



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

March 3, 2015

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

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 - REPORT FOR THE ONSITE  
AUDIT REGARDING IMPLEMENTATION OF MITIGATING STRATEGIES AND  
RELIABLE SPENT FUEL INSTRUMENTATION RELATED TO ORDERS  
EA-12-049 AND EA-12-051 (TAC NOS. MF0864, MF0865, MF0794, AND  
MF0795)

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. ML13063A183), Tennessee Valley Authority (TVA, the licensee) submitted its OIP for Sequoyah Nuclear Plant, Units 1 and 2 (Sequoyah) in response to Order EA-12-049. By letters dated August 28, 2013, February 28, 2014, and August 28, 2014 (ADAMS Accession Nos. ML13247A286, ML14064A295, and ML14247A644, respectively), TVA submitted its first three 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) Office Instruction LIC-111, "Regulatory Audits" (ADAMS Accession No. ML082900195). This audit process led to the issuance of the Sequoyah interim staff evaluation (ISE) (ADAMS Accession No. ML14002A109) and continues with in-office and onsite portions of this audit.

By letter dated February 28, 2013 (ADAMS Accession No. ML13063A011), the licensee submitted its OIP for Sequoyah in response to Order EA-12-051. By letter dated July 17, 2013 (ADAMS Accession No. ML13198A354), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated August 16, 2013, August 28, 2013, February 28, 2014, and August 28, 2014 (ADAMS Accession Nos. ML13235A007, ML13247A291, ML14064A181, and ML14248A478, respectively), the licensee submitted its RAI responses and first three six-month updates to the OIP.

The NRC staff's review led to the issuance of the Sequoyah ISE and RAI dated November 21, 2013 (ADAMS Accession No. ML13312A415). 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 process, to include the in-office and onsite portions, allows the staff to assess whether it has enough information to make a safety evaluation of the Integrated Plans. The audit allows the staff to review open and confirmatory items from the mitigation strategies ISE, RAI responses from the spent fuel pool instrumentation 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 address staff potential concerns.

In support of the ongoing audit of the licensee's OIPs as supplemented, the NRC staff conducted an onsite audit at Sequoyah from December 1-5, 2014, per the audit plan dated November 6, 2014 (ADAMS Accession No. ML14302A197). 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 SFPI orders. The onsite activities included detailed analysis and calculation discussion, walk-throughs of strategies and equipment laydown, visualization of portable equipment storage and deployment, review of staging and deployment of offsite equipment, and review of installation details for SFPI equipment.

The enclosed audit report provides a summary of the activities for the onsite audit portion. Additionally, this report contains an attachment listing all open audit items currently under NRC staff review.

J. Shea

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If you have any questions, please contact me at 301-415-1924 or by e-mail at [Tony.Brown@nrc.gov](mailto:Tony.Brown@nrc.gov).

Sincerely,

A handwritten signature in black ink, appearing to read 'T. Brown', with a long horizontal stroke extending to the right.

Tony Brown, Project Manager  
Orders Management Branch  
Japan Lessons-Learned Division  
Office of Nuclear Reactor Regulation

Docket Nos. 50-327 and 50-328

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  
SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2  
DOCKET NOS. 50-327 and 50-328

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. ML13063A183), Tennessee Valley Authority (TVA, the licensee) submitted its OIP for Sequoyah Nuclear Plant, Units 1 and 2 (Sequoyah) in response to Order EA-12-049. By letters dated August 28, 2013, February 28, 2014, and August 28, 2014 (ADAMS Accession Nos. ML13247A286, ML14064A295, and ML14247A644, respectively), TVA submitted its first three 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) Office Instruction LIC-111, "Regulatory Audits" (ADAMS Accession No. ML082900195). This audit process led to the issuance of the Sequoyah interim staff evaluation

Enclosure

(ISE) (ADAMS Accession No. ML14002A109) and continues with in-office and onsite portions of this audit.

By letter dated February 28, 2013 (ADAMS Accession No. ML13063A011), the licensee submitted its OIP for Sequoyah in response to Order EA-12-051. By letter dated July 17, 2013 (ADAMS Accession No. ML13198A354), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated August 16, 2013, August 28, 2013, February 28, 2014, and August 28, 2014 (ADAMS Accession Nos. ML13235A007, ML13247A291, ML14064A181, and ML14248A478, respectively), the licensee submitted its RAI responses and first three six-month updates to the OIP. The NRC staff's review led to the issuance of the Sequoyah ISE and RAI dated November 21, 2013 (ADAMS Accession No. ML13312A415). 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 process, to include the in-office and onsite portions, allows the staff to assess whether it has enough information to make a safety evaluation of the Integrated Plans. The 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 address staff potential concerns.

In support of the ongoing audit of the licensee's OIPs, as supplemented, the NRC staff conducted an onsite audit at Sequoyah from December 1-5, 2014, per the audit plan dated November 6, 2014 (ADAMS Accession No. ML14302A197). 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 SFPI orders. The onsite activities included detailed analysis and calculation discussion, walk-throughs of strategies and equipment laydown, visualization of portable equipment storage and deployment, review of staging and deployment of offsite equipment, and review of installation details for SFPI equipment.

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 Japan Lessons-Learned Directorate (JLD) 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, Revision 1, "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 Sequoyah facility from December 1, 2014, through December 5, 2014. The NRC audit team staff was as follows:

<b>Title</b>	<b>Team Member</b>	<b>Organization</b>
Team Lead/Project Manager	Tony Brown	NRR/JLD
Technical Support – Balance of Plant	Garry Armstrong	NRR/JLD
Technical Support – Reactor Systems	Joshua Miller	NRR/JLD
Technical Support – Electrical	Prem Sahay	NRR/JLD
Technical Support – I&C	Stephen Wyman	NRR/JLD

The NRC staff executed the onsite portion of the audit per the three part approach discussed in the November 6, 2014, plan, to include conducting a tabletop discussion of the site's integrated mitigating strategies (MS) 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 (December 1, 2014)

At the audit entrance meeting, the NRC staff audit team introduced itself followed by introductions from the licensee's staff. The NRC audit team provided a brief overview of the audit's objectives and anticipated schedule.

#### 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 describing the site's strategies to meet the NRC orders. The licensee reviewed its strategy to maintain core cooling, containment, and SFP cooling in the event of a BDBEE, and the plant modifications being done in order to implement the strategies. Also reviewed was the design and location of the storage facilities for the FLEX equipment, the interface with the National Strategic Alliance for FLEX Emergency Response (SAFER) Response Center including staging areas, the spent fuel pool level indication modification, the modifications planned to enhance emergency communications, preventative maintenance plans for the FLEX equipment, procedural enhancements such as development of FLEX support guidelines, and operator training.

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### 3.0 Onsite Audit Technical Discussion Topics

Based on the audit plan, and with a particular emphasis on the Part 2 "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. Results of these technical reviews and any additional review items needed from the licensee are documented in the audit item status table in Attachment 3, as discussed in the Conclusion section below.

#### 3.1 Reactor Systems Technical Discussions and Walk-Downs

NRC staff met with licensee staff to discuss the amount of leakage from the reactor coolant pump (RCP) seals, the timing of the injection of borated water into the reactor coolant system (RCS), and the availability of borated water sources. NRC staff reviewed the boration calculations and flow calculations along with applicable procedures. NRC staff determined that the amount of leakage from the RCP seals needed to be finalized, and that would affect the other parameters.

#### 3.2 Electrical Technical Discussions and Walk-Downs

- a. NRC staff reviewed the calculations on extending battery life based on load shedding, and walked down the battery rooms to evaluate strategies for hydrogen and temperature control. NRC staff also walked down panels used for load shedding to evaluate feasibility and timing.
- b. NRC staff walked down connection points and locations for FLEX electrical generators. In order to provide electrical power, the licensee will pre-stage two 225kva diesel generators on the roof of the auxiliary building along with two 3MW diesel generators staged in an additional diesel generator building. This is an alternative approach to NEI 12-06, Rev. 0. All pre-staged locations are protected from external events. The staff reviewed the licensee's load and sizing calculations for the FLEX generators and found them acceptable. The staff also walked down the storage locations for the FLEX diesel generators (DGs).

#### 3.3 SFPI Technical Discussions and Walk-Downs

NRC staff walked down instrument, transmitter, electronics, and display locations for the SFP level instrumentation, along with the associated cable runs. No concerns were identified during the walkdown. NRC staff also reviewed the associated calibration, maintenance and test procedures for the SFP level instrumentation.

### 3.4 Other Technical Discussion Areas and Walk-Downs

- a. NRC staff met with licensee staff to discuss the required robust source of water for the turbine-driven auxiliary feedwater (TDAFW) pump. The licensee indicated that the condensate storage tank (CST) will be reinforced to shield from tornado missiles and provide additional seismic support in order to provide the initial source of steam generator (SG) makeup through the TDAFW pumps. The FLEX pumps can be aligned to the CST in the event that the TDAFW pumps are unavailable. Other sources of water will be provided to makeup to the CST based on prioritization, which includes: primary water storage tanks, demineralized water storage tanks, essential raw cooling water (ERCW) in robust piping, and Tennessee River. The staff conducted a walkdown of the locations of the water sources to be used as well as the connection points inside the auxiliary building. The staff also reviewed the procedures for providing makeup to the SGs, as well as alternate methods as needed.
- b. NRC staff toured the designated location of the FLEX equipment storage building (FESB) and reviewed the building plans and noted that it will be a robust building (as defined in NEI 12-06). The staff noted the building is not located above the design-basis flood levels, but the licensee has sufficient time during a flooding event to move all of the FLEX equipment to higher elevations.
- c. NRC staff walked down the FLEX strategies for core cooling, RCS inventory, and SFP inventory functions. This included the point of deployment for the portable FLEX pumps, hose routing and deployment connection points (primary and alternate).
- d. NRC staff reviewed the strategy that will be implemented by the licensee to refuel the portable diesel-powered FLEX equipment. The NRC staff reviewed the instructions for refueling the equipment as well as the equipment needed to perform the refueling. The NRC staff noted that the licensee had not developed any guidance for maintaining adequate fuel quality and the licensee initiated actions to ensure adequate guidance is developed.
- e. The licensee's cooldown strategy relies on operation of the SG atmospheric relief valves (ARVs). The licensee indicated that nitrogen bottles will be used to provide motive force for the ARVs and that one bottle will be used for each ARV and will be sufficient to cool down the plant. Additionally, no electrical power will be required to operate the valves locally. The staff observed these mechanisms during the walkdown in the auxiliary building and also reviewed the site procedures for operation of the ARVs.

### 4.0 Exit Meeting (December 5, 2014)

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 the results of the onsite audit trip will be documented in this report. The NRC staff also discussed the remaining open items with the licensee and information needed for closure. The open items are listed in Attachment 3 of this report.



## CONCLUSION

The NRC staff completed all three parts of the November 6, 2014, onsite audit plan. Each 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 the licensee proceeds towards orders compliance for this site, Attachment 3 provides the status of all open audit review items 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 attachments provide audit information as follows:

- a. Attachment 1: List of NRC staff and licensee staff audit participants
- b. Attachment 2: List of documents reviewed during the onsite audit
- c. Attachment 3: MS/SFPI SE Audit Items currently under NRC staff review (licensee input needed as noted)

While this report notes the completion of the onsite portion of the audit per the audit plan dated November 6, 2014, the ongoing audit process continues as per the letters dated August 28, 2013, and March 26, 2014, to all licensees and construction permit holders for both orders.

Additionally, while Attachment 3 provides a list of currently open items, 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.

### Attachments:

1. NRC and Licensee Staff Onsite Audit Participants
2. Onsite Audit Documents Reviewed
3. MS/SFPI Audit Items currently under NRC staff review

## Onsite Audit Participants

### NRC Staff:

Tony Brown	NRR/JLD/JOMB
Garry Armstrong	NRR/JLD/JCBB
Joshua Miller	NRR/JLD/JERB

Prem Sahay	NRR/JLD/JERB
Stephen Wyman	NRR/JLD/JERB

### Sequoyah and TVA Staff:

John Holcomb	NPG Project Manager, SQN Fukushima Team
Kevin Casey	Corporate Licensing
Brian Flynn	Principal Project Manager, Fukushima
Behrouz Ahmadi	Fukushima Senior Project Manager
Mike Sedlacik	Fukushima Engineering Manager
Jesse Alexander	Fukushima Project
Lenard Bush	Fukushima Project
Phil Hitchcock	Fukushima Project
Ron Gladney	Fukushima Project
Paul Parashak	Operations Procedures
Charles Price	Maintenance Procedures
Neil Gannon	Corporate Fukushima Project Director
Dennis Jones	Corporate EP Manager

## Documents Reviewed

- SQN-DC-V-48.0, "FLEX Response System," Rev. 4
- AOP-N.02, "Tornado Watch/Warning," Rev. 30
- AOP-N.03, "External Flooding," Rev. 53
- Design Change Notice 23096
- Design Change Notice 23414
- Service Request 963905
- Service Request 938927
- Service Request 981252
- Service Request 981262
- Problem Evaluation Report 939667
- FSI-1, "Long Term RCS Inventory Control," Rev. 0000C
- FSI-2, "Alternate AFW Suction Source," Rev. 0000
- FSI-3, "Alternate Low Pressure Feedwater," Rev. 0000
- FSI-4, "DC Bus Management and 480V FLEX DG Alignment/Loading," Rev. 0000F
- FSI-5.01, "Initial Assessment and FLEX Equipment Deployment," Rev. 0000B
- FSI-5.02, "6900V FLEX DG Startup and Alignment," Rev. 0000E
- FSI-5.03, "6.9kV and 480V Shutdown Board Initial FLEX Alignment," Rev. 0000C
- FSI-5.04, "6900V FLEX D/G Plant Equipment Loading," Rev. 0000
- FSI-5.05, "ERCW Alignment for 5000 GPM Portable Diesel Pumps (FLEX ERCW Pumps)," Rev. 0000
- FSI-6, "Alternate CST Makeup," Rev. 0000
- FSI-7, "Loss of Vital Instrumentation or Control Power," Rev. 0000
- FSI-8, "Alternate RCS Boration," Rev. 0000
- FSI-9, "Low Decay Heat Temperature Control," Rev. 0000D
- FSI-10, "Cold Leg Accumulator Isolation," Rev. 0000
- FSI-11, "Alternate SFP Makeup and Cooling," Rev. 0000E
- FSI-12, "Alternate Containment Cooling," Rev. 0000A
- FSI-13, "Transition from FLEX Support Instructions," Rev. 0000C
- SL-012415, "Sequoyah Nuclear Plant FLEX Implementation HVAC ELAP Analysis," Rev. 0
- GENSTP3-001, "Upper Boundary Temperature for Mild Environments Related to Environmental Qualification of Electrical Equipment," Rev. 00
- SQN-CPS-057, "Vital Control Power System Loading Channel I and Continuous Loading Evaluation of Protective Devices in the 120V AC Vital Instrument Power Boards," Rev. 084
- SQN-CPS-058, "Vital Control Power System Loading Channel II and Continuous Loading Evaluation of Protective Devices in the 120V AC Vital Instrument Power Boards," Rev. 097
- SQN-CPS-059, "Vital Control Power System Loading Channel III and Continuous Loading Evaluation of Protective Devices in the 120V AC Vital Instrument Power Boards," Rev. 074
- SQN-CPS-063, "Hydrogen Generation, Vital Batteries," Rev. 0

- EDQ0009992013000086, "Technical Justification for Extended Station Blackout Diesel Generators," Rev. 001
- EDN0003602014000120, "6900V 3MW Flex Diesel Generator A and B Electrical Cable System Analysis," Rev. 000
- EDQ0009992014000102, "FLEX Analysis for 125VDC Vital Batteries," Rev. 000
- ECA-0.0, "Loss of All AC Power," Rev. 26
- EA-250-1, "Load Shed of Vital Loads After Station Blackout," Rev. 16
- O-MI-FMI-360-023.0, "FLEX Portable Diesel Equipment Refueling" Rev. 0000
- CN-SEE-II-13-9, "Determination of the Time to Boil in the Sequoyah Units 1 & 2 Spent Fuel Pool after an Earthquake," Rev. 0
- CN-SEE-II-13-37, "Sequoyah Unit 1 and Unit 2 Reactor Coolant System FLEX Evaluation with Standard Reactor Coolant Pump Seals," Rev. 0
- DAR-FSE-13-3, "FLEX Mechanical Conceptual Design Report for the Sequoyah Unit 1 and 2 Nuclear Plant," Rev. 0-A
- DAR-SEE-II-13-6, "Evaluation of Alternate Coolant Sources for Responding to a Postulated Extended Loss of All AC Power at Sequoyah Nuclear Power Plant," Rev. 0
- MDQ0026970001A, "High Pressure Fire Protection Supply to the Steam Generators for Flood Mode Operation," Rev. 003
- MDQ0009992013000085, "SQN ELAP Transient Temperature Analysis," Rev. 001
- MDQ0003602013000088, "Maximum Temperature for 225 KVA DG Enclosures," Rev. 000
- NDQ0000782014000106, "Beyond Design Basis Dose Evaluation for Spent Fuel Pool Level Instrumentation," Rev. 001
- "Sequoyah Nuclear Plants Units 1 & 2 - Spent Fuel Pool Instrumentation Test and Qualification Summary"
- SAFER Response Plan for Sequoyah Nuclear Plant, Draft, 11/7/2014
- CDQ000020080083, "SQN Stage I and II Warning Time Assessment," Rev. 0
- AMEC Project 3050140254, "Report of Geotechnical Exploration – Deployment Paths Analysis and Condensate Storage Tanks TVA Sequoyah Nuclear Plant," October 15, 2014
- RvM-SOP-10.05.06, "Nuclear Notifications and Flood Warning Procedure," Rev. 0001
- TR-FSE-13-13, "Sequoyah FLEX Integrated Plan," Rev. 0
- "Sequoyah Nuclear Plant Units 1 and 2 FLEX Overall Integrated Plan," Draft, Rev. 4B
- O-MI-FMI-360-005.0, "FLEX-Align Flex High Pressure Pumps From BATS to Unit 1 or Unit 2 RCS Using Why Connection," Rev. 0
- 03D53EPMNQL021993, "Analysis to Support Changing TDAFW LCVs Actuator and Sizing Criteria of the Air Cylinder (for the TDAFW LCVs and MSS ARV's)," Rev. 10

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

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

Audit Item Reference	Item Description	Licensee Input Needed
ISE OI 3.2.1.8.A	Core Sub Criticality - Complete the reanalysis to support the revised core boration coping strategy of providing boration early in the ELAP [extended loss of alternating current power] event including the deployment considerations and the rate of boration as it affects sizing the high pressure (HP) FLEX pump is to be completed.	The licensee provided a calculation showing the boration needed to remain subcritical at 24 hours. The licensee is updating the calculation to ensure that boration is not needed before 24 hours to remain subcritical. Will review when available.
ISE OI 3.2.3.A	Containment Functions - Containment evaluations for Phases 1, 2 and 3 have not been done. Complete the results of the evaluations needed to confirm that containment functions are maintained during the course of the ELAP event.	Open Item #4 in the 8/28/14 6-month update states that Westinghouse Calculation LTR-ISENG-14-2, Rev 0, has been completed which demonstrates that containment functions will be maintained throughout all Phases of the ELAP. This calculation should be added to the ePortal for staff review.
ISE CI 3.4.A	Off-Site Resources - Confirm the licensee's arrangements for off-site resources address the guidance of Guidelines 2 through 10 in NEI 12-06, Section 12.2.	Reviewed draft SAFER playbook. The required equipment is identified. The NRC staff requests to review this document once it is finalized.
OIP OI #7	A thorough analysis of the makeup flow rate requirements and other equipment characteristics will be finalized during the detailed design phase of FLEX.	The licensee indicated that the evaluation for SFP cooling actions will be completed by February 2015. The staff will review the evaluation when it's made available in the office to close this item.

Audit Item Reference	Item Description	Licensee Input Needed
OIP OI #10	Containment temperature instrumentation is only available until flood waters enter the technical support center (TSC) inverter or station battery rooms. A method to monitor containment temperature, post-flood, will be developed.	Open Item #10 in the 8/28/14 6-month update states that this issue is "Started", but not yet closed. Once the licensee completes the development of their plan, it should be submitted to the staff for review.
OIP OI #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 six month update.	The licensee indicated that the evaluation for flood preparations will be completed by February 2015. The staff will review the flood evaluation when it's made available in the office to close this item.
OIP OI #14	Perform an alternate cooling source evaluation. The purpose of this analysis is to examine options to utilize alternate water sources to provide continuous sources of water to maintain key safety functions.	The staff reviewed the evaluation provided and requests additional information regarding additional analyses of existing sludge levels.
OIP OI #15	Perform conceptual hydraulic performance analyses. The purpose of this analysis is to conservatively evaluate hydraulic performance of FLEX systems.	The licensee indicated that Westinghouse is completing the hydraulic analysis and will be available by February 2015. The staff will review the hydraulic analysis when it's made available in the office to close this item.
OIP OI #18	Perform an RCS makeup analysis. The purpose of this analysis is to define FLEX RCS inventory and shutdown margin for Sequoyah.	The NRC staff requests that the licensee demonstrate that the required SI pump injection time, considering RCS shrinkage and RCP seal leakage, will not result in pump room heatup beyond the operating capability of the pumps.
OIP OI #20	Perform a timing and deployment evaluation. The purpose of this analysis is to summarize the FLEX timeline for Sequoyah, identify time constraints and provide for the safety function needs.	The purpose of this analysis is to summarize the FLEX timeline for Sequoyah, identify time constraints and provide for the safety function needs. The draft OIP states this evaluation has been started. The NRC staff requests to review this evaluation once it is finalized.

<b>Audit Item Reference</b>	<b>Item Description</b>	<b>Licensee Input Needed</b>
OIP OI #21	Develop a programmatic control report. The purpose of this report is to summarize the need to implement programmatic control of the FLEX program.	The purpose of this report is to summarize the need to implement programmatic control of the FLEX program. The NRC staff requests to review this document once it is finalized.
OIP OI #24	Further analysis will be performed to determine the required timeline for implementing the 6.9 KV FLEX DGs as an alternate power source for the loads supplied by the 480v FLEX DGs.	During site audit on 12/4/14, the licensee staff stated that the SQN Staffing study table top confirmed starting of the 6.9kV FLEX DGs within 5 hrs as defined in the Sequence Of Events (SOE) document. Provide a copy of SOE document on ePortal.
SE #3	(Westinghouse Standard RCP Seals: NSAL-14-1) On February 10, 2014, Westinghouse issued Nuclear Safety Advisory Letter (NSAL)-14-1, which informed licensees of plants with standard Westinghouse RCP seals that 21 gpm may not be a conservative leakage rate for ELAP analysis. This value had been previously used in the ELAP analysis referenced by many Westinghouse PWRs, including the generic reference analysis in WCAP-17601-P.	No additional input from the licensee is needed at this time. Further review of the information provided is required by the NRC staff.

<b>Audit Item Reference</b>	<b>Item Description</b>	<b>Licensee Input Needed</b>
SE #4	<p>Please provide adequate justification for the seal leakage rates calculated according to the Westinghouse seal leakage model that was revised following the issuance of NSAL-14-1. The justification should include a discussion of the following factors:</p> <ul style="list-style-type: none"><li>a. benchmarking of the seal leakage model against relevant data from tests or operating events,</li><li>b. discussion of the impact on the seal leakage rate due to fluid temperatures greater than 550°F resulting in increased deflection at the seal interface,</li><li>c. clarification whether the second-stage reactor coolant pump seal would remain closed under ELAP conditions predicted by the revised seal leakage model and a technical basis to support the determination, and,</li><li>d. justification that the interpolation scheme used to compute the integrated leakage from the reactor coolant pump seals from a limited number of computer simulations (e.g., three) is realistic or conservative.</li></ul>	<p>Pressurized-Water Reactor Owners Group (PWROG) is still developing and validating that leakage rates in PWROG-series reports are valid. More generic effort may be necessary to support issue resolution.</p>



<b>Audit Item Reference</b>	<b>Item Description</b>	<b>Licensee Input Needed</b>
SE #5	<p>The NRC staff understands that Westinghouse has recently recalculated seal leakoff line pressures under loss of seal cooling events based on a revised seal leakage model and additional design-specific information for certain plants.</p> <p>a. Please clarify whether the piping and all components (e.g., flow elements, flanges, valves, etc.) in your seal leakoff line are capable of withstanding the pressure predicted during an ELAP event according to the revised seal leakage model.</p> <p>b. Please clarify whether operator actions are credited with isolating low-pressure portions of the seal leakoff line, and if so, please explain how these actions will be executed under ELAP conditions.</p> <p>c. If overpressurization of piping or components could occur under ELAP conditions, please discuss any planned modifications to the seal leakoff piping and component design and the associated completion timeline.</p> <p>d. Alternately, please identify the seal leakoff piping or components that would be susceptible to overpressurization under ELAP conditions, clarify their locations, and provide justification that the seal leakage rate would remain in an acceptable range if the affected piping or components were to rupture.</p>	<p>Staff has remaining questions regarding adequacy of PWROG method for computing maximum pressures in PWROG-series reports. The licensee is requested to provide justification that the seal leak off line can withstand the pressures that are predicted by the PWROG work to be seen in the event.</p>

J. Shea

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If you have any questions, please contact me at 301-415-1924 or by e-mail at [Tony.Brown@nrc.gov](mailto:Tony.Brown@nrc.gov).

Sincerely,

*/RA/*

Tony Brown, Project Manager  
Orders Management Branch  
Japan Lessons-Learned Division  
Office of Nuclear Reactor Regulation

Docket Nos. 50-327 and 50-328

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