U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report Nos.	50-272/95-21 50-311/95-21
License Nos.	DPR-70 DPR-75
Licensee:	Public Service Electric and Gas Company P.O. Box 236 Hancocks Bridge, New Jersey 08038
Facility:	Salem Nuclear Generating Station
Dates:	November 19, 1995 - January 13, 1996
Inspectors:	C. S. Marschall, Senior Resident Inspector J. G. Schoppy, Resident Inspector T. H. Fish, Resident Inspector
Approved:	Larry E. Nicholson, Chief Projects Branch 3 — 2/1/96 Date

Inspection Summary:

This inspection report documents inspections to assure public health and safety during day and back shift hours of station activities, including: operations, radiological controls, maintenance, surveillances, security, engineering, technical support, safety assessment and quality verification. The Executive Summary delineates the inspection findings and conclusions.

EXECUTIVE SUMMARY

Salem Inspection Reports 50-272/95-21; 50-311/95-21

November 19, 1995 - January 13, 1996

OPERATIONS (Module 71707) Salem operators demonstrated proper safety perspective in responding to a phase current imbalance on 1A EDG. In resolving the issue, shift management also demonstrated appropriate sensitivity to a possible generic concern that potentially affected all EDGs.

Operators inappropriately based operability of the 1B emergency diesel generator (EDG) on surveillance results. Operations management discovered the inappropriate conclusion, and made an appropriate operability determination based on an assessment of the impact of the frequency oscillations on EDG performance.

MAINTENANCE/SURVEILLANCE (Modules 61726, 62703) Operators exceeded the maximum design speed of no. 1A emergency diesel generator (EDG) during a surveillance. Maintenance performed an in-depth EDG failure analysis and inspection. The EDG overspeed had minimal safety significance due to the plant condition (defueled with offsite power, no. 1B and no. 1C EDGs available) and no resultant damage to the no. 1A diesel engine or generator. Operations management did not determine the root cause analysis in a timely manner. The EDG overspeed is an inspection followup item pending NRC review of root cause analysis.

ENGINEERING (Module 37551) In response to a defective General Electric SBM switch associated with a vital 4160V circuit breaker, engineering personnel demonstrated effective teamwork, proper safety focus, and good technical assessment. Engineers identified potential generic concerns, reviewed equipment history and operating experience, and initiated inspection of related equipment in a timely manner. The inspectors concluded that the improved engineering response to the degraded condition resulted from better performance standards implemented by the current engineering management.

During the inspection period, river debris, icing and silt buildup challenged Unit 1 and Unit 2 service water (SW) on three occasions. There had also been recent challenges to service water and the non-safety related and seismic class III construction of the instruments and controls associated with the SW traveling screens. As a result, the inspectors questioned the ability of the SW system to provide an adequate supply of cooling water to the reactor safeguard and auxiliary equipment under all credible seismic, flood, drought, and storm conditions as stated in UFSAR section 9.2.1.1. This issue remains open pending NRC review of corrective action stemming from the Salem Condition Report associated with this issue.

Based on a review of engineering backlog performance indicators (PIs), the inspector concluded that the current system allows engineering staff and management to effectively monitor trends in the engineering backlog, including work completion, and to assess the impact of the engineering backlog on plant safety.

PLANT SUPPORT (Module 71750) Radiological Controls staff responded quickly and appropriately to notification that the cover had blown off a radiological waste shipment enroute to a disposal site. The shipment contained used tools with low-level contamination that Salem staff had individually wrapped. No contamination of the shipping container or the environment occurred as a result of the individual wrapping of the parts.

In response to several instances of radiation workers forgetting their radiation monitoring devices (Alnors) when entering the radiologically controlled area, radiological controls (RC) staff initiated a Condition Report and implemented several corrective actions. Because of the duplication of dosimetry, no unmonitored exposure occurred. After RC staff implemented the corrective actions, a worker again entered the RCA without an Alnor. The effectiveness of the corrective actions will remain open pending NRC review of licensee response to the additional occurrences.

SELF ASSESSMENT and QUALITY VERIFICATION (Module 71707) The Significant Event Response Team (SERT) 95-02 report, the Addendum to the report, and the associated Licensee Event Report identified a number of significant discrete performance and equipment deficiencies associated with the June 1995 Salem Unit 2 shutdown. The Addendum, and the LER also identified a number of long-standing programmatic weaknesses. The Corrective Action Review Board (CARB), however, made the observations of the underlying causes of the programmatic weaknesses contained in the Addendum and the LER contained. Similarly, the SERT 95-03 report, concerning the October 1995 Salem unit 1 loss of overhead annunciators, identified unacceptable performance, but did not address underlying causes. The CARB review again identified the fundamental underlying weaknesses. The SERTs demonstrated that the Salem staff (prior to October 1995) had been unable to identify and correct unacceptable performance. The CARB, on the other hand, clearly demonstrated the ability to recognize the causes for unacceptable performance. The inspectors concluded that SERTs did not result in effective self-assessment, but (as demonstrated by CARB) the new management demonstrated the ability to perform critical self assessment and hold the Salem staff to high standards of performance. In addition, the Salem Restart Plan contains actions intended to insure effective self-assessment and high standards for performance in all levels of Salem staff.

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DETAILS

1.0 OPERATIONS

The inspectors verified that Public Service Electric and Gas (PSE&G) operated the facilities safely and in conformance with regulatory requirements. The inspectors evaluated PSE&G's management control by direct observation of activities, tours of the facilities, interviews and discussions with personnel, independent verification of safety system status and Technical Specification compliance, and review of facility records. The inspectors performed normal and back-shift inspections, including 12 hours of deep back-shift inspections.

1.1 Summary of Operations

Unit 1 remained defueled for the duration of the inspection period.

Unit 2 began the report period in Mode 5 (Cold Shutdown). On December 16, 1995, Operations commenced core off-load activities and completed the evolution on December 19. The unit remained defueled for the remainder of the inspection period.

1.2 Emergency Diesel Generator (EDG) Current Phase Imbalance

Salem operators demonstrated improved safety perspective in responding to a phase current imbalance on 1A EDG. In resolving the issue, shift management also demonstrated appropriate sensitivity to a possible generic concern that potentially affected all EDGs.

On November 28, during testing on 1A EDG, an equipment operator reported that the load on Phase 2 was approximately 80 amperes less than Phase 3. Because the imbalance appeared to be an anomaly, the senior nuclear shift supervisor (SNSS) contacted system engineers for technical support. The engineers' initial assessment was that line imbalances could damage generator insulation or cause rotor cage cracking. Subsequently, the SNSS declared all EDGs (Unit 1 and 2) inoperable, and requested that system engineers evaluate the effects of operating EDGs with phase loading imbalances and conduct internal inspections of the generators. The SNSS issued a voluntary 4-hour report to the NRC, and appropriately established containment integrity for Unit 2 per Technical Specification 3.8.2.2. Action statement. Senior management notified Hope Creek management of the issue and the possible effect it could have on their diesels.

On November 29, operators measured phase current on all four station vital power transformers to determine if the current imbalance existed on the 4KV vital power system, or if it originated in the EDG. Operators concluded the imbalance existed on the electrical grid. On December 2, operators suspended EDG inspections after 1) the inspections performed on 1A and 2C EDGs did not produce indications of rotor overheating or generator damage, and 2) system engineers completed calculations that indicated the generators could accept up

to 180 ampere phase current imbalance. Shift management subsequently returned the EDGs to operable status. Engineers later revised the imbalance limit to 240 amperes.

Inspectors noted the operator that initially identified the current imbalance displayed a good questioning attitude. The SNSS correctly recognized the potential effect on 1A EDG operability and the possible generic implications of the issue. Senior plant management also demonstrated sensitivity to generic implications. The inspectors concluded Salem operators responded well to the issue.

1.3 Operability Determination

Operators inappropriately based operability of the 1B emergency diesel generator (EDG) on surveillance results. Operations management discovered the inappropriate conclusion, and made an appropriate operability determination based on an assessment of the impact of the frequency oscillations on EDG performance.

During a surveillance on the no. 1B Emergency Diesel Generator (EDG), operators observed small frequency oscillations. The operators completed the surveillance, and concluded that the EDG remained operable based on meeting the acceptance criteria. An Operations assistant manager reviewed the test results and determined that operators had incorrectly concluded that successful completion of the surveillance adequately addressed the effect of the frequency oscillations on EDG operability. The manager appropriately concluded that the oscillations did not affect operability since they remained within acceptable limits.

2.0 MAINTENANCE AND SURVEILLANCE

2.1 Maintenance

The inspectors observed portions of the following safety-related maintenance to learn if the licensee conducted the activities in accordance with approved procedures, Technical Specifications, and appropriate industrial codes and standards.

The inspector observed portions of the following activities:

Unit	Work Order(WO) or Design Change Package (DCP)	Description
Salem 1	WO 950916153	1C 230V Motor Control Center Bus Bolt Replacement
Salem 1	WO 950905138	1C 230V Diesel Generator Vital Motor Control Center Inspection

Salem 1	WO 951212329	No. 12 Auxiliary Feedwater Pump Motor Removal
Salem 1	WO 961108008	No. 12 Safety Injection Pump Bearing Inspection
Salem 1	WO 950216081	No. 12 Component Cooling Pump Discharge Header Crossover MOV Overload Heater Replacement
Salem 1	WO 950913288	Service Water Bay No. 1 Piping Replacement
Salem 1	WO 950830356	No. 1 safety injection boron injection tank outlet MOV VOTES testing
Salem 1	DCP 1EC-3322	Service Water Pipe Replacement For No. 11 CCHX Room
Salem 1	DCP 1EC-3323	Install New Cross-tie Piping in Service Water Bay No. 1

The inspectors observed that the plant staff performed the maintenance effectively within the requirements of the station maintenance program.

2.2 Surveillance

The inspectors performed detailed technical procedure reviews, observed surveillances, and reviewed completed surveillance packages. The inspectors verified that plant staff did the surveillance tests in accordance with approved procedures, Technical Specifications and NRC regulations.

The inspector reviewed the following surveillances:

Unit	Procedure No.	Test
Salem 1	S1.OP-ST.DG-0001	1A Diesel Generator Surveillance Test
Salem 1	S1.OP-ST.DG-0002	1B Diesel Generator Surveillance Test
Salem 2	S2.OP-ST.DG-0003	2C Diesel Generator Surveillance Test

The inspectors observed that plant staff did the surveillances safely, effectively proving operability of the associated systems.

2.3 1A Emergency Diesel Generator Overspeed

As a result of a malfunction, the no. 1A emergency diesel generator (EDG) maximum design speed was exceeded during an overspeed surveillance. Maintenance performed an in-depth EDG failure analysis and inspection. The EDG overspeed had minimal safety significance due to the plant condition (defueled with offsite power, and no. 1B and no. 1C EDGs available) and no resultant damage to the no. 1A diesel engine or generator. The EDG overspeed is an inspection followup item pending NRC review of root cause analysis. **(IFI 50-272&311/95-21-01)**

On November 18, 1995, operators performed S1.OP-ST.DG-0016, *1A Diesel Generator Overspeed Trip Test*. Moments after test initiation, the 1A EDG failed to shut down on overspeed as expected. The Nuclear Shift Supervisor (NSS), realizing the EDG failed to trip as designed, directed the throttle linkage operator to release the throttle lever. The throttle linkage operator released the lever, the throttle linkage returned to the minimum fuel position, and the EDG shut down. The highest speed recorded during the test was 1251 rpm, exceeding the maximum design speed of 1125 rpm.

Engineering personnel identified misalignment and wear of the fuel pump control shaft collar and overspeed trip device reset shaft collar. They also determined that this condition allowed the throttle linkage operator to override the trip device and overspeed the EDG. Maintenance personnel, in concurrence with the system manager and EDG vendor, performed an in-depth inspection of EDG components susceptible to overspeed damage. This inspection verified that the overspeed condition did not cause any EDG damage. Maintenance personnel repaired the overspeed clutch assembly. The Operations Department satisfactorily conducted the 1A EDG overspeed trip device surveillance.

The inspector noted the lack of timeliness (> 60 days) of the root cause analysis. In addition, the maintenance department scheduled overspeed clutch assembly inspections of the remaining Unit 1 and Unit 2 EDGs in future EDG outage windows and planned to complete the inspection prior to further overspeed testing and prior to restart. However, delay in inspecting other EDGs for potential common cause degradation did not affect plant safety due to plant conditions (both units defueled).

3.0 ENGINEERING

3.1 Defective SBM Switch

In response to a defective General Electric SBM switch associated with a vital 4160V circuit breaker. engineering personnel demonstrated effective teamwork, proper safety focus, and good technical assessment. Engineers identified potential generic concerns, reviewed equipment history and operating experience, and initiated inspection of related equipment in a timely manner. The inspectors concluded that the improved engineering response to the degraded condition resulted from better performance standards implemented by the current engineering management.

On November 2, during a scheduled 1A vital bus outage, project engineers discovered that a General Electric Type SBM switch on one of the vital 4 KV feeder breakers had a broken cam follower on an unused contact. The contact was one of six within the switch. None of the other contacts had broken cam followers. Project engineers issued a Condition Report against the defective component that resulted in system engineers performing follow up inspections of the switch. Subsequently, system engineers concluded there was a possible generic failure concern (cracking of the cam follower) that could potentially affect breaker operation. The engineers noted that a broken cam follower would prevent its respective breaker from closing or opening.

System engineers contacted industry sources, reviewed switch maintenance history, and performed an operating experience feedback search for information concerning the failure. Based upon the information they gathered, engineers concluded there was not a failure history with the switch at Salem; however, they identified similar failures at other sites. Subsequently, engineering personnel immediately identified systems where SBM switches had critical applications. Inspection of these systems uncovered no defective switches. Engineers will complete a comprehensive system review of nonessential applications by mid February. Maintenance Department personnel will replace all SBM switches prior to restarting the units.

The inspector noted the continuity from initial problem identification to inspection of the switch demonstrated good teamwork between project engineers and system engineers. System engineers then showed appropriate sensitivity to indications of a possible generic concern with switch operation. In addition, system engineers appropriately considered the switch's design purpose in determining what effect the degraded component could have on the plant. This analysis contrasted with previous engineering performance that accepted use of degraded components.

3.2 Service Water Degradation

During the inspection period, river debris, icing and silt buildup challenged Unit 1 and Unit 2 service water (SW) on three occasions. There had also been recent challenges to service water and the non-safety related and seismic class III construction of the instruments and controls associated with the SW traveling screens. As a result, the inspectors questioned the ability of the SW system to provide an adequate supply of cooling water to the reactor safeguard and auxiliary equipment under all credible seismic, flood, drought, and storm conditions perform as stated in UFSAR section 9.2.1.1. This issue remains open pending NRC review of corrective action stemming from the Salem Condition Report associated with this issue. **(IFI 50-272&311/95-21-02)**

On December 28, 1995, a large mass of river grass caused Unit 1 control room screen wash trouble (high traveling screen differential pressure) and strainer (high differential pressure) alarms. Operators noted that SW header pressure dropped to 60 psig before the automatic start of another SW pump restored header pressure. On January 7, 1996, buildup of grass and ice caused a high differential pressure (d/p) across the traveling screen of the operating Unit 1 SW pump. The SW screen would not operate in auto or test due to the buildup

of ice and grass. Operators started another SW pump. Again, the related SW screen would not run in auto or test. Service water header pressure decreased rapidly from 90 psig to 27 psig. Operators started a third SW pump and observed header pressure increase to 100 psig.

Licensee Event Report (LER) 78-13/01T documented a significant degradation in the Salem Unit 1 service water system on January 11, 1978. Engineers identified two possible causes of the event: (1) random chance simultaneous failure of four shear pins or (2) ingestion of river ice and subsequent binding of the strainer backwash arm. The LER stated:

> "It is concluded that there is a reasonable chance that a failure mechanism exists which could prevent the service water system from fulfilling its design basis safety function. This mechanism is the ingestion of fine floating ice from the river due to the weir effects of siltation buildup. This mechanism can be effectively eliminated through siltation level control. A siltation inspection program is being implemented to prevent silt depths from exceeding three feet in any pump bay"

During a January 13, 1996, Salem Unit 2 silt inspection, engineers found a 10 foot buildup of silt, corresponding to 80 feet above the PSE&G datum. The lowest credible water level for service water is 76 feet above datum. Engineers concluded that, had the postulated low tide occurred, a four foot tall dam of silt would have blocked service water from entering the bay. They also noted that plant staff inspects service water bays for silt buildup every 92 days, typically finding about a three foot buildup of silt if the inspection is conducted regularly. Prior to the January 13, 1996 inspection, plant staff had not previously performed the inspection since September 29, 1995. They documented the silt buildup in a Condition Report (CR). Engineers concluded that the silt buildup did not impose an immediate safety concern because both units were defueled.

The Salem UFSAR, Section 9.2.1.1, states that the service water system is designed to supply an adequate supply of cooling water to the reactor safeguard and auxiliary equipment under all credible seismic, flood, drought, and storm conditions. In addition, UFSAR Section 9.2.1.2 states that the service water system is designed for class I (seismic) conditions except for the turbine area service water piping outside of the service water intake structure. The traveling screen motors and low pressure permissive switches are not safety related and are seismic class III. Given the recent challenges to service water from grass, debris, silt, and ice, and the non-safety related and seismic class III construction of the instruments and controls associated with the SW traveling screens, the inspectors questioned the ability of the SW system to perform its design function under worst case conditions. In addition, the Salem Individual Plant Examination (IPE) stated that the loss of service water event tree sequences were assumed to lead to core damage if the service water system is not recovered within one hour. The loss of service water system initiator contributes 2.7% to the total core damage frequency for Salem Unit 1 (2.2% for Salem Unit 2). The inspector noted that in performing this analysis engineering staff based the probabilistic risk assessment (PRA) on Salem experience during the years 1982 - 1986. No loss of service water

(partial or temporary) events occurred during this time. Based on recent plant experience the risk associated with a loss of service water may be even higher than initially assumed.

3.3 Engineering Backlog Performance Indicators

Based on a review of engineering backlog performance indicators (PIs), the inspector concluded that the current system allows engineering staff and management to effectively monitor trends in the engineering backlog, including work completion, and to assess the impact of the engineering backlog on plant safety.

4.0 PLANT SUPPORT

4.1 Radiological Controls

In response to several instances of radiation workers forgetting their radiation monitoring devices (Alnors) when entering the radiologically controlled area, radiological controls staff initiated a Condition Report and implemented several corrective actions. Because of the duplication of dosimetry, no unmonitored exposure occurred. After RC staff implemented the corrective actions, a worker again entered the RCA without an Alnor. The effectiveness of the corrective actions remain unresolved pending NRC review of licensee response to the additional occurrences. **(UNR 50-272&311/95-21-03)**

4.2 Radiological Waste Shipment

Radiological Controls staff responded quickly and appropriately to notification that the cover blew off a radiological waste shipment enroute to a disposal site. The shipment contained used tools with low-level contamination that Salem staff had wrapped individually. No contamination of the shipping container or the environment occurred as a result of the individual wrapping of the parts.

5.0 SAFETY ASSESSMENT AND QUALITY VERIFICATION

The Significant Event Response Team (SERT) 95-02 report, the Addendum to the report, and the associated Licensee Event Report identified a number of significant discrete performance and equipment deficiencies associated with the June 1995 Salem Unit 2 shutdown. The Addendum, and the LER also identified a number of long-standing programmatic weaknesses. The Corrective Action Review Board (CARB), however, made the observations of the underlying causes of the programmatic weaknesses contained in the Addendum and the LER contained. For example the SERT 95-02 Addendum contained the question, posed by the CARB: "Why did the operators have a minimum operating philosophy stating - 'the RH29 valves are not required in this mode.'" The answer, given by the SERT supplied the statements given by the operators for considering the RH29 valves operable. The SERT did not provide the cause for the minimum operating philosophy - low operator standards established by correspondingly low management expectations. Clearly, CARB understood the root cause of the poor operator performance, and the SERT did not. In the addendum, SERT

concluded that Salem demonstrated acceptance for degraded equipment conditions and ineffective corrective action "because management established an environment in which the resolution of equipment issues and personnel accountability to follow up and correct these issues was diminished." The SERT reached this conclusion at the prompting of the CARB. The inspectors concluded that the environment that tolerated low standards existed because the senior management had low standards for accepting degraded conditions and inappropriately accepted ineffective corrective actions. The SERT, the Addendum, and the LER discuss inadequate management oversight, yet they did not recommend corrective action for management.

Similarly, the SERT 95-03 report, concerning the October 1995 Salem unit 1 loss of overhead annunciators, identified unacceptable performance, but did not address underlying causes. For example, the SERT did not identify the cause of the inappropriate operator conclusion that Salem did not need additional public attention drawn to the facility by declaring an ALERT, or the root cause of inadequate management oversight of emergency preparedness and the corrective action process. The CARB review again identified the fundamental underlying weaknesses. For example, the SERT team incorrectly concluded that operators inappropriately declared an ALERT after the fact, since they had restored the overhead annunciator system. The CARB (and the SERT manager, a member of the new management team) concluded that the overhead annunciators remained inoperable since plant staff had not determined the cause of the failure or verified the effectiveness of the corrective action. The CARB noted that the SERT ineffectively assessed the operability of the overhead annunciators in the same way the operators had assessed it.

The SERTs demonstrated that the Salem staff as it existed up to October 1995 had been unable to identify and correct unacceptable performance. The CARB, on the other hand, clearly demonstrated the ability to recognize the causes for unacceptable performance. The inspectors concluded that SERTs did not result in effective self-assessment, but (as demonstrated by CARB) the new management demonstrated the ability to perform critical self assessment and hold the Salem staff to high standards of performance. In addition, the Salem Restart Plan contains actions intended to insure that management imparts the high standards in all levels of Salem staff.

6.0 REVIEW OF REPORTS AND OPEN ITEMS

The inspectors reviewed the following Licensee Event Reports (LERs) to determine whether the licensee took the corrective actions stated in the report, detect if the licensee responded to the events adequately, and ascertain if regulatory requirements and commitments were appropriately addressed:

Unit 1

Number	Event Date	Description
LER 95-026	October 23, 1995	Main steam safety valves failed lift set test.
LER 95-027	December 11, 1976	Operation of positive displacement pump during a safety injection.
LER 95-028	September 20, 1995	Inadequate technical specification 6.8.4 program for primary coolant sources outside containment.

The inspectors determined that the LERs listed above do not warrant further inspection or enforcement action and considered the LERs closed.

7.0 EXIT INTERVIEWS/MEETINGS

7.1 Resident Exit Meeting

The inspectors met with Mr. C. Bakken and other PSE&G personnel periodically and at the end of the inspection report period to summarize the scope and findings of their inspection activities.

Based on NRC Region I review and discussions with PSE&G, it was determined that this report does not contain information subject to 10 CFR 2 restrictions.

7.2 Licensee Management Changes

Senior management made the following personnel changes: on November 13, John Holden became the Station Planning Manager; on November 27, Eric Salowitz became the Director, Nuclear Business Support.