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

May 15, 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, UNITS 1 AND 2 - REPORT FOR THE AUDIT REGARDING IMPLEMENTATION OF MITIGATING STRATEGIES AND RELIABLE SPENT FUEL INSTRUMENTATION RELATED TO ORDERS EA-12-049 AND EA-12-051 (TAC NOS. MF0950, MF1177, MF0951, AND MF1178)

Dear Mr. Shea:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design-Basis External Events" and Order EA-12-051, "Order to Modify Licenses With Regard To Reliable Spent Fuel Pool Instrumentation," (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML12054A736 and ML12054A679, respectively). The orders require holders of operating reactor licenses and construction permits issued under Title 10 of the *Code of Federal Regulations* Part 50 to submit for review, Overall Integrated Plans (OIPs) including descriptions of how compliance with the requirements of Attachment 2 of each order will be achieved.

By letter dated February 28, 2013 (ADAMS Accession No. ML13067A030), Tennessee Valley Authority (TVA, the licensee) submitted its OIP for Watts Bar Nuclear Plant, Units 1 and 2 (Watts Bar) in response to Order EA-12-049. By letters dated August 28, 2013, and February 7, 2014 (ADAMS Accession Nos. ML13247A288 and ML14062A050), TVA submitted its first two six-month updates to the OIP. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049 in accordance with NRC Office of Nuclear Reactor Regulation (NRR) Instruction LIC-111, "Regulatory Audits" (ADAMS Accession No. ML082900195). This audit process led to the issuance of the Watts Bar interim staff evaluation (ISE) and audit report on December 20, 2013 (ADAMS Accession No. ML13343A036) and continues with in-office and onsite portions of this audit.

By letter dated February 28, 2013 (ADAMS Accession No. ML13063A440), TVA submitted its OIP for Watts Bar in response to Order EA-12-051. By letter dated August 2, 2013 (ADAMS Accession No. ML13204A231), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated August 28, 2013, September 6, 2013, November 22, 2013, January 10, 2014, and February 28, 2014 (ADAMS Accession Nos. ML13254A297, ML13254A065, ML13333B282, ML14014A137, and ML14064A238, respectively), TVA submitted its RAI responses and first two six-month updates to the OIP. The NRC staff's review to date led to the issuance of the Watts Bar ISE and RAI dated October 24, 2013 (ADAMS Accession No. ML13275A373). By letter dated March 26, 2014 (ADAMS Accession No. ML14083A620), the NRC notified all licensees and construction permit holders that the staff is

conducting in-office and onsite audits of their responses to Order EA-12-051 in accordance with NRC NRR Office Instruction LIC-111, as discussed above.

The ongoing audit allows the staff to review open and confirmatory items from the mitigation strategies ISE, RAI responses from the spent fuel pool instrumentation (SFPI) ISE, the licensee's integrated plans, and other audit questions. Additionally, the staff gains a better understanding of submitted and updated information, audit information provided on ePortals, and preliminary Overall Program Documents/Final Integrated Plans while identifying additional information necessary for the licensee to supplement its plan and staff potential concerns.

In support of the ongoing audit of the Watts Bar OIPs as supplemented, the NRC staff conducted an onsite audit at the Watts Bar Nuclear Plant from March 12-13, 2014 per the plan dated March 6, 2014 (ADAMS Accession No. ML14058A105). The purpose of the onsite portion of the audit was to provide the NRC staff the opportunity to continue the audit review and gain key insights most easily obtained at the plant as to whether the licensee is on the correct path for compliance with the Mitigation Strategies and Spent Fuel Instrumentation orders. The onsite activities included detailed analysis and calculation discussion, walk-throughs of strategies and equipment laydown, visualization of portable equipment storage and deployment, staging and deployment of offsite equipment, and physical sizing and placement of SFPI equipment.

The enclosed audit report provides a summary of the activities for the onsite audit portion. Additionally, this report contains attachments providing the NRC staff's current review status of all identified audit items from the respective order ISEs, audit questions, licensee identified open items, and questions since the ISE resulting from licensee plan changes, new generic concerns, and/or other items needing resolution for safety evaluation. The NRC staff's intention is that, barring licensee plan, technology, and/or generic approach changes, the audit item review status enclosures comprise the items under NRC staff consideration for the OIPs' safety evaluation.

If you have any questions, please contact me at 301-415-5430 or by e-mail at james.policksoki@nrc.gov.

Sincerely,

James Policksoki, Project Manager
Project Management Branch
Mitigating Strategies Directorate
Office of Nuclear Reactor Regulation

Docket Nos.: 50-390 and 50-391

Enclosure:
Audit report

cc w/encl: Distribution via Listserv

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

AUDIT REPORT BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO ORDERS EA-12-049 AND EA-12-051 MODIFYING LICENSES

WITH REGARD TO REQUIREMENTS FOR

MITIGATION STRATEGIES FOR BEYOND-DESIGN-BASIS EXTERNAL EVENTS

AND RELIABLE SPENT FUEL POOL INSTRUMENTATION

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-390 and 50-391

BACKGROUND AND AUDIT BASIS

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design-Basis External Events" and Order EA-12-051, "Order to Modify Licenses With Regard To Reliable Spent Fuel Pool Instrumentation," (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML12054A736 and ML12054A679, respectively). Order EA-12-049 directs licensees to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities in the event of a beyond-design-basis external event (BDBEE). Order EA-12-051 requires, in part, that all operating reactor sites have a reliable means of remotely monitoring wide-range SFP levels to support effective prioritization of event mitigation and recovery actions in the event of a BDBEE. The orders require holders of operating reactor licenses and construction permits issued under Title 10 of the *Code of Federal Regulations* Part 50 to submit for review, Overall Integrated Plans (OIPs) including descriptions of how compliance with the requirements of Attachment 2 of each order will be achieved.

By letter dated February 28, 2013 (ADAMS Accession No. ML13067A030), Tennessee Valley Authority (TVA, the licensee) submitted its OIP for Watts Bar Nuclear Plant, Units 1 and 2 (Watts Bar) in response to Order EA-12-049. By letters dated August 28, 2013, and February 7, 2014 (ADAMS Accession Nos. ML13247A288 and ML14062A050), TVA submitted its first two six-month updates to the OIP. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049 in accordance with NRC Office of

Nuclear Reactor Regulation (NRR) Instruction LIC-111, "Regulatory Audits" (ADAMS Accession No. ML082900195). This audit process led to the issuance of the Watts Bar interim staff evaluation (ISE) and audit report on December 20, 2013 (ADAMS Accession No. ML13343A036) and continues with in-office and onsite portions of this audit.

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The ongoing audit allows the staff to review open and confirmatory items from the mitigation strategies ISE, RAI responses from the spent fuel pool instrumentation (SFPI) ISE, the licensee's integrated plans, and other audit questions. Additionally, the staff gains a better understanding of submitted and updated information, audit information provided on ePortals, and preliminary Overall Program Documents (OPDs)/Final Integrated Plans (FIPs) while identifying additional information necessary for the licensee to supplement its plan and staff potential concerns.

In support of the ongoing audit of the Watts Bar OIPs as supplemented, the NRC staff conducted an onsite audit at the Watts Bar Nuclear Plant from March 12-13, 2014 per the plan dated March 6, 2014 (ADAMS Accession No. ML14058A105). The purpose of the onsite portion of the audit was to provide the NRC staff the opportunity to continue the audit review and gain key insights most easily obtained at the plant as to whether the licensee is on the correct path for compliance with the Mitigation Strategies and Spent Fuel Instrumentation orders.

Following the licensee's declarations of order compliance, the NRC staff will evaluate the OIPs, as supplemented; the resulting site-specific OPDs/FIPs; and, as appropriate, other licensee submittals based on the requirements in the orders. For Order EA-12-049, the staff will make a safety determination using the Nuclear Energy Institute (NEI) developed guidance document NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" issued in August 2012 (ADAMS Accession No. ML12242A378), as endorsed by NRC interim staff guidance (ISG) JLD-ISG-2012-01 "Compliance with Order EA-12-049, 'Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events'" (ADAMS Accession No. ML12229A174). For Order EA-12-051, the staff will make a safety determination using the NEI developed guidance document NEI 12-02, "Industry Guidance for Compliance with NRC Order EA-12-051, 'To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation'" (ADAMS Accession No. ML12240A307), as endorsed, with exceptions and clarifications, by NRC ISG JLD-ISG-2012-03 "Compliance with Order EA-12-051, 'Reliable Spent Fuel Pool Instrumentation'" (ADAMS Accession No.

ML12221A339) as providing one acceptable means of meeting the order requirements. Should the licensee propose an alternative strategy for compliance, additional staff review will be required to evaluate the alternative strategy in reference to the applicable order.

AUDIT ACTIVITIES

The onsite audit was conducted at the Watts Bar Nuclear Plant facility from Wednesday, March 12, 2013 through Thursday, March 13, 2013. The NRC audit team staff was as follows:

Title	Team Member	Organization
Team Lead	Carleen Sanders	NRR/DIRS
Technical Support – Electrical	Matthew McConnell	NRR/MSD
Technical Support – Electrical	Kerby Scales	NRR/MSD
Technical Support – Reactor Systems	Diana Woodyatt	NRR/MSD
Special Advisor	Eric Bowman	NRR/MSD
Regional Support	Adam Wilson	R-II
Branch Chief – Reactor Systems	Sheena Whaley	NRR/MSD
Process Oversight	Victor Cusumano	NRR/MSD
Project Manager	James Polickoski	NRR/MSD

The NRC staff executed the onsite portion of the audit per the three part approach discussed in the March 6, 2014, plan, to include conducting a tabletop discussion of the site's integrated mitigating strategies compliance program, a review of specific technical review items, and discussion of specific program topics. Activities that were planned to support the above included detailed analysis and calculation discussions, walk-throughs of strategies and equipment laydown, visualization of portable equipment storage and deployment, staging and deployment of offsite equipment, and physical sizing and placement of SFPI equipment.

AUDIT SUMMARY

1.0 Entrance Meeting (Wednesday, March 12, 2013)

At the audit entrance meeting, the NRC staff audit team introduced itself followed by introductions from the licensee's staff. The list of participating NRC and licensee staff members is provided in Attachment 1. The NRC audit team provided a brief overview of the audit's objectives and anticipated schedule. The licensee provided the list of review staff pairings and site logistics to support the audit.

2.0 Integrated Mitigating Strategies Compliance Program Overview

Per the audit plan and as an introduction to the site's program, the licensee provided a presentation to the NRC audit team titled, "Watts Bar Mitigation Strategies Site Implementation." As elements of the brief, the licensee reviewed the design and purpose of the FLEX equipment storage building (FESB) and auxiliary feedwater storage tank (AFWST), FESB key mechanical equipment, FLEX physical plant connections and tie-ins, the FLEX 480 Vac and 6900 Vac diesel generators (DGs), nitrogen station relocation, spent fuel pool level instrumentation, Watts Bar Regional Response Center

(RRC) update, and communications and staffing. Additionally, the licensee provided and presented the Watts Bar extended loss of alternating current power (ELAP) initiated event flowchart for both the flood and non-flood events.

3.0 Onsite Audit Technical Discussion Topics

Based on the three part audit plan, and with a particular emphasis on the Part B "Specific Technical Review Items," the NRC staff technical reviewers conducted interviews with licensee technical staff, site walk-downs, and detailed document review for the items listed in the plan. Summaries of these activities are discussed below per the particular technical area of review with the documents reviewed listed in Attachment 2. Results of these technical reviews and any additional review items needed from the licensee are documented in the audit item status tables in Attachments 3, 4, and 5, as discussed in the Conclusion section below.

3.1 Reactor Systems Technical Discussions and Walk-Downs

NRC reactor systems review staff met with TVA staff and the licensee's vendor, Westinghouse, to discuss supporting details of the applicability of WCAP-17601 to Watts Bar. The licensee provided a spreadsheet comparing the WCAP-17601 simulation parameters to the Watts Bar specific parameters to support the licensee's assertion that the WCAP analysis is bounding for Watts Bar. TVA staff agreed to provide the spreadsheet for NRC staff further review and submit the information to the NRC, as necessary.

The licensee clarified their intention to follow guidelines as set forth in generic issue white papers, as endorsed by the NRC, related to cold shutdown and refueling modes and the boron mixing model. TVA staff agreed to provide boron mixing information to the NRC staff for review.

The NRC staff discussed the applicability of the Nuclear Safety Advisory Letter (NSAL) 14-1, "Impact of Reactor Coolant Pump No. 1 Seal Leakoff Piping on Reactor Coolant Pump Seal Leakage During a Loss of All Seal Cooling" to Watts Bar regarding higher than earlier anticipated reactor coolant pump (RCP) seal leakage for Westinghouse standard RCP seal plants. TVA staff completed a preliminary calculation, and the licensee anticipates that any changes in RCP seal leakage would have minimal impact on the strategy.

During plant walkdowns, TVA staff showed the locations and explained many strategies for the ELAP scenario to NRC reactor systems staff. The walkdowns helped visualize and describe to the NRC staff the height of flood waters and the proximity of the control room to various locations where operators would need to deploy to take actions. Additionally, the NRC staff observed the location of fueling lines in support of the site's FLEX equipment refueling strategy, and NRC staff was able to view the overall site layout and the FESB and AFWST locations currently under construction.

3.2 Electrical Technical Discussions and Walk-Downs

NRC electrical engineering staff met with TVA staff and reviewed electrical single-line diagrams, summaries of calculations for sizing the FLEX DGs and station batteries, and refueling strategies for portable and pre-staged diesel powered equipment. They also reviewed summaries of calculations that addressed the effects of temperature on the electrical equipment credited in the mitigating strategies integrated plan as a result of losing heating, ventilation, and air conditioning (HVAC) during an ELAP as a result of a BDBEE.

NRC electrical engineering staff also performed a walk-down of the areas where the portable and pre-staged electrical equipment will be located, the connection points to the electrical distribution system, and the cable runs from the portable and pre-staged FLEX DGs.

a. In review of ISE open and confirmatory items (OI/CIs) 3.2.4.8.A and audit question (AQ) 45, the licensee proposed using pre-staged 225 kVA and 3 MW DGs (FLEX Generators) and pre-staged pumps that would be powered by the existing electrical distribution system as part of their mitigating strategies integrated plan. Both the licensee and the NRC staff identified this as an alternative approach from the strategies identified in NEI 12-06, as endorsed by the NRC in JLD-ISG-2012-01, due to reliance on permanently installed plant structures, systems (i.e., electrical distribution system), and components (diesel generators and pumps) in lieu of portable generators and diesel driven pumps.

   For this review, the NRC staff spoke with licensee engineers, reviewed summaries of calculations (e.g., battery sizing, FLEX generator sizing, temperature effects on equipment, battery hydrogen mitigation), procedures, and electrical single line diagrams, as well as, walked-down equipment locations and power supply pathways as they pertained to the pre-staged DGs. The NRC staff also reviewed calculations (EDQ0009992013000147, "Technical Justification for Extended Station Blackout Diesel Generators," EDN0003602013000350, "6900V 3MW Flex Generator 3A and 3B Electrical Cable System Analysis," Proposed Calculation WBNAPS4-004 Rev 031, FLEX Support Instruction 0-FSI-5 (6.9kV and 480V FLEX DG Startup and Alignment (.02)), 6.9kV & 480V Shutdown Board Initial FLEX Alignment, FLEX DG manufacturer specification sheets), single line electrical diagrams, procedures, and held interactions with the licensee's staff.

   The NRC staff's review of this item focused on the location of the pre-staged DGs (above the probable maximum flood level), the robustness of the diesel generator enclosures/buildings (built to withstand design basis earthquakes and weather events), the protection and diversity of the power supply pathways, the separation and isolation of the pre-staged generators from the Class 1E emergency DGs, protection of the fuel oil supply pathways, availability of procedures to direct operators how to align and protect associated systems and components, and sufficient capacity and capability to supply the necessary loads following a BDBEE.

b. In review of ISE CI 3.1.4.1.A related to protection of FLEX DGs from extreme temperature hazards, the NRC staff reviewed the licensee's assessment of temperature effects on the FLEX DGs as a result of extreme temperature hazards. In draft calculation WBNAPS4-004 Rev. 31, the licensee identified that the minimum and maximum abnormal ambient temperatures expected at the Watts Bar Nuclear Plant site are 6 and 102 degrees Fahrenheit (°F), respectively. According to the licensee, the 480 Vac FLEX DGs can sustain an ambient temperature range of 5 to 105 °F under operating conditions at 180kw (kilowatts). The 480 volts alternating current (Vac) FLEX DG can operate above an ambient condition of 105 °F under de-rated loading conditions (178kw for an ambient temperature of 108 °F). The low ambient temperature of 5 °F for the 480 Vac FLEX DG is based on the size of the jacket water heater. The licensee's staff informed the NRC staff that the 6.9kV FLEX DG will be housed in a conditioned building that will ensure operation during extreme temperature hazards.

   The NRC staff's review of this item focused on the adequate protection of the 480 Vac and 6.9kV FLEX DG from extreme temperature hazards to ensure they can perform their intended function during minimum and maximum abnormal temperature events.

c. In review of ISE CI 3.2.4.10.A and AQ 42, 43, and 44 related to battery duty cycle load profiles and load shedding, the NRC staff reviewed the licensee's direct current (dc) system analysis (Calculation EDQ00023620070003, "125V DC Vital Battery System Analysis") to verify the capability of the dc system to supply the required loads during the first phase of the Watts Bar plan. The licensee's analysis identified the required loads and their associated ratings (amperage and minimum voltage) and loads that would be shed to ensure battery operation for at least 8 hours (power is expected to be restored to the battery charger by this time).

   The NRC staff's review of this item focused on whether the Watts Bar dc system has adequate capacity and capability to power the loads required to mitigate the consequences during the first phase of an ELAP provided that necessary load shedding is completed within the times assumed in its analysis.

d. In review of ISE CI 3.2.4.2.D and AQ 26 and 47 related to battery room hydrogen mitigation, the NRC staff reviewed the licensee's analysis (EPM-RIU-112288, "125V DC Vital Battery Rooms Ventilation") to verify that hydrogen gas accumulation in the 125V vital battery rooms will not reach combustible levels while HVAC is lost during an ELAP. The NRC staff's review noted that the licensee's analysis considered hydrogen gas generation rates provided by the battery manufacturer (C&D Technologies) during an equalize charge, worst-case maximum temperatures (104 and 110 °F), and isolation from the existing HVAC system (i.e., HVAC not operating and tornado dampers closed). Given these factors, the licensee's analysis concluded that the hydrogen gas accumulation in the 125 Vdc vital battery rooms would reach 2 percent (design basis limit) in 1.76 days at 110 °F room temperature and 2.33 days at 104 °F room temperature.

The NRC staff's review of this item focused on the licensee's analysis demonstrating that hydrogen accumulation in the 125 Vdc vital battery rooms will not reach the combustibility limit for hydrogen (4 percent) during an ELAP and the reasonability to assume that power will be restored to the vital battery room HVAC systems within the calculated times for hydrogen gas accumulation reaching 2 percent in the 125 Vdc vital battery rooms.

e. In review of ISE CI 3.2.4.9.A, AQ 13 and 32, and the licensee's identified OI 2 regarding the refueling strategy for FLEX equipment, the NRC staff reviewed the licensee's procedure/maintenance instruction for refueling portable diesel powered equipment (Maintenance Instruction - 0-MI-360.011, "FLEX – Portable Diesel Equipment Refueling" Revision 0000A) to verify that the licensee's refueling strategy is adequate to ensure that the required portable diesel powered equipment continues to perform as expected during an ELAP as a result of a BDBEE.

   The NRC staff's review of this item focused on the maintenance instruction and the needed detail to ensure continued operation of the required portable diesel powered equipment during an ELAP as a result of a BDBEE. Additional items will be needed from the licensee to complete this review as noted in Attachment 5.

f. In review of ISE CI 3.2.4.2.A, 3.2.4.2.B, and 3.2.4.2.C related to the effect of temperature on electrical equipment due to loss of HVAC during an ELAP, the NRC staff reviewed the licensee's calculation (MDQ0003602013000272, "WBNP ELAP Transient Temperature Analysis"), to verify that electrical equipment relied upon as part of the Watts Bar plan for an ELAP as a result of a BDBEE will not be adversely affected by increases in temperature as a result of loss of HVAC. The NRC staff observed that the licensee's analysis modeled four cases for the control and auxiliary buildings that contain equipment necessary and/or desired for coping with emergency plant functions during a loss of HVAC as a result of a BDBEE: 1) the first case considered summer-time responses with no compensatory actions taken; 2) the second case analyzed the impact of opening doors between modeled spaces at 4 hours with all other conditions the same as Case 1; 3) the third case analyzed the impact of modeling fans starting after 24 hours for various rooms with all other conditions the same as Case 2; and 4) the fourth case analyzed the impact of replacing the emergency incandescent lights in the main control room with LED (light-emitting diode) lights with all other conditions the same as Case 3. The calculation also included a separate analysis of the turbine driven AFW pump rooms.

   In the calculation, the licensee referenced TVA calculation GENSTP3-001, R000, "Upper Boundary Temperature for Mild Environments Related to Environmental Qualification of Electrical Equipment," which included results for electrical equipment used at nuclear power plants. While the NRC staff did not review this calculation, the licensee noted that the reference calculation concluded that electrical equipment could withstand and remain functional during the following

temperature excursions: 1) up to 140 °F for 24 hours; 2) followed by a period of 120 °F for an indefinite period or slow ramp to 135 °F; and 3) followed by a period of 100 days at 135 °F. The licensee identified that an equipment performance difference for the switchgear and motor control centers exists which may require amperage limitations above 104 °F, and the equipment is expected to perform its function. The licensee concluded that the low voltage circuit breakers and switchgear can withstand 140 °F ambient conditions on a continuous basis while carrying 80 percent of rated load.

For the turbine driven AFW pump rooms, the licensee stated that the room temperature would reach 126.6 °F during the ELAP event. This temperature is acceptable for the first 24 hours but would need to be reduced afterwards for operator habitability if required later in the event. The licensee noted that a temperature reduction for operator habitability could be achieved by propping the doors to the rooms open.

The NRC staff's review of this item focused on whether, for each of the cases described above, did the licensee's calculations demonstrate that temperatures would remain below the design limits for the electrical equipment for the duration of the ELAP event.

3.3 Other Technical Discussion Areas and Walk-Downs

a. In review of ISE CI 3.2.4.5.A related to plant accessibility following a BDBEE, the NRC staff interviewed plant personnel, conducted plant walk-downs, and reviewed TVA white paper, "Impact to FLEX equipment by security boundary systems." The NRC staff discussion with TVA staff focused on the personnel and vehicle access system responses for the owner controlled area, protected areas, and vital areas following an ELAP during a BDBEE.

The NRC staff's review focused on the ability for onsite and supplemental personnel to navigate and access the plant following an ELAP and for any needed vehicles or large, portable FLEX equipment to enter the protected area fence line following the event.

b. In review of ISE CI's 3.1.1.2.A, 3.1.4.1.A, 3.1.5.1.A and AQ 9 and 38 regarding the Watts Bar strategy FLEX equipment, hazard protected storage, deployment methods and paths, and plant implementation, the NRC staff conducted multiple site walk-downs with licensee staff regarding phase 2 and phase 3 strategy implementation approaches. The licensee's staff first showed the protected storage locations (under construction) for most of the FLEX equipment. The NRC staff then walked down most equipment deployment paths relative to their applicable water sources and/or electric motive forces. Finally, the NRC staff walked down and visualized the FLEX equipment deployment locations to the point of the equipment tie-ins to the installed systems that support core cooling, reactor coolant system (RCS) inventory, spent fuel pool cooling, and protecting containment.

The NRC staff's review of the FLEX equipment storage, deployment, and implementation strategies focused on the protection and survival of the equipment following events related to the applicable BDBEE hazards as well as the feasibility, water access, sustainability, and fluid dynamics aspects of the strategies following the event.

c. In review of the draft FLEX Support Guidelines (FSGs) developed for the licensee by Westinghouse, the NRC staff noted that FLEX Support Instruction (FSI)-7, Appendix A, on page 33 of 200, provides a graph of AFW flow required to remove decay heat versus the time after shutdown, but no instructions or cautions are provided in the guidelines to adjust the flow for the power history at shutdown if the unit has not been operating for an extended period at full power. FSI-7, Step 3.2, item 3b requires the operator to set flow for the turbine-driven AFW pump using this graph directly and similarly does not include instructions or cautions related to the power history at shutdown. The NRC staff cross-checked the draft version of 2-ECA-0.0, which is the emergency operating procedure for loss of all alternating current power for Watts Bar Unit 2 and found the same issue in Appendices B and E.

   The NRC staff's review of FSGs focused on the feasibility and completeness of the guidelines and synchronization and coordination with existing procedures. The above information was provided as feedback to the TVA staff for their use in the finalization of the FSGs and was documented in PER #758565-002. Additional items will be needed from the licensee to complete this review as noted in Attachment 5.

d. In review of ISE CI 3.4A and licensee-identified open item 9, the NRC staff reviewed the draft Strategic Alliance for FLEX Emergency Response (SAFER) Response Plan for Watts Bar as well as a site plan showing the contour lines for the flood level currently under review for a license amendment request as the new design basis flood level for the site. The NRC staff noted that the staging area for the receipt of equipment and supplies from the RRC was located in an area on the site plan that would be submerged during a flood at that level and there were no identified deployment routes available that would not also be flooded. In discussions with the TVA staff, the licensee identified a flooding contingency staging area in the vicinity of the Watts Bar Dam, but this area was not listed in the SAFER Response Plan. It was also not clear how equipment and supplies would be moved from that area to the places of use for the materials.

   The NRC staff's review of the capabilities and utilization of offsite resources focused on planning and feasibility of the staging and deployment aspects of the licensee's Phase 3 strategies. Following the NRC staff's review, the TVA staff acknowledged that further development of Phase 3 strategies for the flooding hazard is necessary. Additional items will be needed from the licensee to complete this review as noted in Attachment 5.

e. In review of ISE CI 3.2.4.4.A and AQ 29, the NRC staff discussed the site communications enhancements with licensee staff and conducted walkdowns of currently installed communications upgrades. The equipment walkdown showed examples of the new site hand-held radios and their storage locations, charging stations, power sources for the charging stations, applicable procedures under development in relation to site emergency communications, and other communications capabilities documented in procedure available to operators.

The NRC staff's review of the communications enhancements focused on the viability and storage locations of the charging power source, charging generator fuel locations, and the equipment compatibility of the alternate communications capabilities.

6.0 Exit Meeting (Thursday, March 13, 2013)

The NRC staff audit team conducted an exit meeting with licensee staff following the closure of onsite audit activities. The NRC staff highlighted items reviewed and noted that detailed results of the onsite audit trip will be documented in this report. The following two items were discussed in detail at the exit meeting:

a. As discussed in the Watts Bar ISE and further reviewed between NRC and TVA staff while onsite, the NRC staff considers the use of two-pairs of pre-staged, diesel-powered ac generators that are enclosed in protected structures and that will utilize portions of the installed electrical distribution system to re-power battery chargers, portable high pressure and intermediate pressure RCS and steam generator (SG) make-up pumps, and critical installed instrumentation and equipment to be an alternate approach to the NRC endorsed guidance of NEI 12-06. Furthermore, with major portions of the installed electrical distribution system submerged or impacted by flood waters during the flood hazard event, the NRC staff could not conclude that there is reasonable assurance that complete flood water electrical isolation will occur and that the remaining installed electrical distribution system can be utilized to support powering the high pressure (HP) or intermediate pressure (IP) FLEX pumps.

The NRC staff requested additional detail and audit discussions with the licensee's staff to address the above. These meetings occurred the following week culminating in an audit review discussion on March 20, 2014.

b. In reviewing the Watts Bar Phase 3 strategies, the NRC staff noted additional areas needing consideration in the licensee's approach, especially during the design basis flood event. Specifically, the licensee stated their intention to review equipment staging areas and deployment routes for all Phase 3 strategies, most notable including the flood event in light of challenges revealed during the NRC onsite audit with the current strategy.

The NRC staff requested the licensee to present its Phase 3 strategy again during future audit discussions with NRC staff in light of the concerns noted.

CONCLUSION

The NRC staff completed all three parts of the Watts Bar onsite audit plan as issued on March 6, 2013. Each detailed audit item listed in Part 2 of the plan was reviewed by NRC staff members while on site. In addition to the list of NRC and licensee onsite audit staff participants in Attachment 1, Attachment 2 provides a list of documents reviewed during the onsite audit portion.

In support of the continuing audit process as TVA proceeds towards orders compliance for the Watts Bar site, the three additional attachments noted below provide the status of all audit review items (including what occurred onsite) that the NRC staff is evaluating in anticipation of issuance of a combined safety evaluation for both the Mitigation Strategies and Spent Fuel Pool Level Instrumentation orders. The five sources for the audit items referenced below are as follows:

a. Interim Staff Evaluation (ISE) Open Items (OIs) and Confirmatory Items (CIs)

b. Audit Questions (AQs)

c. Licensee-identified Overall Integrated Plan (OIP) Open Items (OIs)

d. Spent Fuel Pool Level Instrumentation (SFPLI) Requests for Additional Information (RAIs)

e. Additional Safety Evaluation (SE) needed information

The tables in the attachments provide audit item status as follows:

a. Attachment 3: Watts Bar Mitigation Strategies (MS)/Spent Fuel Pool Instrumentation (SFPI) SE Audit Items not requiring further NRC staff review and transition to SE anticipated

b. Attachment 4: Watts Bar MS/SFPI SE Audit Items currently under NRC staff review but not requiring further licensee input

c. Attachment 5: Watts Bar MS/SFPI SE Audit Items currently under NRC staff review and requiring licensee input as delineated

While this report notes the completion of the onsite portion of the audit per the plan dated March 6, 2014, the ongoing audit process continues as per the letters to all licensees and construction permit holders for both orders dated August 28, 2013 and March 26, 2014. Additionally, while Attachments 3-5 provide a progress snapshot of the NRC staff's review of the licensee's OIPs, as supplemented, and as augmented in the audit process, the status and progress of the NRC staff's review may change based on licensee plan changes, resolution of generic issues, and other NRC staff concerns not previously documented. Changes in the NRC staff review will be communicated in the ongoing audit process.

Principal Contributors: M. Levine
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K. Scales
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D. Woodyatt
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C. Sanders
J. Polickoski

Date: May 15, 2014

Attachments:
1. NRC and Licensee Staff Onsite Audit Participants
2. Onsite Audit Documents Reviewed
3. MS/SFPI Audit Items not requiring further NRC staff review
4. MS/SFPI Audit Items currently under NRC staff review (no licensee input needed)
5. MS/SFPI Audit Items currently under NRC staff review (licensee input needed)

Onsite Audit Participants / Meeting Attendees

NRC Staff:

Carleen Sanders	NRR/DIRS/IPAB
James Polickoski	NRR/MSD/MSPB
Diana Woodyatt	NRR/MSD/MRSB
Kerby Scales	NRR/MSD/MSEB
Adam Wilson	R-II/DCP/CPB3

Tomy Nazario	R-II/DCP/CPB3
Matthew McConnell	NRR/MSD/MSEB
Eric Bowman	NRR/MSD
Sheena Whaley	NRR/MSD/MRSB
Victor Cusumano	NRR/MSD/MSPB

TVA Staff:

Ike Zeringue	Watts Bar Unit 2 Project Director
Ray Hruby	Watts Bar Unit 2 General Manager
Thomas Detchemendy	Watts Bar Emergency Preparedness Manager
Bob Williams	Fukushima Project Manager
Gerald Hemmer	Watts Bar Unit 2 Principle Project Manager
Greg Scott	Compliance
John Holcomb	Watts Bar System Engineer
David Langley	Nuclear Construction Special Projects
Steven Hilmes	Watts Bar Unit 1 Electrical/I&C Engineering Manager
Kevin Casey	Corporate Licensing Fukushima Project
Thomas Spink	Licensing Fukushima Project
Kristy McIlnay	Corporate Emergency Preparedness
Bill Sprinkle	Watts Bar Operations
Phil Russell	Maintenance Transition
Jim O'Dell	Watts Bar Licensing
Frank Cuzzort	Watts Bar Fukushima
John Sterchi	Watts Bar Operations Fire Marshal
B.P. Hunt	Operations Transition Manager
Frank Koontz	Watts Bar Unit 2 Engineering Specialist
Mike Earles	Watts Bar FLEX Procedures
Philip Hitchcock	Corporate Fukushima Response Team
Brian Briody	Watts Bar FLEX
Lenard Bush	Watts Bar Fukushima Response Team
Brian Jacques	Watts Bar Security
Joe Calle	Watts Bar Dual Unit Transition Manager
Tom Niessen	Watts Bar Unit 2 Quality Assurance
Tom Wallace	Watts Bar Unit 2
Seth Adams	Westinghouse
S.A. Hikmas	Watts Bar Unit 2 Engineering

Documents Reviewed

- EDQ0009992013000147, "Technical Justification for Extended Station Blackout Diesel Generators"
- EDN0003602013000350, "6900V 3MW Flex Generator 3A and 3B Electrical Cable System Analysis"
- Proposed Calculation WBNAPS4-004 Rev 031
- FLEX Support Instruction 0-FSI-5 (6.9kV and 480V FLEX DG Startup and Alignment (.02), 6.9kV & 480V Shutdown Board Initial FLEX Alignment)
- FLEX DG manufacturer specification sheets
- Draft calculation WBNAPS4-004 Rev. 31
- Received comparison of Watts Bar specific parameters to WCAP-17601 parameters used
- LTR-ISENG-14-1, "Containment Pressures and Temperatures for Watts Bar Units 1 and 2 during an ELAP: Calculated with MAAP 4.07", Rev. 0. Calculation
- MDQ0003602013000272, "WBNP ELAP Transient Temperature Analysis"
- GENSTP3-001, R000, "Upper Boundary Temperature for Mild Environments Related to Environmental Qualification of Electrical Equipment"
- EPM-RIU-112288, "125V DC Vital Battery Rooms Ventilation"
- Security white paper, "Impact to FLEX equipment by Security boundary systems"
- Calculation EDQ00023620070003, "125V DC Vital Battery System Analysis"
- Draft SAFER Response Plan for Watts Bar
- Site plan showing the contour lines for the flood level currently under review for a license amendment request as the new design basis flood level for the site
- Key Diagram, Station AUX Power System (1-15E500-2, R45)
- Key Diagram, 120V AC & 125V DC Vital Plant Control Power System (1-45W700-1)
- Calculation EDQ00023620070003, "125V DC Vital Battery System Analysis"
- FLEX DG and Electrical Supply Pathways – Unit 1 Train A Shown is Typical
- Westinghouse Proprietary document: WNA-DS-02957-GEN, "Spent Fuel Pool Instrumentation System (SFPIS) Standard Product System Design Certification" Rev. 3
- Westinghouse proprietary document: WNA-TP-04752-GEN, "Spent Fuel Pool Instrumentation System Standard Product Integrated Functional Test Procedure" Rev 1
- Westinghouse proprietary document: WNA-TR-03149-GEN, "SFPIS Standard Product Final Summary Design Verification Report" Rev 0
- EQ-QR-269, "Design Verification Testing Summary Report for the Spent Fuel Pool Instrumentation" Rev 0
- Westinghouse proprietary document: CN-PEUS-13-20, "Seismic Analysis of the SFP Primary-Mounting Bracket at WBN I&II" Rev 1
- Westinghouse proprietary document: CN-PEUS-13-21, "Seismic Analysis of the SFP Backup Mounting Bracket at WBN I&II" Rev 1
- EQ-TP-354, "Mechanical Preconditioning, Thermal Aging, and Radiation Aging Procedure for the Spent Fuel Pool Instrumentation System Coaxial Cable and Couplers" Rev 0

- LTR-SFPIS-13-35, "SFPIS: Basis for Dose Requirement and Clarification of Production Equivalency of Electronics Enclosure Used for Seismic Testing" Rev 0
- EQ-TP-351, "Environmental Qualification Test Procedure for the Spent Fuel Pool Instrumentation System Coaxial Cable and Connectors Inside the Spent Fuel Pool Area" Rev 0
- EQ-TP-360, "Environmental Test Procedure for the Sensor Housing for Spent Fuel Pool Instrumentation System" Rev 0
- Westinghouse proprietary document: WNA-CN-00300-GEN, "Spent Fuel Pool Instrumentation System Power Consumption Calculation" Rev 0
- Westinghouse proprietary document: WNA-CN-00301-GEN, "Spent Fuel Pool Instrumentation System Channel Accuracy Analysis" Rev 0
- Westinghouse proprietary document: WNA-GO-00127-GEN, "Spent Fuel Pool Instrumentation System Standard Product Technical Manual" Rev 1
- 0-MI-360.011, “FLEX – Portable Diesel Equipment Refueling”

Watts Bar
Mitigation Strategies/Spent Fuel Pool Instrumentation Safety Evaluation Audit Items:

Audit Items Not Requiring Further NRC Staff Review and Transition to Safety Evaluation Anticipated

Audit Item Reference	Item Description
ISE OI 3.2.4.8.A	Alternate Approach & Sizing of FLEX DG
ISE CI 3.1.4.1.A	Protection of FLEX DGs from Extreme Temperature Hazard - low temperature hazard
ISE CI 3.1.5.1.A	Protection of FLEX DGs from Extreme Temperature Hazards - High temperature hazard
ISE CI 3.2.1.1.A	Computer Code Modeling - Confirm applicability of recommendations in WCAP-17601-P
ISE CI 3.2.1.7.A	Cold shutdown and refueling
ISE CI 3.2.3.A	Demonstration of Maintenance of Containment Functions
ISE CI 3.2.4.2.B	Effect of Temperature on Electrical Equipment Due to Loss of HVAC during ELAP
ISE CI 3.2.4.2.C	Battery Room Temperatures
ISE CI 3.2.4.2.D	Battery Room Hydrogen Mitigation
ISE CI 3.2.4.5.A	Accessibility to protected and internal locked areas
ISE CI 3.2.4.8.A	Alternate Approach & Sizing of FLEX DG
ISE CI 3.2.4.10.A	Battery Duty Cycle Load Profiles & Load Shedding
Audit Question 5	Warning time and persistence of a flood
Audit Question 6	Ability to restock supplies and periodically refuel and have access to the portable diesel-driven pumps and generators considering the flood hazard
Audit Question 7	Ability of the FLEX equipment to operate in an extreme cold environment
Audit Question 8	Availability of equipment for the removal of snow and ice and whether the Ultimate Heat Sink (UHS) flow path could be affected by ice blockage or formation of frazil ice
Audit Question 9	Ability of the portable equipment to operate in conditions of high environmental temperatures
Audit Question 11.d	Reactor coolant pump (RCP) O-ring integrity
Audit Question 11.f	RCP manufacturer and model number and seal leakage model
Audit Question 11.g	Reactor coolant system (RCS) symmetric cooldown
Audit Question 11.h	Valve positioning or operator action during load shed activities
Audit Question 12	WCAP-17601 decay heat model
Audit Question 13	Refueling Strategy for FLEX Equipment
Audit Question 18	Means for borated RCS makeup during the flood mode
Audit Question 19	Bounding heat load and required makeup flow rate to the spent fuel pool
Audit Question 22	Demonstrate Maintenance of Containment Functions – pressure control

Audit Item Reference	Item Description
Audit Question 23	Demonstrate Maintenance of Containment Functions – containment cooling
Audit Question 24	Turbine driven auxiliary feedwater pump specific cooling and support requirements
Audit Question 26	Battery Room Ventilation and Hydrogen Mitigation
Audit Question 30	Appropriate electrical isolations and interactions in regards to portable equipment supplying power to plant electrical busses.
Audit Question 35	Capacity and function with the new auxiliary feedwater storage tank (AFWST)
Audit Question 36	Uses of a FLEX high-pressure pump installed in parallel around Safety Injection Pump A to add water from the RWST to the RCS
Audit Question 37	Unlimited supply of water to maintaining core cooling and heat removal, Phase 2.
Audit Question 38	Location and connections for AFWST
Audit Question 39	Electrical isolation and protection of Class 1E equipment
Audit Question 40	Equipment maintenance and testing program
Audit Question 42	Battery Duty Cycle Load Profiles & Load Shedding - Provide the direct current (dc) load profile
Audit Question 43	Battery Duty Cycle Load Profiles & Load Shedding - detailed discussion on the loads that will be shed from the dc bus, the equipment location, and the required operator actions
Audit Question 44	Battery Duty Cycle Load Profiles & Load Shedding - basis for the minimum DC bus voltage
Audit Question 45	Alternate Approach & Sizing of FLEX DG
Audit Question 47	Battery Room Ventilation and Hydrogen Mitigation
Audit Question 49	Detailed electrical one-line diagram
Audit Question 50	Electrical cable pathway for each FLEX Diesel Generator
Audit Question 51	Tennessee River water quality and filtering
Audit Question 52	Use of the atmospheric relief valves (ARVs) in the mitigating strategy
Licensee Identified Open Item 1	Resolution of non-hardened condensate storage tank (CST)
Licensee Identified Open Item 6	Strategy for clearing and removing debris
Licensee Identified Open Item 8	Need time for SFP cooling actions
Licensee Identified Open Item 14	Implementing the 3 MW DGs as an alternate power source for the loads supplied by the 225 kVA 480 Vac DGs
Licensee Identified Open Item 18	Manual SBO load shedding time revision from 30 minutes to 45 minutes
SFPLI RAI 1	Level 1 identified at normal water level with procedures identified for NPSH
SFPLI RAI 2	Level reading while in the area defined by the manufacturer as the dead zone.
SFPLI RAI 4	Arrangement/Separation/Missile protection

Audit Item Reference	Item Description
SFPLI RAI 5	Mounting and seismic evaluation
SFPLI RAI 7	Structural integrity of structures/equipment where mounting brackets are located.
SFPLI RAI 8	Environmental conditions - radiation
SFPLI RAI 9	Environmental conditions - temperature
SFPLI RAI 10	Environmental conditions - humidity
SFPLI RAI 11	Reliability of installed equipment
SFPLI RAI 13	Configuration for power supply source for each channel, as well as cable and conduit separation
SFPLI RAI 14	Battery capacity
SFPLI RAI 15	SFPI Accuracy
SFPLI RAI 16	SFPI Accuracy
SFPLI RAI 17	SFPI Accuracy
SFPLI RAI 18	SFPI design to provide for in-situ testing
SFPLI RAI 19	Displays locations
SFPLI RAI 20	Procedures addressing operation (both normal and abnormal response), calibration, test, maintenance, and inspection
SFPLI RAI 21	Testing and Calibration program/processes

Watts Bar
Mitigation Strategies/Spent Fuel Pool Instrumentation Safety Evaluation Audit Items:

Audit Items Currently Under NRC Staff Review, Not Requiring Further Licensee Input

Audit Item Reference	Item Description
ISE OI 3.2.1.6.A	Sequence of Events (SOE) - Reanalysis to support the revised timelines, both for the flood and the non-flood conditions
ISE CI 3.1.1.2.A	Deployment of FLEX Equipment - Design features of the FESB including the susceptibility to the loss of ac power
ISE CI 3.2.1.2.B	RCP Seals - Confirm integrity of O-rings if the cold leg temperature exceeds 550 degrees F during the ELAP event
ISE CI 3.2.1.3.A	Decay Heat - Confirm the input values used for the decay heat model for Watts Bar Units 1 and 2
ISE CI 3.2.4.2.A	Ventilation – Analysis to determine the temperature rise in the Safety Injection pump room and component cooling system pump room
Audit Question 10	Description of and justification for the evaluation models (e.g., key code models such as those affecting natural circulation, primary-to-secondary heat transfer, critical flow, and boric acid transport; significant assumptions; boundary and initial conditions) used to ensure adequate core cooling, RCS inventory, and shutdown margin.
Audit Question 11.a	Maximum leak-off value for each RCP seal in gallons per minute (gpm) assumed in the ELAP analysis
Audit Question 11.b	Pressure-dependent RCP seal leakage rate calculations
Audit Question 11.c	NRC Information Notice (IN) 2005-14 impacts with the ELAP analysis
Audit Question 25	Equipment impacts as a result of a loss of forced ventilation cooling
Audit Question 27	Habitability conditions at locations requiring local operator actions, duration operators are in those locations, and provisions for operator protection
Audit Question 29	Lighting, communications, and area access where deployment or operation of equipment is necessary
Audit Question 53	Accumulator injection of borated water
Licensee Identified Open Item 3	Refueling Strategy for Flex Equipment
Licensee Identified Open Item 11	Final HVAC analysis
Licensee Identified Open Item 12	Deployment of FLEX equipment to provide core cooling in Modes 5 and 6 with SGs unavailable
Licensee Identified Open Item 17	Contract with the SAFER team

Watts Bar
Mitigation Strategies/Spent Fuel Pool Instrumentation Safety Evaluation Audit Items:

Audit Items Currently Under NRC Staff Review, Requiring Licensee Input As Delineated

Audit Item Reference	Item Description	Licensee Input Needed
ISE CI 3.1.2.2.A Audit Question 55	Deployment Flood Hazard FLEX equipment - Review timing and location for staging, connecting and powering up the submersible high pressure (HP) and intermediate pressure (IP) FLEX pumps based on the revised strategy resulting from using conventional RCP seals instead of the low leakage design originally assumed in the Integrated Plan.	1. Documentation to support timing constraints for staging of equipment. 2. Verify that use of standard RCP seals does not impact deployment time for intermediate pressure (IP)/high pressure (HP) pumps (in the flood and non-flood hazard scenarios). 3. Describe if/where submersible pumps are still being used in the strategy.
ISE CI 3.2.1.1.B	Computer Code Modeling - Confirm that the ELAP analysis using the NOTRUMP code was limited to flow conditions before reflux condensation initiates. This includes specifying an acceptable definition for reflux condensation cooling.	Provide NOTRUMP analysis.
ISE CI 3.2.1.8.A	Core Sub Criticality- The reanalysis to support the revised core boration coping strategy will be provided in a future 6-month update. The overall approach for providing boration early in the ELAP event including the deployment considerations and the rate of boration as it affects sizing the HP FLEX pump is to be verified.	Provide revised core boration coping strategy.
ISE CI 3.2.1.8.B Audit Question 17	Core Sub Criticality- The generic issue of the boric acid mixing model is not yet resolved. Pending resolution of this issue the impact on the Watts Bar analysis will need to be evaluated.	Provide boron mixing/shutdown margin analysis.

Audit Item Reference	Item Description	Licensee Input Needed
ISE CI 3.2.4.1.A Audit Question 48	Equipment Cooling - Confirm that the spent fuel pool cooling system pumps, component cooling system pumps and the air compressors are sufficiently cooled to function for their expected duration during the ELAP event.	1. Confirm whether the listed equipment is part of the spent fuel pool (SFP) primary strategy or just optional if available. 2. If the equipment is essential to the SFP cooling strategy, provide details on keeping equipment functional.
ISE CI 3.2.4.4.A	Communication- Confirmation will be required that upgrades to the site's communications systems have been completed in accordance with TVAs Communications Assessment and as evaluated by the NRC staff documented in ADAMS Accession No. ML13142A348.	1. Provide communications equipment charger power source storage and implementation location. 2. Provide location for power source fuel. 3. Provide information on back-up communications capabilities as documented in procedure.
ISE CI 3.2.4.9.A Audit Question 32	Refueling Strategy for FLEX Equipment - Confirm the licensee approach on how fuel quality will be assured during long term storage for FLEX equipment.	1. Provide program information on ensuring fuel quality during storage. 2. Provide fuel management strategy/procedure.
ISE CI 3.4.A Licensee Identified Open Item 9	Off-Site Resources - Review how conformance with NEI 12-06, Section 12.2 guidelines 2 through 10 will be met.	Provide conformance plan following SAFER playbook development.

Audit Item Reference	Item Description	Licensee Input Needed
Audit Question 1 Licensee Identified Open Item 2	Nuclear Energy Institute (NEI) document 12-06, Revision 0, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" (hereinafter referred to as NEI 12-06) ADAMS Accession No. ML12242A378, Section 5.3.2 consideration 1 addresses the need to evaluate deployment routes for potential soil liquefaction that could impede movement following a severe seismic event. In its integrated plan, Watts Bar indicated that the transportation routes from the storage area to the staging areas have not yet been evaluated for liquefaction. Provide the evaluation of transportation routes with respect to liquefaction to demonstrate conformance to NEI 12-06, Section 5.3.2, consideration 1.	Provide calculation "Watts Bar White Paper - Liquefaction of Haul Routes for FLEX and Subsurface Investigation and Foundation Report for the Watts Bar Nuclear Plant Unit 1 Steam Generator Replacement Project. (EDMS 24900-100-KOR-CY00-00001).
Audit Question 3	NEI 12-06, Section 5.3.3, considerations 2 through 4 provide guidance on the development of mitigating strategies with respect to procedural interface considerations for 1) seismic hazards associated with large internal flooding sources that are not seismically robust and do not require alternating current (ac) power, 2) loss of ac power and how the licensee will mitigate ground water in critical locations, and 3) potential impacts of non-seismically robust downstream dams. The licensee did not address considerations 2 through 4 in its implementation plan. Address these three areas identified in NEI 12-06, Section 5.3.3.	Provide large internal flooding calculation "CDQ 001 027 2013 000268."

Audit Item Reference	Item Description	Licensee Input Needed
Audit Question 4 Licensee Identified Open Item 5	In its integrated plan, Tennessee Valley Authority (TVA) has provided information regarding its use of the offsite resources through the industry Strategic Alliance for FLEX Emergency Response (SAFER) program, but has not yet identified the local staging area and methods of transportation to be used to deliver the equipment to the site considering the seismic, flooding, high wind, and extreme cold hazards. Identify local staging areas and methods of transportation to these areas to demonstrate conformance to the guidance of NEI 12-06, Section 5.3.4, consideration 1; Section 6.2.3.4, considerations 1 and 2; Section 7.3.4, considerations 1 and 2; and Section 8.3.4.	Provide update of Phase 3 strategies.

Audit Item Reference	Item Description	Licensee Input Needed
Audit Question 11.e.	Section 5.7.1 of WCAP-17601 discusses the analyses for the RCS response with RCP safe shutdown/low leakage seals. In the analyses, the assumed RCS leakage is reduced to one gpm/seal plus one gpm of unidentified allowable Tech. Spec. leakage. Discuss the analysis used to determine the RCP seal leakage of one gpm/seal for the safe shutdown/low leakage seals, and address adequacy of the analysis including computer code/methodology and assumptions used, and supporting testing data applicable to the ELAP conditions. The NRC staff noted that the NRC previously reviewed and approved the use of the Westinghouse SHIELD shutdown seal data for the Model 93A RCP in the plant PRA model. If the Model 93A RCP is used, address the compliance of Sections 3.5 and 4.0 of the NRC safety evaluation (ADAMS Nos.: ML110880122 and ML110880131) approving the use of the shutdown seal with Model 93A RCP in the plant PRA model. If different RCP models are used, specify the RCP models for each applicable plant, and address the acceptability of using the SHIELD shutdown seal with these RCP models in the plant PRA model, since the NRC has not yet issued a safety evaluation approving the use of the SHIELD shutdown seal with other models in the plant PRA model. Westinghouse has issued a 10 CFR Part 21 report, "Notification of the Potential Existence of Defects Pursuant to 10 CFR Part 21," dated July 26, 2013 (ADAMS No. ML13211A168). Discuss how this Part 21 Report impacts the use of a seal leakage of one gpm in the ELAP analysis.	Provide response to the Nuclear Safety Advisory Letter (NSAL) 14-1 regarding issues related to changes to the RCP seal leakage analysis.

Audit Item Reference	Item Description	Licensee Input Needed
Audit Question 14	NEI 12-06, Section 3.2.1.7 (6) requires that strategies with time constraints be identified and a basis provided that the time can reasonably be met. Provide the rationale and/or analysis for the time constraints listed in your sequence of events for actions taken to maintain core cooling and RCS inventory.	Provide results of time-based testing of strategy operator actions.
Audit Question 28 Licensee Identified Open Item 16	NEI 12-06, Section 3.2.2, consideration (12) states that plant procedures/guidance should consider the effects of loss of heat tracing on equipment required to cope with an ELAP. Alternate steps, if needed, should be identified to supplement planned action. The licensee's plan regarding heat tracing only addressed protecting FLEX equipment from freezing temperatures while in storage, and does not discuss the loss of heat tracing and the need to protect existing plant equipment and instrumentation that may be used in the coping strategies. In Open Item OI 16, the licensee identifies the need to address the effects of extreme cold conditions on the RWST and/or BATs and the potential need to reenergize area heaters. Provide an evaluation of the effects of loss of heat tracing on installed plant equipment required to cope with an ELAP event (e.g., outdoor water storage tanks; the boric acid storage tanks and their piping). Include alternate steps in the discussion to supplement planned actions, or justify why alternate steps are not needed.	1. Confirm whether heat tracing will be required to support the strategy. 2. Provide equipment list requiring heat tracing and how the heat tracing is powered during the ELAP. 3. Provide Boric Acid tank (BAT) temperature re-evaluation for possible boron precipitation.

Audit Item Reference	Item Description	Licensee Input Needed
Licensee Identified Open Item 4	RCS Venting into Containment to Support Core Cooling: No information regarding actions to mitigate pressurization of containment due to steaming when RCS vent paths have been established or actions to mitigate temperature effects associated with equipment survivability. An evaluation will be provided to prove indefinite containment coping.	Provide information on when venting of the RCS is necessary in the strategy and for what duration.
Licensee Identified Open Item 7	A thorough analysis of the makeup flow rate requirements and other equipment characteristics will be finalized during the detailed design phase of FLEX.	Provide hydraulic analysis in regards to the makeup flow requirements.
Licensee Identified Open Item 10	Loss of Containment Instrumentation during a Flood: Containment temperature instrumentation is only available until flood waters enter the TSC inverter or station battery rooms. Requirements for NSSS-specific FSGs for containment temperature, as noted in APPENDIX F of Reference 11, are pending further evaluation. A method to monitor containment temperature, post-flood, will be developed.	1. Provide containment temperature instrumentation approach. 2. Provide adequacy justification for this approach during a flood hazard scenario.
Licensee Identified Open Item 13	An evaluation of the impact of FLEX response actions on design basis flood mode preparations will be performed. This evaluation will include the potential for extended preparation time for FLEX. Changes which affect the Integrated Plan will be included in the 6 month update.	Provide evaluation of the impact of FLEX response actions on design basis flood mode preparations.
Licensee Identified Open Item 15	The CETs are only available until water enters the auxiliary instrument room. A method to monitor CET, post flood, will be evaluated and developed, if required.	Provide core exit thermocouple (CET) monitoring method evaluation and the stated reference (16 - OG-12-515, "Transmittal of Final Generic PWROG FLEX Support Guidelines and Interfaces (Controlling Procedure Interface and Recommended Instruments) from PA-PSC-0965," Revision 0, December 2012)

Audit Item Reference	Item Description	Licensee Input Needed
SFPLI RAI 3	Please provide a clearly labeled sketch or marked-up plant drawing of the plan view of the SFP area, depicting the SFP inside dimensions, the planned locations/placement of the primary and back-up SFP level sensors, and the proposed routing of the cables that will extend from the sensors toward the location of the local electronics cabinets and read-out/display devices in the main control room or alternate accessible location.	Provide 90-degree connector evaluation assuming this is the chosen configuration.
SFPLI RAI 6	For RAI 5(a) above, please provide the results of the analyses used to verify the design criteria and methodology for seismic testing of the SFP instrumentation and the electronics units, including, design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.	Provide program pool sloshing analysis final report.
SFPLI RAI 12	For RAI #11 above, please provide the results for the selected methods, tests and analyses utilized to demonstrate the qualification and reliability of the installed equipment in accordance with the order requirements.	1. Provide vendor electromagnetic interference (EMI) qualification white paper. 2. Provide information on the acceptability of the SFPI with the tested aging below the 2.5 year requirement.

Audit Item Reference	Item Description	Licensee Input Needed
Safety Evaluation Review Item 1	In review of the draft FLEX Support Guidelines (FSGs) developed for the licensee by Westinghouse, the NRC staff noted that FLEX Support Instruction (FSI)-7, Appendix A, on page 33 of 200, provides a graph of AFW flow required to remove decay heat versus the time after shutdown, but no instructions or cautions are provided in the guidelines to adjust the flow for the power history at shutdown if the unit has not been operating for an extended period at full power. FSI-7, Step 3.2, item 3b requires the operator to set flow for the turbine-driven AFW pump using this graph directly and similarly does not include instructions or cautions related to the power history at shutdown. The NRC staff cross-checked the draft version of 2-ECA-0.0, which is the emergency operating procedure for loss of all alternating current power for Watts Bar Unit 2 and found the same issue in Appendices B and E.	1. Provide analysis regarding needed AFW flow to remove decay heat per power history following plant shutdown. 2. Update applicable procedures with the necessary instructions or cautions to adjust needed AFW flow per this analysis.

If you have any questions, please contact me at 301-415-5430 or by e-mail at james.polickoski@nrc.gov.

Sincerely,

/RA/

James Polickoski, Project Manager
Project Management Branch
Mitigating Strategies Directorate
Office of Nuclear Reactor Regulation

Docket Nos.: 50-390 and 50-391

Enclosure:
Audit report

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DATE	05/09/2014	05/15/2014		

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