

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

July 3, 2013

10 CFR 2.201

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

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

#### Subject: Reply to a Notice of Violation; EA-13-018

- References: 1. Letter from NRC to TVA, "Watts Bar Nuclear Plant NRC Inspection Report 05000390/2012009; Preliminary Yellow Findings, Preliminary White Findings and Apparent Violations," dated March 12, 2013
  - 2. TVA Nuclear Power Group Hydrology Regulatory Conference slides (ADAMS Accession No. ML13115A020)
  - Letter from NRC to TVA, "Watts Bar Unit 1 Nuclear Plant Final Significance Determination of Yellow Finding, White Finding and Notices of Violations; Assessment Follow-up Letter; Inspection Report No. 05000390/2013009," dated June 4, 2013

In accordance with the NRC letter dated March 12, 2013 (Reference 1), Tennessee Valley Authority (TVA) requested a Regulatory Conference to discuss the apparent violations documented in Reference 1. The Regulatory Conference was conducted on April 22, 2013, during which TVA made a presentation on the issues (Reference 2). Subsequently, the NRC issued Notice of Violation EA-13-018 on June 4, 2013 (Reference 3). In accordance with the NRC's June 4, 2013 letter, TVA is required to respond to the Notice of Violation within 30 days of the date of the letter.

TVA's response to this Notice of Violation is provided in the enclosure in accordance with 10 Code of Federal Regulations (CFR) 2.201, "Notice of Violation."

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There are no new regulatory commitments contained in this response. Should you have any questions concerning this submittal, please contact D. K. Guinn, Nuclear Site Licensing Manager, at (423) 365-1589.

Respectfully,

Shea President, Nuclear Licensing ¢е

Enclosure: Reply to a Notice of Violation; EA-13-018

cc (Enclosures):

NRC Regional Administrator - Region II NRC Senior Resident Inspector - Watts Bar Unit 1 Nuclear Plant

# ENCLOSURE

**Tennessee Valley Authority** 

Watts Bar Nuclear Plant Unit 1

Reply to a Notice of Violation; EA-13-018

# **Restatement of Violation A**

Technical Specification 5.7.1, Procedures, requires in part that written procedures shall be established, implemented, and maintained covering the activities recommended in Regulatory Guide 1.33 [Quality Assurance Program Requirements (Operations)], Revision 2, Appendix A, February 1978.

Regulatory Guide 1.33, Revision 2, Appendix A, includes "Abnormal Conditions" as a typical safety-related activity that should be covered by written procedures.

Abnormal Operating Instruction (AOI) 7.1, "Maximum Probable Flood," Revision 16, provides detailed instructions for implementing required site flood mitigation strategies necessary to cope with design basis flooding events.

Contrary to the above, prior to September 30, 2009, the licensee failed to establish and/or maintain an adequate Abnormal Operating Instruction procedure to implement its flood mitigation strategy. Specifically, AOI 7.1 was inadequate to mitigate the effects of a Probable Maximum Flood (PMF) event, in that earthen dams located upstream of the facility could potentially overtop, causing a subsequent breach. Failure of the earthen dams during a PMF event would have resulted in onsite flooding and subsequent submergence of critical equipment, such as the Emergency Diesel Generators, resulting in an ineffective flood mitigation strategy for these PMF events.

### **Background**

It was determined on July 28, 2009, that an upstream dam (Fort Loudoun) would overtop and fail during a design basis PMF. Subsequent to this date, it was discovered that Cherokee, Tellico, and Watts Bar dams had a similar design vulnerability that would also result in a higher flood elevation at the WBN site.

TVA performed an analysis and determined that the overtopping and failure of the specified earthen embankments would have resulted in an increase in the PMF level at Watts Bar Nuclear Plant (WBN) and would have the potential to affect systems required for safe shutdown. The overtopping of the dams represented an unanalyzed condition. Subsequent analysis determined that the calculated increase in flood level at WBN from a PMF event in which the specified earthen embankments were overtopped and failed rendered existing flood mode procedures ineffective.

In July and August 2009, TVA implemented interim compensatory measures to mitigate impacts of the potential dam overtopping issues. TVA modified River Operations procedures to notify WBN if 5 inches or greater average rainfall over 72 hours occurs over the watershed above the Fort Loudoun and Tellico dams. At the same rainfall threshold, TVA procedures required the mobilization of the necessary heavy equipment to remove the Fort Loudoun Marina Saddle dam to preserve the integrity of Fort Loudoun Dam. In this same time period, TVA commenced installation of the Hercules Engineering Solutions Consortium (HESCO) barriers on the Fort Loudoun, Tellico, Watts Bar, and Cherokee dams. These modifications were implemented to effectively raise dam embankments 3 feet to 8

feet, which prevent flood overtopping and potential impacts to the dam earthen embankments and possible failure, and protect critical WBN facility operations.

By December 30, 2009, the HESCO barriers installation was completed. Post-HESCO PMF calculations were issued for WBN to bring WBN into compliance with the licensed conditions.

# Reason for the Violation

The reasons for this violation are as follows.

- The Simulated Open Channel Hydraulics (SOCH) model had design input errors due to overconfidence in the adequacy of the model and in the calculation process. This resulted in unrecognized inaccuracies in the nuclear plant PMF calculations.
- Nuclear Power Group management failed to ensure a sufficient focus on nuclear safety with regard to flooding by failing to provide effective oversight and engagement on changes being made to the river system in order to ensure that potential impacts on the WBN flooding design basis were properly evaluated.
- Formal flood protection programmatic and process controls had not been established for the protection of critical safety systems at WBN.
- Nuclear Power Group personnel had less than adequate common internal understanding of the applicable regulatory requirements for WBN with respect to river system operation controls.
- Ineffective completion of the Bellefonte Nuclear Plant corrective actions.

# Corrective Steps That Have Been Taken and Results Achieved

The installation of HESCO barriers on the Fort Loudoun, Tellico, Watts Bar, and Cherokee dams has been completed to raise the effective height of the earthen embankments.

Post-HESCO PMF calculations have been issued for WBN to bring WBN into compliance with the licensed conditions.

An Integrated Hydrology Advisory Committee has been implemented. The committee was formed to identify, discuss, and disposition common issues and initiatives relating to TVA hydrology. In addition, the implementing procedure, TVA-SPP-20.009, "Coordination of Hydrology Issues," has been issued. This procedure applies to TVA organizations. Issues and initiatives relating to TVA hydrology are included in the scope of this procedure.

Procedure NEDP-20, "Conduct of the Engineering Organization," has been revised to include a Flood Protection Program within the Corporate Nuclear Engineering organization. The primary function of the Flood Protection Program is to ensure that nuclear plant critical safety systems are protected from all postulated flooding conditions.

## Corrective Steps That Will Be Taken

In addition to the corrective steps that have already been taken, the following corrective steps remain to be taken.

- Procedures will be developed or revised to implement the Corporate Nuclear Engineering Flood Protection Program described above. The implementing procedures will ensure that nuclear plant critical safety functions are protected from postulated flooding conditions, and will include appointing a single-point owner, defining roles and responsibilities, and identifying the nuclear regulatory requirements.
- Procedural requirements will be established to include reviews by TVA Nuclear Power Group of any river or dam changes, including calculations that may affect the Corporate Nuclear Engineering Flood Protection Program.
- A formal risk management process, informed by Institute of Nuclear Power Operations (INPO) 12-008, "Excellence in Integrated Risk Management," for all flood-related engineering products will be created. The process will ensure changes are evaluated to nuclear plant design standards, river system operations, flood-related procedures, project management procedures, and applicable environmental standards.
- An inventory of nuclear programs and processes that are important to nuclear safety will be developed. The programs and processes will be prioritized in order of relative risk or importance to safety, and controlling procedures to assure nuclear safety will be verified to exist. This inventory of programs and processes will be reviewed on a biennial basis and updated, as necessary.

### Date When Full Compliance Will Be Achieved

Full compliance was achieved on December 30, 2009 for the failure to establish and/or maintain an adequate Abnormal Operating Instruction procedure to implement its flood mitigation strategy violation as described in EA-13-018. On this date the HESCO barrier installation was completed to raise the effective height of the earthen embankments and the post-HESCO PMF calculation was issued for WBN, placing WBN in compliance with the licensed conditions.

## **Restatement of Violation B**

Technical Specification 5.7.1, Procedures, requires, in part, that written procedures shall be established, implemented, and maintained covering the activities recommended in Regulatory Guide 1.33 [Quality Assurance Program Requirements (Operations)], Revision 2, Appendix A, February 1978.

Regulatory Guide 1.33, Revision 2, Appendix A, includes "Abnormal Conditions" as a typical safety-related activity that should be covered by written procedures.

Abnormal Operating Instruction AOI-7.1, "Maximum Probable Flood," Revision 21, and the supporting maintenance instructions referenced therein, required that the plant be reconfigured and systems realigned within 27 hours, consistent with Technical Requirements Manual (TRM) 3.7.2 and Watts Bar UFSAR [Updated Final Safety Analysis Report] Section 2.4.

Contrary to the above, the licensee failed to maintain an adequate Abnormal Condition procedure to implement its flood mitigation strategy. Specifically, the licensee was unable to implement AOI-7.1 to reconfigure and realign systems necessary for flood mitigation within 27 hours. As a result, the licensee's flood mitigation strategy for certain flooding events, including PMF events, was inadequate. This condition existed from initial licensing until July 2012.

### **Background**

From August through September, 2012, WBN performed a Reasonable Simulation of Abnormal Operating Instruction (AOI) 7.01, "Maximum Probable Flood," and related implementing procedures as a part of a NRC Near Term Task Force (NTTF) Recommendation 2.3 inspection. Procedure AOI-7.01 contains the requirements to meet TRM 3.7.2, "Flood Protection Plan," and WBN UFSAR Section 2.4. The activities are divided into two stages designated Stage I and Stage II. Stage I actions are essentially preparatory in nature for the plant site to receive flooding levels above plant grade. These include shutting down the reactor and commencing cool down to 350 degrees Fahrenheit and moving equipment. Stage I actions are to be complete within 10 hours of the determination that Stage I actions should be implemented. Based on communications with TVA River Operations, WBN remains in Stage I until River Operations determines that flood levels may reach plant grade level. If River Operations determines that flood levels may reach plant grade, Stage II is entered and significant plant system realignments occur including connecting: the Essential Raw Cooling Water (ERCW) System to the Component Cooling System (CCS); the ERCW to the Raw Cooling Water (RCW) System; the Fire Protection System to the Auxiliary Feedwater (AFW) System; and in some plant conditions, spent fuel pool (SFP) cooling to the Residual Heat Removal (RHR) System. These connections are made with spool pieces that are staged at various locations throughout the plant. Stage II actions are to be completed within 17 hours of the determination that Stage II should be implemented. Thus, a total of 27 hours are allowed to complete the Stage I and Stage II actions.

During the Reasonable Simulation, WBN could not demonstrate that completion of tasks required to realign the plant for flood mode operation could be achieved within the 27 hour requirement specified by TRM 3.7.2 and UFSAR Section 2.4 for the PMF event.

The direct cause of this condition is that the number of personnel required, staging of tools and equipment, and staging of materials have not been maintained for optimum implementation of flood mode operation which resulted in the inability to demonstrate performance of the actions in the time required by the UFSAR Section 2.4.

## **Reason for the Violation**

The reasons for this violation are as follows.

- Failure of WBN personnel to understand the risk significance of issues identified with the station's ability to implement the flood mode protection plan. This resulted in WBN personnel not questioning the assumptions for success nor the need to validate the flood mode response timeline.
- Use of unsubstantiated assumptions related to the number and type of personnel required to perform the actions required by TRM 3.7.2 and UFSAR Section 2.4 and the actual time necessary to perform the actions.
- Failure to thoroughly evaluate missed opportunities identified by line personnel, TVA's Quality Assurance organization, and by the NRC.
- Failure to properly train and maintain proficiency of the workers who perform the flood control procedures. This resulted in unfamiliarity with the challenges and actions required to optimize implementation of flood mode operations.
- Belief in WBN personnel capabilities to implement flood mode procedures as written. This resulted in a low priority being placed on concerns identified related to timely implementation of flood mode operations.

# Corrective Steps That Have Been Taken and Results Achieved

- The implementing instructions, AOIs, and Maintenance Instructions (MIs) have been revised to capture the lessons learned from the performance of the Reasonable Simulation of AOI-7.01.
- A timeline has been created and incorporated into AOI-7.01 to provide a management tool for implementing the flood mode plan in the required sequence.
- A detailed listing of tools and equipment required for implementing each natural disaster-related MI has been incorporated into the procedures. Flood mode tool boxes have been staged, locked, and clearly labeled for the particular Maintenance Instruction at the appropriate locations to ensure tools to implement the required actions are available. Periodic inspection/inventory on a quarterly basis is required to ensure the tool boxes remain in place and are locked.

- Procedure AOI-7.01 has been revised to provide clear guidance to aide in organizational response.
- Operations requalification training for Flood Mode implementation procedures has been reduced from a 4-year frequency to a 2-year frequency.
- Technical training has completed a training needs analysis to revise and incorporate Flood Mode training for those organizations responding to a PMF event.
- Procedure NEDP-20, "Conduct of the Engineering Organization," has been revised to include a Flood Protection Program within the Corporate Nuclear Engineering organization. The primary function of the Flood Protection Program is to ensure that nuclear plant critical safety systems are protected from all postulated flooding conditions.

### Corrective Steps That Will Be Taken

In addition to the corrective steps that have already been taken, the following corrective steps remain to be taken.

- Operations Procedure 0-PI-OPS-19.0, "Periodic Assessment of operations Procedures Related to Natural Disasters," will be revised to include walkdowns of natural disaster-related MIs. The walkdowns will verify that the MIs are accurate, tools and equipment are staged appropriately, and support documentation such as rigging permits and clearances are pre-staged for use.
- The results of the completed Flood Mode training needs analysis described above will be incorporated into training programs for those organizations responding to a PMF event.
- Procedures will be developed or revised to implement the Corporate Nuclear Engineering Flood Protection Program described above. The implementing procedures will ensure the nuclear plant critical safety functions are protected from postulated flooding conditions, and will include appointing a single-point owner, defining roles and responsibilities, and identifying the nuclear regulatory requirements.

### Date When Full Compliance Will Be Achieved

Full compliance was achieved on November 15, 2012 when flood-related Maintenance Instructions and AOI-7.01 were revised to incorporate lessons learned from the August through September, 2012 Reasonable Simulation of AOI-7-01.

# **Restatement of Violation C**

10 CFR 50.72(b)(3)(ii)(B) states that a licensee shall notify the NRC as soon as practical and in all cases within eight hours of the occurrence of the nuclear plant being in an unanalyzed condition that significantly degraded plant safety.

Contrary to the above, on December 30, 2009, the licensee failed to report within eight hours an unanalyzed condition that significantly degraded plant safety for the Watts Bar Unit 1 facility. Specifically, the licensee failed to notify the NRC upon confirmation that a postulated Probable Maximum Flood (PMF) level would exceed the current licensing basis and the design basis PMF flooding event would result in overtopping of critical earthen dam structures upstream of the Watts Bar facility. These overtopping conditions were not previously assumed in the licensing basis for the facility and represented an unanalyzed condition.

# **Background**

It was determined on July 28, 2009, an upstream dam (Fort Loudoun) would overtop and fail during a design basis PMF. Subsequent to this date, it was discovered that Cherokee, Tellico, and Watts Bar dams had a similar design vulnerability that would also result in a higher flood elevation at the site. This condition had the potential to exceed the licensing basis PMF levels at WBN and adversely impact safety functions at the plant. The increase in PMF placed the plant in an unanalyzed condition. Nuclear Power Group personnel failed to recognize that this condition was required to be reported to the NRC by 10 CFR 50.72(b)(3)(ii)(B).

During the period from 2010 to present, TVA's communication with the NRC on this issue included public meetings, letters and correspondence, License Event Reports, License Amendment Requests, a Confirmatory Action Letter, and numerous email and telephone communications. Communication by TVA with the NRC concerning WBN being in an unanalyzed condition (prior to installation of the HESCO barriers) did not take the form of a formal notification by WBN as required by 10 CFR 50.72, until TVA reported the condition in accordance with 10 CFR 50.72 on February 6, 2013, resulting in impediments to NRC processes.

# **Reason for the Violation**

The reasons for this violation are as follows.

• The nuclear processes and procedures failed to lead TVA to realize, in 2009, that invalidated assumptions in calculations of PMF levels constituted a reportable unanalyzed condition that significantly degraded plant safety. In the period from 2009 through 2012, TVA procedure inadequacies did not require Functional Evaluations to address reportability, nor did reporting procedures fully incorporate regulatory guidance on reportability.

- Nuclear Power Group personnel had a cultural bias towards not reporting events and conditions when the consequences of an event or condition were uncertain and not fully analyzed.
- Nuclear Operations, Engineering, and Licensing personnel were weak in understanding unanalyzed conditions and the relationship to reportability.
- An erroneous, centralized decision was made within TVA Corporate Nuclear Licensing that the calculated PMF levels and their potential impacts on WBN were not reportable because of the uncertainties in the calculations.
- Nuclear Power Group personnel failed to adequately challenge the decision that the issue was not reportable.

# Corrective Steps That Have Been Taken and Results Achieved

As stated above, TVA made a 10 CFR 50.72(b)(3)(ii)(B) notification on February 6, 2013 (Emergency Notification Report 48723).

A structured oversight program to assess reportability decisions has been developed. This oversight program requires a review of the reportability determinations of at least 10 percent of the TVA Nuclear Power Group fleet problem evaluation reports (PERs) on a bi-weekly basis.

# Corrective Steps That Will Be Taken

In addition to the corrective steps that have already been taken, the following corrective steps remain to be taken.

- Procedure NPG-SPP-03.5, "Regulatory Reporting Requirements," will be revised to: include the requirements of NUREG-1022, Revision 3 and examples of what constitutes an unanalyzed condition; include direction to refer to Section 2 of NUREG-1022 for special conditions on reportability; and ensure that when using engineering judgment, conservative decision-making is applied (i.e., if there is doubt regarding whether to report or not, the report should be made).
- Procedure NEDP-22, "Functional Evaluations," will be revised to address if a defect is outside current licensing basis and/or design basis (i.e., an unanalyzed condition exists). If such a situation exists, the procedure will provide that the reportability of the defect should be determined.
- The above described revisions to NPG-SPP-03.5 and NEDP-22 will be incorporated into Operations, Engineering, and Licensing training.
- Broad scope reportability program training will be conducted for key organizations with reporting responsibilities.

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- A case study on hydrology and flooding reporting decision errors will be developed for the INPO Significant Operating Experience Report (SOER) 10-2 training conducted this year. Included in the case study will be the dangers of group think, the need for rigor and oversight, and the use of risk in decision making that may affect nuclear safety.
- The structured oversight program described in the corrective steps that have been taken will be maintained for a minimum of one year.

# Date When Full Compliance Will Be Achieved

Full compliance was achieved on February 6, 2013 for the failure to report in accordance with 10 CFR 50.72(b)(3)(ii)(B) violation described in EA-13-018, when the event was reported to the NRC (Event Notification Report 48723).