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Seabrook Station

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September 29, 2005

SBK-L-05185
Docket No. 50-443

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Seabrook Station
License Amendment Request 05-08
"Limited Inspection of the Steam Generator Tube Portion Within the Tubesheet"

References:

1. FPL Energy Seabrook, LLC letter SBK-L-05186, Proprietary Information to Support License Amendment Request 05-08, Limited Inspection of the Steam Generator Tube Portion Within the Tubesheet, dated September 29, 2005.

FPL Energy Seabrook, LLC (FPL Energy Seabrook) has enclosed herein License Amendment Request (LAR) 05-08 (Enclosure 1). License Amendment Request 05-08 is submitted pursuant to the requirements of 10 CFR 50.90 and 10 CFR 50.4.

LAR 05-08 proposes changes to Seabrook Station Technical Specification (TS) 4.4.5, "Steam Generators," to incorporate changes in the steam generator tube inspection scope commencing with the upcoming refueling outage 11 (OR11). FPL Energy Seabrook has revised the Seabrook Station steam generator tube inspection plan to incorporate operating experience information from Catawba Nuclear Station Unit 2 and Vogtle Electric Generating Plant Unit 1 to include a sampling of the bulges and overexpansions within the tubesheet region. The proposed changes define the region of the tube that must be examined and modifies the inspection requirements for certain portions of the steam generator tubes within the hot leg tubesheet region of the steam generators.

Westinghouse Electric Company LLC (Westinghouse) was contracted to provide analysis support for the technical justification to limit inspection of the tubesheet region. Westinghouse has identified that portions of its technical evaluation, LTR-CDME-05-170-P, "Limited Inspection of the Steam Generator Tube Portion Within the Tubesheet at Seabrook Generating Station," contains proprietary information and is requesting withholding this proprietary information from public disclosure. The proprietary version will be submitted under a separate letter (Reference 1) and will contain the application for withholding proprietary information from public disclosure including an affidavit in conformance with the provisions of 10 CFR 2.390 for withholding proprietary information. Enclosure 2 contains the Westinghouse non-proprietary version, LTR-CDME-05-170-NP.

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As discussed in the enclosed LAR, the proposed change does not involve a significant hazard consideration pursuant to 10 CFR 50.92. A copy of this letter and the enclosed LAR has been forwarded to the New Hampshire State Liaison Officer pursuant to 10 CFR 50.91(b). FPL Energy Seabrook has determined that LAR 05-08 meets the criteria of 10 CFR 51.22(c)(9) for a categorical exclusion from the requirements for an Environmental Impact Statement

The Station Operation Review Committee and the Company Nuclear Review Board have reviewed this LAR.

FPL Energy Seabrook requests NRC Staff review and approval of LAR 05-08 with issuance of a license amendment by September 30, 2006 and implementation of the amendment within 90 days.

Should you have any questions regarding this letter, please contact Mr. James M. Peschel, Regulatory Programs Manager, at (603) 773-7194.

Very truly yours,

FPL Energy Seabrook, LLC.

Gene St. Pierre
Site Vice President

Enclosures:

1. Notarized Affidavit and FPL Energy Seabrook Evaluation of the Proposed Changes
2. Westinghouse Non-Proprietary Technical Evaluation: LTR-CDME-05-170-NP, "Limited Inspection of the Steam Generator Tube Portion Within the Tubesheet at Seabrook Generating Station," and accompanying Proprietary Information Notice and Copyright Notice

cc: S. J. Collins, NRC Region I Administrator
V. Nerses, NRC Project Manager, Project Directorate I-2
G.T. Dentel, NRC Senior Resident Inspector

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**ENCLOSURE 1 to SBK-L-05185**

**NOTARIZED AFFIDAVIT**

**AND**

**FPL ENERGY SEABROOK EVALUATION OF THE PROPOSED CHANGES**

FPL Energy
Seabrook Station

# AFFIDAVIT

**SEABROOK STATION UNIT 1**

**Facility Operating License NPF-86**

**Docket No. 50-443**

**License Amendment Request 05-08**

**"Limited Inspection of the Steam Generator Tube Portion Within the Tubesheet"**

**The following information is enclosed in support of this License Amendment Request:**

- **Enclosure 1 - FPL Energy Seabrook Evaluation of the Proposed Changes**
  - **Attachment 1 - Proposed Technical Specification Changes (Mark-up)**
  - **Attachment 2 - Proposed Technical Specification Pages (Retype)**
  - **Attachment 3 - List of Regulatory Commitments**
- **Enclosure 2 - Westinghouse Non-Proprietary Technical Evaluation: LTR-CDME-05-170-NP, "Limited Inspection of the Steam Generator Tube Portion Within the Tubesheet at Seabrook Generating Station," and Accompanying Proprietary Information Notice and Copyright Notice**

**I, Gene St. Pierre, Site Vice President of FPL Energy Seabrook, LLC hereby affirm that the information and statements contained within this License Amendment Request are based on facts and circumstances which are true and accurate to the best of my knowledge and belief.**

**Sworn and Subscribed**
**before me this**
**29th day of September, 2005**

Renée-Nicole M. Douceur
**Notary Public**

Gene St Pierre
**Gene St. Pierre**
**Site Vice President**

RENEE-NICOLE M. DOUCEUR
MY COMMISSION EXPIRES NOV. 10, 2009
NOTARY PUBLIC
NEW HAMPSHIRE

**FPL ENERGY SEABROOK EVALUATION**

**Subject:** **License Amendment Request 05-08, Limited Inspection of the Steam Generator Tube Portion Within the Tubesheet**

## 1.0 DESCRIPTION

License Amendment Request (LAR) 05-08 proposes changes to Seabrook Station Technical Specification (TS) 4.4.5, "Steam Generators," to incorporate changes in the steam generator tube inspection scope commencing with the upcoming refueling outage 11 (OR11).

FPL Energy Seabrook, LLC (FPL Energy Seabrook) will commence a refueling outage at Seabrook Station on or about October 1, 2006 with steam generator tube inspections to be performed on all four (4) steam generators. Prior to each tube inspection, a degradation assessment, which includes operating experience, is performed to identify degradation mechanisms that may be present, and a validation assessment is performed to verify that the eddy current techniques are capable of detecting those flaw types identified in the degradation assessment. Based on recent operating experience at Catawba Nuclear Station Unit 2 and Vogtle Electric Generating Plant Unit 1, FPL Energy Seabrook has revised the steam generator tube inspection plan to include a sampling of the bulges and overexpansions within the tubesheet region. The sampling is based on the guidance contained in Electric Power Research Institute (EPRI) TR-1003138, "Pressurized Water Reactor Steam Generator Examination Guidelines: Revision 6" (Reference 1). This inspection plan will be expanded according to industry guidelines as necessary if degradation (i.e., tube crack) is confirmed. The proposed changes modify the inspection requirements for portions of the steam generator tubes within the hot leg tubesheet region of the steam generators.

The proposed changes define the region of the tube that must be examined. A justification has been developed (Enclosure 2)[1] by Westinghouse Electric Company LLC (Westinghouse) to identify the specific rotating coil probe inspection depth below which any type of axial or circumferential primary water stress corrosion cracking can be shown to meet the Nuclear Energy Institute (NEI) 97-06, "Steam Generator Program Guidelines," (Reference 2) performance criteria.

## 2.0 PROPOSED CHANGES

The proposed changes to TS 4.4.5 are as follows:

- TS 4.4.5.2, "Steam Generator Tube Sample Selection and Inspection" is revised to add the following new requirement:

  d. A sample of the inservice steam generator tubes from the top of the hot leg tubesheet to 17 inches below the top of the tubesheet shall be inspected by rotating probe. This sample shall include a 20% minimum sample of the known total population of bulges and overexpansions within the SG from the top of the hot leg tubesheet to 17 inches below the top of the tube sheet.

1 Enclosure 2 contains the non-proprietary version of Westinghouse LTR-CDME-05-170 and is designated LTR-CDME-05-170-NP. The proprietary version is designated LTR-CDME-05-170-P. Hereinafter, for brevity of discussion, the evaluation will be referred as LTR-CDME-05-170.

- TS 4.4.5.4a.6) currently states:

  "Plugging Limit means the imperfection depth at or beyond which the tube will be removed from service and is equal to 40% of the nominal tube wall thickness;"

  This acceptance criteria is revised as follows:

  "Plugging Limit means the imperfection depth at or beyond which the tube will be removed from service and is equal to 40% of the nominal tube wall thickness. This criterion does not apply to degradation identified in the portion of the tube below 17 inches from the top of the hot leg tubesheet. Degradation found in the portion of the tube below 17 inches from the top of the hot leg tubesheet does not require plugging. Tubes with degradation identified in the portion of the tube within the region from the top of the hot leg tubesheet to 17 inches below the top of the tubesheet shall be removed from service;"

- TS 4.4.5.4a.8) currently states:

  "Tube Inspection means an inspection of the steam generator tube from the point of entry (hot-leg side) completely around the U-bend to the top support on the cold leg; and"

  This acceptance criteria is revised as follows:

  "Tube Inspection means an inspection of the steam generator tube from the point of entry (hot-leg side) completely around the U-bend to the top support on the cold leg. The portion of the tube below 17 inches from the top of the hot leg tubesheet is excluded;"

- TS 4.4.5.4, "Acceptance Criteria," is revised to add a new acceptance criteria to define bulge and overexpansion:

  10) Bulge refers to a tube diameter deviation within the tubesheet of 18 volts or greater, as measured by bobbin probe; and

  11) Overexpansion refers to a tube diameter deviation within the tubesheet of 1.5 mils or greater, as measured by bobbin probe.

The proposed changes delineate the scope of the steam generator tube inspections required in the tubesheet region at Seabrook Station commencing with Refueling Outage 11.

## 3.0 BACKGROUND

Seabrook Station is a four loop Westinghouse-designed plant with Model F steam generators having 5626 tubes in each steam generator. Of the 22,504 tubes, a total of 140 tubes are plugged. The design of the steam generators includes Alloy 600 Thermally Treated tubing, full depth hydraulically-expanded tubesheet joints, and broached hole quatrefoil stainless steel tube support plates.

The steam generator inspection scope is governed by TS 4.4.5, NEI 97-06, "EPRI Steam Generator Examination Guidelines," the FPL Energy Seabrook Steam Generator Management Reference Manual, and the results of the degradation assessment. Criterion IX, "Control of Special Processes" of 10 CFR Part 50, Appendix B, requires in part that nondestructive testing be accomplished by qualified personnel using qualified procedures in accordance with the applicable criteria. The inspection techniques and equipment are capable of reliably detecting the known and potential specific degradation mechanisms applicable to Seabrook Station. The inspection techniques, essential variables and equipment are qualified to Appendix H, "Performance Demonstration for Eddy Current Examination," of the EPRI Steam Generator Examination Guidelines.

The most recent steam generator tube inspection was performed in the October 2003 refueling outage (OR09). Subsequent to the most recent Seabrook Station steam generator tube inspection, indications of cracking were reported at Catawba Nuclear Station, Unit 2 (Catawba). The Catawba results were from the nondestructive eddy current examination of the steam generator tubes during their Fall 2004 outage. NRC Information Notice (IN) 2005-09, "Indications in Thermally Treated Alloy 600 Steam Generator Tubes and Tube-to-Tubesheet Welds," (Reference 3) provided industry notification of the Catawba issue. IN 2005-09 noted that Catawba reported cracklike indications in the tubes approximately seven (7) inches below the top of the hot leg tubesheet in one tube, and just above the tube-to-tubesheet welds in a region of the tube known as the tack expansion in several other tubes. Finally, indications were also reported in the tube-end welds, also known as tube-to-tubesheet welds, which join the tube to the tubesheet.

FPL Energy Seabrook policies and programs, as well as TS 4.4.5, require the use of applicable industry operating experience to be utilized in the operation and maintenance of Seabrook Station. The recent experience at Catawba, as noted in IN 2005-09, shows the importance of monitoring all tube locations (such as bulges, dents, dings, and other anomalies from the manufacture of the steam generators) with techniques capable of finding potential forms of degradation that may be occurring at these locations (as discussed in Generic Letter 2004-001, "Requirements for Steam Generator Tube Inspections"). Since the Seabrook Station Westinghouse Model F steam generators were fabricated with Alloy 600 Thermally Treated tubes, similar to the Catawba Unit 2 Westinghouse Model D5 steam generators fabricated with Alloy 600 Thermally Treated tubes, there is a potential for tube indications similar to those reported at Catawba to be identified in the Seabrook Station steam generators within the hot leg tubesheet region if similar inspections were to be performed commencing with the Refueling Outage 11 (OR11) steam generator inspection.

Potential inspection plans for the tubes and tube welds underwent intensive industry discussions in March 2005. The findings in the Catawba steam generator tubes present three distinct issues with regard to the steam generator tubes at Seabrook Station:

1) Indications in internal bulges and overexpansions within the hot leg tubesheet;

2) Indications at the elevation of the tack expansion transition; and

3) Indications in the tube-to-tubesheet welds and propagation of these indications into adjacent tube material.

As a result of these potential issues and the possibility of unnecessarily plugging tubes in the Seabrook Station steam generators, FPL Energy Seabrook is proposing changes to TS 4.4.5 to limit the steam generator tube inspection to the safety significant portion of the tube within the hot leg tubesheet.

## 4.0 TECHNICAL ANALYSIS

In order to preclude unnecessarily plugging tubes in the Seabrook Station steam generators, Westinghouse Electric Company LLC (Westinghouse) performed an evaluation to identify the safety significant portion of the tube within the hot leg tubesheet necessary to maintain leakage and structural integrity for both normal operating and accident conditions. Tube inspections will be limited to identifying and plugging degradation in this portion of the tubes. The technical justification for the inspection and repair methodology is provided in Westinghouse LTR-CDME-05-170 (Reference 4), "Limited Inspection of the Steam Generator Tube Portion Within the Tubesheet at Seabrook Generating Station." The limited hot leg tubesheet inspection criteria were developed for the hot leg tubesheet region of Model F steam generators considering the most conservative loads associated with plant operation, including transients and postulated accident conditions. The limited hot leg tubesheet inspection criteria were selected to prevent tube burst and axial separation due to axial pullout forces acting on the tube and to ensure that the steam line break accident (SLB) leakage limits are not exceeded. LTR-CDME-05-170 provides the technical justification for allowing tubes with indications that are below 17 inches from the top of the hot leg tubesheet (i.e., within approximately four inches of the tube end) to remain inservice.

The constraint that is provided by the hot leg tubesheet precludes tube burst for cracks within the tubesheet. The criteria for tube burst described in NEI 97-06 and NRC Regulatory Guide (RG) 1.121 (Reference 5), "Bases for Plugging Degraded PWR Steam Generator Tubes," are satisfied due to the constraint provided by the tubesheet. Through application of the limited hot leg tubesheet inspection scope as described below, the existing operating leakage limit provides assurance that excessive leakage (i.e., greater than accident analysis assumptions) will not occur during a postulated steam line break (SLB) event.

The safety significant portion of the tube is the length of tube that is engaged within the tubesheet below the top of the tubesheet (where the tube interfaces with the secondary fluid) that is required to maintain structural and leakage integrity over the full range of steam generator operating conditions, including the most limiting accident conditions. The Westinghouse evaluation determined that degradation in tubing below the safety significant portion of the tube does not require plugging and serves as the basis for the limited hot leg tubesheet inspection scope.

The basis for determining the safety significant portion of the tube within the tubesheet is based upon evaluation and testing programs that quantified the tube-to-tubesheet radial contact pressure for bounding plant conditions as described in LTR-CDME-05-170. The tube-to-tubesheet radial contact pressure provides resistance to tube pullout and resistance to leakage during plant operation and transients. Temperature effects and upward bending of the tubesheet due to primary and secondary differential pressure during normal and transient conditions, result in the tube-to-tubesheet contact pressure increasing with distance from the top of the tubesheet. Due to these effects, the tubesheet bore tends to dilate near the top of the tubesheet and constricts near the bottom of the tubesheet. Testing and analyses have shown that tube-to-tubesheet engagement lengths of approximately 3 inches to 8.6 inches were sufficient to maintain structural integrity (i.e., resist tube pullout resulting from loading at differential pressures of three (3) times the normal operating pressure difference and 1.4 times the limiting accident pressure difference). The variation of the required engagement length is a function of the radial tube location within the tube bundle. FPL Energy Seabrook has decided to add additional conservatism to the minimum structural distances of 3 inches to 8.6 inches by performing an evaluation to a depth of 17 inches below the top of the hot leg tubesheet.

Increased tube-to-tubesheet contact pressure significantly increases the tube structural strength and resistance to leakage, and aids in restricting primary-to-secondary leakage as differential pressure increases. Furthermore, leakage from indications located below the midplane of the tubesheet during postulated accident conditions would be expected to be insignificant as well. The rational for this conclusion is based upon the interaction of temperature and tubesheet bending effects during postulated accident conditions that increases the contact pressure between the tube and tubesheet. Since the proposed 17-inch tube inspection depth traverses below the midplane of the hot leg tubesheet, performing an evaluation to a depth of 17 inches will provide increased confidence of maintaining structural integrity, thus ensuring that there will be no significant primary-to-secondary leakage during normal operation and/or postulated accident conditions from indications located below the midplane of the tubesheet.

Primary-to-secondary leakage from tube degradation in the tubesheet area during the limiting accident (i.e., SLB) is limited by flow restrictions resulting from the crack and tube-to-tubesheet contact pressures that provide a restricted leakage path above the indication. Additionally, increased tube-to-tubesheet contact pressures also limits the degree of potential crack face opening as compared to free span indications. The primary-to-secondary leak rate during postulated SLB accident conditions would be expected to be less that that during

normal operation for indications near the bottom of the tubesheet (i.e., including indications in the tube end welds). This conclusion is based on the observation, as documented in LTR-CDME-05-170, that while the driving pressure causing the leakage increases by approximately a factor of two (2), the flow resistance associated with the increase in the tube-to-tubesheet contact pressure during a SLB accident increases by approximately a factor of 2.5. While such a leakage decrease is logically expected, the postulated accident leak rate could be conservatively bounded by twice the normal operating leak rate even if the increase in contact pressure is ignored. Since normal operating leakage (spiking) is limited to less that 0.104 gpm (150 gpd) for continued power operation per station operating procedure OS 1227.02, "Steam Generator Tube Leak," (Reference 6), the associated accident condition leak rate, assuming all leakage to be from lower tube sheet indications, would be bound by 0.208 gpm (twice normal operating leak rate). This value is well within the assumed accident leakage rate of 0.347 gpm discussed in the Seabrook Station Updated Safety Analysis Report, Section 15.1.5 "Steam System Piping Failure." Hence it is reasonable to omit any consideration of inspection of the tube, tube end weld, bulges / overexpansions or other anomalies below 17 inches from the top of the hot leg tubesheet. Degradation found in the portion of the tube below 17 inches from the top of the hot leg tubesheet does not require plugging as shown in LTR-CDME-05-170.

FPL Energy Seabrook has revised the following inspection requirements in the steam generators inspection plan in order to use the limited hot leg tubesheet inspection methodology:

1. Perform a 20% minimum inspection of the hot leg side tubes using rotating coil probe (RPC) technology from 3 inches above the top of the hot leg tubesheet to 3 inches below the top of the hot leg tubesheet. Expand to 100% of the affected steam generator and 20% of the unaffected steam generators in this region only if cracking is found that is not associated with a bulge or overexpansion as described below.

2. Perform an inspection of the hot leg side tubes using RPC technology to a depth of 17 inches below the top of the tubesheet, based on obtaining a minimum 20% sample of the total population of known bulges and overexpansions within the SG. The size of the sample is to be developed as a fraction of the total tube population with indications of bulges $\geq$ 18 volts and overexpansions $\geq$ 1.5 mils on the diameter, as obtained from data review of the data from a previous inspection for a minimum length of 17 inches below the top of the tubesheet. The inspection of a single tube can simultaneously contribute to meeting the scope of both inspection items 1 and 2.

3. If cracking is found in the sample population of bulges or overexpansions, the inspection scope will be increased to 100% of the known bulges and overexpansions population for the region from the top of the hot leg tubesheet to 17 inches below the top of the tubesheet in the affected steam generator and 20% of the known bulges and overexpansions population in the unaffected steam generators from the top of the hot leg tubesheet to 17 inches below the top of the tubesheet.

4. If cracking is found at one or more tube locations within the tubesheet region not designated as either a top of tubesheet expansion transition, a bulge or overexpansion, an engineering evaluation will be performed. This evaluation will determine the cause for the signal (e.g., some other tube anomaly) in order to identify the critical area for expanding the scope of the inspection. This expanded inspection will be limited to the identified critical area within 17 inches from the top of the hot leg tubesheet,

Per the proposed change to TS 4.4.5.4a.6 plugging limit acceptance criteria, FPL Energy Seabrook is modifying the plugging acceptance criteria such that the 40% nominal tube wall thickness criterion will not be applicable to degradation identified in the portion of the tube below 17 inches from top of the hot leg tubesheet and, therefore, will not require plugging. Tubes with degradation within 17 inches from the top of the hot leg tubesheet shall be plugged.

**Conclusion**

The safety significant portion of the tube is the length of tube that is engaged in the tubesheet from the secondary face that is required to maintain structural and leakage integrity over the full range of steam generator operating conditions, including the most limiting accident conditions. The Westinghouse evaluation determined that degradation in tubing below the safety significant portion of the tube does not require plugging and serves as the bases for the limited hot leg tubesheet inspection scope. As such, the FPL Energy Seabrook inspection program provides a high level of confidence that the structural and leakage criteria are maintained during normal operating and accident conditions.

## 5.0 REGULATORY SAFETY ANALYSIS

### 5.1 No Significant Hazards Consideration

In accordance with 10 CFR 50.92, FPL Energy Seabrook has concluded that the proposed changes do not involve a significant hazards consideration (SHC). The basis for the conclusion that the proposed changes do not involve a SHC is as follows:

1. *The proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.*

   The previously analyzed accidents are initiated by the failure of plant structures, systems, or components. The proposed changes that alter the steam generator inspection criteria do not have a detrimental impact on the integrity of any plant structure, system, or component that initiates an analyzed event. The proposed changes will not alter the operation of, or otherwise increase the failure probability of any plant equipment that initiates an analyzed accident.

Of the applicable accidents previously evaluated, the limiting transients with consideration to the proposed changes to the steam generator tube inspection criteria, are the steam generator tube rupture (SGTR) event and the steam line break (SLB) accident. During the SGTR event, the required structural integrity margins of the steam generator tubes will be maintained by the presence of the steam generator tubesheet area. Tube rupture in tubes with cracks in the tubesheet is precluded by the constraint provided by the tubesheet. This constraint results from the hydraulic expansion process, thermal expansion mismatch between the tube and tubesheet and from the differential pressure between the primary and secondary side. Based on this design, the structural margins against burst, as discussed in Regulatory Guide (RG) 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes," are maintained for both normal and postulated accident conditions.

At normal operating pressures, leakage from primary water stress corrosion cracking (PWSCC) below the proposed limited inspection depth is limited by both the tube-to-tubesheet crevice and the limited crack opening permitted by the tubesheet constraint. Consequently, negligible normal operating leakage is expected from cracks within the tubesheet region. The consequences of an SGTR event are affected by the primary-to-secondary leakage flow during the event. Primary-to-secondary leakage flow through a postulated ruptured tube is not affected by the proposed changes since the tubesheet enhances the tube integrity in the region of the hydraulic expansion by precluding tube deformation beyond its initial hydraulically-expanded outside diameter.

Furthermore, the proposed changes do not affect other systems, structures, components or operational features. Therefore, the proposed changes result in no significant increase in the probability of the occurrence of a SGTR accident.

The probability of a SLB accident is unaffected by the potential failure of a steam generator tube as this failure is not an initiator for a SLB accident.

The consequences of a SLB accident are also not significantly affected by the proposed changes. During a SLB accident, the reduction in pressure above the tubesheet on the shell side of the steam generator creates an axially uniformly distributed load on the tubesheet due to the reactor coolant system pressure on the underside of the tubesheet. The resulting bending action constrains the tubes in the tubesheet thereby restricting primary-to-secondary leakage below the midplane.

Primary-to-secondary leakage from tube degradation in the tubesheet area during the limiting accident (i.e., a SLB) is limited by flow restrictions resulting from the crack and tube-to-tubesheet contact pressures that provide a restricted leakage path above the indications and also limit the degree of potential crack face opening as compared to free span indications. The primary-to-secondary leak rate during postulated SLB accident conditions would be expected to be less than that during normal operation for indications near the bottom of the tubesheet (i.e., including indications in the tube end welds). This conclusion is based on the observation that while the driving pressure causing leakage

increases by approximately a factor of (two) 2, the flow resistance associated with an increase in tube-to-tubesheet contact pressure, during a SLB accident, increases by approximately a factor of 2.5. While such a leakage decrease is logically expected, the postulated accident leak rate could be conservatively bounded by twice the normal operating leak rate even if the increase in contact pressure is ignored. Since normal operating leakage (spiking) is limited to less that 0.104 gpm (150 gpd) for continued power operation per station operating procedure OS 1227.02, "Steam Generator Tube Leak," the associated accident condition leak rate, assuming all leakage to be from lower tube sheet indications, would be bound by 0.208 gpm (twice normal operating leak rate). This value is well within the assumed accident leakage rate of 0.347 gpm discussed in the Seabrook Station Updated Safety Analysis Report, Section 15.1.5 "Steam System Piping Failure." Hence it is reasonable to omit any consideration of inspection of the tube, tube end weld, bulges / overexpansions or other anomalies below 17 inches from the top of the hot leg tubesheet. Therefore, the consequences of a SLB accident remain unaffected.

Therefore, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. *The proposed changes do not create the possibility of a new or different kind of accident from any previously evaluated.*

The proposed changes do not introduce any new equipment, create new failure modes for existing equipment, or create any new limiting single failures. Plant operation will not be altered, and all safety functions will continue to perform as previously assumed in accident analyses. Therefore, the proposed changes do not create the possibility of a new or different kind of accident from any previously evaluated.

3. *The proposed changes do not involve a significant reduction in the margin of safety.*

The proposed changes maintain the required structural margins of the steam generator tubes for both normal and accident conditions. Nuclear Energy Institute (NEI) 97-06, "Steam Generator Program Guidelines," and NRC Regulatory Guide (RG) 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes," are used as the bases in the development of the limited hot leg tubesheet inspection depth methodology for determining that steam generator tube integrity considerations are maintained within acceptable limits. RG 1.121 describes a method acceptable to the NRC for meeting General Design Criteria (GDC) 14, "Reactor Coolant Pressure Boundary," GDC 15, "Reactor Coolant System Design," GDC 31, "Fracture Prevention of Reactor Coolant Pressure Boundary," and GDC 32, "Inspection of Reactor Coolant Pressure Boundary," by reducing the probability and consequences of a SGTR. RG 1.121 concludes that by determining the limiting safe conditions for tube wall degradation the probability and consequences of a SGTR are reduced. RG 1.121 uses safety factors on loads for tube

burst that are consistent with the requirements of Section III of the American Society of Mechanical Engineers (ASME) Code.

For axially oriented cracking located within the tubesheet, tube burst is precluded due to the presence of the tubesheet. For circumferentially oriented cracking, Westinghouse evaluation LTR-CDME-05-170, "Limited Inspection of the Steam Generator Tube Portion Within the Tubesheet at Seabrook Generating Station," defines a length of degradation-free expanded tubing that provides the necessary resistance to tube pullout due to the pressure induced forces, with applicable safety factors applied. Application of the limited hot leg tubesheet inspection criteria will preclude unacceptable primary-to-secondary leakage during all plant conditions. The methodology for determining leakage provides for large margins between calculated and actual leakage values in the proposed limited hot leg tubesheet inspection depth criteria.

Therefore, the proposed changes do not involve a significant reduction in any margin of safety.

Based on the above, FPL Energy Seabrook concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92 (c), and accordingly, a finding of "no significant hazards consideration" is justified.

## 5.2 Applicable Regulatory Requirements / Criteria

General Design Criteria (GDC) 1, 2, 4, 14, 15, 30, 31, and 32 of 10 CFR 50, Appendix A, define the requirements for the reactor coolant pressure boundary (RCPB) with respect to structural and leakage integrity.

GDC 19 of 10 CFR 50, Appendix A, defines the requirements for the control room and for the radiation protection of the operators working within it. Accidents involving the leakage or burst of SG tubing comprise a challenge to the habitability of the control room.

10 CFR 50, Appendix B, establishes the quality assurance requirements for the design, construction, and operation of safety related components. The pertinent requirements of this appendix apply to all activities affecting the safety-related functions of these components. These requirements are described in Criteria IX, XI, and XVI of Appendix B and include control of special processes, inspection, testing, and corrective action.

10 CFR 100, Reactor Site Criteria, established reactor siting criteria, with respect to the risk of public exposure to the release of radioactive fission products. Accidents involving leakage or tube burst of steam generator tubing may comprise a challenge to containment and therefore involve an increased risk of radioactive release.

Under 10 CFR 50.65, the Maintenance Rule, licensees classify steam generators as risk significant components because they are relied upon to remain functional during and after design basis events. Steam generators are to be monitored under 10 CFR 50.65(a)(2) against industry established performance criteria. Meeting the performance criteria of NEI 97-06, Revision 1, provides reasonable assurance that the steam generator tubing remains capable of fulfilling its specific safety function of maintaining the reactor coolant pressure boundary. The NEI 97-06, Revision 1, steam generator performance criteria are:

- Steam generator tubing shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cooldown and all anticipated transients included in the design specification) and design basis accidents. This includes retaining a safety factor of 3.0 against burst under normal steady state full power operation and a safety factor of 1.4 against burst under the limiting design basis accident. Any additional loading combinations shall be included as required by the existing design and licensing basis.
- The primary-to-secondary accident induced leakage rate for the limiting design basis accident, other than a steam generator tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leak rate for an individual steam generator
- The RCS operational primary-to-secondary leakage through any one steam generator shall be limited to 150 gallons per day.

The safety significant portion of the tube is the length of tube that is engaged within the tubesheet below the top of the tubesheet (where the tube interfaces with the secondary fluid) that is required to maintain structural and leakage integrity over the full range of steam generator operating conditions, including the most limiting accident conditions. The Westinghouse evaluation determined that degradation in tubing below the safety significant portion of the tube does not require plugging and serves as the bases for the tubesheet inspection program. As such, the FPL Energy Seabrook inspection program provides a high level of confidence that the structural and leakage criteria are maintained during normal operating and accident conditions.

In conclusion, based on the considerations discussed previously, (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

FPL Energy Seabrook has evaluated the proposed amendment for environmental considerations. The review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, and would change an inspection or surveillance requirement. However, 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 amendments meet the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment needs to be prepared in connection with the proposed amendment.

## 7.0 REFERENCES


1. EPRI 1003138, "Pressurized Water Reactor Steam Generator Examination Guidelines: Revision 6."

2. NEI 97-06, "Steam Generator Program Guidelines," Revision 1, January 2001.

3. NRC Information Notice 2005-09, "Indications in Thermally Treated Alloy 600 Steam Generator Tubes and Tube-to-Tubesheet Welds," April 7, 2005.

4. Westinghouse Electric Company LLC LTR-CDME-05-170-P, "Limited Inspection of the Steam Generator Tube Portion Within the Tubesheet at Seabrook Generating Station," August 2005.

5. NRC Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes," August 1976.

6. Seabrook Station Abnormal Operating Procedure, OS 1227.02, "Steam Generator Tube Leak," Revision 11.

## ATTACHMENT 1

## PROPOSED TECHNICAL SPECIFICATION CHANGES (MARK-UP)

Refer to the attached markup of the proposed change to the Technical Specifications. The attached markup reflects the currently issued version of the Technical Specifications listed below. Pending Technical Specifications or Technical Specification changes issued subsequent to this submittal are not reflected in the enclosed markup. At the time of submittal the Technical Specifications were revised through Amendment No. 104.

The following License Amendment Request(s) (LAR) are awaiting NRC approval that may impact the currently issued version of the Technical Specifications listed below:

| LAR | Title | FPL Energy Seabrook SBK Letter No. | Date of Submittal |
|---|---|---|---|
| None | | | |

The following Technical Specification changes are included in the attached markups:

| Technical Specification | Title | Page |
|---|---|---|
| 4.4.5.2b | Steam Generators - Tube Selection SR | 3/4 4-14 |
| 4.4.5.4a | Steam Generators - Acceptance Criteria SR | 3/4 4-16 |

SURVEILLANCE REQUIREMENTS

4.4.5.2b. (Continued)

1) All nonplugged tubes that previously had detectable wall penetrations (greater than 20%),

2) Tubes in those areas where experience has indicated potential problems, and

3) A tube inspection (pursuant to Specification 4.4.5.4a.8) shall be performed on each selected tube. If any selected tube does not permit the passage of the eddy current probe for a tube inspection, this shall be recorded and an adjacent tube shall be selected and subjected to a tube inspection.

c. The tubes selected as the second and third samples (if required by Table 4.4-2) during each inservice inspection may be subjected to a partial tube inspection provided:

1) The tubes selected for these samples include the tubes from those areas of the tube sheet array where tubes with imperfections were previously found, and

INSERT (A)

2) The inspections include those portions of the tubes where imperfections were previously found.

The results of each sample inspection shall be classified into one of the following three categories:

| Category | Inspection Results |
|---|---|
| C-1 | Less than 5% of the total tubes inspected are degraded tubes and none of the inspected tubes are defective. |
| C-2 | One or more tubes, but not more than 1% of the total tubes inspected, are defective, or between 5% and 10% of the total tubes inspected are degraded tubes. |
| C-3 | More than 10% of the total tubes inspected are degraded tubes or more than 1% of the inspected tubes are defective. |

Note: In all inspections, previously degraded tubes must exhibit significant (greater than 10%) further wall penetrations to be included in the above percentage calculations.

SURVEILLANCE REQUIREMENTS

4.4.5.4 Acceptance Criteria

a. As used in this specification:

1) Imperfection means an exception to the dimensions, finish, or contour of a tube from that required by fabrication drawings or specifications. Eddy-current testing indications below 20% of the nominal tube wall thickness, if detectable, may be considered as imperfections;

2) Degradation means a service-induced cracking, wastage, wear, or general corrosion occurring on either the inside or outside of a tube;

3) Degraded Tube means a tube containing imperfections greater than or equal to 20% of the nominal wall thickness caused by degradation;

4) % Degradation means the percentage of the tube wall thickness affected or removed by degradation;

5) Defect means an imperfection of such severity that it exceeds the plugging limit. A tube containing a defect is defective;

INSERT B

6) ~~Plugging Limit means the imperfection depth at or beyond which the tube shall be removed from service and is equal to 40% of the nominal tube wall thickness;~~

7) Unserviceable describes the condition of a tube if it leaks or contains a defect large enough to affect its structural integrity in the event of an Operating Basis Earthquake, a loss-of-coolant accident, or a steam line or feedwater line break as specified in Specification 4.4.5.3c., above;

INSERT C

8) ~~Tube Inspection means an inspection of the steam generator tube from the point of entry (hot-leg side) completely around the U-bend to the top support of the cold leg; and~~

9) Preservice Inspection means an inspection of the full length of each tube in each steam generator performed by eddy-current techniques prior to service to establish a baseline condition of the tubing. This inspection shall be performed prior to initial POWER OPERATION using the equipment and techniques expected to be used during subsequent inservice inspections.



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AMENDMENT NO.

176

SURVEILLANCE REQUIREMENTS

4.4.5.4 (Continued)

INSERT D

b. The steam generator shall be determined OPERABLE after completing the corresponding actions (plug all tubes exceeding the plugging limit and all tubes containing through-wall cracks) required by Table 4.4-2.

4.4.5.5 Reports

a. Within 15 days following the completion of each inservice inspection of steam generator tubes, the number of tubes plugged in each steam generator shall be reported to the Commission in a Special Report pursuant to Specification 6.8.2;

b. The complete results of the steam generator tube inservice inspection shall be submitted to the Commission in a Special Report pursuant to Specification 6.8.2 within 12 months following the completion of the inspection. This Special Report shall include:

1) Number and extent of tubes inspected,

2) Location and percent of wall-thickness penetration for each indication of an imperfection, and

3) Identification of tubes plugged.

c. Results of steam generator tube inspections which fall into Category C-3 shall be reported in a Special Report to the Commission pursuant to Specification 6.8.2 within 30 days and prior to resumption of plant operation. This report shall provide a description of investigations conducted to determine cause of the tube degradation and corrective measures taken to prevent recurrence.

INSERT
A

d. A sample of the inservice steam generator tubes from the top of the hot leg tubesheet to 17 inches below the top of the tubesheet shall be inspected by rotating probe. This sample shall include a 20% minimum sample of the total population of bulges and overexpansions within the SG from the top of the hot leg tubesheet to 17 inches below the top of the tube sheet.

INSERT
B

Plugging Limit means the imperfection depth at or beyond which the tube will be removed from service and is equal to 40% of the nominal tube wall thickness. This criterion does not apply to degradation identified in the portion of the tube below 17 inches from the top of the hot leg tubesheet. Degradation found in the portion of the tube below 17 inches from the top of the hot leg tubesheet does not require plugging. Tubes with degradation identified in the portion of the tube within the region from the top of the hot leg tubesheet to 17 inches below the top of the tubesheet shall be removed from service;

INSERT
C

Tube Inspection means an inspection of the steam generator tube from the point of entry (hot-leg side) completely around the U-bend to the top support on the cold leg. The portion of the tube below 17 inches from the top of the hot leg tubesheet is excluded;

INSERT
D

10) Bulge refers to a tube diameter deviation within the tubesheet to 18 volts or greater as measured by bobbin probe; and

11) Overexpansion refers to a tube diameter deviation within the tubesheet of 1.5 mils or greater as measured by bobbin probe.

## ATTACHMENT 2

## PROPOSED TECHNICAL SPECIFICATION PAGES (RETYPE)

Refer to the attached retype of the proposed change to the Technical Specifications. The attached retype reflects the revised, currently issued version of the Technical Specifications. Pending Technical Specification changes or Technical Specification changes issued subsequent to this submittal are not reflected in the enclosed retype. The enclosed retype should be checked for continuity with Technical Specifications prior to issuance. At the time of submittal the Technical Specifications were revised through Amendment No. 104.

The following License Amendment Request(s) (LAR) are awaiting NRC approval that may impact the revised, currently issued version of the Technical Specifications listed below:

| LAR | Title | FPL Energy Seabrook SBK Letter No. | Date of Submittal |
|---|---|---|---|
| None | | | |

The following revised Technical Specifications are included in the attached retypes:

| Technical Specification | Title | Page |
|---|---|---|
| 4.4.5.2b | Steam Generators - Tube Selection SR | 3/4 4-14 |
| 4.4.5.4a | Steam Generators - Acceptance Criteria SR | 3/4 4-16 & 4-17 |

4.4.5.2b. (Continued)

1) All nonplugged tubes that previously had detectable wall penetrations (greater than 20%),

2) Tubes in those areas where experience has indicated potential problems, and

3) A tube inspection (pursuant to Specification 4.4.5.4a.8) shall be performed on each selected tube. If any selected tube does not permit the passage of the eddy current probe for a tube inspection, this shall be recorded and an adjacent tube shall be selected and subjected to a tube inspection.

c. The tubes selected as the second and third samples (if required by Table 4.4-2) during each inservice inspection may be subjected to a partial tube inspection provided:

1) The tubes selected for these samples include the tubes from those areas of the tube sheet array where tubes with imperfections were previously found, and

2) The inspections include those portions of the tubes where imperfections were previously found.

d. A sample of the inservice steam generator tubes from the top of the hot leg tubesheet to 17 inches below the top of the tubesheet shall be inspected by rotating probe. This sample shall include a 20% minimum sample of the total population of bulges and overexpansions within the SG from the top of the hot leg tubesheet to 17 inches below the top of the tube sheet.

The results of each sample inspection shall be classified into one of the following three categories:

| Category | Inspection Results |
|---|---|
| C-1 | Less than 5% of the total tubes inspected are degraded tubes and none of the inspected tubes are defective. |
| C-2 | One or more tubes, but not more than 1% of the total tubes inspected, are defective, or between 5% and 10% of the total tubes inspected are degraded tubes. |
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Note: In all inspections, previously degraded tubes must exhibit significant (greater than 10%) further wall penetrations to be included in the above percentage calculations.

4.4.5.4 Acceptance Criteria

a. As used in this specification:

1) Imperfection means an exception to the dimensions, finish, or contour of a tube from that required by fabrication drawings or specifications. Eddy-current testing indications below 20% of the nominal tube wall thickness, if detectable, may be considered as imperfections;

2) Degradation means a service-induced cracking, wastage, wear, or general corrosion occurring on either the inside or outside of a tube;

3) Degraded Tube means a tube containing imperfections greater than or equal to 20% of the nominal wall thickness caused by degradation;

4) % Degradation means the percentage of the tube wall thickness affected or removed by degradation;

5) Defect means an imperfection of such severity that it exceeds the plugging limit. A tube containing a defect is defective;

6) Plugging Limit means the imperfection depth at or beyond which the tube will be removed from service and is equal to 40% of the nominal tube wall thickness. This criterion does not apply to degradation identified in the portion of the tube below 17 inches from the top of the hot leg tubesheet. Degradation found in the portion of the tube below 17 inches from the top of the hot leg tubesheet does not require plugging. Tubes with degradation identified in the portion of the tube within the region from the top of the hot leg tubesheet to 17 inches below the top of the tubesheet shall be removed from service;

7) Unserviceable describes the condition of a tube if it leaks or contains a defect large enough to affect its structural integrity in the event of an Operating Basis Earthquake, a loss-of-coolant accident, or a steam line or feedwater line break as specified in Specification 4.4.5.3c., above;

8) Tube Inspection means an inspection of the steam generator tube from the point of entry (hot-leg side) completely around the U-bend to the top support on the cold leg. The portion of the tube below 17 inches from the top of the hot leg tubesheet is excluded;

9) Preservice Inspection means an inspection of the full length of each tube in each steam generator performed by eddy-current techniques prior to service to establish a baseline condition of the tubing. This inspection shall be performed prior to initial POWER OPERATION using the equipment and techniques expected to be used during subsequent inservice inspections.

4.4.5.4 (Continued)

10) Bulge refers to a tube diameter deviation within the tubesheet to 18 volts or greater as measured by bobbin probe; and

11) Overexpansion refers to a tube diameter deviation within the tubesheet of 1.5 mils or greater as measured by bobbin probe.

b. The steam generator shall be determined OPERABLE after completing the corresponding actions (plug all tubes exceeding the plugging limit and all tubes containing through-wall cracks) required by Table 4.4-2.

4.4.5.5 Reports

a. Within 15 days following the completion of each inservice inspection of steam generator tubes, the number of tubes plugged in each steam generator shall be reported to the Commission in a Special Report pursuant to Specification 6.8.2;

b. The complete results of the steam generator tube inservice inspection shall be submitted to the Commission in a Special Report pursuant to Specification 6.8.2 within 12 months following the completion of the inspection. This Special Report shall include:

1) Number and extent of tubes inspected,

2) Location and percent of wall-thickness penetration for each indication of an imperfection, and

3) Identification of tubes plugged.

c. Results of steam generator tube inspections which fall into Category C-3 shall be reported in a Special Report to the Commission pursuant to Specification 6.8.2 within 30 days and prior to resumption of plant operation. This report shall provide a description of investigations conducted to determine cause of the tube degradation and corrective measures taken to prevent recurrence.

## ATTACHMENT 3

## LIST OF REGULATORY COMMITMENTS

The following table identifies those actions committed to by FPL Energy Seabrook in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments. Please direct questions regarding these commitments to Mr. James M. Peschel, Regulatory Programs Manager, at (603) 773-7194.

| REGULATORY COMMITMENTS | DUE DATE |
|---|---|
| NONE | |

**ENCLOSURE 2 to SBK-L-05185**

**WESTINGHOUSE NON-PROPRIETARY TECHNICAL EVALUATION:**
**LTR-CDME-05-170-NP**
**LIMITED INSPECTION of the STEAM GENERATOR TUBE PORTION WITHIN the TUBESHEET at SEABROOK GENERATING STATION**

**AND**

**ACCOMPANYING PROPRIETARY INFORMATION NOTICE AND COPYRIGHT NOTICE**

## PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

## COPYRIGHT NOTICE