U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-271/91-25

Docket No. 50-271

License No. DPR-28

Licensee: Vermont Yankee Nuclear Power Corporation
RD 5, Box 169
Brattleboro, Vermont 05301

Facility Name: Vermont Yankee Nuclear Power Station

Inspection At: Vernon, Vermont

Inspection Conducted: September 23-27, 1991

Inspectors: Nancy T. McNamara 10/15/91
N. McNamara, Physical Science Technician date
Effluents Radiation Protection Section (ERPS),
Facilities Radiological Safety & Safeguards Branch (FRSSB)
Division of Radiation Safety and Safeguards (DRSS)

J. J. Kottan 10-15-91
J. Kottan, Laboratory Specialist date
ERPS, FRSSB, DRSS

Approved by: Robert G Bores 10-16-91
R. Bores, Chief, ERPS, FRSSB, DRSS date

Inspection Summary: Inspection on September 23-27, 1991 (Inspection Report No. 50-271/91-25)

Areas Inspected: Routine, unannounced inspection of the radiochemistry program. Areas reviewed included: confirmatory measurements, laboratory QA/QC and audits.

Results: The licensee had in place an effective program for measuring radioactivity in process and effluent samples. No violations or deviations were identified.

DETAILS

1.0 Individuals Contacted

Principal Licensee Employees

D. Dyer, QA Engineer, QSG
*D. Farguharson, Chemistry Assistant
*R. Grippardie, QA Supervisor, QSG
R. Leach, Safety Coordinator
*S. McAvoy, Chemistry Assistant
*R. Pagodin, Technical Services Superintendent
D. Reid, Plant Manager
*S. Skibniowsky, Chemistry Supervisor

NRC Employees

*H. Eichenholz, Senior Resident Inspector
P. Harris, Resident Inspector
*L. Carson, Radiation Specialist, Region V

*Denotes those present at the exit meeting on September 27, 1991. The inspectors also interviewed other licensee personnel, including members of the chemistry and radiation protection staffs.

2.0 Purpose

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

a. The licensee's ability to measure radioactivity in plant systems and effluent samples.

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

3.0 Previously Identified Item

(Open) Inspector Follow-up Item (50-271/89-13-01). The licensee shall establish appropriate monitoring for the turbine building roof vents or solicit approval for the deviation from the NRC Office of Nuclear Reactor Regulation. During this i pection, a turbine building roof vent charcoal cartridge and pa. iculate filter were analyzed by the licensee and the NRC for the purpose of intercomparison. This sample was taken from a sampling system the licensee had installed on one of the turbine building roof vents in order to close this unresolved item. During this inspection, the licensee was in the process of operating the sampling system in order to assess the performance of the system and resolve any apparent problems prior to formally placing the system into service. The results of the intercomparisons indicated that the licensee can

accurately quantify radioactivity on charcoal cartridges and particulate filters from the sampling system (see Section 4 and Table I). This item remains open until all monitoring systems are formally installed and operating or other appropriate action to resolve this item is completed.

4 0 Confirmatory Measurements

During this part of the inspection, liquid, airborne particulate (filter) and iodine (charcoal cartridge), and gas samples were analyzed by the licensee and the NRC for the purpose of intercomparison. The samples were not split samples, but the same samples were analyzed by the licensee and the NRC. Where possible, the samples are 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 I Mobile Radiological Measurements Laboratory. Joint analyses of actual effluent samples are 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, gross alpha and tritrum. 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 August 8-12, 1988 (Inspection Report No. 50-271/88-12) were also compared during this inspection.

The results of the comparisons indicated that all of the results were in agreement under the criteria used for comparing results (see Attachment 1 to Table I) with the exception of the Fe-55 result from the liquid sample 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 results will be compared as soon as received in order to resolve this discrepancy. Some possible reasons for the disagreement could be a poor sample split or a matrix effect present in the sample. The licensee's Fe-55 result was higher than the NRC result and would not have resulted in the licensee exceeding any effluent release limits. Also, the licensee's offgas results (when measured in the 14-ml offgas vial), although in agreement with the NRC results, were biased high. This high bias resulted from the licensee's calibration of the 14-ml offgas vial counting geometry with a water calibration standard rather than a gas or "simulated" gas calibration standard. The inspector discussed this matter with the licensee, and the licensee stated that a "simulated" gas calibration standard would be purchased for calibrating this counting geometry. Another question which arose as a result of the comparisons was that of the gamma abundance used by the licensee for

Ba-140. The initial Ba-140 result on the Reactor Vessel sample was in disagreement. Upon investigation it was determined that the licensee used a gamma abundance of 20 percent for the 537 keV photopeak while the NRC used a gamma abundance of 25 percent. This difference in the gamma abundances resulted in the licensee's Ba-140 value being higher than the NRC's value, and hence conservative. The licensee committed to change the Ba-140 gamma abundance in the nuclide library used for nuclide identification to the NRC value. Lastly, the inspector noted that the licensee's results for the offgas sample which was analyzed in the Marinelli beaker counting geometry were biased high when compared to the NRC results, although in agreement. Through discussions with the licensee the inspector determined that the licensee had used a "simulated" gas standard for performing the calibration of this counting geometry. However, the calibration curve obtained with the "simulated" gas standard appeared to be identical to the calibration curve obtained with a water-filled standard. The inspector discussed this matter with the licensee and stated that the calibration curves should not overlap because of the attenuation difference between air and water, particularly at energies below approximately 250 keV. The licensee responded by agreeing with the inspector's comments, and stated that this area would be reviewed. Again, since the licensee's results were higher than the NRC results, the bias was in a conservative direction.

All of the measurement results are presented in Table I. The inspector had no further questions in this area.

5.0 Laboratory QA/QC

The licensee's laboratory QA/QC program was detailed in Procedure AP6600, "Chemistry Laboratory Quality Assurance Program". In the radiochemistry area, the procedure provides for the control of analytical performance through an intralaboratory QC program and an interlaboratory QC program. The intralaboratory program consisted of the use of control charts to assess instrument performance, and the interlaboratory program consisted of the analysis of spiked samples supplied by the Yankee Atomic Environmental Laboratory (E-Lab) on a quarterly basis.

The inspector reviewed selected data generated by the licensee's QA/QC program for 1989, 1990 and 1991 to date and noted that the licensee appeared to be implementing the program as required. In reviewing this data the inspector noted that the E-Lab intercomparison was not specifically included in Procedure AP6600. The inspector discussed this matter with the licensee and stated that the E-Lab intercomparison program appeared to be an excellent interlaboratory QC program and should be formally documented in the licensee's procedure. The licensee stated that this program would be included in Procedure AP6600. Additionally, the inspector noted that, on a semi-annual basis, the licensee reviews the laboratory QC data for the laboratory that performs the analyses of effluent samples which require separation chemistry. This activity, although tracked through the licensee's master surveillance list, was also not included in Procedure AP6600. The licensee stated that this

activity would be added to Procedure AP6600. Finally, the inspector discussed the concept of detection limits with the licensee. This discussion centered on the section of Procedure AP6600 which included detection limits and notes on detection limits. The inspector also provided a copy of a publication on detection limits to the licensee. The licensee stated that this area of Procedure AP6600 would be reviewed and changes made, if appropriate. The inspector stated that the areas discussed above would be reviewed during a subsequent inspection of this area.

The inspector also noted the licensee's commitment to the Electric Council of New England (ECNE) Laboratory Quality Control Manual. This manual provided the philosophical basis and guidelines for ECNE member nuclear power plant chemistry laboratories chemistry and radiochemistry QA programs. Through discussions with licensee personnel, the inspector determined that the appropriate aspects of the ECNE manual were incorporated into Procedure AP6600.

The inspector had no further questions in this area.

6.0 Audit

The inspector reviewed recent quality assurance audits of the licensee's radioactivity measurement programs performed by the Yankee Atomic Electric Company QA Department. The following audits were reviewed.

Audit Report No. VY-90-02, Chemistry/Radiological Effluent Technical Specifications, performed March 5-9, 1990.

Audit Report No. VY-91-02, Chemistry/Radiological Effluent Technical Specifications/Radiological Environmental Monitoring Program, performed March 18-19, 1991; March 26-27, 1991 and April 1-May 5, 1991.

These audits included the licensee's programs and procedures for the measurement of radioactivity in effluents released from the site and the laboratory quality assurance program for those measurements. The audits were performed using an audit plan with an associated check list, and the audit team included a technical specialist. The audits appeared to be of adequate technical depth to identify programmatic problems. The inspector also reviewed the tracking system the licensee has in place to track audits and audit findings in order to resolve these findings in a timely manner.

The inspector reviewed selected Quality Assurance Surveillance Reports of the chemistry area. These surveillance activities were conducted by the onsite Quality Services Group. This group maintained an annual surveillance plan for the following site chemistry areas: chemical material control, chemical training, storage and shipment of non-radioactive hazardous waste, sample valve lineup and control, chemical analysis logging, chemistry Technical Specification

surveillances, chemistry laboratory quality control, QA records and document control, PASS, environmental/RETS/ODCM, and waste oil control. While reviewing the surveillance reports the inspector noted, in particular, that Surveillance Report No. 91-36, "Chemistry Lab Quality Control Program", performed March 22, 1991, appeared to be an excellent in-depth surveillance activity of the laboratory QC program and provided an independent onsite assessment of the chemistry laboratory QC program.

The inspector had no further questions in this area.

7.0 Exit Meeting

The inspectors met with the licensee representatives denoted in Section 1.0 at the conclusion of the inspection on September 27, 1991. The inspectors summarized the purpose, scope and findings of the inspection.

Table I

Vermont Yankee Verification Test Results

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in Microcuries Per Milliliter		
Reactor Vessel Water 9-25-91 0805 hrs (Det.#1)	Na-24	(1.35±0.03)E-4	(1.29±0.02)E-4	Agreement
	Cr-51	(9.9±0.3)E-5	(1.02±0.03)E-4	Agreement
	Mn-54	(2.3±0.2)E-6	(1.9±0.2)E-6	Agreement
	Co-58	(3.5±0.3)E-6	(3.3±0.3)E-6	Agreement
	Co-60	(4.7±0.4)E-6	(4.6±0.3)E-6	Agreement
	Zn-65	(1.56±0.09)E-5	(1.51±0.08)E-5	Agreement
	As-76	(4.05±0.12)E-5	(4.08±0.11)E-5	Agreement
	Np-239	(2.68±0.04)E-4	(2.93±0.02)E-4	Agreement
	I-131	(4.15±0.06)E-5	(4.17±0.05)E-5	Agreement
	I-133	(4.16±0.02)E-4	(4.02±0.02)E-4	Agreement
	I-135	(9.8±0.3)E-4	(9.8±0.3)E-4	Agreement
	Ba-140	(2.55±0.11)E-5	(3.43±0.14)E-5	Disagreement
			*(2.74±0.09)E-5	Agreement
*Ba-140 Value calculated with NRC gamma abundance. See Section 4.				
Reactor Water 9-24-91 0815 hrs (Det. #2)	I-131	(1.20±0.04)E-3	(1.17±0.03)E-3	Agreement
	I-132	(2.81±0.02)E-2	(2.[illegible]±0.009)E-2	Agreement
	I-133	(1.23±0.09)E-2	(1.190±0.004)E-2	Agreement
	I-134	(8.3±0.2)E-2	(8.36±0.07)E-2	Agreement
	I-135	(2.90±0.04)E-2	(2.82±0.02)E-2	Agreement
Reactor Water Crud Filter 9-19-91 0825 hrs (Det. #1)	Mn-54	(1.64±0.04E-5	(1.89±0.06)E-5	Agreement
	Co-58	(4.0±0.3)E-6	(4.4±0.3)E-6	Agreement
	Co-60	(8.3±0.4)E-6	(7.1±0.6)E-6	Agreement
	Fe-59	(9.1±0.7)E-6	(1.08±0.08)E-5	Agreement
	Zn-65	(1.06±0.07)E-5	(1.16±0.09)E-5	Agreement
Offgas 9-24-91 0800 hrs Offgas vial counting geometry (Det. #1)	Kr-85m	(5.51±0.14)E-3	(6.41±0.06)E-3	Agreement
	Kr-87	(2.95±0.09)E-2	(3.38±0.03)E-2	Agreement
	Kr-88	(1.96±0.05)E-2	(2.25±0.02)E-2	Agreement
	Xe-133	(4.60±0.12)E-3	(6.08±0.15)E-3	Agreement
	Xe-135	(2.81±0.02)E-2	(3.184±0.012)E-2	Agreement
Reactor Vessel Water 8-8-88 1200 hrs	Fe-55	(1.51±0.02)E-5	(23.7±1.7)E-5	Disagreement
	gross alpha	(3.4±0.6)E-9	(-1.0±1.8)E-8	No Comparison
	H-3	(1.81±0.03)E-2	(2.02±0.11)E-2	Agreement
	Sr-89	(2.42±0.11)E-6	(2.69±0.18)E-6	Agreement
	Sr-90	(7±4)E-9	(7±4)E-8	No Comparison

Table I (contd)

Vermont Yankee Verification Test Results

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		Results in Microcuries Per Milliliter		
Turbine Building Exhaust Particulate Filter 9-23-91 1432 hrs. (Det. #3)	I-131	(2.46±0.10)E-4	(3.2±0.2)E-4	Agreement
	I-133	(8.2±0.3)E-4	(9.0±0.5)E-4	Agreement
Turbine Building Exhaust Charcoal Cartridge 9-23-91 1432 hrs. (Det. #3)	I-131	(1.68±0.08)E-3	(1.79±0.03)E-3	Agreement
	I-133	(4.9±0.2)E-3	(4.79±0.07)E-3	Agreement
Stack Particulate Filter 9-24-91 1036 hrs. (Det. #3)	I-131	(2.1±0.3)E-4	(2.2±0.2)E-4	Agreement
	I-133	(5.0±0.9)E-4	(4.7±0.4)E-4	Agreement
Stack Charcoal Cartridge 9-24-91 1036 hrs. (Det. #3)	I-131	(3.62±0.11)E-3	(3.87±0.04)E-3	Agreement
	I-133	(4.4±0.3)E-3	(4.44±0.07)E-3	Agreement
Offgas 9-26-91 1110 hrs. Marinelli beaker counting geometry (Det. #2)	Kr-85m	(1.69±0.03)E-2	(2.05±0.02)E-2	Agreement
	Kr-88	(2.68±0.12)E-2	(3.08±0.07)E-2	Agreement
	Xe-133	(5.28±0.05)E-2	(6.59±0.04)E-2	Agreement
	Xe-135	(1.678±0.006)E-1	(1.960±0.005)E-1	Agreement

NOTE: Reported uncertainties are one standard deviation(s) counting uncertainties for both NRC and licensee results.

ATTACHMENT 1

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 this 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 the 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 Agreement[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 = Reference Laboratory Value/Reference Laboratory 1S Uncertainty
[2]Ratio = Licensee's Result/Reference Laboratory (NRC) Result