U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-443/94-06

Docket No. 50-443

License Nos. NPF-86

Licensee: North Atlantic Energy Service Corporation
P.O. Box 300
Seabrook, New Hampshire 03874

Facility Name: Seabrook Nuclear Power Station

Inspection At: Seabrook, New Hampshire

Inspection Conducted: March 28-April 1, 1994

Inspector: Jason C. Jang 4-12-94
Jason C. Jang, Sr. Radiation Specialist date
Effluents Radiation Protection Section
(ERPS), Facilities Radiological Safety
and Safeguards Branch (FRS&SB)

Approved by: Judith A. Joustra 4/12/94
Judith A. Joustra, Chief, ERPS, date
FRS&SB, Division of Radiation Safety
and Safeguards

Inspection Summary: Announced safety inspection of the projected dose calculation capability from radioactive liquid and airborne (noble gases and particulates) effluent releases.

Results: Within the areas inspected, the licensee implemented an excellent projected dose calculation program. The responsible individuals had excellent knowledge to implement the above program. No safety concerns or violations were identified.

DETAILS

1.0 Individuals Contacted

1.1 Licensee

* W. DiProfio, Station Manager
W. Leland, Chemistry/Health Physics Manager
* J. Linville, Chemistry Department Supervisor
R. Litman, Chemistry Support Supervisor
* G. McDonald, Nuclear Quality Manager
J. Peterson, Maintenance Manager
* J. Peschel, Regulatory Compliance Manager
* D. Robinson, Sr. Chemist
* J. Sabotica, NRC Coordinator
* L. Tardif, Sr. Chemist
* L. Walsh, Operations Support Manager

1.2 Yankee Atomic Electric Company

M. Strum, Lead Engineer, Radiation Assessment
A. Gallo, Contractor

1.3 NRC

* R. Laura, Resident Inspector

* Attended the exit meeting on April 1, 1994. Other licensee employees were contacted and interviewed during this inspection.

2.0 Purpose

The purpose of this inspection was to verify the licensee's capability to calculate projected offsite radiation doses from radioactive liquid and airborne (noble gases, tritium, and particulates) effluent releases during normal operation.

3.0 Projected Dose Calculation Methodology and Responsibility

The inspector noted that the Offsite Dose Calculation Manual (ODCM) contained two projected dose calculation methods, Method I and Method II.

Method I is a simple method for computing the projected dose to the public prior to release of radioactive liquids, gases, and particulates from the site. The Chemistry

Department had the responsibility for calculating projected offsite doses, using Method I, to control actual effluent releases. This method contained many conservative parameters in order to ensure that effluent release limits would not be exceeded.

Method II is an in-depth method for computing the realistic doses to the public after the completion of radioactive liquids, gases, and particulates releases from the site. Method II is being used by the contractor, Radiation Assessment Branch, Yankee Atomic Electric Company (YAEC), Bolton, Massachusetts for the Semiannual Report.

4.0 Computer Codes for Projected Dose Calculations

4.1 NRC: PCDOSE Code

The PCDOSE code was developed by Idaho National Engineering Laboratory (EG&G Idaho, Inc.) for the U.S. Nuclear Regulatory Commission. The code was designed to calculate the maximum projected radiation dose to an individual and the average dose to the population due to radionuclides released in radioactive liquid and airborne effluent releases from a nuclear power plant. The code was designed for normal operation rather than for emergency situations. The code was developed from the methodology found in both NUREG-0133 and Regulatory Guide 1.109 (Revision 1). The PCDOSE code serves as a basis for comparison of similar programs conducted by individual utilities which operate nuclear power plants.

4.2 YAEC: Method II Code

The Method II Code was developed by YAEC for its contractors, such as Seabrook Nuclear Power Station and Maine Yankee Atomic Power Station. The code was developed from the methodology found in Regulatory Guide 1.109 (Revision 1).

The licensee identified several radionuclides in radioactive liquid and airborne effluent releases that were not listed in Regulatory Guide 1.109 (Revision 1). The licensee requested YAEC to conduct a study and/or research to determine the appropriate information for these radionuclides to calculate the projected doses to the public. The following study results were compiled by the YAEC.

Antimony 124 and 125 (Sb-124 and Sb-125)

- o Stable Element Transfer Factors
- o Bioaccumulation Factors
- o External Dose Factors for Standing on Contaminated Ground
- o Ingestion Dose Factors
- o Inhalation Dose Factors

Silver 110m (Ag-110m)

- o Bioaccumulation Factors

Bromine 82, 83, 84, and 85 (Br-82, Br-83, Br-84, and Br-85)

- o Stable Element Transfer Factors

The inspector discussed with the responsible YAEC individual the Method II Code and the application of the above study/research results. The inspector noted that the responsible individual had excellent knowledge of dose calculation methodologies, the licensee's ODCM, and regulatory requirements. The inspector had no further questions.

4.3 Licensee: Method I and Effluent Management System (EMS) Code

The licensee had purchased the EMS Computer Code to replace Method I to avoid a potential data transfer error. The EMS Code was developed by a contractor (Canberra) and is being used by many utilities. The contractor tailored many site specific parameters for the Seabrook site. This code is being reviewed by the licensee to satisfy the acceptance criteria. The licensee stated that Method I will be replaced by the EMS code upon the completion of the review.

5.0 Verification of the Projected Dose Calculation Program

During this inspection, the inspector conducted intercomparisons of dose calculation results at YAEC (PCDOSE vs Method II) and at the site (PCDOSE vs EMS).

The inspector evaluated the Method II Computer Code by using site specific parameters and radioactive liquid, noble gases, and particulates release information. All comparisons were made using simulated radioactive material releases because the licensee's actual releases were insignificant. The intercomparison results for the

release pathways for liquids, noble gases, and particulates, are listed in Tables 1, 2, and 3. The results of all release pathway intercomparisons were excellent, as shown in Tables 1, 2, and 3.

The inspector evaluated the EMS Computer Code by using site specific parameters and radioactive liquid, noble gases, and particulates release information. All comparisons were made either by using actual radioactive material releases (for noble gas release pathway) or simulated radioactive material releases (liquid and partuiculates release pathways). The intercomparison results for the release pathways for liquids, noble gases, and particulates, are listed in Tables 4, 5, and 6. The results of all release pathway intercomparisons were excellent, as listed in Tables 4, 5, and 6.

The NRC currently does not have specific criteria for comparisons. However, up to about a 50% difference in projected dose values is acceptable as long as the cause of difference can be identified.

Based on the above comparisons, the inspector determined that the licensee conducted an excellent projected dose calculation program at the Seabrook Nuclear Power Station site.

6.0 Exit Interview

The inspector met with the licensee representatives denoted in Section 1.1 of this inspection report at the conclusion of the inspection on April 1, 1994. The inspector summarized the purpose, scope, and findings of the inspection. The licensee acknowledged the inspection findings.

Table 1. Liquid Dose Projection Comparisons (Method 2)
Adult Dose (mrem)

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	Gi-Lli
Licensee	1.81E-9	3.89E-7	4.72E-7	1.17E-6	3.23E-7	3.17E-7	1.81E-6
NRC	1.81E-9	3.89E-7	4.72E-7	1.17E-6	3.23E-7	3.17E-7	1.81E-6

Table 2. Noble Gas Dose Projection Comparisons (Method 2)

	Beta Air (mrad)	Gamma Air (mrad)	Total Skin (mrem)	Total Body (mrem)
Licensee	2.16E-3	3.49E-3	5.29E-3	3.30E-3
NRC	2.16E-3	3.49E-3	5.32E-3	3.30E-3

Table 3. Particulates Dose Projection Comparisons (Method 2)
Adult Dose (mrem)
Simulated Release and Activity Released
H-3: 5 Curies
Co-60: 5 Curies
I-131: 100 Curies
Cs-137: 3 Curies

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	Gi-Lli
Licensee	2.92E+4	4.11E+4	1.16E+5	3.47E+6	2.82E+4	3.36E+3	1.68E+4
NRC	2.95E+4	4.15E+4	1.16E+5	3.49E+6	2.85E+4	3.40E+3	1.70E+4

Table 4. Liquid Dose Projection Comparisons (EMS CODE)
Child Dose (mrem)

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	Gi-Lli
Licensee	7.52E-6	4.22E-6	1.78E-6	8.89E-8	8.89E-8	2.34E-6	1.70E-6
NRC	7.50E-6	4.20E-6	1.76E-6	7.11E-8	7.11E-8	2.32E-6	1.68E-6

Table 5. Noble Gas Dose Projection Comparisons (EMS CODE)

	Beta Air (mrad)	Gamma Air (mrad)	Total Skin (mrem)	Total Body (mrem)
Licensee	3.82E-6	6.45E-6	1.04E-5	6.12E-6
NRC	3.83E-6	6.45E-6	1.03E-5	6.12E-6

Table 6. Particulate Dose Projection Comparisons (EMS CODE)
Child Dose (mrem) for Inhalation Pathway

	Bone	Liver	T.Body	Thyroid	Kidney	Gi-Lli
Licensee	8.49E-9	1.21E-8	6.90E-9	4.02E-6	2.06E-6	2.12E-9
NRC	8.49E-9	1.21E-8	6.91E-9	4.02E-6	2.07E-6	2.12E-9