

U.S. NUCLEAR REGULATORY COMMISSION  
REGION I

Report Nos. 50-272/88-18  
50-311/88-18

Docket Nos. 50-272  
50-311

License Nos. DPR-70 Priority - Category C  
DPR-75 - C

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

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

Inspection At: Hancocks Bridge, New Jersey

Inspection Conducted: September 26-30 and October 5-6, 1988

Inspectors: R. L. Nimitz 10/28/88  
R. L. Nimitz, Senior Radiation Specialist date

RL Nimitz for 10/28/88  
P. V. O'Connell, Radiation Specialist date

Approved by: M. M. Shanbaky 11/16/88  
M. M. Shanbaky, Chief, Facilities Radiation Protection Section date

Inspection Summary: Inspection conducted on September 26-30 and October 5-6, 1988 ( NRC Combined Inspection Report No. 50-272/88-18; 50-311/88-18 ).

**Areas Inspected:** Routine, unannounced Radiological Controls Inspection of the following: radiological controls organization and staffing; personnel qualifications and training; corrective action system and performance monitoring; ALARA; external and internal exposure controls; hot particle exposure control; industrial safety and worker concerns.

**Results:** One violation was identified ( Failure to implement radiation protection program procedures as required by Technical Specification 6.11 ). A number of weaknesses were also identified in the areas of supervisory and management oversight of work activities, industrial safety and contamination control.

## DETAILS

### 1.0 Individuals Contacted

#### 1.1 Public Service Electric and Gas Company

- \*G. Roggio, Station Licensing Engineer
- \*D. Tauber, Station Quality Control Supervisor
- \*J. Molner, Radiation Protection, Hope Creek
- \*J. Wray, Radiation Protection Engineer, Salem
- \*L. Miller, General Manager, Salem Operations
- \*J. Trejo, RP/Chem Manager, Salem Operations
- \*D. Mohler, RP/Chem Supervisor
- K. O'Hare, RP Supervisor
- M. Gray, Licensing Engineer
- T. Cellmer, Radiation Protection Engineer, Hope Creek
- J. Clancy, RP/Chem Manager, Hope Creek
- S. LaBruna, Vice-President Nuclear

#### 1.2 NRC Personnel

- \*R. Nimitz, Senior Radiation Specialist
- \*P. O'Connell, Radiation Specialist
- \*M. Shanbaky, Chief, Facilities Radiation Protection Section
- \*K. Gibson, Resident Inspector, Salem
- \*R. Borchard, Senior Resident Inspector, Salem

#### 1.3 State of New Jersey

- D. White, Department of Environmental Protection, State of New Jersey
- K. Tosch, Department of Environmental Protection, State of New Jersey

Other licensee and contractor personnel were also contacted or interviewed during the course of this inspection.

\* Denotes those personnel attending the exit meeting on October 6, 1988.

### 2.0 Purpose and Scope of Inspection

This inspection was a routine, unannounced Radiological Controls Inspection. The following areas were reviewed:

- organization and staffing;
- training and qualifications;
- corrective action system;
- external exposure controls;
- hot particle exposure control;
- internal exposure controls;
- ALARA;
- industrial safety concerns;
- worker concerns.

### 3.0 Licensee Actions on Previous Findings

- 3.1 (Closed) Violation (50-272/87-30-03; 50-311/87-31-02): Airborne radiation monitors, specifically MPC-hour meters, were being used to monitor personnel exposure to airborne radioactive material without established procedures for their use and evaluation of their results. Calibrations of the MPC-hour meters were also being performed without established procedures.

On February 24, 1988 the licensee issued procedure M12-ICI306, "Calibration of Lapel Air Samplers", and on July 14, 1988 issued procedure RP 506 "Use of the MPC-Hour Meter", to address calibration and use of the meters respectively. Appropriate personnel were trained on the new procedures. A review of the training program for permanent staff radiation protection technicians (RPTs) showed that the training program had not been updated so that any new permanent staff RPTs would be trained in the use of this procedure. The licensee stated that this was an oversight and the training program would be updated prior to hiring any new permanent RPTs. This item is closed.

- 3.2 (Closed) Unresolved Item (50-272/87-30-04; 50-311/87-31-03): The overall adequacy of the MPC-hour meters for showing compliance with regulatory requirements was left unresolved pending development of formal documentation.

In addition to continuous air sampling of the general plant environment, the licensee utilizes low volume (2-4 cfm) or high volume (18-35 cfm) air samplers for specific surveillance of work activities which have historically presented a potential of personnel exposure to elevated airborne radioactivity or in situations where airborne hazards are unknown. The licensee emphasized that the function of the MPC-hour meter is to serve as a backup air sampler and to provide a method to quickly estimate MPC-hour exposures. The licensee stated that the MPC-hour meter is not used for the purpose of showing compliance with regulatory requirements for determining airborne radioactivity concentrations. Inspector observation of the air sampling of work activities indicated that this was correct. This item is closed.

- 3.3 (Closed) Unresolved Item (50-272/87-30-05): The final determination as to whether a fuel fragment contamination incident which occurred inside the Unit 1 containment on October 10, 1987 constituted an exposure in excess of regulatory limits remained unresolved pending licensee completion of the final dose assessment.

The licensee conducted an appropriate time and motion study and thereby determined that the dose was distributed over a 16 centimeter square area of skin of the whole body. Calculations based on distributing the dose to the 16 centimeter square area of skin exposed to the fuel fragment indicated that the regulatory limit of 7.5 rem/quarter to the skin of the whole body was not exceeded. This item is closed.

- 3.4 (Closed) Violation (50-272/87-30-01): Failure of the licensee to maintain the Unit 1 #14 bioshield door in a locked condition on October 8, 1987. The inspector reviewed the corrective actions which the licensee committed to implement in letter number NLR-N88002 dated January 8, 1988. The inspector determined that the corrective actions had been completed. This item is closed.
- 3.5 (Closed) Violation (50-272/87-30-02, 50-311/87-31-01); Failure to follow T.S. 6.11 required procedures. The inspector verified that the corrective actions specified in licensee's letter NLR-N88002 dated January 8, 1988 were completed. This item is closed.

#### 4.0 Organization and Staffing

The inspector reviewed the organization and staffing of the onsite Radiation Protection Group with respect to criteria contained in the following:

- Technical Specification 6.2, Organization;
- Regulatory Guide 8.8, Information Relevant to Ensuring That Occupational Radiation Exposure At Nuclear Power Stations Will Be As Low As Is Reasonably Achievable;
- Salem Unit 2 Outage Information Manual;
- Procedure ODP-ZZ-001, Outage Implementation Procedure.

Evaluation of licensee performance in this area was based on discussions with cognizant personnel, review of ongoing work and review of documentation.

Within the scope of this review, no violations were identified. Administrative controls and definition of personnel responsibilities were upgraded as compared to the Unit 1 outage. The following licensee initiatives were noted:

- The licensee established and implemented a defined Outage Organization consistent with the newly developed procedure ODP-ZZ-001. The procedure, developed, in-part, to address weaknesses encountered during the previous outage at Unit 1, covered Management Organization, responsibilities, schedule and update requirements, meetings, goals and requirements.
- The outage organization and responsibilities were included in and distributed as an Outage Information Manual. A defined organization chart was included in the manual.
- The licensee used key department heads as Outage Shift Managers. Supervisors from various departments were used as Containment Coordinators. These individuals were used to manage the execution of shift functions in support of the outage and coordinate activities in containment respectively.

- The licensee performed a person-loading study to determine the numbers of radiological controls contractor personnel to be hired to augment the permanent staff. The study reviewed planned work activities versus staffing needed.
- Corporate radiological controls personnel and radiological controls personnel from the Hope Creek Station were used to provide assistance during the outage.

Within the scope of this review, the following areas were discussed with the licensee as areas for improvement:

- As indicated above, the licensee assigned key department managers as Outage Shift Managers. This included the Radiological Controls and Chemistry (RCC) Manager. The RCC Manager was assigned a shift rotation of 2 weeks on and 2 weeks off as Shift Outage Manager. During his "off time" he returned to his principal task as RCC Manager.

The inspector noted that no clearly described delegation of the RCC Manager's responsibilities to other personnel had been made. The Outage Manual and associated procedures did not indicate how the Outage Manager's responsibilities were to be delegated in order to maintain continuity and effective oversight of radiological and chemistry activities at Unit 1 and 2. Licensee management indicated this was the first time that key managers had been used in the role of Shift Outage Managers and that its effectiveness would be critically reviewed.

- As a result of numerous observations during the inspection, as discussed in this report, the inspector concluded that the delegation and assignment of responsibilities for Radiation Protection Supervisory oversight of outage activities was in need of improvement. The licensee concurred in this assessment and issued additional guidance to improve supervisory oversight of outage activities. The licensee also assigned additional supervisors to oversee critical outage work.
- The licensee was provided about 75% of the contractor radiological controls personnel requested. Steps to ensure meeting requested resources should be considered.

## 5.0 Training and Qualifications

The inspector reviewed the qualification and training of members of the Radiological Controls Organization with respect to criteria contained in Technical Specification 6.3, Facility Staff Qualification. Licensee performance in this area was evaluated by review of resumes and training records and discussions with cognizant personnel.

The inspector's review in this area focused on the qualification and training of contractor radiological controls personnel hired to augment the organization during the outage. The inspector also reviewed the adequacy and effectiveness of the infield performance of these personnel.

Within the scope of this review, no violations were identified. Contractor personnel appeared to have received adequate training and qualification.

#### 6.0 Corrective Action System and Performance Monitoring

The inspector reviewed selected aspects of the licensee's corrective action and performance monitoring program. Within the scope of this review the following positive observations were made:

- The licensee assigned an individual to the position of Radiological Assessor at the start of the outage. This individual was responsible for reviewing ongoing work and radiological controls and notifying, as appropriate, supervision and management of deficient conditions or performance.
- The licensee assigned an individual from the Corporate Radiological Controls group to track and monitor Radiological Occurrence Reports (RORs).
- An individual from the corporate Radiological Controls Group was assigned to perform assessments of station radiological activities.

Within the scope of this review, the following areas for improvement were identified:

- Inspector review of Radiological Assessor findings since the start of the outage indicated a number of recurrent problems (e.g. procedure violations). Inspector observations during the inspection identified similar concerns including procedure violations indicating weaknesses in oversight and corrective action. The inspector concluded that corrective action for identified concerns was deficient in that multiple observations of similar concerns were identified previously by licensee assessors and no apparent corrective action for these concerns was apparent to the inspector.
- Inspector review of completed RORs indicated that adequate immediate corrective action for specific concerns appeared to be taken. However, it was not apparent that concerns were reviewed in a timely manner from a generic basis in order to identify root causes of recurrent problems.

The inspector performed a review of the circumstances and licensee corrective actions associated with the improper entry of several personnel into the Unit 2 Seal Table Room. The improper entry was identified by the licensee and an ROR was subsequently issued. The following was noted:

At approximately 11:00 p.m. on September 6, 1988 a work crew signed in on RWP 789, "Trash and PC Removal and Decon in HRAs and HCAs", dated September 2, 1988. The RWP states that entry is not permitted into the Seal Table Room. Administrative Procedure AP 24, Radiological Protection Program, requires in section 5.4 that radiation work permits be complied with. A contractor RP supervisor improperly directed a licensee RP technician to issue the crew the key to the Seal Table Room. The crew performed approximately 30 minutes of work in the Seal Table Room with a contractor RP technician providing coverage.

Approximately 2 hours after the key was returned the control point supervisor realized that an unauthorized entry had been made into the Seal Table Room. A review of the radiation monitoring devices worn by the crew (ALNORs) indicated that there was no unplanned exposure of individuals (maximum dose recorded was 1 millirem), however this room has the potential of having extremely high dose rates and an unplanned entry could result in a potential significant personnel exposure.

A fact finding meeting was held by licensee personnel on September 7, 1988. Licensee review indicated the key had been improperly issued by the radiation protection technician who thought a previous work crew, authorized to work in the Seal Table Room, would again reenter the area. On October 6, 1988 disciplinary letters were placed in the personnel files of the work crew involved and the RP supervisor and RP technician who issued the key.

As of October 6, 1988, about 30 days after the event, the licensee had not yet briefed or retrained all appropriate staff in order to prevent a recurrence. The inspector concluded that the corrective actions were not adequate to prevent recurrence in that the licensee only counseled involved individuals. Other individuals who may issue the key were not retrained in proper key issuance.

In addition to this weakness in completeness of corrective action, the inspector noted that High Radiation Area control at Salem has been a recurrent problem as follows:

- A High Radiation Area door was found improperly controlled on October 8, 1987. (Reference Inspection Report 50-272/87-30; 50-311/87-31). A memo describing HRA control requirements and proper use of locked doors was issued to all Department Managers from the Salem General Manager. All personnel were to be briefed on the contents of this memo. Specific licensee evaluations of this matter focused on the adequacy of the key control program. The memorandum, dated October 12, 1987 stated in part " Proper use of locked doors used for high radiation area control is essential. A review of proper use is as follows 1) In order to enter a locked high radiation area, an individual must sign in on an RWP for the area to be entered..."
- A problem with High Radiation Area access control control was also identified on March 12, 1987. ( Reference NRC Inspection Report 50-272/87-07; 50-311/87-08).

The inspector concluded that the improper entry into the Seal Table Room, identified by the licensee, could reasonably have been prevented by the licensee's corrective actions for the previous violations. Also as discussed above, the licensee's corrective actions were not comprehensive in that all appropriate personnel were not counseled in proper HRA key issuance. Consequently the licensee does not meet the 5 criteria for the NRC discretionary non-issuance of a violation delineated in 10 CFR Part 2. This is an apparent violation of Technical Specification 6.11 which requires radiation protection procedures to be implemented. (50-272/88-18-01; 50-311/88-18-01)

It was noted that during plant operation the key to the Seal Table Room (a Locked High Radiation Area) is left in a key trap inside containment. After containment is opened the key is locked up at the control point. There are no apparent procedures which address this key and its transfer to the control point. The licensee committed to formalizing a procedure for control of the key. This matter remains unresolved pending licensee completion of corrective actions. (50-272/88-18-02; 50-311/88-18-02)

#### 7.0 External Exposure Controls

The inspector reviewed the following elements of the licensee's external exposure control program with respect to criteria contained in applicable procedures and 10 CFR 20 Standards for Protection Against Radiation.

- posting, barricading, and access control (as necessary) of radiation and high radiation areas;
- implementation of the radiological controls specified in radiation work permits (RWPs);
- adequacy of radiological surveys.

Evaluation of licensee performance was based on discussions with personnel, reviews of ongoing work activities and review of documentation.

Within the scope of this inspection one apparent violation was identified, failure to follow radiation protection procedures as follows:

Technical Specification 6.11, "Radiation Protection Program," requires, in part, that procedures for personnel radiation protection shall be approved, maintained and adhered to for all operations involving personnel radiation exposure.

1. Procedure RP 1103 "Radiological Control of Reactor Cavity and Spent Fuel Pool Operations" requires in section 7.2.5 that dose rates are to be carefully monitored while equipment is being withdrawn from the pool.



On September 26, 1988 at about 2:00 p.m. the inspector observed a rolling tool being withdrawn from the Reactor Cavity Pool without the dose rates being monitored. The workers were on the refueling bridge of the 130' elevation of containment and were lifting the rolling tool with the overhead crane. After being inserted into the internals of the reactor vessel the rolling tool was lifted approximately 20 to 30 feet and then moved horizontally and repositioned elsewhere in the pool.

The portion of the rolling tool which was lifted out of the water consisted of a round metal pole with a cable attached. The safety concern was that even with the rolling tool being washed down with demineralized water it was possible for hot particles or other highly activated chips to become caught in the void spaces between the rolling tool and the cable.

Radiation Protection (RP) personnel providing coverage of the job evolution stated that their interpretation was that the lifting and repositioning of an object within the pool was not considered removing or withdrawing an object from the pool. RP management confirmed that the RP personnel providing job coverage misinterpreted the procedure and reinstructed the applicable personnel that any lifting of an object in the pool constitutes removal or withdrawal from the pool.

2. Administrative Procedure AP 24, Radiological Protection Program, requires in section 5.4 that each individual shall comply with the requirements established in Radiation Work Permits. RWP 724, "Install Wear Reduction Inserts/New Flux Thimbles", dated September 20, 1988 requires, in part, that plastics and faceshields be worn while handling equipment removed from the pool.

On September 26, 1988 at about 2:00 p.m. the inspector observed two workers, working under RWP 724 and not wearing the required plastics and faceshields, remove a rolling tool from the Reactor Cavity Pool.

3. Radiation Protection Procedure 808, Discrete Radioactive Particle Exposure and Contamination Control, requires, in part, that as a minimum loose surface contamination surveys are to be performed, once each shift (8 hours) in designated hot particle zones and twice per shift (4 hours) in designated hot particle buffer zones.

A review of survey documentation and the HP log book for the 130' elevation of containment revealed that the loose surface contamination surveys in the buffer zone were not performed with the required frequencies for the time period (approximately) 10 am September 26 to 10 am September 27, 1988.

The surveys in the buffer zone were performed once per shift. On the afternoon of September 27, 1988 cognizant RP personnel were not aware of the frequency requirements for hot particle zone and hot particle buffer zone surveys. Inspector discussions with contractor technicians indicated that Senior licensee radiation protection technicians had provided incorrect survey frequencies to the technicians.

4. Procedure RP 808 also requires, in part, that upon exiting a hot particle zone personnel are to be surveyed by a RP technician using an RO-2.

On the afternoon of September 27, 1988 at about 5:00 p.m., the inspector observed two individuals exit the bioshield area without the required hot particle survey. The two individuals involved were part of the contractor RP technician staff. When questioned, the individuals stated that they did not know of the requirement to survey prior to exiting because the technicians were not informed that the bioshield area was declared a hot particle area. The inspector noted the inner bioshield area had been declared a hot particle area at midnight of the previous day.

The above 4 examples of failure to follow procedures is an apparent violation of Technical Specification 6.11. (50-272/88-18-01; 50-311/88-18-01)

Other concerns noted by the inspector and brought to the attention of the licensee include:

- Junior RP technicians were apparently being used to monitor job activities outside the bioshield. Inspector discussions with a junior technician indicated that he was allowed to provide coverage on low dose jobs, but could not specify exactly which jobs he was allowed to cover. The licensee does not have a clear definition of the job tasks which junior RP technicians are allowed to perform. The licensee stated that they would delineate in writing the exact duties, responsibilities and authorized job tasks for the junior RP technicians.
- The licensee does not verify that an individual is qualified in the use of a radiation monitoring meter prior to issuing the meter to the individual. The licensee indicated this matter would be reviewed.
- The inspector found a radiation monitoring meter (RO-2) being used inside the bioshield which had apparently not been response checked in 6 days. Licensee procedures recommend daily response checks. Personnel had apparently been using this meter without performing the prescribed, recommended response checks. This indicated the apparent need for improved instrument control. The licensee stated that they would review the issue.

- RWP 645 requires, in part, that a double set of protective coveralls (PC's) are to be worn into the bioshield area of containment. On September 27, 1988 while inside the bioshield the inspector observed several workers carrying their second pair of PC's into the bioshield area. The previous night the licensee had posted the area inside the bioshield as a hot particle zone. The RP technician controlling access to the bioshield agreed that carrying the second set of PC's into a hot particle zone was not a good radiological control practice and was contrary to the RWP. The inspector also observed other workers inside the bioshield wearing a single set of PC's. These personnel showed the inspector a copy of their RWP which did not require double PC's even though they were working inside a hot particle zone. The licensee stated that they had not updated all of the RWPs since establishing the hot particle zone (approximately 16 hours). The inspector concluded these discussions and findings were indicative of weak communications between supervisors and personnel in the field.

- Inspector discussions with licensee personnel subsequent to reactor fuel off-loading and prior to Reactor Cavity drain down indicated the licensee would complete the the final cavity drain down using a 55 gallon drum type filter set-up located under the Fuel Transfer Tube in the Outer Annulus Area at the 20' elevation of Containment. No procedures were in place to cover filter setup, system valve manipulation, including plant valves, or system disassembly. The inspector informed licensee personnel that procedures for this operation appear to be required as specified in Technical Specification 6.8 and Regulatory Guide 1.33. The licensee subsequently revised draindown procedures to address this matter prior to final draindown.

Subsequent licensee radiation surveys of sections of the system after draindown was complete indicated contact radiation exposure dose rates of up to 800 R/hr. The area was barricaded and a flashing red light was placed at the filter. The inspector noted that Technical Specification 6.13 states that a flashing red light and barricade may be used to delineate a High Radiation Area inside a large area provided no reasonable enclosure could be constructed around the area. The inspector's initial review indicated that an enclosure around the filter could reasonably be constructed. The inspector informed licensee personnel that this matter was unresolved pending further inspector review and evaluation. (50-272/88-18-03; 50-311/88-18-03). The inspector requested licensee personnel to review other areas which may be subject to this Technical Specification. The licensee indicated this would be done.

## 8.0 Hot Particle Exposures

### 8.1 General Experience

During the course of the inspection the inspector reviewed licensee hot particle exposure frequencies and evaluations. The following was noted:

- As of October 3, 1988 and since the start of the outage (August 31, 1988) the licensee has issued 402 Radiological Occurrence Reports (RORs). The majority of these were low level personnel skin contaminations.
- Since the start of the outage up to October 5, 1988, 46 hot particle contamination incidents were identified. Dose assignments for the contaminations, for which evaluations were complete, indicated that exposures, principally to the skin, ranged from minimal to 6.7 rem. Several evaluations were ongoing at the time of the inspection. Inspector review of licensee methodology for dose assessment indicated the methodology was innovative and appeared to provide an accurate estimate of personnel exposure sustained from a hot particle contamination event.
- The licensee's corporate radiological controls group performed an evaluation of the circumstances and dose assessment methodology for the hot particle exposures. A list of recommendations were generated and are being reviewed to improve controls and exposure determination methodology.

Inspector review of the licensee's implementation of the hot particle exposure control program identified a number of weaknesses which were discussed with licensee representatives. These were as follows:

- The hot particle survey program was not implemented in some instances. This is discussed above.
- Personnel wearing cloth protective clothing ( 2 pair of coveralls) were observed reclining on the floor in hot particle areas. This was considered a poor practice. Although Radiation Protection Supervision were present, the poor practice was not corrected. The poor practice was discussed with supervision present who subsequently corrected the matter.
- The licensee was implementing a hot particle control zone and hot particle buffer zone only after personnel were contaminated with hot particles . This was a questionable practice considering several areas of the Radiological Control Area were known or suspected hot particle areas. The licensee indicated this matter would be reviewed.

## 8.2 High Reading Extremity TLD

An individual, involved in surveying the No. 22 steam generator on September 28, 1988 was identified as having a TLD badge ( right extremity wrist badge ) which indicated about 107 rads total exposure to the extremity based on reading of the individual's skin equivalent (shallow dose ) TLD chip. Although not considered deep dose, the gamma dose to the extremity, based on reading the deep dose equivalent TLD chip, was 1 rem. The wrist pocket dosimeter indicated 800 millirem. The right fingertip TLD strip indicated 767 millirem. Because of the uniformity of gamma penetrating exposure the licensee believes the exposure to the chip was caused by a hot particle. Other dosimetry located on the individual did not indicate any anomalous readings. The individual was prohibited from radiation work pending outcome of the dose assessment.

The inspector reviewed licensee preliminary exposure evaluations. These included test irradiations of the TLD badge to determine its response and linearity and test irradiations of a TLD badge with a hot particle found in the individual's work location. The licensee's preliminary evaluations were considered of good quality. The inspector concurred that the pattern of the irradiation of the TLD badge and other dosimetry tended to support licensee preliminary conclusions that the exposure was due to a hot particle on or very close to the TLD badge. Since the individual was wearing multiply layers of protective clothing, the skin appears to have been shielded from a significant portion of the exposure measured by the badge which was located on the outside of the clothing.

Preliminary licensee dose estimates based on a time and motion study and various skin shielding thicknesses indicate a maximum exposure to one square centimeter of the skin of the lower forearm of about 55 rads. The licensee indicated this exposure evaluation will be reviewed and finalized. The inspector indicated the extremity exposure was an unresolved matter pending review of final licensee dose estimates.  
(50-272/88-18-04; 50-311/88-18-04)

## 9.0 Internal Exposure Controls

The inspector reviewed selected aspects of the internal exposure controls program. The review was with respect to criteria contained in applicable licensee procedures and regulatory requirements. The following matters were reviewed:

- posting of airborne radioactivity areas;
- adequacy of airborne radioactivity sampling and analysis to plan for and support ongoing work;
- timeliness of analysis of airborne radioactivity samples including supervisory review of sample results;
- installation, use and periodic operability verification of engineering controls to minimize airborne radioactivity;
- bioassays and personnel airborne radioactivity intakes.

Evaluation of licensee performance in this area was based on review of documentation, discussions with personnel and independent observation of ongoing work including personnel entry into steam generators, repair of damaged fuel transfer mechanism and work on reactor loops.

Within the scope of this review, one apparent example of failure to follow procedures, an apparent violation, was identified as follows:

- The inspector observed ongoing work on Reactor Loop 23 on September 28, 1988 at about 4:30 p.m. Radiation Work Permit No. 645 covering the work (replacement of loop temperature detectors ) required that a personnel air sampler (called an MPC-hour meter) be worn by a member of the work party. Inspector observation of the two individuals working on the detector nozzle indicated neither of the workers had an MPC-hour meter. The inspector noted that failure to adhere to the work permit as required by Administrative Procedure AP 24, Radiological Protection Program, section 5.4 is an apparent violation of Technical Specification 6.11 which requires adherence to radiation protection program procedures.(50-272/88-18-01; 50-311/88-18-01).

The inspector noted that a low volume air sampler was collecting a sample in the area, however the sample it was collecting was not representative of the breathing zone of the workers. A licensee Radiation Protection Supervisor in the area indicated the sampler had apparently been moved by personnel.

Within the scope of this review the following additional concerns were identified and discussed with licensee personnel:

- The licensee's air sample procedure (RP 601 ) provided inadequate guidance to ensure detection of unusual or unexpected levels of alpha airborne radioactivity.
- A HEPA ventilation system was taking suction on air in the reactor cavity and blowing it into the vicinity of the radiation protection technician desk on the 130' elevation of the Containment. The magnehelic gauge, which is used to indicate proper operation of the system was broken. Although the system was apparently checked for proper operation prior to its setup, there were no procedures for periodic verification of system operability. An informal check sheet for checking the devices had apparently not been implemented since the system was continuing to operate with a broken gauge. The system was replaced.
- The licensee was unable to provide any data showing that smear checks for alpha radioactivity were performed in the Reactor Cavity during repair of the fuel transfer mechanism. This was considered not a good practice, in that beta-gamma contamination in the work area measured up to 400 millirad per hour and that it was known that some fuel was damaged as evidenced by fuel fragments encountered in the cavity.

- During inspector review of airborne radioactivity surveys to support fuel transfer mechanism repair, the inspector noted that a number of the samples collected during work activity in the Reactor Cavity on the fuel transfer mechanism indicated apparent high levels of alpha airborne radioactivity. For example, air sample number 88-4780 collected on September 27, 1988 at about 1600 indicated about 100 times the 10 CFR 20 Appendix B value for unidentified radionuclides. A gamma spectroscopy analysis of the sample indicated only about 80% of the Appendix B values for the radionuclides identified by the gamma spectroscopy device. Licensee radiological controls personnel indicated the activity was due to naturally occurring radon and thoron based on analysis of previous air samples whose activity indicated a short half-life (about 42 minutes) when counted one hour later. This sample (88-4780) was counted only once for alpha radioactivity.

The inspector requested that this sample be counted again to verify that no long-lived alpha emitters were present. Licensee analysis of this sample on September 30, 1988 at about 1400 indicated about 67 times the Appendix B value for unidentified radionuclides. The inspector concluded that the licensee was unaware of the magnitude of long-lived airborne alpha emitters in the Reactor Cavity and had relied on a study previously performed to discount the presence of long-lived alpha emitters.

The inspector noted that licensee procedure RP 601, Air Sampling, rev. 0 requires in section 7.1.3 that particulate alpha airborne radioactivity samples be collected and analyzed as determined by RP supervision. Also, 10 CFR 20.201 requires that evaluations of radiological conditions be made to ensure that the requirements of 10 CFR 20 be adhered to. The inspector noted that personnel working in the Reactor Cavity wore full face respirators which provided a protection factor of 50. 10 CFR 20.103 c.1 prohibits making allowance for respirators when the fraction of the 10CFR20 Appendix B airborne radioactivity concentration present exceeds the protection factor of the respirator used.

The fraction of 10CFR20 Appendix B airborne radioactivity present (about 67 times the Appendix B value) exceeded the protection factor of the respirator. Allowance was not being made for use of the respirators because of low levels of airborne beta gamma radioactivity. The apparent improper use of the respirators was attributed to apparent inadequate analysis and evaluation of air samples. The licensee immediately placed the individuals in respirators with a higher protection factor. The inspector indicated that the adequacy of evaluations of alpha airborne radioactivity in the Reactor Cavity was an unresolved item pending further inspector review. (50-272/88-18-05; 50-311/88-18-05)

## 10.0 ALARA

The inspector reviewed selected aspects of the licensee's ALARA Program. Emphasis was placed on licensee performance during the past outage and planning and goal setting for the upcoming outage. The review was with respect to criteria contained in the following:

- Regulatory Guide 8.8, Information Relevant to Ensuring that Occupational Exposure at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable;
- Regulatory Guide 8.10, Operating Philosophy for Maintaining Occupational Radiation As Low As is Reasonably Achievable;
- NUREG/CR-3254, Licensee Programs for Maintaining Occupational Exposure to Radiation As Low As Is Reasonably Achievable;
- NUREG/CR-4254, Occupational Dose Reduction and ALARA at Nuclear Power Stations; Study on High-Dose Jobs, Radwaste Handling and ALARA Incentives.

Within the scope of this review no violations were identified. The following matters were discussed with licensee personnel:

- Inspector observation of ongoing work indicated good overall ALARA controls to be in place for in-field work. Licensee planning and preparation for major work tasks appeared good. Exposure accrued was within goals established by the licensee. Several isolated instances where the inspector observed workers waiting in non-low dose rate areas were observed. These were of concern because Radiation Protection Supervision in the area did not correct this situation. Licensee management was informed and directed personnel to be more aware of this poor work practice.

## 11.0 Industrial Safety

During initial tours of the Reactor Containment the inspector noted several matters of an Industrial Safety concern as follows:

- The inspector noted on September 26, 1988 that personnel were working in close proximity to the Reactor Cavity. The 40 -50 foot deep cavity did not have any railing around it. The railing had apparently been removed. The inspector noted that personnel walking along the cavity did not have safety belts on. The belts and safety lines were hanging along side the cavity. The inspector informed the refueling floor Radiation Protection Supervisor and the Containment Coordinator of this concern. Personnel were directed to wear safety belts.



The inspector left the area and returned a short time later. The inspector observed the cavity area directly above the Fuel Transfer mechanism not to have in place any railings or barricading to prevent inadvertent falls into this narrow end of the Reactor Cavity. The inspector immediately informed the above individuals of this matter who initiated action to barricade this area.

- During the inspection, the inspector noted a number of instances where individuals experienced apparent heat exhaustion. This included the Reactor Cavity and the steam generator areas. The personnel were in full protective clothing including plastic suits and full face respirators. The inspector questioned licensee personnel as to what measures were being taken to prevent heat exhaustion ( e.g. use of supplied breathing air or ice vests ). Licensee personnel indicated these were considered but not used. Following identification of alpha airborne radioactivity ( discussed above) in the Reactor Cavity, personnel were placed in supplied air full face respirators. This apparently alleviated the problem in this area. The licensee indicated this would be reviewed.

The inspector met with the Plant Manager and Vice President Nuclear Operations on September 27, 1988. The inspector expressed concern regarding the industrial safety matters identified.

On October 5, 1988, the inspector toured the area around the Reactor Cavity (filled). The inspector noted that although the cavity was full of water, there were no life rings readily visible. Personnel were observed walking around the cavity. The inspector discussed this with the Senior Reactor Operator overseeing refueling who subsequently unpacked a life ring and rope contained in a plastic bag to make it readily available for use.

Because of the above observations and the subsequent incident on October 11, 1988 in which a worker fell into the partially drained Reactor Cavity, the Director, Division of Radiation Safety and Safeguards, NRC Region I, contacted the Salem Station Plant Manager to request that the area of Industrial Safety be reviewed in the aggregate in order to identify and correct any potential safety concerns identified during the review. The Station Manager was also requested to review the effectiveness of the station's roving Safety Inspectors.

The above safety concerns were referred to the Occupational Safety and Health Administration (OSHA) in telephone conversations on October 4 and October 11, 1988. Representatives of OSHA subsequently performed an onsite review of the matters referred to them.

## 12. Worker Concerns

### 12.1 General

During the course of the inspection several worker concerns were brought to the attention of the inspector. The concerns and associated findings are discussed below.

### 12.2 Individual A ( RI-A-0097 )

Individual A met with the inspector and the NRC resident inspector on September 30, 1988. The individual's concerns involved some contractual matters and some apparent harassment matters. The inspector recommended that the individual meet with licensee Radiation Protection Management to discuss his concerns. The individual agreed to meet with licensee personnel and discuss his specific concerns. The concerns relayed to the inspector were as follows:

#### Concern 1

The individual was directed to perform decontamination work in his work area. The individual stated such work is not in his job description and that he was not required to perform it.

#### Inspector Finding

The inspector informed the individual that the particular matters contained in his job description were the responsibility of his employer and the licensee and that this was not within the purview of the NRC unless the individual was performing safety significant tasks that he was not qualified to perform. The individual agreed to discuss this with licensee Radiation Protection management. The inspector did not identify any safety significance with this matter. The individual appeared to be qualified to perform this task. This concern is considered closed.

#### Concern 2

The individual was required to stay on the job in containment for long periods of time creating the potential for fatigue. Also there was a lot of work going on resulting in the potential for a job not to receive adequate radiological controls oversight.

#### Inspector Finding

The inspector reviewed the work history, including overtime records for all contractor technicians for the period of three weeks preceding the inspection. Work history and overtime was within NRC and licensee procedural guidelines.

The individual stated he had stop work authority and would stop a job if conditions warranted. Because some contractors had resigned to go to other stations and the licensee did not receive his requested complement of contractor technicians, the frequency of breaks was reduced and some schedule changes were imposed on the remaining contractor technicians. Although this created some morale problems, the inspector did not identify any apparent situation where radiological safety was jeopardized. This concern is closed.

### Concern 3

The individual was harassed on the job by workers when he was trying to do his job.

### Inspector Finding

The inspector recommended that the individual meet with licensee personnel to discuss this concern. The individual stated that this was acceptable. The inspector indicated that if the worker was not satisfied with the licensee's response to his concern he should re-contact the NRC. It was the individual's desire to terminate employment at Salem. The inspector informed the individual that any apparent concerns in the area of discrimination should be brought to the attention of the Department of Labor within 30 days of the concern.

The individual met with licensee Radiation Protection Management on September 30, 1988. Licensee personnel subsequently met with contractor management and personnel identified as responsible on September 30 and October 1, 1988. Based on discussions with the individual's co-workers and with members of the work party, the licensee was unable to clearly identify that the specific apparent incidents of harassment or any other incidents of harassment of other radiological controls personnel had actually occurred. However, the licensee counseled the contractor management and specific workers that any harassment or intimidation of radiation protection personnel would not be tolerated. The licensee concluded that harassment was not a common problem and that this incident, had it occurred, was isolated. The licensee committed to document his evaluation for subsequent NRC review. The inspector did not notice any incidents of harassment or intimidation of radiation protection personnel during numerous tours of the radiological controlled area and discussions with personnel. This concern is closed.

## 12.3 Individual B

### Concern

On October 6, 1988 Individual B informed the inspector that because of a high reading TLD badge identified on or about September 29, the individual was prohibited from signing in and working in the controlled area. However the individual was assigned to frisk out material at the step-off pad inside the controlled area at the Main Control Point.

### Inspector Finding

The inspector requested that this individual discuss his concern with licensee Radiation Protection Management since he had been directed to perform the work by a supervisor. The individual agreed and met with licensee Radiation Protection Management on October 6, 1988. Licensee personnel indicated a review would be performed and the results would be available for subsequent NRC review.

Preliminary inspector review indicated the individual worked on 4 separate occasions on October 4, 1988 just inside the Radiological Controlled Area (RCA) boundary at the Main Access Control Point. This area does not exhibit any significant dose rates nor is there a significant possibility of an individual becoming contaminated. The inspector did note however that Administrative Procedure AP 24 requires that personnel shall be denied access to the RCA unless he is on a valid RWP. The individual was not on a valid RWP. Supervision apparently authorized the individual to perform frisking activities. This matter remains unresolved pending further inspector review.(50-272/88-18-06; 50-311/88-18-06)

### 13.0 Exit Meeting

The inspectors met with licensee representatives denoted in section 1 of this report on September 30 and October 6, 1988. The inspector summarized the purpose, scope and findings of the inspection. No written material was provided to the licensee.