October 2, 2007

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

Gentlemen:

In the Matter of	)	Docket No. 50-390
Tennessee Valley Authority	)	

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - GENERIC LETTER 2004-02 - POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN-BASIS ACCIDENTS AT PRESSURIZED WATER REACTORS - REQUEST FOR EXTENSION OF COMPLETION DATE FOR CORRECTIVE ACTIONS (TAC NO. MC4730) - REVISED

References:

1) TVA Letter to NRC dated August 1, 2007, "Watts Bar Nuclear Plant (WBN) Unit 1 - Generic Letter 2004-02 - Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors - Request for Extension of Completion Date for Corrective Actions (TAC No. MC4730)

2) NRC Generic Letter 2004-02 dated September 13, 2004, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactor"

3) TVA Letter to NRC dated September 1, 2005, "Watts Bar Nuclear Plant (WBN) Unit 1- NRC Generic Letter (GL) 2004-02: Potential Impact of Debris blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors (PWR) - Second Response (TAC No. MC4730)"

4) TVA Letter to NRC dated April 11, 2006, "Watts Bar Nuclear Plant (WBN) Unit 1 - Generic Letter 2004-02 Potential Impact of Debris blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors (PWR) - Response to Request for Additional Information (TAC No. MC4730)"

5) TVA Letter to NRC dated July 3, 2006, "Watts Bar Nuclear Plant (WBN) Unit 1 - Generic Letter 2004-02 - Request for Additional Information Regarding the Nuclear Regulatory Commission Staff Audit on the Containment Sump Modifications (TAC No. MC4730)"

6) TVA Letter to NRC dated August 8, 2003, "Watts Bar Nuclear Plant (WBN) Unit 1 - Response to Bulletin 2003-01 - Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors"

This letter revises TVA's Letter to NRC dated August 1, 2007 (Reference 1) based upon discussions with the NRC Staff after that letter was submitted. The changes are denoted by revision bar. NRC Generic Letter (GL) 2004-02 (Reference 1) requested that licensees provide information regarding the potential impact of debris blockage on emergency recirculation during design basis events. TVA provided the requested information in References 3, 4, and 5.

Item 2(b) of GL 2004-02 states that all actions should be completed by December 31, 2007; provide justification for not implementing the identified actions during the first refueling outage starting after April 1, 2006, and describe how the regulatory requirements discussed in the Applicable Regulatory Requirements section will be met until the corrective actions are completed.

During the fall 2007 outage for WBN Unit 1, corrective actions associated with GL 2004-01 were partially implemented. New sump strainers were installed with increased surface area, the orifice in the high head injection flow path was resized to allow the throttle valves in this flow path to be opened further, and the old Steam Generators were replaced with uncoated Steam Generators to reduce the amount of coating debris transported to the sump.

In response to question 1 of Reference 5, TVA stated that as a result of the revised debris generation analysis, some of the fiber quantities due to Min-K insulation and 3M fire wrap have increased with respect to that tested in the WBN strainer test and that WBN was looking at several options to reduce these quantities to within the tested configuration. These options include: credit for additional jet shielding due to robust barriers and large structures, material testing under jet impingement loading to reduce the zone of influence (ZOI) for encapsulated fiber, removal of material, and/or sump strainer re-testing. Based on additional jet impingement testing following the fall 2006 outage, TVA has determined that in order to meet the fibrous debris loading for the tested sump configuration that some Min-K insulation needs to be replaced with reflective metal insulation and some will require installation of additional restraint bands to prevent damage.

As discussed with the WBN NRC Project Manager, the actions to replace the Min-K insulation and add additional restraint bands will be completed during the upcoming refueling outage (Unit 1 Cycle 8 Outage) that is scheduled to start by February 10, 2008. Enclosure 1 provides the basis supporting TVA's conclusion that it is acceptable to extend the WBN Unit 1 completion date.

A list of regulatory commitments is provided in Enclosure 2. If you have any questions concerning this matter, please call me at (423) 365-1824.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 2nd day of October 2007.

Sincerely,

Original signed by

J. D. Smith
Manager, Site Licensing
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Enclosures
cc: See Page 4

JDS:RAS
Enclosures
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ENCLOSURE 1

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
GENERIC LETTER 2004-02 - POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN-BASIS ACCIDENTS AT PRESSURIZED WATER REACTORS
REQUEST FOR EXTENSION OF COMPLETION DATE FOR CORRECTIVE ACTIONS

In Generic Letter (GL) 2004-02, dated September 13, 2004, the NRC staff summarized their bases for concluding that existing pressurized-water reactors (PWRs) could continue to operate through December 31, 2007, while implementing the required corrective actions for NRC Generic Safety Issue 191 (GSI-191), "Assessment of Debris Accumulation on PWR Sump Performance." In the following discussion TVA has addressed the "Criteria for Evaluating Delay of Hardware Changes," as described in SECY-06-0078, dated March 31, 2006. This discussion supports TVA's request for extension of the completion date for the corrective actions at WBN Unit 1 from December 31, 2007, to the completion of the spring 2008 refueling outage. The proposed extension of the GSI-191 implementation schedule by approximately 2-months for WBN Unit 1 does not alter the original conclusions summarized in GL 2004-02 in which the staff determined that it is acceptable for PWR licensees to operate until the corrective actions are completed.

SECY-06-0078 Criterion:

The licensee has a plant-specific technical/experimental plan with milestones and schedule to address outstanding technical issues with enough margin to account for uncertainties.

The licensee identifies mitigative measures to be put in place prior to December 31, 2007, and adequately describes how these mitigative measures will minimize the risk of degraded ECCS (emergency core cooling system) and CSS (containment spray system) functions during the extension period.

Reason for Request

In response to question 1 of Reference 4, TVA stated that as a result of the revised debris generation analysis, some of the fiber quantities due to Min-K insulation and 3M fire wrap have increased with respect to that tested in the WBN strainer test and that WBN was looking at several options to reduce these quantities to within the tested configuration. These options include: credit for additional jet shielding due to robust barriers and large structures, material testing under jet impingement loading to reduce the zone of influence (ZOI) for encapsulated fiber, removal of material, and/or sump strainer re-testing. Based on additional jet impingement testing, TVA has determined that in order to meet the fibrous debris loading for the tested sump configuration that some Min-K insulation needs to be replaced with reflective metal insulation and some requires installation of additional restraint bands to prevent damage.

Mitigative Measures

1. Measures Completed at WBN Unit 1

During the Unit 1 Cycle 7 (U1C7) refueling outage that concluded in November 2006, TVA implemented changes to the plant that included the installation of the new containment sump strainer design, installation of a resized orifice in the high head injection flow path and replacement of the old coated steam generators with non-coated steam generators.

The new strainer is a significant improvement over the original design and increases the available flow area from approximately 200 ft^2 to approximately 4600 ft^2. The openings in the new strainer are round holes with a diameter of 0.085 inch. This is substantially smaller than the 1/4 inch rectangular mesh of the original sump screens. Testing of the new sump strainer has been conducted that showed very low head loss with extremely conservative debris loadings.

A review of the Emergency Core Cooling System (ECCS) injection pathways was performed and determined that a change to the throttle position of the high head injection flow path throttle valves was necessary to ensure debris would not be trapped in the throttle valves. To allow for the further opening of the throttle valves the orifice in the flow path was replaced with one having a smaller bore size. The new orifice and the throttle valve position changes were accomplished during the U1C7 outage. These changes ensured that the orifice and the throttle valve openings were at least 50 percent larger than the strainer opening size to eliminate any potential blockage in the ECCS injection path.

2. Containment Cleanliness

As discussed in Reference 5, WBN has a formal program for inspecting and cleaning areas inside containment. Technical Instruction TI-12.07, “Containment Access” and procedure SPP-10.7, “Housekeeping/Temporary Equipment Control,” provide guidelines for entering/exiting containment, acceptance criteria for housekeeping/cleanliness to ensure no loose debris is left in containment, and for storage of materials inside containment during MODE 4 and higher.

TI-61.003, “Ice Condenser Loose Debris Log,” records, tracks, and evaluates debris that is found in the ice condenser system to ensure that this debris does not impact sump operation.

3. Procedural Guidance

Emergency operating procedure, ES-1.3, "Transfer to Containment Sump," contains guidance to the operators for monitoring the containment sump for blockage. This procedure provides for monitoring the ECCS pumps and Containment Spray pumps for sump blockage and ability to deliver necessary flow. Monitoring of containment sump level to determine the necessity to refill the refueling water storage tank (RWST). Also with the assistance of the Technical Support Center (TSC) personnel, the procedure provides for guidance on reducing containment spray and ECCS flow to single train operation to reduce the rate of debris accumulation.

4. Risk Evaluation

Included in Generic Letter 2004-02 were the following observations regarding risk significance that remain valid through the proposed extended implementation period to the completion of the Spring 2008 refueling outage. WBN performed a risk evaluation and concluded the probability of a Large Break LOCA resulting in core damage during the two month extension is less than 1E-06. The probability of a Large Break LOCA in the WBN PRA model is 2.67E-06 per year. It was conservatively assumed that the amount of fibrous material released from the existing Min-K insulation inside containment results in a debris layer over the containment sump screen that causes the loss of NPSH to ECCS pumps. It is also assumed that failure of the ECCS pumps in recirculation mode eventually results in core damage. The probability of core damage is then equal to the initiating event probability of a Large Break LOCA or 2.67E-06 per year. The probability of Large Break LOCA resulting in core damage over the estimated 2 months needed for the extension request is 4.39E-07 or less than 1E-06. As stated in the analysis the assumption that the Large Break LOCA results in sump blockage and core damage is conservative because 1) leak before break was not credited; 2) some of the fibrous insulation may be mixed with reflective metallic insulation and there may not be enough flow to dislodge this debris; and 3) mitigative measures to deal with sump blockage were not credited.

5. Safety Features and Margins in Current Configuration/Design Basis

The WBN containment sump incorporates many design features that help to minimize the possibility of strainer blockage. The containment sump is located in the containment floor below the refueling canal to provide protection from high energy pipe failures. The lower containment is an open, one-level area. The only drains which are used to route water to the sump are the two large refueling cavity drains and the twenty ice condenser floor drains. These drains route water away from the sump strainers.

There are two entry paths to the sump area, separated by approximately 320 degrees around lower containment. The water fills the floor areas and covers the sump entrance. This provides two entry points into the sump area on opposite sides. Thus, if a break were to occur near one of the sump entry points, water would travel around to the other side of containment to the strainer modules on the opposite side. Stainless steel reflective metallic insulation (RMI) is the predominant insulation type used in the lower containment. There are no break locations or break sizes in the reactor coolant system that will result in Min-K being debris in the sump without the presence of substantial amounts of RMI debris. The Min-K panels are generally interspersed within the quadrants opposing the containment sump inlet area. The volume of insulation contained in a given replacement Min-K panel is small compared to the volume of RMI that exists on the host piping segment. The Min-K panels having the largest volume are located on two elbows on the main steam lines from steam generators 1 and 4. These Min-K panels will be replaced with RMI during the U1C8 refueling outage. With the exception of the Min-K panels installed on the two main steam line elbows, shielding by the steam generators, reactor coolant pumps, and the reactor cavity wall would allow any single break to release fibers into the sump water that would only marginally exceed the scaled volume under which the prototype strainer module was tested. The blowdown from a high energy line break that would destroy the Min-K panels on the main steam line elbows would also generate RMI debris from the host piping segment and also from the RMI installed on the nearby steam generators. The subsequent washdown by containment spray and the break flow would result in the accumulation of a pile of RMI and Min-K debris on the containment floor. Lower containment would fill with water during the post-LOCA injection phase and immediate release of significant amounts of Min-K captured in the debris pile is not expected. The mitigative measures described in item 3 above provide procedural guidance to respond in the event of a gradual release of Min-K fibers from the debris pile and subsequent collection on the strainer. The containment sump has a high water level compared to most containment designs which provides large margins in available net positive suction head (NPSH). This coupled with the low head losses established during the testing shows that the sump screens have large safety margins. WBN as an ice condenser used sodium tetraborate as the buffering agent, has low temperature in the sump water, and maintains a relatively neutral sump pH throughout the accident period. This limits corrosion of light metals and limits chemical effects. Testing performed to date supports the conclusion that chemical effects are not an issue at WBN. The small hole size selected for the new strainer prevents any large material with a potential to block fuel, ECCS injection pathways, or the containment spray nozzles from bypassing the strainer. While it could be assumed that long fibers could pass through the strainer openings with a potential to block fuel a visual microscopic examination of the type of material that passed through the strainer openings showed that the lengths of such fibers were too short to be of concern.

The Westinghouse fuel installed in WBN, depending on vintage, has two different protective features for foreign material exclusion. WBN core design incorporates Westinghouse RFA-2 fuel with debris filtering bottom nozzles. The size of the holes used in the debris filtering nozzle are larger than the sump screen hole size. Currently, approximately 2/3 of the core has a protective grid (p-grid) design with a leading edge offset slightly from the debris filtering bottom nozzle. This feature provides further protection for the fuel from debris entering the bottom of the fuel assembly during normal operation that might cause wear or fretting damage to the fuel. This grid is situated immediately above the bottom nozzle such that for some flow openings, the grid cruciform bisects the inlet flow openings, whereas for other holes, a single strap crosses the opening. This causes the characteristic flow dimension to be smaller than the debris filtering nozzle opening size. For the cruciform bisected holes, the opening is slightly smaller than the new sump screen hole size, and for the remainder it is slightly larger than the screen hole size. WBN has contracted with Westinghouse to provide an alternate p-grid design on future fuel furnished to the plant. The alternate p-grid design has a shortened grid height which effectively raises the grid further above the bottom nozzle and provides a larger flow dimension than the sump screen opening size for all the nozzle openings. The normal operation protection for the fuel is not significantly impacted by the alternate p-grid while the post accident performance is improved by reducing the likelihood that particulate material passing through the sump screen will be blocked by the protective grid. Approximately 1/3 of the core currently has this design which was first incorporated into the fuel during the last refueling.

Westinghouse has evaluated WBN operation with mixed p-grid/ alternate p-grid design. The evaluation was based on an existing parametric core blockage study conducted for Sequoyah Nuclear Plant with applicability to Watts Bar Nuclear Plant. The study examined arbitrary core blockage percentages from 20 percent to 80 percent using natural circulation flow at the time of sump switchover. Cladding temperatures were determined to be acceptable for all blockages studied and it was concluded that sufficient flow area is therefore available to protect the core for design basis events.

WBN has NRC approval to invoke the leak-before-break methodology to eliminate the dynamic effects (pipe whip and jet impingement) of postulated reactor coolant piping (hot leg, cross-over leg, and cold leg) ruptures from the design basis of the plant. The approval was based on the conclusion that the probability or likelihood of large pipe breaks occurring in the primary coolant loops is sufficiently low. The leak would be detected and the unit brought to a safe shutdown condition prior to the occurrence of a large pipe break. While the leak-before-break methodology was not used in determining the debris loading on the sump strainer, it does provide additional margin in the overall sump strainer design.

6. Unblocked Sump Strainers and Drainage Paths

Surveillance Instructions, 1-SI-304-2 "18 Month ECCS Containment Sump Inspection" is performed during each refueling outage to ensure that the containment sump suction pit is free of debris and that the sump components, including strainers, show no evidence of degradation.

Inspections to assure that the refueling canal drains are not blocked that direct the flow of containment spray water from the upper compartment to the lower compartment are performed by procedure 1-SI-72-3 "Containment Refueling Canal Drains." These drains are accessible during plant operation and are inspected every 92 days.

There are 20 ice condenser floor drains which drain to the floor in lower containment on the outside of the sump strainers. 1-SI-61-9, "18 Months Ice Condenser Floor Drains Visual Inspection", ensures that these floor drains, associated pipe, and valves are free of ice, frost, or debris and each valve seat is free of any corrosion, pitting or cracking.

There are two additional drainage paths available to supply water to the area inside the polar crane wall. These two paths are floor drains that are located in accumulator rooms 3 and 4. These drains are verified clear and free flowing every other outage in accordance with procedure 1-TRI-40-901, "Accumulator Rooms 3 and 4 Open Ended Crane Wall Drains ASME Section XI Unimpaired Flow Test". In addition, 1-SI-304-2 requires inspection of the drains for no blockage each refueling outage, in conjunction with the sump screen inspection.

Conclusion

Based on the above discussion TVA has determined that overall plant safety will be maintained until the corrective actions are completed during the spring 2008 refueling outage.

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
GENERIC LETTER 2004-02 - POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN-BASIS ACCIDENTS AT PRESSURIZED WATER REACTORS
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COMMITMENT LIST

The following provides a list of commitments in this submittal which are being tracked by TVA's commitment process.

1. The actions to replace the Min-K insulation and add additional restraint bands will be completed during the upcoming refueling outage (Unit 1 Cycle 8 Outage) that is scheduled to start in early February 2008.