TVA

Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402-2801

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

Watts Bar Nuclear Plant, Unit 1
Facility Operating License No. NPF-90
NRC Docket No. 50-390

Subject: **Nine-Month Supplemental (Post-Outage) Response to NRC Generic Letter 2008-01: Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems**

References:

1. "NRC Generic Letter 2008-01: Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," dated January 11, 2008
2. TVA letter to NRC dated May 9, 2008, "Initial Response to NRC Generic Letter 2008-01: Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems"
3. TVA letter to NRC dated June 6, 2008, "Revised Initial Response to NRC Generic Letter 2008-01: Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems"
4. TVA letter to NRC date July 11, 2008, "Revised Commitment for NRC Generic Letter 2008-01: Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems"
5. TVA letter to NRC dated October 11, 2008, "Nine-Month Response to NRC Generic Letter 2008-01, Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems"
6. Letter from NRC to TVA dated July 29, 2008, "Watts Bar Nuclear Plant, Unit 1 - Generic Letter 2008-01, Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems, Proposed Alternative Course of Action (TAC No. MD7895)"

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The purpose of this letter is to provide the Tennessee Valley Authority's (TVA's) "Nine-Month Supplemental (Post-Outage) Response to NRC Generic Letter (GL) 2008-01," for Watts Bar Nuclear Plant, Unit 1. TVA's initial responses and the "Nine-Month" response were provided in References 2, 3, 4, and 5 above. NRC acceptance review of the Nine-Month response is provided in Reference 6.

The NRC issued GL 2008-01, Reference 1, to request that each licensee evaluate the licensing basis, design, testing, and corrective actions for the emergency core cooling, decay heat removal, and containment spray systems to ensure that gas accumulation is maintained less than the amount that challenges operability of these systems, and that appropriate action is taken when conditions adverse to quality are identified.

This supplemental response is being submitted within 90 days of startup from the outage in which the deferred actions were completed (Watts Bar Nuclear Plant, Unit 1 Refueling Outage 9). Startup from Refueling Outage 9 occurred on October 20, 2010. GL 2008-01 response activities that remain to be accomplished, such as the long-term items identified in Reference 6, are considered to be confirmatory.

TVA concludes that the subject Watts Bar Nuclear Plant, Unit 1 systems are operable and that Unit 1 is currently in compliance with the licensing basis documentation and applicable regulations, including 10 CFR 50 Appendix B, "Quality Assurance Criteria for Nuclear Plants and Fuel Reprocessing Plants," Criteria III, V, XI, XVI, and XVII, with respect to the concerns outlined in GL 2008-01 regarding managing gas accumulation in these systems.

There are no new regulatory commitments contained in this letter.

Please direct any questions concerning this matter to Kevin Casey at (423) 751-8523.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on the 19th day of January, 2010.

Respectfully,

R. M. Krich
Vice President
Nuclear Licensing

Enclosure: Nine-Month Supplemental (Post-Outage) Response to NRC GL 2008-01 for Watts Bar Nuclear Plant, Unit 1 cc (Enclosure):

NRC Regional Administrator - Region II

NRC Senior Resident Inspector - Watts Bar Nuclear Plant

ENCLOSURE

TENNESSEE VALLEY AUTHORITY (TVA)
WATTS BAR NUCLEAR PLANT, UNIT 1

NINE-MONTH SUPPLEMENTAL (POST-OUTAGE) RESPONSE TO NUCLEAR REGULATORY COMMISSION (NRC) GENERIC LETTER 2008-01

This enclosure provides the Nine-Month Supplemental (Post Outage) Response to Generic Letter (GL) 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," for actions that were deferred until the next refueling outage as requested by the NRC (Reference 1).

The following information is provided in this enclosure.

a) A description of the results of evaluations that were performed pursuant to GL 2008-01 on the previously incomplete activities, such as system piping walkdowns, at Watts Bar Nuclear Plant (WBN), Unit 1 (See Section A of this Enclosure)

b) A description of any additional corrective actions determined necessary to assure system operability and compliance with the quality assurance criteria in Sections III, V, XI, XVI, and XVII of Appendix B to 10 CFR Part 50 and the licensing basis and operating license with respect to the subject systems, including a schedule and a basis for that schedule (see Section B1 of this Enclosure), and

c) A summary of any changes or updates to previous corrective actions, including any schedule change and the basis for the change (See Section B2 of this Enclosure)

The original conclusions documented in the nine-month response (Reference 2) with respect to the licensing basis evaluation, testing evaluations, and corrective action evaluations have not changed. This supplement will only discuss the results of design evaluation reviews conducted during the recent refueling outage associated with previously uncompleted activities.

A. EVALUATION RESULTS

1. Design Basis Documents

As discussed in TVA's nine-month response to GL 2008-01 (Reference 2), the WBN Unit 1 design basis has been reviewed with respect to gas accumulation in the Emergency Core Cooling System (ECCS), Decay Heat Removal System (DHRS), and Containment Spray System (CSS). There were no issues or actions identified from this previous design basis document review that require a refueling outage to investigate or complete. There have been no changes to design basis documents with respect to gas accumulation since TVA's nine-month response to GL 2008-01. There have been no changes to the void acceptance criteria given in TVA's nine-month response to GL 2008-01.

2. Confirmatory Walkdowns

The ECCS and DHRS discharge pipe inside containment was surveyed during this past refueling outage. Due to its design, the CSS pipe inside containment does not need to be surveyed [see TVA's nine-month response to GL 2008-01 (Reference 2) for a complete discussion of this conclusion].

The survey data identified locations in the cold leg injection pipe from the centrifugal charging pumps and the hot leg injection pipe from the safety injection pumps (SIPs) that due to unfavorable pipe slope or pipe bow could contain a void with a maximum cross section of > 20% of the pipe flow area. However, as discussed in TVA's nine-month response to GL 2008-01, voiding in this pipe does not result in pressure pulsations or water hammer when the centrifugal charging pumps (CCPs) and SIPs are placed in service. Therefore, these potential void locations in this pipe do not require corrective action.

A total of 68 pipe segments inside containment that were inaccessible during plant operation remained to be walked down during the refueling outage. Upon visual inspection, 37 segments of the cold leg injection pipe from the DHRS pumps and SIPs were still inaccessible due to obstructions in the vicinity of the pipe, which prevented safe access and construction of scaffolding. The walkdown data from accessible segments of piping, both inside and outside containment, has consistently demonstrated that the accessible horizontal runs of pipe are relatively level and that the piping is adequately vented. Thus, the evaluation concluded that the relatively short, inaccessible segments of piping noted above have no significant adverse impact.

The survey data identified one location in the cold leg injection pipe from the SIPs that due to pipe bow could contain a void with a maximum cross section of > 20% of the pipe flow area; however, the potential void volume in this pipe segment is < 0.5 cubic feet so no corrective actions are necessary.

Despite the lack of survey data for segments of the cold leg injection pipe from the DHRS pumps and SIPs, TVA determined that this pipe does not require corrective action. As discussed below, this conclusion is based on mitigating design features of this discharge pipe and availability of other means to verify that voiding in this pipe is maintained at a level that does not adversely affect the performance of the ECCS and DHRS while mitigating design basis accidents (DBAs) or maintaining safe shutdown (SSD).

<u>ECCS Injection from the Refueling Water Storage Tank (RWST)</u>

The relief valves on the cold leg injection lines from the DHRS pumps have a setpoint > 350 psi above the maximum discharge pressure of the pumps when their suctions are aligned to the RWST for their ECCS function. The relief valves on the cold leg injection lines from the SIPs have a setpoint > 200 psi above the maximum discharge pressure of the SIPs when their suctions are aligned to the RWST for their ECCS function. The only way to produce a discharge pressure at 200 psi or 350 psi above the maximum discharge pressure of the SIPs or DHRS pumps, respectively, is for the injection flow to abruptly stop, such that bulk fluid conditions are <u>not</u> maintained. Bulk fluid conditions are maintained when flow decreases gradually as the pressure increases in the cold leg injection lines compressing voids to the maximum discharge pressure of the pumps. A gradual decrease in flow is one that occurs over a time frame that is long compared to the propagation time in the cold leg injection lines. The propagation time for these cold leg injection lines is very short, about 0.1 second, so in the absence of a substantially voided section of horizontal pipe, which would allow injection flow to slam into a closed injection isolation valve or closed primary check valve, a gradual decrease in flow occurs.

The above conclusion is consistent with operating experience. Prior to June, 2008, there were horizontal sections of SIPs' discharge pipe near closed injection valves that could not be vented. This configuration resulted in the lifting of the SIP discharge relief valves during periodic testing of the SIPs. After the addition of vents, which allowed this horizontal pipe to be filled, subsequent periodic tests of the SIPs have not resulted in the lifting of their discharge relief valves.

While the lifting or potential lifting of one of the SIPs' discharge relief valves is not a condition that would be accepted in TVA's corrective action program, the design of ECCS is very tolerant for lifting of a SIP discharge relief valve. Should one of these relief valves lift and not reseat during a safety injection demand, the resulting flow diversion would not prevent the ECCS from mitigating a design basis Loss of Coolant Accident. This is because the relief valves on the discharge piping of the SIPs have a very small flow rate (< 30 gpm at the maximum discharge pressure of the SIPs). Therefore, the flow diversion does not result in inadequate core cooling. In addition, because the discharge from these relief valves is routed inside containment to the pressurizer relief tank (and ultimately to the containment sump), there is no loss of ECCS or Reactor Coolant System (RCS) inventory from the containment sump.

There have been no instances of a lifting of a relief valve on the discharge of the DHRS pumps during their periodic tests. In addition, the maximum discharge pressure of these pumps when aligned to the RWST is so far below their discharge relief valves' setpoint that the failure of one of the ECCS or DHRS relief valves to close is not expected to occur. Therefore, with respect to the WBN Unit 1 licensing basis, the failure of one of the ECCS or DHRS relief valves to close would be considered a single failure (as opposed to a consequential failure). Under these conditions, flow from both trains of the DHRS would be available for a stuck open discharge relief valve scenario. The flow from both trains of DHRS exceeds the minimum flow required by the safety analysis even with a loss of injection flow to the RCS due to a stuck open relief valve. The discharge from these relief valves is routed inside containment to the pressurizer relief tank. Therefore, there will be no loss of ECCS water or RCS inventory from the containment sump as a result of a pressure pulse causing a relief valve to open and then failing to close.

ECCS Injection from the Containment Sump

When the SIPs are aligned to the discharges of the DHRS pumps for containment sump recirculation, the maximum discharge pressure of the pumps could initially be much closer to the relief valve setpoints (< 50 psi difference). However, in this case, operating procedures prevent the SIPs from being restarted unless RCS pressure is well below the discharge pressure of the SIPs. This means that flow in the discharge pipe cannot abruptly stop because the discharge pressure of the SIPs will be above RCS pressure when the SIPs are restarted. As a result, pressure pulsations that could cause a relief valve to open do not occur when the SIPs are placed in service for containment sump recirculation.

DHRS Shutdown Cooling

When the DHRS pumps are aligned for shutdown cooling, the maximum discharge pressure of the pumps could initially be much closer to the relief valve setpoints (< 25 psi difference). However, in this case, flow in the discharge pipe cannot abruptly stop because the discharge pressure of the DHRS pumps is above RCS pressure. As a result, pressure pulsations that could cause a relief valve to open do not occur when the DHRS is placed in service for shutdown cooling.

Periodic Testing of the ECCS and DHRS Pumps

As discussed above, both the DHRS pumps and the SIPs are periodically tested in their ECCS, cold leg injection configuration (with their suctions aligned to the RWST) when the RCS pressure is above the maximum discharge pressure of these pumps. Successive periodic testing has established that unacceptable pressure pulsations or water hammer does not occur as evidenced by the lack of pipe or pipe support damage and discharge pipe relief valves remaining closed. This is the basis for the conclusion that potential gas voids due to unfavorable pipe slope or pipe bow do not result in pressure pulsations that could cause a relief valve to open or cause a water hammer. It also is the basis for the conclusion that current venting practices are adequate for ensuring voiding in the ECCS and DHRS discharge pipe is being maintained at a level that does not adversely affect their performance when mitigating DBAs or while maintaining SSD.

3. Vent Valves

The survey of the ECCS and DHRS discharge pipe in containment and the subsequent evaluation of this survey data confirmed that existing vents are adequate for ensuring this discharge pipe is sufficiently full of water. That is, use of the existing vent valves during system fill and periodic venting, ensures that voiding in this discharge pipe is maintained less than the amount that challenges the capability of the ECCS and DHRS to mitigate DBAs and maintain SSD. Therefore, no additional vent valves are required to be added to this discharge pipe and no changes to the utilization of existing vent valves is required.

4. Procedures

The survey of the ECCS and DHRS discharge pipe in containment and the subsequent evaluation of this survey data did not identify the need to revise fill and vent procedures or periodic venting procedures. That is, use of the existing fill and vent procedures or periodic venting procedures, ensures that voiding in this discharge pipe is maintained less than the amount that challenges the capability of the ECCS and DHRS to mitigate DBAs and maintain SSD.

B. DESCRIPTION OF NECESSARY ADDITIONAL CORRECTIVE ACTIONS

1. Additional Corrective Actions

The survey of the ECCS and DHRS discharge pipe in containment and the subsequent evaluation of this survey data did not identify any conditions that require corrective actions to ensure that voiding in the discharge piping is maintained less than the amount that challenges the capability of the ECCS and DHRS to mitigate DBAs and maintain SSD.

2. Corrective Action Updates

The following Table from TVA's nine-month response to GL 2008-01 (Reference 2) has been updated to show the status of the WBN corrective actions:

Item Description	Date
1. TVA will evaluate adopting the revised Improved Standard Technical Specification (ISTS) SR 3.5.2.3 (NUREG 1431) at WBN.	Within 6 months of NRC approval of the Traveler
2. The design change review checklist is revised to include an explicit item to determine if the design change introduces or increases the potential for gas accumulation beyond established acceptance criteria.	Complete
3. Operating procedures are being revised to improve instructions for filling portions of the ECCS discharge pipe.	Complete
4. ~~The ECCS, DHR System, and Containment Spray System operating procedures are being revised to require UT inspection or dynamic venting of locations that could contain a significant void should this pipe be drained.~~	Deleted
5. Periodic venting procedures used to meet SR 3.5.2.3 are being revised to require that, for an extended gas release, a report is entered into the Corrective Action Program.	Complete

Corrective action item 4 (above) is deleted since the need to revise the ECCS, DHRS and CSS operating procedures to add dynamic venting and ultrasonic test (UT) examination requirements has been determined to be unnecessary. This determination is based on the evaluations performed for GL 2008-01, which found that due to their configuration, the ECCS, DHRS and CSS suction piping is self-venting so dynamic venting, additional vent valves or UT examination is not necessary to ensure the suction piping of these systems is adequately filled. In addition, a detailed review of the ECCS and DHRS discharge piping was performed in the 2003 time period to identify and evaluate locations that could contain a significant void. As a result of this effort, vent valves were added to 12 locations in the discharge pipe of the ECCS and DHRS and ECCS and DHRS operating procedures were revised to vent at these additional locations. The CSS operating procedures already dynamically vent much of the CSS pipe during filling of this system.

C. CONCLUSION

TVA has evaluated the previously unevaluated portions of the applicable systems at WBN Unit 1 that perform the functions described in the GL and has concluded that these systems are operable as defined in the WBN Unit 1 Technical Specifications and are in conformance with the applicable General Design Criteria, as stated in the Updated Final Safety Analysis Report.

REFERENCES

1. Letter from NRC to TVA dated July 29, 2008, "Watts Bar Nuclear Plant, Unit 1 - Generic Letter 2008-01, Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems, Proposed Alternative Course of Action (TAC No. MD7895)"

2. TVA letter to NRC dated October 11, 2008, "Nine-Month Response to NRC Generic Letter 2008-01: Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems"