June 20, 2005

Mr. Karl W. Singer
Chief Nuclear Officer and
Executive Vice President
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 1 — SUMMARY OF CONFERENCE CALLS WITH TENNESSEE VALLEY AUTHORITY REGARDING THE CYCLE 6 REFUELING OUTAGE STEAM GENERATOR TUBE INSPECTIONS (TAC NO. MC5629)

Dear Mr. Singer:

On March 9 and March 15, 2005, the U.S. Nuclear Regulatory Commission (NRC) staff participated in conference calls with Tennessee Valley Authority (TVA) representatives regarding the steam generator tube inspections at the Watts Bar Nuclear Plant, Unit 1, during the Cycle 6 refueling outage. Enclosed is a brief summary of the conference calls prepared by the NRC staff. The materials prepared by TVA in support of these calls is attached to this summary.

If you have any questions about this material, please contact me at (301) 415-1364.

Sincerely,

/RA/

Douglas V. Pickett, Senior Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-390

Enclosure: As stated

cc w/enclosure: See next page

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SUMMARY OF CONFERENCE CALLS

TENNESSEE VALLEY AUTHORITY

STEAM GENERATOR TUBE INSPECTION RESULTS

FOR THE CYCLE 6 REFUELING OUTAGE

WATTS BAR NUCLEAR PLANT, UNIT 1

March 9, 2005, Conference Call

On March 9, 2005, the Nuclear Regulatory Commission (NRC) staff participated in a conference call with Tennessee Valley Authority (TVA) to discuss the ongoing steam generator (SG) inspection activities at Watts Bar, Unit 1. To facilitate the call, the licensee addressed each of the staff's questions in the attachment to this conference call summary. The following details additional information discussed between the staff and the licensee during the conference call.

The licensee stated that during the secondary side pressure testing of SG #2, a drop of water was observed four times in 30 minutes from the Row 26 Column 21 tube. The licensee also observed that this tube was dark in color. At the time of the call, the licensee determined that there was circumferential cracking of this tube at the hot-leg top-of-tubesheet. Although sizing information was not available, the production analyst indicated that the crack was 208 degrees with a voltage of 3.69 volts (V). Initial profiling of the crack indicates the crack is 100-percent through-wall over 45 degrees of circumference. The licensee plans to in situ test this tube. A look-back performed on the eddy current data from the previous outage for this tube provided no early indication. The licensee suspects this crack may be a mixed-mode crack (i.e., a crack containing both axial and circumferential components); one of five tubes identified with mixed-mode indications of the 500 tubes with indications.

The licensee sampled the cold-leg top-of-tubesheet in all four SGs during the last outage and had no indications. Therefore, the licensee does not plan to complete any cold-leg inspections. In addition, this is the last outage with these SGs.

The dent population from the previous outage was used to develop the +Point™ inspection plan for dents during this outage. The licensee stated that all the hot-leg dents greater than or equal to 2.0 V are inspected. Based on the inspection results from this outage, there is no indication of active denting or dinging in any of the SGs.

During the last outage, one axial crack was found in the Row 4 U-bend region. At the time of the call, the licensee identified one axial indication in the Row 3 U-bend region of SG #4. If there are no additional indications found in the U-bend regions, the licensee plans to evaluate not expanding the inspection beyond Row 5 using the rationale that cracks in this region develop slowly and that cracks in this region were not found during the previous inspection.

Enclosure

The licensee provided the following additional information related to the following indications:

- Anti-Vibration Bar (AVB) Wear:

  Since there were no indications above 40 percent, the tubes with these indications will remain in service.

- Sludge Pile Outer Diameter (OD) Axial:

  The five indications thus far are similar to past indications with the largest being 0.25 V. The licensee plans to profile these indications and calculate burst pressures.

- Support Plate OD Axial:

  For those indications greater than 1.0 V, the indications are characterized and confirmed by +Point™. The licensee will also apply the lessons learned from Diablo Canyon, look at +Point™ profiles, and may choose to plug some indications less than 1.0 V. A look-back at the tube with the largest indication (i.e., 6.32 V in SG #2) was previously 0.6 V; therefore, there was no +Point™ data from the previous outage available.

- Top-of-tubesheet OD Axial:

  All these indications were low voltage, approximately 0.5 V.

- Top-of-tubesheet Inside Diameter (ID) Axial:

  The highest indications were inside the tubesheet, at approximately -3" and -4". Most of the indications were less than 1.0 V and will be left in-service by applying the F* alternate repair criteria (ARC).

- Top-of-tubesheet OD Circumferential:

  The leakage occurred from the highest voltage indication and the detection is believed to have been aided by a failed fuel event. A look-back performed on this tube did not provide any early indication. Most of the indications were under 0.5 V. The licensee plans to in situ pressure test several candidates from this population of indications.

- U-bend Axial Row 3:

  The indication is 0.58 V and will be in situ tested.

- Mixed Mode Indications:

  The licensee plans to in situ pressure test the indications exhibiting both axial and circumferential components.

The licensee clarified that sleeving of the tubes in SGs #1 and #4 with the top-of-tube-sheet OD indications will utilize alloy 800 leak-limiting sleeves.

Regarding loose parts, the licensee applied the Shearon Harris lessons learned to the inspection by applying various turbo-mixes for inspecting the top-of-tubesheet area.

A follow-up phone call was agreed upon to discuss the in situ testing results.

March 15, 2005, Conference Call

On March 15, 2005, the NRC staff participated in a conference call with TVA to discuss the results of its in situ testing at Watts Bar, Unit 1. At the time of the call, 20 in situ pressure tests were completed. In situ testing for tubes in SG #1 and SG #4 were not yet completed.

The 3ΔP for Watts Bar is slightly less than 4000 pounds-per-square-inch (psi). The steam-line-break (SLB) pressure is 2560 psi. The in situ test pressure to simulate 3ΔP and SLB pressure was adjusted to reflect the fact that the test is performed at room temperature rather than at operating temperature. When testing circumferential cracks, the test pressure was also adjusted to overcome the resistance from the locked tube supports during the test. This led to the 3ΔP test pressure of 4619 psi for circumferential cracks and 4600 psi for axial cracks and the SLB test pressures of 3055 psi for circumferential cracks and 2717 psi for axial cracks.

The following describes the population of indications for in situ testing:

- Sludge pile OD stress corrosion cracking (SCC):

  Approximately 25 low voltage indications with highest being 0.25 V. No indications were in situ tested because all calculated burst pressures did not exceed screening criteria.

- ID axial cracks at top-of-tubesheet:

  155 indications with some as F* candidates. In situ tested hot leg top-of-tubesheet axial indications where the calculated burst pressure is less than 3ΔP. SG #3 had 2 tubes tested which passed with no leakage detected. Four tubes with mixed mode indications were scheduled for in situ testing. Two of these indications were in SG #4 and passed with no leakage. The remaining two indications are in SG #1 and are scheduled to be tested.

- Cold leg axial cracks:

  These indications were identified in tubes with overexpanded transitions at the top-of-tubesheet. One tube had indications between 7 and 10 axial indications. This tube was in situ tested at the simulated SLB pressure and held for 10 minutes. A leakage of 0.03 gallons per minute was determined. The 3ΔP test for this tube did not result in any bursting; therefore, the tube passed the structural performance criteria.

- OD axial indications at the top-of-tubesheet:

  In situ tested two tubes with mixed-mode indications. The calculated burst pressures for the 10 candidate tubes in SG #4 was less than 3ΔP.

- OD circumferential cracks at the top-of-tubesheet:

    767 tubes with these indications (some multiple indications in a single tube). Plugging and sleeving for these indications is planned. Most of these indications were low voltage indications with five indications greater than 0.55 V. Two of the largest indications were 1.59 V and 3.8 V. Both these indications were in situ tested. A total of 10 tubes with OD circumferential indications were successfully in situ pressure tested.

    The 3.8 V indication was found in SG #2, Row 26, Column 21, and measured 100 percent at its maximum depth and 187 degrees in circumference. This indication did not leak at the simulated SLB pressure. The licensee will submit additional information discussing why leakage occurred from this tube during operation but not during the simulated SLB test.

- ID top-of-tubesheet circumferential cracks:

    All indications had high calculated burst pressures with the lowest calculated pressure of 7841 psi. All indications were less than 1.0 V with the highest indication of 0.78 V. None of these indications were in situ tested.

- U-bend indications

    One U-bend axial indication at the apex in SG #4 (Row 3, Column 89) will be in situ tested since its calculated burst pressure is less than 3ΔP.

- Pre-heater wear:

    All indications were low with the highest indication measured at 18 percent.

- Loose parts and AVB indications:

    One indication found and subsequently plugged.

- OD stress corrosion cracking axial indication dings in the cold leg:

    The initial scope of the inspection was a 20 percent sample of preheater dings above support plate CL 3. Based on the finding of an indication, the program was expanded to include 100 percent of pre-heater dings up to support plate CL 11. This expansion was based upon the experience at South Texas Project for detecting cracks in dings before these spread to higher regions in the SG. One additional crack in a ding was detected in support plate CL 3. These indications were not in situ tested since these were small indications and did not meet any screening criteria.

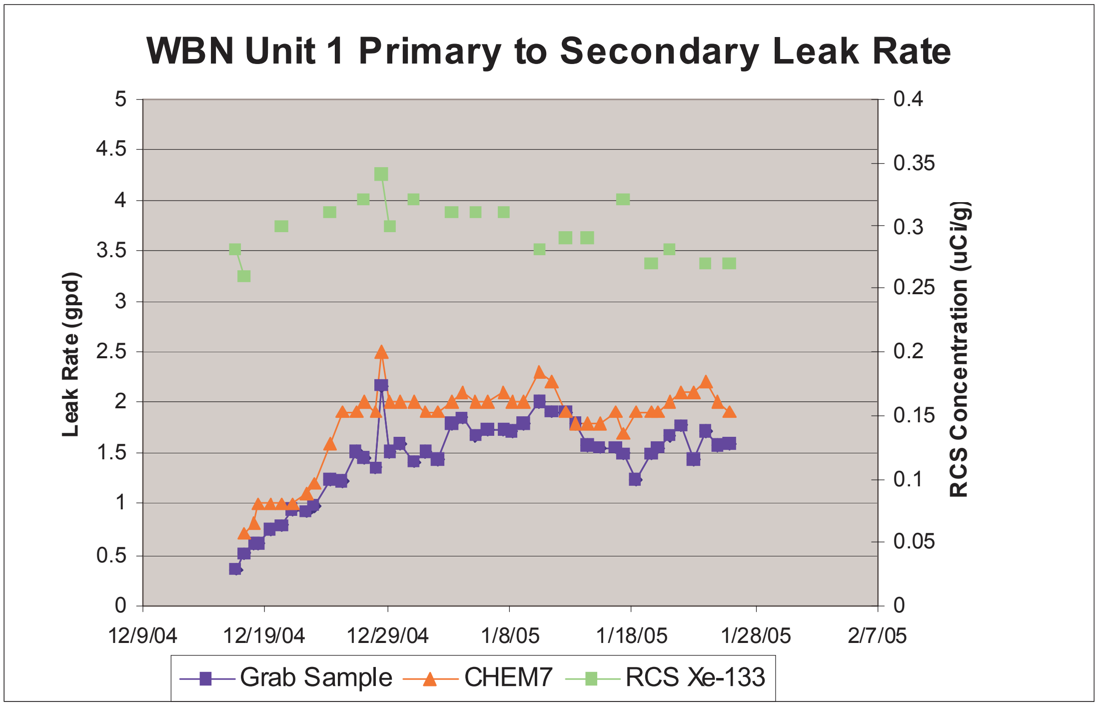
The licensee indicated that in situ testing of candidates in SG #1 would be completed within the next day and candidates in SG #4 would be completed shortly thereafter. The staff requested an additional call if any unusual results of the remaining tubes to be in situ tested were identified.

Attachment: TVA Draft Response

DRAFT RESPONSES PROVIDED BY TVA IN SUPPORT OF TELECONS

1. Discuss any trends in the amount of primary-to-secondary leakage observed during the recently completed cycle.

Response: There has been a very small amount of primary-to-secondary leakage for most of the cycle. It peaked at approximately 2.6 gallons per day. By the time the unit was shut down at the end of February the leakage had decreased to around 1 gallon per day. Chemistry identified the leaking SG as SG#2. The outage was moved one month sooner than planned to address this leakage concern.



2. Discuss whether any secondary side pressure tests were performed during the outage and the associated results.

Response: A secondary side pressure test was performed. The secondary side of the generator was filled with water above the tubes and nitrogen was used to pressurize the SG. Between 300 and 400 psi, the tube was identified as Row 26 Column 21.

3. Discuss any exceptions taken to the industry guidelines.

Response: No exceptions are taken to the industry guidelines.

4. For each SG, provide a description of the inspections performed including the areas examined and the probes used (e.g., dents/dings, sleeves, expansion-transition, U-Bends with a rotating probe), the scope of the inspection (e.g., 100 percent of dents/dings greater than 5 volts and a 20 percent sample between 2 and 5 volts), and the expansion

criteria. Also, discuss the extent of the rotating probe inspections performed in the portion of the tube below the expansion transition region (reference Nuclear Regulatory Commission (NRC) Generic Letter 2004-01, "Requirements for Steam Generator Tube Inspections").

Response:

1. 100% full-length bobbin coil examination in all 4 SGs.
2. 100% hot leg top of tubesheet +3/-2 using + Pt examination in all 4 SGs. F* is licensed for WBN SGs and the inspection depth encompasses the F* distance. The 3 inch inspection above the transition encompasses the sludge pile as identified by history. This will be checked during the inspection to ensure we are testing the sludge pile.
3. Expansion - Nothing will drive us to the cold leg. We sampled in all SGs last inspection and found no indications.
4. 100% TSP H01 to C14 dented with bobbin voltage greater than or equal to 2 volts (Cycle 5) examined using +Pt probe.
5. Expansion – indications in the buffer zone would drive us further down the cold leg supports
6. 20% sample of freespan dings $\geq$ 2 volts between the HTS and H02 will be examined using a +Pt probe.
7. Expansion – indications in the hot leg sample would cause expansion to 100% of the sample area and 20% of the next highest location (buffer zone)
8. 20% sample of freespan dings $\geq$ 2 volts between the CTS and C10 examined using a +Pt probe.
9. Expansion – indications in the cold leg sample would cause a 100% exam of preheater dings
10. 100% Row 1 & 2 U-Bend region (H08 to C14) in all 4 SGs with a magnetic bias +Pt U-bend probe.
11. 100% Rows 3 through 5 U-Bend regions (H08-C14) using +Pt probe examinations in all 4 SGs.
12. Expansion – During development of the DA, it was decided that expansion would be driven by a crack-like indication in Rows 3-5. To date, we have only 1 axial indication in a U-Bend and it is Row 3. We are not at the end of the program. We are evaluating not expanding through the functional evaluation process if no other indications are identified in Rows 3 through 5. Industry results from extensive U-Bend inspections support this evaluation.
13. 100% of locations with both an "MBM" and a dent or ding (Cycle 5) (within an inch of the one another) using +Pt.
14. 100% AVB locations with a dent (Cycle 5) using +Pt.
15. 100% of freespan dings in U-bends using +Pt.
16. 100% of previously installed sleeves using a Plus Point probe.
17. 100% of the tubesheet region below the sleeves using a Plus Point probe. F* is not applicable to sleeved tubes.

5. For each examined (tube supports, dents/dings, sleeves, etc.), provide a summary of the number of indications identified to date of each degradation mode (e.g., number of circumferential primary water stress corrosion cracking indications at the expansion transition). For the most significant indications in each area, provide an estimate of the severity of the indication (provide the voltage, depth, and length of the indication). In

particular, address whether tube integrity (structural and accident induced leakage integrity) was maintained during the previous cycle. In addition, discuss whether any location exhibited a degradation mode that had not previously been observed at this location at this unit (e.g., observed circumferential primary water stress corrosion cracking at the tubesheet expansion transition for the first time at this unit).

AVB Wear	86 total indications nothing over 40%
Sludge Pile OD Axial	5 indications
Support Plate OD Axial	650 total indications, 1,012 predicted, Max Voltage 6.32, Max voltage predicted 5.4

SG 1	48 over 1 volt, 2 between 2 and 3 volts, 3 over 3 volts 3.1, 3.31, 3.66
SG 2	14 over 1 volt, 2 greater than 2 volts, 3.43 and 6.32
SG3	16 over 1 volt, 4 greater than 2 volts, 2.16, 2.36, 2.51, 2.99
SG4	13 over 1 volt, 2 greater than 2 volts, 2.57, 4.06

Top of tubesheet OD Axial	12 indications
Top of tubesheet ID Axial	29 indications
Top of tubesheet OD Circs	497 indications
Top of tubesheet ID Circs	3 indications
U-Bend Axial Row 3	1 indication

Mixed Mode Indications 5 tubes have both axial and circ cracks at the top of the tubesheet

6. Describe repair/plugging plans.

Response: We are plugging in SGs 2 and 3, plugging and sleeving (TTS) in SGs 1 and 4

7. Describe in situ pressure test and tube pull plans and results (as applicable and if available).

Response: We will follow the EPRI In Situ Guidelines for in situ screening. We will in situ pressure test the tube that was identified as leaking and mixed mode indications that are considered to be interacting

Response: No tube pull is planned for this inspection

8. Provide the schedule for steam generator related activities during the remainder of the current outage.

In Situ testing on the 11th
We will be into repairs by early morning on the 12th
Westinghouse equipment removal on the 17th

9. Discuss the following regarding loose parts:

1. What inspections are performed to detect loose parts
2. A description of any loose parts detected and their locations within the SG
3. If the loose parts were removed from the SGs
4. Indication of tube damage associated with loose parts
5. The source or nature of the loose parts if known

Response: In an effort to save dose due to steam generator replacement activities inside containment around the SGs, not secondary side work is being performed this outage. However, all periphery tubes are being examined up front in the outage on common cal groups. These cal groups will be evaluated by the lead analysts as an extra effort to detect any foreign objects that may be in the SGs. A FOSAR crew is on standby in case the leaker is a result of a foreign object or if a foreign object is identified by eddy current and it is determined that the object must be retrieved.

Questions 10 and 11 do not apply to WBN Westinghouse Model D SGs with Alloy 600 mill annealed tubing.