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PSEG
Nuclear LLC
LR-N10-0312

AUG 18 2010

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington DC 20555-001

Salem Nuclear Generating Station Unit 2
Facility Operating License No. DPR-75
NRC Docket No. 50-311

Subject: PSEG Nuclear, LLC (PSEG) Response to Salem Nuclear Generating Station, Unit No. 2, Draft Request for Additional Information (TAC No. ME3884)

Reference: (1) Salem Nuclear Generating Station, Unit No. 2, Draft Request for Additional Information (TAC No. ME3884), dated June 14, 2010

(2) Steam Generator Tube Inspection Report - Seventeenth Refueling Outage (2R17), dated April 30, 2010

On June 14, 2010, the Nuclear Regulatory Commission (NRC) provided to Mr. Jeff Keenan of PSEG Nuclear LLC (PSEG) a draft request for additional information (Reference 1) (ADAMS Accession No. ML101660117). This information was provided to facilitate a teleconference to clarify PSEG's April 30, 2010, letter which submitted the results of the steam generator tube inspections performed at Salem Nuclear Generating Station (Salem), Unit No. 2, during refueling outage 2R17 (Reference 2). The teleconference between PSEG and NRC personnel took place on June 23, 2010.

PSEG hereby formally submits and documents its response to the request for additional information as discussed on June 23, 2010. Attachment 1 contains the NRC's questions as submitted on June 14 followed by PSEG's responses. Attachment 2 provides a general cross sectional representation of the Salem Unit 2 AREVA 61/19 T SG tubesheet. There are no commitments contained in this letter.

Should you have any questions regarding this submittal, please contact Mr. E. Villar at (856) 339-5456.

Sincerely,

Carl J. Fricker
Site Vice President – Salem

A001
NRR

AUG 18 2010

Attachment (2)

cc Mr. W. Dean, USNRC - Administrator - Region I
Mr. R. Ennis, USNRC - Licensing Project Manager - Salem
USNRC Senior Resident Inspector - Salem (X24)
Mr. P. Mulligan, NJBNE Manager IV
Mr. H. Berrick, Salem Commitment Tracking Coordinator
Mr. L. Marabella, Corporate Commitment Tracking Coordinator

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Attachment 1
LR-N10-0312

DRAFT REQUEST FOR ADDITIONAL INFORMATION

REGARDING STEAM GENERATOR TUBE INSPECTION REPORT

FOR REFUELING OUTAGE 2 R17

SALEM NUCLEAR GENERATING STATION, UNIT NO. 2

DOCKET NO. 50-311

By letter dated April 30, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML101250176), PSEG Nuclear LLC (the licensee) submitted the results of the steam generator (SG) tube inspections performed at Salem Nuclear Generating Station (Salem), Unit No. 2, during refueling outage 2R17 (fall 2009). This report was submitted in accordance with the requirements in Salem Unit 2 Technical Specification (TS) 6.9.1.10. The Nuclear Regulatory Commission (NRC) staff has reviewed the information provided by the licensee and would like to discuss the following issues to clarify the submittal.

1. In order for the NRC staff to better understand the design of your replacement SGs and the information presented in your report, please provide the following:

a. Tubesheet thickness (with and without clad)
b. Material used for anti-vibration bars and dimensions
c. Tube support plate and anti-vibration bar thickness
d. Tube supplier
e. Radius of shortest radius U-bend
f. Tubesheet map

PSEG Response

a. The tubesheet is approximately 21.26 inch thick (without cladding). The cladding is approximately 0.24 inch thick; therefore the entire tubesheet thickness with cladding is approximately 21.5 inches thick.
b. The anti-vibration bars are made of stainless steel (405 M), and have cross sectional dimensions of approximately 0.5 inch by 0.1811 inch.
c. The tube support plates (TSP) are approximately 1.18 inch thick. See response b for anti-vibration bar (AVB) thickness.
d. The tube supplier is Sumitomo.
e. The shortest radius U-bend radius is approximately 3.2398 inch.
f. See Attachment 2 for cross sectional representation of the tubesheet. Attachment 2 provides a one half cross sectional view of the typical Salem Unit 2 steam generator tubesheet. The other half is essentially a mirror image. The tubes are positioned within 104 rows and 127 columns, in a triangular pitch configuration.

2. Please discuss the scope and results of any secondary side inspections.

PSEG Response

In each steam generator (SG), following top of tubesheet water lancing (sludge lancing), visual inspections and Foreign Object Search and Retrieval were performed at the top of tubesheet (TTS). These inspections included the full length of the no tube lane (area between row 1 tubes), some inner bundle inspections, 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. Approximately 49.5 pounds of sludge was removed from all four SGs (total).

Overall, only three small foreign objects were reported from the SG secondary side inspection TTS inspections. Retrieval attempts were made, and partly successful. Objects not removed were evaluated in the corrective action program. None of the objects remaining are expected to cause tube wear for the life of the plant. All tubes immediately near the visually confirmed foreign material received rotating coil probe inspections at the area of interest (e.g., TTS). No tube wear from foreign material was identified in any tube.

Two small metallic machine turnings were discovered on the TTS in SG 21, one on the hot leg (H/L) and the other on the cold leg (C/L). The machine turning on the C/L was partially removed. A small, thin metallic object resembling a wire-brush bristle was discovered near the center of the tube bundle in SG 23 on the H/L tubesheet. The part was partially embedded in hard sludge. A summary of the foreign material is provided in the table below.

2R17 Top of Tubesheet SSI/FOSAR Summary

SG	2R17 SSI/FOSAR	Final Result
21	R103-C67 TSC small machine turning	Partly removed, only a tiny piece not retrieved (less than ~1/64" in diameter and 0.05" long). Evaluated in corrective action program, with no tube wear expected for the life of the plant.
21	R98-C50 TSH small machine turning, ~0.12" L x 0.02" D x 0.1" W	Not removed. Evaluated in corrective action program, with no tube wear expected for the life of the plant.
23	R46-C64 TSH Wire bristle embedded in hard sludge, ~0.01" in diameter and 0.5" long	Not removed. Evaluated in corrective action program, with no tube wear expected for the life of the plant.

Upper internals inspections (steam drum area) were also performed in all four steam generators. This was accomplished by inspection personnel entering the SG via the upper secondary manways. These inspections were performed to identify the general condition of the components; including the feedring components and supports, drain pipes, instrument taps, primary and secondary separators, downcomer loose parts

trapping screens, and all "internal" camera port (inspection ports) and hatches (manways).

Thirteen loose nuts were identified on the various hatches and camera ports installed "internal" to the SGs. Five (5) of the ten (10) camera inspection ports also had one nut per cover that was inaccessible to tooling, due to the obstruction of the placement of the camera inspection ports in relation to the steam riser barrel. All accessible nuts (those found loose and those not found loose) were tightened to a higher torque based on information supplied by the component designer. The cause for the loose nuts was attributed to insufficient torque during manufacture. The nuts that were identified as inaccessible were attributed to the camera inspection ports being welded into place as a completed assembly during manufacture (including the cover, bolts, nuts, etc). The corrective actions for the loose nuts on the internal manways / ports included retorque of all accessible nuts (those found loose and those not found loose) to a higher torque based on information supplied by the component designer. Assessment for the 5 inaccessible nuts concluded to use-as-is. Modified tooling is being evaluated to access the inaccessible nuts in future outage inspections.

Two feedring inspection port covers (one in SG 21 and one in SG 22) were each identified as having one slightly loose bolt per cover, however the lock washer was fully engaged and prohibited any rotation. Another feedring inspection port cover lock washer in SG 23 was also found slightly loose, but the bolt was secure. The probable cause for the loose bolts and lock washer on the feedring inspection ports is insufficient torque applied to the bolts, limited by the original design, based on assessments by the component manufacturer. All feedring inspection port hardware (cover, gasket, bolts, and locking washers) were replaced with an improved design, based on component manufacturer recommendations.

The loose nuts, bolts, or lock washer did not compromise the design function of retaining the cover in place. In addition, the hardware design prohibits the generation of loose parts since the hardware is captured in a manner that even if the bolt and nut were to become fully loose, it would not be capable of becoming a loose part.

INPO Operating Experience report 30229 was provided to the industry regarding PSEG's experience during 2R17 with AVB wear and upper secondary side inspection results.

3. You indicated that your condition monitoring limit for wear is 46%. Please confirm this number. If this number is correct, please discuss the plugging criteria used during your 2009 inspections given the growth rates observed during the first inspection. Please identify which tubes were plugged.

PSEG Response

The most limiting and conservative condition monitoring limit of all the degradation detected (AVB, Tube Support Plate (TSP), and Support/Position Device (SPT)) is approximately 46% Through-Wall (TW). The AVB wear, TSP wear, and SPT wear Condition Monitoring limits are approximately 48% TW, 46% TW, and 50% TW; respectively.

All AVB wear 30% TW and greater, and the single tube with SPT wear, was plugged and stabilized. The 30% through-wall repair criterion for wear at the AVBs was based on the Operational Assessment using a probabilistic full bundle analysis approach consistent with guidance from the EPRI SG Integrity Assessment Guidelines, Rev 2. The probabilistic full bundle approach (which considers each wear indication returned to service in each SG) is more responsive to extreme value growth rates because it explicitly captures the fact that, if more deep wear scars are returned to service, there is an increasing probability that large growth rates will be matched with large beginning of cycle depths; making deep end of cycle flaws more likely. Hence, this approach will yield a lower repair limit for a SG which has a large population of flaws. The resulting per-bundle probabilities of meeting 3ΔP are greater than 0.96 for the plugging limit implemented (plug tubes with AVB wear of 30% TW or greater), and exceed the required 0.95 per-bundle probability as identified in the EPRI SG Integrity Assessment Guidelines, Rev 2. This demonstrates with high probability that performance criteria will be met, for each steam generator, during the next operating cycle (up to 2R18).

The following tubes were plugged and stabilized during 2R17:

SG21: R100-C64
SG22: R64-C112, R88-C60, R92-C58
SG23: R91-C59
SG24: R76-C64, R84-C64, R86-C62, R86-C64, R100-C64

4. A few indications of wear were detected at the anti-vibration bar support/positioning device. Please discuss whether there is any operating experience with such a design and whether continued monitoring of these locations (even in plugged tubes) is necessary, since it appears that these structures support the anti-vibration bars (and may continue to interact with the tube due to the weight of the complex).

PSEG Response

Saint Lucie 2 reported similar wear from the AVB support/positioning device in an outage just before Salem 2R17 outage. Saint Lucie 2 replacement SGs are also AREVA, and share some similarities in design to Salem Unit 2 AREVA replacement SGs. At Salem Unit 2, U-bend cable stabilizers were conservatively installed in all plugged tubes, including the tube with AVB support/positioning wear. The stabilizer provides added stability and wear volume in the event of continued wear from the AVB support/positioning device on the plugged tube. Continued wear from the AVB support/positioning device is also expected to be self limited by the SG design. This is because contact between any individual tube and AVB support/positioning device is also dependent on the entire AVB support assembly via the contact of the numerous other surrounding AVB support/positioning devices and tubes. SPT degradation is expected to be detected during normal outage inspections of in-service tubes (e.g – Bobbin inspections), if this form of degradation continues.

5. Your TSs still indicate that W* may be applied to your replacement SGs and have reporting requirements related to implementation of W*. Presumably, W* was not implemented during the 2009 outage because there was no mention of it in your April 30, 2010, letter (as required per TS 6.9.1.10.h). Given that the technical basis for W* relies on explosive expansion of the tubes into the tubesheet and that the explosive expansion process most likely results in different contact pressures between the tube and the tubesheet than the hydraulic expansion process used in your replacement SGs, please discuss any plans to remove W* from your TSs. It appears that the criteria should not be applied to the replacement SGs (even though the TSs indicate it may be applied).

PSEG Response

The Salem Unit 2 Technical Specification 6.8.4.i does contain legacy information (W*) related to the Westinghouse Model 51 SGs. The Technical Specification provides that W* is only applicable to Westinghouse Model 51 SGs. W* was not implemented for 2R17 inspections of the Salem Unit 2 replacement SGs (i.e., AREVA 61/19 T). PSEG has entered this item into the corrective action program to address Westinghouse Model 51 SG legacy information.

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