U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No.: 50-443/94-04

Docket No.: 50-443

License No.: NPF-86

Licensee: North Atlantic Energy Service Company
Post Office Box 300
Seabrook, New Hampshire 03874

Facility Name: Seabrook Station

Inspection At: Seabrook, New Hampshire

Inspection Conducted: February 28 - March 4, 1994

Inspectors: N. T. McNamara 3-21-94
N. McNamara, Laboratory Specialist Date
Effluents Radiation Protection Section (ERPS)

J. Kottan 3-22-94
J. Kottan, Laboratory Specialist, ERPS Date
Facilities Radiological Safety and Safeguards Branch (FRSSB)

Approved By: [signature] for 3/22/94
J. Joustra, Chief, ERPS, FRSSB Date
Division of Radiation Safety and Safeguards

Areas Inspected: Announced inspection of the radiological and non-radiological chemistry programs. Areas reviewed included: Confirmatory Measurements - Radiological, Standards Analyses - Chemistry, Laboratory QA/QC, and Audits.

Results: The licensee had in place effective programs for measuring radioactivity in process and effluent samples and for measuring chemical parameters in plant systems samples. No safety concerns or violations of regulatory requirements were observed.

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Details

1.0 Individuals Contacted

Principal Licensee Employees

* R. Bergeron, Electrical Engineering Manager
* D. Covill, NQ Surveillance Supervisor
* S. Dagher, Chemistry Technician
* B. Drawbridge, Executive Director - Nuclear Production
* J. Gallagher, Chemistry Supervisor
* A. Giotas, Chemistry Technician
* T. Grew, Technical Training Manager
* J. Grillo, Operations Manager
* G. Kline, Technical Support Manager
* W. Leland, Chemistry/Health Physics Manager
* N. Levesque, Electrical Maintenance Department Supervisor
* '. Linville, Chemistry Department Supervisor
J. March, Quality Audit Specialist
* C. Moyhihan, NSA Senior Auditor
* J. Peschel, Regulatory Compliance Engineer
* J. Peterson, Maintenance Manager
* N. Pillsbury, Director of Quality Programs
* D. Robinson, Senior Chemist
* B. Seymour, Security Manager
* J. Sobotka, NRC Coordinator
* L. Tardif, Senior Chemist
* J. Vargas, Manager of Engineering

NRC Employees

* A. Cerne, Senior Resident Inspector
* R. Laura, Resident Inspector
* V. Ordaz, Reactor Engineer

* Denotes those present at the exit meeting on March 4, 1994.

The inspectors also interviewed other licensee personnel including members of the chemistry and health physics staffs.

2.0 Purpose

The purpose of this inspection was to review the following areas.

1. The licensee's ability to measure radioactivity in plant systems samples and effluent samples, and the ability to measure chemical parameters in various plant systems samples.

2. The licensee's ability to demonstrate the acceptability of analytical results through implementation of a laboratory QA/QC program.

3.0 Radiological and Chemical Measurements

3.1 Confirmatory Measurements - Radiochemistry

During the inspection liquid, airborne particulate (filter) and iodine (charcoal cartridge), and gas samples were analyzed by the licensee's chemistry department and the NRC for the purpose of intercomparison. The samples were actual split samples with the exception of the particulate filters and containment gas samples. In these cases, the samples could not be split and the same samples were analyzed by the licensee and the NRC. Also, the licensee could not provide a charcoal cartridge sample which contained radioiodine. Therefore, an NRC spiked charcoal cartridge was submitted to the licensee for analysis. Where possible, the samples were actual effluent samples or in-plant samples which duplicated the counting geometries used by the licensee for effluent sample analyses. The samples were analyzed by the licensee using routine methods and equipment and by the NRC Region I Mobile Radiological Measurements Laboratory. Joint analyses of actual samples were used to verify the licensee's capability to measure radioactivity concentrations in effluent and other samples with respect to Technical Specifications and other regulatory requirements.

In addition, a liquid sample was sent to the NRC reference laboratory, Department of Energy, Radiological and Environmental Sciences Laboratory (RESL), for analyses requiring wet chemistry. The analyses to be performed on the sample are Sr-89, Sr-90, H-3, Fe-55, and gross alpha. The results of these analyses will be compared with the licensee's results when received at a later date and will be documented in a subsequent inspection report. The results of a liquid sample split between the licensee and the NRC during a previous inspection on June 17-21, 1991 (Inspection Report No. 50-443/91-13) were also compared during this inspection.

The licensee's health physics department performed gamma spectrometry analyses of in-plant samples for radiation protection purposes. During this inspection, the charcoal cartridge and particulate filter samples were also analyzed by the licensee's health physics department and compared with the NRC results. These types of samples were those normally analyzed by this department.

The comparisons for all of the above sample results that were available indicated that all of the measurements were in agreement under the criteria for comparing results (see Attachment 1 to Table I) with one exception. The one exception was the Fe-55 result from the liquid sample which was split during the previous inspection. The specific reason for the disagreement could not be determined during this inspection; however, as stated above, a liquid sample was split for Fe-55 analysis during this inspection, and these analysis results will be compared as soon as received in order to resolve this discrepancy. The data are presented in Table I.

In addition to the actual sample analyses, the inspector also witnessed several of the samples being taken. During containment gas sampling, the licensee performed the sampling using a sample pump and a Marinelli beaker as the sampling container. The Marinelli beaker was placed in the sample line before the inlet to the sampling pump. Thus, the Marinelli beaker was positioned on the suction side of the pump. The inspector discussed this matter with the licensee and stated that it appeared that the sampling container, the Marinelli beaker, was under negative pressure. The inspector further inquired if a volume correction was made because of the negative pressure. The licensee stated that a volume correction was not made. The Chemistry Department Supervisor stated that this area would be reviewed and appropriate corrective actions taken. The inspector stated that the licensee's actions in this area would be reviewed during a subsequent inspection in this area.

The inspector had no further questions in this area. No safety concerns or violations were identified in this area.

3.2 **Standard Analyses**

During this part of the inspection, standard chemical solutions were submitted to the licensee for analyses. The standards were prepared by the Oak Ridge National Laboratory (ORNL) for the NRC and were analyzed by the licensee using routine methods and equipment. The analysis of standards is used to verify the licensee's capability to monitor chemical parameters in various plant systems with respect to Technical Specifications and other regulatory requirements. In addition, the analysis of standards is used to evaluate the licensee's procedures with respect to accuracy and precision. The standards were submitted to the licensee for analysis in triplicate at three concentrations spread over the licensee's normal calibration and analysis range. The nickel standards were only analyzed at two concentrations because of the range of the licensee's nickel calibration curve.

The results of the standards measurements comparisons indicated that all of the measurement results were in agreement or qualified agreement under the criteria used for comparing results (see Attachment 1 to Table II). The data are presented in Table II. The hydrazine data presented in Table II were the results obtained after a recalibration of the spectrophotometer. The initial hydrazine results were in disagreement, and this was found to be due to a deteriorated calibration standard. Also, the hydrazine check standard had deteriorated, and, therefore, did not indicate the problem with the calibration standard. The licensee took prompt corrective action to remedy this problem in order to ensure that non-deteriorated hydrazine standards would be used in future analyses.

No safety concerns or violations were identified in this area.

4.0 Laboratory QA/QC

The licensee's laboratory QA/QC program was described in a number of procedures. Specifically, the following procedures were reviewed by the inspector:

CD0904.10, Intralaboratory Performance Verification
CD0904.11, Split and Crosscheck Analysis
CS0904.04, Laboratory Instrument Control Charts
JS0999.001, Radiochemistry Control Charts

These procedures provided for the control of analytical results through a number of mechanisms including: the use of written, approved procedures; the use of traceable standards; instrument control checks; an in-house spiked sample program; and participation in interlaboratory QC programs.

The instrument control checks consisted of the use of control charts for trending instrument performance. The spiked sample program consisted of the submission of unknown spiked samples to the chemistry technicians for analysis. The interlaboratory QC programs consisted of the quarterly analysis of unknown samples received from outside laboratories for both chemical and radiochemical analytes. The licensee also submitted split and spiked samples at least annually to the vendor laboratory used for the analysis of effluent samples requiring radiochemical separations.

The inspector reviewed selected data generated by the licensee's laboratory QA/QC program for 1992, 1993 and 1994 to date, and, based on this review, noted that the licensee was implementing the laboratory QA/QC program as required. The inspector noted that the licensee's laboratory QA/QC program was comprehensive, included long term trending of QC data, and the licensee held periodic QC meetings to assess and evaluate data. The inspector also noted, however, that the licensee's new gamma spectrometry system QC software did not provide the same level of real time control of the measurement process as the analytical chemistry QC software. The gamma spectrometry QC software could identify a data point which exceeded the control limit, but would not identify other trends taking place within the control limits that may indicate a potential problem with the counting system; whereas the analytical chemistry QC software did. The Chemistry Department Supervisor stated that the analytical chemistry QC software would be utilized for the gamma spectrometry QC data. The inspector had no further questions in this area. No safety concerns or violations were identified.

5.0 Audits Activities

The inspector reviewed Audit Report 92-A09-01, Refueling Outage Audit. This audit included many areas of plant operations, including the chemistry area. The chemistry portion of the audit was performed from September 7 to November 15, 1992. This audit was conducted using a detailed audit plan, and the audit team included a technical specialist. In addition, the inspector reviewed Audit Report No. 93-A10-02, "Radiological Environmental Monitoring Program, Radiological Effluent Monitoring Program, Offsite Dose Calculation Manual," dated October 28, 1993, and noted that certain aspects of the chemistry program were covered in this audit as well.

The inspector reviewed surveillances of specific chemistry activities which were conducted in 1993 and 1994 to date. These surveillances included areas such as primary chemistry control program, secondary chemistry control program, and the radiological effluent surveillance program. These surveillances were performed using a detailed surveillance plan and were conducted by an individual with knowledge and experience in the chemistry area. The inspector also reviewed the 1994 chemistry surveillance schedule and noted that seven surveillances of chemistry activities or programs were planned, including the laboratory QA/QC program.

Based on the review of the above audit and surveillance activities, the inspector determined there was independent oversight and assessment of chemistry activities. No safety concerns or violations were identified in this area.

6.0 Exit Meeting

The inspector met with the licensee representatives denoted in Section 1.0 of this report at the conclusion of the inspection on March 4, 1994. The inspector summarized the purpose, scope and findings of the inspection. The licensee acknowledged the inspection findings.

TABLE I

Seabrook Radiochemistry Tests Results

Sample	Isotope	NRC Value	Licensee Value	Comparison
		Results in microCuries per milliliter		
Diluted Reactor Coolant 1430 hrs 06/17/91	Fe-55	(3.58±0.01)E-4	(1.46±0.12)E-4	Disagreement
	gross alpha	(1±2)E-8	<4.17E-8	No Comparison
	H-3	(1.12±0.01)E-1	(1.07±?)E-1	Agreement
	Sr-89	(4.0±0.2)E-6	(4.0±0.2)E-6	Agreement
	Sr-90	(4±2)E-8	(2.8±0.5)E-10	No Comparison
Volume Control Tank Gas 1545 hrs 03/02/94 (Chemistry Detector #2)	Ar-41	(5.7±0.2)E-3	(5.32±0.07)E-3	Agreement
	Kr-85m	(7.3±0.4)E-4	(6.0±0.2)E-4	Agreement
	Kr-88	(1.23±0.14)E-3	(1.08±0.05)E-3	Agreement
	Xe-133	(4.27±0.10)E-3	(3.94±0.05)E-3	Agreement
	Xe-135	(7.41±0.09)E-3	(6.19±0.04)E-3	Agreement
Containment Air 1135 hrs 03/02/94 (Chemistry Detector #5)	Ar-41	(8.5±0.5)E-7	(8.1±0.4)E-7	Agreement
Waste Tank "A" 1610 hrs 03/01/94 (Chemistry Detector #3)	Co-58	(1.38±0.05)E-6	(1.45±0.06)E-6	Agreement

TABLE I - cont'd

Seabrook Radiochemistry Tests Results

Sample	Isotope	NRC Value	Licensee Value	Comparison
		Results in microCuries per milliliter		
Borated Water Storage Tank "B" 1530 hrs 03/02/94 (Chemistry Detector #2)	Mn-54	(1.18±0.07)E-6	(1.14±0.12)E-6	Agreement
	Co-58	(4.48±0.10)E-6	(4.0±0.2)E-6	Agreement
	Co-60	(3.74±0.12)E-6	(4.02±0.13)E-6	Agreement
	Sb-125	(1.7±0.2)E-6	(2.7±0.2)E-6	Agreement
NRC "Spiked" Charcoal Cartridge (Chemistry Detector #5)	Ba-133	(4.18±0.02)E-2	(4.03±0.03)E-2	Agreement
Reactor Coolant Particulate Filter 0915 hrs 03/01/94 (Chemistry Detector #4)	Cr-51	(3.30±0.15)E-4	(3.15±0.09)E-4	Agreement
	Co-58	(1.030±0.009)E-3	(1.053±0.005)E-3	Agreement

TABLE I - cont'd

Seabrook Radiochemistry Tests Results

Sample	Isotope	NRC Value	Licensee Value	Comparison
		Results in microCuries per milliliter		
Reactor Coolant Anion Filter 0915 hrs 03/01/94 (Chemistry Detector #3)	I-133	(4.41±0.12)E-4	(4.17±0.06)E-4	Agreement
	Co-58	(2.45±0.11)E-4	(2.38±0.05)E-4	Agreement
	Na-24	(9.6±0.2)E-4	(9.67±0.15)E-4	Agreement
Reactor Coolant Cation Filter 0915 hrs 03/01/94 (Chemistry Detector #3)	Na-24	(3.47±0.06)E-4	(3.30±0.05)E-4	Agreement
	Co-58	(4.2±0.3)E-5	(4.19±0.12)E-5	Agreement
Reactor Coolant 1425 hrs 03/03/94 (Chemistry Detector #4)	I-132	(9.2±0.6)E-4	(1.01±0.04)E-3	Agreement
	I-133	(5.7±0.4)E-4	(6.1±0.3)E-4	Agreement
	I-135	(1.07±0.11)E-3	(1.19±0.09)E-3	Agreement
NRC "Spiked" Charcoal Cartridge (Health Physics Detector #9)	Ba-133	(4.18±0.02)E-2	(3.89±0.02)E-2	Agreement

TABLE I - cont'd

Seabrook Radiochemistry Tests Results

Sample	Isotope	NRC Value	Licensee Value	Comparison
		Results in microCuries per milliliter		
Reactor Coolant Anion Filter 0915 hrs 03/01/94 (Health Physics Detector #8)	I-133	(4.41±0.12)E-4	(4.06±0.04)E-4	Agreement
	Co-58	(2.45±0.11)E-4	(2.36±0.03)E-4	Agreement
	Na-24	(9.6±0.2)E-4	(9.67±0.12)E-4	Agreement
Reactor Coolant Cation Filter 0915 hrs 03/01/94 (Health Physics Detector #7)	Na-24	(3.47±0.06)E-4	(3.17±0.12)E-4	Agreement
	Co-58	(4.2±0.3)E-5	(4.42±0.11)E-5	Agreement

ATTACHMENT 1 TO TABLE I

CRITERIA FOR COMPARING ANALYTICAL MEASUREMENTS

This attachment provides criteria for comparing results of capability tests and verification measurements. The criteria are based on an empirical relationship which combines prior experience and the accuracy needs of the program.

In these criteria, the judgement limits are variable in relation to the comparison of the NRC Reference Laboratory's value to its associated uncertainty. As that ratio, referred to in this program as "Resolution," increases, the acceptability of a licensee's measurement should be more selective. Conversely, poorer agreement must be considered acceptable as the resolution decreases.

Resolution[1]	Ratio for Comparison[2]
<4	No Comparison
4 - 7	0.5 - 2.0
8 - 15	0.6 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.80 - 1.25
>200	0.85 - 1.18

1.Resolution = (NRC Reference Value/Reference Value Uncertainty)

2.Ratio = (Licensee Value/NRC Reference Value)

TABLE II

Seabrook Chemistry Test Results

Chemical Analysis	Method of Analysis	NRC Known Value	Licensee Value	Comparison
		Results in parts per billion (ppb)		
Sodium	IC	0.53±0.02	0.543±0.008	Agreement
		1.02±0.03	1.049±0.004	Agreement
		1.55±0.04	1.602±0.008	Agreement
Chloride	IC[1]	7.7±0.3	7.3±0.4	Agreement
		19.4±0.5	18.4±0.3	Agreement
		25.6±0.8	26±2	Agreement
Fluoride	IC[1]	8.4±0.4	8.0±0.5	Agreement
		20.2±0.8	19.6±0.9	Agreement
		28.1±1.4	31.2±0.6	Agreement
Chloride	IC[2]	7.7±0.3	7.25±0.09	Agreement
		19.4±0.5	18.72±0.15	Agreement
		25.6±0.8	24.96±0.13	Agreement
Sulfate	IC[2]	7.9±0.2	8.0±0.2	Agreement
		19.4±0.3	19.04±0.05	Agreement
		27.2±0.4	27.03±0.14	Agreement
Silica	SP	28.4±0.4	28.9±0.2	Agreement
		85.1±1.1	87.2±0.7	Agreement
		180±3	192.5±0.3	Agreement

TABLE II - cont'd

Seabrook Chemistry Test Results

Chemical Analysis	Method of Analysis	NRC Known Value	Licensee Value	Comparison
		Results in parts per billion (ppb)		
Hydrazine	SP	13.23±0.06	13.10±0.10	Agreement
		34.1±0.3	35.07±0.15	Agreement
		56.5±1.0	57.57±0.15	Agreement
		Results in parts per million (ppm)		
Boron	T	304±4	297±2	Agreement
		506±8	501±2	Agreement
		1049±11	1020±2	Qual Agreement
Ammonia	IC	0.482±0.007	0.487±0.008	Agreement
		1.10±0.03	1.044±0.011	Agreement
		1.52±0.03	1.493±0.014	Agreement
Copper	AA	0.810±0.010	0.772±0.009	Agreement
		2.02±0.02	1.949±0.004	Agreement
		4.03±0.04	3.90±0.02	Agreement
Iron	AA	0.795±0.007	0.764±0.008	Agreement
		1.99±0.02	1.847±0.014	Agreement
		3.98±0.04	3.84±0.03	Agreement
Nickel	AA	0.800±0.008	0.772±0.013	Agreement
		1.99±0.02	1.958±0.007	Agreement

TABLE II - cont'd

Seabrook Chemistry Test Results

Chemical Analysis	Method of Analysis	NRC Known Value	Licensee Value	Comparison
		Results in parts per million (ppm)		
Lithium	AA	0.493±0.007	0.489±0.002	Agreement
		1.24±0.02	1.202±0.007	Agreement
		2.43±0.03	2.46±0.06	Agreement

Notes: IC = Ion Chromatography
SP = Uv-Vis Spectrophotometry
T = Potentiometric Titration
AA = Flame Atomic Absorption

[1] = IC with tetraborate eluent
[2] = IC with hydroxide eluent

ATTACHMENT 1 TO TABLE II

Criteria for Comparing Analytical Measurements from Table II

This attachment provides criteria for comparing results of capability tests. In these criteria the judgement limits are based on data from Table 2.1 of NUREG/CR-5244, "Evaluation of Non-Radiological Water Chemistry at Power Reactors". Licensee values within the plus or minus two standard deviation range (±2Sd) of the ORNL known values are considered to be in agreement. Licensee values outside the plus or minus two standard deviation range, but within the plus or minus three standard deviation range (±3Sd) of the ORNL known values, are considered to be in qualified agreement. Repeated results which are in qualified agreement will receive additional attention. Licensee values greater than the plus or minus three standard deviations range of the ORNL known value are in disagreement. The standard deviations were computed using the average percent deviation values of each analyte in Table 2.1 of the NUREG.

The ranges for the data in Table II are as follows.

Analyte	Agreement Range	Qualified Agreement Range
Chloride	± 8%	± 12%
Fluoride	± 12%	± 18%
Sulfate	± 10%	± 15%
Silica	± 10%	± 15%
Sodium	± 14%	± 21%
Copper	± 10%	± 15%
Iron	± 10%	± 15%
Boron	± 2%	± 3%
Ammonia	± 10%	± 15%
Hydrazine	± 8%	± 12%
Lithium	± 14%	± 21%
Nickel	± 6%	± 9%