR |
|---|---|---|---|---|---|---|
| Diisopropylamine | C6H15N | 0.5 | 025D<br>025C<br>022<br>023 | 0.2mg/l<br>1.5 mg/l<br>1.1 mg/l<br>0.89 mg/l | Batch(3/W)<br>^Batch(2/M)<br>CONT<br>CONT | 32<br>6.3<br>43.7 |
| Molybdate-3 Reagent | Mo12Na3O40P | 0.5 | WT Reject<br>025C | 0.26 mg/l<br>1 mg/l | CONT<br>CONT | 4.3<br>4.3 |
| Citric Acid | C6H8O7 | | WT Reject<br>025C<br>002 | 0.25 mg/l<br>0.98 mg/l<br>N/A | CONT<br>CONT<br>N/A | 4.2<br>4.2 |
| ***Silica Standard*** | | 0.5 | 023<br>025C | <<1 mg/l<br><<1 mg/l | | |
| Amino Acid F Reagent(sum of two part reagent) | | 0.5 | 023<br>025C | 0.93 mg/l<br>1.63 mg/l | | |
| Lithium Hydroxide | LiOH-(H2O) | 0.5 (as Li) | 025D | 0.18 (as Li) | Batch(3/W) | 44.8<br>(as LiOH-H2O) |
| Hydrogen Peroxide | H2O2 | 0.5 | 025D | 0.08 mg/l | 1/18months | 10.6 |
| Lysol | isopropyl alcohol<br>o-benzyl,p-chlorophenol(10%)<br>o-phenyl phenol(10%) | 0.1 | 022 | 0.15 mg/l | Cont | 6.7 |
| Lestoil | Stoddard solvent<br>Pine Oil<br>sodium Hydroxide | 0.1 | 022 | 1.9 mg/l | Cont | 85.9 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Tall oil Fatty Acid, sodium salt | | | | | |
| Aqueous Fire Fighting Foam(AFFF) | | | 002 | N/A | | |
| Caustic Soda | Na2CO3 | | 002<br>025C | N/A | | |
| Syntech Touch-it-up Spray | (2-butoxy ethanol(1%), octylphenyl polyethoxylate(1%) trisodium phosphate(1%), sodium meta silicate(1%)) | 0.1 | 025C<br>025D | 1.25 mg/l<br>0.33 mg/l | batch<br>batch | 50 |

| CHEMICAL NAME | CHEMICAL FORMULA | CONCENTRATI in 025D (MG/L) | CONCENTRATION in 001 (MG/L) | LIMIT 001 | OUTFALL | DISCHARGE FREQUENCY | TOTAL LBS/YR |
|---|---|---|---|---|---|---|---|
| 1-AMINO-2-NAPTHOL-4-SULFONIC ACID | C10NSO4H9 | 0.131393065802 | 8.92616E-006 | 0.1 | 025D | Batch (3/W) | 2.907E-002 |
| Acetate Standards (1000ppm) | C2H3O2 | 0.119448241638 | 8.11469E-006 | 0.1 | 025D | | 2.643E-002 |
| Acetate Standards (100ppb) | C2H3O2 | 0.000007166894 | 4.86881E-010 | 0.1 | 025D | | 1.586E-006 |
| Acetate Standards (100ppm) | C2H3O2 | 0.011944824164 | 8.11469E-007 | 0.1 | 025D | | 2.643E-003 |
| Acetate Standards (10ppb) | C2H3O2 | 0.000000716689 | 4.86881E-011 | 0.1 | 025D | | 1.586E-007 |
| Acetate Standards (10ppm) | C2H3O2 | 0.001194482416 | 8.11469E-008 | 0.1 | 025D | | 2.643E-004 |
| Acetate Standards (25ppb) | C2H3O2 | 0.000001791724 | 1.21720E-010 | 0.1 | 025D | | 3.965E-007 |
| Acetate Standards (25ppm) | C2H3O2 | 0.002986206041 | 2.02867E-007 | 0.1 | 025D | | 6.608E-004 |
| Acetate Standards (50ppb) | C2H3O2 | 3.58345E-006 | 2.43441E-010 | 0.1 | 025D | | 7.930E-007 |
| Aluminum Standards (100ppb) | AL | 0.000007166894 | 4.86881E-010 | 0.1 | 025D | | 1.586E-006 |
| Aluminum Standards (10ppb) | AL | 0.000000716689 | 4.86881E-011 | 0.1 | 025D | | 1.586E-007 |
| Aluminum Standards (10ppm) | AL | 0.001194482416 | 8.11469E-008 | 0.1 | 025D | | 2.643E-004 |
| Aluminum Standards (1ppm) | AL | 0.000119448242 | 8.11469E-009 | 0.1 | 025D | | 2.643E-005 |
| Aluminum Standards (50ppb) | AL | 0.000003583447 | 2.43441E-010 | 0.1 | 025D | | 7.930E-007 |
| Ammonia Standards (1.02ppm) | NH3 | 0.000121837206 | 8.27698E-009 | 0.1 | 025D | | 2.696E-005 |
| Ammonia Standards (1.7ppm) | NH3 | 0.000203062011 | 1.37950E-008 | 0.1 | 025D | | 4.493E-005 |
| Ammonia Standards (1020ppm) | NH3 | 0.121837206471 | 8.27698E-006 | 0.1 | 025D | | 2.696E-002 |
| Ammonia Standards (1700ppm) | NH3 | 0.203062010785 | 1.37950E-005 | 0.1 | 025D | | 4.493E-002 |
| Ammonia Standards (2.38ppm) | NH3 | 0.000284286815 | 1.93130E-008 | 0.1 | 025D | | 6.291E-005 |
| Ammonia Standards (340ppb) | NH3 | 0.000040612402 | 2.75899E-009 | 0.1 | 025D | | 8.987E-006 |
| Boron Standard (1ppm) | H3BO3 | 0.000238896483 | 1.62294E-008 | 0.1 | 025D | | 5.286E-005 |
| Boron Standard (2ppm) | H3BO3 | 0.000477792967 | 3.24588E-008 | 0.1 | 025D | | 1.057E-004 |
| Boron Standard (4ppm) | H3BO3 | 0.000014333789 | 9.73763E-010 | 0.1 | 025D | | 3.172E-006 |
| Calcium Standards (100ppb) | Ca | 0.000007166894 | 4.86881E-010 | 0.1 | 025D | | 1.586E-006 |
| Calcium Standards (10ppb) | Ca | 0.000000716689 | 4.86881E-011 | 0.1 | 025D | | 1.586E-007 |
| Calcium Standards (10ppm) | Ca | 0.001194482416 | 8.11469E-008 | 0.1 | 025D | | 2.643E-004 |
| Calcium Standards (1ppm) | Ca | 0.000119448242 | 8.11469E-009 | 0.1 | 025D | | 2.643E-005 |
| Calcium Standards (50ppb) | Ca | 0.000003583447 | 2.43441E-010 | 0.1 | 025D | | 7.930E-007 |
| Chloride Standards (1000ppm) | Cl | 0.119448241638 | 8.11469E-006 | 0.1 | 025D | | 2.643E-002 |
| Chloride Standards (100ppb) | Cl | 0.00000477793 | 3.24588E-010 | 0.1 | 025D | | 1.057E-006 |
| Chloride Standards (100ppm) | Cl | 0.011944824164 | 8.11469E-007 | 0.1 | 025D | | 2.643E-003 |
| Chloride Standards (10ppb) | Cl | 0.000000716689 | 4.86881E-011 | 0.1 | 025D | | 1.586E-007 |
| Chloride Standards (1ppb) | Cl | 0.000000597241 | 4.05735E-011 | 0.1 | 025D | | 1.322E-007 |
| Chloride Standards (1ppm) | Cl | 0.000119448242 | 8.11469E-009 | 0.1 | 025D | | 2.643E-005 |

| | | | | | |
|---|---|---|---|---|---|
| Chloride Standards (2.5ppb) | Cl | 0.000000179172 | 1.21720E-011 | 0.1 025D | 3.965E-008 |
| Chloride Standards (20ppb) | Cl | 0.000000955586 | 6.49175E-011 | 0.1 025D | 2.115E-007 |
| Chloride Standards (25ppb) | Cl | 0.000001194482 | 8.11469E-011 | 0.1 025D | 2.643E-007 |
| Chloride Standards (3ppb) | Cl | 0.000000215007 | 1.46064E-011 | 0.1 025D | 4.758E-008 |
| Chloride Standards (3ppm) | Cl | 0.000358344725 | 2.43441E-008 | 0.1 025D | 7.930E-005 |
| Chloride Standards (50ppb) | Cl | 0.000002388965 | 1.62294E-010 | 0.1 025D | 5.286E-007 |
| Chloride Standards (5ppb) | Cl | 0.000000358345 | 2.43441E-011 | 0.1 025D | 7.930E-008 |
| Chloride Standards (6ppb) | Cl | 0.000000430014 | 2.92129E-011 | 0.1 025D | 9.515E-008 |
| Chloride Standards (0.5ppb) | Cl | 0.000000035834 | 2.43441E-012 | 0.1 025D | 7.930E-009 |
| | | | | | |
| Coagulant solution (1%) | | 0.053751708737 | 3.65161E-006 | 0.1 025D | 1.189E-002 |
| | | | | | |
| Copper Standards (10ppm) | Cu | 0.001194482416 | 8.11469E-008 | 0.1 025D | 2.643E-004 |
| Copper Standards (1ppm) | Cu | 0.000119448242 | 8.11469E-009 | 0.1 025D | 2.643E-005 |
| Copper Standards (2ppm) | Cu | 0.000238896483 | 1.62294E-008 | 0.1 025D | 5.286E-005 |
| Copper Standards (3ppm) | Cu | 0.000358344725 | 2.43441E-008 | 0.1 025D | 7.930E-005 |
| Copper Standards (5ppm) | Cu | 0.000597241208 | 4.05735E-008 | 0.1 025D | 1.322E-004 |
| | | | | | |
| Disodium EDTA (pH 10 Buf.)(<10,000ppm) | Na2C10N2O8 | 2.388964832769 | 1.62294E-004 | 0.1 025D | 5.286E-001 |
| Disodium EDTA (pH 10 Buf.)(<10,000ppm) | Na2C10N2O8 | 3.583447249154 | 2.43441E-004 | 0.1 025D | 7.930E-001 |
| Disodium EDTA (pH 10 Buf.)(<10,000ppm) | Na2C10N2O8 | 0.597241208192 | 4.05735E-005 | 0.1 025D | 1.322E-001 |
| | | | | | |
| Ethanolamine Standards (1.0ppm) | C2NOH7 | 0.000597241208 | 4.05735E-008 | 0.1 025D | 1.322E-004 |
| Ethanolamine Standards (1.2ppm) | C2NOH8 | 0.000086002734 | 5.84258E-009 | 0.1 025D | 1.903E-005 |
| Ethanolamine Standards (1000ppm) | C2NOH9 | 0.119448241638 | 8.11469E-006 | 0.1 025D | 2.643E-002 |
| | | | | | |
| Ethanolamine Standards (200ppb) | C2NOH10 | 0.000014333789 | 9.73763E-010 | 0.1 025D | 3.172E-006 |
| Ethanolamine Standards (3ppm) | C2NOH11 | 0.000215006835 | 1.46064E-008 | 0.1 025D | 4.758E-005 |
| Ethanolamine Standards (500ppb) | C2NOH12 | 0.000035834472 | 2.43441E-009 | 0.1 025D | 7.930E-006 |
| | | | | | |
| Fluoride Standards (1000ppm) | F | 0.119448241638 | 8.11469E-006 | 0.1 025D | 2.643E-002 |
| Fluoride Standards (100ppb) | F | 0.00000477793 | 3.24588E-010 | 0.1 025D | 1.057E-006 |
| Fluoride Standards (100ppm) | F | 0.011944824164 | 8.11469E-007 | 0.1 025D | 2.643E-003 |
| Fluoride Standards (10ppb) | F | 0.000001194482 | 8.11469E-011 | 0.1 025D | 2.643E-007 |
| Fluoride Standards (1ppm) | F | 0.000119448242 | 8.11469E-009 | 0.1 025D | 2.643E-005 |
| Fluoride Standards (2.5ppb) | F | 0.000001791724 | 1.21720E-010 | 0.1 025D | 3.965E-007 |
| Fluoride Standards (20ppb) | F | 0.000014333789 | 9.73763E-010 | 0.1 025D | 3.172E-006 |
| Fluoride Standards (25ppb) | F | 0.000017917236 | 1.21720E-009 | 0.1 025D | 3.965E-006 |
| Fluoride Standards (2ppb) | F | 0.000000095559 | 6.49175E-012 | 0.1 025D | 2.115E-008 |
| Fluoride Standards (30ppb) | F | 0.000021500683 | 1.46064E-009 | 0.1 025D | 4.758E-006 |
| Fluoride Standards (3ppb) | F | 0.000001791724 | 1.21720E-010 | 0.1 025D | 3.965E-007 |
| Fluoride Standards (3ppm) | F | 0.000358344725 | 2.43441E-008 | 0.1 025D | 7.930E-005 |
| Fluoride Standards (50ppb) | F | 0.000002388965 | 1.62294E-010 | 0.1 025D | 5.286E-007 |
| Fluoride Standards (5ppb) | F | 0.000000238896 | 1.62294E-011 | 0.1 025D | 5.286E-008 |

| | | | | | |
|---|---|---|---|---|---|
| Fluoride Standards (6ppb) | F | 0.000000286676 | 1.94753E-011 | 0.1 025D | 6.344E-008 |
| | | | | | |
| ormaldehyde (Formazin Turb.)(<10,000pp | CH2O | 1.194482416385 | 8.11469E-005 | 0.1 025D | 2.643E-001 |
| Formaldehyde (pH 4 Buffer) (<10,000ppm) | CH2O | 3.583447249154 | 2.43441E-004 | 0.1 025D | 7.930E-001 |
| Formaldehyde (pH 4 Buffer) (<10,000ppm) | CH2O | 0.597241208192 | 4.05735E-005 | 0.1 025D | 1.322E-001 |
| | | | | | |
| Formate Standards (1000ppm) | CH2O2 | 0.119448241638 | 8.11469E-006 | 0.1 025D | 2.643E-002 |
| Formate Standards (100ppb) | CH2O2 | 0.000007166894 | 4.86881E-010 | 0.1 025D | 1.586E-006 |
| Formate Standards (100ppm) | CH2O2 | 0.011944824164 | 8.11469E-007 | 0.1 025D | 2.643E-003 |
| Formate Standards (10ppb) | CH2O2 | 0.000000716689 | 4.86881E-011 | 0.1 025D | 1.586E-007 |
| Formate Standards (10ppm) | CH2O2 | 0.001194482416 | 8.11469E-008 | 0.1 025D | 2.643E-004 |
| Formate Standards (25ppb) | CH2O2 | 0.000001791724 | 1.21720E-010 | 0.1 025D | 3.965E-007 |
| Formate Standards (25ppm) | CH2O2 | 0.002986206041 | 2.02867E-007 | 0.1 025D | 6.608E-004 |
| Formate Standards (50ppb) | CH2O2 | 0.000003583447 | 2.43441E-010 | 0.1 025D | 7.930E-007 |
| | | | | | |
| Glycolate Standards (1000ppm) | C2H4O3 | 0.119448241638 | 8.11469E-006 | 0.1 025D | 2.643E-002 |
| Glycolate Standards (100ppb) | C2H4O3 | 0.000007166894 | 4.86881E-010 | 0.1 025D | 1.586E-006 |
| Glycolate Standards (100ppm) | C2H4O3 | 0.011944824164 | 8.11469E-007 | 0.1 025D | 2.643E-003 |
| Glycolate Standards (10ppb) | C2H4O3 | 0.000000716689 | 4.86881E-011 | 0.1 025D | 1.586E-007 |
| Glycolate Standards (10ppm) | C2H4O3 | 0.001194482416 | 8.11469E-008 | 0.1 025D | 2.643E-004 |
| Glycolate Standards (25ppb) | C2H4O3 | 0.000001791724 | 1.21720E-010 | 0.1 025D | 3.965E-007 |
| Glycolate Standards (25ppm) | C2H4O3 | 0.002986206041 | 2.02867E-007 | 0.1 025D | 6.608E-004 |
| Glycolate Standards (50ppb) | C2H4O3 | 0.000003583447 | 2.43441E-010 | 0.1 025D | 7.930E-007 |
| | | | | | |
| amethylenetetramine(Form Turb)(<10,000p | C6H20N4 | 1.194482416385 | 8.11469E-005 | 0.1 025D | 2.643E-001 |
| | | | | | |
| Hydrazine Dihydrochloride (1000ppm) | N2H6Cl | 0.005972412082 | 4.05735E-007 | 0.1 025D | 1.322E-003 |
| Hydrazine Dihydrochloride (1ppm) | N2H6Cl | 0.000005972412 | 4.05735E-010 | 0.1 025D | 1.322E-006 |
| Hydrazine Dihydrochloride (20ppb) | N2H6Cl | 0.000002388965 | 1.62294E-010 | 0.1 025D | 5.286E-007 |
| Hydrazine Dihydrochloride (80ppb) | N2H6Cl | 0.000000477793 | 3.24588E-011 | 0.1 025D | 1.057E-007 |
| Hydrazine Dihydrochloride (80ppm) | N2H6Cl | 0.000477792967 | 3.24588E-008 | 0.1 025D | 1.057E-004 |
| | | | | | |
| Hydrochloric Acid (.032M) | HCl | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Hydrochloric Acid (.048M) | HCl | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Hydrochloric Acid (6.05M) | HCl | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Hydrochloric Acid (1.121M) | HCl | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Hydrochloric Acid (12.1M) | HCl | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Hydrochloric Acid (12.1M) | HCl | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Hydrochloric Acid (12.1M) | HCl | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| | | | | | |
| Iron Standards (.5ppm) | Fe | 0.000059724121 | 4.05735E-009 | 0.1 025D | 1.322E-005 |
| Iron Standards (10ppm) | Fe | 0.001194482416 | 8.11469E-008 | 0.1 025D | 2.643E-004 |
| Iron Standards (1ppm) | Fe | 0.000119448242 | 8.11469E-009 | 0.1 025D | 2.643E-005 |
| Iron Standards (2ppm) | Fe | 0.000238896483 | 1.62294E-008 | 0.1 025D | 5.286E-005 |

| | | | | | |
|---|---|---|---|---|---|
| Iron Standards (3ppm) | Fe | 0.000358344725 | 2.43441E-008 | 0.1 025D | 7.930E-005 |
| Iron Standards (5ppm) | Fe | 0.000597241208 | 4.05735E-008 | 0.1 025D | 1.322E-004 |
| Isopropyl Alcohol | C3H8O | 1.791723624577 | 1.21720E-004 | 0.1 025D | 3.965E-001 |
| Isopropyl Alcohol | C3H8O | 0.023889648328 | 1.62294E-006 | 0.1 025D | 5.286E-003 |
| Isopropyl Alcohol | C3H8O | 0.143337889966 | 9.73763E-006 | 0.1 025D | 3.172E-002 |
| Lithium Standards (1ppm) | Li | 0.000119448242 | 8.11469E-009 | 0.1 025D | 2.643E-005 |
| Lithium Standards (2.5ppm) | Li | 0.000298620604 | 2.02867E-008 | 0.1 025D | 6.608E-005 |
| Lithium Standards (3.5ppm) | Li | 0.000418068846 | 2.84014E-008 | 0.1 025D | 9.251E-005 |
| Lithium Standards (3ppm) | Li | 0.000358344725 | 2.43441E-008 | 0.1 025D | 7.930E-005 |
| Lithium Standards (4ppm) | Li | 0.000477792967 | 3.24588E-008 | 0.1 025D | 1.057E-004 |
| Liquinox Soap(99% water) | Anionic Soap | 0.000000281152 | 1.91000E-011 | 025D | 2.500E+001 |
| Magnesium Standards (100ppb) | Mg | 0.000007166894 | 4.86881E-010 | 0.1 025D | 1.586E-006 |
| Magnesium Standards (10ppb) | Mg | 0.000000716689 | 4.86881E-011 | 0.1 025D | 1.586E-007 |
| Magnesium Standards (10ppm) | Mg | 0.001194482416 | 8.11469E-008 | 0.1 025D | 2.643E-004 |
| Magnesium Standards (1ppm) | Mg | 0.000119448242 | 8.11469E-009 | 0.1 025D | 2.643E-005 |
| Magnesium Standards (50ppb) | Mg | 0.000003583447 | 2.43441E-010 | 0.1 025D | 7.930E-007 |
| Mannitol (18%) | C6H14O6 | 47.30150368883 | 3.21342E-003 | 0.1 025D | 1.047E+001 |
| Mannitol (9%) | C6H14O6 | 21.50068349492 | 1.46064E-003 | 0.1 025D | 4.758E+000 |
| Methyl Orange | C14H14N3Na | 0.023889648328 | 1.62294E-006 | 0.1 025D | 5.286E-003 |
| Methanesulfonic Acid (6.5ml/l) | CH6O3S | 0.045031987098 | 3.05924E-006 | 0.1 025D | 9.965E-003 |
| Methoxypropylamine Standards (1000ppm) | C4H11NO | 0.119448241638 | 8.11469E-006 | 0.1 025D | 2.643E-002 |
| Methoxypropylamine Standards (1ppm) | C4H11NO | 0.000071668945 | 4.86881E-009 | 0.1 025D | 1.586E-005 |
| Methoxypropylamine Standards (3ppm) | C4H11NO | 0.000215006835 | 1.46064E-008 | 0.1 025D | 4.758E-005 |
| Methoxypropylamine Standards (4000ppm) | C4H11NO | 0.477792966554 | 3.24588E-005 | 0.1 025D | 1.057E-001 |
| Methoxypropylamine Standards (4ppm) | C4H11NO | 0.002388964833 | 1.62294E-007 | 0.1 025D | 5.286E-004 |
| Methoxypropylamine Standards (500ppb) | C4H11NO | 0.000035834472 | 2.43441E-009 | 0.1 025D | 7.930E-006 |
| Methoxypropylamine Standards (6ppm) | C4H11NO | 0.00043001367 | 2.92129E-008 | 0.1 025D | 9.515E-005 |
| Methyl Alcohol | CH4O | 130.4374798692 | 8.86124E-003 | 0.1 025D | 2.886E+001 |
| Methyl Alcohol (pH 4 buffer)(<10,000ppm) | CH4O | 3.583447249154 | 2.43441E-004 | 0.1 025D | 7.930E-001 |
| Methyl Alcohol (pH 4 buffer)(<10,000ppm) | CH4O | 0.597241208192 | 4.05735E-005 | 0.1 025D | 1.322E-001 |
| Nickel standards (.5ppm) | Ni | 0.000059724121 | 4.05735E-009 | 0.1 025D | 1.322E-005 |
| Nickel standards (1.5ppm) | Ni | 0.000179172362 | 1.21720E-008 | 0.1 025D | 3.965E-005 |
| Nickel standards (10ppm) | Ni | 0.001194482416 | 8.11469E-008 | 0.1 025D | 2.643E-004 |
| Nickel standards (1ppm) | Ni | 0.000119448242 | 8.11469E-009 | 0.1 025D | 2.643E-005 |

| | | | | | |
|---|---|---|---|---|---|
| Nickel standards (2ppm) | Ni | 0.000238896483 | 1.62294E-008 | 0.1 025D | 5.286E-005 |
| Nickel standards (3ppm) | Ni | 0.000358344725 | 2.43441E-008 | 0.1 025D | 7.930E-005 |
| Nickel standards (5ppm) | Ni | 0.000597241208 | 4.05735E-008 | 0.1 025D | 1.322E-004 |
| Nitric Acid (1.59M) | HO3N | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Nitric Acid (15.9M) | HO3N | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Nitric Acid (15.9M) | HO3N | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Nitric Acid (15.9M) | HO3N | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Nitric Acid (15.9M) | HO3N | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Nitric Acid (15.9M) | HO3N | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Oxalic Acid (0.11M) | C2H2O4 | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Para-dimethylaminobenzaldehyde | C9H11NO | 2.580082019391 | 1.75277E-004 | 0.1 025D | 5.709E-001 |
| Phenolphthalein (1%) | C20H14O4 | 0.017917236246 | 1.21720E-006 | 0.1 025D | 3.965E-003 |
| Phenolphthalein (1%) | C20H14O4 | 0.000238896483 | 1.62294E-008 | 0.1 025D | 5.286E-005 |
| Phenolphthalein (1%) | C20H14O4 | 0.0014333789 | 9.73763E-008 | 0.1 025D | 3.172E-004 |
| Phosphoric Acid (2.96M) | H3PO4 | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Potassium Acid Phthalate (100ppb) | C8H5O4K | 0.000011944824 | 8.11469E-010 | 0.1 025D | 2.643E-006 |
| Potassium Acid Phthalate (200ppb) | C8H5O4K | 0.000023889648 | 1.62294E-009 | 0.1 025D | 5.286E-006 |
| Potassium Acid Phthalate (200ppm) | C8H5O4K | 0.023889648328 | 1.62294E-006 | 0.1 025D | 5.286E-003 |
| ot. Acid Phthalate (pH 4 Buf.)(<10,000ppm | C8H5O4K | 3.583447249154 | 2.43441E-004 | 0.1 025D | 7.930E-001 |
| ot. Acid Phthalate (pH 4 Buf.)(<10,000ppm | C8H5O4K | 0.597241208192 | 4.05735E-005 | 0.1 025D | 1.322E-001 |
| Potassium Acid Phthalate (3%) | C8H5O4K | 0.071668944983 | 4.86881E-006 | 0.1 025D | 1.586E-002 |
| Potassium Acid Phthalate (3%) | C8H5O4K | 0.071668944983 | 4.86881E-006 | 0.1 025D | 1.586E-002 |
| orate in formaldehyde(0.1%) (pH 10)(<1000 | KH2O3B | 2.388964832769 | 1.62294E-004 | 0.1 025D | 5.286E-001 |
| orate in formaldehyd(0.1%) (pH 10)(<1000 | KH2O3B | 3.583447249154 | 2.43441E-004 | 0.1 025D | 7.930E-001 |
| orate in formaldehyde(0.1%) (pH 10)(<1000 | KH2O3B | 0.597241208192 | 4.05735E-005 | 0.1 025D | 1.322E-001 |
| Pot. Carbonate (pH buf. 10) (<10,000ppm) | K2CO3 | 2.388964832769 | 1.62294E-004 | 0.1 025D | 5.286E-001 |
| Pot. Carbonate (pH buf. 10) (<10,000ppm) | K2CO3 | 3.583447249154 | 2.43441E-004 | 0.1 025D | 7.930E-001 |
| Pot. Carbonate (pH buf. 10) (<10,000ppm) | K2CO3 | 0.597241208192 | 4.05735E-005 | 0.1 025D | 1.322E-001 |
| Potassium Chloride (744ppm) | KCl | 0.355477967116 | 2.41493E-005 | 0.1 025D | 7.866E-002 |
| Potassium Persulfate (2%) | K2S2O8 | 2.388964832769 | 1.62294E-004 | 0.1 025D | 5.286E-001 |
| Pot. Phosphate (pH buffer 7)(<10,000ppm) | KH2PO4 | 2.388964832769 | 1.62294E-004 | 0.1 025D | 5.286E-001 |
| Pot. Phosphate (pH buffer 7)(<10,000ppm) | KH2PO4 | 3.583447249154 | 2.43441E-004 | 0.1 025D | 7.930E-001 |
| Pot. Phosphate (pH buffer 7)(<10,000ppm) | KH2PO4 | 0.597241208192 | 4.05735E-005 | 0.1 025D | 1.322E-001 |

| | | | | | |
|---|---|---|---|---|---|
| Scintillation Cocktail(99% water) | High MW Eth | 0.000000234048 | 1.59000E-011 | 025D | 2.050E+001 |
| | | | | | |
| Silica standard (1000ppm) | SiO3H2 | 0.119448241638 | 8.11469E-006 | 0.1 025D | 2.643E-002 |
| Silica standard (100ppb) | SiO3H2 | 0.000001194482 | 8.11469E-011 | 0.1 025D | 2.643E-007 |
| Silica standard (10ppm) | SiO3H2 | 0.001194482416 | 8.11469E-008 | 0.1 025D | 2.643E-004 |
| Silica standard (200ppb) | SiO3H2 | 0.000002388965 | 1.62294E-010 | 0.1 025D | 5.286E-007 |
| Silica standard (50ppb) | SiO3H2 | 0.000017917236 | 1.21720E-009 | 0.1 025D | 3.965E-006 |
| | | | | | |
| Silver Nitrate (48.5g/L) | AgNO3 | 0.00289661986 | 1.96781E-007 | 0.1 025D | 6.410E-004 |
| | | | | | |
| Sodium Bicarbonate (142.8ppmg/L) | NaHCO3 | 1.296347876854 | 8.80671E-005 | 0.1 025D | 2.869E-001 |
| Sodium Bisulfite | NaHSO3 | 7.883583948139 | 5.35570E-004 | 0.1 025D | 1.744E+000 |
| | | | | | |
| Sodium Carbonate | Na2CO3 | 0.000358344725 | 2.43441E-008 | 0.1 025D | 7.930E-005 |
| Sodium Carbonate (190.8ppm) | Na2CO3 | 1.732095062351 | 1.17670E-004 | 0.1 025D | 3.833E-001 |
| | | | | | |
| Sodium Hydroxide (0.02M) | NaOH | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Sodium Hydroxide (0.05M) | NaOH | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Sodium Hydroxide (19.4M) | NaOH | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Sodium Hydroxide (19.4M) | NaOH | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| Sodium Hydroxide (19.4M) | NaOH | 0 | 0.00000E+000 | 025D | 0.000E+000 |
| | | | | | |
| Sodium Standards (0.5ppb) | Na | 0.000000035834 | 2.43441E-012 | 0.1 025D | 7.930E-009 |
| Sodium Standards (1000ppm) | Na | 0.119448241638 | 8.11469E-006 | 0.1 025D | 2.643E-002 |
| Sodium Standards (100ppb) | Na | 0.000011944824 | 8.11469E-010 | 0.1 025D | 2.643E-006 |
| Sodium Standards (10ppb) | Na | 0.000000716689 | 4.86881E-011 | 0.1 025D | 1.586E-007 |
| Sodium Standards (10ppm) | Na | 0.001194482416 | 8.11469E-008 | 0.1 025D | 2.643E-004 |
| Sodium Standards (1ppm) | Na | 0.000119448242 | 8.11469E-009 | 0.1 025D | 2.643E-005 |
| Sodium Standards (30ppb) | Na | 0.000002150068 | 1.46064E-010 | 0.1 025D | 4.758E-007 |
| Sodium Standards (3ppb) | Na | 0.000001791724 | 1.21720E-010 | 0.1 025D | 3.965E-007 |
| Sodium Standards (3ppm) | Na | 0.000358344725 | 2.43441E-008 | 0.1 025D | 7.930E-005 |
| Sodium Standards (5ppb) | Na | 0.000000358345 | 2.43441E-011 | 0.1 025D | 7.930E-008 |
| Sodium Standards (80ppb) | Na | 0.000009555859 | 6.49175E-010 | 0.1 025D | 2.115E-006 |
| | | | | | |
| Sodium Sulfate | Na2SO4 | 0.597241208192 | 4.05735E-005 | 0.1 025D | 1.322E-001 |
| Sodium Sulfite | Na2SO3 | 0.262786131605 | 1.78523E-005 | 0.1 025D | 5.815E-002 |
| | | | | | |
| Sodium Tetraborate (10.06g/l) | Na4B4O7 | 80.51050382916 | 5.46946E-003 | 0.1 025D | 1.782E+001 |
| | | | | | |
| Stannous Chloride | SnCl2 | 5.972412081924 | 4.05735E-004 | 0.1 025D | 1.322E+000 |
| | | | | | |
| Sulfate Standards (0.5ppb) | SO4 | 0.000000035834 | 2.43441E-012 | 0.1 025D | 7.930E-009 |
| Sulfate Standards (1000ppm) | SO4 | 0.119448241638 | 8.11469E-006 | 0.1 025D | 2.643E-002 |
| Sulfate Standards (100ppm) | SO4 | 0.011944824164 | 8.11469E-007 | 0.1 025D | 2.643E-003 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Sulfate Standards (1ppb) | SO4 | 0.000000645021 | 4.38193E-011 | 0.1 | 025D | 1.427E-007 |
| Sulfate Standards (1ppm) | SO4 | 0.000119448242 | 8.11469E-009 | 0.1 | 025D | 2.643E-005 |
| Sulfate Standards (20ppb) | SO4 | 0.000000955586 | 6.49175E-011 | 0.1 | 025D | 2.115E-007 |
| Sulfate Standards (25ppb) | SO4 | 0.000001194482 | 8.11469E-011 | 0.1 | 025D | 2.643E-007 |
| Sulfate Standards (3ppb) | SO4 | 0.000000215007 | 1.46064E-011 | 0.1 | 025D | 4.758E-008 |
| Sulfate Standards (50ppb) | SO4 | 0.000002388965 | 1.62294E-010 | 0.1 | 025D | 5.286E-007 |
| Sulfate Standards (5ppb) | SO4 | 0.000000358345 | 2.43441E-011 | 0.1 | 025D | 7.930E-008 |
| Sulfuric Acid (2.7M) | H2SO4 | 0 | 0.00000E+000 | | 025D | 0.000E+000 |
| Sulfuric Acid (25mM) | H2SO4 | 0 | 0.00000E+000 | | 025D | 0.000E+000 |
| Sulfuric Acid (6M) | H2SO4 | 0 | 0.00000E+000 | | 025D | 0.000E+000 |
| Sulfuric Acid (18M) | H2SO4 | 0 | 0.00000E+000 | | 025D | 0.000E+000 |
| Thioglycolic acid (14M) | C2H4SO2 | 0.000000001119 | 7.60000E-014 | | 025D | 1.000E-001 |
| Toluene | C7H8 | 0.000035834472 | 2.43441E-009 | 0.1 | 025D | 7.930E-006 |

# MARINE ACUTE TOXICITY TEST PROCEDURE AND PROTOCOL

## I. GENERAL REQUIREMENTS

The permittee shall conduct acceptable acute toxicity tests in accordance with the appropriate test protocols described below:

- **Mysid Shrimp (Mysidopsis bahia) definitive 48-hour test.**
- **Inland Silverside (Menidia beryllina) definitive 48-hour test.**

Acute toxicity data shall be reported as outlined in Section VIII.

## II. METHODS

Methods to follow are those recommended by EPA in:

Weber, C.I. et al. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, Fourth Edition. Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Cincinnati, OH, August 1993, EPA/600/4-90/027F.

Any exceptions are stated herein.

## III. SAMPLE COLLECTION

A discharge sample shall be collected. Aliquots shall be split from the sample, containerized and preserved (as per 40 CFR Part 136) for the chemical and physical analyses. The remaining sample shall be dechlorinated (if detected) in the laboratory using sodium thiosulfate for subsequent toxicity testing. (Note that EPA approved test methods require that samples collected for metals analyses be preserved immediately after collection.) Grab samples must be used for pH, temperature, and total residual oxidants (as per 40 CFR Part 122.21).

Standard Methods for the Examination of Water and Wastewater describes dechlorination of samples (APHA, 1992). Dechlorination can be achieved using a ratio of 6.7 mg/L anhydrous sodium thiosulfate to reduce 1.0 mg/L chlorine. A thiosulfate control (maximum amount of thiosulfate in lab control or receiving water) should also be run.

All samples held overnight shall be refrigerated at 4°C.

## IV. DILUTION WATER

A grab sample of dilution water used for acute toxicity testing shall be collected at a point away from the discharge which is free from toxicity or other sources of contamination. Avoid collecting near areas of obvious road or agricultural runoff, storm sewers or other point source discharges. An additional control (0% effluent) of a standard laboratory water of known quality shall also be tested.

If the receiving water diluent is found to be, or suspected to be toxic or unreliable, an alternate standard dilution water of known quality with a conductivity, salinity, total suspended solids, and pH similar to that of the receiving water may be substituted **AFTER RECEIVING WRITTEN APPROVAL FROM THE PERMIT ISSUING AGENCY(S).** Written requests for use of an alternative dilution water should be mailed with supporting documentation to the following address:

Director
Office of Ecosystem Protection
U.S. Environmental Protection Agency - New England
One Congress Street
Suite 1100 (Mail Code: CAA)
Boston, Massachusetts 02114-2023

It may prove beneficial to have the proposed dilution water source screened for suitability prior to toxicity testing. EPA strongly urges that screening be done prior to set up of a full definitive toxicity test any time there is question about the dilution water's ability to support acceptable performance as outlined in the 'test acceptability' section of the protocol.

## V. TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA

EPA New England requires tests be performed using four replicates of each control and effluent concentration because the non-parametric statistical tests cannot be used with data from fewer replicates. The following tables summarize the accepted Mysid and Menidia toxicity test conditions and test acceptability criteria:

**EPA NEW ENGLAND RECOMMENDED EFFLUENT TOXICITY TEST CONDITIONS FOR THE MYSID, MYSIDOPSIS BAHIA 48 HOUR TEST[1]**

| | |
|---|---|
| 1. Test type | Static, non-renewal |
| 2. Salinity | 25ppt ± 10 percent for all dilutions by adding dry ocean salts |
| 3. Temperature (°C) | 20°C ± 1°C or 25°C ± 1°C |
| 4. Light quality | Ambient laboratory illumination |
| 5. Photoperiod | 16 hour light, 8 hour dark |
| 6. Test chamber size | 250 ml |
| 7. Test solution volume | 200 ml |
| 8. Age of test organisms | 1-5 days |
| 9. No. Mysids per test chamber | 10 |
| 10. No. of replicate test chambers per treatment | 4 |
| 11. Total no. Mysids per test concentration | 40 |
| 12. Feeding regime | Light feeding using concentrated Artemia nauplii while holding prior to initiating the test |
| 13. Aeration[2] | None |
| 14. Dilution water | Natural seawater, or deionized water mixed with artificial sea salts |
| 15. Dilution factor | ≥ 0.5 |
| 16. Number of dilutions[3] | 5 plus a control. An additional dilution at the permitted effluent concentration (% |

| | |
|---|---|
| | effluent) is required if it is not included in the dilution series. |
| 17. Effect measured | Mortality - no movement of body appendages on gentle prodding |
| 18. Test acceptability | 90% or greater survival of test organisms in control solution |
| 19. Sampling requirements | For on-site tests, samples are used within 24 hours of the time that they are removed from the sampling device. For off-site tests, samples must be first used within 36 hours of collection. |
| 20. Sample volume required | Minimum 1 liter for effluents and 2 liters for receiving waters |

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Footnotes:

1. Adapted from EPA/600/4-90/027F.

2. If dissolved oxygen falls below 4.0 mg/L, aerate at rate of less than 100 bubbles/min. Routine D.O. checks are recommended.

3. When receiving water is used for dilution, an additional control made up of standard laboratory dilution water (0% effluent) is required.

**EPA NEW ENGLAND RECOMMENDED TOXICITY TEST CONDITIONS FOR THE INLAND SILVERSIDE, MENIDIA BERYLLINA 48 HOUR TEST[1]**

| | |
|---|---|
| 1. Test type | Static, non-renewal |
| 2. Salinity | 25 ppt ± 2 ppt by adding dry ocean salts |
| 3. Temperature | 20°C ± 1°C or 25°C ± 1°C |
| 4. Light quality | Ambient laboratory illumination |
| 5. Photoperiod | 16 hr light, 8 hr dark |
| 6. Size of test vessel | 250 mL (minimum) |
| 7. Volume of test solution | 200 mL/replicate (minimum) |
| 8. Age of fish | 9-14 days; 24 hr age range |
| 9. No. fish per chamber | 10 (not to exceed loading limits) |
| 10. No. of replicate test vessels per treatment | 4 |
| 11. Total no. organisms per concentration | 40 |
| 12. Feeding regime | Light feeding using concentrated Artemia nauplii while holding prior to initiating the test |
| 13. Aeration[2] | None |
| 14. Dilution water | Natural seawater, or deionized water mixed with artificial sea salts. |
| 15. Dilution factor | ≥ 0.5 |
| 16. Number of dilutions[3] | 5 plus a control. An additional dilution at the permitted concentration (% effluent) is |

| | |
|---|---|
| | required if it is not included in the dilution series. |
| 17. Effect measured | Mortality-no movement on gentle prodding. |
| 18. Test acceptability | 90% or greater survival of test organisms in control solution. |
| 19. Sampling requirements | For on-site tests, samples must be used within 24 hours of the time they are removed from the sampling device. Off-site test samples must be used within 36 hours of collection. |
| 20. Sample volume required | Minimum 1 liter for effluents and 2 liters for receiving waters. |

Footnotes:

1. Adapted from EPA/600/4-90/027F.

2. If dissolved oxygen falls below 4.0 mg/L, aerate at rate of less than 100 bubbles/min. Routine D.O. checks recommended.

3. When receiving water is used for dilution, an additional control made up of standard laboratory dilution water (0% effluent) is required.

## VI. CHEMICAL ANALYSIS

At the beginning of the static acute test, pH, salinity, and temperature must be measured at the beginning and end of each 24-hour period in each dilution and in the controls. The following chemical analyses shall be performed for each sampling event.

| Parameter | Effluent | Diluent | Minimum Quanti-fication Level (mg/L) |
|---|---|---|---|
| pH | x | x | --- |
| Salinity | x | x | PPT(o/oo) |
| Total Residual Oxidants[*1] | x | x | 0.05 |
| Total Solids and Suspended Solids | x | x | --- |
| Ammonia | x | x | 0.1 |
| Total Organic Carbon | x | x | 0.5 |
| Total Metals | | | |
| Cd | x | | 0.001 |
| Cr | x | | 0.005 |
| Pb | x | | 0.005 |
| Cu | x | | 0.0025 |
| Zn | x | | 0.0025 |
| Ni | x | | 0.004 |
| Al | x | | 0.02 |

Superscript:

*1 Total Residual Oxidants

Either of the following methods from APHA (1992), Standard Methods for the Examination of Water and Wastewater, 18th or subsequent Edition(s) as approved in 40 CFR Part 136 must be used for these analyses:

-Method 4500-Cl E. Low-Level Amperometric Titration (the preferred method);

-Method 4500-Cl G. DPD Colorimetric Method, or use U.S. EPA Manual of Methods Analysis of Water or Wastes, Method 330.5.

## VII. TOXICITY TEST DATA ANALYSIS

LC50 Median Lethal Concentration

An estimate of the concentration of effluent or toxicant that is lethal to 50% of the test organisms during the time prescribed by the test method.

Methods of Estimation:

- Probit Method
- Spearman-Karber
- Trimmed Spearman-Karber
- Graphical

See flow chart in Figure 6 on page 77 of EPA 600/4-90/027F for appropriate method to use on a given data set.

No Observed Acute Effect Level (NOAEL)

See flow chart in Figure 13 on page 94 of EPA 600/4-90/027F.

## VIII. TOXICITY TEST REPORTING

The following must be reported:

- Description of sample collection procedures, site description;
- Names of individuals collecting and transporting samples, times and dates of sample collection and analysis on chain-of-custody; and
- General description of tests: age of test organisms, origin, dates and results of standard toxicant tests; light and temperature regime; other information on test conditions if different than procedures recommended. Reference toxicity test data must be included.
- Raw data and bench sheets.
- All chemical/physical data generated. (Include minimum detection levels and minimum quantification levels.)
- Provide a description of dechlorination procedures (as applicable).
- Any other observations or test conditions affecting test outcome.
- Statistical tests used to calculate endpoints.

ATTACHMENT D NH0020338

# MARINE CHRONIC TOXICITY TEST PROCEDURE AND PROTOCOL

## I. GENERAL REQUIREMENTS

The permittee shall conduct acceptable silverside chronic (and modified acute) and sea urchin chronic toxicity tests in accordance with the appropriate test protocols described below:

- **Inland Silverside (Menidia beryllina) Larval Growth and Survival Test.**
- **Sea Urchin (Arbacia punctulata) 1 Hour Fertilization Test.**

Chronic and acute toxicity data shall be reported as outlined in Section VIII. The chronic Menidia test can be used to calculate an LC50 at the end of 48 hours of exposure when both an acute (LC50) and a chronic (C-NOEC) test is specified in the permit.

## II. METHODS

Methods to follow are those recommended by EPA in:

Klemm, D.J. et al. Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters To Marine and Estuarine Organisms, Second Edition. Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, July 1994, EPA/600/4-91/003.

Any exceptions are stated herein.

## III. SAMPLE COLLECTION

For each sampling event involving the Menidia beryllina, three discharge samples shall be collected. Fresh samples are necessary for Days 1, 3, and 5 (see Section V. for holding times). A single sample is necessary for the Arbacia punctulata test. The sample shall be analyzed chemically (see Section VI). The initial sample (Day 1) is used to start the tests, and for test solution renewal on Day 2. The second sample is collected for use at the start of Day 3, and for renewal on Day 4. The third sample is used on Days 5, 6, and 7. The initial (Day 1) sample will be analyzed chemically (see Section VI). Day 3 and 5 renewal samples will be held until test completion. If either the Day 3 or 5 renewal sample is of sufficient potency to cause lethality to 50 percent or more test organisms in any of the dilutions for either species, then a chemical analysis shall be performed on the appropriate sample(s) as well.

Aliquots shall be split from the sample, containerized and preserved (as per 40 CFR Part 136) for the chemical and physical analyses. The remaining sample shall be dechlorinated (if detected) in the laboratory using sodium thiosulfate for subsequent toxicity testing. (Note that EPA approved test methods require that samples collected for metals analyses be preserved immediately after collection.) Grab samples must be used for pH, temperature, and total residual oxidants (as per 40 CFR Part 122.21).

Standard Methods for the Examination of Water and Wastewater describes dechlorination of samples (APHA, 1992). Dechlorination can be achieved using a ratio of 6.7 mg/L anhydrous sodium thiosulfate to reduce 1 mg/L chlorine. A thiosulfate control (maximum amount of thiosulfate in lab control or receiving water) should also be run.

All samples held overnight shall be refrigerated at 4°C.

## IV. DILUTION WATER

Grab samples of receiving water used for chronic toxicity testing shall be collected from one or several distances away from the discharge. It may be necessary to test receiving water at several distances in a separate chronic test to determine the extent of the zone of toxicity. Avoid collecting near areas of obvious road or agricultural runoff, storm sewers or other point source discharges. An additional control (0% effluent) of a standard laboratory water of known quality shall also be tested.

If the receiving water diluent is found to be, or suspected to be toxic or unreliable, an alternate standard dilution water of known quality with a conductivity, salinity, total suspended solids, organic carbon, and pH similar to that of the receiving water may be substituted **AFTER RECEIVING WRITTEN APPROVAL FROM THE PERMIT ISSUING AGENCY(S).** Written requests for use of an alternative dilution water should be mailed with supporting documentation to the following address:

Director
Office of Ecosystem Protection
U. S. Environmental Protection Agency-New England
JFK Federal Building (CAA)
Boston, MA 02203

It may prove beneficial to the permittee to have the proposed dilution water source screened for suitability prior to toxicity testing. EPA strongly urges that screening be done prior to set up of a full definitive toxicity test any time there is question about the dilution water's ability to support acceptable

performance as outlined in the 'test acceptability' section of the protocol.

## V. TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA

EPA New England requires that tests be performed using four replicates of each control and effluent concentration because the on-parametric statistical tests cannot be used with data from fewer replicates. Also, if a reference toxicant test was being performed concurrently with an effluent or receiving water test and fails, both tests must be repeated.

The following tables summarize the accepted Menidia and Arbacia toxicity test conditions and test acceptability criteria:

**EPA NEW ENGLAND RECOMMENDED TEST CONDITIONS FOR THE SEA URCHIN, ARBACIA PUNCTULATA, FERTILIZATION TEST[1]**

| | |
|---|---|
| 1. Test type | Static, non-renewal |
| 2. Salinity | 30 o/oo ± 2 o/oo by adding dry ocean salts |
| 3. Temperature | 20 ± 1°C |
| 4. Light quality | Ambient laboratory light during test preparation |
| 5. Light intensity | 10-20 uE/$m^2$/s, or 50-100 ft-c (Ambient Laboratory Levels) |
| 6. Test vessel size | Disposal (glass) liquid scintillation vials (20 ml capacity), presoaked in control water |
| 7. Test solution volume | 5 ml |
| 8. Number of sea urchins | Pooled sperm from four males and pooled eggs from four females are used per test |
| 9. Number of egg and sperm cells per chamber | About 2000 eggs and 5,000,000 sperm cells per vial |
| 10. Number of replicate chambers per treatment | 4 |
| 11. Dilution water | Uncontaminated source of natural seawater or deionized water mixed with artificial sea salts |
| 12. Dilution factor | Approximately 0.5 |
| 13. Test duration | 1 hour and 20 minutes |
| 14. Effects measured | Fertilization of sea urchin eggs |
| 15. Number of treatments per test[2] | 5 and a control. An additional dilution at the permitted effluent concentration (% effluent) is required. |

| | | |
|---|---|---|
| 16. | Acceptability of test | Minimum of 70% fertilization in controls. Effluent concentrations exhibiting greater than 70% fertilization, flagged as statistically significantly different from the controls, will not be considered statistically different from the controls for NOEC reporting. |
| 17. | Sampling requirements | For on-site tests, samples are to be used within 24 hours of the time that they are removed from the sampling device. For off-site tests, samples must be first used within 36 hours of collection. |
| 18. | Sample volume required | Minimum 1 liter |

Footnotes:

1. Adapted from EPA/600/4-91/003, July 1994.

2. When receiving water is used for dilution, an additional control made up of standard laboratory dilution water (0% effluent) is required.

## EPA NEW ENGLAND RECOMMENDED TEST CONDITIONS FOR THE INLAND SILVERSIDE, MENIDIA BERYLLINA, GROWTH AND SURVIVAL TEST[1]

| | | |
|---|---|---|
| 1. | Test type | Static, renewal |
| 2. | Salinity | 5 o/oo to 32 o/oo ± 2 o/oo by adding artificial sea salts |
| 3. | Temperature | 25 ± 1°C |
| 4. | Light quality | Ambient laboratory light |
| 5. | Light intensity | 10-20 uE/m²/s, or 50-100 ft-C (Ambient Laboratory Levels) |
| 6. | Photoperiod | 16 hr light, 8 hr darkness |
| 7. | Test vessel size | 600 - 1000 mL beakers or equivalent (glass test chambers should be used) |
| 8. | Test solution volume | 500-750 mL/replicate loading and DO restrictions must be met) |
| 9. | Renewal of test solutions | Daily using most recently collected sample. |
| 10. | Age of test organisms | Seven to eleven days post hatch; 24 hr range in age. |
| 11. | Larvae/test chamber | 15 (minimum of 10) |
| 12. | Number of replicate chambers | 4 per treatment |
| 13. | Source of food | Newly hatched and rinsed Artemia nauplii less than 24 hr old |
| 14. | Feeding regime | Feed once a day 0.10 g wet wt Artemia nauplii per replicate on days 0-2; feed 0.15 g wet wt Artemia nauplii per replicate on days 3-6 |
| 15. | Cleaning | Siphon daily, immediately before test solution renewaland feeding |
| 16. | Aeration[2] | None |

| | | |
|---|---|---|
| 17. | Dilution water | Uncontaminated source of natural seawater; or deionized water mixed with artificial sea salts. |
| 18. | Effluent concentrations[3] | 5 and a control. An additional dilution at the permitted effluent concentration (% effluent) is required. |
| 19. | Dilution factor | $\geq 0.5$ |
| 20. | Test duration | 7 days |
| 21. | Effects measured | Survival and growth (weight) |
| 22. | Acceptability of test | The average survival of control larvae is a minimum of 80%, and the average dry wt of unpreserved control larvae is a minimum of 0.5 mg, or the average dry wt of preserved control larvae is a minimum of 0.43 mg if preserved not more than 7 days in 4% formalin or 70% ethanol. |
| 23. | Sampling requirements | For on-site tests, samples are collected daily and used within 24 hours of the time they are removed from the sampling device. For off-site tests, samples must be first used within 36 hours of collection. |
| 24. | Sample Volume Required | Minimum of 6 liters/day. |

Footnotes:

[1] Adapted from EPA/600/4-91/003, July 1994.

[2] If dissolved oxygen (D.O.) falls below 4.0 mg/L, aerate all chambers at a rate of less than 100 bubbles/min. Routine D.O. checks are recommended.

[3] When receiving water is used for dilution, an additional control made up of standard laboratory dilution water (0% effluent) is required.

## VI. CHEMICAL ANALYSIS

As part of each daily renewal of the Menidia test, pH, dissolved oxygen, salinity, and temperature must be measured at the beginning and end of each 24 hour period in each dilution and in the controls. It must also be done at the start of the Arbacia test. The following chemical analyses shall be performed for each sampling event.

| Parameter | Effluent | Diluent | Minimum Quanti-fication Level(mg/L) |
|---|---|---|---|
| pH | x | x | --- |
| Salinity | x | x | PPT(o/oo) |
| Total Residual Oxidants*1 | x | x | 0.05 |
| Total Solids and Suspended Solids | x | x | --- |
| Ammonia | x | x | 0.1 |
| Total Organic Carbon | x | x | 0.5 |
| Total Metals | | | |
| Cd | x | | 0.001 |
| Cr | x | | 0.005 |
| Pb | x | | 0.005 |
| Cu | x | | 0.0025 |
| Zn | x | | 0.0025 |
| Ni | x | | 0.004 |
| Al | x | | 0.02 |

Superscripts:

*1 Total Residual Oxidants

Either of the following methods from the 18th Edition of the APHA (1992) Standard Methods for the Examination of Water and Wastewater must be used for these analyses:

-Method 4500-CL E the Amperometric Titration Method (the preferred method);
-Method 4500-CL G the DPD Photometric Method.

or use USEPA Manual of Methods Analysis of Water or Wastes, Method 330.5.

## VII. TOXICITY TEST DATA ANALYSIS

LC50 Median Lethal Concentration (Determined at 48 Hours)

Methods of Estimation:

- Probit Method
- Spearman-Karber
- Trimmed Spearman-Karber
- Graphical

See flow chart on page 56 of EPA/600/4-91/003 for appropriate point estimation method to use on a given data set.

Chronic No Observed Effect Concentration (C-NOEC)

Methods of Estimation:

- Dunnett's Procedure
- Bonferroni's T-Test
- Steel's Many-One Rank Test
- Wilcoxin Rank Sum Test

Reference flow charts on pages 191, 192, and 321 of EPA/600/4-91/003 for the appropriate method to use on a given data set.

In the case of two tested concentrations causing adverse effects but an intermediate concentration not causing a statistically significant effect, report the C-NOEC as the lowest concentration where there is no observable effect. The definition of NOEC in the EPA Technical Support Document only applies to linear dose-response data.

## VIII. TOXICITY TEST REPORTING

A report of results will include the following:

- Description of sample collection procedures, site description;
- Names of individuals collecting and transporting samples, times and dates of sample collection and analysis on chain-of-custody; and
- General description of tests: age of test organisms, origin, dates and results of standard toxicant tests; light and temperature regime; other information on test conditions if different than procedures recommended. Reference toxicant test data should be included.
- All chemical/physical data generated. (Include minimum detection levels and minimum quantification levels.)

- Raw data and bench sheets.
- Provide a description of dechlorination procedures (as applicable).
- Any other observations or test conditions affecting test outcome.