UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO INSERVICE TESTING PROGRAM REQUESTS FOR RELIEF

PUBLIC SERVICE ELECTRIC AND GAS COMPANY

SALEM NUCLEAR GENERATING STATION, UNITS 1 AND 2

DOCKET NOS. 50-272 AND 50-311

1.0 INTRODUCTION

The Code of Federal Regulations, 10 CFR 50.55a, requires that inservice testing (IST) of certain American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 pumps and valves be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code (the Code) and applicable addenda, except where relief has been requested and granted or proposed alternatives have been authorized by the Commission pursuant to 10 CFR 50.55a(f)(6)(i), (a)(3)(i), or (a)(3)(ii). In order to obtain authorization or relief, the licensee must demonstrate that: (1) conformance is impractical for its facility; (2) the proposed alternative provides an acceptable level of quality and safety; or (3) compliance would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. Section 50.55a(f)(4)(iv) provides that inservice tests of pumps and valves may meet the requirements set forth in subsequent editions and addenda that are incorporated by reference in 10 CFR 50.55a(b), subject to the limitations and modifications listed, and subject to Commission approval. NRC guidance contained in Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," provided alternatives to the Code requirements determined to be acceptable to the staff and authorized the use of the alternatives in Positions 1, 2, 6, 7, 9, and 10 provided the licensee follows the guidance delineated in the applicable position. When an alternative is proposed which is in accordance with GL 89-04 guidance and is documented in the IST program, no further evaluation is required; however, implementation of the alternative is subject to NRC inspection.

Section 50.55a authorizes the Commission to grant relief from ASME Code requirements or to approve proposed alternatives upon making the necessary findings. The NRC staff's findings with respect to granting or not granting the relief requested or authorizing the proposed alternative as part of the licensee's IST program are contained in this safety evaluation (SE).

Enclosure

2.0 BACKGROUND

The NRC discussed its evaluation of the IST Program (Revision 2) by Public Service Electric and Gas Company, licensee for the Salem Nuclear Generating Station, Units 1 and 2, in SEs dated October 9, 1992, and April 15, 1994. In those documents, the NRC granted relief from the ASME Section XI test frequency requirements for the following safety injection (SI) accumulator outlet check valves in Salem Units 1 and 2:

11SJ55	12SJ55	13SJ55	14SJ55
21SJ55	22SJ55	23SJ55	24SJ55
11SJ56	12SJ56	13SJ56	14SJ56
21SJ56	22SJ56	23SJ56	24SJ56

During a recent IST inspection at Salem, the NRC staff found that the licensee was using a calculation method together with a partial accumulator dump test to verify that the disk of these check valves was exercised to its full accident position. It could not be determined during the inspection whether the licensee's test method was in accordance with the guidance provided in GL 89-04, Position 1, for full flow testing of check valves. The licensee stated that non-intrusive testing during the partial accumulator dump test was used but only for preventative maintenance and not for inservice test acceptance. Therefore, the NRC staff determined that the licensee's test method did not conform to GL 89-04, Position 1, and an approved relief request was required to use the current test method. In a letter dated December 26, 1996, the licensee submitted a proposed revision to the Inservice Testing Program for Salem containing proposed Valve Relief Requests V-24 and V-25.

3.0 VALVE RELIEF REQUEST V-24

Check valves 1SJ55, 2SJ55, 3SJ55 and 4SJ55 for Units 1 and 2 (eight total check valves) are located in the discharge lines from the SI accumulators. The valves must be capable of opening during a large-break loss-of-coolant-accident (LOCA) to provide a flow path for the SI accumulator discharge to the reactor coolant system (RCS) cold legs. The valve must be capable of closure to prevent divergence of safety injection and recirculation flow after accumulator discharge. The valves also serve as RCS pressure isolation valves by preventing exposure of the SI accumulators to RCS pressure. The valves are ASME Class 1 Category AC. The licensee requests relief from the requirements to exercise these check valves at least every 3 months in Section XI, IWV-3521.

3.1 Licensee's Basis for Request

The licensee provided the following basis for the relief request:

> During power operation, these valves are maintained in the closed position by RCS pressure on the downstream side of the valve disk. Quarterly exercising these valves to the full or partially open position during power operation is impracticable because the only flow path is

into the RCS. The operating accumulator pressure cannot overcome normal operating RCS pressure to establish flow. Full stroke exercising these valves at cold shutdown is impracticable because of the potential for low temperature overpressurization due to insufficient expansion volume in the RCS to accept required flow. This testing could also result in the intrusion of nitrogen into the core which could interrupt the normal circulation of cooling water flow. Partial stroke exercising these valves going into cold shutdown is burdensome without a commensurate increase in the level of quality and safety. The associated motor-operated isolation valve (one per accumulator) cannot be partially stroked, but must complete a full stroke before changing direction. This could cause a complete discharge of the water volume in the accumulator and possibly inject nitrogen into the reactor coolant system, causing gas binding of the residual heat removal pumps and a subsequent loss of shutdown cooling. These valves are also verified to close by leak testing per plant technical specifications for Pressure Isolation Valves (PIVs). Reverse exercising these check valves at any time other than refueling is burdensome without a commensurate increase in the level of quality and safety. The valves are normally in the closed position and accumulator pressure is continuously monitored to ensure that an adequate nitrogen blanket is maintained and to verify the lack of RCS inleakage.

3.2 Proposed Alternate Testing

The licensee proposed the following:

> These check valves shall be full stroke exercised to the open position during refuelings utilizing a reduced pressure, partial accident flow test method. This controlled method is performed with the reactor vessel head removed. The test method establishes accumulator pressure between 67 and 70 psig, accumulator level between 96 and 100% and refueling cavity level between 125.5 and 126.5 feet. After establishment of the fixed parameters, the test then measures the time interval required for the pressure in the associated safety injection accumulator to drop from an initial pressure to 35 psig. Engineering calculation S-2-SJ-MDC-1394 - "Accumulator Pressure Decay during Discharge Testing" establishes the test conditions and acceptance criterion and concludes that this methodology is adequate in determining that the associated check valve disk moves to the full open position. Information from other nuclear stations was reviewed regarding partial flow, full stroke exercising using a calculational method. The testing performed at Salem provides a valid methodology for verifying the open function even though the test method differs from the various methods reviewed.
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> In attempting to utilize the guidance of NUREG 1482, Section 4.1.2 - "Exercising Check Valves with Flow and Nonintrusive Techniques," nonintrusive equipment was used during informational testing. These

valves are Darling Valve & Manufacturing Co. "Clear Waterway" swing checks that are fabricated without a backstop. The valve design permits the disk to move sufficiently out of the flow path without contacting the valve body. Nonintrusive testing using acoustic and magnetic technology provides sufficient data for monitoring degradation on a periodic basis, however, full open acoustic indication is not detected or expected to show on the test trace. Nonintrusive testing does not verify full stroke exercising, however, occasional use of this equipment during the pressure decay test provides useful condition monitoring information.

This method of forward flow check valve testing complies with the guidance provided in Generic Letter 89-04, Attachment 1, Position 1.

Regarding reverse flow exercising testing, these valves shall be verified in the closed position during the process of performing seat leakage testing at the frequency specified in Unit 1 Technical Specifications (TS) 4.4.6.3 and Unit 2 TS 4.4.7.2.2. [The licensee subsequently indicated that the Unit 1 SJ55 check valves are not listed in the Unit 1 TS, but are leakage tested in accordance with plant procedures and the licensee will request a license amendment to incorporate the valves in the Unit 1 TS before plant startup from its current outage.]

The open stroke frequency change was previously approved in an NRC safety evaluation dated April 15, 1994.

4.0 VALVE RELIEF REQUEST V-25

Check valves 1SJ56, 2SJ56, 3SJ56 and 4SJ56 for Units 1 and 2 (eight total check valves) are located in the discharge lines from the SI accumulators downstream of the branch connection from the residual heat removal (RHR) system. The valves must be capable of opening during a large break LOCA to provide a flow path for the SI accumulator discharge to the RCS cold legs. The valve must also be capable of opening to provide a path for low head safety injection and cold leg recirculation flow. The valves also serve as RCS pressure isolation valves by preventing exposure of the SI accumulators and RHR system piping to RCS pressure. The valves are ASME Class 1 Category AC. The licensee requests relief from the requirements to exercise these check valves at least every 3 months in Section XI, IWV-3521.

4.1 Licensee's Basis for Request

The licensee provided the following basis for the relief request:

During power operation, these valves are maintained in the closed position by RCS pressure on the downstream side of the valve disk. Quarterly exercising these valves to the full or partially open position during power operation is impracticable because the only flow path is into the RCS. The operating accumulator pressure cannot overcome normal operating RCS pressure to establish flow. Full stroke exercising these

valves at cold shutdown is impracticable because of the potential for low temperature overpressurization due to insufficient expansion volume in the RCS to accept required flow. This testing could also result in the intrusion of nitrogen into the core which could interrupt the normal circulation of cooling water flow. The associated motor-operated isolation valve (one per accumulator) cannot be partially stroked, but must complete a full stroke before changing direction. This could cause a complete discharge of the water volume in the accumulator and possibly inject nitrogen into the reactor coolant system, causing gas binding of the residual heat removal pumps and a subsequent loss of shutdown cooling. These valves are also verified to close by leak testing per plant technical specifications for Pressure Isolation Valves (PIVs). Reverse exercising these check valves at any time other than refueling is burdensome without a commensurate increase in the level of quality and safety.

4.2 Proposed Alternate Testing

The licensee proposed the following:

> These check valves shall be full stroke exercised to the open position during refuelings utilizing a reduced pressure, partial accident flow test method. This controlled method is performed with the reactor vessel head removed. The test method establishes accumulator pressure between 67 and 70 psig, accumulator level between 96 and 100% and refueling cavity level between 125.5 and 126.5 feet. After establishment of the fixed parameters, the test then measures the time interval required for the pressure in the associated safety injection accumulator to drop from an initial pressure to 35 psig. Engineering calculation S-2-SJ-MDC-1394 - "Accumulator Pressure Decay during Discharge Testing" establishes the test conditions and acceptance criterion and concludes that this methodology is adequate in determining that the associated check valve disk moves to the full open position. Information from other nuclear stations was reviewed regarding partial flow, full stroke exercising using a calculational method. The testing performed at Salem provides a valid methodology for verifying the open function even though the test method differs from the various methods reviewed.
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> In attempting to utilize the guidance of NUREG 1482, Section 4.1.2 - "Exercising Check Valves with Flow and Nonintrusive Techniques," nonintrusive equipment was used during informational testing. These valves are Darling Valve & Manufacturing Co. "Clear Waterway" swing checks that are fabricated without a backstop. The valve design permits the disk to move sufficiently out of the flow path without contacting the valve body. Nonintrusive testing using acoustic and magnetic technology provides sufficient data for monitoring degradation on a periodic basis, however, full open acoustic indication is not detected or expected to show on the test trace. Nonintrusive testing does not verify full stroke exercising, however, occasional use of this equipment

during the pressure decay test provides useful condition monitoring information.

The valves shall be partial stroke exercised at cold shutdown during normal RHR shutdown cooling operations.

This method of forward flow check valve testing complies with the guidance provided in Generic Letter 89-04, Attachment 1, Position 1.

Regarding reverse flow exercising testing, these valves shall be verified in the closed position during the process of performing seat leakage testing at the frequency specified in Unit 1 TS 4.4.6.3 and Unit 2 TS 4.4.7.2.2.

The open stroke frequency change was previously approved in NRC Safety Evaluation April 15, 1994.

5.0 EVALUATION

Full-stroke exercising of these check valves during power operation is not practicable because the RCS is at a higher pressure than the SI accumulators. During cold shutdowns, the RCS lacks adequate expansion volume to accommodate the required flow and a low temperature overpressure condition could result. These valves could only be full-stroke exercised quarterly or during cold shutdowns if extensive system modifications were performed, such as installing full-flow test loops. Therefore, imposing the code requirements on the licensee would be a hardship.

The licensee has proposed to use a pressure-decay method to verify that the accumulator discharge check valves have been exercised to their accident condition at a flow lower than the accident flow rate. The NRC staff has approved use of a combination of test and analyses in meeting the intent of the ASME Code requirements for similar check valve applications at Beaver Valley and Fort Calhoun. A preliminary review of the relief request submitted by the Salem licensee indicates that the proposed alternate test method of performing an accumulator dump test to the reactor vessel for a specified period of time is similar to methods used by other licensees.

The licensee will conduct stroke exercising of these check valves as part of its reduced pressure and flow test method during the current refueling outage. The licensee also verifies the closed position of the check valves as part of leak testing in accordance with plant procedures. The proposed testing provides reasonable assurance of operational readiness during the interim period because 1) a flow test is being conducted at a refueling outage frequency at significant flow rates providing indication of a partial-flow test; 2) similar test methods are being employed by other licensees to demonstrate the full-stroke exercise of the accumulator discharge check valves; 3) leakage testing is being performed to verify the closure function

of the check valves; and 4) non-intrusive test techniques are used by the licensee to provide additional information not required by the Code to monitor the condition of the valve.

Salem is using a pressure decay test within a certain time period to verify the full-stroke open exercise of each check valve. The other plants are using flow and pressure data from a fixed-period accumulator dump test to calculate a flow coefficient for each check valve to verify the correct check valve position. In principle, this type of test provides an acceptable approach to verify full stroke open exercise of the check valves, however, the conclusions reached for the other plants cannot be directly applied to the Salem test methodology. Since this review will be potentially lengthy, interim relief is required until a more detailed review of the Salem method is performed. In the event that this detailed review identifies a need for any conditions or limitations on the method proposed by Salem, they will be identified to the licensee prior to the next refueling outage. The licensee must amend the IST program to identify the leak testing of these valves during each cold shutdown as a verification of valve closure.

6.0 CONCLUSION

Based on the determination that the Code-required testing would result in hardship without a compensating increase in the level of quality and safety, and considering the proposed alternative, interim relief of Valve Relief Requests V-24 and V-25 is granted pursuant to 10 CFR 50.55a(a)(3)(ii) from the exercising requirements of Section XI as requested. The interim period will conclude prior to the licensee's next refueling outage. During the interim period, the NRC will complete a detailed evaluation of the licensee's exercising methodology and in the event that this detailed review identifies a need for any conditions or limitations on the method proposed by the Salem licensee, they will be identified prior to the next refueling outage.

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