U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-271/88-12

Docket No. 50-271

License No. DPR-28 Priority -- Category C

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: August 8-12, 1988

Inspectors: O. Kirkwood 9/30/88
A. Kirkwood, Radiation Specialist, ERPS, DRSS date

Approved by: W. J. Pasciak 9/30/88
W. J. Pasciak, Chief, Effluents Radiation Protection Section, DRSS date

Inspection Summary: Inspection on August 8-12, 1988 (Inspection Report No. 50-271/88-12)

Areas Inspected: Routine, unannounced inspection of the licensee's radiochemical measurements program using the NRC:I Mobile Radiological Measurements Laboratory and laboratory assistance provided by DOE's Radiological and Environmental Sciences Laboratory. Areas reviewed included: confirmatory measurements, procedures and records associated with the program for quality control of analytical measurements and management organization, staffing and controls.

Results: Within the areas inspected, no violations were identified.

DETAILS

1.0 Individuals Contacted

1.1 Principle Licensee Employees

*R. Wanczyk, Operations Superintendent
*S. Skibniowsky, Chemistry Supervisor
*S. McAvoy, Chemistry Assistant

The inspector also talked with and interviewed other licensee employees including members of the chemistry and radiation protection staffs.

1.2 Contractor Employee

*D. McCurdy, Yankee Atomic Environmental Lab Manager

2.0 Previously Identified Item

(Closed) Inspector Follow-up Item (50-271/85-03-01): control charts for non-radiological chemistry standards. The inspector reviewed control charts for nine analytical standards used in the water chemistry program. A centered mean with two and three sigma limits, typical of standard industry practice, was used. The licensee is now able to identify the significance of analytical differences and the development of trends.

3.0 Confirmatory Measurements

3.1 Split Sample Results

During this part of the inspection, liquid, filter, charcoal cartridge and gas samples were split between the licensee and NRC for the purpose of intercomparison. Where possible, the split samples are actual effluent samples or inplant samples which duplicate counting geometries used by the licensee for effluent sample analyses. In addition, a spiked charcoal cartridge standard was submitted to the licensee for analysis since radioiodine was present on the charcoal cartridge sample in too low an activity for a valid statistical comparison. The samples and standard were analyzed by the licensee using normal 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 samples with respect to Technical Specifications and other regulatory requirements.

In addition, a liquid inplant 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 split sample by the licensee and RESL are Sr-89, Sr-90, Fe-55, gross alpha, and tritium. The results will be compared with the licensee's results when received at a later date and will be documented in a subsequent inspection report. The inspector noted that liquid releases were not made from the facility on a routine basis.

The results of an effluent sample split between the licensee and the NRC:I, during a previous inspection on October 6-10, 1986, (Inspection Report No. 50-271/86-23) were also compared during this inspection.

The results of the sample measurements comparison indicated that all of the measurements were in agreement under the criteria used for comparing results. (See Attachment 1)

The results of the comparisons are listed in Table 1. Zn-69m was not identified by the licensee on the reactor vessel water samples, although this isotope was present. Zn-69m was not identified and quantified because it was not in the licensee's nuclide identification library. The licensee made an immediate addition to their general isotope library to include Zn-69m. On the same comparison, W-187 was noted to have just met comparison criteria. The inspector reviewed the licensee library and determined that a less abundant peak energy was used by the licensee to identify W-187 than that used by the NRC. The licensee again made an immediate change to its library resulting in closer agreement on the comparison. Finally, the licensee was asked to perform an isotopic gamma analysis on a one-liter marinelli containing demineralized water, for the purpose of determining LLDs as required by Technical Specification limits. The inspector verified that LLDs were met for this geometry.

No violations were identified.

3.2 Laboratory Quality Assurance/Quality Control

The inspector performed a selective review of the licensee's program for the quality control of the radioanalytical measurements made by the chemistry group. The review was performed with respect to the following criteria.

- Principles of Quality Assurance of Chemical Measurements (National Bureau of Standards)

- Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment"

- ANSI N42.14-1978, "American National Standard Calibration and Usage of Germanium Detectors for Measurement of Gamma-Ray Emission of Radionuclides"

- ANSI N42.15-1980, "American National Standard Performance Verification of Liquid - Scintillation Counting Systems"

3.2.1 Procedures

The inspector reviewed the following selected licensee effluent and inplant analysis procedures:

- AP 6600, Rev. 8, "Chemistry Laboratory Quality Control Program"

- OP 0631, Rev. 7, "Radiochemistry"

- OP 2610, Rev. 12, "Liquid Waste Disposal"

- OP 2611, Rev. 18, "Gaseous Radwaste"

- AP 6010, Rev. 7, "Inplant Audits"

- DP 2631, Rev. 11, "Radiochemical Instrumentation"

- AP 6025, Rev. 1, "Quality Control/Independent Inspection

- AP 0645, Rev. 0, "Chemistry Data and Information Logging"

After reviewing the above procedures against the previously mentioned criteria, the inspector noted certain instances where methods need to more accurately reflect industry practice and where procedural updates should be more frequent and thorough. AP 6600, Chemistry Lab QC, outlines the Quality Control Program. Section V.B.2., calls for annual performance of lab checks for contractors conducting analyses of samples collected to evaluate Technical Specification requirements. The licensee has recently changed contractor labs for wet chemistry analyses. A means to accomplish the annual performance check on the new contractor lab had not been thoroughly planned by chemistry management as evident from interviews with the chemistry supervisory staff; insufficient documentation readily available onsite to initially reach a conclusion about the new labs ability to analyze plant samples; and a minimum of data relating to licensee submission

and new contractor lab analyses of spiked samples typical of plant needs. However, during the course of the inspection, numerous QAD documents arrived from the new lab; a conference call was held with the senior members of both lab staffs; and the new lab manager attended the exit interview, all of which demonstrated a good faith effort to assure that the new lab contractor was technically able to perform precise and accurate measurements.

The licensee agreed to document the basis of their QA of the new contractor lab to fulfill the annual performance check required by AP 6600.

Procedure AP 6600, Attachments 6600.01 and 6600.02, Chemistry Personnel QA Check Sheet and Outside Lab QA Check Sheet, reference Appendix C acceptance criteria. These acceptance criteria are actually in Appendix A, as accurately referenced in the body of AP 6600. Procedure OP 2611, Rev. 18, Gaseous Radwaste, does not reference placement of particulate filters on a spacer as is the practice when counting on the gamma spectroscopy detectors. The licensee stated that this is addressed in the counting room on a list of geometries. The licensee agreed to mention the particulate filter counting geometry in the next revision to a more appropriate procedure, DP 2631, "Radiochemical Instrumentation". Procedure DP 2631, Rev. 11, details operational methods, performance checks and calibration steps. Section II.A.3 mentions a minimum of 1000 seconds counting time for standards while performing a gamma spectroscopy efficiency calibration. The inspector discussed ANSI N42.14-1978 recommendations, which call for at least 20,000 counts in each full energy peak. The licensee agreed to specify at least 10,000 counts, a standard practice number, in Rev. 12 of this procedure. The LSC operating procedure section of DP 2631, Rev. 11, Beckman LS-100C, Liquid Scintillation Counter, details in Part A.9. counting a calibration source for 10 minutes or 1000 cpm. The inspector pointed out that ANSI N42.15 - 1980 recommends accumulating 100,000 counts for efficiency calibrations and 20,000 counts for daily check source performance verifications. The licensee agreed to specify minimum counts in Rev. 12, for LSC calibrations. Section 5.2.2.4.2 of the standard also recommends chi-square tests of data determinations to verify a statistically normal distribution of data points around a mean (to some specified degree of confidence). This will determine whether the system is operating within allowable limits. The licensee agreed to evaluate the use of statistical tests for data during calibrations and control chart preparation.

Procedure OP 2610, Rev. 12, "Liquid Waste Disposal" is due to be updated on September 18, 1988. At that time the licensee agreed to replace references to the former contractor's procedures with the new lab contractor's procedures in Appendices A, B and C.

With the exception of the above mentioned items, the procedures reviewed were complete and technically sound.

3.2.2 Records

The inspector reviewed the following selected licensee records and data associated with the chemistry quality control program:

- Liquid Scintillation Counter, LS100C, Control Charts dated April 20 to August 9, 1988 for the tritium standard (H8R 1709), and a Calibration dated February 24, 1988
- Contractor lab wet chemistry data on Plant Vent Stack Composite Filters dated April 5 to June 28, 1988
- DP 0631.01, Liquid Standard Accountability File from January 23, 1988
- Weekly Chemistry Schedule Check-Off Sheet for week of July 16 to 22, 1988
- 6600.03, Quality Control Analysis, Gamma Spectroscopy System calibration data from April 29, 1988
- 6600.01 Chemistry Personnel QA Check Sheet, data on performance of spiked split sample analyses from new contractor lab to VY and vendor lab dated February 3, 1986 and September 14, 1987
- 6600.02, Outside Lab QA Check Sheet, spiked sample results for first two quarters of 1988 and last two quarters of 1987, on old vendor lab
- MCA control charts for peak area and FWHM, 30% HPGe, 1 liter MB, dated June 1 to August 9, 1988
- Non-rad chemistry control charts dated January to August 8, 1988 for Cl, TOC, Silica, B, Cr, Ni, Co, Cu, Fe and Zn

After review of the above records and data the inspector noted instances where supervisory review of trending data at more frequent intervals, combined with required action indicators, would enhance the quality and confidence of chemistry measurements.

Quality control checks on the gamma spectroscopy system consist of a daily energy performance check utilizing a Eu-152 check source and control chart plots of peak area (779 KeV) and resolution (FWHM). Source decay has been factored into the two and three sigma control limits. Also weekly (2000 second count) and monthly (10,000 second count) backgrounds are done, although this data is not plotted. All three detectors (30% and ~ 20% efficiency HPGe; ~ 10% efficiency GeLi) are source checked daily. Procedures detail steps to be taken should problems occur. If the technician cannot resolve them, an out of service (OOS) sign is placed on the detector and a supervisor is notified. QC data on the LSC (liquid scintillation counter) are accumulated from a tritium sealed source and backgrounds prepared in similar quantities and matrices as those routinely analyzed. The inspector reviewed control chart data for the tritium sealed source dated April 20 to August 9, 1988. Data from June 10 to August 2, 1988 had trended below the negative two sigma limit and finally was out of the negative three sigma limit on August 3 and 4, 1988. Supervisory review of this data at frequent intervals could have prevented an unnecessarily long period of suspect equipment reliability. Proceduralized actions at the two sigma limits could have required technicians to alert supervisors even more rapidly. The inspector discussed the use of statistical probability determinants as an action limit tool also. The number of measurements expected to fall outside of two sigma over a twenty working day month can be statistically determined. If exceeded, this could quickly alert the licensee to suspect measurements.

Overall, records were orderly, complete and accurate, with the exception of "white-out" on control charts.

The inspector stated that the above areas, including improvements in the quality control of Liquid Scintillation Counting measurements discussed in this section, and modifications to procedures and documentation of the basis for QA of the new contractor lab identified in Section 3.2.1, would be reviewed during a subsequent inspection (50-271/88-12-01).

No violations were identified.

4.0 Management Controls

4.1 Organization and Staffing

Recent changes in the Chemistry Department involve the splitting of the RP/Chemistry technician pool in two. Chemistry technicians are now exclusively assigned to the Chemistry Supervisor. Seven chemistry

technicians are desired and interviewing was being done to fill four positions while the inspector was on site. One contract technician is currently filling a vacancy and two more are being sought until all vacancies can be filled by permanent employees. This change demonstrates positive steps to improve the quality of chemistry measurements by use of a dedicated workforce. The experienced, long term staff is a program strength.

4.2 Audits

The inspector reviewed the following documents with respect to management control of the chemistry QA program.

- AP 6010, Rev. 7, In-Plant Audits
- Audit 87-02, Chemistry/RETS, dated February 9 to 13, 1987
- Audit 88-02, Chemistry, RETS/ODCM and Radiation Environmental Monitoring dated February 1 to 5, 1988

Procedure AP 6010, Rev. 7, was reviewed by the inspector and found to be complete and thorough with regard to followup on audit deficiencies and observations. Audit 88-02 exhibited good technique in that a historical review for recurring items was conducted and noted in a memo of May 16, 1988. Senior Management attention and followup was noted in a memo from the Plant Manager dated July 13, 1988. Audit thoroughness and technical depth were adequate.

No violations were noted within the scope of this review.

5.0 Exit Interview

The inspector met with the licensee's representatives (denoted in Section 1 by an asterisk) at the conclusion of the inspection on August 12, 1988 and summarized the scope and findings of the inspection.

TABLE 1

VERIFICATION TEST RESULTS

SAMPLE	ISOTOPE	RESULTS IN MICROCURIES/MILLILITER		COMPARISON
		NRC VALUE	LICENSEE VALUE	
Reactor Vessel	Na-24	(1.328 ± 0.009) E-3	(1.379 ± 0.008) E-3	Agreement
Water	Cr-51	(2.3 ± 0.2) E-4	(2.27 ± 0.13) E-4	Agreement
8/9/88	Mn-54	(1.40 ± 0.02) E-4	(1.38 ± 0.02) E-4	Agreement
1200 hrs.	Co-60	(1.17 ± 0.02) E-4	(1.20 ± 0.02) E-4	Agreement
	Co-58	(6.6 ± 0.2) E-5	(6.69 ± 0.12) E-5	Agreement
	Fe-59	(1.25 ± 0.04) E-4	(1.21 ± 0.03) E-4	Agreement
	Cu-64	(3.62 ± 0.10) E-4	(3.95 ± 0.09) E-2	Agreement
	Zn-65	(1.27 ± 0.04) E-4	(1.36 ± 0.03) E-4	Agreement
	Zn-69m	(6.7 ± 0.5) E-5	(Not In Lib)	No Comparison
	As-76	(3.25 ± 0.05) E-4	(3.43 ± 0.04) E-4	Agreement
	W-187	(9.8 ± 0.8) E-5	(8.1 ± 0.8) E-5	Agreement
	I-133	(1.02 ± 0.03) E-4	(1.02 ± 0.03) E-4	Agreement
	I-135	(2.3 ± 0.5) E-4	(2.7 ± 0.3) E-4	Agreement
	Ag-110m	(9.9 ± 0.2) E-5	(9.87 ± 0.13) E-5	Agreement
	*W-187	(9.8 ± 0.8) E-5	(1.5 ± 0.2) E-4	Agreement
WCT	Zn-65	(1.39 ± 0.13) E-6	(1.27 ± 0.10) E-6	Agreement
8/11/88	As-76	(3.4 ± 0.2) E-6	(3.44 ± 0.11) E-6	Agreement
1030 hrs	Ag-110m	(6.5 ± 0.5) E-7	(7.3 ± 0.4) E-7	Agreement
	Cs-134	(6.5 ± 0.6) E-7	(4.7 ± 0.5) E-7	Agreement
	Cs-137	(1.36 ± 0.06) E-6	(1.38 ± 0.06) E-6	Agreement
	Na-24	(1.04 ± 0.08) E-6	(1.26 ± 0.07) E-6	Agreement
	I-133	(4.8 ± 0.5) E-7	(6.2 ± 0.4) E-7	Agreement
Rx Crud Filter	Mn-54	(2.29 ± 0.08) E-3	(2.91 ± 0.08) E-3	Agreement
8/9/88	Co-60	(1.65 ± 0.07) E-3	(1.84 ± 0.07) E-3	Agreement
1200 hrs	Fe-59	(2.5 ± 0.2) E-3	(3.36 ± 0.13) E-3	Agreement
	Cr-51	(2.1 ± 0.3) E-3	(1.9 ± 0.3) E-3	Agreement
	Co-58	(3.9 ± 0.5) E-3	(4.6 ± 0.5) E-4	Agreement
	Zn-65	(6.67 ± 0.10) E-4	(7.6 ± 0.9) E-4	Agreement
	As-76	(1.8 ± 0.3) E-3	(2.0 ± 0.2) E-3	Agreement
WCT	Gross Alpha	(5.9 ± 1.4) E-10	L.T. 7 E-8	No Comparison
10/8/86	B-3	(4.89 ± 0.07) E-3	(5.3 ± 0.1) E-3	Agreement
0905 hrs.	Sr-89	(9.7 ± 1.0) E-8	(8.4 ± 1.7) E-8	Agreement
	Sr-90	(1.8 ± 0.2) E-8	(2.1 ± 0.5) E-8	Agreement
Charcoal Cartridge	Co-60	(6.65 ± 0.14) E-2	(6.55 ± 0.03) E-2	Agreement
8/11/88	Cd-109	(3.59 ± 0.06) E-1	(3.314 ± 0.014) E-1	Agreement
1200 hrs	Cs-137	(8.85 ± 0.14) E-2	(8.69 ± 0.03)	Agreement
(Total activity spike - NRC)				
Off-Gas	Kr-85m	(3.18 ± 0.15) E-4	(3.20 ± 0.05) E-4	Agreement
13.53 ml	Kr-87	(1.06 ± 0.06) E-3	(1.02 ± 0.02) E-3	Agreement
8/9/88	Kr-88	(7.9 ± 0.5) E-4	(8.8 ± 0.2) E-4	Agreement
1014 hrs	Xe-133	(9.1 ± 0.3) E-4	(9.31 ± 0.12) E-4	Agreement
	Xe-135	(1.0 ± 0.18) E-3	(1.080 ± 0.009) E-3	Agreement

*Key peak changed to reflect higher abundance energy of 686keV

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 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 Agreement[2]
<3	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 = (License Value/NRC Reference Value)