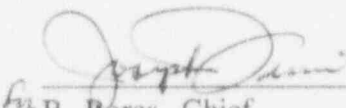


U.S. NUCLEAR REGULATORY COMMISSION  
REGION I

Report No. 50-271/94-14  
Docket No. 50-271  
License No. DPR-28  
Licensee: Vermont Yankee Nuclear Power Corporation  
Brattleboro, Vermont 05301  
Facility Name: Vermont Yankee Nuclear Power Station  
Inspection At: Vernon, Vermont  
Inspection Period: May 16 - 20, 1994

Inspector:   
J. Nick, Radiation Specialist 6/10/94  
Date

Approved by:   
for R. Bores, Chief 6/13/94  
Date  
Facilities Radiation Protection Section, DRSS

Areas Inspected: Implementation of the radiological controls program. Areas of this program included audits and appraisals, changes to the organization or program, training and qualifications of personnel, external exposure controls, internal exposure controls, control of radioactive materials and contamination, the program to maintain workers' exposures as low as reasonably achievable (ALARA), and effectiveness of licensee controls. Previously identified items were reviewed for status and update.

Results: The radiological controls program was very effective in protecting the health and safety of workers in radiological areas. Areas toured in the facility were well maintained and exhibited good housekeeping. The radiation protection group was adequately staffed by qualified individuals. Improvements were noted in radiological area housekeeping and reduction of contaminated areas. One previously identified item concerning control of radioactive material was closed. No violations or major safety concerns were identified.

## DETAILS

### 1.0 Individuals Contacted

#### 1.1 Licensee Personnel

- \*D. Calsyn, Quality Services Group Supervisor
- J. Geyster, Plant Health Physicist
- \*S. Jefferson, Assistant to Plant Manager
- \*J. Herron, Technical Services Superintendent
- \*E. Lindamood, Radiation Protection Manager
- T. McCarthy, Technical Instructor, Training
- \*J. Meyer, Operations Support Project Engineer
- D. Tkatch, Radiation Protection Assistant
- M. Thornhill, Radiation Protection Assistant
- \*R. Wanczyk, Plant Manager

#### 1.2 NRC Personnel

- \*H. Eichenholz, Senior Resident Inspector
- P. Harris, Resident Inspector
- R. Conti, Division of Reactor Projects, Section Chief

\* Denotes those present during the exit meeting

### 2.0 Purpose

The purpose of this announced inspection was to assess the licensee's implementation of the radiological controls program. Areas of this program included audits and appraisals, changes to the organization or program, training and qualifications of personnel, external exposure controls, internal exposure controls, control of radioactive materials and contamination, the program to maintain workers' exposures as low as reasonably achievable (ALARA), and effectiveness of licensee controls. Previously identified items were reviewed for status and update.

### 3.0 Previously Identified Items

#### 3.1 (Closed) NRC Unresolved Item (50-271/93-13-01) Control of Radioactive Material

The licensee had documented a problem with control of radioactive material in a recent corrective action report (CAR 93-29) which was identified as an unresolved item in NRC Inspection Report 50-271/93-12. The problem was further discussed in NRC Inspection Report No. 50-271/93-22. Contaminated items had been found outside the radiologically controlled area (RCA) in the licensee's storage facility located in Vernon, Vermont. The licensee had implemented many immediate and long-term corrective actions to better

control radioactive material. The licensee performed a thorough investigation and evaluation of the improper release of this material from the RCA. Immediate corrective actions taken included surveying the storage facility for other contaminated items, tightening controls for release of materials from the RCA, and limiting the amount of material entering or exiting the RCA. Longer-term corrective actions included establishing performance criteria for measuring successful control of radioactive materials, developing performance indicators for program surveillance, and requesting an "assist visit" from the Institute of Nuclear Power Operations (INPO). The INPO team performed an assessment in November, 1993, and recommended improvements for control of radioactive materials. The licensee reviewed the assessment report and evaluated the INPO recommendations. The licensee continued to research the problem among other utilities and obtain information from plants with good radioactive material control programs. Although the licensee was not finished with the assessment and had not fully implemented all corrective actions, a trending program had not identified any recent problems in this area. The inspector noted that the comprehensive actions taken by the licensee should help to prevent a recurrence of this problem.

#### 4.0 Facility Tours

The inspector toured many of the radiologically controlled areas (RCAs) of the facility including the reactor building, the refueling floor, the turbine building, the torus room, radwaste processing areas, and outside areas within the protected area. All areas were generally well posted and exhibited good housekeeping. The inspector observed that most radiological controls signs posted on the exterior of the building doors were faded from exposure to the elements. The licensee personnel had already noted the faded colors and had added the task of replacing the signs on a department work list.

Improvements in housekeeping were evident in contaminated and radiologically controlled areas. The inspector noted the licensee's efforts in applying an epoxy paint to many areas for easier decontamination and cleaning. The lower level of the radioactive waste building had been extensively decontaminated, cleaned, and painted. The area was accessible by personnel without protective clothing in almost all locations. All areas toured during the period of this recent inspection were well maintained and the inspector did not observe any problems as identified in previous inspections.

The licensee provided good controls to prevent the spread of radioactive contamination. Contaminated areas were well posted and marked with tape or rope. Step-off pads were placed at the entries/exits to these areas to alert workers of the change from a contaminated area to a cleaner area. A sufficient inventory of protective clothing was available for work in contaminated areas. After leaving a contaminated area and removing potentially contaminated protective clothing, radiological frisking instruments were provided to workers for checking their hands and feet for contamination. The receptacles provided for the collection of potentially contaminated protective clothing

were periodically emptied and the undressing areas were neatly kept to prevent inadvertent spread of contamination.

High Radiation Area (HRA) and Very High Radiation Area (VHRA) postings and barriers were checked throughout the facility. All areas were posted as required by NRC regulations. All areas were appropriately barricaded and all areas were locked as required.

The inspector noted that some containers were labelled with radioactive material stickers, but did not provide other information (such as radioactivity levels, dose rates, the radionuclides present, kinds of the material, etc.) to allow workers to maintain their exposure ALARA. The containers were generally tool boxes or metal storage bins. The licensee had labelled the containers with the radioactive material labels even though the material inside the container may not have met the criteria for radioactive material. In some instances, the contents were also labelled and contained in plastic bags with more specific information written on the bags. In all cases, the materials were not highly contaminated or did not produce a very high radiation level. The inspector identified this use of radioactive material posting as a minor weakness in the radiological controls program because it could desensitize workers to the presence of an actual hazard with radioactive materials. The licensee representatives agreed to review the use of the radioactive material stickers in an attempt to improve the control of radioactive materials. The inspector will review the licensee's progress in this area in future inspections.

#### 5.0 Organization and Staffing

The inspector reviewed the organization and staffing levels through interviews with licensee personnel. The licensee maintained five supervisors (including radwaste and radiation protection assistants) to direct the activities of 15 health physics technicians. The licensee had recently hired three new individuals as radiation protection technicians. The individuals were attending classroom and on-the-job training during the period of this inspection. The inspector reviewed the lesson plans and job qualifications with the radiation protection training instructor. The training covered relevant topics including basic radiation theory, health physics fundamentals, site specific procedures, and industry events. Licensee management expected the technicians to be fully qualified by the end of July 1994. Since the training had not been finished, the qualifications and documentation of the technicians will be reviewed during a future inspection.

The licensee's management had recently made some personnel changes within the radiation protection staff. The two individuals in the ALARA Engineer and the Radiation Protection Training Coordinator positions were rotated in January 1994. The rotation was well planned and no negative impact on the radiation protection or ALARA programs had resulted.

## 6.0 Audits/Appraisals

A quality assurance audit was performed by the licensee of the radiation protection and radwaste program in September 1993. The inspector reviewed the audit report and the licensee's response. Coordination for the audit was provided by the Quality Assurance group and the audit was performed by three licensee auditors, a technical specialist from Yankee Nuclear Services Division, and a health physics supervisor from Seabrook Nuclear Power Station. The auditors reviewed procedures, interviewed plant personnel, observed work activities, reviewed log books, and reviewed program records. The auditors concluded that the radiation protection program was effective, although there were many problems with attention to detail. Three deficiencies and two recommendations were identified by the auditors. None of the findings indicated a serious threat to worker or plant safety. The inspector concluded that the audit contained very good detail with appropriate references to industry standards and regulatory guidance. Effective and timely corrective actions were implemented to ensure that specific problems were resolved and would not recur.

Incidents or problems were documented by the licensee's staff in Radiation Protection Incident Reports (RPIRs). The inspector reviewed the RPIRs generated for 1994. As of May 17, 1994, the licensee had written 13 RPIRs dealing with a variety of incidents. Most incidents involved personnel errors and minor violations of the licensee's practices or procedures. The individuals involved in each situation were counselled or disciplined, but the incidents did not appear intentional or malicious. The licensee was monitoring the number and type of incidents to observe trends and programmatic weaknesses. Since many of the incidents involved a problem with attention to detail, the licensee was attempting to provide further corrective actions to address the audit findings discussed above. Corrective actions included further management oversight and encouraging all plant personnel to pay attention to details during work activities. The inspector found that the corrective actions were appropriate and the licensee's progress in this area will be reviewed in future inspections.

The licensee also maintained an observation program that documented the results of personnel tours for housekeeping, procedure adherence, and radiation protection practices. Items observed by the staff were documented on brief reports, added to a work list (if applicable), and tracked through completion or resolution. The inspector reviewed various observation reports and verified that the items were added to a work list. Although the items were generally minor problems with housekeeping, the inspector found that the program improved the licensee's ability to maintain plant equipment, improve personnel safety, or reduce the spread of contamination.

In addition to formal audits, the licensee also performed surveillance of work activities in radiological areas. The inspector reviewed seven surveillance reports of work activities during the period from February 1994 through May 1994. The surveillance activities

included radiological waste processing and packaging, control of radiological survey equipment, procedure adherence, establishing and posting restricted areas, and radiological controls for a reactor building (containment building) entry during a reduction in reactor power operations. The licensee used the surveillance activities to measure and determine the effectiveness of previous corrective actions. Some minor problems were documented as well as very good performance in some areas. The surveillance of control of radiological survey equipment and procedure adherence was a check on the audit finding concerning attention to detail. Both areas showed significant improvement based on new emphasis and corrective actions. As another independent review, the inspector performed an audit to ensure that radiation protection technicians were documenting the daily source checks and issuance logs for radiation protection survey instruments. Several instruments used on various dates were selected at random and the inspector found 100% compliance with the requirements for documentation of the source check and the issue log. The inspector concluded that the surveillance reports were another productive method to help the licensee trend and resolve small areas of weakness.

The inspector found that the licensee's self-assessment and corrective action program was continuing to document, track, and trend minor areas for improvement in the radiological controls program. Timely and effective corrective actions were implemented. The inspector noted no deficiencies or violations of NRC regulations in this area.

#### 7.0 External Exposure Controls

The licensee monitored individuals for radiation while performing work in the RCA by the use of alarming self-reading dosimeters (ASRDs) and thermoluminescent dosimeters (TLDs). After initial issuance, the TLD was worn during each work shift within the protected area. At the end of the work shift, the TLD was stored at the main security facility within the restricted area. The ASRD was issued upon each entry to the RCA. After exiting the RCA, the ASRD was placed on a rack outside the control point for charging and storage.

The inspector observed workers in the RCA wearing their assigned SRD and the whole body TLD with the correct body placement. The licensee used an off-site laboratory to process whole body TLDs that was currently accredited through the National Voluntary Laboratory Accreditation Program (NVLAP).

The licensee maintained an automated exposure tracking system that recorded the worker's dose from the ASRD. The worker's radiation exposure was read and recorded by the ASRD reader after each entry into the RCA. The TLD was processed periodically, and the radiation protection staff monitored and performed trending on the results including a comparison with the ASRD total for the same period. Abnormal readings (poor agreement between TLD and ASRD readings) were investigated and



resolved. Typically, the ASRD total was slightly higher (e.g. 5 to 10%) than the TLD reading.

The licensee was currently monitoring three pregnant females under the guidance of their procedure for declared pregnant women (DPW). The workers received a baseline in-vivo bioassay (whole body count) upon declaration of the pregnancy, and once a month thereafter. The workers were placed on restricted duty assignments to maintain their radiation exposure uniform and ALARA. An administrative exposure limit of 50 millirem per month was assigned to each worker. The TLDs for the workers were processed every month to further ensure that the dose to the worker and the embryo/fetus were below regulatory limits. Of the three individuals, the highest dose total for 1994 was 45 millirem that had been assigned to the worker before the declaration of her pregnancy. Since the time of declaration, all three workers had received little or no assigned dose. The regulatory limit for the embryo/fetus due to occupational exposure of the mother is 500 millirem during the entire pregnancy.

The licensee documented incidents of skin contamination found on workers when they exited a contaminated area or the RCA. As of May 9, 1994, the licensee had written 21 skin contamination reports. The reports were used to determine the shallow dose assignment to the workers' skin of the whole body. The highest skin dose assignment for 1994 was 132 millirem. This is well below the regulatory limit of 50,000 millirem per year for each worker.

The inspector concluded that the licensee was providing effective external dose controls. No violations or safety concerns were identified in this area of the program.

#### 8.0 Internal Exposure Controls

The control of internal exposure control was inspected through a review of internal dose assignments, the presence of air sampling instruments in the work locations, the use of respirators or other engineering controls, the review of the licensee's procedures for the issuance of respiratory protection equipment, and the review of the internal exposure tracking system. The licensee's internal dose tracking software was maintained on a network computer system. The system allowed the assignment of internal dose from air sample results, bioassay results, or calculations. Although most individuals did not meet the threshold dose for summing of external and internal dose, the licensee was summing the total external dose and the effective internal dose for all monitored individuals in the tracking system. The inspector found that the licensee had an effective tracking system to control internal exposure.

Licensee procedures outlined the method used to determine whether the workers would receive more total exposure with or without respiratory protection. In many circumstances the individuals would receive more whole body exposure when wearing respirators than when performing the same job without wearing respirators, and the

historical data on some jobs had shown very little internal dose potential. The licensee stated that respirator usage had decreased from past practice without a significant increase in internal dose assignments. The licensee's data showed an approximate 50% decrease in total dose assignment for control rod drive and refueling work activities when respirators were eliminated. This data was based on similar work activities and conditions in 1992 and 1993.

Estimated internal dose was assigned to workers based on the results of air samples in the work areas. Air sample results were calculated in Derived Air Concentrations (DACs) and multiplied by the time spent by the worker in the area to obtain DAC-hours. After an individual had accumulated greater than 4 DAC-hours (10 millirem, committed effective dose) in a calendar year, the individual was contacted for a bioassay determination. The dose calculated from the bioassay replaced the estimated dose assigned from the air sample results. The licensee did not have any individuals who had received greater than 4 DAC-hours in 1994, but whole body bioassays were performed on many individuals for termination of work assignment or other reasons.

The NRC regulatory limit is 2000 DAC-hours or a total effective dose of 5000 millirem per calendar year. There were no internal dose assignments to any individual from bioassay in 1994. Approximately 37 dose assignments were made in 1993. The maximum dose assignment to an individual was 43 millirem, and most assignments were less than 10 millirem for each individual.

The licensee maintained a bioassay program to verify the effectiveness of the respiratory protection program and determine internal dose assessments. The program included annual whole body counts for personnel with RCA access, whole body counts after personnel radioactive contamination events, and random whole body counts for individuals with RCA access for respiratory protection verification. The inspector noted that the random counts were performed on five personnel per week.

During tours of the radiological controlled areas, the inspector observed air sampling equipment in the work place when it was appropriate. The inspector also observed air sampling equipment in the work place with current calibration dates and documented, daily operational checks. Air filtration and air handling units were placed in many areas to provide better breathing air in potentially contaminated areas.

Overall, the inspector concluded that the licensee provided adequate control of internal exposure to the workers through engineering or process controls. The licensee effectively tracked and assigned internal dose and performed bioassay assessments when necessary. No deficiencies or violations were noted in this area of the program.

#### 9.0 ALARA Program

The licensee's radiological controls program contained several components to maintain personnel radiation exposure ALARA. The licensee held quarterly ALARA committee



meetings, posted radiological controls and dose data summaries on plant bulletin boards, published an ALARA newsletter, maintained an ALARA suggestion program, and posted signs indicating lower dose rate areas in the plant. ALARA responsibilities and instructions were stressed in the general employee training classes.

The Radiological Controls staff prepared ALARA reviews of jobs and tasks performed in the RCA. ALARA reviews for major tasks and jobs were maintained by the ALARA Coordinator. Engineering personnel, job supervisors, and job planners were also included in ALARA reviews. The ALARA coordinator also generated reports, dose summaries, and other graphs and charts showing the staff's progress with total exposure and other radiation protection goals.

The licensee dose reports stated the total personnel exposure for all workers from January 1, 1994 through May 14, 1994, was approximately 16 person-rem. Most of this exposure was attributed to routine activities. Some exposure was attributed to main steam isolation valve work in March (approximately 2 person-rem). The total personnel exposure goal for 1994 was 94 person-rem. The licensee noted that if the staff met this goal, it would be the first year that the licensee had accumulated under 100 person-rem since the plant started operation. The staff also believed that they could achieve the lowest dose for all operating boiling water reactors in the United States. The total exposure for all workers at Vermont Yankee during 1993 was approximately 204 person-rem. This was below their goal of 310 person-rem. The large difference was attributed to greater than 20% reduction in average dose rates within the plant and other successful ALARA initiatives.

The licensee had not allowed any individuals to exceed the regulatory limits nor participate in a planned special exposure (PSE) during 1993 or 1994. There were no minors being monitored for radiation exposure at the site.

The licensee's ALARA committee reviewed the personnel exposure estimates and accumulated personnel exposure for major jobs. The committee was composed of the plant manager and management representatives from each department within the licensee's organization. Members of the committee commented on performance and suggested ways to maintain personnel radiation exposure ALARA. The inspector reviewed the minutes from the ALARA Committee meetings held on February 2, 1994 and May 16, 1994. The inspector found that the committee discussed appropriate trends and results, and assigned good action items to individual members of the committee.

The inspector concluded that the program to maintain personnel exposures ALARA was very effective. The licensee used planning, mock-up training, worker education, and departmental accountability to exposure goals. Overall, radiation exposures were very good compared to other pressurized water reactors of the same age. No deficiencies or violations were noted.

## 10.0 Effectiveness of Licensee Controls

The licensee provided very good radiological controls for a recent entry into the reactor containment building with the reactor at reduced power. The licensee used mock-up training before actually performing the work activities. These activities included main steam isolation valve time adjustments. The other controls included constant health physics coverage, a pre-planning meeting, appropriate personnel monitoring, and using the airlock door for shielding during some of the work. Neutron TLDs were issued to the personnel due to the neutron dose rate. Seven personnel were issued neutron dose, with dose assignments between 40 and 90 millirem.

The licensee had implemented some radiation protection program improvements. These improvements included adding a foot guard on the automated personnel friskers to keep worker's feet over the detector during a count, ensuring that all locked high radiation area doors would allow someone to leave an area and not get locked in the area, hydrolazing drains and lines to reduce hot spots and high dose rates in the plant, implementation of automated tool monitors to check items leaving the RCA for contamination, development of a cart to perform radiological surveys of "clean" areas, and the use of a task force to reduce paperwork and logging redundancies.

Overall, the inspector found that the licensee maintained a very good radiation protection program with continuing improvements. Minor areas of weakness were being corrected over an extended period of time. Although corrective actions for the control of radioactive materials were slow, the staff had made significant progress in this area. Other areas of improvement were continuing and were incorporated into a five year plan.

## 11.0 Exit Meeting

A meeting was held with licensee representatives at the end of the inspection period on May 20, 1994. The purpose and scope of the inspection were reviewed and the findings of the inspection were discussed. The licensee acknowledged the inspector's findings.