UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 16, 2014

Mr. Joseph W. Shea
Vice President, Nuclear Licensing
Tennessee Valley Authority
1101 Market Street, LP 3D-C
Chattanooga, TN 37402-2801

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 1 - STAFF ASSESSMENT OF THE FLOODING WALKDOWN REPORT SUPPORTING IMPLEMENTATION OF NEAR-TERM TASK FORCE RECOMMENDATION 2.3 RELATED TO THE FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT ACCIDENT (TAC NO. MF0297)

Dear Mr. Shea:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) staff issued a request for information letter per Title 10 of the *Code of Federal Regulations*, Part 50, Section 50.54(f) (the 50.54(f) letter). The 50.54(f) letter was issued to power reactor licensees and holders of construction permits requesting addressees to provide further information to support the NRC staff's evaluation of regulatory actions that may be taken in response to lessons learned from Japan's March 11, 2011, Great Tōhoku Earthquake and subsequent tsunami. The request addressed the methods and procedures for plants to conduct flooding hazard walkdowns to identify and address degraded, nonconforming, or unanalyzed conditions through the corrective action program, and to verify the adequacy of the monitoring and maintenance procedures.

By letter dated November 27, 2012, Tennessee Valley Authority (TVA) submitted a report documenting the flooding walkdowns as requested per Enclosure 4 of the 50.54(f) letter for Watts Bar Nuclear Plant, Unit 1. By letter dated December 2, 2013, TVA provided a response to the NRC request for additional information for the NRC staff to complete its assessments.

The NRC staff has reviewed the information provided and, as documented in the enclosed staff assessment, determined that you have provided sufficient information to be responsive to the 50.54(f) letter. This closes out the NRC's efforts associated with TAC No. MF0297.

If you have any questions, please contact me at (301) 415-1564 or by e-mail at Siva.Lingam@nrc.gov.

Sincerely,

Siva P. Lingam

Siva P. Lingam, Project Manager
Watts Bar Special Projects Branch
Division of Operating Reactor Regulation
Office of Nuclear Reactor Regulation

Docket No. 50-390

Enclosure:
Staff Assessment of Flooding Walkdown

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STAFF ASSESSMENT BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO FLOODING WALKDOWN REPORT

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT, UNIT 1

DOCKET NO. 50-390

1.0 INTRODUCTION

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.54(f) (hence referred to as the 50.54(f) letter). The request was issued as a part of implementing lessons-learned from the accident at the Fukushima Dai-ichi, Japan, nuclear power plant. Enclosure 4 "Recommendation 2.3: Flooding" (ADAMS Accession No. ML12056A050), to the 50.54(f) letter requested licensees to conduct flooding walkdowns to identify and address degraded, nonconforming, or unanalyzed conditions using the corrective action program (CAP), verify the adequacy of monitoring and maintenance procedures, and report the results to the NRC.

Enclosure 4 of the 50.54(f) letter requested licensees to respond with the following information:

a. Describe the design basis flood hazard level(s) for all flood-causing mechanisms, including groundwater ingress.

b. Describe protection and migration features that are considered in the licensing basis evaluation to protect against external ingress of water into structures, systems, and components (SSCs) important to safety.

c. Describe any warning systems to detect the presence of water in rooms important to safety.

d. Discuss the effectiveness of flood protection systems and exterior, incorporated, and temporary flood barriers. Discuss how these systems and barriers were evaluated using the acceptance criteria developed as part of Requested Information item 1.h.

e. Present information related to the implementation of the walkdown process (e.g., details of selection of the walkdown team and procedures) using the documentation template discussed in Requested Information item 1.j, including actions taken in response to the peer review.

f. Results of the walkdown including key findings and identified degraded, nonconforming, or unanalyzed conditions. Include a detailed description of the actions taken or planned to address these conditions using guidance in Regulatory Issue Summary 2005-20,

Revision 1, Revision to the NRC Inspection Manual Part 9900 Technical Guidance, "Operability Conditions Adverse to Quality or Safety," including entering the condition in the corrective action program.

g. Document any cliff-edge effects identified and the associated basis. Indicate those that were entered into the corrective action program. Also include a detailed description of the actions taken or planned to address these effects.

h. Describe any other planned or newly installed flood protection systems or flood mitigation measures including flood barriers that further enhance the flood protection. Identify results and any subsequent actions taken in response to the peer review.

In accordance with the 50.54(f) letter, Enclosure 4, Required Response Item 2, licensees were required to submit a response within 180 days of the NRC's endorsement of the flooding walkdown guidance. By letter dated May 21, 2012 (ADAMS Accession No. ML121440522), the Nuclear Energy Institute (NEI) staff submitted NEI 12-07, Revision 0, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features," to the NRC staff to consider for endorsement. NEI 12-07 describes a methodology for performing walkdowns in a manner that will address requested information Items 1.a through 1.j of Enclosure 4 of the 50.54(f) letter. By letter dated May 31, 2012 (ADAMS Accession No. ML12144A142), the NRC staff found that the performance and reporting of flooding protection walkdowns in accordance with the guidance would be responsive to the 50.54(f) letter. As a result, NEI 12-07, Revision 0-A was published (ADAMS Accession Nos. ML12173A215).

By letter dated November 27, 2012 (ADAMS Accession No. ML12335A340), Tennessee Valley Authority (TVA or the licensee) provided a response for the Watts Bar Nuclear Plant (WBN), Unit 1. The NRC staff issued a request for additional information (RAI) to the licensee regarding the available physical margin (APM) dated December 23, 2013 (ADAMS Accession No. ML13325A891). The licensee responded by letter dated February 7, 2014 (ADAMS Accession No. ML14042A393).

The NRC staff evaluated the licensee's submittals to determine if the information provided in the walkdown report met the intent of the walkdown guidance and if the licensee responded appropriately to Enclosure 4 of the 50.54(f) letter.

2.0 REGULATORY EVALUATION

The SSCs important to safety in operating nuclear power plants are designed either in accordance with, or meet the intent of Appendix A to 10 CFR Part 50, "General Design Criteria for Nuclear Power Plants," Criterion 2: "Design bases for protection against natural phenomena," and Appendix A "Seismic and Geological Criteria for Nuclear Plants," to 10 CFR Part 100. Criterion 2 states that SSCs important to safety at nuclear power plants shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunamis, and seiches without loss of capability to perform their safety functions.

For initial licensing, each licensee was required to develop and maintain design bases that, as defined by 10 CFR 50.2, identify the specific functions to be performed by an SSC, and the specific values or ranges of values chosen for controlling parameters as reference bounds for the design.

The design bases for the SSCs reflect appropriate consideration of the most severe natural phenomena that have been historically reported for the site and surrounding area. The design bases also reflect sufficient margin to account for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

The current licensing basis (CLB) is the set of NRC requirements applicable to a specific plant, and a licensee's written commitments for ensuring compliance with, and operation within, applicable NRC requirements and the plant-specific design-basis.

3.0 TECHNICAL EVALUATION

3.1 Design-Basis Flooding Hazard for Watts Bar Nuclear Plant, Unit 1

The licensee reported that the design basis flood (DBF) hazard for the site is the probable maximum flood (PMF) resulting from the probable maximum precipitation in the Tennessee River watershed upstream of the site, plus the wave runup resulting from a 21-miles per hour overland wind. The current DBF is 736.9 feet (ft) relative to mean sea level (MSL), composed of a 734.9 ft MSL still water PMF elevation on Chickamauga Lake plus a 2.0 ft wind wave runup on 4:1 slopes approaching the plant or on the vertical wall of the Intake Pumping Station (IPS). The WBN plant grade is 728.0 ft MSL.

The licensee reported that the CLB for WBN, Unit 1 includes a warning time of 27 hours (hr) from receipt of a flood warning to the time the local water elevation would exceed plant grade. According to the Updated Final Safety Analysis Report (UFSAR), WBN could be readied for flood-mode operation in 27 hr and maintained in flood mode "for a sufficient period of time (100 days) until appropriate recovery steps can be formulated and taken." TVA's flooding walkdown report gives a flood duration (i.e., the period that flood waters would be above plant grade) of 1 to 5 days. The staff notes that this is a discrepancy from the WBN UFSAR, which gives the expected duration as 1 to 4 days. Hence, it is not clear that the flooding walkdown "documented the flood duration assumed as part of the licensing basis" as intended by NEI 12-07 guidance.

Throughout its report, TVA references the revised WBN Unit 1 UFSAR submitted with TVA's License Amendment Request (LAR), stating that "the flooding evaluation report is based on the LAR updated design basis flood elevations because they are more conservative (higher) than the current licensing basis." The purpose of Recommendation 2.3 with respect to flooding was that the walkdown verify flood protection and mitigation features relative to the CLB. Since the licensee stated that they inspected to more conservative flood elevations, the NRC staff concludes that the CLB flood protection has been enveloped by this walkdown. The NRC staff note that the LAR is currently undergoing staff review under another regulatory process.

The licensee reported that the PMF is the controlling flood hazard; however, TVA discussed in the walkdown report that seismic dam failure and local intense precipitation (LIP) could result in flood water elevations above plant grade. The report states that the warning time from a

seismic dam failure flood would provide enough time to prepare the site for flood waters above site grade. The report describes how the LIP flooding will not exceed elevation 729.0 feet MSL at any location adjacent to safety-related structures.

Based on the NRC staff's review, the licensee appears to have described the design basis flood hazard level(s) as requested in the 50.54(f) letter and consistent with the walkdown guidance.

3.2 Flood Protection and Mitigation

3.2.1 Flood Protection and Mitigation Description

The licensee reported that the current licensing basis flood protection elevation is the DBF of 736.9 ft MSL.

The licensee stated that WBN Unit 1 is designed to meet Regulatory Position 2 of Regulatory Guide 1.59, Design Basis Floods for Nuclear Power Plants. The Turbine, Control, and Auxiliary Buildings are allowed to flood. Equipment required to maintain the plant safely during the flood, and for 100 days after the beginning of the flood, is designed to operate submerged, located above the maximum flood level, or otherwise protected. Additionally, the licensee stated that WBN Unit 1 can be prepared for flood-mode operation (in which "the plant is safely maintained during the time when flood waters exceed plant grade [728.0 ft] and during the subsequent period until recovery is accomplished") within 24 hr of a Stage I flood warning, plus a 3-hr contingency margin.

TVA's walkdown report summarizes WBN Unit 1 flooding-protection design features per the CLB in the current UFSAR. TVA states that the Shield Building is maintained watertight to 742.0 ft MSL and that exterior doors to the Diesel Generator Building are at 742.0 ft MSL. At- and below-grade seals in the Auxiliary and Reactor Buildings are designed to prevent leakage of water or air, and to withstand external water pressure. The operating floor of the Reactor Building is at elevation 756.6 ft (TVA 2008). The Service, Turbine, Auxiliary, and Control Buildings are allowed to flood; equipment is either above the DBF or is operable when submerged. The essential raw cooling water pumps in the IPS are located above the PMF at 741.0 ft MSL, as are personnel access doors, but the electrical equipment room in the IPS would be flooded if the flood water level exceeded the plant grade of 728.0 ft. Category 1E manholes have access shafts above grade level and are equipped with watertight covers and sump pumps.

In addition to flood-protection design features, TVA reported that they rely upon an advance Tennessee River Operations (RO) flood forecast system that triggers flood-mode preparations for the fastest rising flood, and an Abnormal Operating Instruction (AOI) for a two-stage flood response. TVA's flood response considers flood-preparation procedures under two plant configurations: full power operation and reactor refueling. Stage I procedures consist of a controlled reactor shutdown and other easily revocable steps, such as moving flood-mode supplies above the PMF elevation and making load adjustments on the onsite power supply. Stage II procedures are the steps necessary to have the plant in flood mode when the flood exceeds plant grade. As stated in the walkdown report and noted above "flood mode" allows the plant to be safely maintained from when flood waters exceed plant grade until recovery is accomplished (TVA 2012a). Stage I flood-preparation procedures are initiated when RO issues

a Stage I flood warning. For WBN, a Stage I warning is triggered when there is sufficient upstream rainfall to result in a water-level elevation at WBN of 715.5 ft MSL in winter or 720.6 ft in summer; a forecast allowing at least 10 hr to complete Stage I procedures. A Stage II warning occurs when RO confirms that rainfall conditions would result in a flood above plant grade at WBN; Stage II is forecast to provide at least 17 hr warning time. The seasonal trigger levels for Stage I and confirmatory estimate for Stage II ensure that TVA's RO system would provide a minimum of 27 hr warning from the time a rainfall flood is predicted to occur, to the time a flood would reach 727.0 ft at WBN. With 4 hr to evaluate rainfall data, the warning system provides 31 hr from the start of precipitation in the watershed, to flood water elevation reaching 727.0 ft MSL at WBN. TVA's flood-warning plan considered adverse weather conditions such as concurrent wind waves by setting the critical predicted flood elevation 1 ft below plant grade.

3.2.2 Incorporated and Exterior Barriers

The licensee did not specifically describe incorporated and exterior flood-protection barriers that are credited in the CLB for WBN Unit 1. However, the design features described in Section 3.2.1 above are credited with maintaining all safety-related SSCs from floods up to plant grade. The Shield Building is watertight to above the DBF elevation, and the Diesel Generator Building and essential raw cooling water pumps are located above the DBF elevation. The flood-warning system and flood-preparation procedures are credited for flood protection above plant grade.

3.2.3 Temporary Barriers and Other Manual Actions

The licensee reported that the site has temporary flood-protection barriers and other manual actions that require operator action. The temporary barriers are around the thermal barrier booster pumps (TBBPs), which are located in the Auxiliary Building at an elevation 737.0 ft (0.1 ft above the CLB PMF). TVA also stated that the IPS personnel access doors at 741.0 ft MSL would require installation of temporary flood barriers during Stage I flood preparation. In its calculation of the PMF in streams and rivers, TVA states that temporary flood barriers have been installed to increase the height of embankments at the upstream Watts Bar, Fort Loudon, Tellico, and Cherokee Dams. The PMF calculation assumes that these barriers would remain stable under the most severe flooding conditions and would function to prevent overflow and embankment failure.

The WBN Unit 1 UFSAR does not contain descriptions of the temporary flood barriers around the TBBPs, IPS access doors, or installed at upstream reservoirs. However, the WBN Unit 1 UFSAR does describe actions that must be taken during flood preparation, such as manually securing certain doors or actuating valves and connecting prefabricated spool pieces to switch plant cooling loads from the component cooling water to the essential raw cooling water system. According to the UFSAR, if flood preparation were to occur during refueling, the spent fuel pool cooling and cleanup system heat exchanger output flow requires a temporary piping (spool piece) connection to the residual heat removal system; this prefabricated spool piece connection is installed only in preparation for flood-mode operation.

3.2.4 Reasonable Simulation and Results

The licensee reported that they reviewed their operating procedures, used a reasonable simulation of its flood-response AOI, and conducted field simulations of time-critical operation and maintenance activities. The flood-response AOI is a collection of maintenance and operational procedures for activities that need to be accomplished to place the plant in safe shutdown mode within 27 hr of a Stage I flood warning. These simulations showed that TVA's flood-mode procedures could perform their function as credited in the CLB; however, TVA's ability to meet the CLB was reliant on the 3-hr contingency added to a 24-hr warning time provided by TVA's Tennessee RO system. The licensee did not discuss the conditions considered during its flood-response AOI simulation, for example, whether actions or movement were assumed to be affected by adverse weather.

From its reasonable simulation, TVA entered a number of observations into its CAP, most of which would reduce the response time of Stage II flood preparations.

TVA's simulation was primarily a step-through of the procedures by a licensed Senior Reactor Operator with assistance from a team of key staff (i.e., maintenance, engineering, chemistry, and assistant operator) to determine the time and resources required at each step. At least one AOI, manipulation of electrical switchgears by an assistant unit operator, was simulated in the field to establish time and resource requirements. In addition, eight maintenance procedures were field-simulated by personnel to establish time and resource requirements for locating tools and flood-mode components. The simulation data were used to develop a timeline for flood preparations for comparison to the available warning time. The simulation data were also used to evaluate the effectiveness of maintenance procedures for flood-mode components (e.g., spool pieces and gaskets) and special tools needed to perform flood-preparation activities.

TVA concluded the following from its reasonable simulations of the flood-response AOI:

- Flood-response AOI procedures could be performed within 27 hr of a Stage I flood warning (i.e., 10 hr for Stage I preparation and about 16 hr for Stage II preparation).
- Flood-response AOI procedures were adequate, but could be improved to reduce the response time.
- Tool and equipment accessibility was adequate, but accessibility, staging, and maintenance could be improved to reduce the response time.
- Operations and maintenance personnel could perform flood-mode preparation, but personnel training could be improved (following procedure modification) to reduce the response time.

The NRC staff determined that TVA's simulation of its flood-response AOI was reasonable, but noted that it required most of the 3-hr contingency period to complete. The licensee did not discuss the conditions considered during its flood-response AOI simulation, for example, whether actions or movement were assumed to be affected by adverse weather. As conducted, the simulation showed that the flood-response AOI met the CLB, and revealed a number of potential improvements that would reduce the response time. These potential improvements are discussed in Sections 3.6.2 and 3.6.3.

3.2.5 Conclusion

Based on the NRC staff's review, that the licensee appears to have described protection and mitigation features as requested in the 50.54(f) letter and consistent with the walkdown guidance.

3.3 Warning Systems

The licensee stated that there are no water level detection devices at WBN credited for detection of external flooding. The licensee stated that SSCs located in the containment structure are protected from flooding by the shield building, which is designed and constructed water tight elements. Although not credited, the licensee indicated that the reactor building floor and equipment drain sump level is continuously monitored by two level detecting devices. The licensee stated that the Turbine, Control and Auxiliary Buildings will be allowed to flood for conditions where flooding exceeds the plant grade. However, a flood detection system, and individual detectors, not credited by the WBN CLB, are used to monitor and actuate alarms of Emergency Core Cooling System and other leakages. In addition, a common alarm in the main control room and a flood detector indicator panel will alert the operators and identify the exact location of the tripped detector.

As stated above, the CLB postulates that WBN Unit 1 would be flooded during the PMF event and the effects of the PMF on the plant are mitigated by staged flood-response procedures that prepare the reactor for safe shutdown. Flood response is reliant upon TVA's RO system for monitoring upstream precipitation, reservoir operations, and reservoir water levels and for communicating flood warnings to WBN Unit 1. The CLB does not credit warning systems in rooms with safety-related SSCs.

Based on the NRC staff's review, the licensee appears to have provided information to describe any warning systems as requested in the 50.54(f) letter and consistent with the walkdown guidance.

3.4 Effectiveness of Flood Protection Features

The licensee stated that the WBN flood protection relies on the ability of TVA's RO system to predict a flood that has the potential to exceed plant grade at WBN and to provide adequate warning time for WBN operations and maintenance personnel to ready the plant for flood-mode operations. TVA's evaluation of flood-protection effectiveness focused on its reasonable simulation of flood-response AOI procedures being accomplished within the warning time credited in the CLB. As noted in Section 3.2.4, TVA found that its flood-response AOI could be performed in less than 27 hr, but not within 24 hr. Thus, this form of protection was found to be adequate as long as the 3-hr contingency time was available. TVA identified a number of physical and procedural improvements that would shorten the response time and documented these improvements in its CAP. In addition, TVA identified a number of improvements to maintenance procedures that would ensure that flood-response equipment, components, and tools would be accessible and would function reliably.

TVA's evaluation of the effectiveness of flood-protection features at WBN Unit 1 also involved visual inspections of site features and flood-protection barriers and reviews of flood-protection procedures. However, TVA did not discuss specific findings with respect to the effectiveness of the following features that were described in its walkdown process:

- site grading and drainage systems to direct water away from safety-related structures
- integrity of seals of any penetrations in the Shield Building
- condition or integrity of temporary flood-protection barriers around the TBBPs
- availability and tools required for installation of temporary flood barriers to protect personnel access doors at the IPS

TVA reported that these inspections and field observations were performed in accordance with NEI 12-07 and documented on NEI 12-07 Forms C or D. As necessary, findings were entered into the CAP.

Based on the NRC staff's review, the licensee appears to have discussed the effectiveness of flood protection features as requested in the 50.54(f) letter and consistent with the walkdown guidance.

3.5 Walkdown Methodology

By letter dated June 11, 2012 (ADAMS Accession No. ML12164A674), the licensee responded to the 50.54(f) letter that they intended to utilize the NRC-endorsed walkdown guidelines contained in NEI 12-07, Revision 0-A. The licensee's walkdown submittal dated November 27, 2012, indicated that the licensee implemented the walkdowns consistent with the intent of the guidance provided in NEI 12-07. The licensee did not state any exceptions from NEI 12-07.

Based on the NRC staff's review, the licensee appears to have presented information related to the implementation of the walkdown process as requested in the 50.54(f) letter and consistent with the walkdown guidance.

3.6 Walkdown Results

3.6.1 Walkdown scope

The licensee performed walkdowns of the WBN Unit 1 Shield, Turbine, Auxiliary, and Control Buildings and the IPS. Flood-protection features were visually inspected, incorporated features verified, and flood-protection procedures were reviewed. As noted in Section 3.2.4, TVA performed a reasonable simulation of its flood-response AOI using a representative team of personnel to step-through procedures, combined with field physical simulations of one operational procedure and eight maintenance procedures.

TVA considered normal power operation mode and refueling mode in its walkdown; however, it did not explicitly state which mode or if more than one mode was considered during its reasonable simulation. TVA also did not describe any concurrent environmental conditions that may have been assumed during its reasonable simulation.

The licensee did not state whether flooding walkdown acceptance criteria were developed in accordance with NEI 12-07, and did not state specific acceptance criteria for visual or physical inspections of flood-protection features. For its reasonable simulation that evaluated the credited flood-response procedures, TVA did use the time limit stated in the CLB to determine acceptability of its flood-response AOI.

3.6.2 Licensee evaluation of flood protection effectiveness, key findings, and identified deficiencies

The licensee performed an evaluation of the overall effectiveness of the plant's flood protection features using a combination of visual inspections of site features and flood-protection barriers, reviews of flood-protection procedures, and the reasonable simulation of its flood-response AOI. TVA identified 1 deficiency and entered 56 items into its CAP to document observations as well as deficiencies. The results of TVA's evaluation are summarized as follows:

Inspection of civil features: TVA stated that its flooding walkdown included review of existing site topography and water runoff calculations and observations in the field. Its walkdown report did not present any walkdown findings with respect to site grading or drainage, or note any deficiencies or observations entered into the CAP.

Inspection of flood-mode barriers: TVA stated that its flooding walkdown included inspection of temporary flood barriers around TBBPs in the Auxiliary Building, inspection of Shield Building penetrations below 742.0 ft MSL, pressure testing of the annulus between the Shield Building wall and containment vessel, and inspection for availability of materials to install temporary flood barriers at the IPS personnel access doors. The walkdown report did not present walkdown findings with respect to these inspections or the effectiveness of the barriers, nor did it identify any deficiencies or observations entered into the CAP. The walkdown report noted that the flood barriers around TBBPs and IPS access doors were installed in response to the higher proposed flood elevations in the WBN LAR.

Review of maintenance procedures for flood-mode components: TVA entered observations into the CAP regarding permanently installed flood-response components that were not included in a preventive-maintenance program.

Reasonable simulation of flood-response AOI: As described in Section 3.2.4, TVA concluded that while the flood-response AOI conformed to the CLB, response time could be improved by revising operation and maintenance procedures, by preventive maintenance and staging of flood-response components, and by improvements to personnel training. These items resulted in a number of CAP entries.

NEI 12-07 defines a deficiency as follows: "a deficiency exists when a flood protection feature is unable to perform its intended function when subject to a design basis flooding hazard." The licensee identified one deficiency at WBN Unit 1 because of the flooding walkdowns. Two chilled-water-circulating pumps in the Main Control Room and two chilled-water-circulating pumps in the Shutdown Board Room would be partially submerged during the LAR proposed flood elevation. This potential deficiency was entered into the CAP. The action planned to

address this deficiency is to provide protection to those pumps so that they would remain operable during the PMF.

NEI 12-07 specifies that licensees identify observations in the CAP that were not yet dispositioned at the time the walkdown report was submitted. TVA identified a number of observations awaiting disposition at the time the walkdown report was submitted. Observations related to reducing the flood-mode preparation timeline by reviewing and modifying maintenance procedures and flood-preparation procedures, equipment and tool availability are being addressed in a fleetwide Flood Mode Operation Improvement Strategy.

3.6.3 Flood Protection and Mitigation Enhancements

The licensee, as a result of its flooding walkdown, has implemented or planned the following enhancements that improve or increase flood protection or mitigation throughout its operating reactor fleet, including WBN Unit 1:

- clarify and express, consistently, the response time for implementing flood-response procedures, particularly with respect to consideration of the 3-hr contingency period
- improve flood-response procedures to ensure optimum usage during flood events and to reduce flood-response time
- improve flood-mode equipment reliability by including it in the plant preventive-maintenance program
- improve flood-mode tool and equipment accessibility and ease of installation

TVA has implemented or planned the following additional enhancements that improve or increase flood protection or mitigation at WBN Unit 1 as a result of its flooding walkdown:

- revise site-specific flood-mode procedures to improve the response time by adding specific instructions, better tool identification, critical step sequencing, and identification of responsible organizations
- revise other operations and maintenance procedures to enhance flood-mode preparation procedures
- review operation and maintenance personnel training needs and modify training as appropriate (for new/revised procedures)

TVA discussed several implemented or planned flood protection or mitigation enhancements in response to the higher PMF elevation resulting from an updated hydrological analysis that is being proposed in the WBN LAR, however these are outside the scope of the flooding walkdowns, and are not being reviewed under the LAR NRC staff review.

3.6.4 Planned or Newly Installed Features

The licensee determined that changes were necessary by the flooding walkdowns. As noted in Section 3.6.3, TVA is implementing a fleetwide review of flood-mode equipment accessibility and flood-mode equipment maintenance programs, which will include relocating tools and equipment. In its walkdown report, TVA stated that permanent flood-protection barriers for the TBBPs and for spent fuel pit cooling pumps and motor were scheduled for completion by

March 31, 2013. However, these actions were initiated in response to the revised LAR DBF rather than as a result of the flooding walkdown.

3.6.5 Deficiencies Noted and Actions Taken or Planned to Address

The licensee noted one deficiency as a result of its flooding walkdown: in the Main Control Room and the Shutdown Board Room, two chilled-water-circulating pumps per location would be partially submerged during the PMF. This deficiency was entered into the CAP. The action planned to address this deficiency is to provide permanent protection to those pumps so that they would remain operable during the PMF. TVA stated that a design change had been issued, and that flood-protection barriers and sealing for ancillary equipment had been designed to protect the chilled-water-circulating pumps.

3.6.6 Staff Assessment of Walkdowns

The NRC staff reviewed the licensee walkdown report dated November 27, 2012. TVA implemented its flooding walkdown process in accordance with NEI 12-07, with the exception of inspecting to the LAR proposed flood elevation, which is higher than the CLB flood protection elevation and therefore conservative. TVA evaluated whether flood-protection features and procedures were able to perform their function as would be credited in the proposed LAR flood elevations, which is greater than credited in the CLB flood protection. TVA reviewed its operating procedures, used a reasonable simulation of its flood-response AOI, and conducted field simulations of time-critical operation and maintenance activities. The NRC staff noted that TVA's ability to meet the CLB was reliant on the 3-hr contingency added to a 24-hr warning time provided by TVA's Tennessee RO system. TVA did not discuss the conditions considered during its flood-response AOI simulation, for example, whether actions or movement were assumed to be affected by adverse weather. From its reasonable simulation, TVA entered a number of observations into its CAP, most of which would reduce the response time of Stage II flood preparations.

TVA did not provide details on inspection, testing, or monitoring of specific flood-protection features or equipment, but did find that some flood-mode equipment was not covered by a preventive-maintenance program. Other findings were that improvements could be made in tool and equipment accessibility, maintenance procedures, and staff training. In other aspects of its flooding walkdown, such as inspection of credited features, the NRC staff noted that TVA's submittal included features that protect to the LAR proposed flood elevation, which is higher than the CLB flood protection level, but the walkdown report does not clearly state which features protect to the CLB and which are used to protect to this higher flood elevation. TVA did not identify any inaccessible or restricted access features at WBN Unit 1.

TVA stated that many observations entered into the CAP would be addressed in a Fleet Flood Mode Operation Improvement Strategy. TVA discussed several other planned or recently installed flood-protection barriers being installed as a result of the higher proposed LAR DBF. These include permanent barriers surrounding the TBBPs, protection for spent fuel pit cooling pumps, and temporary barriers at the IPS personnel access doors.

Based on the NRC staff's review, the licensee appears to have provided results of the walkdown and described any other planned or newly installed flood protection systems or flood mitigation

measures as requested in the 50.54(f) letter and consistent with the walkdown guidance. Based on the information provided in the licensee's submittals, the NRC staff concludes that the licensee's implementation of the walkdown process meets the intent of the walkdown guidance.

3.6.7 Available Physical Margin

The NRC staff issued an RAI to the licensee regarding the APM dated December 23, 2013. The licensee responded by letter dated February 7, 2014. The licensee has reviewed their APM determination process, and noted that the APM was based on the higher LAR proposed flood elevation. The NRC staff reviewed the response, and concluded that the licensee met the intent of the APM determination per NEI 12-07.

Based on the NRC staff's review, the licensee appears to have documented the information requested for any cliff-edge effects, as requested in the 50.54(f) letter and consistent with the walkdown guidance. Further, staff reviewed the response, and concludes that the licensee met the intent of the APM determination per NEI 12-07.

3.7 Independent Verification by Resident Inspectors

On June 27, 2012, the NRC issued Temporary Instruction (TI) 2515/187, "Inspection of Near-Term Task Force Recommendation 2.3 Flooding Walkdowns" (ADAMS Accession No. ML12129A108). In accordance with the TI, NRC inspectors independently verified that the licensee implemented the flooding walkdowns consistent with the intent of the walkdown guidance. Additionally, the inspectors independently performed walkdowns of a sample of flood protection features. In Inspection Report (IR) 05000390/2012005, dated February 13, 2013 (ADAMS Accession No. ML13050A237) and IR 05000390/2013002, dated May10, 2013 (ADAMS Accession No. ML13130A218), the results of this inspection were documented. No findings of significance were identified.

3.8 SSCs Not Walked Down

The licensee did not identify any restricted access or inaccessible features.

4.0 CONCLUSION

The NRC staff concludes that the licensee's implementation of flooding walkdown methodology meets the intent of the walkdown guidance. The NRC staff concludes that the licensee, through the implementation of the walkdown guidance activities and in accordance with plant processes and procedures, verified the plant configuration with the current flooding licensing basis; addressed degraded, nonconforming, or unanalyzed seismic conditions; and verified the adequacy of monitoring the maintenance programs for protective features. Furthermore, the NRC staff notes that no immediate safety concerns were identified. The NRC staff concludes that the licensee responded appropriately to Enclosure 4 of the 50.54(f) letter, dated March 12, 2012.

If you have any questions, please contact me at (301) 415-1564 or by e-mail at Siva.Lingam@nrc.gov.

Sincerely,

/RA/

Siva P. Lingam, Project Manager
Watts Bar Special Projects Branch
Division of Operating Reactor Regulation
Office of Nuclear Reactor Regulation

Docket No. 50-390

Enclosure:
Staff Assessment of Flooding Walkdown

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