UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
2100 RENAISSANCE BLVD.
KING OF PRUSSIA, PA 19406-2713

March 2, 2017

EA-16-221

Mr. Peter P. Sena, III
President and Chief Nuclear Officer
PSEG Nuclear, LLC – N09
P. O. Box 236
Hancocks Bridge, NJ 08038

SUBJECT: NRC INVESTIGATION REPORT NO. 1-2015-005 AND
INSPECTION REPORT 05000311/2017009

Dear Mr. Sena:

This letter refers to an investigation conducted by the U.S. Nuclear Regulatory Commission (NRC) Office of Investigations (OI) conducted at the PSEG Nuclear, LLC (PSEG) Salem Nuclear Generating Station, Unit 2 (Salem). The investigation, which was completed on September 29, 2016, was conducted to determine whether a senior manager deliberately failed to follow procedures during the troubleshooting of a safety-related system. Based on the evidence gathered during the OI investigation, the NRC did not substantiate that a senior manager engaged in deliberate misconduct. However, the NRC concluded that the actions of the senior manager caused PSEG to violate the Salem Technical Specifications and station procedures.

Therefore, the NRC is documenting one finding of very low safety significance (Green) in this report. The finding involved a violation of NRC requirements. The NRC is treating this violation as a non-cited violation (NCV) consistent with Section 2.3.2.a of the Enforcement Policy.

You are not required to respond to this letter. However, if you contest the violation or the significance of this NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region I; the Director, Office of Enforcement; and the NRC Resident Inspectors at Salem.

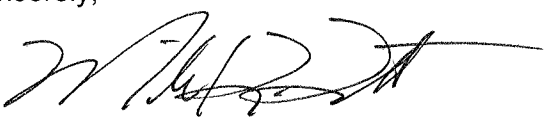
In addition, if you disagree with the cross-cutting aspect assigned in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the U. S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC, 20555-0001; with copies to the Regional Administrator, Region I, and the NRC Resident Inspectors at Salem.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at http://www.nrc.gov/reading-rm/adams.html and at the NRC Public Document Room in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Please note that final NRC investigation documents, such as the OI report described above, may be made available to the public under the Freedom of Information Act (FOIA), subject to redaction of information appropriate under the FOIA. Requests under the FOIA should be made in accordance with 10 CFR 9.23, "Requests for Records." Additional information is available on the NRC website at http://www.nrc.gov/reading-rm/foia/foia-privacy.html.

Should you have any questions regarding this letter, please contact Mr. Fred Bower at 610-337-5200.

Sincerely,



Michael L. Scott, Director
Division of Reactor Projects

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SUMMARY AND NON-CITED VIOLATION

Introduction. A self-revealing, Green NCV of TS 6.8.1, "Procedures and Programs," was identified when PSEG performed troubleshooting activities that were not in accordance with documented instructions. Specifically, PSEG operators performed mechanical agitation of the leaking boron injection tank (BIT) relief valve, 2SJ10, which was beyond the scope of the approved troubleshooting plan. As a consequence, both trains of Unit 2 high head safety injection (HHSI) system were declared inoperable, and an Unusual Event (UE) was declared for a reactor coolant system (RCS) leak greater than the 10 gallon per minute (gpm) limit allowed by the Salem technical specifications (TS).

Description. On November 23, 2015, while in Mode 3 at normal operating pressure and temperature following refueling and maintenance outage 2R21, PSEG operators noticed Unit 2 BIT pressure was 1044 psig when it was expected to be approximately 2400 psig. PSEG captured this issue in their corrective action program (CAP) under Notification 20711368. PSEG suspected the BIT relief valve may have been leaking and developed a troubleshooting plan (Notification 20711369) in accordance with MA-AA-716-004, "Conduct of Troubleshooting," Revision 12.

PSEG dayshift staff created a troubleshooting plan to determine the cause of the Unit 2 BIT pressure lowering. PSEG suspected leakage past the seat of the 2SJ10, or the BIT drain valve, 2SJ7, based on non-intrusive test data that had been obtained during the dayshift. An additional troubleshooting plan was developed for the nightshift to confirm the results of the troubleshooting plan performed during the dayshift. The nightshift troubleshooting plan specified the use of a pyrometer to measure and record temperature upstream and downstream of 2SJ10. Additionally, a sonic leak detection device was to be used to measure decibel levels upstream and downstream of the 2SJ10 relative to ambient decibel levels. PSEG data indicated slight leakage past the 2SJ10 with the BIT at approximately 830 psig. After obtaining the as-found temperature and decibel readings, the BIT inlet valve, 2SJ4, was to be "manually throttled open off its closed seat to raise BIT pressure to the shutoff head of the centrifugal charging pumps" (approximately 2400 psig). With the BIT re-pressurized, operators again measured and recorded temperatures and decibel levels, and concluded that 2SJ10 leak-by had increased.

After confirming that the 2SJ10 was leaking and beyond the guidance in the approved troubleshooting document, PSEG personnel mechanically agitated the 2SJ10 in an effort to fully re-seat the relief valve. As a result, the relief valve lifted and leakage through the 2SJ10 increased, causing RCS leakage to exceed 10 gpm and a lowering in pressurizer level which met the entry criteria for an emergency action level. The inspectors reviewed PSEG procedures and noted the following steps were applicable when considering the performance of additional actions that were outside of the troubleshooting plan:

- MA-AA-716-004, Revision 12:
  - Step 4.1.4 states "any need for changes to an approved troubleshooting plan requires that the plan be revised and reapproved. Work is to be stopped in the field until the plan is revised and reapproved."

The control room operators observed pressurizer level and charging system flowrate decrease. The operators immediately closed 2SJ4, the BIT inlet valve, performed a rapid RCS inventory balance, and estimated that a leakrate of approximately 16 gpm from the RCS had occurred. An UE was declared at 9:48 pm when PSEG determined that there had been unidentified RCS leakage greater than the TS 3.4.7.2.b limit of 10 gpm. Once control power was removed from the redundant inlet isolation valves, 2SJ4 and 2SJ5, isolating HHSI, PSEG terminated the UE at 1:00 am on November 24. The control room operators also declared both

trains of HHSI inoperable, entered Technical Specification 3.0.3, and commenced a Unit 2 cooldown to Mode 5. PSEG performed a prompt investigation to evaluate the human performance aspects associated with the troubleshooting, and determined that mechanical agitation of the 2SJ10 was not in accordance with the troubleshooting plan instructions. Corrective actions to address the human performance aspects included a site-wide communication on standards and expectations for the use of human error tools to reinforce operator fundamentals, as well as the conduct of troubleshooting. Additionally, PSEG conducted training on troubleshooting roles and responsibilities and incorporated the event into internal lessons learned and associated mitigating lessons. PSEG's corrective actions included conducting a thorough investigation and an Apparent Cause Evaluation (ACE) to further investigate the causes of the 2SJ10 leakage and the conduct of troubleshooting, and to evaluate the need for additional corrective actions.

Analysis. The inspectors determined that PSEG's performance of activities on the HHSI system that were beyond those documented in the approved troubleshooting instructions was a performance deficiency that was reasonably within PSEG's ability to foresee and correct, and should have been prevented. This finding was more than minor because it was associated with the equipment performance attribute of the Mitigating System cornerstone in Inspection Manual Chapter (IMC) 0305, "Operating Reactor Assessment Program," and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, failure to execute the troubleshooting plan as written resulted in HHSI system inoperability and adversely affected the availability, reliability, and capability of both trains of the HHSI.

This performance deficiency required a detailed risk evaluation (DRE) in accordance with IMC 0609, "Significance Determination Process," Appendix A, screening questions in Exhibit 2, "Initiating Events," because the finding affected other systems used to mitigate a loss of coolant accident (LOCA), namely high head safety injection. Specifically, due to a failure of the 2SJ10, the 2SJ4 and 2SJ5 valves were de-energized, isolating HHSI. Operators declared both trains of HHSI inoperable which resulted in a loss of the high head safety function.

The inspectors and a Region I Senior Reactor Analyst (SRA) conducted a bounding DRE and determined this finding to be of very low safety significance (Green). The leakage was determined to be sufficiently below the leak rate bounding a small break LOCA and the risk of the leak itself was considered to be minimal. The impact on the loss of HHSI system was evaluated using the Salem Standardized Plant Analysis model with both trains of HHSI out-of-service, assuming at power operations, and resulted in a core damage frequency risk increase of less than 1E-6. This was due in large part to the short exposure period of the degraded condition. Recognizing that the unit was shutdown and coming out of an outage with very little decay heat, the actual risk of core damage was considerably lower and the potential for impacts from a large early release was negligible.

In accordance with IMC 0310, "Aspects Within Cross Cutting Areas," this finding had a cross-cutting aspect in the area of Human Performance, Procedure Adherence, in that individuals did not follow processes, procedures, and work instructions. Specifically, PSEG operators in the field performed actions outside of the written instructions while performing troubleshooting activities in the field to investigate lowering pressure in the Unit 2 BIT. [H.8]

Enforcement. TS 6.8.1, "Procedures and Programs," states, in part, that "written procedures shall be established, implemented and maintained covering the applicable procedures recommended in Appendix 'A' of Regulatory Guide (RG) 1.33, Revision 2, February 1978."

RG 1.33, Section 9, "Procedures for Performing Maintenance," states, in part, that "maintenance

that can affect the performance of safety-related equipment should be properly preplanned and performed in accordance with written procedures, documented instructions, or drawings appropriate to the circumstances."

MA-AA-716-004, "Conduct of Troubleshooting," Revision 12, is one administrative procedure controlling the conduct of maintenance involving troubleshooting that can affect the performance of safety-related equipment.

Step 4.1.4 of MA-AA-716-004, states that any need for changes to an approved troubleshooting plan requires that the plan be revised and reapproved. Work is to be stopped in the field until the plan is revised and reapproved.

Contrary to the above, on November 23, 2015, PSEG did not properly implement procedures related to the performance of maintenance involving troubleshooting of a safety-related system. Specifically, while troubleshooting the Unit 2 BIT and its associated relief valve (2SJ10), PSEG personnel did not follow procedure MA-AA-716-004 when changes to the approved troubleshooting plan were implemented. The 2SJ10 relief valve was mechanically agitated in the field without stopping work in the field to revise and reapprove the documented instructions in the troubleshooting plan. Mechanically agitating the 2SJ10 relief valve outside of the documented instructions in the troubleshooting plan resulted in increased RCS leakage that exceeded the TS limit for unidentified RCS leakage and Unusual Event entry criterion and caused TS inoperability of both trains of the HHSI.

PSEG operators immediately isolated the RCS leak, and declared both trains of high head safety injection inoperable, entered TS 3.0.3, and conducted a cooldown to Mode 5. PSEG entered this in their corrective action program (CAP) as 20711368, performed a prompt investigation, and commenced an apparent cause evaluation. Because this finding was of very low safety significance and was entered into PSEG's CAP, this violation is being treated as an NCV consistent with Section 2.3.2.a of the NRC's Enforcement Policy. **(NCV 05000311/2017009-01, Failure to Follow Troubleshooting Procedure for BIT Relief Valve Leakage)**

SUPPLEMENTAL INFORMATION

LIST OF ITEMS OPENED AND CLOSED

Opened/Closed

05000311/2017009-01	NCV	Failure to Follow Troubleshooting Procedure for BIT Relief Valve Leakage