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

October 31, 2016

Mr. Peter P. Sena, III
President
PSEG Nuclear LLC - N09
P.O. Box 236
Hancocks Bridge, NJ 08038

SUBJECT: SALEM NUCLEAR GENERATING STATION, UNIT NOS. 1 AND 2 – REGULATORY AUDIT SUMMARY REGARDING LICENSE AMENDMENT REQUEST TO MODIFY CHILLED WATER SYSTEM REQUIREMENTS (CAC NOS. MF6724 AND MF6725)

Dear Mr. Sena:

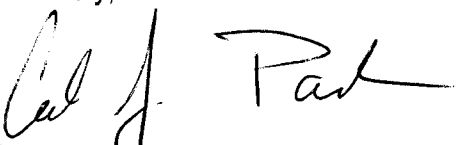
By letter dated September 11, 2015,[1] as supplemented by letters dated November 5, 2015; March 31, 2016; August 12, 2016; and August 30, 2016,[2] PSEG Nuclear LLC (the licensee) submitted a request for changes to the Salem Nuclear Generating Station (Salem), Unit Nos. 1 and 2, Technical Specifications (TSs). The requested changes would revise the TSs to support planned plant modifications to implement chiller replacements, for performing maintenance, and for unplanned operational issues.

To support its review of the license amendment request, the U.S. Nuclear Regulatory Commission (NRC) staff conducted a regulatory audit at the Salem site from May 23 to May 26, 2016, to verify information submitted by the licensee and the supporting calculations. The NRC staff completed its audit efforts from NRC headquarters in Rockville, Maryland, and conducted an exit meeting by teleconference on August 31, 2016. The regulatory audit summary is enclosed.

[1] Agencywide Documents Access and Management System (ADAMS) Accession No. ML15254A387
[2] ADAMS Accession Nos. ML15309A750, ML16091A237, ML16225A436, and ML16243A227, respectively

If you have any questions, please contact me at (301) 415-1603 or Carleen.Parker@nrc.gov.

Sincerely,



Carleen J. Parker, Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-272 and 50-311

Enclosure:
Regulatory Audit Report

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REGULATORY AUDIT SUMMARY FOR AUDIT

TO SUPPORT REVIEW OF LICENSE AMENDMENT REQUEST

TO MODIFY CHILLED WATER SYSTEM REQUIREMENTS

PSEG NUCLEAR LLC

SALEM NUCLEAR GENERATING STATION, UNIT NOS. 1 AND 2

DOCKET NOS. 50-272 AND 50-311

Background

By letter dated September 11, 2015,[1] as supplemented by letters dated November 5, 2015; March 31, 2016; August 12, 2016; and August 30, 2016,[2] PSEG Nuclear LLC (PSEG or the licensee) submitted a request for changes to the Salem Nuclear Generating Station (Salem), Unit Nos. 1 and 2, Technical Specifications (TSs). The requested changes would revise the TSs to support planned plant modifications to implement chiller replacements, for performing maintenance, and for unplanned operational issues.

Specifically, the license amendment request (LAR) proposes to add two limiting condition for operation (LCO) configurations and two surveillance requirements to TS 3/4.7.10, "Chilled Water System-Auxiliary Building Subsystem." In addition, the LAR requests a change to TS 3/4.7.6, "Control Room Emergency Air Conditioning System," to add a note limiting single control room emergency air conditioning system train alignment during the two new proposed LCO 3.7.10 configurations.

The U.S. Nuclear Regulatory Commission (NRC) staff is performing a detailed review of these proposed TS changes. Due to the complexity of the proposed TS changes, supporting calculations, and computer-based modelling, the staff determined that face-to-face interactions at the Salem site could resolve complex technical issues more quickly than several rounds of request for additional information (RAI) questions with followup responses from the licensee. Face-to-face interactions also allowed the staff to review and assess physical aspects of the LAR at the site through field walkdowns.

The NRC staff conducted the regulatory audit of the Salem chilled water system LAR in accordance with the Office of Nuclear Reactor Regulation (NRR) Office Instruction LIC-111, "Regulatory Audits," in order to gain a better understanding of the licensee's calculations and other aspects of the LAR.

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Enclosure

Audit Dates and Location

The on-site portion of the regulatory audit was held at the Salem site from May 23 to May 26, 2016. The remainder of the audit was conducted from the NRC headquarters facility located in Rockville, Maryland. An exit meeting was conducted by teleconference on August 31, 2016.

Tables 2 and 3 below show the attendance list for the entrance meeting and status briefing held on-site. Table 4 below shows the attendance list for the exit meeting.

Audit Team Members

The on-site audit team consisted of:

- Larry Wheeler, Audit Team Lead, Balance of Plant Branch Technical Reviewer
- Nicholas Hobbs, Balance of Plant Branch Technical Reviewer
- Thomas Wengert, Salem Project Manager, Plant Licensing Branch I-2

Support staff and management from NRC headquarters consisted of:

- Nageswara Karipineni, Balance of Plant Branch Technical Reviewer
- Robert Dennig, Balance of Plant Branch Chief
- Matthew Hamm, Technical Specifications Branch Technical Reviewer
- Carleen Parker, Salem Project Manager, Plant Licensing Branch I-2

Licensee staff who participated in key discussions are listed in Tables 2, 3, and 4 of this summary.

Audit Summary

The purpose of this confirmatory audit was to determine if calculations performed by PSEG for Salem support the bases for the proposed changes to the TSs. The areas of focus during the audit were the calculation methodologies, assumptions, and results used to reach conclusions in the LAR and associated RAI responses.

There were 21 items identified during the audit related to the PSEG LAR. Table 1 of this summary provides a detailed list of these items and how they were resolved. At the end of the on-site portion of the audit, the staff conducted a status briefing. At that time, many open and unresolved items existed, which included these highlights:

- GOTHIC file review
- Technical issues related to flow and temperature margins
- Format issues of proposed TS 3/4.7.10
- Proposed completion times for configurations b and c, after chiller replacement

The final exit of this audit was done by teleconference on August 31, 2016. The NRC staff exited with no open items. RAI responses (References 12 and 13 listed below) closed out eight audit open items as shown in Table 1.

In summary, the audit was very beneficial to the NRC staff's understanding of the calculations and computer-based model (GOTHIC) used in support of the LAR. The NRC staff found that the calculations adequately supported the proposed TS changes and that PSEG's calculation methodologies, assumptions, and results are reasonable, in order to reach the conclusions presented in the LAR.

References

PSEG calculations (primary focus of audit) and drawings:

1. PSEG Nuclear Calculation No. S-C-SW-MDC-1967, "Service Water System Thermal Hydraulic Model," Revision 8.

2. PSEG Nuclear Calculation No. S-C-CH-MDC-2319, "Hydraulic Evaluation of Salem Unit 1 and Unit 2 Chilled Water Systems during Reduced Chiller Availability," Revision 1.

3. PSEG Nuclear Calculation No. S-C-CH-MDC-2282, "Chiller Service Water Flow Requirements," Revision 2.

4. PSEG Nuclear Calculation No. S-C-CAV-MDC-2320, "Evaluation of the Control Area Ventilation System during Chilled Water System Chiller Replacement," Revision 1.

5. PSEG Calculation No. S-5-ZZ-MEE-1680, "Historical River Temperature Data," Revision 0.

6. PSEG Vendor Technical Document 903136(001), MPR-4027, "Salem Chilled Water System Evaluation to Support Reduction in Required Chillers," Revision 0.

7. Piping and instrumentation drawings for various related systems, including the chilled water system.

8. GOTHIC model.

9. PSEG LAR dated September 11, 2015 (ADAMS Accession No. ML15254A387).

10. PSEG LAR supplement dated November 5, 2015 (ADAMS Accession No. ML15309A750).

11. RAI response dated March 31, 2016 (ADAMS Accession No. ML16091A237).

12. RAI response dated August 12, 2016 (ADAMS Accession No. ML16225A436).

13. RAI response dated August 30, 2016 (ADAMS Accession No. ML16243A227).

Table 1: Audit Summary

Audit Item	NRC Request	PSEG Response	Resolution	RAI No.
1	Followup to RAI response #11: Are calculation bounding and include tube plugging.	Response was uploaded to SharePoint site.	Closed: Tube plugging is addressed and was evaluated in PSEG response – no negative effects to calculations.	None
2	Followup to RAI response #11: Are calculation bounding and include emergency diesel generator (EDG) frequency TS low band tolerances.	Response was uploaded to SharePoint site.	Closed: Based on 2% decrease in EDG frequency; thus, motor revolutions per minute (rpms) are reduced by 2%. Delta T is reduced by 0.2 °F. There is sufficient room temperature margin to cover this.	None
3	Followup to RAI response #11: Any concerns with Auxiliary Building Chilled Water (AB CH) pump runout with needed flow > 400 gallons per minute (gpm) (pump rated at 370 gpm).	Pump curve provided.	Closed. No issues identified with pump runout.	None
4	Followup to RAI response #13: When will all the calculations that support the new chillers be completed.	Response was uploaded to SharePoint site.	Closed: Calculations will be performed as part of the design change process with new chiller ratings of 62.5 tons. Chiller outlet temperature to be 44 °F or less.	None
5	Followup to RAI response #12: Staff's concern with using the proposed TS (configurations b and c) for operational conveniences (180-day window).	Response was uploaded to SharePoint site.	Closed to new RAI SBPB-17 to address allowed contiguous time periods for being in configurations b and c. Proposed was 60 days contiguous for configuration b and 45 days for configuration c post chiller replacement.	RAI SBPB-17
6	General concern # 6: 78.3 °F is the bounding service water temperate for November 1 - April 30. Need licencing place to list this new temperature limit, TS, TS bases, and final safety analysis report.	Response was uploaded to SharePoint site.	Closed: PSEG stated that the bounding service water (SW) temperature for chiller replacements and November 1 - April 30 configuration will be added to the updated final safety analysis report.	None

7	Followup to RAI response Cross-tie #1: Setpoint alarms for relay room and electrical room.	Main Control Room (MCR) limit of 76 °F is for comfort, for equipment qualification (EQ) limits are higher. 85 °F is the setpoint alarms for relay and equipment rooms.	Closed to new RAI SBPB-19 to address temperature margins and MCR and other areas. Calculations indicate there is ~ 26 °F temperature margin for EQ and 0.2 °F for personnel comfort.	RAI SBPB-19.
8	General concern # 8: It appears PSEG said they want the ability to use configuration c for chiller replacement in case configuration b is not working. **Question 8 and 15 are related.**	Memo states that transfer from configuration b to configuration c within 2 hours, and this includes unlocking cross-tie valves.	Closed to new RAI SBPB-18 to address chiller replacement in configuration c and the transition between configuration b to c.	RAI SBPB-18.
9a	General concern # 9a: Duration of needed repairs for being in configuration c is not well defined.	Response was uploaded to SharePoint site.	Closed to new RAI SBPB-17. Proposed to changed TS to allow 45 days of contiguous period for configuration c.	RAI SBPB-17.
9b	General concern # 9b: Subpart 4 of configuration b appears to describe a requirement; however, the single train alignment has additional actions. The TS column does not state the dual CREAC alignment has no special actions. Possible rewrite.	Response was uploaded to SharePoint site.	Closed to new RAI STSB-4 to address proposed TS formatting.	RAI STSB-4.

10	Followup to RAI response #11: Service water (SW) and AB CH pumps - Are calculations related to pump flow using TS allowance or ASME OM Code allowance. Calculations include 10% degraded pump curves.	Response was uploaded to SharePoint site.	Closed: IST minimum performance vs. calculation will be aligned for the AB CH pumps. Calculations remain valid. There are no operability issues. SW pumps IST and calculation are in alignment.	None
11	Followup to RAI response #TS-1: First of a kind TS with tables and alignment; will operators be adequately trained to this new format.	Response was uploaded to SharePoint site.	Closed: Formal training will be provided on the new chiller TS.	None
12	General concern # 12: Table 4-15, 2% SW flow margin. Explain details of recirculation and other margins.	Response was uploaded to SharePoint site. For SW – 2% margin and does not account for recirculation flow of 154 gpm. Flow margins are established in calculation and input into heat load and temperature margins.	Closed. SW flow margin described as if related to MCR comfort and not EQ. With recirculation water pumps on (68 °F) and off (80 °F) setpoints.	None
13	General concern # 13: Flow margins are part of input into heat load margins. (See ITEM A) Tables 4-17, 4-18 (0% flow margin,	Response was uploaded to SharePoint site.	Closed to new RAI SBPB-19 – general discussion on margin.	RAI SBPB-19.

	5.6% flow accident margin). Help to tie in with temperature margin.			
14	General concern #14: Proposed TS note 5 states to transition to configuration c if two of the required chillers become inoperable (for example, while in chiller replacement configuration b).	Response was uploaded to SharePoint site.	Closed to new RAI SBPB-18. PSEG plans to start with chiller replacement in configuration b, and configuration c would be a contingency configuration.	RAI SBPB-18.
15	General concern #15: It appears PSEG said it wants the ability to use configuration c for chiller replacement in case configuration b is not working. Can the station transition from b to c safely within 6 hours. Are the cross-tie valves locked closed. **Question 8 and 15 are related.**	Memo states that transition between configuration b to configuration c within 2 hours, and this includes unlocking cross-tie valves.	Closed. Transition between configuration b and c can be accomplished safely within 6 hours (2 hours needed). See response for Question 8 for more information.	None
16	General concern #16: GOTHIC executable files are needed for review.	PSEG provided disk of the GOTHIC files that support this LAR.	Closed: The NRC staff reviewed the GOTHIC files after the site visit. Followup questions: 1) Were the chilled water flow measurements taken during the heatup test? 2) Did the heatup test include verification that all the heat loads in the control room envelope are actually present at the time of the test? PSEG response: GOTHIC sensitivity was supported by two followup letters: MPR Associates Inc. letter dated 8/18/16, and Enercon letter dated 8/17/16. The NRC staff	None

			finds that the GOTHIC analysis results support this LAR and adequately define over a 25 °F margin in EQ when only two operable chillers remain for the SW conditions (November 1-April 30) with loads isolated per the proposed TS configurations.	
17	General concern #17: "CONFIGURATION" and "APPLICABILITY" are capitalized, but not defined in Salem TS	Closed to new RAI STSB #3.	Closed to new RAI STSB-3.	RAI STSB-3.
18	General concern #18: "Configuration" vs. "alignment" Consider revising between "configuration" and "alignment" in Salem TS? Ensure consistent use.	Closed to new RAI STSB #3.	Closed to new RAI STSB-3.	RAI STSB-3.
19	RAI response: Cross-tie #3 Benchmark info in GOTHIC model - questions related to room heatup. Is it based on actual loss of chiller events (January 22, 2008, and May 27, 2008).	Data from the heatup events from 2008 are not available.	Closed. Data from the heatup events from 2008 are not available. E-mail from PSEG: In followup to your questions below on the 2008 events, I had both Operations and Engineering look to see what information we had from the events, and there was no specific data recorded from either of these events beyond a recording in the Control Room (CR) narrative log of the maximum temperature during the May 2008 event (see below). However, the initial temperatures were not recorded. The maximum temperature recorded in the log below was about 60 minutes after the expansion tank level was lost. Without any specific data, there is not any useful information for benchmarking.	None

			CR at 76 °F; Equipment Room at 79 °F, and Relay Room at 81 °F. These are the highest temperatures noted during loss of all chillers.	
20	Followup to RAI response #20: Expansion tanks auto makeup not working. Is this addressed as an operator work-around.	NA	Closed: Salem NRC Senior Resident Inspector (SRI) found work order for this repair. Outside the scope of this audit – SRI to review.	None
21	General concern #21: Review correlation between all LAR tables and calculations.	Verbal response to identify the table data.	Closed. Correlation between LAR tables and calculations verified.	None

Table 2
NRC Audit - Attendees
May 24, 2016 (Site Entrance)

Larry Wheeler	NRC - NRR
Tom Wengert	NRC - NRR
Matt Hamm (by phone)	NRC - NRR
Nick Hobbs	NRC - NRR
Brian Thomas	PSEG
Justin Hargrave	PSEG
Ben Frazier	MPR Associates Inc.
Robert DeNight	PSEG
Kevin King	PSEG
Ken Knaide	PSEG
Paul Duke	PSEG
Elliot Rosenfelk	New Jersey Department of Environmental Protection
Matthew Pennington	PSEG
Jason Stajrs	PSEG
Jeffery Owad	PSEG
Patrick Martinu	PSEG
Pat Finney	NRC - SRI

Table 3
NRC Audit - Attendees
May 26, 2016 (Status Briefing)

Bob Dennig (by phone)	NRC - NRR
Andy Hon (by phone)	NRC - NRR
Larry Wheeler	NRC - NRR
Tom Wengert	NRC - NRR
Rao Karipineni (by phone)	NRC - NRR
Matt Hamm (by phone)	NRC - NRR
Nick Hobbs	NRC - NRR
Robert DeNight	PSEG
Ken Knaide	PSEG
Sam Markos	PSEG
Paul Duke	PSEG
Justin Hargrave	PSEG
Jim Barnes	PSEG
Kevin King	PSEG
Bob Garver	PSEG
Brian Thomas	PSEG
Ben Frazier	MPR Associates Inc.
Pat Finney	NRC - SRI

Table 4
NRC Audit - Attendees
August 31, 2016 (Exit; Teleconference)

Larry Wheeler	NRC - NRR
Carleen Parker	NRC - NRR
Rao Karipineni	NRC - NRR
Matt Hamm	NRC - NRR
Eric Carr	PSEG
Jason Stairs	PSEG
Jeff Owad	PSEG
Paul Duke	PSEG
Justin Hargrave	PSEG
Tom Cachaza	PSEG
Kevin King	PSEG
Brian Thomas	PSEG
Ben Frazier	MPR Associates Inc.

If you have any questions, please contact me at (301) 415-1603 or Carleen.Parker@nrc.gov.

Sincerely,

/RA/

Carleen J. Parker, Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-272 and 50-311

Enclosure:
Regulatory Audit Summary

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