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U.S. NUCLEAR REGULATORY COMMISSION

REGION I

Report Nos. 50-272/84-28
50-311/84-27

Docket Nos. 50-272
50-311

License Nos. DPR-70
DPR-75

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

Facility Name: Salem Nuclear Generating Station - Units 1 and2

Inspection At: Hancocks Bridge, New Jersey

Inspection Conducted: July 7, 1984 - August 13, 1984

Inspectors: for J. C. Linville, Senior Resident Inspector — 8.22.84 date

for R. J. Summers, Resident Reactor Inspector — 8.22.84 date

Approved By: L. J. Norrholm, Chief, Reactor Projects Section No. 2B, Projects Branch No. 2, DPRP — 8/23/84 date

Inspection Summary
Inspections on July 7, 1984 - August 13, 1984 (Combined Report Numbers 50-272/84-28 and 50-311/84-27)
Areas Inspected: Routine inspections of plant operations including: status of previous inspection items, review of periodic and special reports, licensee event report review, operational safety verification, surveillance observations, maintenance history program review, ESF system walkdown, and operating events. The inspection involved 183 inspector hours by the resident NRC inspectors.

Results: One violation involving two examples of failure to follow system alignment procedures was identified (paragraph 8). Other issues of concern which the inspectors will review further during subsequent inspections when the licensee evaluations are complete include the cracked eductors on the Unit 2 primary safety valves, the problem with the Unit 2 PORV block valve closure during a depressurization event which resulted in a reactor trip and safety injection and the premature tagout of both containment spray pumps in mode 4 (paragraph 9).

DETAILS

1. Persons Contacted

Within this report period, interviews and discussions were conducted with members of licensee management and staff as necessary to support inspection activity.

2. Status of Previous Inspection Items

(Closed) Unresolved Item (272/81-12-03) This item involved repetitive failures of the containment airlock seals. These failures have continued to occur and the licensee has attributed them to a combination of misuse by personnel operating the airlocks and the high test pressure required by the Technical Specifications to check for seal leakage. The licensee completed changes to the annual training programs in January 1984, to include a video tape showing the proper use of the airlock doors and, on July 16, 1984, the licensee received a license amendment to both licenses reducing the test pressure for the "between the seals" periodic testing. These two actions should prevent repetitive failures of the airlock door seals. The inspector had no further questions at this time.

(Closed) Violation (272/82-05-01; 311/82-08-01) This item involved two examples of failures by the work supervisor to ensure that the equipment is completely isolated and that all tags are properly placed before starting work in accordance with AP-15, Safety Tagging Program. The licensee stated that the first example was a result of a personnel error and that it was discovered prior to required supervisor review. However, the second example was a result of miscommunication in the tagging request and a failure by the work supervisor to ensure complete isolation. The licensee provided training for maintenance supervisors specifically addressing the requirements of AP-15 and, in addition, the proper method of tagging and verifying the tags for a Limitorque operator valve. The inspector reviewed the training records for a sample of maintenance supervisors and all had documentation showing they had received the training. The inspector had no further questions at this time.

(Open) Unresolved Item (272/83-13-01) This item involved repeated tagging errors involving confusion between the two units during the operation. The licensee contracted General Physics Corporation to do a human factors review of equipment tagging at Salem. The inspector reviewed the report and the Operations Department response. It was noted that, although not all of the recommendations were accepted, a large majority of the recommendations have been or will be implemented. This item remains open pending completion of these actions to help prevent future tagging errors resulting from unit confusion.

(Closed) Inspector Followup Item (311/84-23-04) This item involved a unit shutdown to repair a crack in the charging pump suction header which could have made the high head safety injection system inoperable had it failed. In LER 311/84-016 the licensee reported that analysis of the section of cracked pipe by an independent laboratory confirmed that the cause was most probably normal system vibration and that the crack had initiated from the O.D. of the pipe. In addition, Design Change Requests have been initiated to reduce the length of certain charging system vent and drain line piping, thereby reducing the moment arm and minimizing the stress from normal vibration. Until these modifications are complete, a periodic inspection program on a six week basis has been implemented on selected vent and drain connections.

3. Review of Periodic and Special Reports

Upon receipt, the inspectors reviewed periodic and special reports. The review included the following: inclusion of information required by the NRC; test results and/or supporting information consistent with design predictions and performance specifications; planned corrective action for resolution of problems, and reportability and validity of report information. The following periodic reports were reviewed:

-- Unit 1 Monthly Operating Report for June 1984

-- Unit 2 Monthly Operating Report for June 1984

4. Licensee Event Report (LER) Review

The inspectors reviewed LER's to verify that the details of the events were clearly reported. The inspectors determined that reporting requirements had been met, the report was adequate to assess the event, the cause appeared accurate and was supported by details, corrective actions appeared appropriate to correct the cause, the form was complete and generic applicability to other plants was not in question.

Unit 1

* 84-14 Unit 1 Vital Bus Blackout Actuation

* 84-15 Inconsistency Between Technical Specifications and Safety Analysis

* 84-16 Late Submittal of Procedure Change to SORC for Review

Unit 2

* 84-16 Controlled Shutdown Due to Charging Line Leak

84-17 Impingement of Sea Turtle in the Circulating Water Intake

*Denotes onsite followup

Unit 1

84-14 This report documents the loss of service water cooling to the emergency diesel generators as a result of an SEC actuation for "station blackout". The event took place while the reactor was defueled and requirements for operable electrical trains were not imposed. Additional details of the event can be found in NRC Inspection Report 50-272/84-19, paragraph 9a. This report proposed a number of corrective actions, most of which, have not been completed. These actions will be reviewed during a future inspection (272/84-28-01).

84-15 This report details an inconsistency between the Technical Specifications and the safety analysis. Westinghouse notified the licensee of the potential unreviewed safety question concerning the number of operating reactor coolant pumps (RCP) when in mode 3, Hot Standby. At Salem, the Technical Specifications would permit operations in mode 3 with only one RCP in operation; however, the FSAR assumes that either two or all of the RCPs are in service for certain accidents. Westinghouse determined that for a bank rod withdrawal from subcritical event, the design basis DNB may not be met with only one RCP running. The licensee has initiated actions to change the Technical Specification to ensure consistency with the FSAR and, in addition, to implement procedural changes and an interpretation guide to administratively control operations such that the accident analysis is valid. The inspector will review these corrective actions during a future inspection (272/84-28-02).

84-16 This report details a late review and approval of a temporary change to a chemistry procedure by the Station Operations Review Committee and the General Manager. Technical Specification 6.8.3 requires this to be accomplished within fourteen days of implementation. On this occasion, an additional six days were required due to an administrative error. The inspector discussed the reporting requirements of the event with the licensee and it was determined that although information, including corrective actions, pertaining to violations of procedures and the administrative section of the Technical Specifications should be readily available for inspector review, that this type of event is not reportable under the provisions of 10 CFR 50.73. Subsequent to this event, the licensee identified a total of six additional on-the-spot-changes from two different departments also were not reviewed and approved within the required time frame. The General Manager - Salem Operations has initiated corrective actions to prevent recurrence by issuing a memorandum to all department managers to review the requirements for on-the-spot-changes with the department supervisory staff. An emphasis on attention to detail, safety reviews, and procedure adherence were specifically required. This item is a licensee identified violation.

Unit 2

84-16 This report details a shutdown of the unit due to a through wall crack in the charging pump suction header which could have made the high head safety injection system inoperable had it failed. Inspector review of this event is detailed in paragraph 8 of Inspection Report 50-311/84-23.

5. Operational Safety Verification

a. Control Room Observations

Daily, the inspectors verified selected plant parameters and equipment availability to ensure compliance with limiting conditions for operation of the plant Technical Specifications. Selected lit annunciators were discussed with control room operators to verify that the reasons for them were understood and corrective action, if required, was being taken. The inspectors observed shift turnovers biweekly to ensure proper control room and shift manning. The inspectors directly observed operations to ensure adherence to approved procedures.

b. Shift Logs and Operating Records

Selected shift logs and operating records were reviewed to obtain information on plant problems and operations, detect changes and trends in performance, detect possible conflicts with Technical Specifications or regulatory requirements, determine that records are being maintained and reviewed as required, and assess the effectiveness of the communications provided by the logs.

c. Plant Tours

During the inspection period, the inspectors made observations and conducted tours of the plant. During the plant tours, the inspectors conducted a visual inspection of selected piping between containment and the isolation valves for leakage or leakage paths. This included verification that manual valves were shut, capped and locked when required and that motor operated valves were not mechanically blocked. The inspectors also checked fire protection, housekeeping/cleanliness, radiation protection, and physical security conditions to ensure compliance with plant procedures and regulatory requirements.

d. Tagout Verification

The inspectors verified that selected safety-related tagging requests were proper by observing the position of breakers, switches and/or valves.

6. Surveillance Observations

The inspectors observed portions of the surveillance procedures listed below to verify that the test instrumentation was properly calibrated, approved procedures were used, the work was performed by qualified personnel, limiting conditions for operation were met, and the system was correctly restored following the testing:

-- 1 IC 16.2.010 Channel Functional Test Power Range Channel 1N44 per I.O. 400195

-- 1 IC 16.4.032 Discriminator and Plateau Voltage Adjustments - Source Range Channel 1N31 per I.O. 406336

-- 1 IC 2.8.033 Channel Sensor Time Response Test; 1LT-517 No. 11 Steam Generator Level Protection Channel IV per W.O. 84-06-08-117-1

-- 2 IC 2.10.067 Channel Calibration 2TE-433B Loop No. 23 Reactor Coolant Wide Range Temperature (Cold Leg) per W.O. 84-05-22-908-6

-- Unit 1 Containment Type "A" test. The inspector observed portions of the preparation and performance of the test. Additional details of this activity can be found in NRC Inspection Report 50-272/84-26.

7. Maintenance History Program Review

The inspector reviewed licensee records such as LERs, incident reports, deficiency reports, monthly operating reports and work orders for calendar year 1983 to determine the maintenance history of ECCS components, and to evaluate the licensee's program for ensuring equipment failures are evaluated for frequency and root cause. The inspector found that while procedure A-19, Maintenance Department Equipment History Administration and Review establishes a formal program for maintaining equipment history files, performing an annual review for problems, and performing a quarterly review on the status of corrective action for problems, the formal program is ineffective. This seems to be because work orders are arbitrarily retained in manually kept system files, the review frequency does not necessarily lend itself to identification of recurring problems, and the review is performed by different planners who are not intimately familiar with the equipment.

Although the formal program seems ineffective, there appear to be informal programs at work in both the maintenance and instrument and control departments which seem to be effective. These informal programs seem to rely on the expertise of individual supervisors and their ability to identify recurring problems on their equipment and obtain management support to get the resources to solve these problems. The most noteworthy example in 1983 involved the spurious actuation of safeguards equipment

control cabinets (SECs) which sequence the starting of ECCS equipment after a safety injection actuation signal. In 1983 there were 28 work orders, 6 deficiency reports, 9 incident reports, and 4 LERs written on SECs, the largest number being associated with 2A SEC. Throughout this time period the licensee had retained a consultant to assist in pinpointing the problems. The consultant wrote five reports on the problems and assisted the licensee in developing several design changes to prevent the spurious actuations. The design changes included replacing the wiring harness in 2A SEC, replacing the power supplies and relays in all SECs, and providing noise shielding in all SECs. The consultant also developed test equipment for the licensee to aid in troubleshooting SEC problems. During this program, the licensee improperly replaced 24 VDC relays with 12 VDC relays which were erroneously stored in the same bin. This resulted in a failure during the first retest. The modifications which seem to have been effective in resolving the problem were developed by narrowing down the possibilities using a Dranetz recorder to record partial spurious actuation signals. The licensee and the consultant maintained that the SEC would respond properly to an actual signal throughout the troubleshooting process.

Another example involved the development of a detailed study of valve failures in 1983 covering the years 1982 and 1983. The study broke down the failures by valve type, failure mode, valve system application, and relative failure rate. The study was used to develop preventive maintenance requirements and frequencies.

In response to concerns raised during the ATWS events of February 1983, the licensee developed an action plan to study and implement a computerized managed maintenance program which will provide the information necessary to conduct more effective and timely reviews of equipment history trends to identify and correct problems. This project is currently scheduled for completion in mid 1985. The licensee plans to have one full time maintenance engineer dedicated to failure analysis and equipment history review. The inspector emphasized the importance of involving the maintenance supervisors most familiar with the equipment in this type of activity to assure its effectiveness.

The licensee's methods of post maintenance testing were scrutinized during calendar year 1983 as a result of the followup to the February 1983 ATWS events. As a result, the licensee changed their practices and procedures governing retesting. In addition, in early 1984, a new computerized Work Order system was installed. This system is being used in lieu of the old manual system, although the manual system is still used to some degree. This new system permits better tracking of work in progress. When fully operational, it will also provide a better equipment history file.

One area where the Administrative Procedure (AP-9), Maintenance Program, may need improvement is in documentation control for "retest" work orders. When work is completed on a given item, the supervisor in charge of the work provides a copy of the work order stamped "Retest" to the senior

shift supervisor. This ensures that the Operations Department is aware that the system or component can be returned to service after successful completion of an "operability" retest. This "retest" work order becomes a part of the work package and is maintained as an official record. However, if the system or component fails the retest, then the "retest" copy is sent back to the department responsible for work. The "failed-retest-copy" is not required to be retained as part of the work package. After maintenance and successful completion of retest the new work order and the referenced work order would be closed. In addition, since there is no procedural requirement in this area, the responsible department may elect to continue the work on the original work order in lieu of issuing a new work order if the component fails retest. In this case, upon successful completion of the work and the retest, the work order would be closed. Again, the "failed-retest-copy" is not necessarily included as part of the work package for equipment history data. Retest failure data could be useful to determine maintentance procedures adequacy; maintenance procedure adherence; and, system restoration adequacy.

8. Engineered Safety Feature (ESF) System Walkdown

The inspector verified the operability of the selected ESF system by performing a walkdown of accessible portions of the system to confirm that system lineup procedures match plant drawings and the as-built configuration, to identify equipment conditions that might degrade performance, to determine that instrumentation is calibrated and functioning, and to verify that valves are properly positioned and locked as appropriate.

The inspector selected the Unit 2 High-head Safety Injection System. During the walkdown of the system no apparent discrepancies were identified for major flowpath valves between the current alignment and the operating procedure and drawings. However, valve 2SJ149, a vent valve on the BIT discharge piping inside containment, was found slightly open. The vent line was capped, but water was leaking through the cap seal. A maintenance department employee terminated the leak by closing the vent valve approximately 1/2 to 3/4 of a full turn. The valve is normally locked closed and the locking device was in place. The inspector will review the licensee's findings as to the cause of the valve not being fully closed (311/84-27-01).

During a review of the licensee's documentation of proper alignment of the Safety Injection System, the inspector found that the checkoff sheet used to lineup the Safeguards Equipment Cabinets (SEC) had not been completed as required by Operating Procedure II-4.3.1, Safety Injection System-Normal Operation. Technical Specification 6.8.1 requires that applicable procedures referenced in Regulatory Guide 1.33, Revision 2, Appendix A, which include procedures for startup, operation and shutdown of PWR Emergency Core Cooling Systems shall be implemented. Failure to implement Operating Procedure II-4.3.1 is a procedure violation.

In addition, Integrated Operating Procedure, IOP-2, Cold Shutdown to Hot Standby, required as a prerequisite for initiating plant heatup specifies that the Safety Injection System be aligned for operation in accordance with its operating procedure (OP II-4.3.1). The referenced procedure requires not only a proper TRIS system valve lineup, but also a SEC switch checkoff list that apparently had not been completed. Thus the prerequisite for heating up the plant in accordance with IOP-2 had not been met. Since OP II-4.3.1 had apparently not been completed during the initial lineup of the system (conducted July 1983), the operating staff had numerous opportunities during each plant startup from Cold Shutdown, to identify the inadequate documentation of the Safety Injection (SI) System alignment for operation. Technical Specification 6.8.1 and Regulatory Guide 1.33, Revision 2, Appendix A require that plant operating procedures for Cold Shutdown to Hot Standby be implemented. On August 6, 1984, IOP-2, Cold Shutdown to Hot Standby was initiated without properly verifying that the SI System was aligned for operation. This constitutes a second example of a procedure violation (311/84-27-02). When the inspector brought this to the licensee's attention the required checkoff list was completed immediately without noting any discrepancies.

9. Operating Events

a. Unit 1

At 3:57 p.m. on July 13, 1984, an inadvertent safety injection occurred with the unit in the refueling mode due to personnel error while testing train A of the solid state protection system. There was no injection into the vessel and all available equipment functioned as required. The inspector will review the LER when it is submitted.

b. Unit 2

On July 14, 1984, Wyle laboratory reported to the licensee that they had found cracked eductors on the Unit 2 primary safety valves. The safeties had been sent to Wyle for inspection and testing, after the licensee discovered that 2 of 3 apparently had leaking bellows. The licensee also sent the Unit 1 safeties, which had been installed in Unit 2 in preparation for startup, to Wyle for inspection and testing. The eductors in these valves were found intact. Wyle replaced the cracked eductors in the Unit 2 valves with spares obtained by the licensee and the licensee reinstalled the valves after Wyle retested them. The inspector will review the results of the licensee evaluation when they become available (311/84-27-03).

At 1:18 p.m. on July 25, 1984, a reactor trip and subsequent safety injection occurred as a result of depressurizing the reactor coolant system while at approximately 66% power, due to a stuck open valve (2PR47) in a line coming from the Pressurizer steam space. The operators initially suspected a stuck open primary PORV (2PR1) because the event occurred while restoring conditions to normal upon

completion of a surveillance test for the low temperature Pressurizer Overpressure Protection System (POPS), during which the PORV had been cycled open. The operator initiated a closure of the PORV block valve (2PR6) which also isolated 2PR47. However, through review of the transient data, it appears as though the valve took 4 to 5 minutes to close, terminating the depressurization event. The normal closure time for 2PR6 is less than 10 seconds, although the valve has never been tested on site with flow and full differential pressure. The block valve had been qualified per post TMI action by an EPRI study on relief valves and block valves.

The licensee subsequently initiated a cooldown to facilitate testing and repairs. It was determined that the cause of the depressurization was a failed open 2PR47 valve, by slowly opening the PORV block valve at 300 psig and checking both PORV and 2PR47 temperatures with a surface pyrometer. This valve had formerly served as a low temperature POPS valve, but due to repeated position indication problems, the licensee removed it from service and planned to physically remove it during the next refueling outage. The valve has an internal pilot valve that directs system pressure to operate the valve. The pilot valve was found stuck open due to a piece of magnetic material being wedged in the pilot. This was apparently part of the magnetic reed switches used for position indication. The 2PR47 and its redundant valve 2PR48 were both removed from the system and their penetrations blanked.

The post trip review required a SORC meeting prior to restart of the unit. The inspector observed this review during which a number of issues were resolved including: the cause of event, the reason 2PR6 took so long to close, the control circuitry for 2PR6, and any generic implications with Limitorque operators in use at Salem based on the 2PR6 investigation. The licensee concluded that the cause of the event had been corrected by removing the defective 2PR47; that based on information from Limitorque the control design of 2PR6 should be modified to require full stroke of the valve in one direction prior to stroking it in the reverse direction; the 2PR6 torque setting should be increased to assure closure against high differential pressure; and, that the cause of the slow 2PR6 closure was probably a broken lead found subsequent to extensive testing of the valve following the incident. The inspectors will review the results of the licensee investigation further when the LER is submitted.

During the cooldown following the reactor trip and safety injection, both containment spray (CS) pumps were inadvertently tagged out of service at 3:39 a.m. on July 26, 1984 when reactor coolant system temperature decreased to less than 350 degree F, and mode 4 was entered. However, Technical Specification 3.6.2.1 requires that both CS pumps be operable in modes 1 through 4. When the licensee realized the error at 5:30 a.m. Technical Specification action statement 3.0.3

was entered and both CS pumps were restored to service by 6:34 a.m. The inspector will review the licensee evaluation of and corrective action for this event when the LER is submitted.

10. Exit Interview

At periodic intervals during the course of this inspection, meetings were held with senior facility management to discuss inspection scope and findings. On August 13,1984, the inspectors met with licensee representatives and summarized the scope and findings of the inspection as they are described in this report.