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

December 4, 2017

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

SUBJECT: SALEM NUCLEAR GENERATING STATION, UNIT NO. 1 – SUMMARY OF OCTOBER 27, 2017, CONFERENCE CALL WITH PSEG NUCLEAR LLC RE: FALL 2017 STEAM GENERATOR INSPECTIONS (CAC NO. MG0215; EPID L-2017-LRO-0028)

Dear Mr. Sena:

On October 27, 2017, the U.S Nuclear Regulatory Commission staff participated in a conference call with representatives of PSEG Nuclear LLC (the licensee) regarding the ongoing steam generator inspection activities at Salem Nuclear Generating Station, Unit No. 1. A list of participants is provided as Enclosure 1. A summary of the conference call is provided as Enclosure 2, which includes a list of questions and the licensee's draft responses discussed during the call.

If you have any questions regarding this matter, I may be reached at (301) 415-1603 or Carleen.Parker@nrc.gov.

Sincerely,

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

Docket No. 50-272

Enclosures:
1. List of Participants
2. Conference Call Summary

cc w/Enclosures: Distribution via Listserv

LIST OF PARTICIPANTS

OCTOBER 27, 2017, CONFERENCE CALL WITH PSEG NUCLEAR LLC

SALEM NUCLEAR GENERATING STATION, UNIT NO. 1

FALL 2017 STEAM GENERATOR INSPECTIONS

U.S. Nuclear Regulatory Commission

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SUMMARY OF OCTOBER 27, 2017, CONFERENCE CALL WITH PSEG NUCLEAR LLC

SALEM NUCLEAR GENERATING STATION, UNIT NO.1

FALL 2017 STEAM GENERATOR TUBE INSPECTIONS

DOCKET NO. 50-272

On October 27, 2017, the U.S. Nuclear Regulatory Commission (NRC) staff participated in a conference call with representatives of PSEG Nuclear LLC (PSEG or the licensee) regarding the ongoing steam generator (SG) tube inspection activities at Salem Nuclear Generating Station (Salem), Unit No. 1. The licensee provided the attached draft information in support of the call.

Salem, Unit No. 1, has four Westinghouse Model F SGs, each of which contains 5,626 U-bend thermally treated Alloy 600 tubes. Each tube has a nominal outside diameter of 0.688 inches and a nominal wall thickness of 0.040 inches. During SG fabrication, the tubes were hydraulically expanded at both ends over the full depth of the tubesheet. The tubesheet was drilled on a square pitch with 0.98-inch spacing. The U-bends in rows 1 through 10 were stress relieved after bending. Eight Type 405 stainless steel tube support plates (TSPs), which have broached quatrefoil holes, support the vertical section of the tubes, and chrome-plated Alloy 600 anti-vibration bars support the U-bend section of the tubes.

Several topics regarding the ongoing SG inspections were discussed during the conference call. A summary of the discussion is included below.

- At the time of the call, the SG tube inspections were approximately 70 percent complete overall and approximately 90 percent complete in SG 13.

- On May 15, 2017, the licensee identified a primary-to-secondary leak in SG 13. This leak remained well below the technical specification limit of 150 gallons per day through May 28, 2017. On May 28, 2017, the leak decreased and remained below the threshold of detection through the end of the operating cycle.

- In order to determine the source of the leak in SG 13, the licensee performed a secondary side pressure test on October 25, 2017. The secondary side of the steam generator was pressurized incrementally with a final pressure of approximately 750 pounds per square inch gauge (psig). The licensee determined the source of the leak to be on the cold leg side of the tube located at row 2, column 91 of the bundle. The licensee performed a bobbin probe inspection of this tube and identified a small volumetric indication near the third TSP location.

- At the time of the call, the licensee characterized the indication in the "leaker" tube as an indication of loose part wear. The +Point™ voltage for the indication was 3.71 volts. The licensee stated that there were no indications of either loose parts or loose part wear at this location in the previous outage. In addition, the licensee clarified that the possible loose part (indication identified in the table in the response to question 8 of Attachment 1) was near row 36, column 78 of the bundle (i.e., away from the "leaker" tube).

- The licensee performed chemical cleaning and sludge lancing on the SGs during the

outage and removed more than 2,000 pounds of sludge from each SG (approximately 1,900 pounds from chemical cleaning and approximately 200 pounds from sludge lancing).

- The licensee stated that there are 161 tubes with possible higher stress (i.e., 2 sigma tubes).

- The licensee has been updating its analyses regarding the remaining life on its welded plugs in the four SGs. The NRC staff asked about the conclusions of the updated weld plug analysis compared to the initial re-analysis. The staff's understanding was that the reanalysis supported the plugs remaining in service until at least the next SG outage. The licensee participants on the call did not have detailed information related to the updated weld plug finite element analysis assumptions and conclusions.

- The licensee indicated that in-situ pressure testing was to be performed on the SG 13 row 2, column 91 tube on October 18, 2017. The NRC staff asked that the licensee contact the staff in the event that the tube did not pass the in-situ pressure testing.

Additional discussion points are included in the licensee-provided document attached to this summary. Undefined abbreviations used in the licensee-provided document include:

AVB – Anti-Vibration Bar
BLG – Bulge
BHT – Bottom Hydraulic Transition
circ – Circumference
Col – Column
DNG – Ding
DNT – Dent
ECT – Eddy Current Testing
EPRI – Electric Power Research Institute
ETL – Expansion Transition Location
FBC – Flow Baffle Cold
FBH – Flow Baffle Hot
FBP – Flow Distribution Baffle Plate
FDB – Flow Distribution Baffle
FOSAR – Foreign Object Search and Retrieval
GBD – Gallons per Day
in – Inch
NDD – No Detectable Degradation
OEX – Over Expansion (a localized variation in tube diameter within the hydraulically expanded tubesheet)
OXP – Over Expansion (hydraulic expansion occurring above the top of tubesheet)
Salem-1 – Salem Nuclear Generating Station, Unit No. 1
SGBD – Steam Generator Blow Down
SSI – Secondary Side Inspection
TBD – To be Determined
TEC – Tube End Cold
TSC – Tube Sheet Cold
TSH – Tube Sheet Hot
TSP – Tube Support Plate
TTS – Top of Tubesheet

The NRC staff did not identify any issues that required followup action at the time of the call; however, the NRC staff asked to be notified in the event that any unusual conditions were detected during the remainder of the outage.

Attachment 1

SALEM NUCLEAR GENERATING STATION, UNIT NO. 1

STEAM GENERATOR TUBE INSPECTION DISCUSSION POINTS

(DRAFT INFORMATION)

SALEM NUCLEAR GENERATING STATION, UNIT NO. 1
STEAM GENERATOR TUBE INSPECTION DISCUSSION POINTS

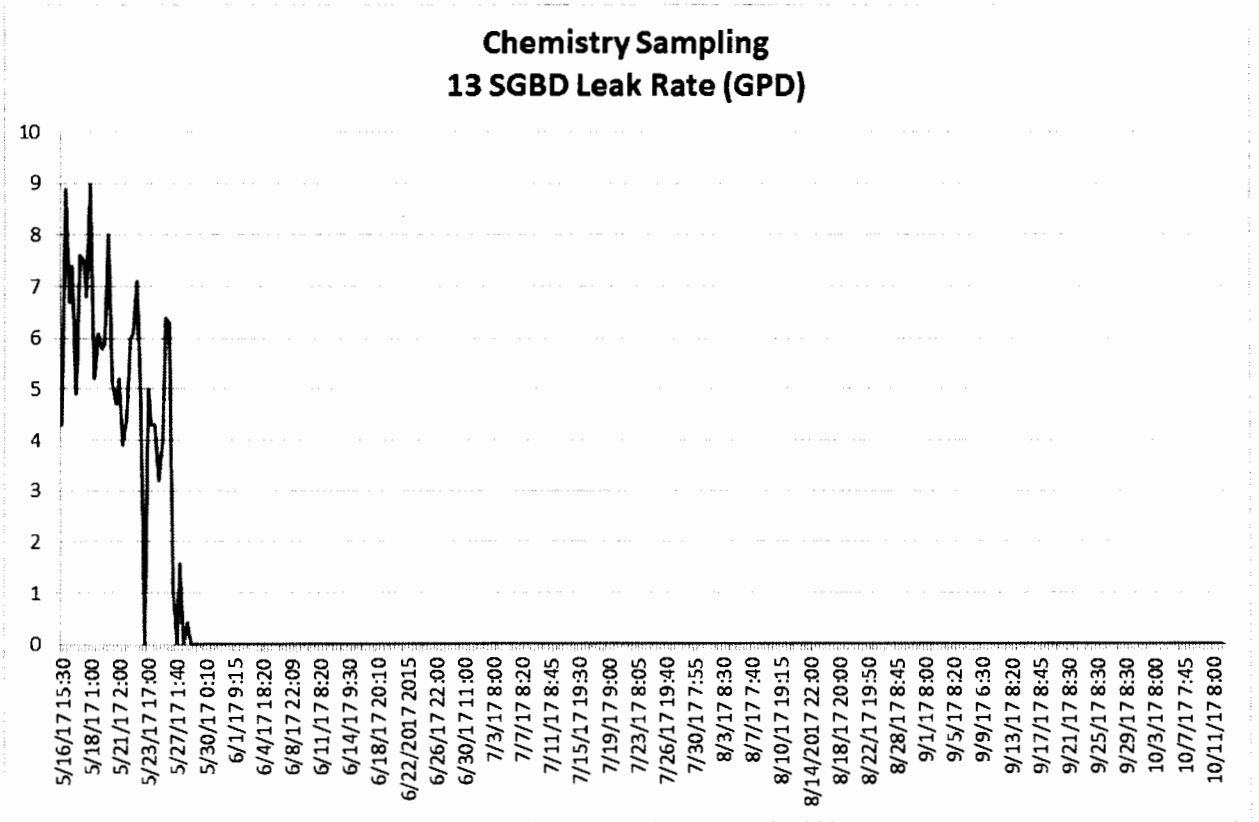
The following discussion points have been prepared to facilitate the conference call arranged with the licensee to discuss the results of the steam generator (SG) tube inspections to be conducted during the upcoming fall 2017 refueling outage at Salem Nuclear Generating Station, Unit No. 1. This conference call is scheduled to occur towards the end of the planned SG tube inspections, but before the inspections and repairs are completed.

The U.S. Nuclear Regulatory Commission staff plans to document a summary of the conference call, as well as any material that is provided in support of the call.

1. Discuss any trends in the amount of primary-to-secondary leakage observed during the recently completed cycle.

PSEG Response:

On Monday May 15, 2017 at approximately 1800, operators in the Salem-1 Control Room identified a rise in the primary-to-secondary leakage from radiation monitor indications. The small leak was identified in SG 13, and went below detection around May 28, 2017. Below is the chemistry grab sample results for the duration of the leak event, including up to the start of outage 1R25 (October 12, 2017). Subsequent to May 28, 2017, the leak remained below detection. Online radiation monitors provided similar trend.



2. Discuss whether any secondary side pressure tests were performed during the outage and the associated results.

PSEG Response:

A secondary side pressure test was completed on October 25, 2017, in SG 13. The pressure test identified tube Row 2 Column 91, on the cold leg side, as the source of the leak. Eddy current testing was not completed in this SG at the time of the secondary side pressure test (i.e. – the pressure test was done in parallel with eddy current testing). After the pressure test, bobbin coil inspection of this tube was performed and identified a small through-wall volumetric indication near the 3rd TSP on the cold leg side of the steam generator.

3. Discuss any exceptions taken to the industry guidelines.

PSEG Response:

PSEG currently has no deviations to industry guidelines (i.e. – no exceptions to EPRI Guidelines).

4. For each SG, provide a description of the inspections performed, including the areas examined and the probes used (e.g., dents/dings, sleeves, expansion-transition, U-bends with a rotating probe), the scope of the inspection (e.g., 100 percent of dents/dings greater than 5 volts and a 20 percent sample between 2 and 5 volts), and the expansion criteria.

PSEG Response:

Eddy current tube inspections are not complete at this time, below is the inspection plan summary applicable for all four steam generators, except as noted.

Bobbin Probe

1. A full-length (tube end to tube end) bobbin coil probe inspection on 100% of the in-service tubes.

Array Probe (X-Probe)

1. 100% of the first 3 outer periphery tubes on both hot leg (HL) and cold leg (CL); and the first 3 rows of no-tube lane on the HL and CL (SG 13 included 100% of all tubes on HL and CL). Inspection extent from TSH -15.21" (i.e. - 15.21 inches below the TTS) to the first tube support above the TTS (i.e. – 01H), and TSC -2" to the first tube support above the TTS (i.e. – 01C).
2. 50% HL TTS Expansion Transitions, TSH +3" to -15.21".
3. 100% OXP, ETL, BHT >= 0 or BHT <= -0.40 inches, TSH +3" to -15.21" and TSC +3" to -2".
4. 50% HL BLG >= 18 volts and OEX > 0.25 inches, TSH +3" to -15.21"
5. Special Interest Inspections, including bounding locations with possible loose parts identified by eddy current or secondary side inspections.

Rotating Probe (+Point)

1. 50% HL DNT and DNG > 2 volts as reported from 1R24, TSH to 07H (Includes 50% of the DNT and DNG > 5 volts)
2. 20% CL DNT and DNG > 5 volts as reported from 1R24, TSC to 07C

3. 20% U-bend DNT and DNG > 2 volts, as reported from 1R24, 07H to 07C (Includes 20% of the DNT and DNG > 5 volts)
4. 20% Row 1 and Row 2 tubes, 07H to 07C
5. 100% FBP and TSP wear as reported by Bobbin or Array probe
6. 100% of the HL FBP and TSP intersections, FBH to 07H, of the tubes screened for possible higher stress (i.e. – 2 Sigma Tubes).
7. Special Interest Inspections, including Bobbin "I" codes, and sizing locations with loose parts wear.

5. For each area examined (e.g., tube supports, dent/dings, sleeves, etc.), provide a summary of the number of indications identified to date for each degradation mode (e.g., number of circumferential primary water stress corrosion cracking indications at the expansion transition). For the most significant indications in each area, provide an estimate of the severity of the indication (e.g., provide the voltage, depth, and length of the indication). In particular, address whether tube integrity (structural and accident-induced leakage integrity) was maintained during the previous operating cycle. In addition, discuss whether any location exhibited a degradation mode that had not previously been observed at this location at this unit (e.g., observed circumferential primary water stress corrosion cracking at the expansion transition for the first time at this unit).

PSEG Response:

See summary tables below, noting SG tube inspections are not complete at this time. Tube integrity (structural and accident-induced leakage integrity) was maintained during the previous operating cycle, however also pending results of in-situ pressure test (see response to items 1 and 2). The degradation types (mode) identified is consistent with degradation in prior outages. No stress corrosion cracking has been identified this outage, or any prior inspection outage, in any location of the tubes.

AVB Wear		
SG	**# Indications**	**Max Depth**
11	396	34
12	322	32
13	444	31
14	348	34

TSP Wear		
SG	**# Indications**	**Max Depth**
11	3	6
12	2	5
13	4	13
14	9	11

FDB Wear		
SG	**# Indications**	**Max Depth**
11	1	9
12	0	-
13	1	6
14	1	7

Loose Part Wear					
SG	**Row**	**Col**	**Location**	**Depth**	**Length (in)**
13	2	91	03C	98%*	0.26 axial, 0.45 circ
13	15	117	FBH	Pending +Point	Pending +Point
13	16	118	FBH	Pending +Point	Pending +Point
13	17	117	FBH	Pending +Point	Pending +Point
13	55	53	TSC	Pending +Point	Pending +Point

*Tube with leak confirmed by pressure test.

6. Describe repair/plugging plans.

PSEG Response:

The tube discussed in response to item 2 above will be plugged. At the completion of SG inspections, all tubes meeting the Technical Specification (6.8.4.i.c) tube plugging criteria will be plugged.

7. Describe in-situ pressure test and tube pull plans and results (as applicable and if available).

PSEG Response:

In-situ pressure test is planned for tube Row 2 Column 91, in SG 13. No tube pulls are planned.

8. Discuss the following regarding loose parts:

- **what inspections are performed to detect loose parts;**
- **a description of any loose parts detected and their location within the SG (including the source or nature of the loose part, if known);**
- **if the loose parts were removed from the SG; and**
- **indications of tube damage associated with the loose parts.**

PSEG Response:

Eddy current inspections using bobbin probe full length of the tube, and supplemented by X-probe inspections (also see response to item 4). In each steam generator, following top of tubesheet water lancing (sludge lancing), visual inspections and Foreign Object Search and Retrieval (FOSAR) are performed at the top of tubesheet. These inspections included the full length of the no tube lane (area between row 1 tubes), some inner bundle inspections (hot leg and cold leg), completely around the annulus tube areas (shell-to-tube bundle region, including periphery tubes), and locations with foreign material. The annulus / periphery tubes inspection include articulating the camera angle to view into the bundle (from the annulus region) allowing inspection between the periphery tubes into the bundle. The purpose of these inspections was to identify and remove foreign material and to assess the effectiveness of the water lancing. Visual inspections and FOSAR are also performed,

as possible, at other locations on the top of the tubesheet or the flow baffle plates. This can occur when eddy current inspections identify possible loose parts (PLP).

See the table below for description of loose parts and their location within the SG, and if removed (retrieved). Discussion of tube damage from loose parts is provided in response to item 5.

Foreign Objects at 1R25					
SG	**Description**	**Location**	**ECT**	**SSI**	**Retrieved**
11, 13	Lancing Strainer Objects (sludge rocks, wires, graphite, foil, sludge)	N/A	N/A	N/A	Yes
11	Small Spring Coil	Annulus	N/A	Confirmed	Yes
11	Irregular Rock-Like Object	FBC	TBD	Confirmed	No
11	ECT PLP	FBH	NDD	In Process	In Process
13	Possible sludge rock	TSC	NDD	Confirmed	No
13	ECT PLP	TSC	NDD	In Process	In Process
12	Lancing recently completed, awaiting SSI / FOSAR				
14	Awaiting completion of lancing and SSI / FOSAR				

9. Discuss the scope and results of any secondary side inspection and maintenance activities (e.g., in-bundle visual inspections, feed-ring inspections, sludge lancing, assessing deposit loading, etc.).

PSEG Response:

During outage 1R25, all 4 steam generators were chemical cleaned, and sludge lancing of the TTS and baffle plate is performed. See response to item 8 for discussions of TTS visual inspections and results.

Other secondary side inspections performed in each steam generator included visual inspections of the upper tube support plates (TSP) and accessible areas. These visual inspections were accomplished by removing small inspection ports located at the uppermost tube support plate and inserting a camera probe. The visual inspections were performed to identify the general conditions in the area of support structures (e.g. – TSPs), wrapper plug assemblies, and tubing areas (as- possible). These visual inspections did not identify conditions adverse to quality.

10. Discuss any unexpected or unusual results.

PSEG Response:

See response above for items 1 and 2.

11. Provide the schedule for SG-related activities during the remainder of the current outage.

PSEG Response:

See estimated summary schedule provided below

Eddy current testing complete - 10/28/2017 or 10/29/2017
In-situ Testing (SG 13 tube R2 C91) - 10/28/2017

SUBJECT: SALEM NUCLEAR GENERATING STATION, UNIT NO. 1 – SUMMARY OF OCTOBER 27, 2017, CONFERENCE CALL WITH PSEG NUCLEAR LLC RE: FALL 2017 STEAM GENERATOR INSPECTIONS (CAC NO. MG0215; EPID L-2017-LRO-0028) DATED DECEMBER 04, 2017

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