PSEG

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

Salem Generating Station

July 2, 1993

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Dear Sir:

SALEM GENERATING STATION
LICENSE NO. DPR-75
DOCKET NO. 50-311
UNIT NO. 2

LICENSEE EVENT REPORT 93-008-00

This Licensee Event Report is being submitted pursuant to the requirements of the Code of Federal Regulations 10CFR 50.73(a)(2)(v)(A). This report is required to be issued within thirty (30) days of event discovery.

Sincerely yours,

C. A Vondra
General Manager -
Salem Operations

MJPJ:pc

Distribution

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NRC FORM 366 (6-89) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WTH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Salem Generating Station - Unit 2	0 5 0 0 0 3 1 1	1 OF 0 6

TITLE (4)

Rod Control System Design Basis Concern (both Salem Units)

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 5	2 7	9 3	9 3	0 0 8	0 0	0 7	0 2	9 3	Salem Unit 1	0 5 0 0 0 3 1 1
										0 5 0 0 0

OPERATING MODE (9)	3	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
	AREA CODE
M. J. Pastva, Jr. - LER Coordinator	6 0 9 3 3 9 - 2 2 1 5

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
X	A A	E C B D	W 1 2 0	Y							
X	A A	E C B D	W 1 2 0	Y							

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

During Unit 2 Reactor startup activities, following the unit's 7th refuel outage, it was determined on 6/4/93 that a postulated single failure concern existed where failure of one Rod Control System slave cycler decoder card, in conjunction with a rod motion command signal, may cause an unplanned Rod Control Cluster Assembly (RCCA) withdrawal. At 1734 hours, all control rods were inserted, the Reactor trip breakers were opened, and the Unit was stabilized in MODE 3. On 5/27/93, at 1844 hours, rod 1SA3 had withdrawn approximately 15 steps from fully inserted following a manual insertion command. Rod control power was then deenergized to fully insert the rod. The RCS single failure concern is attributed to RCS design. 1SA3 withdrew as the result of inappropriate current orders to the RCCA. Integrated circuit chips on two slave cycler decoder cards had failed due to the relay driver circuit card connector pin No. 4 not making electrical contact with the surge suppression diode. Pin No. 4 was repaired and the slave cycler cards were replaced to restore operability of rod 1SA3. Prior to Unit 2 startup 5/27/93, an additional corrective action was installation of suppression diodes on the rod step counters of the RCS circuitry, of each unit, to mitigate consequences of an open or bad connection on the relay driver circuit card connector pin no. 4. All Unit 2 RCS logic cards were replaced and satisfactorily tested and all RCS Power Cabinet cards were pulled, visually inspected, and retested satisfactorily . On 6/29/93 Unit 2 was taken critical.

PLANT AND SYSTEM IDENTIFICATION:

Westinghouse - Pressurized Water Reactor

Energy Industry Identification System (EIIS) codes and component function identifiers are identified in the text as {xx/xx}

IDENTIFICATION OF OCCURRENCES:

Rod Control System Design Basis Concern (both Salem Units)

Event Date: 5/27/93

Discovery Date: 6/4/93

Report Date: 7/2/93

This report was initiated by Incident Report No. 93-263.

CONDITIONS PRIOR TO OCCURRENCE:

5/27/93: Unit 1 - Mode 1 - Reactor Power 100% - Unit Load 1145 MWe
5/27/93: Unit 2 - Mode 3 Reactor Power 0% - Unit Load -0- MWe; Unit 2 Reactor startup activities in progress following completion of the unit's seventh refueling outage.

DESCRIPTION OF OCCURRENCE:

On May 27, 1993, at 1844 hours, control rod 1SA3 withdrew to approximately 15 steps from fully inserted in response to a manual insertion command (rod full out is 228 steps). Rod control power was deenergized to fully insert the rod. On June 4, 1993 at approximately 1700 hours, investigation determined that a single failure in the Rod Control System (RCS) could possibly result in a single rod withdrawal event (applicable to both Salem Units). All control rods on Unit 2 were inserted at 1734 hours, the Reactor trip breakers were opened, and the Unit was stabilized in MODE 3. A Justification for Continued Operation (JCO) of Unit 1, with the RCS in manual control, was provided to the NRC on June 8, 1993 (reference evaluation S-C-RCS-EEE-0819).

The Nuclear Regulatory Commission (NRC) was notified of this event in accordance with the requirements of Code of Federal Regulations 10CFR50.72(b)(1)(ii)(B). The identified failure is conservatively postulated to be a single failure. The Updated Final Safety Analysis Report (UFSAR) states that only multiple failures would cause the withdrawal of a single Rod Cluster Control Assembly (RCCA). This condition in which a single RCCA withdrew results in an Unreviewed Safety Question, per 10CFR50.59. Public Service Electric and Gas (PSE&G) submitted an Emergency License Amendment to the Operating

DESCRIPTION OF OCCURRENCE: (cont'd)

License (for both Salem Units) to address the postulated RCS single failure.

ANALYSIS OF OCCURRENCE:

The RCS {AA} is used to withdraw control rods for reactor startup and to control reactor power during power operation. It consists of one Logic Cabinet, five Power Cabinets, and one Direct Current (DC) Hold Cabinet:

The Logic Cabinet translates manually initiated or automatic commands into signals required by the Power Cabinets to step the banks of Shutdown and Control rod assemblies. This cabinet contains power supply assemblies and processes logic commands required for rod movements.

The Power Cabinets provide DC power pulses to drive the Control Rod Drive Mechanisms (CRDMs) by converting three-phase alternating current (AC) power to DC power and applying it to the CRDM magnetic coils.

The DC Hold Cabinet is used to supply power to the stationary gripper coils of one group when required by Power Cabinet maintenance.

Westinghouse was contracted for full RCS refurbishment service during the Unit 2 seventh refueling/maintenance outage to avoid aging-related RCS circuit card failures. Westinghouse supervised removal and testing of RCS logic cabinet and power cabinet printed circuit cards,and their return to service. Numerous card problems were repaired, including suspect solder joints, arced and pitted terminals, and bad resistors.

On May 25, 1993, the PSE&G Controls Group satisfactorily completed Individual Rod Position Indication (IRPI) calibrations and Control Rod Drop testing. At 2300 hours (same day), following completion of prerequisite testing, initial Reactor startup commenced. After encountering various RCS card failures, all control rods were inserted. The cards were replaced or repaired, card edge connectors adjusted, and rod testing was completed satisfactorily. It was during these repairs to the RCS that pin No. 4 of the relay driver was repaired.

On May 27, 1993 at 1837 hours, Reactor startup commenced. At 1844 hours, when Shutdown Bank A was withdrawn to 20 steps, the Individual Rod Position Indicators (IRPIs) did not indicate rod movement. A rod insertion signal was applied to the bank. As the group step counter indication decreased from 20 to 0 steps, the IRPI for rod 1SA3 indicated a rod withdrawal to 15 steps. The position of 1SA3 was verified and rod control power fuses were removed to reinsert

ANALYSIS OF OCCURRENCE: (cont'd)

(drop) the rod. Troubleshooting revealed the withdrawal of 1SA3 RCCAwas caused by failure of integrated circuit chips on two RCS slave cycler decoder cards. This failure resulted in inappropriate current orders being supplied to and simultaneously energizing the RCCA lift, movable, and stationary coils of all eight rods in Shutdown Bank A. The sequence of these current orders was such that the most probable result would be outward rod motion for all rods in the bank. However, only 1SA3 withdrew. The two logic cards (slave cycler decoders) were replaced with new, tested cards.

On May 28, 1993, a functional check of the Logic Cabinet was satisfactorily completed. In addition, a recorder was connected to monitor the RCS 15 VDC power supplies. Station management obtained Westinghouse assurance that the May 27th withdrawal of 1SA3 had not damaged the rod control rod drive mechanism. Post-maintenance and operability testing confirmed that the RCS was ready for Reactor start-up, which commenced at 1512 hours. At 1812 hours, Control Bank C, Group 1 rods dropped and the reactor was tripped manually. of defective firing orders on an RCS firing circuitry card due to an intermittent component failure. The reactor trip of May 28, 1993 is reported in LER 311/93-007-00.

On June 2, 1993, at 2053 hours, following satisfactory RCS post-maintenance testing and Operations surveillance testing, a Reactor startup commenced. At 2338 hours (same day) a Pulse to Analog (P/A) converter read zero for Control Rod Banks B and D. Troubleshooting revealed a faulty supervisory data logging card with a failed integrated circuit chip and at 0347 hours (next day) all control rods were fully inserted. These problems were resolved and on June 3, 1993 at 0620 hours, a Reactor start-up commenced and at 1359 hours criticality was achieved.

On June 4, 1993, at approximately 1700 hours, it was determined that a design basis concern exists where a single RCS failure could result in the withdrawal of a single RCCA. This resulted in an Unreviewed Safety Question in accordance with 10CFR50.59. At 1705 hours, a Unit 2 reactor shutdown commenced and at 1734 hours the reactor trip breakers were opened. The Unit was stabilized in MODE 3. This event is reportable in accordance with 10CFR50.73(a)(2)(v)(A).

A Unit 1 Justification for Continued Operation (JCO) with the RCS in manual control was provided to the NRC for review (reference letter evaluation S-C-RCS-EEE-0819 dated June 8, 1993). Following a reactor trip on June 8, 1993, Unit 1 was subsequently maintained in MODE 3 (Hot Standby) pending resolution of the design basis concern. The Unit 1 reactor trip is being reported in a separate LER. On June 20, 1993, following restart authorization, Unit 1 was subsequently synchronized to the grid.

APPARENT CAUSE OF OCCURRENCE:

The apparent root cause of the postulated RCS single failure design basis concern is "Design, Manufacturing, Construction/Installation" inadequacy, as per NUREG-1022. Subsequent testing and evaluation has demonstrated that failure of one slave cycler decoder card of an RCCA in conjunction with a rod motion command signal may cause an unplanned RCCA withdrawal.

1SA3 withdrew due to failure of integrated circuit chips on the 22AC and 22BD slave cycler decoder cards {AA/ECBD}. This resulted in inappropriate current orders being supplied to the RCCA operating coils causing the rod lift, movable, and stationary coils to energize at the same time. Although the current orders produced did not replicate those required for a normal rod withdrawal, the form of the resulting current orders was such that the most probable result would be outward rod motion. However, only 1SA3 withdrew. The reason why only 1SA3 withdrew has been attributed to manufacturing tolerances. The Westinghouse Owners Group is continuing to pursue resolution of this issue.

Failure of the integrated circuit (IC) chips resulted from the relay driver circuit card not making electrical contact with the surge suppression diode in the circuit. This allowed the back electromagnetic field from the RCS step counters to apply voltage transients to the components of the Logic Cabinet's circuit cards which caused failure of the cards' IC chips. The poor electrical connection was caused by a spread pin on the logic card connector. The diodes suppress counter-electromotive force (CEMF) from the collapsing field coil of the group step demand indicators

PRIOR OCCURRENCES:

This is the first occurrence of a single control rod withdrawal at either Salem Unit.

SAFETY SIGNIFICANCE:

This event did not affect the health and safety of the public. The current Licensing basis, as described in UFSAR sections 4.3 and 15.3.5, assumes that only multiple failures would cause the withdrawal of a single Rod Cluster Control Assembly (RCCA). PSE&G now considers this event as an American Nuclear Standards Institute (ANSI) Condition II "FAULTS OF MODERATE FREQUENCY" event rather than a Condition III "INFREQUENT FAULTS" event. The Amendment/JCO issued June 17, 1993, discusses this in detail.

For the current fuel cycles on each unit, analysis indicates two adjacent rods withdrawn from Control Rod Bank D (one from each group) is more limiting than one rod withdrawn from Control Bank D, which is addressed by UFSAR section 15.3.5. This increase in probability

SAFETY SIGNIFICANCE: (cont'd)

resulted in an Unreviewed Safety Question, in accordance with 10CFR50.59. However, by taking credit for the available generic thermal margins, the Departure from Nucleate Boiling Ratio (DNBR) limit is still met. On June 17, 1993, Public Service Electric and Gas Company (PSE&G), requested an Emergency Amendment to the Operating License, for both Salem Units, to address the potential RCS single failure analysis.

CORRECTIVE ACTION:

On June 17, 1993, Public Service Electric and Gas Company (PSE&G), requested an Emergency License Amendment to the Operating License/Justification for Continued Operation, for both Salem Units, to address the postulated RCS single failure (reference NLR-N93098).

The RCS Logic Cabinet slave cycler stationary decoder card, Westinghouse Part No. 3359C62G02, and the slave cycler movable card, Westinghouse Part No. 3359C62G03, were replaced to restore operability of rod 1SA3.

Additional suppression diodes were installed on the group step demand indicators (the source of the CEMF) of the RCS circuitry of each Unit. This action eliminates the consequences of an open or bad connection on the relay driver circuit card connector pin no. 4.

All RCS logic cards on Unit 2 were replaced and satisfactorily tested. In addition, all RCS Power Cabinet cards were pulled, visually inspected, and satisfactorily retested.

Additional immediate corrective actions to this event, as committed to on June 18, 1993 in a meeting at NRC Region I, have been implemented.

PSE&G Nuclear Fuels will incorporate this new Condition II event into the fuel reload safety analysis for each unit.

The UFSAR will be reviewed and revised as appropriate in reference to this event.

Recommendations resulting from the Westinghouse Owners Group evaluation of this event will be evaluated.

General Manager -
Salem Operations

MJPJ:pc
SORC Mtg. 93-061