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**SALEM GENERATING STATION – UNIT 1  
FACILITY OPERATING LICENSE NOS. DPR-70  
NRC DOCKET NO. 50-272**

**Subject: LICENSE CHANGE REQUEST S06-011  
WCAP-16640, STEAM GENERATOR ALTERNATE REPAIR  
CRITERIA (H\* / B\* METHODOLOGY)**

In accordance with the provisions of 10 CFR 50.90, PSEG Nuclear, LLC (PSEG) hereby transmits a request for amendment of the Technical Specifications (TS) for Salem Generating Station Unit 1. In accordance with 10 CFR 50.91(b)(1), a copy of the transmittal has been sent to the State of New Jersey.

The proposed amendment will modify the Salem Unit 1 Technical Specifications by changing the scope of the steam generator (SG) tubesheet inspections required in the SG tubesheet region, using the H\* / B\* methodology, as defined in WCAP-16640, dated August 2006.

The WCAP-16640 analyses support a license amendment to eliminate inspection of the region of the tubesheet below a bounding H\* or B\* distance from the top of the tubesheet. For the Salem Unit 1 SGs, a conservative distance of 8.0 inches from the top of the tubesheet is justified as the inspection distance. This distance takes into account variation in the location of the bottom of the hydraulic expansion transition from the top of the tubesheet, NDE uncertainty in determining the location of the tip of axial cracks from the bottom of the expansion transition (BET), and NDE uncertainty in determining the H\* length. Such an amendment is interpreted to constitute a redefinition of the primary-to-secondary pressure boundary relative to the original design of the SG and requires the approval of the NRC staff through a license amendment.

Based on the proposed change, PSEG Nuclear LLC will implement the following repair criteria and acceptance criteria:

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OCT 02 2006

- Any type or combination of tube degradation below 8 inches from the top of the tubesheet (TTS) on the hot or cold leg side may be left in service.
- Degradation in tubes less than or equal to 8 inches from the top of the tubesheet on the hot leg or cold leg side must be plugged.

PSEG has evaluated the proposed changes in accordance with 10CFR50.91(a)(1), using the criteria in 10CFR50.92(c), and has determined this request involves no significant hazards considerations.

Attachment 1 provides an evaluation of the proposed changes. Attachment 2 provides Westinghouse WCAP-16640-P, August 2006, (proprietary), "Steam Generator Alternate Repair Criteria for Tube Portion Within the Tubesheet at Salem Unit 1." Attachment 3 contains the Westinghouse affidavit on conforming to the provisions of 10CFR2.390 for withholding the proprietary letter from public disclosure. Attachment 4 provides Westinghouse WCAP-16640-NP, August 2006, (non-proprietary), "Steam Generator Alternate Repair Criteria for Tube Portion Within the Tubesheet at Salem Unit 1." Attachment 5 provides the Significant Hazards Consideration, EVAL-06-58 SHC. Attachment 6 contains the existing TS pages marked up to show the proposed changes.

PSEG requests a 60-day implementation period after amendment approval. Approval of this change is requested by March 1, 2007 to support Salem Generating Station Unit 1 refueling outage 1R18.

If you have any questions or require additional information, please do not hesitate to contact Mr. Jamie Mallon at (610) 765-5507.

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

Executed on 10/2/06  
(Date)

Sincerely,



Thomas P. Joyce  
Site Vice President  
Salem Generating Station

Attachments (6)

OCT 02 2006

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**SALEM GENERATING STATION - UNIT 1  
DOCKET NO. 50-272  
CHANGE TO TECHNICAL SPECIFICATIONS  
WCAP-16640, AUGUST 2006, STEAM GENERATOR ALTERNATE REPAIR CRITERIA  
FOR TUBE PORTION WITHIN THE TUBESHEET AT SALEM UNIT 1 (H\* / B\*  
METHODOLOGY)**

Table of Contents

1.	DESCRIPTION .....	1
2.	PROPOSED CHANGE .....	2
3.	BACKGROUND .....	5
4.	TECHNICAL ANALYSIS .....	5
5.	REGULATORY SAFETY ANALYSIS.....	5
5.1	No Significant Hazards Consideration.....	5
5.2	Applicable Regulatory Requirements/Criteria.....	5
6.	ENVIRONMENTAL CONSIDERATION .....	7
7.	REFERENCES .....	7

## 1.0 DESCRIPTION

This letter requests an amendment to Operating License DPR-70 for Salem Generating Station Unit 1. PSEG Nuclear LLC (PSEG) is proposing to modify the Salem Unit 1 Technical Specifications (TS) changing the scope of the steam generator (SG) tube sheet inspections required in the SG tubesheet region, using the H\* / B\* methodology (as defined in WCAP-16640, August 2006). For Salem Unit 1 SGs, a conservative distance of 8.0 inches from the top of the tubesheet is justified as the inspection distance.

The proposed change will implement the following repair criteria and acceptance criteria:

- Any type or combination of tube degradation below 8 inches from the top of the tubesheet (TTS) on the hot or cold leg side may be left in service.
- Degradation in tubes less than or equal to 8 inches from the top of the tubesheet on the hot leg or cold leg side must be plugged.

The WCAP-16640 analyses support a license amendment to eliminate inspection of the region of the tube below the bounding H\* / B\* distance (8 inches) from the top of the tubesheet. The evaluation considers the requirements of the ASME Code, Regulatory Guides, NRC Generic Letters, NRC Information Notices, the Code of Federal Regulations, NEI 97-06, and additional industry requirements. The conclusion of the technical evaluation is that:

- 1) the structural integrity of the primary-to-secondary pressure boundary is unaffected by tube degradation of any magnitude below a tube location-specific depth ranging from 2.25 to 7.05 inches, designated as H\* (considering both hot and cold leg H\* values), and,
- 2) that the accident condition leak rate can be bounded by twice the normal operation leak rate from degradation below a distance from the top of the tubesheet known as the B\* distance of 6.83 inches.

These results follow from finite element analyses demonstrating that the tube-to-tubesheet hydraulic joints make it extremely unlikely that any operating or faulted condition loads are transmitted below the H\* elevation, and the contact leak rate resistance increases below a certain elevation within the tubesheet. The analyses results support a license amendment to eliminate inspection of the region of the tube below a bounding H\* or B\* distance from the top of the tubesheet. For the Salem Unit 1 SGs, a conservative distance of 8.0 inches from the top of the tubesheet is justified as the inspection distance. This distance takes into account variation in the location of the bottom of the hydraulic expansion transition from the top of the tubesheet, NDE uncertainty in determining the location of the tip of axial cracks from the bottom of the expansion transition (BET), and NDE uncertainty in determining the H\* length. Such an amendment is interpreted to constitute a redefinition of the

primary-to-secondary pressure boundary relative to the original design of the SG and requires the approval of the NRC staff through a license amendment.

A similar type of Technical Specification change was approved, on a one-time basis, to limit inspections of the Braidwood 2 and Wolf Creek SGs during the Spring 2005 inspection campaigns. Subsequent approvals were also obtained for use at Byron 2 and Vogtle 2 in their Fall 2005 inspection campaigns.

## 2.0 PROPOSED CHANGE

The proposed changes will revise the following Salem Unit 1 Technical Specifications on a permanent basis:

TS 6.8.4.i Steam Generator (SG) Program  
TS 6.9.1.10 Steam Generator Tube Inspection Report  
TS 6.9.1.5.b Reports<sup>1</sup>  
TS B3/4.4.5 Steam Generator (SG) Tube Integrity

The specific changes are discussed below.

### TS 6.8.4.i Steam Generator (SG) Program

TS 6.8.4.i c) currently states:

- c. "Provisions for SG tube repair criteria. Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding 40% of the nominal tube wall thickness shall be plugged."

This criterion will be revised as follows as noted in bold type:

- c. "Provisions for SG tube repair criteria. Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding 40% of the nominal tube wall thickness shall be plugged. **In lieu of the 40% of the nominal wall thickness repair criteria, the portion of the tube within the tubesheet of the inspected SGs shall be plugged in accordance with the alternate repair criteria defined in WCAP-16640-P, "Steam Generator Alternate Repair Criteria for the Tube Portion within the Tubesheet at Salem Unit 1." Degradation found in the portion of the tube below 8 inches from the top of the tubesheet does not require plugging. Degradation identified in the portion of the tube from the top of the tubesheet to 8 inches below the top of the tubesheet shall be plugged on detection.**

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<sup>1</sup> The change to TS 6.9.1.5.b is not a direct consequence of the B\* criteria, but is a related correction to the TS that has been superseded by Salem Unit 1 Amendment 268, dated October 1, 2005.

TS 6.8.4.i d) currently states:

- d. "Provisions for SG tube inspections. Periodic SG tube inspections shall be performed. The number and portions of the tubes inspected and methods of inspection shall be performed with the objective of detecting flaws of any type (e.g., volumetric flaws, axial and circumferential cracks) that may be present along the length of the tube, from the tube-to-tubesheet weld at the tube inlet to the tube-to-tubesheet weld at the tube outlet, and that may satisfy the applicable repair criteria. The tube-to-tubesheet weld is not part of the tube....."

This criterion will be revised as follows as noted in strikethrough text and bold type:

- d. "Provisions for SG tube inspections. Periodic SG tube inspections shall be performed. The number and portions of the tubes inspected and methods of inspection shall be performed with the objective of detecting flaws of any type (e.g., volumetric flaws, axial and circumferential cracks) that may be present along the length of the tube **beginning 8 inches from the top of the tubesheet on the tube hot leg side to 8 inches below the top of the tubesheet on the tube cold leg side as defined in WCAP-16640-P** ~~from the tube-to-tubesheet weld at the tube inlet to the tube-to-tubesheet weld at the tube outlet, and that may satisfy the applicable repair criteria.~~ The tube-to-tubesheet weld is not part of the tube....."

#### TS 6.9.1.10 Steam Generator Tube Inspection Report

TS 6.9.1.10 currently states:

A report shall be submitted within 180 days after the initial entry into HOT SHUTDOWN following completion of an inspection performed in accordance with the Specification 6.8.4.i, "Steam Generator (SG) Program." The report shall include:

- a. The scope of inspections performed on each SG,
- b. Active degradation mechanisms found,
- c. Nondestructive examination techniques utilized for each degradation mechanism,
- d. Location, orientation (if linear), and measured sizes (if available) of service induced indications,
- e. Number of tubes plugged during the inspection outage for each active degradation mechanism,
- f. Total number and percentage of tubes plugged to date, and
- g. The results of condition monitoring, including results of tube pulls and in-situ testing

This criterion will be revised as follows as noted in bold type:

A report shall be submitted within 180 days after the initial entry into HOT SHUTDOWN following completion of an inspection performed in accordance with the Specification 6.8.4.i, "Steam Generator (SG) Program." The report shall include:

- a. The scope of inspections performed on each SG,
- b. Active degradation mechanisms found,
- c. Nondestructive examination techniques utilized for each degradation mechanism,
- d. Location, orientation (if linear), and measured sizes (if available) of service induced indications,
- e. **The number of indications detected in the upper 8 inches of the tubesheet thickness along with their location, measured size, orientation, and whether the indication initiated on the primary or secondary side.**
- f. **The operational primary to secondary leakage rate observed in each steam generator during the cycle preceding the inspection and the calculated accident leakage rate for each steam generator from the lowermost 13 inches of tubing (the tubesheet is nominally 21.03 inches thick) for the most limiting accident. If the calculated leak rate is less than 2 times the total observed operational leakage rate, the 180 day report should describe how the calculated leak rate is determined.**
- g. Number of tubes plugged during the inspection outage for each active degradation mechanism,
- h. Total number and percentage of tubes plugged to date, and
- i. The results of condition monitoring, including results of tube pulls and in-situ testing

#### TS 6.9.1.5 Annual Reports

TS 6.9.1.5.b currently states:

[Report required on an annual basis shall include:] The complete results of steam generator tube inservice inspections performed during the report period (reference Specification 4.4.5.5.b).

**TS 6.9.1.5.b will be deleted;** this reporting requirement was superceded by Salem Unit 1 Amendment 268, dated October 14, 2005, which implemented TSTF-449. Amendment 268 deleted TS 4.4.5.5.b and added TS 6.9.1.10 for SG inspection reporting.

### TS B 3/4.4.5 Steam Generator Tube Integrity

TS B 3/4.4.5 Steam Generator Tube Integrity currently states:

In the context of this Specification, a steam generator tube is defined as the entire length of tube, including the tube wall, between the tube-to-tubesheet weld at the tube inlet and the tube-to-tubesheet weld at the tube outlet. The tube-to-tubesheet weld is not considered part of the tube.

This criterion will be revised as follows as noted in strikethrough text and bold type:

In the context of this Specification, a steam generator tube is defined as the ~~entire length of tube, including the tube wall, between the tube to tubesheet weld at the tube inlet and the tube to tubesheet weld at the tube outlet~~ **beginning 8 inches from the top of the tubesheet on the tube hot leg side and extending to 8 inches below the top of the tubesheet on the tube cold leg side.** The tube-to-tubesheet weld is not considered part of the tube.

### **3.0 BACKGROUND**

Attachments 2 (proprietary) and 4 (non-proprietary), WCAP-16640, August 2006, "Steam Generator Alternate Repair Criteria for Tube Portion Within the Tubesheet at Salem Unit 1," provide the background information supporting this proposed TS change.

### **4.0 TECHNICAL ANALYSIS**

Attachments 2 (proprietary) and 4 (non-proprietary), WCAP-16640, August 2006, "Steam Generator Alternate Repair Criteria for Tube Portion Within the Tubesheet at Salem Unit 1," provide the technical analyses supporting this proposed TS change.

### **5.0 REGULATORY SAFETY ANALYSIS**

#### **5.1 No Significant Hazards Consideration**

Attachments 5, Westinghouse EVAL-06-58 SHC, "Significant Hazards Consideration (SHC), Salem Unit 1," provides the Significant Hazards Evaluation supporting this proposed TS change. PSEG has reviewed and evaluated EVAL-06-058 SHC and concurs with the conclusions reached on the three standards set forth in 10 CFR 50.92, "Issuance of Amendment.

#### **5.2 Applicable Regulatory Requirements/Criteria**

The regulatory requirements associated with SG tube inspections include the following:

*10 CFR 50 Appendix A Criterion 14 - Reactor Coolant Pressure Boundary -* The reactor coolant pressure boundary shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and gross rupture.

*10 CFR 50 Appendix A Criterion 15 - Reactor Coolant System Design -* The reactor coolant system and associated auxiliary, control, and protection systems shall be designed with sufficient margin to assure that the design conditions of the reactor coolant pressure boundary are not exceeded during any condition of normal operation, including anticipated operational occurrences.

*10 CFR 50 Appendix A Criterion 30 - Quality of Reactor Coolant System Pressure Boundary -* Components which are part of the reactor coolant pressure boundary shall be designed, fabricated, erected, and tested to the highest quality standards practical. Means shall be provided for detecting and, to the extent practical, identifying the location of the source of reactor coolant leakage.

*10 CFR 50 Appendix A Criterion 31 - Fracture Prevention of Reactor Coolant Pressure Boundary -* The reactor coolant pressure boundary shall be designed with sufficient margin to assure that when stressed under operating, maintenance, testing, and postulated accident conditions (1) the boundary behaves in a nonbrittle manner, and (2) the probability of rapidly propagating fracture is minimized. The design shall reflect consideration of service temperatures and other conditions of the boundary material under operating, maintenance, testing, and postulated accident conditions and the uncertainties in determining (1) material properties, (2) the effects of irradiation on material properties, (3) residual steady state and transient stresses, and (4) size of flaws.

*10 CFR 50 Appendix A Criterion 32 - Inspection of Reactor Coolant Pressure Boundary -* Components that are part of the reactor coolant pressure boundary shall be designed to permit periodic inspection and testing of important areas and features to assess their structural and leak tight integrity, and an appropriate material surveillance program for the reactor pressure vessel.

*Regulatory Guide 1.83, Revision 1 – Inservice Inspection of Pressurized Water Reactor Steam Generator Tubes.*

*Regulatory Guide 1.121, Revision 0 - Bases for Plugging Degraded Pressurized Water Reactor (PWR) Steam Generator Tubes.*

PSEG's amendment application revises Salem Unit 1 TS to clearly delineate the scope of the SG inspection required in the tubesheet region. PSEG continues to comply with applicable regulatory requirements listed above.

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

## **6.0 ENVIRONMENTAL CONSIDERATION**

A review has determined that the proposed amendment relates to changes in a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR Part 20, or relates to changes in an inspection or surveillance requirement. The proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 50.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

## **7.0 REFERENCES**

- 7.1** WCAP-16640, August 2006, (proprietary), "Steam Generator Alternate Repair Criteria for Tube Portion Within the Tubesheet at Salem Unit 1."
- 7.2** WCAP-16640, August 2006, (non-proprietary), "Steam Generator Alternate Repair Criteria for Tube Portion Within the Tubesheet at Salem Unit 1."
- 7.3** Westinghouse EVAL-06-58 SHC, "Significant Hazards Consideration (SHC), Salem Unit 1"