

Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

December 17, 2007

U.S. Nuclear Regulatory Commission ATTN: Document Control Desk Mail Stop: OWFŃ P1-35 Washington, D.C. 20555-0001

In the Matter of Tennessee Valley Authority

Docket No. 50-391

WATTS BAR NUCLEAR PLANT (WBN) UNIT 2 – RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING GENERIC LETTERS NOS. 95-03, 95-05, 97-05, 97-06, 2004-01, AND 2006-01 PERTAINING TO STEAM GENERATOR TUBE INTEGRITY (TAC NOS. MD6715, MD6716, MD6720, MD6721, MD6725, AND MD6727)

The purpose of this letter is to respond to an NRC request for additional information (Reference 1) regarding several Generic Letters that concern steam generator tube integrity. TVA's original response to the Generic Letters was submitted on September 7, 2007 (Reference 2).

The WBN Unit 2 steam generators are Westinghouse Model D3 generators. They are of the same design as the original WBN Unit 1 steam generators that were in service from May 1996 until September 2006. The WBN Unit 2 steam generators have never been in service.

Enclosure 1 provides the NRC requests and TVA's responses. Enclosure 2 provides the listing of commitments made in Enclosure 1.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 17th day of December, 2007.

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NRR

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If you have any questions, please contact me at (423) 365-2351.

Sincerely,

Watts Bar Unit 2 Vice President

References:

- NRC letter dated November 27, 2007, "Watts Bar Nuclear Plant, Unit 2 Request for Additional Information Regarding Generic Letters Nos. 95-03, 95-05, 97-05, 97-06, 2004-01 AND 2006-01 Pertaining to Steam Generator Tube Integrity (TAC NOS. MD6715, MD 6716, MD6720, MD6721, MD 6725, AND MD 6727)".
- 2. TVA letter dated September 7, 2007, "Watts Bar Nuclear Plant (WBN) Unit 2 Initial Responses to Bulletins and Generic Letters".

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cc (Enclosures):

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Enclosure 1 TVA Responses to NRC Requests

GL 95-03: Circumferential Cracking of Steam Generator Tubes

NRC Request:

- 1. With respect to the Westinghouse Model D3 steam generators that are to be used in Watts Bar Unit 2, please address the following:
 - a. Discuss whether all tubes were subject to rotopeening at the hot-leg expansion transition and shotpeening at the cold-leg expansion transition.

TVA Response:

All WBN Unit 2 tubes were Rotopeened in the hot leg tube sheet region including the expansion transition regions. Shot peening was not performed in the cold leg tubesheet regions.

NRC Request:

b. Discuss whether the U-bend region of the low row tubes (e.g., rows 1 and 2) were heat treated.

TVA Response:

All WBN Unit 2 Row 1 and 2 U-bend regions were heat treat stress relieved.

NRC Request:

c. Discuss the extent to which any tubes were expanded into the tube support plates. In addition, confirm that the design modifications discussed in NUREG-0966, "Safety Evaluation Report related to the D2/D3 Steam Generator Design Modification," were implemented at Watts Bar Unit 2.

TVA Response:

No WBN Unit 2 tubes were expanded at tube support plate intersections (Unit 1 steam generator tubes were not expanded at the pre-heater tube support intersections). The WBN Unit 2 steam generators pre-heater inlets were modified at approximately the same time and in the same way WBN Unit 1 steam generators pre-heater inlets were modified. The WBN Unit 2 pre-heater inlet was modified such that the four hole reverse flow limiter was replaced with a 19 hole reverse flow limiter and the original flow impingement plate assembly was replaced by an internal manifold assembly. This modification is consistent with NUREG-0966, "Safety Evaluation Report related to the D2/D3 Steam Generator Design Modification".

NRC Request:

2. It was indicated that 100 percent of the tubes would be inspected prior to fuel load. Please discuss the specific probe types that will be used during this inspection (e.g., Will the full length of 100 percent of the tubes be examined with a bobbin coil? Will 100 percent of the tubes be inspected at both the hot-leg and cold-leg expansion transition with a rotating probe equipped with a +Point[™] coil?).

TVA Response:

In Reference 1, TVA committed to perform a complete 100% steam generator inspection prior to fuel load. As part of the preservice inspection the following examinations are planned:

100% bobbin coil full length.

100% Plus Point probe (or equivalent) examination at hot leg expansion transition. 100% Plus Point probe (or equivalent) examination of dents/dings greater than 2 volts. 100% Plus Point probe (or equivalent) examination of Row 1 and 2 U-bend regions.

TVA does not plan to inspect the cold-leg expansion transition based on the results of inspections performed on the original WBN Unit 1 steam generators. A sample inspection of the WBN Unit 1 cold-leg expansion transition was performed during the 4th and 5th refueling outages. No indications were found in the cold-leg expansion transition zone.

NRC Request:

3. Please discuss the extent to which circumferential cracking could occur in "larger" radius U-bends (i.e., larger than those in row 2). Please refer to NRC Information Notice 2003-13, "Steam Generator Tube Degradation at Diablo Canyon." If circumferential cracking can occur at these locations, discuss your plans to inspect these locations with a probe capable of detecting this form of degradation.

TVA Response:

WBN Unit 2 steam generator tubing is susceptible to circumferential cracking in "larger" radius U-bends. However, WBN Unit 1 did not discover circumferential cracking in larger radius U-bends during the examinations performed to detect this degradation mechanism in the original steam generators. The Westinghouse Owner's Group (WOG) funded Westinghouse to evaluate the susceptibility of the various Westinghouse plants. This evaluation was documented in Westinghouse Report SG-SGDA-03-33, "Evaluation of U-bend PWSCC Susceptibility for Model 51 SGs with Mill Annealed Alloy 600 Tubing" dated September 15, 2003. This report documents that the WBN Unit 1 susceptibility could be expected at 5.20 Effective Full Power Years. At approximately Cycle 4 refueling outage, the Degradation Assessment will determine the critical areas and buffer zones for the inspection samples and expansion sample strategies.

NRC Request:

4. Please discuss the extent to which circumferential cracking could occur in dings. If circumferential cracking can occur at these locations, discuss your plans to inspect these locations with a probe capable of detecting this form of degradation.

TVA Response:

WBN Unit 2 tubing is susceptible to circumferential cracking in dings/dents. During refueling outages, TVA plans on performing Plus Point probe (or equivalent) examinations on a sample of dings/dents greater than 2 volts (volts determined by bobbin coil examinations). Once the degradation mechanism is discovered or expected to be active, then the Degradation Assessment will determine the critical area and buffer zones for the inspection samples and expansion sample strategies.

NRC Request:

5. With respect to your inspection program for dents, you indicated that a typical inspection plan would be to inspect a 20 percent sample of the dents greater than or equal to 5 volts (as determined with a bobbin coil) with a technique qualified for crack detection at dents. Please provide the basis for limiting this sample to the first two support plates on the hot-leg side of the steam generator given that these locations are susceptible to cracking and the bobbin coil is not qualified for inspecting dents greater than 5 volts (i.e., shouldn't the 20 percent sample be for all dents greater than 5 volts?). In addition, discuss the extent to which circumferential cracking could occur in dents less than 5 volts. If circumferential cracking can occur at these locations, discuss your plans to inspect these locations with a probe capable of detecting this form of degradation. If your scope is limited to just the lower hot-leg tube support plates, discuss the basis for this approach (given more recent operating experience that indicates cracking can occur in dings on the cold leg before it is observed on the hot-leg since the potential for cracking relies on not only the temperature, but also the stresses and the material, which can vary).

TVA Response:

During refueling outages, TVA will sample dents with a technique capable of detecting circumferential cracks in both hot and cold legs at various elevations, and the sampling will include dents from 2 volts and greater (this is similar to the examination samples performed on WBN Unit 1). Once the degradation mechanism is discovered to be active or expected to be active, then the Degradation Assessment will determine the critical areas and buffer zones for the inspection samples and expansion sample strategies.

NRC Request:

6. If any tubes were expanded into the tube support plates (refer to previous question), please discuss the extent to which circumferential cracking could occur at these locations. If circumferential cracking can occur at these locations,

discuss your plans to inspect these locations with a probe capable of detecting this form of degradation.

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TVA Response:

No tube support plate intersections were expanded in the pre-heater region on WBN Unit 1 or Unit 2. Therefore, circumferential cracking due to the expansion is not an issue.

NRC Request:

7. Please clarify the statement that the minimum inspection scope at the first refueling outage will be "based on the current version of the Technical Specifications" and Electric Power Research Institute (EPRI) guidelines. In particular, clarify that the "current version" of the technical specifications that you are referring to are essentially identical to those contained in Technical Specification Task Force Traveler 449 (TSTF-449), Revision 4, "Steam Generator Tube Integrity."

TVA Response:

The WBN Unit 2 steam generator related technical specifications will adopt TSTF 449.

NRC Request:

8. Clarify the statement that if cracking is detected, "the examination expansion requirements of the technical specifications will be fulfilled." The staff notes that there are no sample expansion requirements in the technical specifications that are modeled after TSTF-449 (which the staff is under the impression you will adopt prior to commencing commercial operation per your response to GL 2006-01, "Steam Generator Tube Integrity and Associated Technical Specifications"). Rather, technical specifications modeled after TSTF-449 require inspections to be performed to ensure tube integrity.

TVA Response:

WBN Unit 2 will perform inspection sample expansions which ensure tube integrity in accordance with the steam generator program (similar to WBN Unit 1 Technical Specification section 5.7.2.12) and industry guidelines. Industry guidelines require the Degradation Assessment contain both the initial sample requirements and expansion sample requirements.

NRC Request:

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9. During the Maine Yankee outage in July/August 1994, several weaknesses were identified in their eddy current program as detailed in NRC Information Notice 94-88, "Inservice Inspection Deficiencies Result in Severely Degraded Steam Generator Tubes." In Information Notice 94-88, the NRC staff observed that several circumferential indications could be traced back to earlier inspections when the data was reanalyzed using terrain plots. These terrain plots had not been generated as part of the original field analysis for these tubes. For the

rotating probe (or equivalent) examinations to be performed at your plant, discuss the extent to which terrain plots will be used to analyze the data at locations susceptible to circumferential cracking.

TVA Response:

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Terrain plots are an important part of the analysis process. The following information is from the analysis technique sheets used at WBN Unit 1 which is part of the analysis instruction. This will be used at WBN Unit 2 as well.

- The evaluation shall consist of reviewing lissajous, strip chart and C-Scan displays to the extent that all tube wall degradation and other conditions are reported.
- All data shall be screened using the 300 kHz plus-point (Channel 7 & P2) as a minimum. All data shall be screened using the C-Scan display, in the area of interest, to increase the visibility of small amplitude indications. Review of additional coils shall be performed as appropriate in order to ensure adequate evaluation of the complete data.

GL 97-05, "Steam Generator Tube Inspection Techniques"

NRC Request:

Regarding the types of indications that you will size and leave in service, please confirm that the only indications that you size for purposes of leaving in service are wear attributed either to loose parts or to support structures (i.e., antivibration bars or tube support plates). Confirm that these wear indications are sized using methods that were evaluated using the EPRI "Pressurized Water Reactor Steam Generator Examination Guidelines: Revision 6."

TVA Response:

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WBN Unit 2 will not leave crack-like indications in service. All other indications will be analyzed and sized in accordance with EPRI guidelines or site-validated techniques as allowed by the steam generator program. The EPRI Guideline revision will be Revision 7 or later (industry is requiring Revision 7 to be implemented by September 2008 which is expected to be before the WBN Unit 2 preservice inspection).

GL 97-06, "Degradation of Steam Generator Internals"

NRC Request:

In your March 30, 1998, response to GL 97-06, you indicated that one end of the blowdown pipe in two of the four steam generators in Watts Bar Unit 1 had severed after operating one cycle. Please discuss whether a similar situation could occur at Watts Bar Unit 2. If so, discuss any corrective action that you have planned and/or any inspection program for assessing this potential degradation mechanism. If no corrective action is planned prior to commencing commercial operation, please describe the basis for concluding that operating with this condition is acceptable.

TVA Response:

The blowdown pipe of WBN Unit 2 is susceptible to the same problem that was discovered in WBN Unit 1. TVA will review the WBN Unit 1 steam generator analysis for the cracked blowdown pipe to ensure the WBN Unit 1 solution and analysis are bounding and applicable to WBN Unit 2. If found to be bounding and applicable, then the same strategy for managing this issue will be applied to WBN Unit 2. If the WBN Unit 1 analysis is not bounding, TVA will perform additional analysis for WBN Unit 2. WBN Unit 2 will perform similar visual inspections of the secondary side each outage for detection and/or monitoring of the blowdown pipe cracking.

References:

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1. TVA letter to NRC dated September 7, 2007, "Watts Bar Nuclear Plant (WBN) – Unit 2 – Initial Responses to Bulletins and Generic Letters".

Enclosure 2

Commitment Summary

- During refueling outages, TVA plans on performing Plus Point probe (or equivalent) examinations on a sample of dings/dents greater than 2 volts (volts determined by bobbin coil examinations). TVA will sample dents with a technique capable of detecting circumferential cracks in both hot and cold legs at various elevations, and the sampling will include dents from 2 volts and greater (this is similar to the examination samples performed on WBN Unit 1).
- 2. TVA will review the WBN Unit 1 steam generator analysis for the cracked blowdown pipe to ensure the WBN Unit 1 solution and analysis are bounding and applicable to WBN Unit 2. If found to be bounding and applicable, then the same strategy for managing this issue will be applied to WBN Unit 2. If the WBN Unit 1 analysis is not bounding, TVA will perform additional analysis for WBN Unit 2. WBN Unit 2 will perform similar visual inspections of the secondary side each outage for detection and/or monitoring of the blowdown pipe cracking.

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