Public Service
Electric and Gas
Company

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DEC 22 1994

NLR-N94193

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

ASME CODE CASE N-514
SALEM GENERATING STATION UNIT NOS. 1 & 2
FACILITY OPERATING LICENSE NOS. DPR-70 & DPR-75
DOCKET NOS. 50-272 & 50-311

Public Service Electric and Gas Company (PSE&G) requests, in accordance with the requirements of 10CFR50.55a(a)(3), approval to utilize American Society Of Mechanical Engineers (ASME) Code Case N-514, "Low Temperature Overpressure Protection," for Salem Generating Station Unit Nos. 1 and 2. This letter also requests, in accordance with 10CFR50.12, "Specific Exemptions," an exemption from certain requirements of 10CFR50.60.

10CFR50.60 states that all nuclear power reactors shall meet the fracture toughness and material surveillance program requirements for the reactor coolant pressure boundary as set forth in Appendix G and H of 10CFR50. Proposed alternatives to the requirements of 10CFR50.60 requires approval by the NRC in accordance with 10CFR50.12. The purpose of this letter is to request approval of Code Case N-514 which allows exceedance of the Pressure/Temperature (P/T) limits calculated in accordance with the requirements of 10CFR50, Appendix G by 10%. This additional 10% margin will increase the P/T limits operating margin for the Pressurizer Overpressure Protection System (POPS) during Low Temperature Overpressure Protection (LTOP) conditions.

This letter also addresses nonconservatisms recently identified in the POPS analysis. The initial POPS analysis for the mass addition transient did not account for (a) the differential pressure between the mid-plane of the core and the location of the pressure sensors located at the Reactor Coolant System hot legs with the reactor coolant pumps in operation, and (b) operation of the Positive Displacement Charging Pump following initiation of a Safety Injection signal.

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A detailed discussion of the basis for the request, and technical justification for the exemption in accordance with 10CFR50.12 and 10CFR50.55a(a)3 is provided in Attachment 1.

Procedural controls currently in place for Salem Units 1 and 2 to ensure that the Technical Specification P/T limits are not exceeded due to injection of an Intermediate Head SI pump are outlined in Attachment 2. These administrative controls were discussed with the NRC in a telecon on December 16, 1994, and provided to the NRC in Letter NLR-N94229 dated December 16, 1994. These controls will remain in place until receipt of Code Case N-514 approval.

The calculations completed by PSE&G that revised the POPS analysis bases as discussed in the Attachment 1 request are contained in Attachment 3.

It is noted that the NRC has issued an exemption to Duke Power for operation of McGuire 1/2 in accordance with 10CFR50.60 by allowing the application of ASME Code Case N-514.

Should you have any questions on this submittal, please contact us.

Sincerely,

Attachments (3)
Affidavit

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REF: NLR-N94193

STATE OF NEW JERSEY)
) SS.
COUNTY OF SALEM)

S. LaBruna, being duly sworn according to law deposes and says:

I am Vice President - Nuclear Engineering of Public Service Electric and Gas Company, and as such, I find the matters set forth in the above referenced letter, concerning Salem Generating Station Unit Nos. 1 and 2, are true to the best of my knowledge, information and belief.

S. LaBruna

Subscribed and Sworn to before me
this 22nd day of December, 1994

Kimberly Jo Brown
Notary Public of New Jersey

My Commission expires on

KIMBERLY JO BROWN
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires April 21, 1998

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ATTACHMENT 1
REQUEST FOR ASME CODE CASE N-514

BACKGROUND

The Technical Specification Pressure/Temperature (P/T) limits for plant heatup (Figure 3.4-2) and cooldown (Figure 3.4-3), which are determined in accordance with the requirements of 10CFR50, Appendix G, ensure reactor vessel integrity. The Pressurizer Overpressure Protection System (POPS) protects the Reactor Coolant System (RCS) from exceeding the Tech. Spec. limits by opening the Power Operated Relief Valves (PORV) during cold overpressure transients (RCS cold leg temperature $\leq$ 312°F). According to the existing design bases, either PORV has adequate relieving capacity to protect the RCS from overpressurization when the transient is limited to either (1) the start of an idle RCP with the secondary water temperature less than or equal to 50°F above the RCS cold leg temperature (heat addition), or (2) the start of a Safety Injection (SI) pump and resultant injection into a water solid RCS (mass addition).

The pressure limits at the low temperature end of the P/T curves are 450 and 475 psig for Salem Units 1 and 2, respectively, as read from the current heatup and cooldown curves (Tech. Spec. Figures 3.4-2 and 3.4-3, respectively). The original Salem POPS analysis calculated a maximum peak pressure for the most limiting mass addition transient of 446 psig with the PORV set at a pressure of 375 psig. In this analysis, the RCS pressure due to injection of 780 gpm flow into an initially cold water solid RCS was considered. In the limiting heat addition transient, a maximum peak pressure of 418 psig was calculated.

Westinghouse has identified in letter PSE-93-204 dated March 15, 1993 (NSAL-93-005B) a non-conservatism in the calculation for peak pressure for the heat input and mass addition transients that affects both Salem Units 1 and 2. The concern is that the difference between the wide range pressure transmitters (PT403 and PT405) elevations, which sense hot leg pressure and the reactor vessel midplane (where the Tech. Spec. heatup and cooldown pressure/temperature (P/T) limits are defined) with the reactor coolant pumps (RCP) operating was not considered in the original Salem POPS analysis. This results in encroachment on the P/T limits.

To quantify the effects on Salem, specific pressure differences associated with RCP operation have been calculated for one, two and four RCPs operating. The results of these calculations provided values of 29, 37, and 71 psig with one, two and four RCPs operating, respectively. A correction pressure of 2.0 psig

has been added to these values to account for transmitter elevation differences not previously accounted for in the calculations. As a result, procedure revisions have been implemented to limit the number of RCPs in operation to 1 while in Mode 5 (≤ 200°F). In addition, plant operating procedures require that the power supplies be removed from both Intermediate Head Safety Injection (IHSI) pumps (675 GPM) during operation in Modes 4 and 5 (< 350°F). Therefore, only the mass input from a High Head Safety Injection (HHSI) pumps (560 GPM) is considered. The net results, assuming operation of a HHSI pump and the pressure difference from operation of one RCP, are peak pressures below the specified limits in the Unit 1 and 2 P/T curves.

Following the completion of these evaluations, it was determined that the Positive Displacement Charging Pump (PDP), if already in operation, would continue to operate upon initiation of an accident signal if offsite power remains available. During this postulated event, letdown would be automatically isolated as part of the actuation. The additional flow from the PDP is a concern for the period of time when the RCS is ≤ 200°F, the PDP is in operation, and one (1) HHSI pump has its associated power supply available. Therefore, the combined flow of 665 GPM from the PDP (105 GPM) and the HHSI (560 GPM) is now considered the most limiting mass addition transient.

PSE&G has re-analyzed the mass addition event using the GOTHIC computer code assuming an actual maximum combined pump flow rate of 675 gpm. This calculation is provided in Attachment 3. The resulting peak pressure is 443 psig. After including the pressure differential due to the operation of one RCP and the 2 psig elevation correction, a peak pressure of 474 psig is established. This pressure exceeds the current limit of 450 psig for Salem Unit 1. The P/T limit of 475 psig for Unit 2 continues to be met with relatively no margin. These results are summarized in the following table:

UNIT	POPS SETPOINT (PSIG)	CALC. PEAK PRESS. (PSIG) BASED ON MASS INPUT CASE W/ 675 GPM FLOW	ΔP W/ 1 RCP RUNNING & ELEV. CORRECTION (PSIG)	CORRECTED PEAK RCS PRESSURE (PSIG)	T/S PRESS. LIMITS - HEATUP OR 20°F/HR COOLDOWN (PSIG)
S1	375	443	31	474	450
S2	375	443	31	474	475

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REQUEST FOR ASME CODE CASE N-514

For the heat addition transient (i.e., the start of an idle RCP with the secondary water temperature less than or equal to 50°F above the RCS cold leg temperature), the original peak pressure calculated was 418 psig. When the pressure differential due to the operation of one RCP (29 psi) and the 2.0 psig to correct for elevation is added, the peak pressure is 449 psig. This peak pressure remains below the POPS limits of 450 and 475 psig for Salem Units 1 and 2, respectively.

The NRC has been notified of the potential for the Unit 1 P/T limits to be exceeded based on the above in accordance with 10CFR50.72 and 10CFR50.73. As compensatory action, administrative controls ensure RHR relief valve RH3 is available by placing the associated RHR isolation valves in the open position. These actions are necessary when RCS temperature is ≤ 200°F, the PDP is in operation and a HHSI pump has power available. The relieving capacity of RH3 has been determined to slightly exceed the capacity of a single PORV at the same setpoint. A summary of the administrative controls is provided in Attachment 2.

Salem Unit 1 operating procedures limit operation to one RCP in Mode 5, require that power be removed from the IHSI pumps in Mode 4 and below, and require relief valve RH3 to be available to ensure the current P/T limits are met when RCS temperature is ≤ 200°F. Similar administrative controls for Salem Unit 2 are in place although RH3 is not needed to meet its P/T limits. However, without credit for the relieving capacity of RH3, relatively no operating margin between the current P/T limits calculated in accordance with 10CFR50, Appendix G and the peak pressure during low temperature overpressure transients exists for Salem Unit 2.

Code Case N-514 allows exceedance of the P/T limits calculated in accordance with 10CFR50, Appendix G by 10%. The application of Code Case N-514 provides sufficient margin such that the inadvertent SI actuation that results in a mass input from both a IHSI and the PDP will not result in any P/T limits being exceeded. Code Case N-514 also allows the operation of up to two RCPs when RCS temperature is ≤ 200°F, and removes the Salem Unit 1 requirement for RH3. Therefore, PSE&G requests application of the additional 10% pressure margin allowed by Code Case N-514 to address these operational restraints, and provide additional operating margin between the calculated peak pressure and the P/T limits.

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REQUEST FOR ASME CODE CASE N-514

DISCUSSION

Additional operating margin on the Tech. Spec. curves can be gained when operating with POPS (RCS cold legs ≤ 312°F) by taking credit for ASME Code Case N-514. This Code Case states that the LTOP systems shall limit the maximum pressure in the vessel to 110% of the pressure determined to satisfy Appendix G of ASME Section XI, Article G-2215. Crediting the Code Case will allow the maximum allowable pressure (Tech. Spec. P/T limits) for POPS to be increased to 495 psig and 522.5 psig for Salem Units 1 and 2, respectively. (It is noted that the contents of Code Case N-514 have been incorporated into Appendix G of Section XI of the ASME Code in the 1993 Addenda to Section XI.)

Current POPS P/T limits produce operational constraints by limiting the range available to the operator to heat-up and cooldown the plant. For example, the operating window through which the operator can heat-up and cooldown the plant is determined by the difference between the maximum allowable pressure determined from ASME Section XI, Appendix G and, the minimum allowable pressure for the reactor coolant pump seals (i.e., an RCP operating limit of 325 psig).

Also, the lowering of the POPS setpoint to account for further vessel embrittlement due to irradiation may be necessary in the future to continue to ensure that the P/T limits contained in Technical Specification Figures 3.4-2 and 3.4-3 would not be exceeded. As the reactor pressure vessel becomes more irradiated, allowable pressure determined in accordance with ASME Section XI, Appendix G, at a given temperature is lowered. This reduces the operating window for heat-up and cooldown during low temperature operation. Should the setpoint need to be lowered due to the reduction in the P/T limits, the pressure surges associated with the start of a RCP during reactor startup and during the filling and venting process that requires the "bumping" of the RCPs may result in the unnecessary opening of a POPS relief valve. The current POPS setpoint of 375 psig and the RCP operating limit of 325 psig have in the past resulted in unnecessary challenges to the POPS. Should the POPS setpoint need to be lowered, it would be expected that additional unnecessary challenges would occur.

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REQUEST FOR ASME CODE CASE N-514

The ASME Working Group on Operating Plant Criteria (WGOPC) developed code guidelines to define POPS limits that will avoid certain unnecessary operational restrictions, provide adequate margins against failures, and reduce the potential for unnecessary activation of pressure relieving devices used for POPS (PORVs). The philosophy used by the WGOPC for developing these guidelines was to ensure that the POPS limits are still below the P/T limits during normal plant operation, but allows the pressure that may occur with activation of the POPS to exceed the P/T limits by a maximum of 10% provided acceptable margins are maintained during these events. This philosophy was to protect the reactor vessel from low temperature overpressure transients and still maintain the P/T limits in the Technical Specifications applicable for normal heatup and cooldown in accordance with Appendices G to 10CFR50 and Section XI of the ASME Code.

The WGOPC applied deterministic and probabilistic analysis techniques for several different flaw locations and heat-up and cooldown rates to establish the conditions delineated by the Code Case.

For consideration, there are several conservatisms inherent in the development of the ASME Section XI, Appendix G P/T curve calculations for Salem Units 1 and 2 (Reference 1) that include:

1) The safety factor of 2 on the principal membrane (pressure) stresses.

2) A margin factor applied to RT_{NDT} in accordance with the requirements of Regulatory Guide 1.99, Revision 2 (eg., 2-sigma margins are applied in determining the adjusted reference temperature).

3) The disregarding of increased mechanical properties of the reactor vessel which accompany material embrittlement (elevated yield strength and flow stress).

4) An assumed flaw in the wall of the reactor vessel that has a depth equal to 1/4 the thickness of the vessel wall and a length equal to 1-1/2 times the vessel wall thickness. No flaws exceeding the ASME Section XI allowable flaw size for volumetric examination have been detected on either Salem Units during performance of the 10 year ISI of the reactor vessel beltline region.

5) The reference stress intensity curves defined in Section XI, Appendix G are used to bound the dynamic crack initiation and crack arrest toughness.

These conservatisms support the use of ASME Code Case N-514 to allow setting the POPS setpoint such that the Appendix G curves are not exceeded by more than 10%.

BASES FOR EXEMPTION REQUEST

The requested exemption to the regulations is authorized by law, will not represent an undue risk to public health and safety, and is consistent with the common defense and security. In accordance with the requirements of 10CFR 50.60, PSE&G believes the requested exemption meets the criteria in 10CFR50.12(a)(2) and 10CFR50.55a(a)(3) as follows.

10CFR50.12(a)(2)(ii)

Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule.

The Technical Specification bases for the current POPS setpoint is to ensure that the P/T curves calculated in accordance with Appendices G to 10CFR50 and Section XI of the ASME Code are not exceeded. ASME Code Case N-514 recognizes the conservatisms inherent in the methodology for calculating the P/T curves for heat-up and cooldown. The Code Case N-514 also recognizes that a POPS setpoint could be established which preserves the safety margins while allowing plant operation such that unnecessary opening of the POPS will be prevented. Utilizing the Code Case N-514 criteria by increasing the maximum P/T limits by 10% satisfies the underlying purpose of the ASME Code and NRC regulations while continuing to ensure an acceptable level of safety.

10CFR50.12(a)(2)(iii)

Compliance would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted, or that are significantly in excess of those incurred by others similarly situated.

Administrative restrictions on the number of RCPs that can be operated when RCS temperature is $\leq$ 200°F are currently in place to account for the delta-P from the mid-plane of the core to the

location of the pressure sensor for POPS actuation. In addition, current operating procedures require that power be removed from the IHSI pumps upon entry into Mode 4 and below to preclude the possibility of an inadvertent pump start. Relief valve RH3 is required to be available to ensure the current P/T limits are met when RCS temperature is ≤ 200°F for Salem Unit 1. Code Case N-514 allows exceedance of the P/T limits calculated in accordance with 10CFR50, Appendix G by 10%. The application of Code Case N-514 provides sufficient operating margin such that the inadvertent SI actuation that results in a mass input from both a HHSI and the PDP pump will not result in the P/T limits being exceeded. Code Case N-514 allows the operation of up to two RCPs when RCS temperature is ≤ 200°F, and removes the Salem Unit 1 requirement for RH3.

Relatively no operating margin between the current P/T limits calculated in accordance with 10CFR50, Appendix G and the peak pressure during low temperature overpressure transients exists for Salem Unit 2. Although RH3 is not required for Unit 2 to provide relieving capacity, it is foreseeable that as the P/T limits are reduced due to radiation embrittlement, RH3 may need to be credited. Therefore, the application of Code Case N-514 will provide additional margin such that future additional administrative controls for Unit 2 will not be needed.

As the reactor pressure vessel becomes further irradiated, the POPS setpoint requirements can impose significant operating burdens on the plants. As the vessel embrittlement levels are increased due to irradiation, the allowable pressure determined in accordance with ASME Section XI, Appendix G, at a given temperature is lowered. This reduces the operating window for heat-up and cooldown during low temperature operation. Again, reducing the operating window further increases the likelihood of challenges to the POPS relief valves. The guidelines contained in the Code Case for P/T limits provide acceptable margin against crack initiation and failure in reactor vessels.

10CFR50.12(a)(2)(v)

The exemption provides only temporary relief from the applicable regulation and PSE&G has made a good faith efforts to comply with the regulation.

PSE&G requests that the exemption be granted until the time that the NRC approves the Code Case for general use by the industry.

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REQUEST FOR ASME CODE CASE N-514

PSE&G is currently in compliance with the requirements of 10CFR50.60 with implementation of the administrative controls discussed above, which reflects PSE&G's good faith effort has been made to comply with the current regulation.

10CFR50.55a(a)(3)

Approval of the use of Code Case N-514 ensures an acceptable level of quality and safety, and compliance with the specified requirements of 10CFR50.55a would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

As discussed above, the Code Case provides acceptable margin against crack initiation and failure in reactor vessels. The Code Case also reduces the potential for the unnecessary opening of the POPS. Therefore, application of the Code Case for Salem Units 1 and 2 continues to ensure an acceptable level of quality and safety as discussed above in response to 10CFR50.12(a)(2)(iii).

SUMMARY

ASME Code Case N-514 allows setting the POPS setpoint such that the present Technical Specification heat-up and cooldown P/T curves in accordance with Appendices G of 10CFR50 and Section XI of the ASME Code are not exceeded by more than 10% during low temperature overpressure transients. The ASME Code Committee has concluded that Code Case N-514 provides acceptable margin against crack initiation and vessel failure. The additional 10% pressure margin allowed by Code Case N-514 removes existing operational constraints, and provides additional operating margin between the calculated peak pressure and the P/T limits. Approval of this Code Case may also reduce the potential for future unnecessary POPS actuations as the P/T limits are reduced due to vessel embrittlement. Consequently, POPS limits allowed by Code Case N-514 provides acceptable margins of safety while providing additional operational flexibility.

ATTACHMENT 1 (Cont'd)
REQUEST FOR ASME CODE CASE N-514

REFERENCES

1.WCAP-14040, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves", June, 1994.

ATTACHMENT 2
ADMINISTRATIVE ACTIONS

The following is a summary of the procedural controls currently or planned to be in place for Salem Units 1 and 2 to ensure that the Technical Specification P/T limits are not exceeded due to injection of an Intermediate Head SI pump. These administrative controls were outlined to the NRC in Letter NLR-N94229 dated December 16, 1994, and will remain in place until receipt of Code Case N-514 approval.

Salem Unit 1

IOP-6 (Hot Standby to Cold Shutdown)

When RCS temperature is less than 350°F, the electrical supplies to both Intermediate Head Safety Injection pumps are cleared and tagged. Remove lockout and close pump discharge isolation valve 1SJ135 to cold legs.

When RCS is $\leq$ 250°F, reduce the number of running RCPs to one.

IOP-2 (Cold Shutdown to Hot Standby)

A maximum of one RCP is allowed to be placed in service when RCS temperature is $\leq$ 200°F.

S1.OP-SO.RC-0001(Q) (Reactor Coolant Pump Operation)

A maximum of one RCP is allowed to be placed in service when RCS temperature is $\leq$ 200°F.

S1.OP-SO.RHR-0001(Q) (Initiating RHR)

Valves RH1 and RH2 are placed in the open position to ensure the availability Of Relief Valve RH3 when initiating RHR (< 350°F). A procedure change will be completed to ensure the administrative control of RH1 and RH2 prior to the next entry into Mode 5 ($\leq$ 200°F).

S1.OP-SO.RHR-0002(Q) (Terminating RHR)

A procedure change will be completed prior to entry into Mode 5 to add a Caution Statement to ensure RH1 and RH2 are administratively controlled and open during Mode 5 ($\leq$ 200°F).

ATTACHMENT 2 (Cont'd)
ADMINISTRATIVE ACTIONS

S1.OP-PT.SJ-0002(Q) (Safety Injection Pump Flow Test Modes 5 & 6)

Prerequisites for this procedure require RHR to be in service which ensures RH3 is available. A vent path is established through either 2 POPs, or a Safety valve is removed when in Mode 5 (≤ 200°F).

S1.OP-ST.SJ-0014(Q)/0015(Q) (Intermediate Head Cold/Hot Leg Flow Balance Verification)

A vent path is established through either 2 POPs or an equivalent vent path when in Mode 5 (≤ 200°F).

S1.OP-SO.SW-0002(Q)/0003(Q) (SWS 11/12 Nuclear Header Outage)

Should an Intermediate Head SI pump be required to be available to meet Tech. Spec. requirements for single Service Water Header operation (i.e., Tech Spec Table 3.4-3), the pump discharge isolation valves will be maintained in the closed position.

Salem Unit 2

IOP-6 (Hot Standby to Cold Shutdown)

When RCS temperature is less than 350°F, the electrical supplies to both Intermediate Head Safety Injection pumps are cleared and tagged. Remove lockout and close valve 1SJ135 SI discharge to cold legs.

When RCS is ≤ 250°F, reduce the number of running RCPs to one.

IOP-2 (Cold Shutdown to Hot Standby)

A maximum of one RCP is allowed to be placed in service when RCS temperature is ≤ 200°F.

S2.OP-SO.RC-0001(Q) (Reactor Coolant Pump Operation)

A maximum of one RCP is allowed to be placed in service when RCS temperature is ≤ 200°F.

S2.OP-PT.SJ-0002(Q) (Safety Injection Pump Flow Test Modes 5 & 6)

Prerequisites for this procedure require RHR to be in service which ensures RH3 is available. A vent path is established through either 2 POPs, or a Safety valve is removed when in Mode 5 (≤ 200°F).

ATTACHMENT 2 (Cont'd)
ADMINISTRATIVE ACTIONS

S2.OP-ST.SJ-0014(Q)/0015(Q) (Intermediate Head Cold/Hot Leg Flow Balance Verification)

A vent path is established through either 2 POPs, or an equivalent vent path when in Mode 5 (≤ 200°F).

S2.OP-SO.SW-0002(Q)/0003(Q) (SWS 21/22 Nuclear Header Outage)

Should an Intermediate Head SI pump be required to be available to meet Tech. Spec. requirements for single Service Water Header operation (i.e., Tech. Spec. Table 3.4-3), the pump discharge isolation valves will be maintained in the closed position.

ATTACHMENT 3

POPS ANALYSES USING THE GOTHIC COMPUTER CODE