



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

Sequoyah Nuclear Plant, Units 1 and 2  
Facility Operating License Nos. DPR-77 and DPR-79  
NRC Docket Nos. 50-327 and 50-328

**Subject: Reply to Notices of Violation; EA-13-023 and EA-13-045**

- References:
1. Letter from NRC to TVA, "Sequoyah Nuclear Plant - NRC Inspection Report 05000327/2013009, 05000328/2013009; Preliminary Yellow Finding, and Apparent Violations," dated March 12, 2013
  2. Letter from NRC to TVA, "Sequoyah Nuclear Plant - NRC Inspection Report 05000327/2013010, 05000328/2013010; Preliminary Greater Than Green Finding and Apparent Violation," dated March 18, 2013
  3. TVA Nuclear Power Group Hydrology Regulatory Conference slides (ADAMS Accession No. ML13115A020)
  4. Letter from NRC to TVA, "Sequoyah Nuclear Plant - Final Significance Determination of White Finding, Notices of Violations, and Assessment Follow-up Letter: NRC Inspection Report No. 05000327/2013011, 05000328/2013011," dated June 4, 2013

In accordance with NRC letters dated March 12, 2013 (Reference 1) and March 18, 2013 (Reference 2), Tennessee Valley Authority (TVA) requested a Regulatory Conference to discuss the apparent violations documented in References 1 and 2. The Regulatory Conference was conducted on April 22, 2013, during which TVA made a presentation on the issues (Reference 3). Subsequently, the NRC issued Notices of Violation EA-13-023 and EA-13-045 on June 4, 2013 (Reference 4). In accordance with the NRC's June 4, 2013 letter, TVA is required to respond to the Notices of Violation within 30 days of the date of the letter.

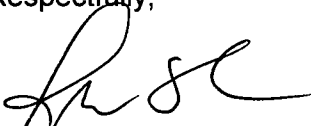
IEDI  
NRR

U.S. Nuclear Regulatory Commission  
Page 2  
July 3, 2013

TVA's response to these Notices of Violation is provided in Enclosures 1 (EA-13-023) and 2 (EA-13-045) in accordance with 10 Code of Federal Regulations (CFR) 2.201, "Notice of Violation."

There is one regulatory commitment contained in this response. This commitment is identified in Enclosure 3. Should you have any questions concerning this submittal, please contact M. W. McBrearty, Nuclear Site Licensing Manager, at (423) 843-7170.

Respectfully,



J. W. Shea  
Vice President, Nuclear Licensing

Enclosures:

1. Reply to a Notice of Violation; EA-13-023
2. Reply to a Notice of Violation; EA-13-045
3. List of Regulatory Commitments

cc (Enclosures):

NRC Regional Administrator - Region II  
NRC Senior Resident Inspector - Sequoyah Nuclear Plant

**ENCLOSURE 1**

**Tennessee Valley Authority**

**Sequoyah Nuclear Plant, Units 1 and 2**

**Reply to a Notice of Violation; EA-13-023**

## **Reply to a Notice of Violation; EA-13-023**

### **Restatement of Violation A**

Technical Specification 6.8.1, "Procedures and Programs," 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 procedure AOP-N.03, "External Flooding," Revision 29, 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 an adequate Abnormal Condition Procedure to implement its flood mitigation strategy. Specifically, AOP-N.03, "External Flooding," 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 SQN 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 Sequoyah Nuclear Plant (SQN) 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 SQN 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 were modified to notify SQN 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 SQN facility operations.

## **Reply to a Notice of Violation; EA-13-023**

By December 30, 2009, the HESCO barriers installation was completed. Post-HESCO PMF calculations were issued for SQN to bring SQN 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 SQN 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 SQN.
- Nuclear Power Group personnel had less than adequate common internal understanding of the applicable regulatory requirements for SQN 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 SQN to bring SQN 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.

## **Reply to a Notice of Violation; EA-13-023**

### **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 Condition Procedure to implement its flood mitigation strategy violation as described in EA-13-023. 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 SQN, placing SQN in compliance with the licensed conditions.

## **Reply to a Notice of Violation; EA-13-023**

### **Restatement of Violation B**

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 Sequoyah 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 Sequoyah 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 SQN 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 SQN being in an unanalyzed condition (prior to installation of the HESCO barriers) did not take the form of a formal notification by SQN 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.

## Reply to a Notice of Violation; EA-13-023

- 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 SQN 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 48725).

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.
- 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.



**Reply to a Notice of Violation; EA-13-023**

- The structured oversight program described in the corrective steps that have been taken will be maintained for a minimum of one year.

**Reply to a Notice of Violation; EA-13-023**

**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-13-023, when the event was reported to the NRC (Event Notification Report 48725).

**ENCLOSURE 2**

**Tennessee Valley Authority**

**Sequoyah Nuclear Plant, Units 1 and 2**

**Reply to a Notice of Violation; EA-13-045**

## **Reply to a Notice of Violation; EA-13-045**

### **Restatement of Violation**

10 CFR 50, Appendix B, Criterion III, "Design Control," states in part, that measures shall be established to assure that applicable regulatory requirements and the design basis as specified in the license are correctly translated into specifications, drawings, procedures, and instructions.

The Sequoyah licensing basis related to onsite flooding is specified in UFSAR Section 2.4, "Hydrologic Engineering" and states in part, that the Essential Raw Cooling Water (ERCW) Intake Station will be maintained dry during a Design Basis Flood (DBF).

UFSAR Section 2.4.2.2, "Flood Design Considerations" states, "Protective measures are taken to ensure that all safety-related systems and equipment in the ERCW pump station will remain functional when subjected to the maximum flood level."

UFSAR Section 2.4A.2.1, "Flooding of Structures" states, "Only the Reactor Building, the Diesel Generator Building (DGB), and the Essential Raw Cooling Water Intake Station will be maintained dry during the flood mode. Walls and penetrations are designed to withstand all static and dynamic forces imposed by the DBF."

Contrary to the above, prior to December 15, 2012, the licensee failed to translate the design basis related to onsite flooding into specifications, drawings, procedures, and instructions. Specifically, Sequoyah's existing design documentation including current licensing documents and configuration controlled drawings for the ERCW Pumping Station do not contain information to identify Design Basis flood barriers to prevent water from flooding the building during a design basis flood affecting the ERCW strainer motors. As a result, the ERCW pump station would not remain functional when subjected to the maximum flood level, the ERCW Intake Station would not remain dry during flood mode, and portions of the ERCW walls and penetrations would not withstand all static and dynamic forces imposed by the DBF.

### **Background**

The licensing basis for the Sequoyah Nuclear Plant (SQN) ERCW Intake Station requires the structure be maintained dry during a DBF. The original design criteria established for construction were consistent with this licensing basis. Specifically, the 1971 revision of applicable design criteria (currently titled SQN-DC-V-12.4, "Cable Support Systems for Capability of Testing Cables for the Design Basis Flood") included a requirement for the electrical cables in the manholes leading up to the ERCW building to be sealed and pressure tested prior to licensing. That test required the manholes to be filled with water and pressurized. To be able to perform this test each of the manholes and hand holes would have to be water tight. This was accomplished with metal plate covers over the manholes. However, in 1974 a revision of SQN-DC-V-12.4 removed the test requirement, allowing subsequent changes to manhole covers, including removal. A separate design criteria, SQN-DC-V-12.1, "Flood Protection Provisions," provided that the ERCW Pumping Station was to remain dry during a design basis event. However, it does not identify barriers or other means to ensure the ERCW Pumping Station remains dry. TVA determined that design documentation existing in 1978 for the initial construction of the ERCW Pumping

## **Reply to a Notice of Violation; EA-13-045**

Station lacked clear information regarding the ERCW Pumping Station design basis flood boundaries.

In 1980, an engineering change added a note to an ERCW Pumping Station control drawing 35W830-4, "Conduit and Grounding Drawing," referencing a generic Fire Penetration drawing 45W880-26, "Conduit and Grounding Cable Trays Fire Stop Penetrations," for sealing instructions of a similar electrical conduit cover. This incident resulted in a loss of configuration control for the ERCW Pumping Station flood barriers. The fire penetration drawing 45W880-26, contained many sealing details, with some of the sealing details not pertaining to flooding barriers. Subsequent changes to the fire penetration seal drawing in the mid 1980s led to substitution of conduit seals and fittings. The fire penetration drawing did not specify particular seals to be watertight until 1986, even after which, no supporting sealing analysis existed for design basis flood application.

In 1991, an engineering change allowed a 1-inch access hole in the manhole missile shields to assist in determining if the manholes or hand holes had been flooded. It was documented in the change that there is no requirement for periodic pressuring testing of the manholes and hand holes, thus their associated covers were removed. This resulted in conduit seals as the only barrier against a flood above plant grade, even though the seals may have been inadequate. In September 2012, during a Near Term Task Force (NTTF) walk-down, TVA identified that a potential existed for water in-leakage into the ERCW Pumping Station during a flood above plant grade through manhole 33. A subsequent review of the issue determined the condition to be degraded and non-conforming with the licensing basis, and compensatory measures were developed. Also, a design change was initiated to provide adequate conduit seals for the conduit penetrations located inside manhole 33. On December 12, 2012, pre-modification work was conducted to inspect and document the as-found condition of the conduits in manhole 33. At this time, TVA discovered that the ERCW Pumping Station was at risk of flooding during a flood event due to conduit penetrations not being filled with material required to make the building watertight. Upon this discovery, TVA notified the NRC of the unanalyzed condition (Emergency Notification Report 48584) and installed additional sump pumps in the ERCW Pumping Station.

### **Reason for the Violation**

The reason for this violation is that the ERCW penetration seals were described in general design documents, but their functional requirements were not specifically addressed in original design documents.

### **Corrective Steps That Have Been Taken and Results Achieved**

Additional sump pumps in the ERCW Pumping Station have been installed to assist in mitigating water in-leakage in the event of a DBF.

Two open conduits identified on the north side of the ERCW Pumping Station have been sealed.

New penetration seals have been installed in manhole 33 to address the initial problem.

## **Reply to a Notice of Violation; EA-13-045**

### **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.

- A comprehensive design basis document will be developed to fully address external flooding protection for the ERCW building.
- New exterior flood barrier drawings for the ERCW building will be issued that identify exterior flood boundaries and contain penetration seal details.

### **Date When Full Compliance Will Be Achieved**

Full compliance will be achieved by October 1, 2013 for the violation of the failure of existing ERCW Pumping Station design documentation, including current licensing basis documents and configuration-controlled drawings, to contain information to identify design basis flood barriers to prevent water from flooding the ERCW building during a design basis flood. Full compliance will be achieved by the inclusion of the new design basis documentation and configuration controlled drawings showing design basis flood barriers and penetration seal details for the ERCW Pumping Station building in SQN design criteria standards.

## **ENCLOSURE 3**

### **List of Regulatory Commitments**

1. Tennessee Valley Authority will revise the Essential Raw Cooling Water (ERCW) Pumping Station building design basis documents and configuration controlled drawings to clearly identify design basis flood barriers and penetration seal details by October 1, 2013.