



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

November 2, 2015

Mr. Eric A. Larson
Site Vice President
FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
Mail Stop A-BV-SEB1
P.O. Box 4, Route 168
Shippingport, PA 15077

SUBJECT: BEAVER VALLEY POWER STATION, UNITS 1 AND 2 - REPORT FOR THE AUDIT REGARDING IMPLEMENTATION OF MITIGATING STRATEGIES AND RELIABLE SPENT FUEL POOL INSTRUMENTATION RELATED TO ORDERS EA-12-049 AND EA-12-051 (TAC NOS. MF0799, MF0800, MF0841 AND MF0842)

Dear Mr. Larson:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design-Basis External Events" and Order EA-12-051, "Issuance of 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 27, 2013 (ADAMS Accession No. ML13064A243), FirstEnergy Nuclear Operating Company (FENOC, the licensee), submitted its OIP for Beaver Valley Power Station (BVPS), Units 1 and 2, in response to Order EA-12-049. By letters dated August 26, 2013, February 27, 2014, August 28, 2014, February 26, 2015 and August 27, 2015 (ADAMS Accession Nos. ML13238A260, ML14058A666, ML14240A285, ML15057A398 and ML15239A290, respectively), FENOC submitted its first five 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 BVPS interim staff evaluation (ISE) (ADAMS Accession No. ML13364A168) and continues with in-office and onsite portions of this audit.

By letter dated February 27, 2013 (ADAMS Accession No. ML13059A495), the licensee submitted its OIP for BVPS, in response to Order EA-12-051. By letter dated June 25, 2013 (ADAMS Accession No. ML13172A179), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated July 18, 2013, August 26, 2013, February 27, 2014, August 28, 2014, February 26, 2015 and August 18, 2015 (ADAMS Accession Nos. ML13200A122, ML13238A259, ML14058A665, ML14240A230, ML15057A396 and

ML15230A202, respectively), the licensee submitted its RAI responses and first five six-month updates to the OIP. The NRC staff's review to date led to the issuance of the BVPS ISE and RAI dated November 19, 2013 (ADAMS Accession No. ML13297A233). 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 audits allow 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 licensee's OIPs, as supplemented, the NRC staff conducted an onsite audit at BVPS from July 20 - 23, 2015, per the audit plan dated June 9, 2015 (ADAMS Accession No. ML15152A218). 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 discussions, 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.

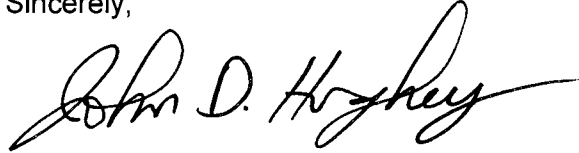
The enclosed audit report provides a summary of the activities for the onsite audit portion. Additionally, this report contains an attachment listing all open audit items currently under NRC staff review.

E. Larson

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If you have any questions, please contact me at 301-415-3204 or by e-mail at John.Hughey@nrc.gov.

Sincerely,

A handwritten signature in black ink that reads "John D. Hughey". The signature is written in a cursive style with a long, sweeping underline that extends to the right.

John D. Hughey, Project Manager
Orders Management Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Docket Nos.: 50-334 and 50-412

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
FIRSTENERGY NUCLEAR OPERATING COMPANY
BEAVER VALLEY POWER STATION, UNITS 1 AND 2
DOCKET NOS. 50-334 AND 50-412

BACKGROUND AND AUDIT BASIS

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design-Basis External Events" and Order EA-12-051, "Issuance of 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 27, 2013 (ADAMS Accession No. ML13064A243), FirstEnergy Nuclear Operating Company (FENOC, the licensee), submitted its OIP for Beaver Valley Power Station (BVPS), Units 1 and 2, in response to Order EA-12-049. By letters dated August 26, 2013, February 27, 2014, August 28, 2014, February 26, 2015 and August 27, 2015 (ADAMS Accession Nos. ML13238A260, ML14058A666, ML14240A285, ML15057A398 and ML15239A290, respectively), FENOC submitted its first five 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 BVPS interim staff evaluation (ISE) (ADAMS Accession No. ML13364A168) and continues with in-office and onsite portions of this audit.

By letter dated February 27, 2013 (ADAMS Accession No. ML13059A495), the licensee submitted its OIP for BVPS, in response to Order EA-12-051. By letter dated June 25, 2013, (ADAMS Accession No. ML13172A179), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated July 18, 2013, August 26, 2013, February 27, 2014, August 28, 2014, February 26, 2015 and August 18, 2015 (ADAMS Accession Nos. ML13200A122, ML13238A259, ML14058A665, ML14240A230, ML15057A396 and ML15230A202, respectively), the licensee submitted its RAI responses and first five six-month updates to the OIP. The NRC staff's review to date led to the issuance of the BVPS ISE and RAI dated November 19, 2013 (ADAMS Accession No. ML13297A233). 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 audits allow 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 BVPS from July 20 - 23, 2015, per the audit plan dated June 9, 2015 (ADAMS Accession No. ML15152A218). 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 audit's onsite portion is intended to occur prior to declarations of compliance for the first unit at each site.

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 BVPS facility from July 20, 2015, through July 23, 2015. The NRC audit team staff was as follows:

Title	Team Member	Organization
Team Lead/Project Manager	John Hughey	NRR/JLD
Technical Support – Electrical	Matthew McConnell	NRR/JLD
Technical Support – Reactor Systems	Reed Anzalone	NRR/DSS
Technical Support – Balance of Plant	Garry Armstrong	NRR/JLD
Technical Support – Containment / Ventilation	Bruce Heida	NRR/JLD
Technical Support – SFPI	Duc Nguyen	NRR/JLD
NRC Contractor Support	John Bowen	Mega-Tech
Observer	Christopher Cahill	Region I/SRA

The NRC staff executed the onsite portion of the audit per the three part approach discussed in the June 9, 2015, 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 (July 20, 2015)

At the onsite 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 presented a review of 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 were the design and location of the storage facilities for the FLEX equipment, the interface with the National SAFER [Strategic Alliance for FLEX Emergency Response] Response Centers (NSRCs), and the SFPI modification.

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

The NRC staff met with licensee staff to discuss the amount of leakage from the reactor coolant pump (RCP) seals and the timing of the injection of borated water into the reactor coolant system (RCS), and the availability of water sources. The NRC staff reviewed the analyses and flow calculations along with applicable procedures including the plant parameters that will be monitored to indicate the potential for reactor core damage. The NRC staff also walked down the licensee's strategies and reviewed plant procedures for implementing the core cooling and makeup strategies. The NRC staff also reviewed BVPS modeling of an extended loss of alternating current power (ELAP) event and its ability to mitigate the event, including the computer code used for the ELAP analysis and input parameters assumed to generate the results of the analysis. Following discussions with the NRC staff during the audit, the licensee intends to revise its mitigating strategy to rely on a limited secondary depressurization to control RCS pressure in a range sufficient to avoid undesired accumulator injection. See Attachment 3 to this report for the associated open audit items.

3.2 Electrical Technical Discussions and Walk-Downs

The NRC staff reviewed the calculations regarding battery life, FLEX generator sizing and walked down the procedures for electrical load shedding. The NRC staff also walked down the diesel-driven auxiliary feedwater pump room, battery rooms and control room envelope to evaluate strategies for hydrogen control and temperature control due to heat generating electrical equipment. The NRC staff reviewed the isolation and interactions of electrical power sources regarding the protection of class 1E equipment from faults in portable FLEX equipment and the design elements that ensure multiple electrical sources do not attempt to simultaneously power electrical buses. The NRC staff also walked down panels used for load shedding to evaluate feasibility and timing. Lastly, the NRC staff conducted a walk-through of portable FLEX diesel generator procedures, to include power pathways, areas where manual actions are required, and electrical isolation. Attachment 3 to this report lists open audit items associated with the completion of electrical analyses to verify the capacity and capability of the FLEX turbine generators, as well as sizing calculations for the dc [direct current] batteries. Heat up analyses related to the survivability electrical equipment in various rooms also remains to be completed.

3.3 SFPI Technical Discussions and Walk-Downs

The NRC staff walked down instrument, transmitter, electronics, and display locations for the SFP level instrumentation, along with the associated cable runs. In addition, the NRC staff noted that the licensee had completed design calculations and drawings detailing the installation of the SFPI components, as well as the associated calibration, maintenance and test procedures.

3.4 FLEX Equipment Storage Configuration Discussion Areas and Walk-Downs

The BVPS FLEX storage configuration includes a FLEX Storage Building (FSB) that is located outside the site protected area and hardened against all applicable BDBEE hazards. During the onsite audit the licensee identified that the FSB will store N sets of FLEX equipment. After the onsite audit, the BVPS fifth six-month FLEX implementation status update dated August 27, 2015 (ADAMS Accession No. ML15239A290), identified that the FLEX RCS boration pumps will be stored in the BVPS-1 and BVPS-2 auxiliary buildings. The +1 set of FLEX equipment will be stored in an existing onsite commercial warehouse. The commercial warehouse will not protect the stored FLEX equipment from all BDBEE hazards.

In NEI 12-06, Rev. 0, Section 11.3.3 states the following:

FLEX mitigation equipment should be stored in a location or locations informed by evaluations performed per Sections 5 through 9 such that no one external event can reasonably fail the site FLEX capability (N).

In NEI 12-06, Rev. 0, Section 10.1, "Aggregation of FLEX Strategies," includes the following:

Provision of at least N+1 sets of portable on-site equipment stored in diverse locations or in structures designed to reasonably protect from applicable BDBEEs is essential to provide reasonable assurance that N sets of FLEX equipment will remain deployable to assure success of the FLEX strategies.

Per the guidance above, it is essential to reasonably protect N+1 sets of FLEX equipment from all applicable BDBEEs to reasonably assure that N sets (FLEX capability, per section 11.3.3) will remain deployable after the BDBEE.

The BVPS commercial warehouse does not protect the +1 set of FLEX equipment from all BDBEE hazards. Therefore, the BVPS FLEX equipment storage configuration does not meet the guidance contained in NEI 12-06, Rev. 0, Section 10.1, in that it only affords reasonable protection from all applicable BDBEEs for N sets of FLEX equipment, not N+1 sets, as stipulated in the NEI guidance, as described above.

The NRC staff further identified that the BVPS FLEX storage configuration would not support the maintenance and testing provisions contained in Section 11.5.3 of NEI 12-06, Rev. 0. Specifically, section 11.5.3.b states:

Portable equipment may be unavailable for 90 days provided that the site FLEX capability (N) is available.

Should an item of FLEX equipment be made unavailable in the FSB or the BVPS auxiliary buildings, the site FLEX capability (N) would no longer be available to mitigate all BDBEE hazards. The corresponding +1 item of FLEX equipment is not considered to be reasonably protected, and therefore, is not reasonably assured to be available or remain deployable to assure success of the FLEX strategies. The remaining available and deployable FLEX equipment, reasonably protected in the FSB and/or the BVPS auxiliary buildings, would be less than the site FLEX capability (N). Therefore, the BVPS FLEX equipment storage configuration would not meet the condition included in NEI 12-06, Rev. 0, Section 11.5.3.b (site Flex capability (N) is available) stipulated for the allowance of the 90-day portable equipment unavailability.

The NRC staff communicated to the licensee that the BVPS FLEX storage configuration is not consistent with guidance contained in NEI 12-06, Rev. 0. Further consideration of the BVPS FLEX storage configuration by the NRC staff would require that the licensee propose the configuration as an alternative to the guidance of NEI 12-06, Rev. 0, accompanied with appropriate justification. In addition, additional information is required from BVPS to confirm that the FLEX RCS boration pumps, stored in the BVPS-1 and BVPS-2 auxiliary buildings, will be protected from all applicable BDBEEs, including seismic interactions. See Attachment 3 to this report for the associated open audit items.

3.5 Other Technical Discussion Areas and Walk-Downs

- a. The NRC 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.
- b. The NRC staff Reviewed Revision 1 of the BVPS SAFER Response Plan. The response plan identified equipment staging areas, as well as off-site transportation methods and routes. Appendix 4b of the plan also included an Abnormal Conditions Checklist for consideration of impacts due to inclement weather relative to the logistics and transportation procedures.
- c. The NRC staff walked down the FLEX strategies for core cooling, RCS 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 NRC staff also identified that the licensee had performed hydraulic analyses to evaluate pump sizing and location relative to the water flow necessary to perform the associated functions.
- d. The NRC staff walked down the licensee's strategy for ventilating the control room envelope, battery room and auxiliary feedwater room to ensure equipment reliability and personnel habitability.
- e. The 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 staff noted that the licensee's controls for ensuring adequate fuel quality will be addressed in the BVPS FLEX maintenance and testing program.
- f. The NRC staff identified that the development of the FLEX maintenance and testing program is in progress. The licensee issued corrective action item CR-2015-09873 in the BVPS corrective action program to track development and completion of the FLEX maintenance and testing program to include consideration of shelf life and acceptance criteria, manufacture's recommendations and plant practices, as well as consideration of the Electric Power Research Institute preventative maintenance templates. The associated audit item was closed to BVPS corrective action item CR-2015-09873.
- g. The NRC staff confirmed that the licensee had performed deployment path and debris removal evaluations to address the site capability to deploy FLEX equipment to mitigate the applicable BDBEEs.

- h. The NRC staff reviewed documentation regarding the implementation of FLEX-related training for Licensed Operators (LO), Non-Licensed Operators (NLO), Emergency Response Organization personnel and Maintenance/Operations site management. The NLO Continuing training was scheduled on the BVPS 3-Year Continuing Training plan dated 7/30/2014. The licensee issued corrective action CR-2015-09882 in the BVPS corrective action program to track implementation of LO Continuing Training.

4.0 Exit Meeting (July 23, 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 June 9, 2015, 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 (SE) for both the Mitigation Strategies (MS) and SFPI orders. The five sources for the audit items referenced below are as follows:

- a. ISE Open Items (OIs) and Confirmatory Items (CIs)
- b. Audit Questions (AQs)
- c. Licensee-identified OIP OIs
- d. SFPI RAIs
- e. Additional 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 June 9, 2015, 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:

John Hughey	NRR/JLD/JOMB
Duc Nguyen	NRR/JLD/JERB
Matthew McConnell	NRR/JLD/JERB
Garry Armstrong	NRR/JLD/JCBB

Reed Anzalone	NRR/JLD/DSS
John Bowen	NRC Contractor
Bruce Heida	NRR/JLD/JCBB
Christopher Cahill	Region I/SRA

BVPS Staff:

R. Tim Green	Site Fukushima Manager
Mike Ressler	Design Engineering / Alternate Lead
Jim Blattner	Electrical Engineering Supervisor
Mike Unfried	Hydraulic Engineer
Robert Hayward	Mechanical Engineer
Ronald Schubert	Structural Engineer
David Hwang	BVPS SFPI Lead
Blasé Bartko	Operations Support
Jim Popp	Operations Procedures
Roy Price	Training
Fulton Schaffner	Emergency Response
Russ Knight	FLEX Project Manager
George Thomas	FLEX Modification Coordinator

Documents Reviewed

- BVPS Calculation BVPS-FSB-01, "FLEX Storage Building Liquefaction Analysis," Rev. 0, February 27, 2015.
- BVPS Calculation BVPS-FSB-02, "FLEX Storage Building Bearing Capacity & Settlement Calculation," Rev. 0, February 18, 2015.
- BVPS Calculation BVPS-FSB-04, "FLEX Storage Building Foundation Design Calculation," Rev. 0, March 4, 2015.
- BVPS Calculation BVPS-FSB-05, "FLEX Storage Building Superstructure Design Calculation," Rev. 0, March 25, 2015.
- BVPS Calculation BV012-CALC-003, "Liquefaction Analysis of the BVPS ISFSI [independent spent fuel storage installation] Site," Rev. 0, January 31, 2013.
- BVPS Calculation DSC-0349, "Spent Fuel Pool Level Instrumentation Equipment Mounting," Rev. 4.
- BVPS Calculation 12241-B-21, "Primary Auxiliary Building and Waste Handling Building Air Conditioning Loads and Air Flow Rates," Rev. 1.
- BVPS Calculation 10080-UR(B)-512, "Radiation Levels Following Spent Fuel Pool Drain Down and Environmental Dose to NEI 12-02 SFP Level Instrumentation," Rev. 0.
- BVPS Calculation 12241-B-8A, "Control Building Air Conditioning Loads Air Flow Rates," Rev. 4.
- BVPS Engineering Change Package (ECP) 15-0065, Rev. 0, DRAFT.
- BVPS ECP 13-0562-000, Rev. 0, DRAFT.
- BVPS ECP 13-0636-001, Rev. 2.
- BVPS ECP 11-0698-000, Rev. 2.
- BVPS ECP 11-0706-000, Rev. 6.
- BVPS Drawing No. RE-0001T, "480V One Line Diagram Sheet 12," Rev. 0.
- BVPS Drawing No. 10080-RE-1BC, "One Line Diagram Essential Bus Sheet 1," Rev. 10.
- BVPS Drawing No. 8700-RE-1GA, "Main One Line Diagram ERFS[Emergency Response Facility Substation] Transformer 3A & 3B," Rev. 9
- BVPS Drawing No. 11700-RE-1GB-8, "4160V One Line Diagram Emergency Response Facility Substation Unit No. 1," Rev. 10.
- BVPS Drawing No. 12241-RE-1AB-8, "One Line Diagram Standby Diesel 480V Substation 2-5," Rev. 9.
- BVPS Abnormal Operation Procedure 1/2OM-53C.4A.75.2, "Acts of Nature – Flood," Rev. 31, January 15, 2015.
- BVPS Procedure 1/2OM-53E.1.FSA-A2, "FLEX General Debris Removal, Misc. Equipment Deployment and Water Management," DRAFT.
- BVPS Procedure 1OM-53E.1.FSA-4, "FLEX Use of River Water for AFW [auxiliary feedwater]," Rev. 0, DRAFT.
- BVPS Procedure 1/2OM-53E.1.FSA-10, "ELAP Battery Management," Revision 0.
- BVPS Procedure 1/2OM-53E.1.FSA-11, "DC/UPS ELAP Load Shed," Revision 0.
- BVPS Procedure 1/2OM-53E.1.FSA-13, "Deploying FLEX 480VAC Generator," Revision 0.

- BVPS Procedure 1OM-53E.1.FSA-15, "PPDWST [Primary Plant Demineralized Water Storage Tank] Makeup From River Water Using FLEX Make Up Water Pump," Rev. 0, DRAFT.
- BVPS Procedure 1OM-53E.1.FSA-30, "Spent Fuel Pool Makeup From The Ohio River Using FLEX Make Up Pump (M/U & Spray)," Rev. 0, DRAFT.
- BVPS Procedure 1/2OM-53E.1.FSG-4, "ELAP DC Bus Load Shed/Management," Revision 0.
- BVPS Procedure 1/2OM-53E.1.FSG-5, "Initial Assessment and FLEX Equipment Staging," Revision 0.
- BVPS Procedure 1/2OM-53E.1.FSG-7, "Loss of Vital Instrumentation and Control Power," Revision 0.
- BVPS Procedure, "Calibration of Fuel Pool Level Instrumentation Loop 2LCP-20-L101A," Rev. 0.
- BVPS Procedure "Calibration of Fuel Pool Level Instrumentation Loop 2FNC-L101A, and 2LCP-20-L101B," Rev. 0.
- BVPS Procedure "Calibration of Fuel Pool Level Instrumentation Loop 2FCN-L101B," Rev. 0.
- BVPS Unit 1 Updated Final Safety Analysis Report (UFSAR), Section 2.6, "Soil Mechanics," Rev. 19.
- BVPS Unit 2 UFSAR, Section 2.5.4.8, "Liquefaction Potential and Dynamic Settlement," Rev. 19.
- NSRC-005, SAFER Response Plan for BVPS, Rev. 1, dated July 2, 2015.

**Beaver Valley Power Station
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	Verify resolution of the generic concern associated with the modeling of the timing and uniformity of the mixing of a liquid boric acid solution injected into the RCS under natural circulation conditions potentially involving two-phase flow	Licensee to submit revised FLEX mitigating strategy to rely on a limited secondary depressurization to control RCS pressure in a range sufficient to avoid undesired accumulator injection.
AQ 1-B	<p>In NEI 12-06, Section 5.3.2, Consideration 5, states: "A means to move the equipment should be provided that is also reasonably protected from the event."</p> <p>The licensee's plan for deployment of FLEX equipment does not provide reasonable assurance that the plan will comply with NEI 12-06 Section 5.3.2, Consideration 5, for deployment of FLEX equipment because the means to move the equipment that is also reasonably protected from the event is not identified. Although FENOC has listed debris removal equipment and pickup trucks that would be used for the FLEX strategies, they have not described how this equipment would be reasonably protected from the event.</p> <p>The licensee is requested to provide details regarding how this equipment would be reasonably protected from the event to demonstrate conformance to NEI 12-06, Section 5.3.1, Consideration 5</p>	Licensee to submit alternative to the guidance of NEI 12-06, Rev. 0, for the BVPS FLEX equipment storage configuration accompanied with appropriate justification. In addition, additional information is required from BVPS to confirm that the FLEX RCS boration pumps, stored in the BVPS-1 and BVPS-2 auxiliary buildings, will be protected from all applicable BDBEEs, including seismic interactions.

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AQ 30-B	<p>In NEI 12-06, Section 11.5, provides that "mitigation equipment should be initially tested or other reasonable means used to verify performance conforms to the limiting requirements."</p> <p>By using load shedding, it appears that the licensee is expecting the batteries to be available for more than 20 hours after the ELAP event. The licensee is requested to address the following with regard to the load shedding of the dc bus in order to conserve battery capacity: Provide the following: a). A dc load profile with the required loads for the mitigation strategies to maintain core cooling, containment, and spent fuel pool cooling; b) A detailed discussion on the loads that will be shed from the dc bus, the equipment location (or location where the required action needs to be taken), and the required operator actions necessary and the time to complete each action. In your response, explain which functions are lost as a result of shedding each load and discuss any impact on defense-in-depth strategies and redundancy.</p>	<p>Licensee to provide dc sizing calculations that show that the batteries have sufficient capacity to cope for 17 hours. Include the basis for the minimum dc bus voltage that is required to ensure proper operation of all required electrical equipment.</p>
AQ 34-B	<p>Operator Actions: Attachment 1A, SOE [sequence of events] Timeline on pages 81-84 of the OIP lists the operator actions and associated completion times to mitigate the consequences of ELAP.</p> <p>The licensee is requested to discuss how the plant specific guidance, mitigation strategies and the associated administrative controls and training program will be developed and implemented to assure that the required operator actions are consistent with that</p>	<p>Licensee to provide final validation of SOE timeline.</p>

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	assumed in the ELAP analysis and can be reasonably achieved within the required completion times.	
AQ 38-B	Load reduction to conserve dc power: Provide a summary of the sizing calculation for the FLEX turbine generators to show that they can supply the loads assumed in phases 2 and 3.	Licensee to provide electrical analyses to verify the capacity and capability of the FLEX turbine generators.
AQ 40-B	On page 31 of 172 under "Mobile Boration Unit", the OIP states that "A mobile boration unit will be received from the RRC [Regional Response Center] to provide demineralized makeup to the PPDWST [Primary Plant Demineralized Water Storage Tank]." The rest of the terminology in this section indicates that the boration unit will be used to provide makeup to the Refueling Water Storage Tank. Please clarify the use of the boration unit in this section.	Licensee to submit alternative to the guidance of NEI 12-06, Rev. 0, for the assigned location for borated water to be stored during Phase 3.
AQ 43-B	The submittal does not address a method for isolating accumulators to prevent nitrogen injection into the RCS. Please discuss the analytical methodology (e.g., see Attachment 1 to PA-PSC-0965) and key assumptions (e.g., containment temperature / heat transfer to accumulator) for assessing the potential for nitrogen injection. Please further identify instrumentation operators would rely upon to ensure that nitrogen injection will not occur.	Licensee to submit revised FLEX mitigating strategy to rely on a limited secondary depressurization to control RCS pressure in a range sufficient to avoid undesired accumulator injection.
SE 12-E	The licensee needs to confirm that the temperature and pressures within containment, other areas within the plant (i.e., electrical switchgear rooms), and Atmospheric Dump Valve rooms will not exceed the qualification of electrical equipment that is being relied upon as part of their FLEX strategies. The licensee	Licensee to provide heat up analyses related to the survivability electrical equipment in various rooms.

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	needs to ensure that the qualification of the required electrical equipment remains bounding for the entire duration of the event (i.e., indefinitely).	
SE 16-E	Following discussion with the NRC staff during the audit, the licensee intends to revise its mitigating strategy to rely on a limited secondary depressurization to control RCS pressure in a range sufficient to avoid undesired accumulator injection. This aspect of the revised strategy would be similar in concept to the recommended strategy in the existing generic analysis performed for the Pressurized Water Reactor Owners Group in WCAP-17601-P. Once revisions to its FLEX procedures are completed, the licensee should (1) summarize the specifics of its revised FLEX procedures related to RCS cooldown, depressurization, and level / inventory maintenance, (2) provide a revised sequence of events that is consistent with the revised strategy, and (3) confirm that the RCS conditions for the revised strategy are consistent with the temperature and pressure history assumed in the SHIELD white paper.	Licensee to submit revised FLEX mitigating strategy to rely on a limited secondary depressurization to control RCS pressure in a range sufficient to avoid undesired accumulator injection.

E. Larson

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If you have any questions, please contact me at 301-415-3204 or by e-mail at John.Hughey@nrc.gov.

Sincerely,

/RA/

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Docket Nos.: 50-334 and 50-412

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