



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

Salem Generating Station

April 13, 1988

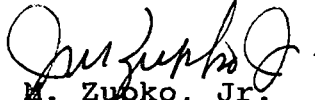
U. S. Nuclear Regulatory Commission
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Dear Sir:

SALEM GENERATING STATION
LICENSE NO. DPR-70
DOCKET NO. 50-272
UNIT NO. 1
SPECIAL REPORT 87-10

This Special Report addresses the circumstances surrounding the flooding of Number 1 Service Water Bay. This report is being submitted for information only.

Sincerely yours,


J. W. Zupko, Jr.
General Manager-
Salem Operations

MJP:pc

Distribution

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SPECIAL REPORT NUMBER 87-10

PLANT IDENTIFICATION

Salem Generating Station - Unit 1
Public Service Electric & Gas Company
Hancock's Bridge, New Jersey 08038

IDENTIFICATION OF OCCURRENCE:

NUMBER 1 SERVICE WATER BAY FLOODING DUE TO EQUIPMENT FAILURE

Event Date(s): 12/22/87

Report Date: 4/13/88

This report was initiated by Incident Report No. 87-501

CONDITIONS PRIOR TO OCCURRENCE:

Mode 5 - Reactor Power 0% - Unit Load 0 MWe

DESCRIPTION OF OCCURRENCE:

Initial Conditions

Unit #1 was shutdown in Mode 5 for a refueling outage. The #11 Nuclear Service Water Header was isolated and tagged for repair work on valves 11SW305, 11SW49, and 11SW23. Service Water to the turbine building was partially isolated by valves 11SW20, 1SW26, and 13SW20. The ST-1 valve located in the turbine building had been removed and a blank flange was installed but was loose. A blank flange was also installed on the downstream side of 11SW5 but was also loose. Both flanges were originally installed for the 10 year ISI hydro (completed satisfactorily) however they were left on but loose to provide a leak path while a 3" line upstream of 1SW27 was being repaired. The #12 Nuclear Service Water Header and #13 Service Water Pump were in service. The Service Water Sump Pump and high level alarm were functioning properly in Bay #1. See Attachment I for simplified schematic.

DESCRIPTION OF OCCURRENCE: (Cont'd)Sequence of Events (12-22-87)

- 1600-1830 - #11, 13, 14, 15 and 16 Service Water Pumps were tested satisfactorily in accordance with SP(0)4.3.2.1.3 Rev. 7 (#12 Service Water Pump motor was uncoupled for maintenance).
- 1830 - All Service Water Pumps were taken out of service except #13 which supplied water to #12 Nuclear Service Water Header.
- 1910-1922 - Operator checks Service Water Bay #1. No flooding condition noted.
- 1937 - #15 "Turbine Area Sump Pump Alarm".
- 1949 - #14 "Turbine Area Sump Pump Alarm".

NOTE: Control Room operators dispatched Unit #1 Secondary operator to investigate second Turbine Area Sump Pump Alarm. Secondary operator found loose blank flange upstream of ST-1 in the turbine building leaking, and returned to report the condition at about the time the Service Water Bay was reported flooding by the Fire Watch.

- 1958 - #13 "Turbine Area Sump Pump Alarm".
NOTE: Operator in area as noted above.
- 2001 - #11 "Turbine Area Sump Pump Alarm".
- 2014 - Fire Watch enters Service Water Bay #1 for 17 seconds; reports bay flooding.
- 2022 - Operator enters Bay #1 for 11 seconds. Reports to Control Room that #1 Bay is flooding.
- 2025 - Started #15 Service Water Pump and stopped #13 Service Water Pump.
- 2025 - Shut #11SW17 and 12SW17 (cross connect between #11 and #12 Nuclear Service Water Headers). (Water level 1 foot below motors' base.)

DESCRIPTION OF OCCURRENCE: (Cont'd)

- 2110 - Moved 600 GPM Sump Pump from Bay #3 to Bay #1
(Water level 1 foot up on the motors).
- 2115 - 600 GPM sump pump was operating, but could not keep up with the water flowing in.
- 2130 - Tried to manually seat valve #13SW20 (electrically isolated) but all attempts failed. (Water level up to the top of the Service Water Motors.)
- 2147 - #13 "Turbine Area Sump Pump Alarm".
- 2153 - #13 "Turbine Area Sump Pump Alarm".
- 2159 - #13 "Turbine Area Sump Pump Alarm".
- 2214 - #14 "Turbine Area Sump Pump Alarm".
- 2221 - #15 "Turbine Area Sump Pump Alarm".
- 2230 - Installed 2000 GPM Sump Pump into Bay #1. (Water level is 1 foot from the top of the 18' ceiling-- about 144,000 gallons.) NOTE: Water level begins to decrease at about 1' per 10 minutes.
- 2237 - #11 "Turbine Area Sump Pump Alarm".
- 2240 - #13 "Turbine Area Sump Pump Alarm".

(12/23/87)

- 0037 - Level of the water in #1 Service Water Bay is about 10" deep. Some of the water was directed to Turbine Building via the piping normally connected to the removed ST-1 valve. Water leaked into the Unit #1 Cardox Room through an electrical conduit. Incoming water was directed out of the Cardox Room and into floor drains located by the seal injection filter. This leakage did not enter any of the Diesel Generator Rooms. Additionally, the leak from the 3" connection up stream of the 1SW27 valve sprayed into the ventilation system which resulted in water on the floor of the motor control center.

DESCRIPTION OF OCCURRENCE: (Cont'd)

0400 - In-leakage of #1 Service Water Bay controlled upon installation of a damaged control plug in the 3" open ended pipe.

(12/31/87)

AM - Inspected 1SW26 valve internals following removal of expansion joint. Found that the valve had rotated past its seat and was partially open.

PM - The valve was repositioned to the shut position.

PM - Boundary valve 13SW20 failed due to the partial disengagement of the rubber seat from the valve body. This was due to the corrosion of the valve body which was caused by separation of the rubber liner of the valve body.

1750 - Hydro tested valve 1SW26 satisfactorily to 230 psig for 20 minutes. Zero leakage.

(1/1/88)

PM - Replaced valve 13SW20 with a new valve.

(1/2/88)

AM - Maintenance conducted Limitorque Maintenance Surveillance and Testing on valve 13SW20 satisfactorily.

AM - Operations conducted exercise test and stroke time on valve 13SW20 satisfactorily.

APPARENT CAUSE OF OCCURRENCE:

The root cause of this incident is attributed to an equipment malfunction. The equipment is a 30" butterfly valve manufactured by Pratt Corp. The disengagement of the rubber seat was due to the corrosion of the valve body. The valve body corroded due to the failure of the rubber liner.

ANALYSIS OF OCCURRENCE:

Boundary valve 13SW20 failed due to the partial disengagement of the rubber seat from the valve body. This was due to the corrosion of the valve body which was caused by separation of the rubber liner of the valve body.

ANALYSIS OF OCCURRENCE: (Cont'd)

Boundary valve 1SW26 was partially open, though the Limitorque Operator position indicated that the valve was closed.

The blank flanges installed downstream of 11SW5 and upstream of 1ST-1 should not have been loose. These blank flange installations were outside Administrative Procedure 13, "Temporary Modification Control Program."

CORRECTIVE ACTION:

1. An evaluation was performed to determine the leakage tolerances for the Service Water Turbine Header Isolation Valves and the feasibility of leak rate testing these valves. The most limiting mode for pump flow is the recirculation phase of Emergency Core Cooling System (ECCS). The total flow for this phase establishes the service water pump design capacity of approximately 10,875 GPM. The evaluation conclusively establishes that a flow margin of 2,550 GPM exists.

Leak rate testing is generally reserved for applications where leakage is critical and specifically required by technical specifications, such as containment isolation valves. Since there is significant flow margin available in the Salem Service Water System the current periodic stroke testing and maintenance inspections are adequate to ensure the proper function of these valves.

2. An analysis of the root cause of the failure of the 13SW20 valve was performed by PSE&G Research Corporation. The valve body castings contained pitting corrosion on the inside surface to a maximum depth of 5/32 inches or 15.6% of the valve body wall thickness. The pitting corrosion occurred in areas where the inner rubber coating had been ruptured. The pits were formed by chloride attack. The chemical analysis identified a trace of corrosive chlorine in the scale removed from the pitted area. The rubber liner contained the corrosives sulphur and chlorine. Previous maintenance activities were not contributing factors to the failure of this valve.
3. Maintenance Procedure M3L is in the process of being revised to verify that actual butterfly position agrees with the Limitorque Operator position. The procedure revision will be issued prior to being used again.

CORRECTIVE ACTION: (Cont'd)

4. The twelve remaining safety-related Pratt butterfly valves in both unit's service water system, located in intake structure will be replaced with soft seat Jamesbury Type 815L Model A valves of aluminum-bronze body and disc. This will be accomplished under Design Change Requests 1EC-2202 and 2EC-2203. The new valves do not need liners due to their improved corrosion resistance. A tefzel soft seal is mechanically held in place with a socket head cap screw arrangement.



General Manager - Salem
Operations

MG/TW/DAP/RJD
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SORC Mtg. 88-024

