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United States Nuclear Regulatory Commission
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**RESPONSE TO GENERIC LETTER 2004-01, "REQUIREMENTS FOR STEAM
GENERATOR TUBE INSPECTIONS"
SALEM GENERATING STATION UNIT 1 AND UNIT 2
DOCKET NOS. 50-272 AND 50-311
FACILITY OPERATING LICENSE NOS. DPR-70 AND DPR-75**

Generic Letter (GL) 2004-01 requested PSEG Nuclear, LLC (PSEG) to provide information within 60 days of the date of the generic letter to enable the NRC staff to determine whether licensees are implementing steam generator tube inspections in accordance with applicable requirements.

PSEG's response for Salem Unit 1 is provided in Attachment 1. Attachment 2 is the PSEG response for Salem Unit 2. Attachment 3 is the safety assessment for Salem Unit 2 performed in accordance with GL 2004-01. Should you have any questions regarding these responses, please contact Mr. Courtney Smyth at (856) 339-5298.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 10/29/04 Sincerely,
(Date)

Michael H. Brothers
Vice President – Operations

Attachments (3)

A15

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**SALEM GENERATING STATION UNIT 1
DOCKET NO. 50-272
RESPONSE TO NRC GENERIC LETTER 2004-01,
"REQUIREMENTS FOR STEAM GENERATOR TUBE INSPECTIONS"**

This Attachment is structured to list the information requested by Generic Letter 2004-01 followed by the response for Salem Unit 1.

- 1. Addressees should provide a description of the SG tube inspections performed at their plant during the last inspection. In addition, if they are not using SG tube inspection methods whose capabilities are consistent with the NRC's position, addressees should provide an assessment of how the tube inspections performed at their plant meet the inspection requirements of the TS in conjunction with Criteria IX and XI of 10 CFR Part 50, Appendix B, and corrective action taken in accordance with Appendix B, Criterion XVI. This assessment should also address whether the tube inspection practices are capable of detecting flaws of any type that may potentially be present along the length of the tube required to be inspected and that may exceed the applicable tube repair criteria.**

Salem Unit 1 Response

Steam Generator (SG) tube inspections performed at Salem Unit 1 are consistent with the NRC's position regarding tube inspections.

Salem Unit 1 is a four loop Westinghouse Pressurized Water Reactor (PWR) with Model F steam generators; each containing 5,626 thermally treated Inconel Alloy 600 U-tubes. During SG fabrication, all tubes were full length hydraulically expanded into the tubesheet, both hot and cold legs. In addition, the first 10 rows were stress relieved after bending in the U-bend area.

The Westinghouse Model F SGs were installed at Salem Unit 1 via a Steam Generator Replacement Project (SGRP), with the SGs being supplied from the canceled Seabrook Unit 2 plant. The SGRP was completed in 1998, coinciding with the start of plant operating cycle 13.

In summary during the last refueling outage, Outage 1R16 (Spring 2004), PSEG Nuclear, LLC (PSEG) performed the following tube inspection scope in all four steam generators at Salem Unit 1:

- With the exception of those row 1 and row 2 U-bends inspected under rotating coil inspection program, a full-length bobbin coil inspection was performed on 100% of the in-service tubes in each steam generator.
- 20% rotating coil (+ Point) exam of the row 1 and row 2 U-bends.

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- Approximately 50% rotating coil (+ Point) exam of the Hot Leg (HL) Top of Tubesheet (TTS) transition regions in each steam generator at an extent of +3 inches above and -3 inches below the TTS.
- 20% rotating coil (+ Point) exam of the > 5-volt dented HL Tube Support Plate (TSP) intersections (Flow Distribution Baffle Plate (FBH) to 07H).
- 20% rotating coil (+ Point) exam of the > 5-volt HL free span dings (TSH +0.5 inches to 07H) in each steam generator.
- 100% rotating coil (+ Point) of \geq 2-volt U-bend dings (07H to 07C).
- 100% rotating coil (+ Point) of \geq 2-volt dented Anti-Vibration Bar (AVBs) locations.
- Rotating coil (+ Point) of all AVB wear indications that exceeded the repair criteria (40%TW).
- Rotating coil (+ Point) on historical tubesheet expansion anomalies.

PSEG uses tube inspection methods that are capable of detecting flaw types that may be present at Salem Unit 1. Prior to each inspection, a degradation assessment, which includes operating experience, is performed to identify degradation mechanisms that may be present, and a technique validation assessment is performed to verify that the eddy current techniques are capable of detecting those flaw types identified in the degradation assessment.

- 2. If addressees conclude that full compliance with the TS in conjunction with Criteria IX, XI and XVI of 10 CFR Part 50, Appendix B, requires corrective actions, they should discuss their proposed corrective actions (e.g., changing inspection practices consistent with the NRC's position or submitting a TS amendment request with the associated safety basis for limiting the inspections) to achieve full compliance. If addressees choose to change their TS, the staff has included in the attachment suggested changes to the TS definitions for a tube inspection and for plugging limits to show what may be acceptable to the staff in cases where the tubes are expanded for the full depth of the tubesheet and where the extent of the inspection in the tubesheet region is limited.**

Salem Unit 1 Response

Steam Generator tube inspections performed at Salem Unit 1 are consistent with the NRC's position regarding tube inspections. Therefore this question does not apply.

3. For plants where SG tube inspections have not been or are not being performed consistent with the NRC's position on the requirements in the TS in conjunction with Criteria IX, XI, and XVI of 10 CFR Part 50, Appendix B, the licensee should submit a safety assessment (i.e., a justification for continued operation based on maintaining tube structural and leakage integrity) that addresses any differences between the licensee's inspection practices and those called for by the NRC's position. Safety assessments should be submitted for all areas of the tube required to be inspected by the TS where flaws have the potential to exist and inspection techniques capable of detecting these flaws are not being used, and should include the basis for not employing such inspection techniques. The assessment should include an evaluation of (1) whether the inspection practices rely on an acceptance standard (e.g., cracks located at least a minimum distance of x below the top of the tube sheet, even if these cracks cause complete severance of the tube) which is different from the TS acceptance standards (i.e., the tube plugging limits or repair criteria), and (2) whether the safety assessment constitutes a change to the "method of evaluation" (as defined in 10 CFR 50.59) for establishing the structural and leakage integrity of the joint. If the safety assessment constitutes a change to the method of evaluation under 10 CFR 50.59, the licensee should determine whether a license amendment is necessary pursuant to that regulation.

Salem Unit 1 Response

Steam Generator tube inspections performed at Salem Unit 1 are consistent with the NRC's position regarding tube inspections. Therefore this question does not apply.

**SALEM GENERATING STATION UNIT 2
DOCKET NO. 50-311
RESPONSE TO NRC GENERIC LETTER 2004-01,
"REQUIREMENTS FOR STEAM GENERATOR TUBE INSPECTIONS"**

This Attachment is structured to list the information requested by Generic Letter 2004-01 followed by the response for Salem Unit 2.

- 1. Addressees should provide a description of the SG tube inspections performed at their plant during the last inspection. In addition, if they are not using SG tube inspection methods whose capabilities are consistent with the NRC's position, addressees should provide an assessment of how the tube inspections performed at their plant meet the inspection requirements of the TS in conjunction with Criteria IX and XI of 10 CFR Part 50, Appendix B, and corrective action taken in accordance with Appendix B, Criterion XVI. This assessment should also address whether the tube inspection practices are capable of detecting flaws of any type that may potentially be present along the length of the tube required to be inspected and that may exceed the applicable tube repair criteria.**

Salem Unit 2 Response

Salem Unit 2 is a four loop Westinghouse Pressurized Water Reactor with Series 51 steam generators, each steam generator contains 3,388 mill annealed Inconel Alloy 600 U-tubes. Prior to initial operation, all tubes were full length explosively expanded into the tubesheet, both hot and cold legs, using the Westinghouse "WEXTEx" process. In addition, during outage 2R8 (Fall 1994), shot peening of the hot leg tubesheet region was performed as a preventative measure against stress corrosion cracking.

In summary during the last refueling outage, Outage 2R13 (Fall 2003), PSEG Nuclear, LLC (PSEG) performed the following tube inspection scope in all four steam generators (unless otherwise noted) at Salem Unit 2:

- With the exception of those row 2 and row 3 U-bends inspected under rotating coil inspection program, a full-length bobbin coil inspection was performed on 100% of the in-service tubes in each steam generator (Note: All row 1 tubes have been preventatively plugged).
- 100% Rotating Coil (+ Point) examination of the rows 2 through 10 U-bends and 20% of the rows 13 through 17 U-bends (07C-07H or 07H – 07C) in steam generators 21, 22 and 24. In steam generator 23, 100% of rows 2 thru 20 were inspected with Rotating Coil (+ Point).
- 100% Rotating Coil (+ Point) examination of the Hot Leg (HL) WEXTEx Top of Tubesheet (TTS) transition regions in each steam generator at a minimum extent of +3 inches above and -8 inches below the TTS.

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- 100% Rotating Coil (+ Point) examination of the ≥ 1 -volt dented HL Tube Support Plate intersections at 01H, 02H and 03H and 20% of the ≥ 1 -volt dented HL Tube Support Plate intersections at 04H in each steam generator.
- 25% Rotating Coil (+ Point) examination of the ≥ 5 -volt dented HL TSP population at 04H, 05H, 06H and 07H.
- 100% Rotating Coil (+ Point) examination of the ≥ 1 -volt dented HL Tube Support Plate intersections at 01H, 02H and 03H and 20% of the ≥ 1 -volt dented HL Tube Support Plate intersections at 04H in each steam generator.
- 25% Rotating Coil (+ Point) examination of the ≥ 2 -volt HL free span dings (TSH +0.5 inches to 07H +2.0 inches) was performed.
- 100% Rotating Coil (+ Point) examination of TSP ligament indications identified from bobbin coil.
- 100% Rotating Coil (+ Point) examination of ≥ 2 -volt U-bend dings (07H to 07C).
- 100% Rotating Coil (+ Point) examination of ≥ 1 -volt dented Anti-Vibration Bar locations.
- 100% Rotating Coil (+ Point) examination of the freespan indications that were dispositioned in 2R12 and 2R13 as historical bobbin coil signals not related to in-service degradation when compared to the first In-service Inspection (ISI) bobbin coil data was performed.
- 100% Rotating Coil (+ Point) examination of Cold Leg Thinning (CLT) Indications, excluding those rotating coil inspected during outage 2R11 and 2R12.

Prior to each inspection, a degradation assessment, which includes operating experience, is performed to identify degradation mechanisms that may be present, and a technique validation assessment is performed to verify that the eddy current techniques are capable of detecting the degradation. In this sense, all inspections performed have met the inspection requirements of Technical Specifications and have ensured tube integrity in accordance with 10 CFR Part 50, Appendix B. However, steam generator tube inspections performed at Salem Unit 2 are not consistent with the NRC's position as related to tube inspections in the hot leg region of the tubesheet.

PSEG has not performed rotating coil, or equivalent, inspections over the full length of the hot leg tubesheet region to the tube end at Salem Unit 2. Bobbin coil probe was utilized for inspection of this region, however these tube inspection practices are typically not capable of detecting flaws of any type that may potentially be present in the tubesheet region and that may exceed the tube repair criteria. This condition has been entered into PSEG's corrective action program.

The following provides a summary of Salem Unit 2 safety assessment, as detailed in response to NRC Request 3.

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Tubesheet inspections are performed in accordance with WCAP-14797, Revision 1, "Generic W* Tube Plugging Criteria for Model 51 Series Steam Generator Tubesheet Region WEXTX Expansions," dated February 1997. This WCAP provides the technical bases for an Alternate Repair Criteria (ARC) that was approved by the NRC for application at Diablo Canyon Nuclear Power Plant, Units 1 and 2 on February 19, 1999. Salem Unit 2 has applied the WCAP technical basis to limit the rotating coil inspection extent to a minimum of 8 inches below the top of tubesheet. The rotating coil is capable of detecting flaws of any type that may potentially be present along the WCAP-14797 inspection length, and all detected degradation has been repaired in accordance with the TS. Potential degradation that may be present below the WCAP inspection length is not inspected by rotating coil probes, and is not typically capable of being detected by the bobbin coil probe. However, degradation below the rotating coil inspection depth established by WCAP-14797 does not have an adverse effect on the structural integrity and leakage requirements, and as such, would not affect the safety function of the steam generator.

- 2. If addressees conclude that full compliance with the TS in conjunction with Criteria IX, XI and XVI of 10 CFR Part 50, Appendix B, requires corrective actions, they should discuss their proposed corrective actions (e.g., changing inspection practices consistent with the NRC's position or submitting a TS amendment request with the associated safety basis for limiting the inspections) to achieve full compliance. If addressees choose to change their TS, the staff has included in the attachment suggested changes to the TS definitions for a tube inspection and for plugging limits to show what may be acceptable to the staff in cases where the tubes are expanded for the full depth of the tubesheet and where the extent of the inspection in the tubesheet region is limited.**

Salem Unit 2 Response

In accordance with the Salem Unit 2 response provided for NRC information request item 1, steam generator tube inspections performed at Salem Unit 2 are not consistent with the NRC's position. This issue has been entered in the corrective action program. To improve the Salem Unit 2 Technical Specifications and achieve consistency with the NRC's position, PSEG plans to submit a License Change Request (LCR) following the notice of availability of a Consolidated Line Item Improvement Process item (CLIP), for the Generic License Change Package (GLCP, in accordance with TSTF-449, Revision 2). In accordance with the proposed PSEG submittal for the GLCP, the TS requirements as related to definitions for plugging limit and tube inspection will be revised accordingly recognizing WCAP-14797 as the basis for limited rotating coil probe inspections in the tubesheet region. PSEG currently intends to submit

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WCAP-14797 for inspection basis only, and not for ARC purposes. Tubes with cracks detected would be plugged on detection.

- 3. For plants where SG tube inspections have not been or are not being performed consistent with the NRC's position on the requirements in the TS in conjunction with Criteria IX, XI, and XVI of 10 CFR Part 50, Appendix B, the licensee should submit safety assessment (i.e., a justification for continued operation based on maintaining tube structural and leakage integrity) that addresses any differences between the licensee's inspection practices and those called for by the NRC's position. Safety assessments should be submitted for all areas of the tube required to be inspected by the TS where flaws have the potential to exist and inspection techniques capable of detecting these flaws are not being used, and should include the basis for not employing such inspection techniques. The assessment should include an evaluation of (1) whether the inspection practices rely on an acceptance standard (e.g., cracks located at least a minimum distance of x below the top of the tube sheet, even if these cracks cause complete severance of the tube) which is different from the TS acceptance standards (i.e., the tube plugging limits or repair criteria), and (2) whether the safety assessment constitutes a change to the "method of evaluation" (as defined in 10 CFR 50.59) for establishing the structural and leakage integrity of the joint. If the safety assessment constitutes a change to the method of evaluation under 10 CFR 50.59, the licensee should determine whether a license amendment is necessary pursuant to that regulation.**

Salem Unit 2 Response

Attachment 3 provides a safety assessment that addresses differences between the Salem Unit 2's inspection practices and those called for by the NRC's position.

Question 3 of Generic Letter 2004-01 also requests licensees to consider whether the safety assessment, performed for those conditions where tube inspections within the tubesheet are not being performed consistent with the NRC's position, constitutes a change to the "method of evaluation" (as defined in 10CFR50.59) for establishing the structural and leakage integrity of the tube and/or tubesheet joint. In assessing this question, Generic Letter 2004-01 inquires as to whether the safety assessment is redefining the ASME Section III pressure boundary and is using a different method of evaluation to demonstrate the structural and leakage integrity of the revised pressure boundary. PSEG has reviewed the NRC's position and has concluded that the analysis approach does not redefine the ASME pressure boundary and is not a change in the method of evaluation per 10CFR50.59 based on the following:

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1. PSEG does not consider the assessment approach, or the described inspection program scope, as redefining the ASME Section III pressure boundary. The selection of NDE techniques or extent of inspection does not, by itself, define the limits of the ASME pressure boundary. For example, Generic Letter 2004-01 indicates that current technical specifications include language that excludes sections of cold leg tubing from inspection extent. Generic Letter 2004-01 also states that the selection of NDE techniques is not specified in the Technical Specifications, but is governed by the provisions of 10 CFR Part 50 Appendix B, and as such, is not used to define pressure boundary limits. From an integrity assessment perspective, neither past NRC approval of Alternate Repair Criteria (ARC) nor the suggested changes to the Technical Specification provided in Generic Letter 2004-01 address or indicate that the basis for approval is a redefinition of the pressure boundary.
2. The NRC endorsed guidance for 10CFR 50.59 evaluations (NEI 96-07) defines "method of evaluation" and the associated 10CFR50.59 screening protocol. Section 4.3.8 of NEI 96-07 states that methods of evaluation that are not described, outlined or summarized in the UFSAR are excluded from departure consideration. The tube integrity assessments employed by PSEG consider the entire length of pressure boundary tubing. Undetected flaws and their impact on tube integrity are addressed. The assessments are consistent with industry standards. The analyses and analysis parameters are not described, outlined or summarized in ASME Section III, ASME Section XI or in the UFSAR, and therefore would not constitute a change/departure in the method of evaluation per 10CFR 50.59.

**SALEM GENERATING STATION UNIT 2
DOCKET NO. 50-311**

SAFETY ASSESSMENT IN ACCORDANCE WITH GENERIC LETTER 2004-01

I. Introduction:

On August 30, 2004; the NRC staff issued Generic Letter (GL) 2004-01 providing the staff's position as related to SG tube inspections and the Technical Specifications (TS) in conjunction with 10 CFR 50 Appendix B. In summary of the GL, the staff's position is as follows:

"...It is the staff's position that pending a license amendment clarifying the inspection approach to be followed, licensees are required to employ inspection methods capable of detecting all flaw types that may be present at locations that are required to be inspected by the TS and where flaws at those locations may exceed the applicable TS tube repair criteria..."

The NRC staff's position as provided in the GL is further emphasized recognizing requirements of 10 CFR 50 Appendix B. In addition, the Technical Specifications do not prescribe the specific nondestructive test methods used to inspect steam generator tubing.

Currently, specialty probes such as rotating coil probes (+ Point), are the only type of probe that are capable of detecting all types of degradation within the tubesheet region, including cracking (axial or circumferential). The industry (including PSEG for the Salem units) currently employs an eddy current test with a bobbin probe over the entire length of the tubing to satisfy Technical Specification requirements; and to satisfy Appendix B requirements, the Degradation Assessment is performed to determine areas of the tubing that require supplemental rotating coil inspections. In accordance with generic industry efforts and plant specific review of the GL, Salem Unit 2 steam generator tube inspection practices throughout the SG tubes are consistent with the NRC staff's position, with exception of inspection practices within the tubesheet region. Discussions provided in this assessment are therefore focused on any differences between PSEG's inspection practices and those called for by the NRC's position. This safety assessment includes an evaluation of whether the inspection practices rely on an acceptance standard, which is different from the TS acceptance standards and includes the basis for not employing such inspection techniques.

II. Design Basis Requirements:

The SG tubes at Salem have a number of important safety functions and are considered safety-related. SG tubes are an integral part of the reactor coolant pressure boundary (RCPB) and, as such, are relied upon to maintain the primary

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system's pressure and inventory. As part of the RCPB, the SG tubes are unique in that they are also relied upon as a heat transfer surface between the primary and secondary systems such that residual heat can be removed from the primary system. In addition, the SG tubes also isolate the radioactive fission products in the primary coolant from the secondary system. SG tube integrity is necessary in order to satisfy the tubing's safety functions. Maintaining tube integrity ensures that the tubes are capable of performing their intended safety functions consistent with their licensing basis, including applicable regulatory requirements.

III. Analysis/Assessment:

PSEG employs the bobbin probe over the entire length of the tubing to satisfy Technical Specification requirements; and to satisfy Appendix B requirements, the Degradation Assessment is performed to determine areas of the tubing that require supplemental rotating coil inspections. The Salem Unit 2 Degradation Assessment, in accordance with NEI 97-06, "Steam Generator Program Guidelines," utilizes Westinghouse WCAP-14797 as a basis for the limiting the use of supplemental rotating coil inspections within the tubesheet region. Degradation below the rotating coil inspection depth established by WCAP-14797 does not have an adverse effect on the structural integrity and leakage requirements, and as such would not affect the safety function of the steam generator. However, the inspections performed within the hot leg tubesheet region are not consistent with the NRC staff's position as provided in GL 2004-01.

The WCAP-14797 inspection methodology is used at Salem Unit 2 only for determination of the appropriate tubesheet region inspection depth using rotating coil probes. Alternate repair criteria are not utilized; all degradation identified from the rotating coil probe (+ Point) examinations in the tubesheet region of the tube bundle is plugged upon detection. Therefore, these examinations provide compliance with the technical specifications and NEI 97-06, and therefore, the operability of the steam generators is assured. Furthermore, the technical basis for inspections performed in the tubesheet region of the Salem Unit 2 steam generators is consistent with the NRC approval of Diablo Canyons' Technical Specification Tubesheet Alternate Repair Criteria (ARC)(Reference 3), which is based on WCAP-14797. PSEG utilizes the same engineering evaluation (WCAP-14797) as used to license the Diablo Canyon ARC to justify their tubesheet inspection depth. PSEG did not previously pursue a technical specification amendment to justify the tubesheet inspection depth, since unlike Diablo Canyon, PSEG implements a plug on detection repair criteria, which does not warrant approval of an ARC.

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IV. Conclusions/Actions:

PSEG concludes that Salem Unit 2 inspection practices within the hot leg tubesheet region are not consistent with NRC staff's position provided in GL 2004-01. This issue has been entered into PSEG's corrective action program in accordance with Appendix B Criterion XVI. To improve the Salem Unit 2 Technical Specifications and achieve consistency with the NRC's position, PSEG plans to submit a License Change Request (LCR) following the notice of availability of a Consolidated Line Item Improvement Process item (CLIP), for the Generic License Change Package (GLCP, in accordance with TSTF-449, Revision 2). PSEG anticipates using WCAP-14797 as the basis for limited rotating coil probe inspections in the tubesheet region in the TS to be proposed in accordance with the CLIP for the GLCP.

V. Resolution:

Closure of this inconsistency between the NRC staff's position and PSEG's inspection practices at Salem Unit 2; and in accordance with GL 91-18, may be achieved by receiving a license amendment for limiting inspection within the tubesheet region and therefore limiting the use of specialty probes (e. g., + Point) via technical basis provided from WCAP-14797. This license change is not necessary for start up or for continued operation of Salem Unit 2.

VI. Attachments:

None

VII. References:

1. NRC GL 2004-01, "Requirements for Steam Generator Tube Inspections," August 30, 2004.
2. WCAP-14797 Revision 1, "Generic W* Tube Plugging Criteria for Model 51 Series Steam Generator Tubesheet Region WEXTX Expansions," February 1997.
3. Diablo Canyon Nuclear Power Plant, Unit 1 and 2 Amendments 129/127 dated February 19, 1999.
4. NEI 97-06 Revision 1, "Steam Generator Program Guidelines," January 2001.
5. NRC GL 91-18, Revision 1, "Information to Licensees Regarding NRC Inspection Manual Section on Resolution of Degraded and Nonconforming Conditions," October 8, 1997.