



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

August 31, 2010

Mr. Thomas Joyce  
President and Chief Nuclear Officer  
PSEG Nuclear  
P.O. Box 236, N09  
Hancocks Bridge, NJ 08038

SUBJECT: SUMMARY OF CONFERENCE CALL REGARDING THE SPRING 2010 STEAM  
GENERATOR TUBE INSPECTIONS AT SALEM NUCLEAR GENERATING  
STATION, UNIT NO. 1 (TAC NO. ME3459)

Dear Mr. Joyce:

On April 14, 2010, the Nuclear Regulatory Commission (NRC) staff participated in a conference call with PSEG Nuclear LLC (PSEG) to discuss the steam generator tube inspections performed during refueling outage 1R20 (spring 2010) at Salem Nuclear Generating Station, Unit No. 1. A summary of the conference call is included as Enclosure 1. Information provided by PSEG to facilitate the discussion is included as Enclosure 2.

This completes the NRC staff efforts for TAC No. ME3459. If you have any questions, please contact me at (301) 415-1420.

Sincerely,

A handwritten signature in black ink, appearing to read "RBE Ennis".

Richard B. Ennis, Senior Project Manager  
Plant Licensing Branch I-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-272

Enclosures: As stated

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SUMMARY OF CONFERENCE CALL WITH PSEG NUCLEAR LLC

SPRING 2010 STEAM GENERATOR TUBE INSPECTIONS

SALEM NUCLEAR GENERATING STATION, UNIT NO. 1

DOCKET NUMBER 50-272

On April 14, 2010, the Nuclear Regulatory Commission (NRC) staff participated in a conference call with PSEG Nuclear LLC (the licensee) to discuss the steam generator (SG) tube inspections performed during refueling outage 1R20 (spring 2010) at Salem Nuclear Generating Station (Salem), Unit No. 1.

Salem Unit 1 has four Westinghouse Model F SGs, each of which contains 5626 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 support plates, 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.

Additional clarifying information or information not included in the information provided by the licensee in Enclosure 2 is summarized below:

- During the spring 2010 outage, tube inspections were planned for all SGs.
- The SGs have accumulated approximately 120 effective full power months (EFPM) of operation. The 2010 outage is the last refueling outage in the 120-EFPM sequential period. Based on a comprehensive review of industry operating experience, the licensee indicated that stress corrosion cracking is not considered a potential degradation mechanism during this refueling outage due to the relatively low accumulated service time and hot-leg primary water operating temperature at Unit 1. As such, the licensee stated that a 20 percent sample size is used for +Point probe inspections in the following areas: bulges and over expansions (BLG and OEX), top of tubesheet expansion transition, dents and dings, and the U-bend region.
- The licensee reported that secondary-side inspections did not include feed-ring inspections this outage. The feed-rings were inspected during the spring 2007 refueling outage and the results did not indicate significant degradation.
- The following defines acronyms used in Enclosure 2:
  - AVB anti-vibration bar
  - TSP tube support plate
  - FDB flow distribution baffle
  - TTS top of tube sheet
  - HL hot-leg
  - CL cold-leg
  - ECT eddy current technique

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

Salem Unit 1  
Outage 1R20

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

There was no indication of primary-to-secondary leakage observed during the recently completed cycle.

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

There was no secondary side pressure tests performed during outage 1R20.

3. Discuss any exceptions taken to the industry guidelines.

PSEG currently does not have any exceptions (deviations) in place for the EPRI Guidelines used to support the SG Program or outage 1R20 inspections.

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% sample between 2 and 5 volts), and the expansion criteria.

Bobbin probe inspections support wear mechanisms such as AVB, TSP, and loose parts wear (potential mechanisms). Proactive inspections are also planned using rotating coil probes. See attachment 1 for summary of inspection plans.

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).

The only tube degradation currently detected is AVB and TSP wear. A summary of the number of indications and tubes with AVB and TSP wear is provided below.

Salem Unit 1  
Outage 1R20

Outage 1R20  
# Indications / # Tubes Summary

	SG 11	SG 12	SG 13	SG 14
AVB Wear	360 / 176	287 / 148	434 / 215	306 / 167
TSP Wear	2 / 2	0 / 0	2 / 2	4 / 4

The most severe AVB wear indication is 44 % TW, and the most severe TSP wear indication is 11 % TW.

The following table provides the AVB wear indications meeting or exceeding the Tech Spec repair limit of 40 %TW:

SG	Row	Col	Location	Bobbin Depth
SG11	50	28	AV5 -0.04"	44 %TW
SG13	45	95	AV6 +0.02"	42 %TW

The following table provides the TSP and FDB indications detected:

SG	Row	Col	Location	Bobbin Depth
SG11	30	55	06H -0.28"	11 %TW
SG11	47	24	03C +0.20"	4 %TW
SG13	36	15	FBC -0.25"	7 %TW
SG13	53	85	01C +0.28"	8 %TW
SG14	17	119	02C -0.29"	5 %TW
SG14	26	116	02C -0.24"	7 %TW
SG14	31	113	02C -0.26"	9 %TW
SG14	33	111	02C -0.26"	8 %TW

Tube integrity (structural and leakage integrity) was maintained during the previous operating cycles.

6. Describe repair/plugging plans.

All wear >39% Through-wall (TW) will be plugged, this is currently 2 tubes.

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

PSEG currently does not have any plans to perform in-situ pressure testing or tube pull for outage 1R20 (based on inspections completed to date).

Salem Unit 1  
Outage 1R20

8. Discuss the following regarding loose parts:

- what inspections are performed to detect loose parts;

In each steam generator, following TTS water lance, visual inspections and Foreign Object Search and Retrieval (FOSAR) are performed at the top of tubesheet. These inspections include the full length of the no tube lane (area between row 1 tube), inner bundle inspections on the HL and CL, and completely around the annulus tube areas (shell-to-tube bundle region, including periphery tubes). The annulus / periphery tubes inspection included 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.

100% of the bobbin and rotating coil data is reviewed for possible loose part indications. All in-service HL and CL peripheral and no tube lane tubes, 3 tubes in from periphery and no tube lane in each SG are inspected with rotating coil (+Point), extent is +3" above and -2" below the TTS.

- a description of any loose parts detected and their location within the SG (including the source or nature of the loose part, if known);

Long (from a couple inches to several inches), but narrow (approximately 1/16" to 1/32") strips of a very brittle material resting on the 3<sup>rd</sup> and 4<sup>th</sup> TSPs (SG 14) have been identified by SSI. These strips break apart upon contact with the video probe. Based on the lack of an eddy current response, and visual appearance, they are not believed to be metallic. Similar object was detected in same SG in 1R18 (3<sup>rd</sup> TSP).

- if the loose parts were removed from the SG; and

Attempts were made to remove some of the strips of a very brittle material, however the material breaks apart with little effort and was irretrievable.

- indications of tube damage associated with the loose parts.

No indications of tube damage from loose parts have been detected.

**Salem Outage 1R20  
Summary Inspection Scope  
Attachment 1**

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.).

In each SG, high pressure sludge lancing to remove TTS deposits is performed, followed by TTS foreign object search and retrieval (FOSAR). In bundle and periphery inspections provided that the sludge lancing was very effective at removing deposits on the tubesheet. The current sludge removed is approximately as follows:

SG	11	12	13	14
Sludge weight (lbs)	31.5	26	Work in Process	40.5

Deposit Mapping of the entire tube surface from HL TTS to CL TTS is being performed during 1R20, using bobbin data and special ECT standards. Visual inspections were also performed at the TSPs, including the 7<sup>th</sup> (upper most TSP) and down to the 3<sup>rd</sup> TSP. Visual inspections show that there are negligible deposits on the tubes and TSP surfaces, and the TSP broach flow openings are not significantly fouled. The visual and ECT information supports assessment of deposit loading within the SGs.

10. Discuss any unexpected or unusual results.

N/A

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

- Eddy Current Inspections are estimated to be completed April 17, 2010
  - Bobbin coil inspections are about 90% complete
  - Rotating coil inspections are about 65% complete
- Complete Sludge Lancing and Post sludge lancing SSI / FOSAR (SG 13)

**Salem Outage 1R20  
Summary Inspection Scope  
Attachment 1**

	<b>Area</b>	<b>Probe</b>	<b>Inspection Plan</b>
	Full Length Tube end to Tube end	Bobbin	100% of all in-service tubes in each SG, Tube end to Tube end.
	Top of Tubesheet (TTS) Foreign Objects	+Point™	All in-service HL and CL peripheral and no tube lane tubes, 3 tubes in from periphery and no tube lane in each SG. Extent is +3" above and -2" below the TTS.
	Tubesheet Anomalies OXP & ETL & BHT	+Point™	All in-service 1R18 history OXP & ETL, and BHT => 0 or BHT =< -0.40 inches, on the HL & CL in each SG. Inspections shall axially bound the anomaly and be no less than +3" above the TTS to -2" below the TTS.
	Internal Tubesheet Tubesheet Anomalies BLG & OEX	+Point™	All in-service HL BLG (=> 18 volt) and OEX (>0.25 inch) from +3" above TTS to -13.1" below TTS, including those OEX that partially extend within this region (e.g. OEX that go from -14" to -12", etc), in each SG. Inspection extent shall be no less than +3" above the TTS to -13.1" below the TTS for all tubes inspected for BLG or OEX.
	Top of Tubesheet (TTS) Expansion Transition	+Point™	20% of all in-service HL TTS Expansion Transitions randomly selected in each SG, with exception that HL TTS Expansion Transitions inspected for BLG, OEX, ETL, OXP, BHT, and HL TTS inspections for 1R18 historical loose parts can be credited for part of the 20% HL TTS Expansion Transition inspections. In addition, based on the random selection, those peripheral and no tube lane HL TTS exams can also be credited for part of the 20% HL TTS Expansion Transition inspections. Inspection extent is +3" above and -2" below HL TTS.
	TSP Intersections Dent	+Point™	20% of the in-service =>2 volt dented HL TSP locations (FDB to 07H) in each SG, as reported from 1R18.
	Freespan Ding	+Point™	20% of the in-service =>2 volt HL Dings (TSH to 07H) in each SG, as reported from 1R18.
	U-bend Dents & Dings (07H to 07C)	+Point™	20% of the in-service => 2 volt dented AVB locations and 20% of the =>2 volt dings in the U-bend (07H to 07C) in each SG, as reported from 1R18.
	Short Radius U-Bends (07H to 07C)	+Point™	20% of the in-service Row 1 and 2 tubes in each SG, 07H to 07C, from the population of tubes NOT inspected in 1R15 or 1R16.

**Salem Outage 1R20  
Summary Inspection Scope  
Attachment 1**

	<b>Area</b>	<b>Probe</b>	<b>Inspection Plan</b>
	Historical Foreign Objects	+Point™ & Visual	<p>100% +Point of 1R18 historical foreign objects defined as irretrievable (ref. AREVA CR 2007-1670, CR 2007-1662) or retained ECT signal after SSI could not confirm (ref. AREVA 51-9048311-002, Table 13-2).</p> <p>Exams shall be performed in a manner to bound the axial extent of potential tube contact/wear, and include all tubes within 1 tube radius of target tubes(s), and no less than +3” above TTS and -2” below TTS.</p> <p>Foreign Object Search and Retrieval (FOSAR) in area of interest.</p>
	Tube Plugs	Visual	Visual inspection of all previously installed tube plugs, and plugs installed during 1R20, in each steam generator.

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