



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

April 6, 2015

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

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3 - 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. MF0902, MF0903, MF0904, MF0881, MF0882, AND MF0883)

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. ML13064A465), Tennessee Valley Authority (TVA, the licensee) submitted its OIP for Browns Ferry Nuclear Plant, Units 1, 2, and 3 (Browns Ferry) in response to Order EA-12-049. By letters dated August 28, 2013, February 28, 2014, August 28, 2014, and February 27, 2015 (ADAMS Accession Nos. ML13247A284, ML14064A240, ML14248A496, and ML15064A162, respectively), TVA submitted its first four 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 Browns Ferry interim staff evaluation (ISE) on December 19, 2013 (ADAMS Accession No. ML13353A166), and continues with in-office and onsite portions of this audit.

By letter dated February 28, 2013 (ADAMS Accession No. ML13063A437), the licensee submitted its OIP for Browns Ferry in response to Order EA-12-051. By letter dated June 18, 2013 (ADAMS Accession No. ML13157A164), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated July 18, 2013, August 28, 2013, February 28, 2014, August 28, 2014, and February 27, 2015 (ADAMS Accession Nos. ML13206A005, ML13247A290, ML14064A240, ML14247A430, and ML15064A188, respectively), the licensee submitted its RAI responses and first four six-month updates to the OIP.

The NRC staff's review led to the issuance of the Browns Ferry ISE and RAI dated November 14, 2013 (ADAMS Accession No. ML13274A657). 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/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 Browns Ferry from January 5-9, 2015, per the audit plan dated November 26, 2014 (ADAMS Accession No. ML14323A295). 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.

Sincerely,

A handwritten signature in black ink, appearing to read 'Tony Brown', with a stylized flourish extending to the right.

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

Docket Nos.: 50-259, 50-260, and 50-296

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  
BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3  
DOCKET NOS. 50-259, 50-260, and 50-296

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. ML13064A465), Tennessee Valley Authority (TVA, the licensee) submitted its OIP for Browns Ferry Nuclear Plant, Units 1, 2, and 3 (Browns Ferry) in response to Order EA-12-049. By letters dated August 28, 2013, February 28, 2014, August 28, 2014, and February 27, 2015 (ADAMS Accession Nos. ML13247A284, ML14064A240, ML14248A496, and ML15064A162, respectively), TVA submitted its first four 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

Enclosure

Accession No. ML082900195). This audit process led to the issuance of the Browns Ferry interim staff evaluation (ISE) on December 19, 2013 (ADAMS Accession No. ML13353A166), and continues with in-office and onsite portions of this audit.

By letter dated February 28, 2013 (ADAMS Accession No. ML13063A437), the licensee submitted its OIP for Browns Ferry in response to Order EA-12-051. By letter dated June 18, 2013 (ADAMS Accession No. ML13157A164), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated July 18, 2013, August 28, 2013, February 28, 2014, August 28, 2014, and February 27, 2015 (ADAMS Accession Nos. ML13206A005, ML13247A290, ML14064A240, ML14247A430, and ML15064A188, respectively), the licensee submitted its RAI responses and first four six-month updates to the OIP. The NRC staff's review led to the issuance of the Browns Ferry ISE and RAI dated November 14, 2013 (ADAMS Accession No. ML13274A657). 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 (MS) ISE, RAI responses from the SFP 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 Browns Ferry from January 5-9, 2015, per the audit plan dated November 26, 2014 (ADAMS Accession No. ML14323A295). 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 Browns Ferry facility from January 5, 2015, through January 9, 2015. 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	Matthew McConnell	NRR/JLD
Technical Support – I&C	Stephen Wyman	NRR/JLD
Technical Support – Hazards	John Bowen	Contractor
Technical Support – Containment	Brett Titus	NRR/JLD

The NRC staff executed the onsite portion of the audit per the three part approach discussed in the November 26, 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 (January 5, 2015)

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 SFP 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.

### 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 identified 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 recirculation pump (RCP) seals, the timing of the makeup of water to the Reactor Core Isolation Cooling (RCIC) system used for core cooling, and the availability of water sources. NRC staff reviewed the analysis and flow calculations along with applicable procedures. NRC staff noted that the Modular Accident Analysis Program (MAAP) 4 analysis is not finalized and requested to review it once completed. NRC staff reviewed the licensee's strategy for utilizing raw water sources (Tennessee River), including water filtration and monitoring of core parameters to ensure adequate cooling. NRC staff also walked down the licensee's strategies and reviewed plant procedures for implementing the core cooling and makeup strategies.

#### 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 location for FLEX electrical generators. The staff noted that there is only one pre-determined location for staging the Phase 2 FLEX generators, which is located adjacent to structures that are not fully protected from all hazards. The staff requested the licensee provide justification that the generator can be placed into service in the required time in the event the area is severely obstructed (Attachment 3). The staff reviewed the licensee's load and sizing calculations for the Phase 2 FLEX generators and also requested the sizing calculations for the Phase 3 4.16kV generators that will be received from the National SAFER Response Center. 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 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 walked down equipment haul routes from the storage building to the designated deployment sites, and walked down haul routes from designated staging areas for equipment that will be delivered from the National SAFER Response Center.
- b. NRC staff walked down the FLEX strategies for core cooling, reactor coolant system inventory, and SFP cooling functions. This included the point of deployment for the portable FLEX pumps, hose routing and deployment connection points (primary and alternate). The licensee's strategy relies upon portable FLEX pumps that will be staged east of the forebay to take suction from the Tennessee River to supply water to the Residual Heat Removal Service Water and Emergency Equipment Cooling Water permanent piping systems to maintain core cooling, containment cooling and spent fuel pool cooling functions. The staff also reviewed the licensee's hydraulic analyses to ensure pump sizing and location were sufficient to provide the necessary water flow to perform the associated functions.
- c. 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. Additionally, the staff reviewed the licensee's procedures for ensuring adequate fuel quality.
- d. NRC staff walked down the licensee's strategy for ventilating the main control rooms and battery board rooms to ensure equipment reliability and personnel habitability. The staff noted that the licensee is relying upon the new hardened containment vent system (HCVS), as required by Order EA-13-109, as part of its strategy to meet Order EA-12-049. The NRC has granted relaxation to compliance with Order EA-12-049, for Browns Ferry, Units 2 and 3, to coincide with the licensee's compliance with Order EA-13-109. As such, the staff has requested that the licensee provide final design documentation for the HCVS, along with the associated calculations and procedures to ensure equipment reliability and personnel habitability in the reactor building.
- e. The staff reviewed the licensee's plans to ensure adequate communications, lighting, personnel access, and equipment access, to successfully implement the strategies. The staff interviewed plant personnel responsible for these areas, and observed lighting and communication needs during plant walkdowns.

### 4.0 Exit Meeting (January 9, 2015)

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 26, 2014, onsite audit plan. The audit items identified 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 OIP Open Items (OIs)
- d. Spent Fuel Pool Level Instrumentation (SFPLI) 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 26, 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
Matthew McConnell	NRR/JLD/JERB

Stephen Wyman	NRR/JLD/JHMB
Brett Titus	NRR/JLD/JCBB
John Bowen	Contractor

### Browns Ferry and TVA Staff:

Keith Polson	BFN Site Vice President
Steve Bono	BFN Plant Manager
Jim Kent	Site Projects, Sr. Project Manager
Gerald Doyle	Director, EPU/PUP
Scott Hunnewell	Engineering Director
Mike Oliver	Site Licensing, Sr. Program Manager
Phillip Summers	Plant Support Director
John Kulisek	Emergency Preparedness Manager
Aaron Bergeron	Training Director
Neil Gannon	Director, Fukushima Strategies
Pat Parker	Site Security Manager
Micah Nash	FLEX Response
Anthony Feltman	FLEX Response
Wes Howard	Site Security Support Manager
Greg Burgess	Site Security Coordinator
David Matherly	Site VP Technical Advisor
Amy Reagan	Communications
D.L. Hughes	Operations Director
Jeff Barker	Operations Support Superintendent
Brandon Gray	Project Manager, BFN Fukushima Project
Victoria Dennis	Work Management
Kevin Casey	Corporate Licensing, Fukushima Project Sr. Program Manager

## Documents Reviewed

- AMEC Environment & Infrastructure, Inc., AMEC Project 3043121002, "Report Of Geotechnical Exploration Commercial Grade "Bunker" Building TVA Browns Ferry Nuclear Plant," December 11, 2012
- "Addendum To Report Of Geotechnical Exploration Ground Motion And Liquefaction Studies Commercial Grade "Bunker" Building TVA Browns Ferry Nuclear Plant", AMEC Environment & Infrastructure, Inc., March 7, 2013
- AMEC Environment & Infrastructure, Inc., AMEC Project 3050140243, "Report Of Geotechnical Exploration Alternative Travel Path Analysis TVA Browns Ferry Nuclear Plant," June 19, 2014
- AMEC Environment & Infrastructure, Inc., AMEC Project 3050-14-0240, "Report of State Route Study Emergency Equipment Mobilization Routes TVA Browns Ferry Nuclear Plant," July 11, 2014
- AMEC Environment & Infrastructure, Inc., AMEC Project 3050140251, "Report Of Geotechnical Exploration Additional Haul Paths Analysis TVA Browns Ferry Nuclear Plant," August 19, 2014
- General Criteria Document No. BFN-50-7360, RIMS #: R14 141114 102, "FLEX Mitigation System," Rev. 3
- CDQ0003602013000136, "FLEX Equipment Storage Building – Structural Calculations," Rev. 0
- CDQ0003602013000135, "FLEX Equipment Storage Building – Civil Design Basis and Criteria," Rev. 0
- CDQ007920030261, "Soil Structure Interaction Analysis for BFN ISFSI Pad (Holtec Report No. HI-2022963 For The Dry Cask Storage Project)," Rev. 0
- CDQ0009992014000268, "BFN Expedited Seismic Evaluation Process (ESEP) HCLPF Capacity Evaluations," Rev. 001
- Design Change Notice 70745
- Design Change Notice 70807
- Design Change Notice 70852
- Design Change Notice 71159
- Design Change Notice 71160
- Design Change Notice 71161
- Design Change Notice 71329
- Design Change Notice 71335
- Design Change Notice 71386
- Design Change Notice 71387
- Design Change Notice 71389
- Design Change Notice 71390
- Design Change Notice 71391
- Design Change Notice 71405

- Design Change Notice 71454
- Design Change Notice 71470
- EDQ0003602014000281, "Electrical Evaluation for Portable Power Supply for Unit Battery Chargers," Rev. 000
- EDQ0009992013000202, "250V DC Unit Batteries 1, 2 & 3 Evaluation for Beyond Design Basis External Event (BDBEE) Extended Loss of AC Power (ELAP)," Rev. 001
- 0-AOI-57-1A, "Station Blackout," Rev. Draft N
- 0-FSI-1, "FLEX Response Instruction," Rev. Draft H
- 0-FSI-2E, "FLEX Mechanical Hose Connections from EECW," Draft Rev. 0
- 0-FSI-3A, "480V FLEX Diesel Generator Setup and Operation," Draft Rev. 0
- 0-FSI-3C, "4KV FLEX Generator Setup and Operation," Draft Rev. 0
- 0-FSI-3F, "Load Shed of 250V Main Bank Battery 1, 2, 3," Draft Rev. 0
- 0-FSI-4A, "Localized Temporary Lighting, Ventilation and Communications," Draft Rev. 0
- 0-FSI-5A, "Control Bay, Reactor Building Lighting and Communications from 4KV Distribution System," Draft Rev. 0
- 0-FSI-5D, "MISC Electrical Alignments from 4KV Distribution System," Draft Rev. 0000B2
- 0-FSI-6A, "Damage Assessment," Draft Rev. 0
- 0-FSI-6B, "FLEX – Long Term Fueling Operations," Draft Rev. 0
- 0-FSI-6C, "Key Instrument Readings During Loss of DC Power," Draft Rev. 0
- 2-EOI Appendix 16K, "Bypassing RCIC High Temperature Isolation," Rev. 0002
- 2-EOI Appendix 20M, "RCIC Operations During Station Blackout," Rev. 0000
- 2-EOI-1, "RPV Control," Draft Rev. H3
- 2-OI-35, "Generator Hydrogen Cooling System," Rev. 65
- MDN0003602014000233, "Hydraulic Analysis for Fukushima FLEX Connections Modifications," Rev. 001
- MDQ0003602014000222, "ELAP Transient Temp Analysis," Rev. 001
- NDQ0031890069, "Hydrogen Concentration in the Control Bay 250-Volt Station Battery Rooms," Rev. 1
- NPG-SPP-06.2, "Preventive Maintenance," Rev. 0009
- NPG-SPP-09.22.2, "NPG Programs and Processes, Diverse and Flexible Coping Strategies [FLEX] Program Document," Rev. 0000-A
- OPDP-1, "Conduct of Operations," Rev. 0033
- OPDP-8, "Operability Determination Process and Limiting Conditions for Operation Tracking," Rev. 0017
- PIP-02-03, "AC Electrical Distribution System Browns Ferry Nuclear Plant," 4/15/2014
- TRN-30, "Radiological Emergency Preparedness Training," Rev. 29
- AREVA Inc., Engineering Information Record, Document No.: 51-9233061-000, "Browns Ferry Nuclear Plant SAFER Response Plan," DRAFT, 1/30/2014

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

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

<b>Audit Item Reference</b>	<b>Item Description</b>	<b>Licensee Input Needed</b>
ISE CI 3.2.1.1.A	From the June 2013 position paper, benchmarks must be identified and discussed which demonstrate that MAAP4 is an appropriate code for the simulation of an ELAP event at your facility.	The staff requests that the licensee make available for audit the final MAAP analysis when complete and ensure this item is discussed.
ISE CI 3.2.1.1.B	The collapsed level must remain above Top of Active Fuel (TAF) and the cool down rate must be within technical specification limits.	The staff requests that the licensee make available for audit the final MAAP analysis when complete and ensure this item is discussed.
ISE CI 3.2.1.1.C	MAAP4 must be used in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper.	The staff requests that the licensee make available for audit the final MAAP analysis when complete and ensure this item is discussed.
ISE CI 3.2.1.1.D	In using MAAP4, the licensee must identify and justify the subset of key modeling parameters cited from Tables 4-1 through 4-6 of the "MAAP4 Application Guidance, Desktop Reference for Using MAAP4 Software, Revision 2" (Electric Revision 1 Page 64 of 71 2013-12-18 Power Research Institute Report 1 020236). This should include response at a plant-specific level regarding specific modeling options and parameter choices for key models that would be expected to substantially affect the ELAP analysis performed for that licensee's plant.	The staff requests that the licensee make available for audit the final MAAP analysis when complete and ensure this item is discussed.
ISE CI 3.2.1.1.E	The specific MAAP4 analysis case that was used to validate the timing of mitigating strategies in the integrated plan must be identified and should be available on the ePortal for NRC staff to view. Alternately, a comparable level of information may be included in the supplemental response. In either case, the analysis should include a plot of the collapsed vessel level to confirm that TAF is not reached (the elevation of the TAF should be provided) and a plot of the temperature cool down to confirm that the cool down is within technical specification limits.	The staff requests that the licensee make available for audit the final MAAP analysis when complete and ensure this item is discussed.
ISE CI 3.2.1.2.A	There is insufficient information provided to determine the adequacy of the determination of recirculation pump seal or other sources of leakage used in the ELAP analysis.	No additional input from the licensee is needed at this time. Further review of the information provided is required by the NRC staff.

<p>ISE CI 3.2.1.3.A</p>	<p>On page 10 of the Integrated Plan, the licensee stated that the Main Steam Relief Valve (MSRV) control is maintained from the control room with sufficient dc [direct current] power and pneumatic pressure to operate the MSRVs throughout Phase 1 and Phase 2. The licensee describes that SRV actuation may require a higher than nominal dc voltage to actuate the MSRVs due to higher containment temperature with a longer duration event than an existing SBO [station blackout] coping time. The SRV pilot solenoid coil electrical resistance will increase due to a higher containment temperature with a longer duration event than an existing SBO coping time. The licensee is planning to evaluate MSRV qualification against the predicted containment response with FLEX implementation to ensure there will be sufficient dc bus voltage during the ELAP event. The licensee also provides that if required, there will be a modification to increase voltage as necessary to achieve the necessary coil current, or modifications will be made to reduce the coil resistance under higher temperature conditions. Because the MSRV control system will be exhausting control gas to the containment and containment pressure will be higher, the licensee is evaluating methods to establish any required increases in pneumatic supply pressure and modifications that may be required to ensure a supply of control gas for the MSRVs over the longer ELAP interval. These two questions were asked during the audit process and the licensee stated that the analysis/evaluation has not yet been completed.</p>	<p>The NRC staff requests that the licensee demonstrate that the MSRVs will continue to operate as needed during the ELAP event, assuming that calculated drywell temperatures exceed the environmental qualification of the MSRVs for the duration of the event.</p>
<p>ISE CI 3.2.3.A</p>	<p>The licensee has not provided finalized calculations which support the primary strategy timeline by concluding that venting or other heat removal activities will not be required during the first eight hours of the event, maintaining a suppression pool temperature low enough to support continued RCIC [Reactor Core Isolation Cooling] operation for this time period.</p>	<p>Once the design of the system is finalized, the NRC staff requests that the licensee make available for audit any formal calculations that will be performed for the configuration.</p>

<p>ISE CI 3.2.4.2.A</p>	<p>The licensee did not provide details regarding the effects of loss of ventilation in the HPCI [high-pressure coolant injection] /RCIC pump rooms to conclude that the equipment in the HPCI/RCIC pump rooms would perform its function and assist in core cooling throughout all Phases of an ELAP. During the audit process, the licensee stated that preliminary analysis has been performed, but the calculations have not been finalized. Based on preliminary analysis, the RCIC room would reach 140 degrees at 32 hours. The electronic governor module (EGM) for RCIC could fail with temperatures at 150 degrees Fahrenheit. RCIC has steam isolation at 165 degrees in the room or torus area. EOI [emergency operating instruction] Appendix 5C, Injection System Lineup RCIC, allows bypassing of the high temperature isolation using booted contacts in accordance with EOI Appendix 16K, Bypassing RCIC High Temperature Isolation. Core Spray room cooler strategy is being evaluated to aid in cooling of the Core Spray/RCIC room. A detailed summary of the analysis and/or technical evaluation performed to demonstrate the adequacy of the ventilation provided in the HPCI/RCIC pump rooms to support equipment operation throughout all phases of an ELAP is requested.</p>	<p>The NRC staff requests the licensee clarify the timeline during which RCIC is relied upon and when it is not needed. Additionally, the NRC staff requests the licensee make available for audit the reactor building temperature calculation, MDQ0009992014000291, and also clearly identify any actions to address personnel habitability or room cooling.</p>
<p>ISE CI 3.2.4.6.B</p>	<p>RCIC Room Habitability and RHR/CS Room Habitability</p>	<p>The NRC staff requests the licensee make available for audit the reactor building temperature calculation, MDQ0009992014000291. The resolution of this item is related to the successful closure of ISE CI 3.2.4.2.A.</p>
<p>ISE CI 3.2.4.10.A</p>	<p>The Integrated Plan lacked information regarding battery availability, and lack of availability to review the battery load shed analysis, there is insufficient information presented in the integrated plan to conclude that the requirements of NEI 12-06, Section 3.2.2, consideration 6, regarding load reduction to conserve dc power will be implemented. During the audit process, the licensee provided a listing of the loads that would be part of the initial load shed that extended the battery availability to twelve hours. The licensee also stated that the shedding of these loads was determined to have no detrimental effects on unit safety and that the described load shedding would be included in a future revision to 0-AOI-57-1A, Blackout Station Procedure.</p>	<p>The NRC staff requests the licensee make available for audit any documentation to support the basis for the minimum required voltage.</p>

<p>AQ 35</p>	<p>Page 54 of the Integrated Plan indicates that items such as hoses will be deployed to the refuel floor early in the ELAP event “to avoid having to access the refuel deck while the SFP is boiling.” Additionally, pages 70 and 71 of the Integrated Plan provide a discussion of how ventilation will be achieved to avoid overpressurization in the SFP area. However, no analysis or technical justification was provided to verify the adequacy of the ventilation and/or support the conclusion of habitability in the spent fuel pool area. Clarify whether any actions will be required in the SFP area and provide additional information relative to the ventilation and/or habitability analyses which provide the bases for concluding that the proposed strategies in this area will be successful as specified in NEI 12-06 Section 3.2.2 consideration 11.</p>	<p>The NRC staff requests the licensee make available for audit the calculation which supports the closure of this issue for review.</p>
<p>AQ 39</p>	<p>For RCIC room habitability in phases 1 and 2 and RHR/CS Room Habitability, page 66 of the Integrated Plan discusses the use of ice vests or other personnel protective measures implemented in accordance with Site Administrative and Safety Procedures and Processes. Several hours into an ELAP condition, the availability of ice vests may be questionable. Clarify what areas of the plant are anticipated to require personnel entry (including for the Alternate Phase 2 Strategy specified on page 29), what the anticipated habitability conditions will be in those environments at the anticipated time of personnel entry, and what personnel protection measures will be required to carry out those actions in high heat environments several hours into an ELAP.</p>	<p>The NRC staff requests the licensee make available for audit the calculation for the RCIC room for review.</p>
<p>AQ 52</p>	<p>Open Items 3.2.1.6.C and 3.2.1.6.D.  Provide a summary of the sizing calculation for the FLEX generators to show that they can supply the loads assumed in phases 2 and 3.</p>	<p>The NRC staff requests the licensee make available for audit the sizing calculation for the 4.16 kV FLEX generators that will be received from the National SAFER Response Center.</p>
<p>OIP OI #1</p>	<p>Flood and seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012, are not completed and therefore not assumed in this submittal. As the re-evaluations are completed, appropriate issues will be entered into the corrective action system and addressed</p>	<p>The NRC staff requests the licensee make available for audit the flood and seismic hazard re-evaluations.</p>
<p>OIP OI #7</p>	<p>Browns Ferry will take actions as necessary to assure RCIC can operate at elevated temperatures.</p>	<p>The NRC staff requests the licensee make available for audit the design of the hardened containment vent system, and the corresponding calculations and procedures.</p>



SFPI RAI #6	Please provide information indicating what will be the maximum expected ambient temperature in the room in which the associated transmitter (electronics package) will be located under BDB [beyond-design-basis] conditions in which there is no AC power available to run Heating Ventilation and Air Conditioning (HVAC) systems.	The NRC staff requests the licensee make available for audit calculation MDQ0009992014000291, "Temperature Response of the Reactor Building Following an Extended Loss of AC Power."
SE #4	Verification of phase rotation for FLEX DGs	The NRC staff requests the licensee make available for audit information on how it will verify phase rotation after connecting the DGs to the equipment.
SE #6	Final SAFER Playbook	The NRC staff requests the licensee make available for audit the Browns Ferry SAFER Response Plan after the document is finalized.
SE #7	Browns Ferry Nuclear Plant plans to diagnose ELAP and complete the load shed for the three units within one hour of the initiation of the event. Please provide validation that the timeframe that is required by the analysis is able to be completed by the operators.	The NRC staff requests the licensee make available for audit validation of the ability to enter ELAP and complete the ELAP load shed within 1 hour of the event.
SE #8	The staff walked down the lay down site of the 480v generators. Due to the non-fully protected structures around the lay down area, the staff requests that Browns Ferry Nuclear Plant provide justification that the 480v generator will be able to be positioned, connected and put into operation in the time required. This should include justification of the ability to clear debris that may be in the way, access to the hallway to connect to the cables, and the the voltage drop across the cables if a longer cable run was necessary would still be acceptable.	The NRC staff walked down the lay down site of the 480v generators. Due to the non-fully protected structures around the lay down area, the NRC staff requests the licensee make available for audit justification that the 480v generator will be able to be positioned, connected and placed into operation in the time required. The justification should include the ability to clear debris that may be in the way, access to the hallway to connect to the cables, and any impact of the voltage drop across the cables if a longer cable run was necessary.

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.

Sincerely,

**/RA/**

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

Docket Nos.: 50-259, 50-260, and 50-296

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