TVA

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

May 24, 2011

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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant, Unit 2
NRC Docket No. 50-391

Subject: **Watts Bar Nuclear Plant (WBN) Unit 2 – Additional Responses to Request for Additional Information Regarding (1) Bottom Mounted Instrument (BMI) Tube Failure and (2) Mass Addition Events**

References:

1. NRC letter to TVA dated April 27, 2011, "Watts Bar Nuclear Plant, Unit 2 - Audit Report of Westinghouse Documents Relating to Final Safety Analysis Report Accident Analyses (TAC NO. ME4620)"
2. TVA letter to NRC dated April 29, 2011, "Watts Bar Nuclear Plant (WBN) Unit 2 – Response to Requests for Additional Information (RAIs) Regarding Inadvertent ECCS Actuation Analysis, And Chemical & Volume Control System Malfunction Analysis"
3. TVA letter to NRC dated November 9, 2010, "Watts Bar Nuclear Plant (WBN) Unit 2 - Final Safety Analysis Report (FSAR) - Response to Request for Additional Information"
4. TVA letter to NRC dated May 13, 2010, "Watts Bar Nuclear Plant (WBN) Unit 2 – Additional Responses to Request for Additional Information Regarding (1) Large Break Loss of Coolant Accident, (2) Steam Line Break, and (3) Miscellaneous Analysis"

The purpose of this letter is to provide additional responses to requests for additional information (RAIs) regarding (1) bottom mounted instrument (BMI) tube failure and (2) mass addition events. These RAIs were received during a recent meeting with NRC the week of May 9, 2011. The BMI RAI was received within the NRC Audit Report issued April 27, 2011 (Reference 1).

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Reference 1 requested an analysis of a BMI tube failure. During the week of March 14th audit, a copy of a generic industry report (WCAP-16468 - NP, "Risk Assessment of Potential Cracking in Bottom Mounted Instrumentation Nozzles," September 2005) was provided. The purpose of WCAP-16468 was to summarize the information provided to EPRI for development of Materials Reliability Program guidelines for inspection of BMIs. The staff requested a specific analysis of a tube failure for WBN. A response to a similar RAI was provided by Reference 4. (Refer to Enclosure 1, section 15.3.1-2, item h of Reference 3.) In addition, Enclosure 1 of this letter provides additional information from Westinghouse regarding the use of WINCISE probe detectors in lieu of movable incore detectors relative to a BMI tube failure.

Relative to the mass addition events previously provided in Reference 2, additional RAIs were received the week of May 9, 2011. Enclosure 2 provides a response to the RAIs. Enclosure 3 provides the commitment associated with operator actions and timing for the mass addition events.

If you have any questions, please contact Bill Crouch at (423) 365-2004.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 24th day of May, 2011.

Respectfully,

David Stinson
Watts Bar Unit 2 Vice President

Enclosures:

1. Westinghouse Document WBT-D-3180 NP-Attachment, "NRC RAI on Bottom Mounted Instrument Tube Failure"
2. Response to new RAIs received the week of May 9, 2011, regarding Mass Addition Events
3. Commitment List

cc (Enclosures):

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Enclosure 1
TVA Letter Dated May 24, 2011
Additional Responses to Request for Additional Information
Regarding (1) Bottom Mounted Instrument (BMI) Tube Failure and
(2) Mass Addition Events

Westinghouse Document WBT-D-3180 NP-Attachment,
"NRC RAI on Bottom Mounted Instrument Tube Failure"

During the Reference 1 audit, the staff requested an analysis of a BMI tube failure. During the audit a generic report (Reference 2) on instrument tube failure was provided. The staff again asked for a specific analysis of a tube failure for WBN.

The generic topical report provided to the NRC addressed all plant designs that were active. WBN Unit 1 was addressed, but WBN Unit 2 was not included. The report contained several tasks associated with determination of credible break sizes and generic thermal hydraulic analysis considering these break sizes. One of the key aspects of determination of the credible breaks sizes is discussed in Reference 2, Section 2.3. Section 2.3 states:

"From the list of credible failure modes above, and if initial cracking propagates through-wall so that leakage occurs, the maximum leak path flow area varies between 0.04 and 0.21 $inch^2$ for the Westinghouse design..."

This area is the net area of the BMI tube penetration (inner diameter) with the area of the thimble tube (outer diameter) subtracted. This flow area results from the conclusion that the thimble tube will remain in the BMI tube for the more likely scenarios.

A comparison of the WBN Unit 1 design to the WBN Unit 2 design was completed for the bottom mounted instrumentation to determine if the break area discussed above would be bounding for the Unit 2 design. The comparison documented in Reference 3 concludes that the break areas considered in the Reference 2 report would apply to WBN Unit 2. Therefore, the generic thermal hydraulic analysis discussed in Section 2.5.1 of Reference 2 would also apply to WBN Unit 2.

References:

1. ML111030624, "Watts Bar Nuclear Plant, Unit 2 - Audit Report of Westinghouse Documents Relating to Final Safety Analysis Report Accident Analyses (TAC NO. ME4620)"

2. WCAP-16468-NP, "Risk Assessment of Potential Cracking in Bottom Mounted Instrumentation Nozzles"

3. LTR-SEE-III-11-128, "Watts Bar Unit 1 and Unit 2 Bottom Mounted Instrumentation Guide Tubes" (Can be made available in Westinghouse Rockville Office)

Enclosure 2
TVA Letter Dated May 24, 2011
Additional Responses to Request for Additional Information
Regarding (1) Bottom Mounted Instrument (BMI) Tube Failure and
(2) Mass Addition Events

Response to New RAIs Received the Week of May 9, 2011,
Regarding Mass Edition Events

15.2.14 Inadvertent Operation of Emergency Core Cooling System

1. NRC Question: *Operator action to terminate safety injection flow is assumed to occur 10 minutes from the event's initiation. Show that the operators can, by following the Emergency Operating Procedures, diagnose the situation and terminate the safety injection flow by ten minutes.*

   TVA Response: Operator response to this event will be demonstrated on the simulator and the results will be available for NRC review.

2. NRC Question: *For the pressurizer filling case, the AFW System is assumed to be actuated by the SI signal. What is the worst single failure that is assumed to occur in the AFW system? What is the resultant flow rate?*

   TVA Response: The analysis assumes that the highest capacity auxiliary feedwater pump (the turbine driven pump) fails. The two motor driven auxiliary feedwater pumps start and deliver 820 gpm which is split equally between the four steam generators.

3 NRC Question: *The analysis includes the core residual heat generation that is calculated according to the 1979 version of ANSI 5.1. Does this calculation, as used in the transient analysis, include a 2σ adder for uncertainties?*

   TVA Response: Yes--the analysis assumes the full ANS 1979 decay heat including 2σ for uncertainties.

15.2.15 Chemical and Volume Control System Malfunction during Power Operation

1. NRC Question: *The analysis of the CVCS Malfunction event indicates that an unspecified alarm is expected to appear (and/or annunciate), in the Control Room, 60 seconds after the event is initiated. The operators, alerted by this alarm are credited with terminating the event within the next ten minutes. Four possible alarms are listed as examples: high charging flow, high pressurizer water level, pressurizer water level deviation, and low VCT level. Specify the alarm, plus a second, backup alarm, that are predicted to be generated, in this transient analysis, by 60 seconds.*

Response to New RAIs Received the Week of May 9, 2011,
Regarding Mass Edition Events

TVA Response: Simulator runs were conducted to determine the alarm response for the single and dual charging pump CVCS malfunction event. The simulator indicates that for both events, the CVCS Charging flow high alarm is received within one minute, the letdown HX return flow alarms at approximately 2 minutes and that back up alarms of Boric Acid blender flow deviation and PZR Level Hi deviation are received within 4 minutes.

2 *NRC Question: Operators are credited with terminating the charging flow 10 minutes after receipt of the alarm. Show that the operators can, by following the appropriate procedures, locate the charging flow source/path, and terminate the charging flow within ten minutes.*

TVA Response: Operator response to this event will be demonstrated on the simulator, and the results will be available for NRC review.

3. *NRC Question: Why was a two-pump case analyzed?*

TVA Response: It was TVA's understanding from the discussions in the March 15, 2011 audit of Westinghouse at the Westinghouse Washington D.C. office that the NRC staff wished to see cases for both single and dual charging pump CVCS malfunctions. Accordingly, hypothetical events for both cases were postulated, analyzed, and presented for NRC review.

4. *NRC Question: In the two-pump scenario, letdown is not isolated. Since minimum letdown flow is 75 gpm, the net charging flow is decreased by 75 gpm. The analysis results indicate that the one-pump case, with letdown isolation, results in a higher peak pressurizer water volume (about 1680 ft3) than does the two-pump case (1635 ft3), assuming that both events are terminated by the operator at the same time (660 sec). Does this mean that two charging pumps, with letdown, would deliver less water to the RCS than would one pump, without letdown? What are the net charging flows for these cases?*

TVA Response: The net flow addition for the 2 charging pumps case with 75 gpm of letdown is less than the net flow addition for the 1 pump case for the RCS pressures encountered during the transient. The total delivered mass from the initiation of the event until the operator terminates charging flow is approximately 14100 lbm and 13100 lbm for the 1 pump and 2 pump cases, respectively. The specific flow rates modeled as a function of RCS pressure are:

Response to New RAIs Received the Week of May 9, 2011, Regarding Mass Edition Events

RCS Pressure (psia)	One Pump Flow Rate without letdown (gpm)	Two Pump Flow Rate with Letdown (gpm)
2114.7	198	206
2214.7	175	173
2314.7	149	137
2414.7	117	96

5. *NRC Question: Figure 15.2.15-4, "CVCS Malfunction - Pressurizer Water Volume versus Time-, shows that a peak (plateau) water volume of about 1680 ft3, for the one-pump case, is reached soon after the charging flow is terminated. For the two charging pump case, the figure shows that a plateau at about 1635 ft3 is reached; but the peak water volume, at 1479.1 seconds (from Table 15.2.15-1, "Time Sequence of Events for CVCS Malfunction") is not shown, since this would be at a point 79.1 seconds beyond the time range of the plot. What is the peak pressurizer water volume at 1479.1 seconds? Why does it occur so long after the operator has terminated the charging flow?*

   TVA Response: Operator action terminates charging flow at 660 seconds. At 671.4 seconds, the pressurizer water volume reaches 1663 ft3 and remains essentially constant at 1663 ft3 for the remainder of the transient. The computer code looks at more decimal places and notes that the absolute peak pressurizer water volume of 1663.42 ft3 occurs at 1479.1 seconds. There is very little change in the pressurizer water volume from 671.4 seconds until the computer run is terminated. The differences in pressurizer volume between 671.4 seconds and 1479.1 seconds are due to round off and are not significant.

Enclosure 3
TVA Letter Dated May 24, 2011
Additional Responses to Request for Additional Information
Regarding (1) Bottom Mounted Instrument (BMI) Tube Failure and
(2) Mass Addition Events

Commitment List

1. Relative to the mass addition events, operator response to these events will be demonstrated on the simulator, and the results will be available for NRC review.