U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report Nos. 50-272/84-45
50-311/84-44

Docket Nos. 50-272
50-311

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

Licensee: Public Service Electric and Gas Company
80 Park Place
Newark, New Jersey 07101

Facility Name: Salem Nuclear Generating Station, Unit 1 & 2

Inspection At: Hancocks Bridge, NJ

Inspection Conducted: November 26-30, 1984

Inspectors:

J. R. White, Senior Radiation Specialist, NRC — date 2/5/85

for A. Hall, Brookhaven National Laboratory — date 2/5/85

for S. Musolino, Brookhaven National Laboratory — date 2/5/85

for S. W. Knox, Brookhaven National Laboratory — date 2/5/85

for R. Paolino, Senior Reactor Engineer, NRC — date 2/5/85

for T. Dragoun, Radiation Specialist — date 2/5/85

for A. Weadock, Radiation Specialist — date 2/5/85

Approved by: M. Shanbaky
M. M. Shanbaky, Chief, PWR Radiation Safety Section — date 2/5/85

Inspection Summary:

Inspection on November 26-30, 1984 (Combined Inspection Report Nos. 50-272/84-45; 50-311/84-44)

Areas Inspected: Special announced inspection of the implementation of the licensee's commitments relative to post-accident sampling and monitoring in accordance with the specification of NUREG-0737, the Confirmatory Order dated March 14, 1983, and license conditions. Additionally, certain radiological control aspects were reviewed relative to the Unit 2 outage and previously identified items were evaluated for acceptability. The inspection involved 208 hours on-site by four region-based inspectors and three contractors.

Results: No violations were identified relative to the licensee's commitments associated with post-accident sampling and monitoring, however several areas requiring improvement were noted. No violations were identified relative to radiological controls to support the Unit 2 outage.

DETAILS

1.0 Persons Contacted

During the course of the inspection, the following licensee personnel were contacted or interviewed:

*J. Zupko, Jr., General Manager - Salem Operations
W. Bacon, Instrument and Control Supervisor
*W. Britz, Manager of Radiation Protection Services
*J. Clancy, Health Physicist
*R. Dolan, Chemistry Supervisor
*G. Dzibua, Chemistry Supervisor
*H. Miller, Chemistry Engineer
*R. Oakes, Systems Engineer
*J. O'Connor, Radiation Protection Engineer
*M. Orr, Chemistry Technician
*J. Theurer, Chemistry Technician
*J. Vojtko, Consultant
*L. Fry, Operation Manager
*J. Ronafalvy, Technical Manager
*E. Liden, Manager, Nuclear Licensing and Engineering
*R. Patwell, Nuclear Licensing and Engineering
*P. Benini, Quality Assurance Engineer
*L. Leitz, Instrument and Control Engineer
*D. Tauber, Quality Control Supervisor
*N. Allman, Radiation Analyst

Other members of the licensee's staff were also contacted and/or participated in an exercise of post-accident and effluent monitoring systems during the inspection.

*Denotes attendance of exit interview on November 26, 1984.

2.0 Purpose

The purpose of this inspection was to verify and validate the adequacy of the licensee's implementation of the following task actions identified in NUREG-0737, Clarification of TMI Action Plan Requirements:

Task No.	Title
II.B.3	Post Accident Sampling Capability
II.F.1-1	Noble Gas Effluent Monitors
II.F.1-2	Sampling and Analysis of Plant Effluents
II.F.1-3	Containment High-Range Radiation Monitor
III.D.3.3	Improved Inplant Iodine Instrumentation under Accident Conditions

3.0 TMI Action Plan Generic Criteria and Commitments

The licensee's implementation of the task actions specified in Section 2.0 were reviewed against criteria and commitments contained in the following documents:

- NUREG-0737, Clarification of TMI Action Plan Requirements
- Generic Letter 82-05, Letter from Darrell G. Eisenhut, Director, Division of Licensing (DOL), NRC, to all Licensees of Operating Power Reactors, dated March 14, 1982.
- NUREG-0578, TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations, dated July 1979.
- Letter from Darrell G. Eisenhut, Acting Director, Division of Operating Reactors, NRC, to all Operating Power Plants, dated October 30, 1979.
- Letter from Darrell G. Eisenhut, Director, Division of Licensing, NRR to Regional Administrators, "Proposed Guidelines for Calibration and Surveillance Requirements for Equipment Provided to Meet Item II.F.1, Attachments 1, 2, and 3, NUREG-0737," dated August 16, 1982.
- Regulatory Guide 1.4, "Assumptions Used for Evaluating Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors".
- Regulatory Guide 1.97, Rev. 3, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident".
- Regulatory Guide 8.8, Rev. 3, "Information Relevant to Ensuring that Occupational Radiation Exposure at Nuclear Power Stations will be As Low As Reasonably Achievable".
- Updated Final Safety Analysis Report (FSAR) for the Salem Nuclear Station, Units 1 and 2, dated September 23, 1983, Public Service Electric and Gas Company.
- S. A. Vargas, Chief Operating Reactors, Branch No. 1 to A. A. Uderitz, V. P. Nuclear, PSE&G, Confirmatory Order Docket 50-272, dated March 14, 1983.

4.0 Post Accident Sampling System, Item II.B.3

4.1 Position

NUREG-0737, Item II.B.3, specifies that licensees shall have the capability to promptly collect, handle, and analyze post accident

samples which are representative of conditions existing in the reactor coolant and containment atmosphere. Specific criteria are denoted in commitments to the NRC relative to the specifications contained in NUREG-0737.

Documents Reviewed

The implementation, adequacy and status of the licensee's post-accident sampling and monitoring systems were reviewed against the criteria identified in Section 3.0 and in regard to license letters, memoranda, drawings and station procedures as listed in Attachment 1.A.

The licensee's performance relative to these criteria was determined from interviews with principal personnel associated with post-accident sampling, reviews of associated procedures and documentation, and the conduct of a performance test to verify hardware, procedures and personnel capabilities.

4.2 Findings

Within the scope of this review, the following items were identified:

4.2.1 System Description

The licensee has installed a post-accident reactor coolant and containment air sampling system for both units which was designed and fabricated by the Sentry Equipment Company. One sampling station serves both units.

The Post Accident Sampling System consists of the following subsystems:

a. Liquid Sampling Panel (LSP)

b. Containment Air Sampling Panel (CASP)

c. Chemical Analysis Panel (CAP)

d. CASP Control Panel

e. Chemical Monitor Panel

f. Air Operated Valves Control Panel

g. Primary Heat Trace Control Panels

h. Secondary Heat Trace Control Panels

The subsystems allow licensee personnel to obtain the following samples and perform in-line analysis as listed.

a. Undiluted Reactor Coolant (depressurized) Sample

b. Diluted Reactor Coolant (depressurized) Sample

c. Undiluted Reactor Coolant (pressurized) Sample

d. Reactor Coolant Stripped Gas Analysis

e. Containment Air Sample

f. Containment Air (partitioned) Analysis

g. Conductivity Analysis

h. Chloride Analysis

i. pH Analysis

j. Dissolved Oxygen Analysis

k. Dissolved Hydrogen Analysis

By means of valves which are located in an accessible room outside the containment buildings, a selection can be made of the unit to be sampled. Liquid samples may be obtained from hot legs and of the reactor heat removal system at each reactor. Containment air samples are obtained via containment penetrations.

The grab samples are transferred to the Chemistry Laboratory for boron analysis and preparation for isotopic analysis. Shielded transfer carts are used to transport the samples from the PASS Room to the Chemistry Lab.

The reactor coolant sample lines are tied directly into the 11 and 13 hot legs on Unit 1, and the 21 and 23 hot legs in Unit 2. Operation of this system requires a minimum of 50 psig in the Reactor Coolant System (RCS) in order to obtain a sample. In the event there is no pressure on the RCS, a sample can be taken off the discharge of the Residual Heat Removal pumps.

The liquid sample is collected in a glass bottle which has a septum cap. The liquid sample transfer cart is capable of inserting the bottle into the LSP and removing the filled bottles. Once the cart has been moved into the Chemistry Lab, an aliquot of the sample can be withdrawn from the bottle while still in the cart.

An eductor located in the CASP provides the motive force for removing air from containment to the CASP, and returning the air back to containment. Containment air samples are trapped within a small piece of tubing contained within the CASP transfer carts.

4.2.2 PASS Performance Test

Reactor coolant and containment air samples were collected during an operational test which was witnessed by the Inspection Team on November 28, 1984. The test included comparisons of normal sampling results with those obtained from the PASS system. The test which was performed by licensee personnel verified the integrated ability to collect and analyze a sample within the time and dose constraints of NUREG-0737, II.B.3.

4.2.3 Sampling

Reactor Coolant Sampling

The reactor coolant sampling system is designed to obtain samples of liquids and dissolved gases during all modes of operation. The ability to obtain representative samples within the stated commitments were satisfactorily demonstrated. High pressure samples may be collected from the hot leg or low pressure samples from the RHR during all modes of operation.

Containment Air Sampling

The Sentry PASS system is designed so that containment air samples are collected in a sampling cask. The section of sample line leading to the assembly was not heat traced, as specified in the drawings. Since this section is the lowest point in the system, condensation in the line may occur and cause line blockage. A design change request had been issued for the correction of this condition.

During the test, the indicator used to determine the pressure inside the cask assembly did not function properly.

The containment air sample is collected in a 5 cm^3 volume within the wheeled cask which can be purged, filled and then valved off. After transport to the licensee's chemistry laboratory, a line with a needle tip is injected into a 15 cm^3 gas bottle. The sample is then drawn by vacuum into this bottle. After being disconnected, the 15 cm^3 bottle is taken into the chemistry lab for hydrogen and isotopic analysis.

Recommendation for Improvement

Based on the above finding the following items should be accomplished:

- Heat trace the section of the sample line leading to the cask/cart assemblies.

- Repair the cask/cart assembly pressure indicator.

These items will be reviewed in a subsequent inspection (272/84-45-01)

4.2.4 Analytical Capability

Chlorides Analysis

The Sentry System provides for the in-line analysis of chloride by using an ion chromatograph. Provisions have not been made in the procedures for back-up chloride analysis of a grab sample. The results of the on-line tests are contained in Attachment II.

Recommendations for Improvement

Based on the above finding the following item should be accomplished:

- Make arrangements for conducting a back-up chloride analysis of a grab sample.

This item will be reviewed in a subsequent inspection (272/84-45-02)

Boron Analysis

The licensee's procedures require the use of a fluoroborate specific ion electrode for boron analysis. As indicated in Attachment II, the test analysis results were unsatisfactory. There was a 30% analysis error. The maximum allowable error was specified as 5%.

Recommendations for Improvement

Based on the above finding, the following item should be accomplished:

- Improve the capability for an accurate analysis of grab samples for boron concentration.

This item will be reviewed in a subsequent inspection (272/84-45-03)

pH Analysis

The Sentry system provides for the in-line analysis of pH using a Rexnord probe. Provisions have not been made for a pH back-up analysis of an undiluted reactor coolant grab sample.

The calibration procedure for the in-line probe specifies a tolerance of +/-0.5 pH units. However, the licensee sample analysis error is specified as +/-0.3 pH units and the acceptance criterion in procedure CH3.1.004 is specified as +/-0.1 pH units. These specifications are contradictory to each other.

Recommendations for Improvement

Based on the above findings, the following items should be accomplished:

- Correct the in-line pH probe calibration tolerance to the value specified in the procedures.

This item will be reviewed in a subsequent inspection (272/84-45-04)

Gross Activity and Isotopic Analyses

During the test, the method for the collection of a representative sample of the stripped gas from the Post Accident Sampling System for isotopic analysis could not be demonstrated since there were no procedures specific to its analysis.

The isotopic analyses of the liquid and containment air samples were satisfactorily demonstrated and are contained in Attachment II.

Recommendations for Improvement

Based on the above findings, the following item should be accomplished:

- Develop procedures for the acquisition and isotopic analyses of stripped dissolved gas samples.

This item will be reviewed in a subsequent inspection (272/84-45-05)

Hydrogen Analysis

The licensee satisfactorily demonstrated the capability for analysis of hydrogen. The results are contained in Attachment II.

Additional Findings

- Neither radiation detection instrumentation associated with the system or area background radiation monitors have been provided.

- A long set-up time is required to make the system operable.

- During normal operation, the exhaust of the ventilation from the sampling station is routed only through HEPA filters. The emergency damper line-up for the Auxiliary Building provides only for additional particulate but not halogen absorption.

- The control panel lights did not reliably indicate the position of valves.

- Several valve position indicators were not functioning.

Recommendation for Improvement

Based on the above findings, the following items should be accomplished:

- Install radiation monitoring equipment in the sampling station.

- Make preparations for sample collection and analysis based on an anticipated use, rather than starting when the decision is made to actually collect the sample.

- Make provision for assuring that the sampling station exhaust will pass through charcoal filters during emergency conditions.

- Provide a reliable means to verify the status of the system valves.

These items will be reviewed in a subsequent inspection (272/84-45-06)

5.0 Noble Gas Effluent Monitor, Item II.F.1.1

5.1 Position

NUREG-0737, Item II.F.1-1 requires the installation of noble gas monitors with an extended range designed to function during normal and accident conditions. The criteria, including the design basis range of monitors for individual release pathways, power supply, calibration and other design considerations are set forth in Table II.F.1-1 of NUREG-0737.

Documents Reviewed

The implementation, adequacy and status of the licensee's monitoring systems were reviewed against the criteria identified in Section 3.0 and in regard to documents listed in Appendix I.B.

The licensee's performance relative to these criteria was determined from interviews with the principal persons associated with the design, the testing, installation and surveillance of the high range gas monitoring systems, reviews of associated procedures and documentation, examination of personnel qualifications and direct observation of the systems.

5.2 Findings

Within the scope of this review, the following was identified:

5.2.1 Description and Capability

Each Unit has a plant vent to which all plant ventilation would be routed during accident conditions. Each is provided with an identical Eberline AXM-1 Accident Range Monitor which is physically located at ground level in a shed located at the rear of and against the exterior wall of its respective containment and fuel handling building. The AXM-1 consists of three basic modules, including a noble gas pallet. This provides an intermediate range shielded sample volume of 2,669 cm^3 which contains an energy compensated GM tube and a high range sample volume of 23 cm^3 in a 1" OD stainless steel tube which is viewed by a very small energy compensated GM tube within a shielded volume. Ambient background compensation is provided by means of an identical small GM tube which is embedded in the shield assembly.

The AXM-1 System includes a self-contained microprocessor-based subsystem for the collection of data. It performs the task of data acquisition, history file management, operational status check and alarm determination. Flow through the system is initiated upon receipt of a signal from the normal range plant vent monitor when the noble gas concentration equals or exceeds 1 x 10^{-4} uCi/cm^3.

A Control Terminal is located in a rear room area behind the Control Room. The Emergency Procedures call for the assignment of an emergency control room "liaison" whose duty is to obtain essential radiological information, including the release concentration indicated by the AXM-1, for the shift supervisor and to dose assessment personnel. The terminal has the capability to provide historical information and real time information relative to concentration and release rate. However, only a few personnel are sufficiently conversant with the AXM-1 to interrogate it through the control terminal to obtain such data.

A bulk filter assembly (BFA) is located in the inlet line to the noble gas pallet which serves to remove both iodine and particulates from the gas stream prior to its entry into the gas monitoring volume. The vendor specifies that the purchaser shall supply appropriate shielding. However, this had not been accomplished by the licensee at the time of this inspection. A design change request to do so had been initiated.

Although the licensee's dose assessment procedure considers the changing mix of gaseous nuclides with time post-accident, the possible variation in the energy response of the detectors over time post-accident is not considered.

Each reactor unit has been provided with identical on-line steam radiation monitors which have been installed on each of four steam lines. A fifth channel is installed to monitor a summation of the four devices. Plant staff reported difficulties in maintaining the detectors due to condensation which was attributed to faulty seals on the wells in which they are situated. At the time of this review, Channel B at Unit 2 was inoperative due to maintenance problems.

Proper detector response during accident conditions is possible with the use of documentation supplied by TEC or from a procedure developed by Porter Consultants. The licensee has stated that the Porter document will be used to interpret data derived from the system, although no procedure or draft yet exists documenting the response of these detectors for use by emergency response personnel.

5.2.2 Acceptability

The AXM-1 system as reviewed meets the requirements for high-range gaseous monitoring as contained in NUREG-0737, Attachment II.F.1.-1.

The installed steam line monitors were found to be technically acceptable. The Channel B maintenance problem did not limit the licensee's capability to measure radioactivity gas in that steam leg, since the fifth detector, coupled with existing instrumentation to measure pressure in each of the four steam generators, made the system redundant. The document produced by Porter Consultants is superior to the TEC manual and should enable the licensee to make an adequate assessment of accident conditions in the secondary steam system.

5.2.3 Recommendation for Improvement

- Procedures should be developed and appropriate training provided so that the control room liaisons would be sufficiently conversant with the control of the AXM-1 so as to be able to make full interrogation of its information storage capabilities.

- The shielding of the bulk filter assembly should be accomplished as expeditiously as practicable.

- The energy responses of the AXM-1 detectors, as installed, should be documented by the licensee. If they affect the interpretation of its readout by more than a factor of two, suitable corrections should be provided in the procedures for the interpretation of the indications.

- The licensee should promptly resolve the maintenance and reliability problem due to the steam leaks around the steam line detectors.

- Procedures to implement the use of the Porter document for the interpretation of steam line monitor data should be finalized.

These items will be reviewed in a subsequent inspection (272/84-45-07).

6. Sampling and Analysis of Plant Effluents Item II.F.1.2

6.1 Position

NUREG-0737, Item II.F.1-2, requires the provision of a capability for the collection, transport, and measurement of representative samples of radioactive iodines and particulates that may accompany gaseous effluents following an accident. It must be performable within specified dose limits to the individuals involved.

The criteria including the design basis shielding envelope, sampling media, sampling considerations, and analysis considerations are set forth in Table II.F.1-2.

Documents Reviewed

The implementation, adequacy and status of licensee's sampling and analysis system and procedures were reviewed against the criteria identified in Section 3.0 and in regard to licensee correspondence, memoranda, drawings and station procedures as listed in Attachment 1B.

The licensee's performance relative to these criteria was determined from interviews with the principal persons associated with the design, testing, installation, and surveillance of the systems for sampling and analysis of high activity radioiodine and particulate effluents, by reviews of associated procedures and documentation, by an examination of personnel qualifications, and by direct observation of the systems.

6.2 Findings

6.2.1 Description and Capabilities

Currently, an identical provision is made for each unit for the collection of a normal sample of iodine or particulates from the effluent air in the vent by means of sampling system which draws a continuous 40 lpm stream through a 1" line from the 190' elevation (90' above ground level). The line is heat-traced and maintained at 70°F. The sampling station, which consists of a shielded charcoal canister, is located in the shed which also houses the AXM-1 gaseous monitor.

If the concentration of the plant effluent, as indicated by the normal range gaseous monitor, reaches or exceeds 1×10^{-4} uCi/cm^3, the continuous flow through the normal charcoal canister sampler is terminated. By means of solenoid valves, the continuous flow is redirected through the AXM-1 unit (at a rate of 8 lpm). Provision is also made for the optional collection of a grab sample of radioiodines and particulates at a rate of 20 lpm through a standard sized canister which contains silver zeolite. It has not been established that this flow rate is sufficient to maintain isokinetic flow through the one installed stack probe, which is designed for the normal 40 lpm flow rate. Thus, the ability of the system to collect a representative sample under accident conditions is questionable. The grab sample flow is maintained by the manual depression of a spring loaded switch, which is located on the wall at the opposite end of the shed from the sampling station, about 6' away.

Thus, two persons are required to establish the necessary valve line-up one to hold the switch in the "on" position; and one to adjust the flow rate. It was not evident that flow rate is corrected for the actual pressure in the system.

The procedure provides for the collection of a 4×10^3 uCi sample at a rate of 20 lpm. This sample would read approximately 1.2 R/hr at 1' (for the NUREG-0737 specified concentration of 100 uCi/cm^3, with an average

energy of 0.5 Mev). The licensee has a procedure for the laboratory Ge-Li analysis of such a sample, by positioning it at a distance from the detector. However, it is doubtful that this approach would be adequate for the full 30 minute sample called for by NUREG-0737, II.F.1-2. The licensee's procedure provides only for the use of distance from the sample during its transport to the analysis laboratory. Although suitable casks are available, the use of a shielded cask is not specified. The licensee could not provide an evaluation of the dose which might be incurred by personnel during the collection and transport of a post-accident sample.

It should be noted that the AXM-1 Accident Range Monitor includes a Grab Sample Pallet Assembly, which is designed for the collection of airborne particulates and iodine samples for laboratory analysis. It provides a side stream which is collected isokinetically (from the 8 lpm flow to the noble gas monitor) at a rate of 100 cm^3/min, through a shielded standard sized silver zeolite canister. This canister is continuously monitored by a small energy compensated GM tube, with a low sensitivity so that it would remain on-scale for a full 30 minute sample. This sample would read about 0.9 R/hr at 1'.

The licensee has devised an Emergency Procedure (EP IV-213) for the evaluation of data from the AXM-1's monitor for the iodine cartridges. However, only a few skilled supervisory personnel are sufficiently trained and familiar enough with the AXM-1 to be able to utilize the procedure.

6.2.2 Acceptability

If the licensee can demonstrate that the current system can collect and analyze a representative sample in accordance with the design criteria of NUREG-0737 II.F.1-2 (100 uCi/cm^3; 0.5 Mev; 30 minutes; and not more than a personnel exposure of 5 rem) then the system as installed would be acceptable.

6.2.3 Recommendations for Improvement

1. The intake line should be maintained at a temperature of at least 150°F to minimize the possibility of condensation and to minimize the possibility of the plate-out of elemetal iodine in the line.

2. The capability of the system to obtain a representative sample under accident conditions should be documented.

3. A shielding design analysis should be conducted to establish that the persons responsible for the collection and transport of samples from the existing system can do so within the requirements of GDC 19.

4. The sampling procedures should incorporate a step for the correction of flowmeter readings relative to the pressure in the sampling system at their location.

5. As an alternative, the licensee should investigate the ability of the AXM-1 Accident Range Monitor to obtain a sample in a manner that more fully complies with the requirements of NUREG-0737, II.F.1-2, than does the currently utilized system.

These items will be reviewed in a subsequently inspection (272/84-45-08)

7.0 In-Containment High Rad Monitors, Item II.F.1-3

7.1 Position

NUREG-0737, Item II.F.1-3, calls for the installation of high range containment radiation monitors. The specific requirements are set forth in Table II.F.1-3.

Documents Reviewed

The implementation, adequacy, and status of the licensee's monitoring system were reviewed against the criteria identified in Section 3.0 and in regard to licensee correspondence, memoranda, drawings and station procedures as listed in Attachment 1.C.

The licensee's performance relative to these criteria was determined by interviews with the consultant and principal persons associated with the purchase design, testing, installation and surveillance of the containment high range monitoring systems and by reviews of associated procedures and documentation.

7.2 Findings

Within the scope of this review the following was observed:

Two Victoreen Model 875 ionization chambers were installed in each unit's containment as of June 3, 1983. The dynamic range of these chambers, which are designed to cover the range of 10^1 to 10^8 R/hr, was type tested by Porter Consultant's at the Armed Forces Radiobiology Research Institute (AFRRI) in radiation fields up to 10^6 R/hr. Acceptance tests of the installed detectors consisted of DC testing only, which electronically confirmed the detector response to 10^3 R/hr.

The inspector reviewed Environmental Qualification Report No. 950.301 & IEC-0754 for the High Range Containment Monitors. There was no data in the reports to support Environmental Qualification of the installed High Range Monitor cable connector termination assembly. The licensee indicated that such data would be submitted for review. This item is unresolved pending NRC review of licensee's qualification data. (272/84-45-09)

One detector was installed at an elevation of 132 feet, on the wall between the equipment hatch and the personnel access hatch such that it is capable of monitoring a widely spaced area. A second detector is installed at an elevation of 91 feet in the stairwell landing between the 11 and 13 steam generators, in a manner that does not appear to monitor a broad area. The licensee stated that this location was chosen because it enabled "line of sight" monitoring of the containment sump.

The calibration performed by the licensee after installation was determined to be inadequate, since an in-situ calibration below 10 R/hr has not been performed. The licensee's expect to fulfill this requirement with the use of a recently acquired Victoreen High Range Calibrator.

7.3 Acceptability

The installation of both detectors was found to be acceptable, although the location of the lower detector was not in precise regulatory compliance i.e. the monitor did not view a large fraction of the containment volume.

It was determined from this review that this did not result in a deficiency, since the ability to monitor the containment sump presented advantages over the choice of a redundant location to monitor a broad area at the 132 foot elevation.

The licensee indicated that immediate action would be initiated to submit the design for the current installation to NRR for review and approval; and that source checks of the installed monitors would be performed. This is unresolved pending NRR review of the monitor installation. (272/84-45-10)

8.0 Improved In-plant Iodine Instrumentation Under Accident Conditions, Item III.D.3.3

8.1 Position

NUREG-0737, Item III.D.3.3 requires that each licensee shall provide equipment and associated training and procedures for an accurate determination of the airborne iodine concentration in areas within the facility where plant personnel may be present during an accident.

The implementation, adequacy, and status of the licensee's inplant iodine monitoring under accident conditions was reviewed against the criteria in Section 3.0 and in regard to the documents referenced in Attachment I.D.

The licensee's performance was evaluated by interviews with cognizant licensee personnel, review of applicable calibration and surveillance documentation, direct observation during a walk-through, and verification of equipment availability and storage.

8.2 Findings

With the scope of this review, the following was observed:

The licensee demonstrated instrumentation and personnel training to collect and to make an accurate analysis of an air sample for radioiodine under accident conditions. The air sample consisted of an evacuated 9.5 liter marielli beaker, with a silver zeolite filter, for grab samples; or a low volume Radeco pump (2 CFM) with a silver zeolite filter, for long term samples. Analysis is performed with a solid state gamma spectrometer and computer based data reduction. Calibration standards were demonstrated for routine and accident level samples.

Procedures for collections, analysis, and handling of samples under accident conditions were still in draft form and not implemented.

8.3 Acceptability

Based on the review of the licensee's capability to monitor the plant airborne radioiodine levels under accident conditions should be finalized.

This item will be reviewed in a subsequent inspection. (272/84-45-11)

9.0 REP System/Control of Exposure

The implementation of the licensee's Radiation Exposure Permit (REP) system and exposure control program was reviewed by the following methods:

- Review of selected REPs controlling high exposure work, including steam generator eddy current testing and RTD manifold valve replacement.

- Review of pre-job and during job radiological surveys performed in conjunction with the above REPs.

- Direct observation of Unit 2 steam generator work

- Interview of various work parties

Within the scope of the above review, no violations were identified. REP associated surveys were being performed as required, were receiving appropriate review, and were found to be adequate. It was noted that the licensee was maintaining effective positive control of worker's stay times, entry and exposure at the steam generator work site.

The inspector discussed management oversight with the licensee who indicated that radiation protection supervisory personnel were performing periodic tours of the work areas. No formal documentation of these tours was being maintained. The licensee is currently interviewing workers to determine the adequacy of their briefings and awareness of radiological conditions. The results of these interviews are being documented and follow-up actions are being taken.

10.0 Respiratory Protection Program

The inspector reviewed the implementation of the licensee's respiratory protection program by the following methods:

- Review of qualifications of personnel performing fit-testing, maintenance and issue of respirators.
- Discussion with supervisory and training personnel
- Direct observation of respirator fit-testing, maintenance and issue areas and activities.

Several weaknesses were noted with the respiratory protection training provided to all radiation workers. The training takes approximately one hour and includes an eight minute film, instructor presentation, and a test. The following deficiencies were identified:

- Practical factors (donning, removal, and negative-pressure checking) are not included in the training.
- Inadequate emphasis is given on the topic of relief from respirator use, i.e. all situations prompting relief from respirator use as listed in 10 CFR 20.103c.3 are not described to the worker.
- The training does not familiarize the worker in the mechanics of check out and return of respirators, including forms to be filled out and the method for taking nasal smears.

Further investigation revealed that the weaknesses in this area had been previously identified by the licensee and action had been initiated for the development of a new respiratory protection training program. The training department indicated the new training program would be four hours in length and would include practical factors. During the exit interview the licensee indicated the new training program would address the above weaknesses and would be in place by April 31, 1985. This area will be reviewed in a subsequent inspection (84-45-12).

11.0 ALARA

The inspectors reviewed the implementation status of the licensees in-plant ALARA program. The ALARA organization is largely comprised of contract personnel. The contract ALARA supervisor was recently replaced by a full time PSE&G employee. The ALARA effort at Unit 2 has been effective as indicated by a 1984 cumulative exposure of 80 man-rem. This good performance is attributed to the assignment of full-time HP technicians and ALARA coordinators to all major work, use of lessons learned from past outages, use of a robot for steam generator tube testing and plugging, and management control of work using daily computer analysis of exposures. Training is provided for all HP technicians and workers assigned to steam generators using a full scale mock-up.

The licensee stated that procedure AP-7 "ALARA Program" will be revised to incorporate recent outage experience and that additional ALARA procedures are in development.

Within the scope of this review, no violations were identified.

12.0 Lapse of Radiological Controls Reports

NRC Team interviews with plant personnel indicated that some HP personnel were reluctant to report Lapse of Radiological Controls (LRC) problems. This was due to the belief that workers would be terminated if involved in minor violations of radiological controls, particularly subcontractor personnel.

The inspectors reviewed the 230 LRC reported in 1984 and found no support for these beliefs. Four subcontractor workers had been terminated for serious violations of radiological controls. However, management action appeared appropriate in each case.

Regulation 10 CFR 19.12 "Instruction to workers" states, in part, that workers "shall be instructed of their responsibility to report promptly to the licensee any condition which may lead to or cause a violation of Commission regulations and licenses or unnecessary exposure to radiation or radioactive material". To ensure compliance with this requirement, the licensee stated that the LRC procedure would be revised and steps taken to clarify worker misconceptions regarding the LRC system. This matter will be reviewed in a future inspection. (84-44-01)

13.0 Previous Inspection of Gaseous Radwaste System

During an inspection conducted on September 17-21, 1984 (Inspection Nos. 50-272/84-34 and 50-311/84-34), the inspector reviewed the results of tests of air filtration systems required by Technical Specifications. The licensee had stated that records of tests for the Fuel Handling Area (Units 1 and 2) could not be located. In addition, the records of laboratory tests of carbon samples for methyl iodide removal were incomplete and inconclusive relative to whether such tests had been performed within the 31 day period following their removal, as required by Technical Specifications. The licensee subsequently presented documentation to indicate that all required tests had been performed. This item is considered closed.

14.0 Exit Interview

On November 30, 1984, a meeting was held with licensee representatives (denoted in paragraph 1.0) to discuss the inspection scope and findings as identified in this report. Written material was not provided to the licensee during this inspection effort.

Attachment I.A.

Documentation for NUREG-0737, II.B.3

Public Service Electric Gas Company - Salem Generating Nuclear Station Emergency Procedures

-- EP IV-121, "Containment Atmosphere Remote Sampling", Rev. 1, undated.

-- EP IV-202, "Chemistry Senior Supervisor Response", Rev. 1, undated.

-- EP IV-301, "Interim Post-Accident Primary Coolant Sampling", Rev. 2, undated.

Public Service Electric Gas Company - Salem Generating Station Chemistry Prccedure

-- CH-3.1.001 - "PASS Diluted Liquid Sampling During Accident Conditions", Rev. 2, dated October 22, 1984.

-- CH-3.1.002 - "PASS Undiluted Liquid Sampling During Accident Conditions", Rev. 2, dated October 22, 1984.

-- CH-3.1.003 - "PASS Containment Air Sampling Procedures", Rev. 1, dated November 26, 1984.

-- CH 3.1.004 - "PASS PH/conductivity/YSI Dissolved Oxygen Analysis Accident Conditions"

-- CH-3.1.005 - "PASS Reactor Coolant Stripped - Gas Sampling During Accident Conditions", Rev. 2, dated November 1, 1984.

-- CH-3.1.006 - "PASS Gas Chromatographic Hydrogen Analysis During Accident Conditions", Rev. 1, dated March 21, 1984.

-- CH.3.1.007 - "PASS Ion Chromatographic Chloride Analysis During Accident Conditions", Rev. 2, dated November 1, 1984.

-- CH-3.1.008 - "Transfer of Containment Air Sample from Cask/Cart", Rev. 1, dated August 22, 1984.

-- CH-3.1.009 - "Transfer and Dilution of Diluted Reactor Coolant Samples for Boron and Isotopic Analysis", Rev. 0, dated June 30, 1983.

-- CH-3.1.022 - "Emergency Plan Equipment Storage", Rev. 0, dated April 19, 1984.

-- CH-3.2.004 - "Determination of Hydrogen, Nitrogen and Oxygen by Gas Chromatography", Rev. 5, dated November 22, 1982.

-- CH-3.2.080 - "Boron Analysis - Fluoroborate Selective Ion Electrode", Rev. 1, dated March 28, 1984.

-- CH-3.3.011 - "Fisson Gases by Gamma Spectroscopy", Rev. 5, dated February 19, 1982.

-- CH-3.1.013 - "Use of the RCT Gas Partitioner for Containment Air Sampling", Rev 0, dated November 26, 1984.

Correspondence

Letters

-- E. A. Liden, Mgr. - Nuc. Lic., PSE&G, to S. A. Varga, Chief, OR Br., No. 1, DOL, dated December 7, 1981.

-- E. A. Liden, Mgr. Nuc. Lic. and Reg. PSE&G, to D. G. Eisenhut, Director of Lic., dated April 15, 1982.

-- E. A. Liden, Mgr. Nuc. Lic. and Reg. PSE&G, to D. G. Eisenhut, Director of Lic., dated June 11, 1982.

-- E. A. Liden, Mgr. Nuc. Lic. and Regulation, PSE&G, to S. A. Varga, Chief, OR Br. #1, dated August 13, 1982.

-- J. D. Vojtko, Prin. Eng. NUS Corp, to D. Meils, Tech. Sup. PSE&G, dated May 27, 1983.

-- E. A. Liden, Mgr. Nuc. Lic. and Reg., PSE&G, to S. A. Varga, Chief, OR Br., No. 1, dated August 31, 1983.

-- S. A. Varga, Chief, Branch No. 1, to R. A. Uderitz, VP, PSE&G, dated November 4, 1983.

-- D. L. Vetal, Sr. Exec. Consultant, NUS Oper. Svcs. Corp. to R. J. Dola, Chem. Eng. PSE&G, dated October 12, 1984.

Reports

PSE&G Salem Nuclear Generating Station

-- IV-17.3.1, "Auxiliary Building Ventilation Operation", Rev. 2, dated May 16, 1984.

-- SD-M911, "Auxiliary Building Ventilation System (Mechanical Area)", Rev. 2, dated December 12, 1979.

NUS Corporation

-- NUS 3656, "High Radiation Sampling System Airborne Dose Assessment", dated March 9, 1981.

-- NUS 4538, "Post Accident Dose Assessment for Salem Nuclear Generating Station", dated May 1984.

-- NUS 150-11-010, "Sentry High Radiation Sampling System Operating and Maintenance Manual", dated May 1981.

Salem Nuclear Generating Station Drawings

-- 205210-A-8760-20, "Reactor Coolant P and ID - Mechanical", Sheets 2, 3 of 3, dated April 9, 1984

-- 205216-A-8760-30, "Chilled Water P and ID - Mechanical", Sheets 1-4 of 4, dated July 31, 1984.

-- 205217-A-8760-19, "Compressed Air Piping Diagram - Mechanical", Sheets 1-3 of 3, dated July 9, 1984.

-- 205244-A-8761-16, "Sampling P and ID - Mechanical", Sheets 1, 2 of 2, dated April 19, 1984.

-- 205246-A-8761-18, "Demineralized Water - Restricted Areas P and ID - Mechanical", Sheets 1, 2 of 2, dated June 27, 1984.

-- 205247-A-8761-24, "Reactor Control Penetration Area Control Air P and ID - Controls", Sheets 1-3 of 3, dated May 9, 1984.

-- 205317-A-8762-10, "Compressed Air P and ID - Mechanical", Sheets 1, 2 of 2, dated August 30, 1984.

-- 205327-A-8763-12, "Equipment Vents Drains - Contaminated Piping Diagram - Mechanical", dated June 4, 1973.

-- 205331-A-8763-20, "Component Cooling Piping Diagram - Mechanical", Sheet 1 of 1, dated August 3, 1972.

-- 205337-A-8763-8, "Auxiliary Building - Ventilation Diagram - Mechanical", Sheet 1 of 1, dated December 21, 1972.

-- 205340-A-8763-9, "Waste Disposal - Gas Piping Diagram - Mechanical", Sheet 1 of 1, dated February 26, 1972.

-- 205343-A-8763-14, "Auxiliary Building Control Air Piping Diagram - Controls", Sheet 1 of 1, dated January 7, 1975.

-- 205344-A-8763-12, "Sampling P and ID - Mechanical", Sheet 1 of 2, dated October 10, 1984.

-- 205347-A-8763-10, "Control Air Piping Diagram - Controls", Sheet 1 of 1, dated January 10, 1975.

-- 207510-B-9491-2, "Post-Loca Sampling System Instrument Schematic - Controls", Sheet 1 of 1, dated July 9, 1982.

-- 238211-A-4286, "Post Loca Sample System", sheet 71, Rev. 4, dated November 1, 1984.

-- 239077-B-9639-15, "Radiation Monitoring Gaseous Effluent Discharges Instrument Schematic - Controls", January 27, 1975.

-- 600061-B-9478-0, "Auxiliary Building Post Accident Sample System Instrument Schematic - Controls", dated July 13, 1982.

Attachment 1.B.

Documentation for NUREG-0737, II.F.1-1, II.F.1-2

Salem Nuclear Generating Station Emergency Plant

-- Section 10.0 "Accident Assessment", Rev. 3, dated August 29, 1984

Salem Nuclear Generating Station Emergency Procedures

-- EP IV-111 "Effluent Dose Calculations", Rev. 4, dated October 21, 1983.

-- EP IV-112 "Emergency Operations Facility -- Rad. Assessment", Rev. 0.

-- EP IV-113 "Computerized Dose Calculations", Rev. 3.

-- EP IV-213 "Evaluation of RMS Data from High Range Channel R-45D", Rev. 0

-- EP IV-302 "Emergency Sampling Procedure for the Plant Vent", Rev. 2.

Salem Generating Station Procedures

-- CH-3.5.062 "Sampling the Plant Vent", Rev. 3, dated February 15, 1984.

-- CH-3.5-072 "Plant Vent Gaseous Effluent Emergency Sampling", dated March 21, 1984.

-- 2 IC-4.4.007 "Detector Calibration Main Steam Line Radiation Monitors 2R46A-E", Rev. 0, June 2, 1983.

-- 2 IC-4.1.078-82 "Main Steam Line Radiation Monitor Channel Calibration, 2R46A, Rev. 0, May 19, 1983.

-- 1 IC-4.1.005 "Detector Calibration Area Monitors", Rev. 5, February 3, 1984.

-- 1 IC-4.1.078 "Main Steam Line Radiation Monitor Channel Calibration, 1R46A", Rev. 0, December 30, 1982.

-- 1 IC-4.1.079 "Main Steam Line Radiation Monitor Channel Calibration, 1R46B", Rev. 0, December 30, 1982.

-- 1 IC-4.1.080 "Main Steam Line Radiation Monitor Channel Calibration, 1R46C", Rev. 0, December 30, 1982.

-- 1 IC-4.1.081 "Main Steam Line Radiation Monitor Channel Calibration, 1R46D", Rev. 0, December 30, 1982.

-- 1 IC-4.1.082 "Main Steam Line Radiation Monitor Channel Calibration, 1R46E", Rev. 0, December 30, 1982.

Salem Nuclear Generating Station Design Change Request

-- 1 EC-1177A, "Post-Implementation Engineering Review and Document Update", Supplemental Plant Vent Radiation Samples", dated May 26, 1983.

-- 1 EC-0758, "Post-Installation Engineering Review and Document Update, "Installation of a High-Range Plant Vent Radiation Monitor", dated May 30, 1983.

-- 2 EC-1185 "Radiation Monitoring Status 11", June 15, 1984.

Salem Nuclear Generating Station Drawings

-- 239077B 9139-15 "Gaseous Effluent Discharges" No. 1 Unit Radiation Monitoring, dated January 27, 1985.

-- 600216 B 9126-0 "No. 2 Unit Auxiliary Building Ventilation System" dated July 20, 1983.

Vendor Manuals

"Calibration of TEC Model 1207 Off-Line Steam Radiation Monitor for Public Service Electric and Gas", Technology for Energy Corporation.

Calculation of the Response of the Steam Line Monitor R-46", Portor Consultants.

"Eberline Accident Range Effluent Monitoring System, Model AXM-1, Eberline Instrument Corporation", dated April 1981.

NRC Memoranda

-- W. E. Kregar, NRR to T. M. Novak, NRR, dated December 31, 1981.

-- D. C. Disanni, OR Br 3, dated March 10, 1982.

-- W. J. Ross, DR Br. No. 1 to S. A. Varga, Chief OR, Br. No. 1, dated April 5, 1982.

-- L. J. Norrholm, R. Summers, L. Chung, I&E Inspection Report 50-272/82-14, dated July 9, 1982.

Licensee Correspondence

-- S. A. Varga, Chief OR Br. No. 1 to F.W. Schneida, VP Prod. PSE&G, dated October 1, 1981.

-- F. W. Schneider, VP Prod., PSE&G to S. A. Varga, Chief OR Br., No. 1, dated December 7, 1981.

-- E. A. Liden, Mgr. Nuc. PSE&G to S. A. Varga, Chief OR Br. No. 1, dated October 29, 1981.

-- E. A. Liden, Mgr. Nuc. Lic. & Reg. PSE&G to S. A. Varga, Chief OR Br. No. 1, dated November 30, 1981.

-- E. A. Liden, Mgr. Nuc. Lic. & Reg., PSE&G to S. A. Varga, Chief, OR Br. No. 1, dated March 9, 1982.

-- E. A. Liden, Mgr. Nuc. Lic. & Reg., PSE&G to D. C. Eisenhut, Dir. Lic. dated April 15, 1982.

-- E. A. Liden, Mgr. Nuc. Lic. & Reg., PSE&G to S. A. Varga, Chief OR Br. No. 1, dated May 28, 1982.

-- E. A. Liden, Mgr. Nuc. Lic. & Reg. PSE&G to D. G. Eisenhut, Dir. Lic., dated June 11, 1982.

-- T. E. Murley, Dir. Region I to R. A. Uderitz, VP, Nuclear PSE&G dated November 7, 1983.

-- S. A. Varga, Chief OR Br. No. 1 to R. A. Uderitz, Gen. Mgr., Nuc. Prod. PSE&G, dated February 19, 1984.

Attachment I.C.

Documentation for NUREG-0737, II.F.1-3

Public Service Electric and Gas Company - Salem Generating Stations Procedure

-- 1 PD-4.1.072 "1R44A High Range Channel Calibration", Rev. 1, October 26, 1984.

-- 1 PD-4.1.073 "1R44B High Range Channel Calibration", Rev. 1, September 19, 1984.

-- 2 IC-4.1.072 "2R44A High Range Channel Calibration", Rev. 0, June 2, 1983.

-- 2 IC-4.1.073 "2R44B High Range Channel Calibration", Rev. 0, June 2, 1983.

Salem Nuclear Generating Station Design Change Request

-- 2 EC-0755 Radiation Monitoring Status 11, November 9, 1983.

Victoreen Incorporated

-- Instruction Manual for High Range Containment Monitor 875.

Porter Consultants

-- Notes of Meeting, Calibration of 2R21 Radiation Monitor, Salem Nuclear Generator's Station, Unit 2, Armed Forces Radiobiology Research Institute.

-- "Calculation of the Response of Area Monitor R-44A to a Mix of Gases in the Containment Atmosphere", November 25, 1984.

-- PGG-TR-166, "High Dose Rate Calibration of SNGS Radiation Monitoring System Channel 2R-21 (LOCA Monitor - Victoreen Aluminum Parallel Plate Condenser Ion Chamber)", January 22, 1979.

-- Attachment 1 to PCG-TR-166, U.S. Department of Commerce, National Bureau of Standards, Washington, D.C., Report of Calibration, DS 1751/74A, March 29, 1974.

Attachment I.D.

Documentation for NUREG-0737, III.D.3.3

Correspondence

Mr. Steven A. Varga, Chief DOL to Mr. R. A. Uderitz, V.P., PSE&G dated February 19, 1982.

Public Service Electric and Gas Company - Salem Generating Station Radiation Protection Procedure

-- RP 3.053 "Calibration of Various Types of Germanium - Detector", Rev. 0, December 1, 1983.

Public Service Electric and Gas Company - Salem Generating Station Chemistry Procedure

-- PD 3.9.043 "Efficiency Calibration of the 8100 MCA Systems", Rev. 0, January 10, 1983.

-- PD 3.9.042 "Energy Calibration of the 8100 MCA Systems, Rev. 0, dated January 10, 1983.

Salem Nuclear Generating Station Emergency Procedures

-- EP IV-123 Emergency In Plant Air Sampling, Rev. 0, November 30, 1984.

-- EP IV-118 High Activity Sample Analysis, Rev. 3, November 30, 1984.

Attachment II

Comparison of Analytical Results

A. Chemical Analysis
- Boron

The test data were:

Standard	Analysis Result	Error	NUREG 0737 Requirements	Licensee Commitment
1079 ppm	1530 ppm*	30%	+/- 5%	not clearly specified

*Normal mannitol titration method.

- Chloride

The test data were:

Standard	Analysis Result	Error	NUREG-0737 Requirements	Licensee Commitment
0.05 ppm	0.045 ppm	--	+/- 0.05 ppm	None

- pH

The test data were:

Standard	Analysis Result	Error	NUREG-0737 Requirements	Licensee Commitment
5.86 pH	5.52 pH	0.34 pH	+/- 0.3 pH	+/- 0.3 pH

- Hydrogen

The test date were:

Standard	Analysis Result	Error	NUREG-0737 Requirements	Licensee Commitment
27.8 cc/Kg	31.5 cc/Kg	3.7cc/Kg	+/- 5cc/Kg	+/- 8.8 cc/Kg

- Containment Hydrogen (Dilution/Transfer)

The test data were:

Standard	Analysis Result	Error	NUREG-0737 Requirements	Licensee Commitment
19.6%	19.5%	0.1%	None	None

B. Gross Activity and Isotopic Analysis

The following is an isotopic comparison of the normal and PASS sample results for selected radionuclides:

Isotope	PASS uCi/ml	Normal uCi/ml	%Error	NUREG-0737 Requirements
Unit 2 RHR				
Co-58	9.97E-03	9.99E-03	0.2%	-50/+100%
Co-60	2.23E-03	2.20E-03	-1.3%	-50/+100%
Cr-51	4.23E-04	4.60E-04	11.1%	-50/+100%
Unit 1 Hot Leg 13				
F-18	5.87E-02	8.79E-02	49.7%	-50/+100%
I-131	2.69E-03	2.88E-0	7.1%	-50/+100%
I-133	1.01E-03	1.06E-03	4.9%	-50/+100%
Cs-138	1.30E-02	3.19E-02	145.4%	-50/+100%
Na-24	4.11E-03	4.20E-03	2.2%	-50/+100%
Xe-135	5.41E-04	5.51E-04	1.8%	-50/+100%
Containment Air				
Xe-133	3.57E-05	2.33E-05	-34.7%	-50/+100%
Xe-135	3.11E-05	1.92E-06	-38.2%	-50/+100%