

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report Nos.: 50-245/93-31
50-336/93-26
50-423/93-28

Docket Nos.: 50-245
50-336
50-423


License Nos.: DPR-21
DPR-65
NPF-49

Licensee: Northeast Nuclear Energy Company
P. O. Box 270
Hartford, Connecticut 06101

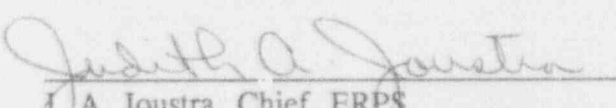
Facility Name: Millstone Station, Units 1, 2 and 3

Inspection At: Waterford, Connecticut

Inspection Conducted: November 29 - December 3, 1993

Inspector: 
J. Kottan, Laboratory Specialist
Effluents Radiation Protection Section (ERPS)

1-10-94
Date

Approved by: 
J. A. Joustra, Chief, ERPS
Facilities Radiological Safety and Safeguards
Branch
Division of Radiation Safety and Safeguards

1/11/94
Date

Areas Inspected: Announced inspection of the radiochemistry program. Areas reviewed included: Confirmatory Measurements and Laboratory QA/QC.

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

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DETAILS

1.0 Individuals Contacted

Principal Licensee Employees

- * G. D'Auria, Senior Chemist
- V. Ballestrini, Chemistry Specialist
- T. Burns, Training
- * F. Ducinio, Director, Millstone Unit 3
- * R. Factora, Director, Unit Services
- * J. Glaub, Chemistry Specialist
- * C. Libby, Supervisor, Assessment Services
- * S. Macklin, Chemistry Supervisor, Unit 3
- * D. Peiffer, Chemistry Supervisor, Technical Support
- * J. Sullivan, Manager, HP Operations
- * J. Waters, Manager, Chemistry

NRC Employees

- P. Swetland, Senior Resident Inspector
- * R. Arrighi, Resident Inspector

Other Personnel

- * S. Morton, Senior Scientist, DOE
- K. Shirley, Physical Scientist, DOE

* Denotes those present at the exit meeting on December 3, 1993.

The inspector also interviewed other licensee personnel, including members of the chemistry, radiation protection, and training 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 and effluent samples.
2. The licensee's ability to demonstrate the acceptability of analytical results through implementation of a laboratory QA/QC program.

3.0 Laboratory Organization

The Millstone site had two chemistry laboratories, two chemistry counting rooms, and three radiation protection counting rooms. Units 1 and 2 shared a combined chemistry laboratory and chemistry counting room. Unit 3 had a separate chemistry laboratory and chemistry counting room. Each unit had a separate radiation protection counting room. All of the above counting rooms were equipped with gamma spectrometry counting systems.

3.1 Confirmatory Measurements

During the inspection, liquid, particulate filter, 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 filter and charcoal cartridge. In these cases, the samples could not be split, and the same samples were analyzed by the licensee and the NRC. Where possible, the samples were actual effluent samples or in-plant samples which duplicated the actual counting geometries used by the licensee for effluent samples 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 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, Fe-55, H-3 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 May 6-10, 1991 (Inspection Report Nos. 50-245/91-09, 50-336/91-11 and 50-423/91-10) were also compared during this inspection.

Since the licensee's radiation protection department possessed a gamma spectrometry counting system in each of its unit counting rooms, the charcoal cartridge and particulate filter were also analyzed by the radiation protection 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 exception was the

Fe-55 result from the sample which was split during the previous inspection. The specific reason for the Fe-55 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 those results will be compared as soon as received, in order to resolve this discrepancy. Some possible reasons for the Fe-55 disagreement could be a poor sample split or a matrix effect present in the sample. Since additional precautions were taken and new techniques employed during this inspection in order to ensure and verify a good sample split, an NRC spiked sample will not be sent to the licensee at this time in order to attempt to resolve the disagreement. The data are presented in Table I.

No safety concerns or violations were identified in the area.

3.2 Laboratory QA/QC

The licensee's radiochemistry laboratory QA/QC program was described in Procedure CP800/2800/3800, Quality Control Program. The inspector reviewed this procedure as well as other laboratory procedures and noted that the licensee assured the quality of its analytical results through a number of mechanisms including: the use of written, approved procedures; the use of traceable standards; instrument control checks; and participation in interlaboratory QC programs.

The instrument control checks consisted of monthly control charts used to trend and assess instrument performance. In addition, the licensee was trending the gain, resolution, and efficiency of the gamma spectrometry systems over the long-term at both chemistry counting rooms in order to identify trends that might not be apparent over the shorter term of the control charts. The interlaboratory QC program consisted of participation in a traceability program with the National Institute of Standards and Technology (NIST), the analysis of spiked samples supplied by the Yankee Atomic Environmental Laboratory (E-Lab), and the analysis of split samples with another power plant. The licensee also provided spiked and duplicate samples to the vendor laboratory used for certain effluent sample analyses which require separation chemistry.

The inspector reviewed selected data generated by the licensee's laboratory QA/QC program for 1991, 1992 and 1993 to date and, based on this review, noted that the licensee was implementing the laboratory QA/QC program, as required. In addition, the inspector stated that the comprehensive laboratory QA/QC program which the licensee had implemented and the use of data from the program to improve analytical capability in a proactive manner were noted strengths.

No safety concerns or violations were identified in the area

4.0 Exit Meeting

The inspector met with the licensee representatives denoted in Section 1.0 at the conclusions of the inspection on December 3, 1993. The inspector summarized the purpose, scope and findings of the inspection. The licensee acknowledged the inspection findings.

Table I
Millstone Radiochemistry Test Results

<u>Sample</u>	<u>Isotope</u>	<u>NRC Value</u>	<u>Licensee Value</u>	<u>Comparison</u>
<u>Results in microCuries per milliliter</u>				
RCS	Cr-51	(2.90±0.11)E-4	(2.82±0.07)E-4	Agreement
Particulate Filter	Mn-54	(4.66±0.14)E-5	(4.12±0.10)E-5	Agreement
1026 hrs	Co-58	(4.68±0.04)E-4	(4.31±0.03)E-4	Agreement
11/30/93	Co-60	(3.62±0.13)E-5	(3.46±0.10)E-5	Agreement
(Detector #2) ¹	Zr-95	(3.8±0.2)E-5	(3.72±0.13)E-5	Agreement
RCS	Cr-51	(2.90±0.11)E-4	(2.85±0.09)E-4	Agreement
Particulate Filter	Mn-54	(4.66±0.14)E-5	(4.44±0.11)E-5	Agreement
1026 hrs	Co-58	(4.68±0.04)E-4	(4.59±0.03)E-4	Agreement
11/30/93	Co-60	(3.62±0.13)E-5	(3.76±0.11)E-5	Agreement
(Detector #4) ¹	Zr-95	(3.8±0.2)E-5	(3.99±0.16)E-5	Agreement
<u>Results in total microCuries</u>				
Enclosure Building	I-131	(3.6±0.2)E-4	(3.5±0.2)E-4	Agreement
Roof Vent	I-133	(2.9±0.3)E-4	(2.8±0.2)E-4	Agreement
Charcoal Cartridge				
0955 hrs				
11/30/93				
(Detector #2) ¹				
Enclosure Building	I-131	(3.6±0.2)E-4	(3.4±0.2)E-4	Agreement
Roof Vent		(2.9±0.3)E-4	(2.8±0.2)E-4	Agreement
Charcoal Cartridge				
0955 hrs				
11/30/93				
(Detector #4) ²				

Table I - continued
Millstone Radiochemistry Test Results

<u>Sample</u>	<u>Isotope</u>	<u>NRC Value</u>	<u>Licensee Value</u>	<u>Comparison</u>
<u>Results in microCuries per milliliter</u>				
Liquid Radwaste (U2 "B" CWRT) 1335 hrs. 12/02/93 (Detector #1) ¹	Mn-54	(3.2±0.2)E-6	(3.1±0.2)E-6	Agreement
	Co-58	(4.97±0.04)E-5	(4.80±0.07)E-5	Agreement
	Co-60	(6.4±0.2)E-6	(6.3±0.3)E-6	Agreement
	Cs-134	(4.94±0.04)E-5	(5.26±0.08)E-5	Agreement
	Cs-137	(1.111±0.006)E-4	(1.131±0.010)E-4	Agreement
Liquid Radwaste (U2 "B" CWRT) 1335 hrs. 12/02/93 (Detector #2) ¹	Mn-54	(3.2±0.2)E-6	(3.0±0.2)E-6	Agreement
	Co-58	(4.97±0.04)E-5	(4.99±0.08)E-5	Agreement
	Co-60	(6.4±0.2)E-6	(7.5±0.3)E-6	Agreement
	Cs-134	(4.94±0.04)E-5	(5.23±0.08)E-5	Agreement
	Cs-137	(1.111±0.006)E-4	(1.121±0.012)E-4	Agreement
Offgas 0837 hrs. 12/01/93 (Detector #1) ¹	Kr-87	(4.9±0.7)E-4	(4.0±0.2)E-4	Agreement
	Xe-135	(3.1±0.2)E-4	(2.56±0.06)E-4	Agreement
"C" Waste Gas Decay Tank 1300 hrs. 11/30/93 (Detector #1) ¹	Kr-85	(1.239±0.006)E-2	(1.238±0.005)E-2	Agreement
	Xe-133	(3.81±0.16)E-6	(4.05±0.13)E-6	Agreement

Table I - continued
Millstone Radiochemistry Test Results

<u>Sample</u>	<u>Isotope</u>	<u>NRC Value</u>	<u>Licensee Value</u>	<u>Comparison</u>
<u>Results in microCuries per milliliter</u>				
"C" Waste Gas Decay Tank 1300 hrs. 11/30/93 (Detector #2) ¹	Kr-85	(1.239±0.006)E-2	(1.253±0.006)E-2	Agreement
	Xe-133	(3.81±0.16)E-6	(3.9±0.2)E-6	Agreement
Unit 1 Reactor Coolant 0733 hrs. 12/01/93 (Detector #3) ¹	I-132	(3.00±0.05)E-4	(3.52±0.09)E-4	Agreement
	I-133	(8.6±0.2)E-5	(8.9±0.4)E-5	Agreement
	I-134	(1.33±0.07)E-3	(1.22±0.05)E-3	Agreement
	I-135	(2.64±0.10)E-4	(2.54±0.16)E-4	Agreement
Unit 2 Reactor Coolant 0700 hrs. 12/01/93 (Detector #1) ¹	I-131	(2.97±0.07)E-3	(2.93±0.13)E-3	Agreement
	I-132	(2.14±0.02)E-2	(2.40±0.03)E-2	Agreement
	I-133	(2.448±0.010)E-2	(2.52±0.02)E-2	Agreement
	I-134	(3.23±0.08)E-2	(3.41±0.08)E-2	Agreement
	I-135	(3.38±0.04)E-2	(3.32±0.06)E-2	Agreement
RCS Particulate Filter 1026 hrs. 11/30/93 (Detector #3) ²	Cr-51	(2.90±0.11)E-4	(2.98±0.13)E-4	Agreement
	Mn-54	(4.66±0.14)E-5	(4.29±0.14)E-5	Agreement
	Co-58	(4.68±0.04)E-4	(4.39±0.04)E-4	Agreement
	Co-60	(3.62±0.13)E-5	(3.57±0.14)E-5	Agreement
	Zr-95	(3.8±0.2)E-5	(3.8±0.3)E-5	Agreement

Table I - continued
Milestone Radiochemistry Test Results

<u>Sample</u>	<u>Isotope</u>	<u>NRC Value</u>	<u>Licensee Value</u>	<u>Comparison</u>
<u>Results in total microCuries</u>				
Enclosure Building	I-131	(3.6±0.2)E-4	(3.4±0.2)E-4	Agreement
Roof Vent	I-133	(2.9±0.3)E-4	(2.0±0.3)E-4	Agreement
Charcoal Cartridge 0955 hrs. 11/30/93 (Detector #2) ²				
Enclosure Building	I-131	(3.6±0.2)E-4	(3.2±0.2)E-4	Agreement
Roof Vent	I-133	(2.9±0.3)E-4	(2.5±0.4)E-4	Agreement
Charcoal Cartridge 0955 hrs. 11/30/93 (Detector #1) ²				
<u>Results in microCuries per milliliter</u>				
Liquid Radwaste	Mn-54	(3.2±0.2)E-6	(2.8±0.3)E-6	Agreement
(U2 "B" CWRT)	Co-58	(4.97±0.04)E-5	(5.04±0.08)E-5	Agreement
1335 hrs.	Co-60	(6.4±0.2)E-6	(7.0±0.4)E-6	Agreement
12/02/93	Cs-134	(4.94±0.04)E-5	(5.31±0.09)E-5	Agreement
(Detector #1) ²	Cs-137	(1.111±0.006)E-4	(1.156±0.012)E-4	Agreement

Table I - continued
Millstone Radiochemistry Test Results

<u>Sample</u>	<u>Isotope</u>	<u>NRC Value</u>	<u>Licensee Value</u>	<u>Comparison</u>
<u>Results in microCuries per milliliter</u>				
Liquid Radwaste (U "B" CWRT) 1335 hrs. 12/02/93 (Detector #2) ²	Mn-54	(3.2±0.2)E-6	(3.2±0.3)E-6	Agreement
	Co-58	(4.97±0.04)E-5	(5.17±0.09)E-5	Agreement
	Co-60	(6.4±0.2)E-6	(7.5±0.4)E-6	Agreement
	Cs-134	(4.94±0.04)E-5	(5.37±0.10)E-5	Agreement
	Cs-137	(1.111±0.006)E-4	(1.177±0.013)E-4	Agreement
"C" Waste Gas Decay Tank 1300 hrs. 11/30/93 (Detector #1) ²	Kr-85	(1.239±0.006)E-2	(1.248±0.006)E-2	Agreement
	Xe-133	(3.81±0.16)E-6	(4.4±0.2)E-6	Agreement
"C" Waste Gas Decay Tank 1300 hrs. 11/30/93 (Detector #2) ²	Kr-85	(1.239±0.006)E-2	(1.234±0.005)E-2	Agreement
	Xe-133	(3.81±0.16)E-6	(4.0±0.2)E-6	Agreement
"C" Waste Gas Decay Tank 1300 hrs. 11/30/93 (Detector #3) ²	Kr-85	(1.239±0.006)E-2	(1.234±0.006)E-2	Agreement
	Xe-133	(3.81±0.16)E-6	(4.0±0.2)E-6	Agreement

Table I - continued
Millstone Radiochemistry Test Results

<u>Sample</u>	<u>Isotope</u>	<u>NRC Value</u>	<u>Licensee Value</u>	<u>Comparison</u>
<u>Results in microCuries per milliliter</u>				
Unit 3	I-132	(2.98±0.12)E-3	(3.46±0.05)E-3	Agreement
Reactor Coolant	I-133	(4.87±0.07)E-4	(5.08±0.14)E-4	Agreement
1026 hrs.	I-134	(2.67±0.12)E-3	(2.6±0.5)E-3	Agreement
11/30/93	I-135	(1.23±0.03)E-3	(1.31±0.06)E-3	Agreement
(Detector #1) ²				
Unit 3	I-132	(2.98±0.12)E-3	(3.51±0.05)E-3	Agreement
Reactor Coolant	I-133	(4.87±0.07)E-4	(5.37±0.15)E-4	Agreement
1026 hrs.	I-134	(2.67±0.12)E-3	(2.5±0.4)E-3	Agreement
11/30/93	I-135	(1.23±0.03)E-3	(1.23±0.06)E-3	Agreement
(Detector #2) ²				
RCS	Cr-51	(2.90±0.11)E-4	(2.93±0.05)E-4	Agreement
Particulate Filter	Mn-54	(4.66±0.14)E-5	(4.43±0.08)E-5	Agreement
1026 hrs.	Co-58	(4.68±0.04)E-4	(4.51±0.03)E-4	Agreement
11/30/93	Co-60	(3.62±0.13)E-5	(3.79±0.08)E-5	Agreement
(Detector #1) ³	Zr-95	(3.8±0.2)E-5	(3.92±0.11)E-5	Agreement
RCS	Cr-51	(2.90±0.11)E-4	(2.94±0.05)E-4	Agreement
Particulate Filter	Mn-54	(4.66±0.14)E-5	(4.32±0.07)E-5	Agreement
1026 hrs.	Co-58	(4.68±0.04)E-4	(4.43±0.02)E-4	Agreement
11/30/93	Co-60	(3.62±0.13)E-5	(3.54±0.07)E-5	Agreement
(Detector #2) ⁴	Zr-95	(3.8±0.2)E-5	(4.01±0.10)E-5	Agreement

Table I - continued
Millstone Radiochemistry Test Results

<u>Sample</u>	<u>Isotope</u>	<u>NRC Value</u>	<u>Licensee Value</u>	<u>Comparison</u>
<u>Results in microCuries per milliliter</u>				
RCS	Cr-51	(2.90±0.11)E-4	(2.77±0.05)E-4	Agreement
Particulate Filter	Mn-54	(4.66±0.14)E-5	(4.40±0.07)E-5	Agreement
1026 hrs.	Co-58	(4.68±0.04)E-4	(4.56±0.02)E-4	Agreement
10/30/93	Co-60	(3.62±0.13)E-5	(3.43±0.07)E-5	Agreement
(Detector #2) ⁵	Zr-95	(3.8±0.2)E-5	(3.95±0.11)E-5	Agreement
<u>Results in total microCuries</u>				
Enclosure Building	I-131	(3.6±0.2)E-4	(3.13±0.12)E-4	Agreement
Roof Vent	I-133	(2.9±0.3)E-4	(1.7±0.2)E-4	Agreement
Charcoal Cartridge				
0955 hrs.				
11/30/93				
(Detector #2) ³				
Enclosure Building	I-131	(3.6±0.2)E-4	(4.3±0.2)E-4	Agreement
Roof Vent	I-133	(2.9±0.3)E-4	(3.2±0.5)E-4	Agreement
Charcoal Cartridge				
0955 hrs.				
11/30/93				
(Detector #1) ⁴				

Table I - continued
Willstone Radiochemistry Test Results

<u>Sample</u>	<u>Isotope</u>	<u>NRC Value</u>	<u>Licensee Value</u>	<u>Comparison</u>
<u>Results in total microCuries</u>				
Enclosure Building	I-131	$(3.6 \pm 0.2)E-4$	$(3.30 \pm 0.14)E-4$	Agreement
Roof Vent	I-133	$(2.9 \pm 0.3)E-4$	$(2.4 \pm 0.3)E-4$	Agreement
Charcoal Cartridge 0955 hrs. 11/30/93 (Detector #2) ⁵				
<u>Results in microCuries per milliliter</u>				
Liquid Radwaste (²²² Rn FDST) 1100 hrs. 05/07/91	Fe-55 gross alpha Sr-89 Sr-90 H-3 H-3	$(4.52 \pm 0.02)E-5$ $(3 \pm 4)E-9$ $(-1.3 \pm 1.8)E-8$ $(1.44 \pm 0.09)E-7$ $(8.71 \pm 0.10)E-4$ $(8.71 \pm 0.10)E-4$	$(2.7 \pm 0.2)E-5$ <7.2E-8 $(6.6 \pm 0.5)E-8$ $(1.90 \pm 0.11)E-7$ $[(9.03 \pm 0.06)E-4]^1$ $[(8.20 \pm 0.07)E-4]^2$	Disagreement No Comparison No Comparison Agreement Agreement Agreement

Notes: ¹Results from Unit 1/Unit 2 Chemistry Counting Room
²Results from Unit 3 Chemistry Counting Room
³Results from Unit 1 Health Physics Counting Room
⁴Results from Unit 2 Health Physics Counting room
⁵Results from Unit 3 Health Physics Counting Room
 Reported uncertainties are one standard deviation counting
 uncertainties for both NRC and licensee results

ATTACHMENT I TO TABLE I

CRITERIA FOR COMPARING RADIOCHEMICAL 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.

<u>Resolution¹</u>	<u>Ratio for Comparison²</u>
< 4	No Comparison
4 - 7	0.5 - 2.0
8 - 15	0.6 - 1.66
16 - 50	0.75 - 1.33
> 200	0.85 - 1.18

1. Resolution = NRC Value/one sigma counting uncertainty
2. Ratio = Licensee Value/NRC Value