U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report Nos. 50-272/95-16; 50-311/95-16

Docket Nos. 50-272, 50-311

License Nos. DPR-70, DPR-75

Licensee: Public Service Electric and Gas Company
P. O. Box 236
Hancocks Bridge, NJ 08038

Facility Name: Salem Nuclear Generating Station, Units 1 and 2

Inspection At: Hancocks Bridge, New Jersey

Inspection Conducted: August 7 - 11, 1995

Inspector:

J. Noggle, Senior Radiation Specialist — Date: 8/17/95

Approved by:

for R. Bores, Chief Facilities
Radiation Protection Section — Date: 8/23/95

Areas Reviewed: Announced inspection of the radiation control program, including: audits and surveillances, radiation control operations, radiation instrumentation, dosimetry, and respiratory protection.

Results: The licensee's radiation control program elements generally were of very good quality. Minor areas for improvement were identified in several areas. No safety concerns or violations of regulatory requirements were identified.

DETAILS

1.0 INDIVIDUALS CONTACTED

1.1 PRINCIPAL LICENSEE EMPLOYEES

W. Billings, Radiological and Chemistry Support
J. Foti, Operation Services, Radiation Protection Instruments
C. Fricker, Salem Quality Assurance
R. Gary, Hope Creek Radiation Protection Operations
R. Granberg, Radiological and Chemistry Support
T. DiGuiseppi, Emergency Preparedness/Radiological and Chemistry Support
E. Lawrence, Salem Quality Assurance
K. O'Hare, Salem Radiation Protection, As Low As Reasonably Achievable (ALARA)
E. Villar, Salem Licensing
J. Wray, Radiological and Chemistry Support
R. Yewdall, Radiological and Chemistry Support

1.2 STATE OF NEW JERSEY

D. Vann, Bureau of Nuclear Engineering

1.3 NRC EMPLOYEES

C. Marschall, Senior Resident Inspector

The above individuals attended the inspection exit meeting on August 11, 1995.

The inspector also interviewed other individuals during the inspection.

2.0 PURPOSE OF INSPECTION

The purpose of this inspection was to review the radiation control program at the Salem Nuclear Generating Station.

3.0 AUDITS AND SURVEILLANCES

3.1 LICENSEE AUDIT

The latest licensee audit of the radiation protection program (Audit Report No. 95-150) was conducted on June 5-23, 1995. This high quality technical audit identified the following strengths: self-assessment, radiation worker knowledge, management effectiveness, ALARA briefings, and high radiation area key control. The audit also identified seven minor findings that were not safety significant. The audit team included four technical specialists from four outside utilities.

3.2 SURVEILLANCES

The licensee implemented an internal self-assessment program of the radiation protection program beginning in 1995 as part of a station-wide effort to enhance the self-identification of weaknesses in each

department area. The inspector reviewed several individual self-assessment reports and reviewed the first and second quarter 1995 self-assessment summary reports. Several areas for improvement were identified and this program appeared to provide a focus for the department. The inspector viewed this as a very good surveillance program.

The licensee also utilizes Radiological Occurrence Reports (RORs) that may be used by any station worker to report radiological events. RORs require the investigation of radiological events, causal analysis, and determination of corrective actions to prevent recurrence. The licensee includes personnel contaminations as RORs, and these compose most of the level "one" RORs. Level "one" RORs are the least safety significant and level "three" RORs are the most safety significant. As of August 7, 1995, the licensee had recorded 59 level "one" RORs, 15 level "two" RORs, and 6 level "three" RORs during 1995. The inspector reviewed 15 of the level "two" and "three" RORs to determine the effectiveness of the licensee's radiological problem solving capability and the use of radiological events as feedback on program adequacy. Most of the RORs reviewed by the inspector were the result of low significance personnel errors, and corrective actions typically specified counselling of the individual. Two of the RORs (95-036 and 95-051) involved the use of the wrong RWP and not wearing proper dosimetry, respectively. The licensee provided very thorough investigations of these events, considered several causal aspects of the events and provided multiple corrective actions that were tracked until closure. The inspector determined that the licensee demonstrated very effective radiological problem resolution capability.

4.0 ORGANIZATION CHANGES

The licensee has a stable radiation protection (RP) organization. The previous Senior ALARA Supervisor has taken a leave of absence to work for the Institute of Nuclear Power Operations. A qualified ALARA Supervisor has been promoted to fill the senior supervisor position. During the current long-term plant shutdown, the RP organization has been expanded to include 93 contractor RP technicians providing around-the-clock coverage. The radiation protection/ chemistry (RP/C) services group has been reorganized to include the emergency preparedness group. The radiation protection instrument calibration responsibility has been transferred to the measurement and test equipment (M & TE) group. The inspector determined that RP instrument selection and inventory levels were still controlled by the RP organizations of Salem and Hope Creek stations. The above mentioned changes were determined not to have any deleterious affect on the radiation controls program.

5.0 RP OPERATIONS AND ALARA

During this inspection, Salem Units 1 and 2 were in an extended shutdown condition with some limited radiologically significant work in progress. The inspector toured areas of the station, observed some radiological work and attended several ALARA pre-job briefings.

The licensee had originally developed an ALARA goal of 220 person-rem for both Salem Units 1 and 2 for 1995. This estimate included the Salem Unit 1 refueling outage of 180 person-rem. The ALARA goal-to-date as of this inspection was 28.6 person-rem versus actual accumulated personnel exposures of 78.2 person-rem. The licensee indicated that the previous Salem Unit 2 refueling outage extended into 1995 due to extended workscope which resulted in 15.7 person-rem carryover into 1995. In addition, Unit 1 experienced an unplanned forced outage in 1995 that resulted in another 15.7 person-rem that was not budgeted for 1995. Due to the continued shutdown of Salem station, the licensee has begun developing a Unit 1 extended outage work schedule. At the time of this inspection, the work planning for this extended outage had not been finalized and therefore, the ALARA exposure estimate could not be defined. The ALARA group was working with the maintenance and scheduling groups to obtain maintenance work plans as early as possible (generally one week in advance). In spite of the limited advance notice, the ALARA group appeared to provide the requisite resources to limit exposures for the emergent work situation caused by the unplanned extended outage shutdown condition.

The ALARA group added approximately 15 ALARA contract technicians and was in the process of procuring quantities of lead shielding to address the outage ALARA needs. The inspector participated in ALARA pre-job briefings of workers tasked with steam generator maintenance mobilization and with the residual heat removal heat exchanger end bell removal work. Both meetings demonstrated a good RP organization and work group rapport and appropriate discussions of the radiological hazards/controls and work evolution details.

The inspector observed workers in the station and determined that very good RP technician oversight of jobs was being provided and that workers appeared to be conscientious in observing protective clothing dress requirements and other radiation work permit requirements. Good RP support was also observed at the central radiological controlled area access point throughout the inspection period. The inspector determined that appropriate radiation protection coverage was being provided and that adequate ALARA exposure reduction efforts were being provided during the emergent work condition environment found during this inspection.

6.0 RADIATION INSTRUMENTATION

The inspector reviewed the licensee's program for calibration and ensuring continued operability of portable radiation survey instruments and counting laboratory instruments with respect to regulatory requirements.

The licensee has established a new RP instrument calibration facility in the new Services Building. The facility was designed and built with significant lead and concrete shielding to safely support operation of

calibration sources. The calibration facility was kept locked and was appropriately posted. A rotating beacon was mounted outside the facility to indicate when a calibration source was exposed, however, the rotating beacon was not automatically activated when a source was exposed, but was operated manually by a wall switch located inside the facility. During this inspection the inspector observed two instances when a calibration source was exposed. During one instance, the calibration technician forgot to turn on the warning beacon and during the other instance the beacon was turned on some time after the source was withdrawn from its shield. The facility contains three calibrators of which two contain protective interlocks to ensure the source is shielded when the area is accessible to personnel. Only one calibrator did not have automatic personnel access controls, and this calibrator was not capable of generating a high radiation area that would require locking.

The licensee's portable gamma radiation survey instruments were calibrated with a 400-Curie cesium-137 source, housed in a Shepherd 89 calibration shield and with a 100-milliCurie cesium-137 source housed in a Shepherd 28 calibrator. Electronic pocket dosimeters were calibrated with a 3-Curie cesium-137 source housed in a Shepherd 81 calibrator.

Located in the basement of the security building was an additional calibration facility utilized for exposing TLDs for quality control purposes. The security building calibration facility utilized a 20-Curie cesium-137 source housed in a Shepherd 81 calibrator. This calibration facility was properly secured and posted. At both calibrator locations, the inspector verified the current operation of each calibrator's safety interlock devices and noted that for the 400-Curie calibrator, the 20-Curie calibrator, and the 3-Curie calibrator, that they were designed to prevent access to personnel while the sources were exposed. The calibrator containing the 100-milliCurie cesium-137 source did not contain an interlock device and produced a dose rate field of approximately 400 mrem/hr at 30 centimeters from the exposed source. Although the licensee had the required posting and control requirements in place for the high radiation area generated by the 100-milliCurie source, the exposed source condition indication could be improved to ensure personnel inside the facility and those attempting to enter the facility during a source exposure condition would be appropriately warned of the immediate radiological hazard. The licensee agreed that enhancements could be made and indicated plans to electrically couple the outside rotating beacon with the 100-milliCurie and the 3-Curie source position indicator circuits to cause the beacon to energize automatically while the sources are exposed.

The inspector reviewed the most recent calibration of each calibrator and found that each had been calibrated by a National Institute of Science and Technology (NIST)-traceable transfer standard using an electrometer within an annual time period. The annual calibration of each calibrator was detailed and incorporated appropriate correction factors for temperature and barometric pressure. The inspector reviewed the reproducibility of the various exposure geometries and determined

that they were accurately defined for each calibrator. The calibration method of each calibrator except for one, consisted of repetitive measurements at differing source distances utilizing a transfer standard.

The 100-milliCurie calibrator was calibrated at only one distance from the source and approximately 30 other source distances were calculated assuming a point source geometry. The inspector discussed with the licensee the limitations of assuming a simple point source geometry and the need for verification of this approach. The licensee committed to revising the calibration methodology of the 100-milliCurie calibrator and provide transfer standard measurements at several distances as the basis of the calibration. This revised approach was found acceptable to the inspector.

Calibration of portable radiation instrumentation was performed on a semi-annual basis. Calibrations generally consisted of three points on each of the instrument scales with an acceptance criterion of $\pm$10%. The calibration date and due date were recorded on stickers affixed to each instrument and documented in a file for each instrument maintained in the M & TE instrument facility. The inspector sampled the instrument inventory and calibration records and determined that all of the instruments reviewed were found to be within the six-month calibration frequency.

The HP counting laboratory utilized high purity germanium (HPGe) detectors, gas-flow proportional counters, thin-window Geiger-Mueller detectors and zinc sulfide scintillation detectors for the measurement of various media samples to determine the gamma isotopic content and gross beta and gross alpha activity. The inspector verified that the HPGe detectors had been properly calibrated within one year and that the other counting laboratory instrumentation had been calibrated within the past six months. All calibration sources used were traceable to NIST. The licensee utilizes daily source measurements to determine if counting instrumentation is still functioning properly between calibrations. Appropriate trending of the daily source measurements were maintained for each detector used. The inspector observed indications of deteriorating performance for one of the HPGe detectors (No. 4) since August 2, 1995. The daily source measurements indicated that this detector was positively biased greater than two standard deviations from the mean for several days and was approaching a positive bias of three standard deviations from the mean. The inspector reviewed the licensee's actions to assess a deteriorating performance trend. The licensee has a contingency procedure, including a checklist, to verify detector operating characteristics and a followup source count acceptance criterion of $\pm$5% to allow for continued operation of the detector. The checklist had been utilized to monitor the detector's deteriorating performance, but the licensee had not yet discovered the cause of the noted performance trend. Projecting from the daily performance trend, the detector could expect to fail outside of the positive 3 standard deviations within 2 or 3 days. The procedure checklist did not provide instructions to increase the level of

attention in order to correct the performance trend before failure. The licensee agreed to review the procedure checklist and provide additional instructions as necessary.

The inspector determined that the RP instrument calibration program was sound and well implemented with only a few areas where enhancements were recommended.

7.0 DOSIMETRY

7.1 EXTERNAL EXPOSURE DOSIMETRY

The inspector reviewed the licensee's external exposure dosimetry program with respect to regulatory requirements. The licensee utilizes the vendor-supplied services of Teledyne Brown Engineering (hereafter referred to as Teledyne) for thermoluminescent dosimetry (TLD) and TLD processing services. The licensee utilized the Teledyne model P-300DS TLD which is currently National Voluntary Laboratory Accreditation Program (NVLAP) approved in all eight radiation categories of TLD testing. The accreditation remains effective until October 1, 1995. The inspector requested from the licensee records of recent NVLAP TLD performance test results and NVLAP onsite assessment report. The licensee had not received or reviewed the subject NVLAP evaluations that form the basis of continued NVLAP accreditation. The licensee contacted the vendor and provided the inspector with documentation of NVLAP fourth quarter 1994 performance test results and the onsite NVLAP assessor's inspection field notes dated April 28-29, 1994. The TLD performance results were generally good, with results averaging within 60% of the NVLAP acceptance limits. The NVLAP onsite inspection resulted in a few administrative quality control deficiencies, which were addressed by Teledyne as indicated in a May 23, 1994, letter to NVLAP.

During the inspection, the inspector was apprised of a TLD performance problem that occurred during the fourth quarter of 1994. In implementing a quality control (QC) blind spike TLD program with Teledyne, the licensee discovered that 30% of the spiked spare TLDs resulted in readings that were 25% low, with the other badges indicating accurate results. The licensee indicated that historically, Teledyne processing of the licensee's QC TLD badges have been within -1% to +3% bias. Teledyne's preliminary evaluation determined that the calibration factors or element correction factors (ECFs) for the affected TLDs had changed. Teledyne implemented corrective action to determine new ECFs for each TLD read to ensure correct readings were obtained. The fourth quarter 1994 personnel TLD badges were processed in January 1995 and each was provided with a new ECF calibration that was applied to each badge.

The inspector reviewed with the licensee the past QC badge results and Alnor electronic personnel dosimetry vs. TLD comparisons since the fall of 1993 when ECFs were previously determined for the TLDs. The inspector determined that the above discussed bias problem was strictly a 4th quarter 1994 TLD problem. The licensee's QC spike program

utilized a cesium-137 source to deliver a 200-400 mrem exposure. The corresponding NVLAP acceptance criteria for category IV (high photon group) is 50% when summing the bias and the standard deviation values. For the fourth quarter 1994 QC badges, an average bias of -11.9% with a standard deviation of 13.4% was calculated by the licensee. This sums to 25.3%, a passing NVLAP grade. Therefore, the licensee did not consider the fourth quarter, 1994 TLD performance to be unacceptable. As a result of this inspection, the licensee has agreed to discuss the issue with other Teledyne TLD users on an informal basis.

The inspector's review of past personnel TLD and spiked TLD data and comparisons with electronic pocket dosimeter (EPD) data indicate that there were no significant exposure discrepancies caused by the TLD ECF changes that remain to be addressed. The licensee and Teledyne cooperated well to ensure the accuracy of the personnel exposure records were maintained. The cause of the TLD ECF changes and long-term corrective actions have not been determined as of this inspection period. The inspector considers the licensee's actions adequate, with no violations of regulatory requirements identified.

Official record personnel dosimetry results were obtained from quarterly TLD processing. During each calendar quarter, EPDs were used to provide real-time occupational exposure control in the plant. The inspector reviewed the licensee's program for calibration of EPDs. The inspector determined that the EPDs were calibrated appropriately and there were appropriate administrative controls in place to ensure they are calibrated on a semi-annual basis. The inspector reviewed dosimetry data that compared TLD results with EPD results for each quarter of 1994 and the first quarter of 1995. The EPD results showed a positive bias of between 4% and 12% when compared to TLD results during this time period. This is a good conservative relationship that helps prevent the occurrence of over-exposures while awaiting the quarterly TLD results. The licensee also reviews individual EPD versus TLD data discrepancies of greater than 20% above a 300 mrem threshold. Less than 1% of the badges have required a discrepancy investigation based on 1994 and first quarter 1995 data.

The inspector determined that the licensee has a good external exposure dosimetry program that produces reliable results. The licensee has implemented a good quality control spiked TLD program that provided effective warning of deteriorating TLD performance and the licensee successfully recovered from such an event that occurred during the fourth quarter of 1994. The inspector discussed with the licensee closer ties with the vendor TLD service to include more timely review of NVLAP testing results and NVLAP inspection findings as well as ensuring long-term corrective actions associated with TLD processing problems are resolved. The licensee representatives indicated that this area would be evaluated.

7.2 INTERNAL EXPOSURE DOSIMETRY

The licensee utilizes a single standup sodium-iodide whole body counter

that provides for relatively quick whole body screening of workers to determine the presence of gamma-emitting radionuclides. As was analyzed and discussed in a previous inspection report[1], the standup sodium-iodide whole body counter was found to have questionable capability to accurately discriminate the radionuclides found at the Salem and Hope Creek Generating Stations. At the conclusion of the previous inspection, the licensee had committed to restoring to service a high purity germanium detector whole body counter and maintaining an annual calibration to provide the capability of accurate internal exposure measurement. During this inspection, the licensee indicated that the high purity germanium whole body counter was not a servicable instrument and no contingency for providing investigational internal exposure measurements, as in response to a station emergency or due to planned internal exposures, had been developed.

The inspector reviewed results of whole body counts over the past five months and noted that there were only seven investigational whole body counts, all of which were well below exposure tracking levels. Historically, the radiation control programs of both Salem and Hope Creek have provided very good contamination controls and controlled the generation of airborne radioactive areas. No precedent has been established that would suggest the need for an indepth internal exposure measurement and dose assessment program. The inspector indicated that establishment of such a capability at least on a contingency basis would be prudent. The licensee agreed and committed to establish a memorandum of understanding with another facility that can provide additional internal exposure dosimetry services in the event of a radiological event or plant emergency involving significant internal exposures. This will be reviewed in a future inspection (IFI 50-272,311/95-16-01).

8.0 RESPIRATORY PROTECTION

The inspector reviewed the licensee's respiratory protection program with respect to regulatory requirements.

Maintenance of all the respiratory protection equipment for Salem and Hope Creek Nuclear Generating Stations was performed at the Hope Creek Nuclear Generating Station. The inspector toured the Hope Creek respirator maintenance facility and determined that a good program was being implemented. Sound respirator cleaning, surveying, repairing, inspecting, and storing procedures were being implemented. One minor area of discrepancy was identified by the inspector. Respirator face pieces and high efficiency particulate air (HEPA) filters were tested for percent penetration using a corn oil aerosol/photometer test apparatus. The licensee used an acceptance criteria of 0.1% penetration for this test. This was not compatible with the penetration acceptance criteria for the HEPA canisters (99.97% removal efficiency). The licensee revised the applicable procedure to incorporate a more

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[1]NRC Inspection No. 50-272/94-05; 50-311/94-05 conducted on February 14-18, 1994

restrictive penetration acceptance criterion of 0.01%. Air pressure regulators were calibrated annually as evidenced by calibration stickers affixed to each air regulator. The inspector opened several respirators at random and inspected each for condition of use and reviewed maintenance records for each. All sampled respirators appeared to be in good condition and acceptable for issue. Maintenance records were available for each as required. The inspector reviewed the respirators found in the facility and determined that there were National Institute for Occupational Safety and Health/ Mine Safety and Health Administration approvals for each type of respirator utilized. The inspector determined that the licensee's respirator maintenance program was of good quality with only one minor discrepancy noted with respect to particulate penetration acceptance criterion.

Respirator issuance was confined to the Salem RP access point to the radiologically controlled area. Only RP technicians were authorized to issue respirators to workers. The procedure requires the RP technician to access the PREMS (local area network RP computer system) to review whether a medical examination, a respirator fit test, and respirator training have been provided for an individual within a one-year period. If the computer network indicated an individual was qualified, the RP technician would issue the respirator to the individual. No discrepancies were noted by the inspector with respect to respirator issue and control.

Respirator fit testing was provided by use of a dust-sensitive photometer that measured respirator efficiency during a multiple-step dynamic movement of the test individual, to ensure adequate protection was afforded the individual by the respirator under normal work conditions. The inspector verified that the dust photometer had been calibrated by the manufacturer within one year.

The inspector's review of the licensee's respiratory protection program found the program to be well developed and very well implemented. No significant discrepancies were noted.

9.0 EXIT MEETING

The inspector met with licensee representatives (denoted in Section 1.0) on August 11, 1995. The inspector summarized the purpose, scope and findings of the inspection. The licensee acknowledged the inspection findings.