



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

February 18, 2015

Vice President, Operations  
Entergy Operations, Inc.  
River Bend Station  
5485 U.S. Highway 61N  
St. Francisville, LA 70775

**SUBJECT: RIVER BEND STATION, UNIT 1 - 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 NO. MF0952 AND MF0953)**

Dear Sir or Madam:

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. ML13066A738), Entergy Operations, Inc. (Entergy, the licensee) submitted its OIP for River Bend Station, Unit 1 (RBS) in response to Order EA-12-049. By letters dated August 28, 2013, February 26, 2014 and August 28, 2014 (ADAMS Accession Nos. ML13247A414, ML14064A202 and ML14253A210, respectively), the licensee 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 RBS interim staff evaluation (ISE) (ADAMS Accession No. ML13365A281) on February 25, 2014, and continues with in-office and onsite portions of this audit.

By letter dated February 28, 2013 (ADAMS Accession No. ML130660550), the licensee submitted its OIP for RBS in response to Order EA-12-051. By letter dated July 3, 2013 (ADAMS Accession No. ML13179A193), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated July 25, 2013, August 28, 2013, February 26, 2014 and August 28, 2014 (ADAMS Accession Nos. ML13217A092, ML13247A416, ML14064A263, and ML14253A209, respectively), the licensee submitted its RAI responses and first three six-month updates to the OIP. The NRC staff's review of these submittals led to the issuance of the RBS ISE and RAI dated November 25, 2013 (ADAMS Accession No. ML13316C065). 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.

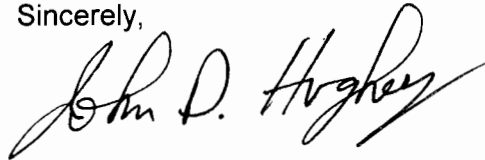
The ongoing audits allow the staff to review open and confirmatory items from the mitigation strategies ISE, RAI responses from the spent fuel pool instrumentation (SFPI) ISE, the licensee's integrated plans, and other audit questions. Additionally, the staff gains a better understanding of submitted 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 RBS from October 20 - 23, 2014, per the audit plan dated October 1, 2014 (ADAMS Accession No. ML14272A319). 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 onsite audit items currently under NRC staff review.

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

Sincerely,

A handwritten signature in black ink that reads "John D. Hughey". The signature is fluid and cursive, with the first letters of each word being capitalized and prominent.

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

Docket No. 50-458

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  
ENTERGY OPERATIONS, INC  
RIVER BEND STATION, UNIT NO. 1  
DOCKET NO. 50-458

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. ML13066A738), Entergy Operations, Inc. (Entergy, the licensee) submitted its OIP for River Bend Station, Unit 1 (RBS) in response to Order EA-12-049. By letters dated August 28, 2013, February 26, 2014 and August 28, 2014 (ADAMS Accession Nos. ML13247A414, ML14064A202 and ML14253A210, respectively), the licensee 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

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RBS interim staff evaluation (ISE) (ADAMS Accession No. ML13365A281) on February 25, 2014, and continues with in-office and onsite portions of this audit.

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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 RBS from October 20 - 23, 2014, per the audit plan dated October 1, 2014 (ADAMS Accession No. ML14272A319). 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 (MS) 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 RBS facility from October 20, 2014, through October 23, 2014. The NRC audit team staff was as follows:

<b>Title</b>	<b>Team Member</b>	<b>Organization</b>
Team Lead/Project Manager	John Hughey	NRR/JLD
Technical Support – Containment	Brian Lee	NRR/JLD
Technical Support – Electrical	Prem Sahay	NRR/JLD
Technical Support – Reactor Systems	Joshua Miller	NRR/JLD
Technical Support – Balance of Plant	Michael Levine	NRR/JLD
Technical Support – SFPI	Stephen Wyman	NRR/JLD

The NRC staff executed the onsite portion of the audit per the three part approach discussed in the October 1, 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 (October 20, 2014)

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 Strategic Alliance for FLEX Emergency Response (SAFER), 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

- a. NRC staff met with licensee staff and confirmed that the licensee had performed evaluations to demonstrate that the amount of leakage from the reactor core isolation cooling (RCIC) pump seals is acceptable. The licensee also determined that the operating temperatures that the RCIC pumps would be subjected to during the mitigation of an extended loss of alternating current (ac) power (ELAP) event were acceptable.
- b. NRC staff reviewed the licensee’s use of the Modular Accident Analysis Program (MAAP) and the licensee’s documentation stating that MAAP was utilized consistent with the guidelines contained in NEI 12-06.
- c. NRC staff discussed the licensee’s evaluations that determined that the collapsed reactor pressure vessel (RPV) level will remain above the Top of Active Fuel in the vessel and that the reactor coolant system (RCS) cool down rate is within technical specifications limits.
- d. NRC staff reviewed the licensee’s evaluation determining the adequacy of the compressed gas system used to support safety relief valve (SRV) operation as well as the acceptability of the stresses associated with passing liquid phase water through the SRV tail pipe.

#### 3.2 Balance of Plant Technical Discussions and Walk-Downs

- a. NRC staff walked down the deployment locations for FLEX diesel powered generators at outside locations and confirmed that air quality impacts to adjacent buildings from portable equipment exhaust were evaluated and addressed by the licensee.
- b. NRC staff confirmed the acceptability of the licensee’s calculations demonstrating that the standby service water (SSW) cooling tower will provide adequate heat removal capacity without cooling tower fans per the RBS coping strategy for maintaining core cooling during the transition phase (Phase 2).
- c. NRC staff reviewed the adequacy of the licensee’s calculations addressing portable FLEX equipment fuel consumption.

- d. NRC staff reviewed the appropriate procedures to confirm that the upper containment pool (UCP) siphon breakers are administratively controlled such that use of the UCP as a water source to mitigate the BDBEE is appropriate.
- e. NRC staff discussed the licensee's Phase 3 (use of off-site resources) strategy to supply makeup cooling water from the Mississippi River. Specifically, NRC staff expressed concern that no liquefaction analysis was performed for the primary haul path from the river. Subsequent to the onsite audit, the licensee provided additional information during the ongoing audit process. RBS justified not performing a liquefaction analysis based on the following: 1) multiple haul route options are available from the river, 2) access is not needed until 72 hours after the event, and 3) multiple types of protected FLEX heavy duty equipment will be available to clear an acceptable route from the river. Associated audit item AQ-62 is closed based on the additional information provided by the licensee.

### 3.3 Electrical Technical Discussions and Walk-Downs

- a. NRC staff discussed the key assumptions and conclusions of the direct current (dc) bus voltage calculations to confirm that the final minimum dc bus voltage was determined as part of the evaluation of an acceptable battery and dc loading profile for the ELAP event. However, during discussions with NRC staff, the licensee stated that the review identified a discrepancy in modeling an electrical load in the dc voltage drop calculation. Therefore, the dc voltage drop calculation is under further review by the RBS engineering staff. The licensee issued RBS Licensing Action Request (LAR) LR-LAR-2013-0131, CA 45 in the RBS Corrective Action Program (CAP) under which this discrepancy will be resolved. Associated confirmatory item CI 3.2.4.10.A has been closed to RBS action item LR-LAR-2013-0131, CA 45.
- b. NRC staff discussed the design-basis implications of the RBS coping strategy to cross-tie Class 1E Division I/II dc buses. Entergy has addressed a coping strategy to increase station battery coping time by momentarily cross-tying Class 1E Division I and Division II dc buses. The NRC staff determined that the momentary cross-tie will not result in catastrophic failure of the division II battery and it will continue to supply dc power to its loads with adequate capacity. In addition, since this action will only be implemented during an ELAP event and will be administratively controlled, there is no adverse safety implication regarding the design or licensing basis of the plant.
- c. NRC staff reviewed the summary, key assumptions and conclusion of the RBS electrical calculation G13.18.3.6-023, Rev. 0, and determined that Phase 2 and 3 portable FLEX generators have been adequately sized to power the required loads and that the rating of these generators bounds the loading requirements. The licensee also provided an RBS action tracking item AR 00183654 to address, evaluate and resolve a licensee identified unverified assumption regarding a maximum voltage dip of 30 percent at the FLEX generator output for the FLEX 1 Pump and the suppression pool cleanup (SPC) pump upon starting that will allow motor acceleration to full speed (Section 7.A1 of the RBS Calculation G13.18.3.6-023, Rev. 0).

- d. NRC staff discussed the conclusion, summary and results of the RBS battery load shedding, battery sizing and battery charger calculations. The NRC staff determined that the RBS station batteries and battery chargers will have adequate capacity and capability to support required loads during the ELAP event.
- e. NRC staff reviewed RBS calculations regarding the adequacy of the ventilation provided in the battery room to protect the batteries from the effects of extreme high and low temperatures. The NRC staff determined that the RBS proposed procedural actions reasonably ensure that the station batteries in the battery rooms will remain operational when ventilation in the battery rooms is lost during an ELAP event. NRC staff also concluded that there will be no adverse impact on the electrical equipment in the RCIC, Switchgear, and DC Equipment rooms due to higher temperature during an ELAP event.
- f. NRC staff reviewed RBS protection of station emergency diesel generators, station electrical switchgear and electrical components from damage per the guidance contained in NEI 12-06, Section 3.2.2, Consideration (13). The licensee provided additional information identifying that appropriate controls for this equipment will be implemented in procedures to ensure compliance with the guidance. In addition to administrative controls, physical protection is provided through the use of transfer switches when portable FLEX generators will be connected to existing permanent plant equipment by newly installed cabling. This provides protection and isolation for the normal power circuits for those components. New circuit breakers or circuit breaker disconnect switches are also included in the new installed power feeds required for FLEX. When cable is routed directly to repower components (typically as an alternate strategy) the output circuit breaker on the FLEX portable generator is credited for equipment protection. In addition, the licensee performed evaluations for correct breaker coordination and confirmed adequate protection of affected cables and equipment.

Class 1E equipment will be protected from fault on portable electrical equipment by two breakers in series, one safety related breaker from Class 1E MCC and other non-class breaker from swing bus. This configuration will maintain electrical isolation between Class 1E installed equipment and portable FLEX electrical equipment. The licensee staff stated that procedure RBS-FSG-013, "Transition from FLEX Equipment," will control transition from installed sources to portable sources (and vice versa). This procedure is in draft form and is pending approval.

- g. NRC staff reviewed Attachment T of the RBS approved calculation G13.18.3.6\*21, Rev. 1, "DC System Analysis, methodology & Scenario Development," and confirmed that it provides an appropriate tabulation and assessment of the impact of loss of power for the loads which are shed for the deep load shedding strategy.
- h. NRC staff reviewed equipment instrumentation, as it relates to the licensee's OIP and determined that the licensee has shown that the installed plant instrumentation that will be relied upon as part of the RBS mitigation strategy for an ELAP event as a result of a BDBEE is adequately designed and/or qualified.



- i. NRC staff reviewed equipment instrumentation, as it relates to the licensee's OIP and determined that the licensee has shown that the installed plant instrumentation that will be relied upon as part of the RBS mitigation strategy for an ELAP event as a result of a BDBEE are adequately designed and/or qualified.

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

- a. NRC staff walked down the location of the SFPI level sensors in the northeast and southeast corners of the SFP and observed that cable routing separation was maintained. NRC staff also reviewed calculation G13.18.9.4\*022, Rev. 2, to confirm that dose rates and total integrated dose in the areas for the installed SFPI equipment were acceptable.
- b. NRC staff reviewed RBS calculation G13.18.12.4-038, Rev. 0, to confirm that the SFPI sensor electronics are capable of continuously performing their required functions under the temperatures expected during ELAP conditions when no ac power is available.
- c. During the onsite walkdown of the SFPI installation, NRC staff confirmed the adequacy of the access time to the indicators located at the 98-foot elevation of the control building, two flights of stairs below the control room. The access time was less than 5 minutes.
- d. NRC staff confirmed that the licensee's maintenance and testing procedures for SFPI components will reference the Mohr vendor documentation. The licensee provided RBS Licensing Action Request item LR-LAR-2013-0131, CA 44, to track completion of the SFPI maintenance and testing procedures. Associated audit item SFPI RAI 17 has been closed to this RBS Action Tracking Item.
- e. NRC staff confirmed Electro Magnetic Compatibility compliance during the onsite SFPI walkdown.

#### 3.5 Core and Containment Cooling Strategy and Alternative Discussions and Walk-Downs

During the RBS onsite audit NRC staff discussed the licensee's proposed strategy to provide containment and core cooling. The strategy utilized the single-train, installed SPC system, with two parallel pumps connected to a common discharge header, a single heat exchanger and 1 RPV injection point. The licensee identified the use of the installed SPC pumps, rather than portable FLEX pumps, as an alternative to the guidance in NEI 12-06 Section 3.2.2, but the licensee considers the remainder of the strategy to be consistent with NEI 12-06 guidance.

During the onsite audit, the NRC staff described the following concerns with the conformance of the RBS strategy to the guidance in NEI 12-06:

- The lack of diverse RPV injection points.
- The lack of primary and alternate connection points (i.e. parallel SPC pumps that connect to a common discharge header and piping).

- The lack of diverse cooling trains.
- The reliance on only 1 cooling source (i.e. SPC heat exchanger).

One objective of the NEI 12-06 guidance is to ensure that diverse means are available to provide injection to the RPV and accomplish core cooling. NEI 12-06 specifies the use of separate divisions and trains to ensure that the injection/cooling flowpaths are independent and, therefore, capable of providing diverse means. However, the proposed strategy appears to use large amounts of common piping and active components (e.g., valves). This approach lacks the diversity intended in NEI 12-06 as it introduces a number of single-point vulnerabilities for RPV injection, particularly if these valves are required to change state to initiate the function. The proposed path also uses a common heat exchanger. While this by itself is not specifically prohibited or addressed in the guidance for containment cooling (NEI 12-06, Table C-2, page C4), it is not clear whether failure of the cooling function would result in common-mode failure of the RPV injection (e.g., due to loss of NPSH of the SPC pumps).

Through the continuing audit process, RBS communicated that an additional RPV injection point was added via the RHR-B piping. However, this alternate injection point is accomplished with a cross-tie from the original injection path, RHR-C. Thus, the same, single cooling source (SPC heat exchanger) and common piping/valves are still relied upon for all proposed methods of RPV injection. The guidance in NEI 12-06, page 24, includes the following:

Unlike 50.54(hh)(2), the intention of this guidance is to have permanent, installed connection points for portable fluid and electrical equipment. The portable fluid connections for core and SFP cooling functions are expected to have a primary and an alternate connection or delivery point (e.g., the primary means to put water into the SFP may be to run a hose over the edge of the pool).

and,

At a minimum, the primary connection point should be an installed connection suitable for both the on-site and off-site equipment.

The NRC staff considers that a common SPC heat exchanger in the flowpath for both the primary and alternate connection and points does not satisfy the guidance for separate divisions/trains. Therefore, the NRC staff views the entire RBS strategy to be an alternative to the NEI guidance. In order for the staff to find an alternative approach acceptable, the approach must provide sufficient diversity for RPV injection. Associated audit item OIP-13 will remain open pending resolution of this issue.

### 3.6 FLEX Equipment Storage Configuration Discussions and Walk-Downs

The RBS FLEX storage configuration consists of 2 FLEX storage buildings designed according to ASCE 7-10 seismic and high wind requirements that are adequately separated to provide reasonable protection from tornados and tornado missiles. In addition, the FLEX-1 pump is pre-staged in the G-tunnel that is robust against tornado winds/missiles. This configuration conforms to the guidance contained in NEI 12-06, Section 7.3.1.1.c. The FLEX buildings are

also designed to protect FLEX equipment from extreme cold and high temperatures with the provision to utilize local block heaters or other devices such that heating of the entire building may not be necessary. Additionally, the buildings are located above the site flood elevation.

NEI 12-06, 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).

NEI 12-06, 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. RBS is a single unit site and must reasonably protect 2 sets (N+1) of FLEX equipment to conform to the guidance.

One FLEX storage building will contain a complete set of FLEX equipment including a portable diesel driven pump (FLEX-2 pump). The other FLEX storage building will contain a second set of FLEX equipment including a portable diesel generator that will be deployed to power the FLEX-1 pump, which is pre-staged in the G-tunnel. Therefore, the complete RBS FLEX storage configuration relies on both of the FLEX storage buildings and the G-tunnel to provide reasonable protection for both sets of N FLEX equipment.

The G-tunnel is a structure that is protected from tornado winds/missiles, extreme high and low temperatures, external flooding and direct seismic effects. However, per audit item OIP-11, the licensee identified that the G-tunnel is susceptible to seismic induced flooding from ruptured piping that could impact the pre-staged FLEX-1 pump. The NRC staff identified that the potential for the FLEX-1 pump to be impacted by the seismic BDBEE indicated that the RBS FLEX storage configuration does not reasonably protect N+1 sets of FLEX equipment from all applicable BDBEEs as stipulated in NEI 12-06, Section 10.1.

The NRC staff further identified that the RBS FLEX storage configuration would not support the maintenance and testing provisions contained in Section 11.5.3 of NEI 12-06. 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 the FLEX-2 pump be unavailable, the site FLEX capability (N) would no longer be available to mitigate a seismic BDBEE because the corresponding FLEX-1 pump is not considered to be reasonably protected against the seismic hazard due to seismic-induced flooding. Therefore, the RBS FLEX equipment storage configuration would not meet the

condition included in NEI 12-06, Section 11.5.3.b (site Flex capability (N) is available) stipulated for the allowance of the 90-day portable equipment unavailability.

NRC staff communicated to the licensee that the RBS FLEX storage configuration is not consistent with guidance contained in NEI 12-06, should the FLEX-1 pump be susceptible to seismic induced flooding in the G-tunnel. The NRC staff is reviewing additional information provided by the licensee in the ongoing audit process. Associated audit item OIP-11 will remain open pending resolution of this issue.

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

- a. NRC staff discussed the procedure revisions and administrative controls required and implemented to address portable lighting needs during ELAP conditions. The license stated that RBS will proceduralize the implementation of portable lighting to define the credited portable lights and where they will be deployed. RBS is tracking completion of these actions in the RBS CAP under action item WTRBS-2014-00262, CA 23. The procurement of FLEX lighting is tracked under action item WTRBS-2014-00262, CA 22.

The licensee discussed the use of four trailer-towed FLEX lighting towers powered by diesel generators to provide large area lighting. These FLEX lights will illuminate along the north side of the plant and will broadly cover the major staging areas in and around the east and west canyons as well as the diesel building to support fuel refueling operations. The licensee also discussed plans to paint staging area markings to ease location and deployment following the BDBEE and to prevent the placement of other materials in these areas. In addition, RBS will store and maintain 28 Pelican model 9480 portable battery operated lights in the in the FLEX storage buildings. Each Pelican light provides up to 28 hours of lighting and is rechargeable. The licensee stated that personal lighting will be added to the control room FLEX lockers, Operations Support Center, Technical Support Center FLEX lockers and dedicated FLEX job boxes. Personal lighting will be controlled under the maintenance program.

- b. NRC staff discussed the licensee's implementation status of the RBS communication assessment reviewed in NRC safety evaluation (SE) dated May 24, 2013 (ADAMS Accession No. ML13130A068). The associated flex support guideline (FSG), RBS-FSG-101, is in draft form and the communications equipment is in the process of being purchased and staged. These activities are being tracked to completion in the RBS CAP under action item WTRBS-2014-00262, CA 24.
- c. NRC staff discussed the compatibility of portable FLEX equipment with onsite ambient temperatures. RBS site specification 215.200 stipulates ambient air temperature extremes of 2°F to 110°F. RBS Nuclear Change EN-DC-115, Rev. 16, stipulates that procured FLEX equipment to be staged in outside areas will operate between 0°F and 115°F. Therefore, the FLEX equipment will be capable of operating at the RBS site extreme temperatures.
- d. The NRC staff confirmed that licensee is implementing appropriate procedures and strategies to deploy FLEX equipment and access security doors and gates during ELAP conditions.

- e. NRC staff reviewed draft procedures that contain contingency plans and direction to address mitigating strategies in shutdown and refueling modes as described in the NEI position paper dated September 18, 2013 (ADAMS Accession No. ML132273A514). The licensee has established corrective action items LR-LAR-2013-00131, CA 36, 37 and 38, to track final completion of associated procedures AOP-0065, Section 5.2, OSP-0037, Section 4.1.8 and RBS-FSG-003, Attachment 3.
- f. NRC staff reviewed the method for providing makeup to the RBS ultimate heat sink (UHS) as described on page 25 of 60 of the RBS OIP. Entergy is in the process of establishing a "Cooperative Endeavor Agreement" with a vendor (Rain for Rent) to provide 20,000 gallons per hour of makeup water to the UHS (i.e. standby cooling tower basin.) Corrective action items LR-LAR-2013-0013, CA 42 and No. 43 were issued to ensure completion of the contract agreement now in process and to add an administrative control to ensure that a contract with a vendor will continue to remain in place.
- g. NRC staff confirmed that the draft FLEX program document contains initial acceptance testing and subsequent preventative maintenance (PM) and testing for FLEX equipment. FLEX equipment is to be maintained under the site's PM program and testing and maintenance procedures will be based on the Electric Power Research Institute (EPRI) FLEX equipment templates.
- h. NRC staff reviewed the current draft of the RBS SAFER Response Plan and determined that it follows the AREVA generic format and content. Additional information, specific to RBS information will be added and completion of the plan will be tracked by corrective action LR-LAR-2013-00131, CA 41.
- i. NRC staff reviewed the draft FIP and draft FLEX program plan. The final versions to document evaluations, procedures and modifications are in progress. Corrective Action LR-LAR-2013-00131 CA 46 was issued to track completion of final versions of FLEX Program Procedure and Plan.
- j. NRC staff reviewed the RBS FLEX training activities. Institute of Nuclear Power Operations general FLEX computer based training has been completed for all site personnel as well as advanced FLEX training for Emergency Response Organization decision makers. In addition, initial FSG training has been completed for the operating crews, including incorporation into simulator training and emergency operations training. Periodic, continuing training and associated training plans are being developed as well as job task-specific training for operation and deployment of the FLEX equipment. Future completion of these actions is tracked in the RBS corrective action program under Condition Report No. RBS 201302865, Action Items, 26, 28, 33, 37, 38, 39, 40 and 41.
- k. NRC staff reviewed draft PM basis templates for various FLEX equipment. The draft FLEX Program Document references the guidance in NEI 12-06 and the EPRI PM templates. Development of the FLEX PM and Testing documents continues and RBS corrective action LR-LAR-2013-00131, CA 38, has been issued to track their completion.

- I. NRC staff discussed the effectiveness of the licensee's strategy to swap RCIC suction from the suppression pool (SP) to the UCP under ELAP conditions. Currently the licensee plans to enter primary containment during the event. Additional information is needed to justify that containment integrity will be maintained and that appropriate personnel protection will be ensured at the time of the containment entry. Associated audit item SE #3 remains open pending NRC staff review of additional information provided by the licensee under the ongoing audit process.

#### 4.0 Exit Meeting (October 24, 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 following open items were discussed at the exit meeting (see Attachment 3 for additional information):

- a. The NRC staff discussed the RBS proposed strategy and alternate method to provide RPV injection and containment and core cooling using the single cooling train SPC system as described in Section 3.5 above. The NRC staff communicated its concern regarding the proposed strategy to accomplish core heat removal and maintain containment integrity with a single cooling flowpath as opposed to primary and alternate flowpaths in separate divisions/trains as stipulated in NEI 12-06. The NRC staff is reviewing additional information provided by the licensee in the ongoing audit process. Associated audit item OIP-13 will remain open pending resolution of this issue.
- b. The NRC staff discussed the susceptibility of the pre-staged FLEX-1 pump to seismic induced flooding in the G-tunnel as described in section 3.6 above. The NRC staff communicated its concern that that the potential for the FLEX-1 pump to be impacted by the seismic BDBEE indicated that the RBS FLEX storage configuration does not reasonably protect N+1 sets of FLEX equipment from all applicable BDBEEs as stipulated in NEI 12-06, Rev. 0, Section 10.1. The NRC staff is reviewing additional information provided by the licensee in the ongoing audit process. Associated audit item OIP-11 will remain open pending resolution of this issue.

#### CONCLUSION

The NRC staff completed all three parts of the October 1, 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 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 October 1, 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:

John Hughey	NRR/JLD/JOMB
Brian Lee	NRR/JLD/JCBB
Prem Sahay	NRR/JLD/JERB

Michael Levine	NRR/JLD/JCBB
Joshua Miller	NRR/JLD/JERB
Stephen Wyman	NRR/JLD/JERB

### RBS Staff:

Joey Clark	Manager – Regulatory Assurance
Chuck Miller	Manager – Site Projects & Maintenance Services
Faleisha Corley	Manager – Design Engineering
Ron Findish	Sr. Engineer
Donavan Baker	Sr. Engineer
Jordan Carter	Engineer I
George Mermigas	Sr. Engineer
Chuck Blackledge	Supervisor - Modifications
Eve Clevenger	Sr. Engineer
Rob Barrios	Engineer II
Norman Tison	Sr. Emergency Planner
Tim Venable	Sr. Staff Operations Instructor
Danny Williamson	Sr. Licensing Specialist
Curtis Plumlee	Absolute Consulting, Project Manager
Jeff Throm	Sargent & Lundy, Asst. Project Manager
Lucas Hoyt	Sargent & Lundy, ERO logistics
Gary Smith	Enercon, FLEX conceptual design
Mike Pope	Enercon, responsible engineer
Dykes Cupstid	TLD Group, LLC FLEX corporate lead
John Patterson	Footbridge, ERO logistics
Dave Stallings	Absolute Consulting, EP communications



## Documents Reviewed

- Calculation G13.18.2.6-192, Rev. 1, Determine Number of Air Cylinders Required to Support FLEX Phase 2 Strategy for Operation of SRVs and SP Level Instrumentation
- Calculation G13.18.3.6\*021 Rev. 1, DC System Analysis, Methodology and Scenario Development
- Calculation G13.18.9.4\*022, Rev. 2, Environmental Design Criteria (EDC) Radiation Zone Dose Rates and Doses (Normal, Abnormal, and Accident)
- Calculation G13.18.3.6-023, Rev. 0, Portable Diesel Generator System Sizing
- Calculation G13.18.12.4-038, Rev. 0, River Bend Station Standby Switchgear Rooms: A, B, and C Heat up for Extended Loss of AC Power
- Calculation E-143, Rev 11, Standby Battery “ENB-BAT01A” Duty Cycle, Current Profile and Size Verification
- Calculation E-144, Rev. 7, ENB-BAT01B Duty Cycle, Current Profile and Size Verification
- SAFER Response Plan for River Bend Station (Draft)
- Final Integrated Plan for River Bend Station (Draft)
- FLEX Program Plan for River Bend Station (Draft)
- Procedure EOP-0005, Rev. 311, Emergency Operations and Severe Accident Management Procedures Enclosures
- Procedure AOP- 0050, Rev. 47, Station Blackout
- Procedure RBS-FSG-003 (Draft), Alternate Reactor Vessel Cooling
- Procedure RBS-FSG-004, Rev. 0, ELAP DC Bus Load Shed and Management, Attachment 3
- Procedure SPI-06, Rev. 58, Alarm Station Supervisor
- Procedure RBS-FSG-013 (Draft), “Transition from FLEX Equipment’
- Procedure AOP-0065 (Draft), Alternate Reactor Vessel Cooling (draft)
- Procedure OSP-0037, Rev. 28, Shutdown Operations Protection Plan (SOPP)
- Procedure OSP-0066, Rev. 22, Extensive Damage Mitigation Procedure

**River Bend  
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>
OIP-11	The need for evaluation of the seismic robustness of non-safety related class 4 piping located in RBS piping tunnels utilized in the FLEX strategy is identified on pages 20 and 21 of the OIP. The completed evaluation has confirmed that there are a number of pipe lines in the tunnels, including sections that are not considered seismically robust. The evaluation also identified that these piping sections can be isolated by closing five individual valves if the ELAP is initiated by a seismic event. RBS FLEX procedures will include directions to isolate the valves following a seismic event.	The NRC staff is reviewing additional information provided by the licensee in the ongoing audit process. Associated audit item OIP-11 will remain open pending resolution of this issue. Additional information is provided in Section 3.6, of this audit report.

<b>Audit Item Reference</b>	<b>Item Description</b>	<b>Licensee Input Needed</b>
OIP-13	<p>While the following is not a change in the compliance strategy described in the OIP, it is a clarification with regard to the RBS FLEX strategy and the guidance of NEI 12-06. NEI 12-06 Section 3.2.2, Consideration 13 states that regardless of installed coping capability, all plants will include the ability to use portable pumps to provide RPV/RCS/SG makeup as a means to provide a diverse capability beyond installed equipment. The RBS FLEX strategy does not include this capability, and thus, the crediting of installed SPC pumps for the RBS FLEX Phase 2 strategy is an alternative method for satisfying the NEI 12-06 guidance. The use of the installed SPC pumps to provide RPV makeup is an acceptable alternative to a portable FLEX pump for the transitional phase of FLEX. The guidance states that the ELAP response is to be addressed with a combination of three categories of equipment: installed plant capability, portable on-site equipment, and off-site equipment resources. Only one phase of the response is limited to utilizing equipment from just one of the equipment categories. To ensure that there is enough time to deploy and implement portable equipment, Phase 1 can only use installed plant equipment. Even though Phase 2 and Phase 3 will utilize portable equipment (onsite for Phase 2 and offsite from RRC for Phase 3), there is no prohibition against the use of permanently installed equipment in those two phases, as long as it is robust with respect to design-basis external events.</p>	<p>The NRC staff is reviewing additional information provided by the licensee in the ongoing audit process. Associated audit item OIP-13 will remain open pending resolution of this issue. Additional information is provided in Section 3.5, of this audit report.</p>

<b>Audit Item Reference</b>	<b>Item Description</b>	<b>Licensee Input Needed</b>
SE #3	Discuss strategy for swapping RCIC suction from SP to the UCP and justify that the strategy will be effective under ELAP conditions.	NRC staff is reviewing additional information provided by the licensee under the ongoing audit process. Additional information is provided in Section 3.7, item I, of this audit report.

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 RBS from October 20 - 23, 2014, per the audit plan dated October 1, 2014 (ADAMS Accession No. ML14272A319). 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 onsite audit items currently under NRC staff review.

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

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

Docket No. 50-458

Enclosure:  
Audit report

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**ADAMS Accession No: ML15026A645**

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NAME	MHalter	AWang	JHughey	
DATE	02/09/15	01/29/15	02/18/15	

OFFICIAL AGENCY RECORD

Letter to Vice President, Operations from John D. Hughey dated February 18, 2015

SUBJECT: RIVER BEND STATION, UNIT 1 - 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 NO. MF0952 AND MF0953)

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