

June 2, 2003

Mr. Roy A. Anderson
President & Chief Nuclear Officer
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Post Office Box 236
Hancocks Bridge, NJ 08036

SUBJECT: SALEM NUCLEAR GENERATING STATION, UNIT NOS. 1 AND 2 -
CORRECTION TO THE SAFETY EVALUATION RELATING TO GENERIC
LETTER 96-06 (TAC NOS. M96860 AND M96861)

Dear Mr. Anderson:

In a letter dated June 23, 1999, the U.S. Nuclear Regulatory Commission (NRC) issued a Safety Evaluation (SE) documenting the NRC staff's review of PSEG Nuclear, LLC's (then the Public Service Electric and Gas Company) response to Generic Letter 96-06, "Assurance of Equipment Operability and Containment Integrity During Design Basis Accident Conditions." Unfortunately, Page 2 to the SE was not included in the distribution of the original and copies of the June 23, 1999, letter. Therefore, the NRC is providing a duplicate original copy of the SE for your records. We are sorry for any inconvenience this may have caused.

Sincerely,

/RA/

Robert J. Fretz, Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-272 and 50-311

Enclosure: Safety Evaluation

cc w/enclosure: See next page

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Office of Nuclear Reactor Regulation

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Enclosure: Exemption

cc w/enclosure: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
LICENSEE RESPONSE TO GENERIC LETTER 96-06, "ASSURANCE OF EQUIPMENT
OPERABILITY AND CONTAINMENT INTEGRITY DURING DESIGN BASIS
ACCIDENT CONDITIONS"
SALEM NUCLEAR GENERATING STATION, UNIT NOS. 1 AND 2
DOCKET NOS. 50-272 AND 50-311

1.0 INTRODUCTION

On September 30, 1996, the U.S. Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design Basis Accident Conditions," to request that licensees take certain actions to evaluate (1) piping systems that penetrate containment for potential overpressurization due to heatup and expansion of fluid during normal operation and accident conditions and (2) cooling water systems that serve containment air coolers to assure that these components are not vulnerable to waterhammer and two-phase flow conditions during accident conditions.

In a letter dated January 28, 1997, as supplemented on October 20, 1997, and May 8, 1998, the Public Service Electric and Gas Company (the licensee) provided its response to the NRC for the Salem Nuclear Generating Station, Unit Nos. 1 and 2, regarding thermally-induced pressurization of piping runs inside of containment. In a letter dated October 25, 1996, as supplemented by letters dated December 11, 1996, January 28, March 27, April 24, June 3, and June 12, 1997, the licensee responded to the waterhammer and two-phase flow issues in a proposed amendment to the Salem Units 1 and 2 Technical Specifications (TS). Although the amendment request was approved by the NRC staff on June 19, 1997, the staff requested additional information concerning post-modification testing, two-phase flow, and the station blackout (SBO) scenario in order to complete review of the GL response. In a letter dated October 15, 1998, the licensee provided this information.

2.0 EVALUATION

2.1 Thermally-Induced Overpressurization of Piping

In its submittal of January 28, 1997, the licensee provided its screening criteria and identified fluid lines penetrating containment and potentially vulnerable to a water-solid volume subjected to an increase in pressure due to heating of trapped fluid. The licensee stated that it did not perform operability assessment of the affected penetrations of the basis that the Salem Generating Station, Unit 1, was shutdown and defueled, and the Salem Generating Station, Unit 2, was in Mode 5, Cold Shutdown, in which loss-of-coolant accident and main steam line

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break events are not credible due to limited amount of stored energy in the reactor coolant and main steam lines. The licensee committed to resolve and take corrective action by completing all evaluations, revisions to administrative procedures to drain pipe segments, and modifications by installing relief valves, as required, prior to restart of each affected unit.

In response to an NRC letter dated September 19, 1997, the licensee provided the details of resolutions and corrective actions in its submittal of October 20, 1997, and May 8, 1998. The licensee resolved the potential overpressurization in five penetrations by employing an administrative procedure to drain the affected pipe segment, and by installing relief valves in four penetrations and the two affected piping segments inside the containment. The licensee evaluated the remaining 14 penetrations and determined them to be within the design-basis code allowable stress values.

The licensee performed two sets of calculations for its evaluation of the 14 penetrations. Six of the connecting lines are containment atmospheric sensing lines which are stainless steel capillary tubes filled with silicon oil, and 6 lines are reactor vessel level sensing lines which are stainless steel capillary tubes filled with distilled water. The capillary tubing senses containment pressure or reactor vessel level through a hydraulic sensor bellows. The licensee performed one set of bounding calculations or the evaluation of all 12 capillary tubes. The licensee calculated heat transfer by convection into the capillary tubing inventory for design-basis accident conditions and determined that hydraulic sensor bellows expansion, with sufficient design margins, can accommodate the expansion of tube inventory without challenging the integrity of the capillary tubing. The licensee performed a second set of calculations for evaluating the remaining two lines, safety injection test and drain lines. The licensee determined that the stresses in the piping due to thermally-induced overpressure condition are within the design basis code allowable stress values.

2.2 Waterhammer and Two-Phase Flow Conditions

In GL 96-06, the NRC also requested licensees to evaluate cooling water systems that serve containment air coolers to assure that the systems are not vulnerable to waterhammer and two-phase flow conditions. The licensee responded to the waterhammer and two-phase flow issues for the Salem units in a proposed TS amendment dated October 25, 1996, as supplemented by letters dated December 11, 1996, January 28, March 27, April 24, June 3, and June 12, 1997. While the licensee's request was approved by the NRC in a letter dated June 19, 1997, the NRC staff required additional information in a letter dated July 1, 1998, concerning post-modification testing, two-phase flow, and the SBO scenario in order to complete its review. The licensee responded to this request in a letter dated October 15, 1998.

Based on a review of the information that was provided, the NRC staff is satisfied with the postmodification testing that was performed and the actions that were taken by the licensee to address the discrepancies that were identified. The staff is also satisfied with the licensee's evaluation of two-phase flow conditions. However, with regard to the waterhammer vulnerability associated with the SBO scenario, the staff needed clarification about how plant operators would respond to this particular situation. The licensee provided additional information about this scenario during a phone call on February 17, 1999, and the staff understands that the event scenario is very much dependent on the timing of operator actions. If the operators restore control air via the diesel-powered SBO air compressor before electrical power is restored to the vital busses, service water flow to the containment fan coolers will be isolated

before the service water pumps are energized and waterhammer will not occur. If the service water pumps are energized before control air is restored, service water will be admitted to the containment fan coolers and waterhammer is likely to occur. The licensee does not expect this waterhammer to be very severe due to the presence of nitrogen gas in the voided service water lines. The licensee also expects that control air would be restored very soon after electrical power is available and, at that point, service water to the containment fan coolers would be automatically isolated. Therefore, not interruption of service water flow to the emergency diesel generators is anticipated for this scenario. The NRC staff is satisfied with the information provided and steps taken by the licensee to address the waterhammer and two-phase flow conditions.

3.0 CONCLUSION

On the basis of this evaluation, the NRC staff finds that the licensee has performed appropriate evaluations and corrective actions to resolve the issues of potential thermally-induced overpressurization of piping systems that penetrate containment and vulnerability of cooling water systems that serve containment air coolers to waterhammer and two-phase flow conditions during accident conditions. Therefore, the NRC staff concludes that the licensee has adequately addressed the requested actions discussed in GL 96-06.

Principal Contributor: B. P. Jain
J. Tatum

Date: June 30, 1999