



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

July 14, 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 - REQUEST FOR ADDITIONAL INFORMATION REGARDING CHILLED WATER SYSTEM MODIFICATIONS (CAC NOS. MF6724 AND MF6725)**

Dear Mr. Sena:

By letter dated September 11, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15254A387), as supplemented by letters dated November 5, 2015, and March 31, 2016 (ADAMS Accession Nos. ML15309A750 and ML16091A237, respectively), PSEG Nuclear LLC (PSEG, the licensee) submitted a license amendment request for Salem Nuclear Generating Station, Unit Nos. 1 and 2. The proposed amendment would revise the technical specifications to support planned plant modifications to implement chiller replacements and for performing maintenance on common line components.

The U.S. Nuclear Regulatory Commission staff has reviewed the licensee's application and, based upon this review, determined that additional information is needed, as set forth in the enclosed Request for Additional Information. On July 1, 2016, a draft of these questions was sent to Mr. Brian Thomas of your staff to ensure that the questions were understandable, the regulatory basis for the questions was clear, and to determine if the information was previously docketed. On July 13, 2016, Mr. Thomas indicated that PSEG will submit a response within 30 days from the date of this letter.

P. Sena

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

Sincerely,

A handwritten signature in black ink, appearing to read "Carleen J. Parker". The signature is fluid and cursive, with a long horizontal stroke at the end.

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:  
Request for Additional Information

cc w/enclosure: Distribution via Listserv

REQUEST FOR ADDITIONAL INFORMATION

CHILLED WATER SYSTEM MODIFICATIONS

PSEG NUCLEAR LLC

SALEM NUCLEAR GENERATION STATION, UNIT NOS. 1 AND 2

DOCKET NOS. 50-272 AND 50-311

By letter dated September 11, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15254A387), as supplemented by letters dated November 5, 2015 (ADAMS Accession No. ML15309A750) and March 31, 2016 (ADAMS Accession No. ML16091A237), PSEG Nuclear LLC (PSEG, the licensee) submitted a license amendment request (LAR) for Salem Nuclear Generating Station (Salem), Unit Nos. 1 and 2. The proposed amendment would revise the technical specifications (TSs) to support planned plant modifications to implement chiller replacements and for performing maintenance on common line components.

Specifically, the proposed amendment would revise TS 3/4.7.10, "Chilled Water System – Auxiliary Building Subsystem," to allow for:

- (1) planned chiller replacement (three per unit for a total of six chillers), and
- (2) maintenance on common chilled water components with operating a unit cross-tie.

In addition, the proposed amendment would revise TS 3/4.7.6, "Control Room Emergency Air Conditioning System," to add a note stating that certain alignments of the control room emergency air conditioning system (CREACS) are only permitted when in the chiller unit cross-tie configuration.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the licensee's application and, based upon this review, determined that additional information is needed, as set forth below.

**Request for Additional Information (RAI)**

**RAI SBPB-17**

Followup to RAI SBPB-12.

**BACKGROUND:**

The existing TS 3/4.7.10 ACTION allows 14 days completion time with one inoperable chiller and 72 hours completion time with two inoperable chillers for MODES 1, 2, 3, and 4. PSEG stated in its LAR, under proposed TS 3/4.7.10, that Configuration b is proposed to allow chiller replacement.

Enclosure

“Standard Technical Specifications - Westinghouse Plants: Specifications (NUREG 1431, Revision 4),” Volume 2, Bases, Limiting Condition for Operation (LCO) 3.0.2 states, in part:

The Completion Times of the Required Actions are also applicable when a system or component is removed from service intentionally. The reasons for intentionally relying on the ACTIONS include, but are not limited to, performance of Surveillances, preventive maintenance, corrective maintenance, or investigation of operational problems. Entering ACTIONS for these reasons must be done in a manner that does not compromise safety. Intentional entry into ACTIONS should not be made for operational convenience. Additionally, if intentional entry into ACTIONS would result in redundant equipment being inoperable, alternatives should be used instead. Doing so limits the time both subsystems/trains of a safety function are inoperable and limits the time conditions exist which may result in LCO 3.0.3 being entered.

ISSUE:

Over a period of time, all three safety-related chillers at Salem, Unit No. 1, will be replaced, and all three safety-related chillers at Salem, Unit No. 2, will be replaced. PSEG’s RAI response to SBPB-12 on March 31, 2016, states, in part:

The new proposed configurations (LCO 3.7.10b and LCO 3.7.10c) have significant restrictions that must be met, as outlined in the proposed applicability sections of the LCOs. Because of these restrictions, the new LCO 3.7.10b and 3.7.10c configurations will be used judiciously. From an operational standpoint, it is preferred to remain in the original LCO 3.7.10 a configuration whenever possible and practical (i.e., less likelihood that a Unit, or both Units, would need to make an unplanned transition out of the LCO, or even shutdown).

...

Originally, PSEG only explored the proposed Cross-Tied LCO (LCO 3.7.10c configuration) for the chiller replacement project (as well as the maintenance on common line components). Due to the Cross-Tie configuration restrictions required by the analysis (particularly the prohibited use of the CREACS single filtration alignment in the Cross-Tie configuration), the additional Two Chiller LCO 3.7.10b configuration was subsequently evaluated and included in the proposed TS change to allow for the necessary time, flexibility and realistic operating conditions to perform the required work. The LCO 3.7.10b configuration will initially be used to support the chiller replacements; however, use for other operating reasons is not restricted by the analysis supporting the LCO configuration.

In accordance with Standard TSs Bases 3.0.2, which focuses on plant safety, proposed Configurations b and c should only be entered for the performance of TS Surveillances, preventive maintenance, corrective maintenance, or investigation of operational problems. Entering into Configuration b and c must be done in a manner that does not compromise safety, and intentional entry into Configuration b and c should not be made for operational convenience.

An example of operational convenience includes, but is not limited to, securing equipment without a need to perform maintenance.

RAI:

Since the stated purpose of TS 3/4.7.10, Configuration b, is three per unit chiller replacements justify keeping Configuration b for future chiller maintenance following chiller replacement, beyond the existing 14-day completion time, and address the following:

- a. Establish a bounding timeframe for those maintenance activities/repairs (post-chiller replacements) and address anticipated chiller repair completion times.
- b. Based on the above, what is a reasonable allowed outage time for those maintenance activities/repairs (post-chiller replacements). If less than 180 days, justify why the additional time is appropriate.
- c. Describe how TS operational restrictions will be imposed, since the proposed TS 3/4.7.10 has an open maintenance window of approximately 180 days (November 1 to April 30).
- d. Since chiller replacement will be performed in Configuration b, provide justification for the 180-day window created by Configuration c or propose an applicability window aligned with the expected need time. Note that the NRC staff has accepted TS completion times for other chiller designs for one train out of service as follows:
  - i. 72 hours (Comanche Peak, Palo Verde, Shearon Harris, Vogtle, and Waterford)
  - ii. 7 days (Crystal River, South Texas, and Surry – less than three of five chillers for two units)
  - iii. 14 days (San Onofre and Salem)
  - iv. 30 days (Catawba, Duane Arnold, McGuire, North Anna, Oconee, and Prairie Island)

**RAI SBPB-18**

Followup to RAI SBPB-CROSS-TIE 2.

BACKGROUND:

PSEG stated by letter dated September 11, 2015, that the reason for the unit cross-tie request was to permit maintenance on common line Auxiliary Building (AB) chilled water (CH) components. Common line components are components on lines that require the removal of a single unit's chillers/pumps in order to perform maintenance. To reduce demand on the AB CH system when in the reduced equipment and cross-tied configurations, the licensee proposes to perform upgrades and maintenance during cooler portions of the year, consistent with the operating restrictions proposed for the TSs.

Proposed Note (5) for TS 3/4.7.10 states that when in the LCO 3.7.10b configuration, implement Action b.2 AND Action b.4 OR transition to the LCO 3.7.10c configuration.

PSEG's RAI SBPB-CROSS-TIE 2 response on March 31, 2016, states:

Currently, maintenance (i.e., internal inspection) or replacement on certain components and piping associated with the chillers cannot be performed without impacting multiple chiller trains (i.e., cannot be performed with existing TS) as identified below:

- The CH22/27 isolation valves, which provide chilled water isolation to each chiller. Freeze seals to isolate the CH22/27 valves have been considered in the past: however, this was ultimately deemed impossible without impacting at least two chillers simultaneously.
- Many of the CH23-26 drain valves within the boundary of the isolation valves.
- The chilled water expansion tank.
- Replacement of piping within the boundary of the chillers and chilled water pumps.

Since the cross-tie option was eliminated via Amendments 199 and 182 (ADAMS ML011720149), there has been no available option for performing the above activities.

PSEG's RAI SBPB-12 response on March 31, 2016, states, in part:

The new proposed configurations (LCO 3.7.10b and LCO 3.7.10c) have significant restrictions that must be met, as outlined in the proposed applicability sections of the LCOs. Because of these restrictions, the new LCO 3.7.10b and 3.7.10c configurations will be used judiciously. From an operational standpoint, it is preferred to remain in the original LCO 3.7.10 a configuration whenever possible and practical (i.e., less likelihood that a Unit, or both Units, would need to make an unplanned transition out of the LCO, or even shutdown).

...

Originally, PSEG only explored the proposed Cross-Tied LCO (LCO 3.7.10c configuration) for the chiller replacement project (as well as the maintenance on common line components). Due to the Cross-Tie configuration restrictions required by the analysis (particularly the prohibited use of the CREACS single filtration alignment in the Cross-Tie configuration), the additional Two Chiller LCO 3.7.10b configuration was subsequently evaluated and included in the proposed TS change to allow for the necessary time, flexibility and realistic operating conditions to perform the required work. The LCO 3.7.10b configuration will initially be used to support the chiller replacements; however, use for other operating reasons is not restricted by the analysis supporting the LCO configuration.

ISSUE:

RAI response to SBPB-CROSS-TIE 2 conflicts with TS 3/4.7.10 Note (5) since this Note allows a transition from Configuration b (used for chiller replacement) to Configuration c (used for maintenance on common components).

RAI:

Clarify if Configuration c will be used for chiller replacement. If so, address the following questions:

- a. Describe the testing planned to demonstrate that transitioning from Configuration b to c and from Configuration c to b can be safely accomplished and will accomplish chiller design conditions without exceeding design temperatures, while conducting "Loss of Unit 1/2 Control Area HVAC" in accordance with S1 (S2).OP-AB.CAV-0001(Q).
- b. Describe the time duration for this transition from Configuration b to c and if this transition can be safely achieved within 6 hours, without exceeding room design temperatures.
- c. Describe the time duration plan for being in Configuration c for chiller replacement.
- d. Describe the station's probabilistic risk assessment (PRA) risk for being in Configuration c for chiller replacement.
- e. Justify the 14-day LCO completion time is reasonable if in Configuration c while conducting chiller replacement and one of the required chillers becomes inoperable. Note that the NRC staff has accepted TS completion times for other chiller designs for one train out of service as follows:
  - i. 72 hours (Comanche Peak, Palo Verde, Shearon Harris, Vogtle, and Waterford)
  - ii. 7 days (Crystal River, South Texas, and Surry – less than three of five chillers for two units)
  - iii. 14 days (San Onofre and Salem)
  - iv. 30 days (Catawba, Duane Arnold, McGuire, North Anna, Oconee, and Prairie Island)

**RAI SBPB-19**

BACKGROUND:

PSEG stated by letter dated September 11, 2015, that the supporting calculations for two chiller operation (Configuration b) demonstrate that only one chiller is required to be operating in each unit for normal operation and accident conditions. This supports operating with two chillers available and the potential loss of a chiller during an accident as the single failure or the unexpected loss of a chiller during normal operation resulting in entering a TS ACTION statement until the chiller is restored.

PSEG stated by letter dated September 11, 2015, that the supporting calculations demonstrate that in Configuration c, only two chillers are required to be operating for normal operation and accident conditions. This supports operating with three chillers available and the potential loss of a chiller during an accident as the single failure or the unexpected loss of a chiller during normal operation resulting in entering a TS ACTION statement until the chiller is restored.

PSEG stated in its supplemental letter dated November 5, 2015, that the following tables are the current heat loads for normal and accident conditions based on design summer ambient conditions.

Normal Operation

Component/Area	Normal Alignment		Maintenance Mode*	
	Unit 1	Unit 2	Unit 1	Unit 2
CAACS (BTU/hr)	926380	887683	1073502	1044456
PACUs (BTU/hr)	491100	485700	491100	485700
Misc. coolers (BTU/hr)	---	469500	---	469500
<b>Totals</b>				
Total (BTU/hr)	1417480	1842883	1564602	1999656
Total (tons)	118.12	153.57	130.38	166.64
Load/chiller (tons)**	39.4	51.2	43.5	55.5

\* For each unit, the values represent the loads when that unit is in Maintenance Mode

\*\* Based on three chillers running

Accident Conditions

Component/Area	Normal Alignment		Maintenance Mode*	
	Unit 1	Unit 2	Unit 1	Unit 2
CAACS (BTU/hr)	516921	501499	516921	501499
CREACS (BTU/hr)	240869	240869	355802	355802
ECAC (BTU/hr)	334000	334000	334000	334000
<b>Totals</b>				
Total (BTU/hr)	1091790	1076368	1206723	1191301
Total (tons)	90.98	89.70	100.56	99.28
Load/chiller (tons)**	45.5	44.8	50.3	49.6

\* For each unit, the values represent the loads when that unit is in Maintenance Mode

\*\* Based on two chillers running

ISSUE:

There are no heat load tables provided that describe the bounding heat loads that would occur from November 1 to April 30 with the bounding service water temperature of 79.9 degrees Fahrenheit (°F).

Based on heat loads provided by PSEG, the NRC staff estimated the following heat loads with emergency control air compressor (ECAC) loads removed and compared this to available chiller tonnage.



ACCIDENT OPERATIONS – SUMMER	Normal Alignment		Maintenance Mode	
	Unit 1	Unit 2	Unit 1	Unit 2
CAACS (BTU/hr)	516921	501499	516921	501499
CREACS (BTU/hr)	240869	240869	355802	355802
ECAC (BTU/hr)	0	0	0	0
<b>Totals</b>				
Total (BTU/hr)	757790	742368	872723	857301
Total (tons)	63.15	61.86	72.73	71.44
Existing chiller rating (design conditions)	60	60	60	60

RAI:

During dual unit operations for Configuration b, the analysis assumes that a chiller is operating on both units, and for Configuration c, the analysis assumes two operating chillers on one unit.

With a focus on room temperature margins and bounding service water temperature of 79.9 °F:

- a. Describe the normal and accident design heat load for the proposed TS 3/4.7.10 Configurations b and c (November 1 to April 30 conditions) and state the available (or adjusted based on existing chiller curves) heat removal capability British thermal unit/hour (BTU/hr) of the existing chillers.
- b. Describe the normal and accident heat removal margins that are available, assuming chillers are being replaced while in Configuration c, and add a single failure of one chiller (two chillers remaining), normal alignment.
- c. Describe the normal and accident temperature margins for Configurations b and c as they relate to the main control room acceptance criteria for personnel comfort and equipment qualification.

**RAI STSB-3**

BACKGROUND:

The proposed TS table contains a row titled "CONFIGURATION." Typically, a word with all letters capitalized signifies a term with a definition in Section 1.0 of the Salem TSs. The word 'configuration' is also used in the proposed changes to the LCO statement and the proposed footnotes. Throughout the majority of the Salem TSs, the term 'alignment,' rather than 'configuration,' is used to refer to particular equipment states.

RAI:

Please provide justification for deviation from typical Salem TS format and terminology or provide an alternate TS table title and corresponding proposed changes to the LCO and footnotes.

**RAI STSB-4**

BACKGROUND:

The proposed format and text for Item 4 in the "b" applicability statement is not clear. It appears to be a list of items that must be met, rather than a list of items that are required only for CREACS single filtration train alignment.

RAI:

Please provide justification for the proposed format and text for Item 4 in the "b" applicability statement, or provide an alternate format and text that clarifies the items.

P. Sena

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If you have any questions, please contact me at 301-415-1603 or [Carleen.Parker@nrc.gov](mailto: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:  
Request for Additional Information

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