U. S. NUCLEAR REGULATORY COMMISSION
REGION I

REPORT/DOCKET NOS. 50-272/92-81
50-311/92-81

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

INSPECTION DATES: December 14-23, 1992

INSPECTORS: Leonard Cheung, Sr. Reactor Engineer, DRS
Robert A. Spence, Reactor Systems Engineer, AEOD
Jose Ibarra, Sr. I&C Engineer, AEOD
John Calvert, Reactor Engineer, DRS
Allison Pelletier, Project Engineer, NRR
Craig Gordon, Sr. Emergency Preparedness Specialist, DRSS

TEAM LEADER: W. H. Ruland — 1/26/93
W. H. Ruland, Chief, Electrical Section, Engineering Branch, DRS — Date

APPROVED BY: Jacque P. Durr — 1/27/93
Jacque P. Durr, Chief, Engineering Branch, Division of Reactor Safety — Date

Areas Inspected: An Augmented Inspection Team (AIT) consisting of personnel from Region I, AEOD, and NRR inspected those areas necessary to ascertain the facts and determine probable cause(s) of the December 13, 1992, Salem Unit 2 event involving the loss of overhead annunciators for approximately 1½ hours. The team also evaluated the licensee's response, including assessment of emergency conditions and corrective actions.

Results: See Executive Summary

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ACRONYMS AND INITIALISMS

ARP	Annunciator Response Procedure
CCW	closed-cooling water
CFR	code of federal regulations
CPU	central processing unit
CRT	cathode ray tube
DCP	design change package
EAL	emergency action level
ECG	emergency classification guide
GM-SO	General Manager - Salem Operator
HED	human engineering deficiency
I&C	Instrumentation and Control
INPO	Institute of Nuclear Plant Operations
mV	millivolt
NCO	nuclear control operator
NI	nuclear instrumentation
NRPDS	Nuclear Reliability Plant Data System
NSS	nuclear shift supervisor
OHA	overhead annunciator system
P-250	plant process computer
PM	preventative maintenance
PROM	programmable read only memory
PSE&G	Public Service Electric and Gas
RAM	random access memory
RCP	reactor coolant pump
RCW	remote configuration workstation program
RCWS	remote configuration workstation
RHR	residual heat removal
RP	reactor protection
RPS	reactor protection system
RMS	radiation monitoring computer system
RVLIS	Reactor Vessel Level Indication System
SE	safety evaluation
SE	safety engineer
SER	sequential events recorder
SERT	Significant Event Review Team
SNSS	senior nuclear shift supervisor
SORC	site operating review committee
SOER	Significant Operating Event Report
SPDS	safety parameter display system
STA	Shift Technical Advisor
TAS	temporary annunciator system
TS	technical specification
WO	work order

EXECUTIVE SUMMARY

NRC established an Augmented Inspection Team (AIT) on December 14, 1992, after Salem Unit 2 lost all control room overhead annunciators without the operators' knowledge. The team's charter required detailed fact-finding, identification of root causes, and review of licensee performance.

The team concluded that the loss of overhead annunciators, for about 1½ hours on December 13, 1992, was most likely caused by a member of the operating shift making the wrong key strokes on a computer workstation for the system. These key strokes, coupled with a panel switch in the wrong position, put the annunciator system computer in a mode such that it was waiting for additional commands that never came. This prevented the annunciator system from displaying alarms in the control room. The team could not conclusively establish which individual made the keystrokes or whether those actions were inadvertent or intentional.

The loss of annunciators and failure to recognize that loss for 90 minutes had several root causes. The multi-microprocessor overhead annunciator system that was recently installed failed to provide the necessary human-machine interface. The system design also gave higher priority to other actions besides providing alarm indications to the operators and did not provide indication of failure. Finally, operators were not trained to routinely verify proper system operation.

The team found that there were no safety consequences due to the loss of the overhead annunciators. However, the undetected loss of the overhead annunciator system could delay operator response or increase the likelihood of errors while responding to abnormal plant conditions. Further, the team was concerned about the failure of operators to abide by station operating practices when they tried to use password-protected software.

The team found that PSE&G performed little software review of the overhead annunciator modification. Once the annunciator system was installed, staff knowledge of the system was inadequate. A lack of training on the system was a prime contributor to that inadequacy.

In the emergency preparedness area, the team found that the plant conditions existed for an Alert declaration until shortly after discovery that the annunciators were lost, and that this Alert condition was terminated before its classification and reporting were practicable. We also found that, because the annunciators were promptly restored upon discovery of their loss, an Alert level activation of your emergency response organization was not then needed to assure plant or public safety. Operators were trained to view the annunciator loss from time of discovery when implementing emergency procedures.

The plant operating staff delayed informing their management of the event. PSE&G made a 1-hour non-emergency notification to the NRC more than 18 hours after the event. Senior licensee management, the NRC, and State and local officials were not notified of an event that may have met the classification criteria until well after the event.

The team found that PSE&G did not have a loss-of-annunciator procedure. Also, simulator training was not conducted on loss of annunciators. However, during a simulator demonstration, operators responded well to several events without the overhead annunciators.