



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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May 10, 2013

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 FALL 2012 STEAM
GENERATOR TUBE INSPECTIONS AT SALEM NUCLEAR GENERATING
STATION, UNIT NO. 2 (TAC NO. ME9602)

Dear Mr. Joyce:

On October 26, 2012, 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 2R19 (fall 2012) at Salem Nuclear Generating Station, Unit No. 2. A summary of the conference call is provided in Enclosure 1. Information provided by PSEG to facilitate the discussion is included in Enclosure 2.

This completes the NRC staff efforts associated with TAC No. ME9602. If you have any questions, please contact me at (301) 415-3204.

Sincerely,

A handwritten signature in black ink, appearing to read "John D. Hughey", is written over the word "Sincerely,".

John D. Hughey, Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-311

Enclosures:
As stated

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SUMMARY OF CONFERENCE CALL WITH PSEG NUCLEAR LLC
REGARDING FALL 2012 STEAM GENERATOR TUBE INSPECTIONS
SALEM NUCLEAR GENERATING STATION, UNIT NO. 2
DOCKET NUMBER 50-311

On October 26, 2012, the staff of the Steam Generator Tube Integrity and Chemical Engineering Branch (ESGB) of the Division of Engineering participated in a conference call with representatives of PSEG Nuclear, LLC (the licensee), regarding the ongoing steam generator (SG) tube inspection activities at Salem Nuclear Generating Station Unit 2 (Salem 2). In support of this conference call, the licensee provided a written summary of the results of their inspections. A summary of the items discussed during the call as well as information not included in the licensee's written summary is provided below.

Salem 2 has four AREVA Model 61/19T replacement SGs, each of which contains 5,048 U-bend thermally treated Alloy 690 tubes. Each tube has a nominal outside diameter of 0.750 inches and a nominal wall thickness of 0.043 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 triangular pitch. The U-bends in rows 1 through 16 were stress relieved after bending. Eight stainless steel (Type 410) support plates, which have broached trefoil holes, provide lateral tube support to the vertical section of the tubes and three sets of stainless steel (Type 405M) anti-vibration bars support the U-bend section of the tubes.

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

- The designation PRX is for proximity. There are four tubes (two in two of the SGs) that are in close proximity to each other. These calls are historical (since fabrication) and are located in the U-bend region. There has been no change in the bobbin or rotating probe data for these tubes.
- The designation BLG is for bulge and these indications are from fabrication.
- All tube plugs were inspected visually and no issues were identified during the inspections.
- From the first to the second in-service inspection of the SG tubing, the number of new indications of anti-vibration bar (AVB) wear has decreased. In addition, the growth rate of the AVB indications has decreased approximately 50 percent.
- AVB wear is the predominant degradation mechanism for the current outage. At the time of the conference call, there were approximately 300 new AVB wear indications. The operational assessment projections bound the current inspection results. The initial inspections focused on the area in the SG where AVB wear has historically occurred.

- Rotating probe inspections are performed on all AVB wear indications greater than or equal to 40 percent throughwall. Tubes with wear indications at the AVBs that are plugged are also stabilized. This practice has also been implemented in prior inspections.
- Wear at the tube support plate elevations has also been observed, but it is not as prevalent as AVB wear. Most, if not all, wear indications at the tube supports have been observed in prior outages.
- The most likely source of the small sheared bolt head found in the SG 21 cold leg channel head is the reactor coolant pump (RCP) thermal barrier bolt. The two small metal objects were approximately 1 inch by 1 inch. The licensee is planning a visual inspection of the tubesheet surface to ensure the parts did not adversely impact the tubesheet or tube-to-tubesheet welds. The licensee postulated that there may have been some reverse flow during the plant shutdown that resulted in the loose parts entering the cold leg channel head. A couple of similar loose parts were found in the reactor vessel. There is a metal impact alarm system. The participants in the conference call were not sure if there were any alarms on this system as a result of the loose parts detected.
- Wear associated with the Appui had not been detected at the time of the conference call.
- Video inspections were performed in response to Nuclear Safety Advisory Letter (NSAL) 12-1. The licensee stated that the inspections detected marks on channel head that were characterized as surface blemishes or tooling marks (e.g., from the aluminum nozzle dam contacting the bottom of the channel head). The marks were black and some were linear and some were jagged. Some of the marks were several inches long. There were no signs of material loss to the cladding, and no cladding was removed. After performing eddy current exams on some of these marks, the licensee plans on attempting to scrub or buff out the marks. All of the SGs have these marks and an enhanced video inspection will be performed to confirm these marks are surface blemishes. The licensee's SGs do not have drain lines (as a result, they must pump out any residual water in the channel head that has to be removed).
- Sludge lancing was not performed in the prior inspection. As a result, some of the loose parts detected during this outage may have been in the SG during the previous outage.
- The small washer (approximately 5/8 inch in diameter), the two small plug gripper pieces (approximately 1/2 inch by 3/4 inch wide), and the several pieces of soft graphite and small metal foil found in the sludge lance equipment strainer were all removed from the SGs.
- The rubber piece and small weld splatter were removed from the SGs.
- The small bristle/wire-like material was not removed from the SGs. These foreign objects are fixed in place. There are some hard collars around the tubes in the sludge pile region.
- The SGs have a loose part trapping system.

Based on the information provided, the NRC staff did not identify any issues that warranted immediate follow-up action.

STEAM GENERATOR TUBE INSPECTION DISCUSSION POINTS

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

Response: There was no detectable 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.

Response: There were no secondary side pressure tests performed this outage.

3. Discuss any exceptions taken to the industry guidelines.

Response: There were no exceptions (deviations) taken to the industry guidelines (EPRI Guidelines).

4. For each steam generator (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% of dents/dings greater than 5 volts and a 20% sample between 2 and 5 volts), and the expansion criteria.

Response:

Eddy current Bobbin probe examinations (All 4 SGs):

- All in-service tubes, full length tube-end to tube-end

Eddy current Array probe examinations (All 4 SGs):

- Tubesheet Periphery 3-tubes deep, 01H to TSH -3", 01C to TSC -3"
- No-tube lane 3-tubes deep, 01H to TSH -3", 01C to TSC -3"

Eddy current Rotating probe examination (All 4 SGs):

- Used for proactive examinations, diagnostics based on bobbin and array probe results, and for discretionary profiling
 - Possible loose part wear
 - Bobbin probe and array probe I-codes
 - All 2R18 BLG and PRX
 - AVB wear, etc

Primary Side Visual Inspections (All 4 SGs):

- Tube plugs in accordance with the examination guidelines
- SG channel head bowl/cladding (NSAL 12-1)

Secondary Side Inspections (All 4 SGs):

- Foreign Object Search and Retrieval (FOSAR) following TTS sludge lancing of entire annulus/periphery and divider lane
- Foreign Object Search and Retrieval (FOSAR) as required based on 2R17 objects and as needed from eddy current inspections
- General Secondary side inspections of TTS to access the effectiveness of sludge lancing
 - Approximately 9 to 17 pounds of sludge were removed from each SG.

Salem Unit 2
Outage 2R19

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).

Response:

Summary of AVB wear (currently):

	SG21	SG22	SG23	SG24	Combined
Count	690	488	110	420	1708
Max Depth	45	46	34	42	46
Average Depth	18.06	18.90	12.90	17.59	17.85
Max Growth (%/EFY)	11.48	10.76	10.76	10.76	11.48
Upper 95th (%/EFY)	6.46	5.74	5.02	6.46	5.74
Average Growth (%/EFY)	2.13	1.79	0.80	1.60	1.82
Max Depth (New)	18.00	11.00	10.00	18.00	18.00

Tube integrity has been maintained (indications less than condition monitoring limit). This degradation has been seen at Salem previously.

6. Describe repair/plugging plans.

Response: Currently 15 tubes require plugging for Tech Spec plugging requirement for AVB wear. Largest was 46% TW. PSEG plans to plug and stabilize all these tubes. Administrative plugging still being evaluated when data is completed.

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

Response: PSEG currently evaluating degradation. Largest AVB wear indication will require rotating coil inspection to further categorize (planned for all 40% and greater). Currently none are required for in-situ pressure testing. Tube pulls are not planned.

8. Discuss the following regarding loose parts:

- What inspections are performed to detect loose parts

Response: Eddy Current inspections (bobbin and array probes), and visual inspections at the secondary side top of tubesheet are used to detect foreign material / loose parts. Also see discussions for FOSAR.

Salem Unit 2
Outage 2R19

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

Response: A small washer, 2 small plug gripper pieces, several pieces of soft graphite, several pieces small metal foil; all from sludge lance strainer. A couple small bristle / wire like pieces removed. A couple inner bundle small bristle/wire like material (unremoved), rubber piece, small weld splatter.

- If the loose parts were removed from the SG

Response: See above. Some appear to be legacy from feedwater heater powerfect tube plugs (all removed from feedwater heaters last outage).

- Indications of tube damage associated with the loose parts

Response: No tube damage / wear has been detected from loose parts at this time.

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

Response: See previous discussions.

10. Discuss any unexpected or unusual results.

Response: PSEG identified 3 loose parts in SG 21 CL channel head. 2 small metal objects, and a small bolt head.

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

Response: We are currently about 60% complete or more with eddy current inspections. Eddy current should be completed between October 27 and 28 (pending unforeseen delays). Sludge lancing completed.

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*via memo dated

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