



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

August 25, 2015

Mr. C. R. Pierce
Regulatory Affairs Director
Southern Nuclear Operating Co., Inc.
P.O. Box 1295, Bin 038
Birmingham, AL 35201-1295

SUBJECT: VOGTLE ELECTRIC GENERATING PLANT, 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. MF0714, MF0715, MF0723, AND MF0724)

Dear Mr. Pierce:

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 27, 2013 (ADAMS Accession No. ML13059A382), Southern Nuclear Operating Company, Inc. (SNC, the licensee), submitted its OIP for Vogtle Electric Generating Plant, Units 1 and 2 (VEGP) in response to Order EA-12-049. By letters dated August 27, 2013, February 26, 2014, August 26, 2014, and February 26, 2015 (ADAMS Accession Nos. ML13240A239, ML14058A664, ML14239A306, and ML15057A286, respectively), SNC 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 VEGP interim staff evaluation (ISE) on January 16, 2014 (ADAMS Accession No. ML13339A777), and continues with in-office and onsite portions of this audit.

By letter dated February 27, 2013 (ADAMS Accession No. ML13059A386), SNC submitted its OIP for VEGP in response to Order EA-12-051. By letter dated June 18, 2013 (ADAMS Accession No. ML13157A176), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated July 17, 2013, August 27, 2013, February 26, 2014, August 26, 2014, and February 26, 2015 (ADAMS Accession Nos. ML13199A182, ML13240A237, ML14057A777, ML14239A297, and ML15057A324, respectively), SNC submitted its RAI responses and first four six-month updates to the OIP. The NRC staff issued the VEGP ISE and RAI on November 4, 2013 (ADAMS Accession No. ML13280A381). 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 NRC 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 NRC 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 SNC's OIPs, as supplemented, the NRC staff conducted an onsite audit at VEGP from May 11-14, 2015, as discussed in the audit plan dated March 31, 2015 (ADAMS Accession No. ML15082A162). 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, staging and deployment of offsite equipment, and physical sizing and placement of SFPI equipment.


The enclosed audit report provides a summary of the activities for the onsite audit portion.

C. Pierce

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If you have any questions, please contact me at 301-415-1544 or by e-mail at Stephen.Monarque@nrc.gov.

Sincerely,


Stephen R. Monarque, Project Manager
Orders Management Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Docket Nos.: 50-424 and 50-425

Enclosure:
Audit report

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UNITED STATES
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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
SOUTHERN NUCLEAR OPERATING COMPANY, INC
VOGTLE ELECTRIC GENERATING PLANT, UNITS 1 AND 2
DOCKET NOS. 50-424 AND 50-425

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 27, 2013 (ADAMS Accession No. ML13059A382), Southern Nuclear Operating Company, Inc. (SNC, the licensee), submitted its OIP for Vogtle Electric Generating Plant, Units 1 and 2 (VEGP) in response to Order EA-12-049. By letters dated August 27, 2013, February 26, 2014, August 26, 2014, and February 26, 2015 (ADAMS Accession Nos. ML13240A239, ML14058A664, ML14239A306, and ML15057A286, respectively), SNC 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

Enclosure

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 VEGP interim staff evaluation (ISE) on January 16, 2014 (ADAMS Accession No. ML13339A777), and continues with in-office and onsite portions of this audit.

By letter dated February 27, 2013 (ADAMS Accession No. ML13059A386), SNC submitted its OIP for VEGP in response to Order EA-12-051. By letter dated June 18, 2013 (ADAMS Accession No. ML13157A176), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated July 17, 2013, August 27, 2013, February 26, 2014, August 26, 2014, and February 26, 2015 (ADAMS Accession Nos. ML13199A182, ML13240A237, ML14057A777, ML14239A297, and ML15057A324, respectively), SNC submitted its RAI responses and first four six-month updates to the OIP. The NRC staff issued the VEGP ISE and RAI on November 4, 2013 (ADAMS Accession No. ML13280A381). 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 NRC staff to review open (OI) and confirmatory items (CI) from the mitigation strategies ISE, RAI responses from the spent fuel pool instrumentation (SFPI) ISE, the licensee's integrated plans, and other audit questions (AQs). Additionally, the NRC 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 VEGP from May 11-14, 2015, as discussed in the audit plan dated March 31, 2015 (ADAMS Accession No. ML15082A162). 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, staging and deployment of offsite equipment, and physical sizing and placement of 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 NRC 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 Project 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 NRC 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 NRC staff review will be required to evaluate the alternative strategy in reference to the applicable order.

AUDIT ACTIVITIES

The onsite audit was conducted at VEGP from May 11-14, 2015. The NRC staff that participated in this audit was as follows:

Title	Team Member	Organization
Lead Project Manager	Stephen Monarque	NRR/JLD
Technical Support – Electrical	Kerby Scales	NRR/JLD
Technical Support – Reactor Systems	Joshua Miller	NRR/JLD
Technical Support – Balance of Plant	Michael Levine	NRR/JLD
Technical Support –SFPI	Khoi Nguyen	NRR/JLD
Technical Support – Reactor Systems	Laura Okruhlik	NRR/JLD

The NRC staff executed the onsite portion of the audit pursuant to the three part approach discussed in the March 31, 2015, plan, to include conducting a tabletop discussion of the site's integrated mitigating strategies (MS) compliance program, a review of specific technical review items, and discussion of specific program topics. Activities that were planned to support the above included detailed analysis and calculation discussions, walk-throughs of strategies and equipment laydown, visualization of portable equipment storage and deployment, staging and deployment of offsite equipment, and physical sizing and placement of SFPI equipment.

AUDIT SUMMARY

1.0 Entrance Meeting (May 11, 2015)

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

2.0 Integrated Mitigating Strategies Compliance Program Overview

As an introduction to the site's program, SNC provided a presentation to the NRC staff titled "Vogtle NRC Briefing May 11, 2015." The licensee discussed its strategy to implement the FLEX program, the installation of the spent fuel pool level instrumentation, the implementation of the Emergency Preparedness Communications Program, the design and location of the FLEX equipment storage facility, and the access routes to the plant.

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 the SNC staff, conducted site walk-downs, and detailed the document review for the items listed in the plan.

3.1 Reactor Systems Technical Discussions and Walk-Downs

The NRC staff met with the SNC to discuss the timing of the injection of water into the reactor coolant system, the leakage out of the system, and the flow rates needed to make up to the system.

- a. The NRC staff reviewed the O-rings that are used at VEGP. SNC stated that it is installing SHIELD reactor coolant pump (RCP) seals. By letter dated May 28, 2014 (ADAMS Accession No. ML14132A128), the NRC endorsed Westinghouse Technical Report (TR) TR-FSE-14-1-P, Revision 1, "Use of Westinghouse SHIELD Passive Shutdown Seal for FLEX Strategies." The NRC staff has no further questions and ISE CI 3.2.1.2.A, 3.2.1.2.C, 3.2.1.2.D, and AQ 10 are closed.
- b. The NRC staff reviewed whether the integrity of the O-rings will be maintained during an extended loss of alternating current (ac) power (ELAP) event, and whether postulated RCP seal leakage rate of 21 gpm is adequate. VEGP, Units 1 and 2 utilize model 93A-1 RCPs. These RCPs do not contain a shaft sleeve. That design feature is limited to model 93A RCPs. As such, no O-rings are present. The licensee assumed a 5 gpm leakage rate as described in the SHIELD White paper. The licensee provided TR-FSE-14-1-P for discussion of locations in 93A-1 pumps that are subject to a pressure differential of full reactor coolant system (RCS) pressure. The licensee provided the NRC staff diagrams from Westinghouse Instruction and Operating Book Reactor Coolant Pump, Model W-11012-A1 (93A-1) to verify the pump type. The NRC staff had no further questions and ISE CI 3.2.1.2.B is closed.
- c. The NRC staff examined SNC's strategy of venting the RCS. The licensee stated that venting is part of the plan for RCS boration. The reactor pressure vessel (RPV) head vents are the preferred path and SNC plans to operate them from the control room (Flex support guideline (FSG) -8). As described in FSG-8, step 6, the reactor head vent will be opened to establish conditions sufficient for RCS boration if the RCS pressure is greater than 500 psig or the pressurizer level is greater than 75 percent. The RPV head vents will be closed if the pressurizer level decreases below 19 percent (50 percent for adverse containment conditions) or a boration pump fails. Step 8 of FSG-8 requires that the RPV head vent will be closed if the required boration volume has been injected and the pressurizer volume is greater than 25 percent. In addition, Step 6 of FSG-8 states that a pressurizer power-operated relief valve (PORV) will be cycled to depressurize the RCS for boration if the RPV head vent valves are not available. The PORV block valves cannot be repowered and are unavailable. Opening a pressurizer PORV with its associated block valve unavailable would be contrary to the recommendation of the Pressurized Water

Reactor Owners Group (PWROG) expressed in WCAP-17792-P, "Emergency Procedure Development Strategies for the Extended Loss of AC Power Event for all Domestic Pressurized Water Reactor Designs," and the PWROG Core Cooling Position Paper. Neither is it clear that the licensee's FLEX strategy could supply boric acid makeup to the RCS at a rate sufficient to offset the inventory loss from a stuck-open PORV. As such, the NRC staff does not agree with the licensee's existing procedure to allow use of a PORV for venting the RCS under ELAP conditions. However, based on the fact that the reactor vessel head vents are robust equipment that may be credited with functioning properly under ELAP conditions, operation of a pressurizer PORV would not be necessary to support the licensee's mitigation strategy for the analyzed ELAP event; therefore, the NRC staff considered SE No. 4 to be closed.

- d. The NRC staff confirmed SNC's strategy, during an ELAP, is to perform a symmetric cooldown using all RCS loops. For both units, Procedure ECA 0.0 "Loss of all AC Power" (Procedure 19100) (p. 37 of 65) ensures the auxiliary feedwater is provided and maintained in all four Steam Generators. SNC's training of licensed operators for FLEX implementation has stressed the need to perform a symmetric cooldown. The NRC staff did not have any additional questions; therefore AQ 15 is closed.
- e. SNC was requested to clarify whether the intended timeline for aligning the FLEX RCS makeup pump may be delayed based on procedural guidance that derives from the analysis in WCAP-17792-P. The NRC staff also reviewed Procedure 19100-C ECA 0.0. Step B1 of ECA 0.0 initiates FSG-5 (Initial Assessment and FLEX equipment staging) that initiates Boron Injection and makeup to the RCS. SNC stated that these steps are not based on RCS leak rate. The emergency operating procedures, abnormal operating procedures, and FSG procedures have the operators look for RCS leakage above the expected leak rate and take action, and these procedures do not call for operators to look for lower than expected leakage. The NRC staff did not find any discrepancies with SNC's analysis; therefore, SE No. 6 was closed.
- f. The NRC staff reviewed SNC's boron mixing strategy to determine if SNC was following the NRC staff's endorsement letter, dated January 8, 2014. The licensee provided calculation CN-PSCA-14-6. If VEGP is using water from the Boric Acid Storage Tank (BAST), then SNC must start boron injection preparations by 14.8 hours into the ELAP event. The NRC staff verified shutdown margins and flexibility of strategy and did not have any additional questions. ISE CI 3.2.1.8.A is closed.
- g. The NRC staff toured inside and outside the plant and observed aspects of human factors in making connections and hauling equipment. The NRC staff discussed other human factors questions during interviews. These questions ranged from operator actions during a potentially hazardous event to the effects of the mitigating strategies planning on the current plant operations. The NRC staff had no further questions and SE No. 1 was closed.

3.2 Electrical Technical Discussions and Walk-Downs

- a. The NRC staff reviewed the licensee's assessment of hydrogen accumulation and equipment cooling due to loss of the Heating Ventilation and Air Conditioning (HVAC) system during an ELAP event. The NRC staff reviewed Procedures SIG-2; NMP-OS-019-382, Vogtle Unit 2 SIG-2, 480V Power, Attachment 6: 125 VDC Switchgear and Battery Room Ventilation Engineering Document No. AX4DT012, Rev. 1.0 – FLEX Portable System FLEX Ventilation Subsystem; and Calculations X3CF16, Version 2: Class 1E Battery Hydrogen Generation after an Extended Loss of AC Power (ELAP).

SNC noted that the primary strategy for maintaining the environment of the battery room during Phase 1 is to open the electrical switchgear and battery room doors. In addition, SNC plans to use a blower and fan to cool the rooms and reduce hydrogen buildup. Battery room temperatures are not expected to exceed the equipment limitation during Phase 1. Hydrogen generation is only a concern when batteries are charging, and therefore hydrogen generation will not occur during Phase 1.

The licensee has determined that the mitigating strategies and procedures ensure that accumulation of hydrogen in the battery rooms will not reach the point of combustibility and the vital batteries will not be adversely affected by increases in temperature as a result of loss of HVAC. The NRC staff did not find any discrepancies during its review; therefore, ISE CI 3.2.4.2.A, ISE CI 3.2.4.2.B, AQ 38, and AQ 40 were closed.

- b. The NRC staff reviewed SNC's strategy to reduce power in order to maintain battery loads. The NRC staff reviewed summaries of the results, and key assumptions of SNC's 19100-1 ECA-0.0, Version 5.7.15, "Loss of All AC Power," X3CF02, Version 22.0, "Class 1E Battery Systems," FSG-4, and X3CF14, Version 2.0, "Class 1E Battery Station Blackout Extended Coping Time Study." The NRC staff reviewed these procedures to verify the adequacy of the capacity and capability of the vital batteries to supply direct current (dc) power to the required loads during the first phase of the SNC FLEX mitigation strategies plan for an ELAP event. The NRC staff also successfully walked down the load shedding procedures with SNC to verify that load shedding could be completed within the time assumed in its analysis.

SNC's evaluations identified the required loads and their associated ratings (ampere and minimum required voltage) and the loads that would be shed within 45 minutes. Power is expected to be restored to the battery chargers by the end of the battery coping period.

SNC has determined that the VEGP dc system has adequate capacity and capability to power the loads required to mitigate the consequences during the first phase of an ELAP event, and necessary load shedding should be accomplished within the times assumed in the licensee's analysis. The NRC staff did not find any discrepancies during its review; therefore, ISE CI 3.2.4.10.A, ISE CI 3.2.4.10.B, and AQ 29 were closed.

- c. The NRC staff performed a walkdown of the FLEX diesel generator (DG) area and reviewed SNC's FLEX DG sizing calculations, manufacture's specifications, and FSGs to confirm that they are of sufficient capacity to supply the expected loads. The NRC staff reviewed Calculations AX3DT120, Version 1.0, "FLEX Portable System Units 1 & 2 480V Diesel Generator Sizing Calculation;" AX3DT119, Version 1.0, "FLEX Portable System 4160V FLEX Diesel Generator Sizing Calculation;" Cable Sizing Procedures DOEJ-VDSNC473105-E001, Version 1, "Evaluation for Permanent 480V FLEX Cables (Unit 1);" and DOEJ-VDSNC475965-E001, Version 1, "Evaluation for Permanent 480V FLEX Cables (Unit 2)."

SNC has determined that the FLEX generators will have adequate capacity and capability to power the loads assumed during Phases 2 and 3 of an ELAP event. The NRC staff did not find any discrepancies during its review; therefore, CI 3.2.4.8.A is closed.

- d. SNC provided copies of conceptual design electrical single line diagrams showing electrical connections to the Phase 2 and 3 electrical connection equipment. The NRC staff reviewed the drawings and did not have any additional questions. Therefore, AQ 42 is closed.

3.3 Balance of Plant Technical Discussions and Walk-Downs

- a. The NRC staff reviewed SNC's plan to ensure that the FLEX equipment would be protected against seismic interactions. While on site, the NRC staff reviewed the licensee's strategy for securing large portable equipment and for ensuring unsecured or non-seismic components do not damage the equipment. The NRC staff walked down the storage building and other storage locations. The licensee stated that equipment will be tied down using anchors embedded in the floor of the seismically qualified storage building. In addition, SNC stated that equipment will be stored in a configuration such that unsecured or non-seismic components do not damage the equipment. The NRC staff did not have any further questions regarding securing of large portable equipment. Therefore AQ 1 is closed.
- b. The NRC staff reviewed SNC's strategy for ensuring that the Phase 2 FLEX equipment would be protected against high winds and high temperatures. While on site, the NRC staff reviewed SNC's procedural interface considerations as they relate to severe storms with high winds. The licensee stated that existing procedures NMP-OS-17, "Severe Weather," Version 1.1 and 11889-C, "Severe Weather Checklist," Version 23 provided guidance to anticipate severe weather including ensuring emergency safety-related DGs not in maintenance were protected, minimizing the potential for debris, supplemental on-site staffing, placing the units in mode 3, pre-ordering extra diesel fuel, food, potable, etc. These procedures also include instructions to brief crews on applicable Abnormal Operating Procedures, and evaluate the need for conducting just-in-time training for the operations staff to prepare for potential storm-induced events, including a station blackout, loss of off-site power, load rejection casualty, single-loop service water operations, severe weather, and rapid shutdown.

For hurricanes, the anticipatory shutdown to mode 3 will increase the available coping time for Phases 1 and 2. Pre-staging of FLEX phase 2 equipment is not planned. Leaving the equipment in its protected storage locations ensures the equipment survival for an ELAP event, if it were to occur. The NRC staff had no further questions regarding procedural interfaces for severe storms with high winds and AQ 6 is closed.

- c. While on site, the NRC staff also reviewed the ability of the portable FLEX equipment to function in areas with high temperatures. The NRC staff walked down equipment storage locations. The licensee stated that all portable FLEX equipment deployed to locations outside of enclosed structures will be procured to function in the anticipated maximum ambient outside temperatures. SNC plans to pre-stage electric charging pumps in the auxiliary building, and the locations of these pumps are in areas which should provide sufficient space to allow for air cooling. The NRC staff has no further questions regarding operation of FLEX equipment in high ambient temperatures. Therefore, AQ 8 is closed.
- d. While on site, the NRC staff reviewed SNC's strategy for refueling portable FLEX equipment. The NRC staff reviewed calculation AX4DT106, "FLEX Portable System Evaluation for On-site FLEX Equipment Fuel Consumption" and AX4DT105, "FLEX Portable System Beyond Design Basis External Event Sizing Criteria For The Diesel Fuel Oil Transfer Pump." The licensee stated that an existing DFOST pump is repowered using a 480V FLEX DG and is used to pump diesel fuel from the DFOST to the FLEX fuel tanker. The FLEX fuel tanker is capable of being transported to the various FLEX equipment that use diesel fuel. The four underground DFOSTs are seismically qualified and have a Technical Specification minimum storage capacity of 68,000 gallons for a total of 272,000 gallons of fuel oil.

The fuel used in the first 72 hours of a BDBEE is approximately 8,682 gallons. In order to maintain an indefinite supply of fuel oil, the licensee will use its existing supplier to restock fuel supplies. The NRC staff had no further questions; therefore, ISE CI 3.2.4.9.A, AQ 28, and AQ 41 are closed.

- e. While on site, the NRC staff reviewed the licensee's strategy for mitigating the effects of loss of heat tracing during an ELAP. For installed equipment SNC stated that the exposed portions of fill and drain lines are not freeze protected because these small sections of line do not normally contain water. In addition, SNC stated that the BAST is located on "D" level of the auxiliary building and contains a 4 percent concentration of boric acid. The minimum solubility temperature of a 4 percent boric acid solution is 57.5°F. The BAST is used as the primary source of boric acid to achieve the required shutdown margin. The usable capacity of the BAST is 46,000 gallons. FLEX connection to the BAST is at the suction of the Boric Acid Transfer Pumps close to the BAST. The RCS boration from the BAST is started at approximately 12 hours after the start of the event and is completed by 24 hours after the start of the event.

Precipitation of the boric acid following an ELAP event is not a concern because: "D" level of the Auxiliary Building is 4 levels below grade. Due to the large thermal capacity of the structure and ground temperature, it is unlikely the temperature in the vicinity of the BAST would drop below 57.5°F. Boration of the RCS is started at 12 hours and completed no later than 24 hours. Due to thermal capacity of the contents in the BAST, it is unlikely that the temperature would drop below 57.5°F. The connection points are very close to the BAST, therefore freeze protection of the piping is not required. The NRC staff had no further questions regarding loss of heat tracing and AQ 25 is closed.

- f. While on site the NRC staff reviewed the licensee's FLEX pumping equipment hydraulic analysis. The NRC staff reviewed the following calculations: AX4DT100, "Sizing Criteria for the Boron Injection Pump," Version 1.0; AX4DT105, "FLEX Portable System Beyond Design Basis External Event Sizing Criteria for the Diesel Fuel Oil Transfer Pump," Version 1.0; AX4DT109, "FLEX Portable System Phase 2 Core Cooling Subsystem CST Cross-Connect Evaluation," Version 1.0; AX4DT112, "FLEX Portable System Phase 2 Tank Makeup Subsystem CST Makeup Sizing Criteria for the CST FLEX Pump," Version 1.0; AX4DT113, "FLEX Portable System Phase 2 Tank Makeup Subsystem, CST Makeup Sizing Criteria for the NSCW Sump Pump," Version 1.0; AX4DT118, "FLEX Portable System: Phase 2 Spent Pool Cooling Pump Sizing Using NSCW Basin as Primary Source and CST or RMWST as Alternate Source," Version 1.0; AXDT005, "FLEX Portable System Phase 2 Core Cooling Subsystem Operating Modes 1-5 with Steam Generators Available," Version 2.0; and AX4DT108, "FLEX Portable System Phase 2 Core Cooling Subsystem Sizing Criteria for the Steam Generator FLEX Pump," Version 2.0. The calculations determined the minimum pumping requirements of each credited FLEX pump. The NRC staff noted several minor discrepancies between the design inputs and the actual anticipated operating conditions (e.g. design input RCS pressure vs anticipated RCS pressure, modeled suction/discharge hose length/diameter vs anticipated length/diameter, etc.). SNC is tracking this item in its corrective action program under TE-921692 and TE-921693. The NRC staff had no additional questions; therefore, AQ 21 is closed.

3.4 SFPI Technical Discussions and Walk-Downs

NRC staff met with SNC, reviewed diagrams and walked down the areas showing the locations and routing cables from the SFP area to the display locations. The NRC staff also reviewed documentation related to the mounting of the SFPI to the SFP deck and discussed the issue of electromagnetic interference with SNC.

- a. The NRC staff reviewed SNC's strategy for mitigating electromagnetic interference/radio frequency interference (EMI/RFI) of the SFPI. Licensee Procedure DOEJ-VDSNC521783-J001 evaluated the electromagnetic compatibility (EMC) design verification test results of the Westinghouse Spent Fuel Pool Level Instrumentation System (SFPLIS) that was installed under DCP SNC521783. The SAT [Site Acceptance Test] report included the EMI Testing for radio susceptibility of the

installed SFPI. Based on the DOEJ and the SAT results, SNC concluded that the SFPI is not affected by EMI/RFI. The licensee stated the SAT will include testing for radio susceptibility of the installed SFPI at VEGP, Unit 1. The NRC staff did not find any discrepancies with SNC's analysis; therefore SE No. 2 is closed.

- b. In SFPI RAI No. 2, SNC was requested to provide information on the proposed arrangement of the guided wave radar and routing of the SFPI cabling. Drawing AX2D09A011 depicted the placement of the SFP level instrument channels and the inside dimensions of the SFP. The distance between the probes, inferred from Drawing AX2D09A011, is approximately 30' – 6 ¾", comparable to the short side of the pool. Drawing 2X3DF435 shows the routing of the coaxial cables extending from the probes to the transmitters and electronic enclosures. During the site audit walkdown, the NRC staff observed that the cable from the sensor to the wall, crossing the walkway, was routed in the flexible conduit. The flexible conduit did not provide sufficient protection from damages caused by traffic and internal missiles. In response to the NRC staff's concern, SNC generated Technical Evaluation Quality Record No. 921511, in which it states that SNC will add additional protection to the flexible conduit at the Unit 2 SFP level probe brackets and either use rigid conduit or install additional protection to the flexible conduit for VEGP, Unit 1 SFP level probe brackets. The NRC staff had no additional questions; therefore, SFPI No. 2 is closed.
- c. The licensee was requested to demonstrate that the SFPI channels will retain accurate performance values following a loss of power and subsequent restoration of power. In response, SNC provided the SAT report. During the site audit, the NRC staff reviewed SAT Report SNC576693, "SAM-U2-SFP SAT Test." The NRC staff did not find any discrepancies with SNC's analysis; therefore, SFPI No. 10 was closed.
- d. The NRC staff requested that SNC provide further information describing the maintenance and testing program that it will implement in order to ensure that regular testing and calibration is performed to demonstrate conformance with the design and system readiness requirements. The licensee was also requested to provide a plan to ensure that necessary channel checks, functional tests, periodic calibration, and maintenance will be conducted for the level measurement system and its supporting equipment.

In response, SNC stated that while the SFP is operating within design-basis and at normal level, the indicators will be compared to fixed marks within the SFP, by visual observation, to confirm indicated level weekly as described in Radwaste Rounds Sheets 11883-1 and 11883-2. The periodic calibration verification will be performed within 60 days of a refueling outage considering normal testing scheduling allowances. Calibration verification will not be required to be performed more than once per 12 months. Preventive maintenance procedure to include tests, inspection and periodic replacement of the backup batteries will be developed based on recommendation from Westinghouse.

If a channel is out of service (OOS), a condition report will be initiated and addressed through the SNC's Corrective Action Program, and the OOS condition will be tracked in accordance with Procedure NMP-OS-019-013. If one of OOS channel cannot be restored to service within 90 days, appropriate compensatory actions, including the use of alternate suitable equipment, will be taken. If both channels become OOS, actions would be initiated within 24 hours to restore one of the channels to operable status and to implement appropriate compensatory actions, including the use of alternate suitable equipment and/or supplemental personnel, within 72 hours.

Additionally, if both channels are OOS, a condition report will be initiated and addressed through the SNC's corrective action program and the OOS condition will be tracked in accordance with the procedure NMP-OS-019-013. The licensee will maintain sufficient spare parts for the SFPI, taking into account the lead time and availability of spare parts, in order to expedite maintenance activities, when necessary, to provide assurance that a channel can be restored to service within 90 days. The NRC staff did not find any discrepancies with SNC's analysis; therefore, SFPI No. 13 is closed.

3.5 Other Technical Discussion Areas and Walk-Downs

- a. The NRC staff reviewed the Response Center local staging area, the access routes, and method of transportation to the site. Refer to staff assessment of National SAFER Response Centers Established in Response to Order EA-12-049, dated September 16, 2014 (ADAMS Accession No. ML14265A107). The 'SAFER Response Plan for Vogtle Electric Generating Plant,' discusses the local staging area and transportation, and the five helicopter companies that will transport FLEX equipment from Barnwell regional airport to staging area C. The NRC staff had no additional questions and ISE CI 3.1.1.4.A is closed.
- b. The NRC staff met with SNC to discuss ISE 3.2.4.4.A Communications Assessment. The NRC staff conducted a walk through and observed that sound powered phones jacks and Gai-tronics were installed next to steam generator (SG) -2 and 3 atmospheric relief valves (ARVs). In addition, emergency lighting was installed above the manual actuation of SG-2 and 3 ARVs. The batteries will provide lighting for 10 hours. The Gai-tronics will operate for 10 hours until the Phase 2 DG can recharge the battery. The NRC staff also observed FLEX rapid Communications Case and satellite. The satellite sends a signal to the Case via satellite router. The fiberoptics cable is connected to the Case, the technical support center (TSC) Flux Switch, and the Main Control Room. SNC plans to also use runners to relay messages. The NRC staff has confirmed that upgrades to the site communications have been completed. Therefore, ISE 3.2.4.4.A is closed.
- c. The 'SAFER Response Plan for Vogtle Electric Generating Plant,' discusses the local staging area and transportation. The NRC observed that SNC has acquired a Caterpillar 950, which will be used to remove debris. The NRC staff had no further questions and AQ 5 is closed.

- d. The NRC staff reviewed SNC's strategy to deploy FLEX equipment during ice hazards. The licensee issued Condition Report to revise Vogtle Electric Generating Plant, "Cold Weather Checklist," Procedure 11877-1, Version 25.3, Completion Sheet 5 "Outside Area and Building Rounds" to incorporate a check of roads and access routes in the owner control area and protected area for icing conditions and designate a sand procurement location and deploy ice melt from warehouse. The NRC staff had no further questions and ICE CI 3.1.4.2.A is closed.
- e. The NRC staff audited SNC's strategy for providing protection to equipment against tornado missiles and cold temperatures. The licensee stated that it is constructing a FLEX building that complies with JLD-ISG-2012-01 EA-12-049, Section 7.3.1.1.a to hold N+1 equipment. SNC's analysis indicates this FLEX building is qualified for site specific design-basis loads for high winds and tornados, as discussed in Specification No FHC-S-13-001/X1AR50 Version 2.0, Southern Nuclear Operating Company, Procurement Specification for FLEX Equipment Storage Building for Alvin W. Vogtle, Edwin Hatch, Joseph Farley Nuclear Plant - Units 1 and 2, Section 4.2.7 Minimum Design Loads. Section 4.13, 'Heating Ventilating and Air Conditioning Systems,' of this same report discusses how the HVAC will maintain a temp range of 50 to 100 degrees °F to protect the equipment against cold weather. The NRC staff had no further questions and ISE CI 3.1.3.1.A is closed.
- f. The NRC staff reviewed SNC's strategy to depressurize the SGs by sending operators to locally operate the ARVs. The ARVs are locally operated in accordance with Attachment 7 of Procedure 19100. The licensee personnel are dispatched by the MCR to go to the local ARV station, where communication is established using plant paging system or sound powered phones. When directed by the MCR, an operator will locally position the ARV using hydraulic operated hand pump. The NRC staff had no further questions and AQ 44 is closed.

4.0 Exit Meeting (May 14, 2015)

The NRC staff 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.

CONCLUSION

The NRC staff completed all three parts of the March 31, 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.

The five sources for the audit items referenced below are as follows:

- a. ISE OIs and CIs
- b. AQs

- c. Licensee-identified OIP OIs
- d. SFPI RAIs
- e. Additional Staff Evaluation (SE) needed information

While this report notes the completion of the onsite portion of the audit per the audit plan dated March 31, 2015, the ongoing audit process continues as discussed in the letters dated August 28, 2013, and March 26, 2014, to all licensees and construction permit holders for both orders.

Additionally, 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

Onsite Audit Participants

NRC Staff:

Stephen Monarque	NRR/JLD
Kerby Scales	NRR/JLD
Joshua Miller	NRR/JLD

Laura Okruhlik	NRR/JLD
Khoi Nguyen	NRR/JLD
Michael Levine	NRR/JLD

SNC and Support Staff:

Steve Prewitt	FLEX Team
Simon Yang	Enercon
Nathan Raines	Enercon
Bryan Hess	Enercon
Edward Kozinsky	FLEX Team contractor
Jesse Thomas	Work Management Director
Alvin Robertson	Westinghouse
Darren Stiles	Training Director
Darin Myers	Plant Manager
Famaraz Pournia	Engineering
Ben Frey	Maintenance Director
Tony Parton	Nuclear Oversight Manager
Tim Baker	Site Security Manager
Steve Waldrup	Operations Support Manager
Kevin Parker	FLEX Procedures
Lowell Wakefield	Financial Operations
Lek Chestnut	Security
Tim Baker	FLEX Team
Gary VanGilder	Vogtle FLEX
John Giddens	SNC Licensing Manager
Kevin Walden	Vogtle Licensing Engineer
David Hall	Farley SAM Program Manager
J. D. Williams	Vogtle, Units 1 through 4 Integration
Randy Bunt	SNC SAM Corp Manager
Mark Winsor	FLEX Team Enercon
Brian Mohr	SNC SAM Project Manager
Cliff Buck	SNC – FLEX Support
John Pfabe	VC Summer – FLEX Licensing
Bert Cline	SNC Vogtle FLEX Team
Terry Sides	SNC Licensing
Brinton Pusey	Bechtel Spent Fuel Pool Level Engineering
Harshesh Patel	Bechtel Spent Fuel Pool Level Engineering
Tom Petrak	SNC Vogtle FLEX Team

Vogtle Electric Generating Plant, Units 1 and 2 - Documents Reviewed

- SNC Procedure DOEJ-VDSNC521783-J001, "DCP Discipline J001 Worksheet," Revision 4.0
- DCP SNC521783, "Spent Fuel Pool Level Instrumentation," Revision 4.0
- Drawing AX2D09A011, "Fuel Handling Building Area 3A2 3D2 Plan EL. 220'-0" (Level 1)," Revision 16.0
- Drawing 2X3DF435, "Conduit and Tray Plan Area 3 EL. 220'-0" Level 1 Fuel Handling Building Unit," Revision 17.0
- Site Acceptance Test (SAT) Report SNC576693, "SAM-U2-SFP SAT Test," Revision 0
- Radwaste Rounds Sheets 11883-1, Revision 33.
- 18030-C, "Loss of Spent Fuel Pool Level or Cooling," Revision 23.1
- Procedure 19100-C ECA – 0.0, "Loss of All AC Power," dated December 27, 2012, DRAFT
- 16005-C, "1kW FLEX Generator," Revision 1
- NMP-OS-019-362, "Vogtle Unit 1 SIG-2, 480V Power," Draft, dated April 22, 2015
- NMP-OS-019-382, "Vogtle Unit 2 SIG-2, 480V Power," Draft
- Procedure 23981-1, "Spent Fuel Pool Level Indication System 1L-5330 Channel Calibration," Revision 1
- Procedure 23982-1, "Spent Fuel Pool Level Indication System 1L-5331 Channel Calibration," Revision 1
- Procedure 23981-2, "Spent Fuel Pool Level Indication System 2L-5330 Channel Calibration," Revision 2.1
- Procedure 23982-2, "Spent Fuel Pool Level Indication System 2L-5331 Channel Calibration," Revision 2.1
- NMP-OS-019-013, "Beyond Design Basis Equipment Unavailability Tracking," Revision 1

- Drawings 2X6AN10-00121, "Spent Fuel Pool Mounting Bracket Plan, Sections and Details," Revision 1.0
- 2X6AN10-00120, "Spent Fuel Pool Level Instrumentation System Sensor Level Assembly Sheet 4," Revision 1.0
- 2X6AN10-00119, "Spent Fuel Pool Level Instrumentation System Sensor Level Assembly Sheet 3," Revision 1.0
- AX2D09G009, "Fuel Handling Building Miscellaneous Steel Details," Revision 1.0
- X2CK06.21.01, "Seismic Analysis of The SFP Mounting Bracket at Farley Nuclear Plant And Vogtle Electric Generating Plant," Revision 1
- X2CK06.21, "Evaluation of Anchorage for The Probe Mount In The Fuel Handling Bldg. for SFP Instrumentation," Revision 1
- 2X3DG030-1, "Lighting Panel Riser Diagram Unit 2," Revision 16
- 2X3D-AA-F03A, "One Line Diag 480V Motor Control Center 2ABC 2-1805-S3-ABC," Revision 18
- 2X3D-AA-F04A, "One Line Diag 480V Motor Control Center 2BBC 2-1805-S3-BBC," Revision 18
- 2X3D-AA-A01A, "Main One Line Unit 2," Revision 19
- SAFER Response Plan for Vogtle Electric Generating Plant, Revision 0, dated April 22, 2015
- Specification No. FHC-S-13-001/X1AR50 Version 2.0, "Southern Nuclear Operating Company, Procurement Specification for FLEX Equipment Storage Building for Alvin W. Vogtle, Edwin Hatch, Joseph Farley Nuclear Plant - Units 1 and 2," dated October 8, 2014
- Condition Report to Revise Vogtle Electric Generating Plant, "Cold Weather Checklist," Procedure 11877-1, Version 25.3, Completion Sheet 5 "Outside Area and Building Rounds"
- NMP-OS-019-382, "Vogtle Unit 2 SIG-2, 480V Power," Attachment 6: 125 VDC Switchgear and Battery Room Ventilation Engineering Document No. AX4DT012, Rev. 1.0 – FLEX Portable System FLEX Ventilation Subsystem
- Calculation X3CF16, Version 2: "Class 1E Battery Hydrogen Generation after an Extended Loss of AC Power (ELAP)"

- AX3DT120, Version 1.0, "FLEX Portable System Units 1 & 2 480V Diesel Generator Sizing Calculation"
- AX3DT119, Version 1.0, "FLEX Portable System 4160V FLEX Diesel Generator Sizing Calculation"
- Cable Sizing Procedures DOEJ-VDSNC473105-E001, Version 1, "Evaluation for Permanent 480V FLEX Cables (Unit 1)"
- Cable Sizing Procedures DOEJ-VDSNC475965-E001, Version 1, "Evaluation for Permanent 480V FLEX Cables (Unit 2)"
- FLEX Support Guidelines FSG-4, "NMP-OS-019-304, Vogtle Unit 1 FSG-4 ELAP DC Load Management," Version 1.0 DRAFT
- FLEX Support Guidelines FSG-5, Version 4.28.15, "Vogtle Unit 1 FSG-5, Initial Assessment and FLEX Equipment Staging"
- SIG-1, "NMP-OS-019-381, Vogtle Unit 2 SIG-1, 4160V Power," dated February 24, 2015
- SNC's 19100-1 ECA-0.0, Version 5.7.15, "Loss of All AC Power"
- Calculation Number X3CF02, Version 22.0, "Class 1E Battery System"
- Calculation Number X3CF14, Version 1.0, "Class 1E Battery Station Blackout Extended Coping Time Study"
- 1X3D-AA-E41A, "One Line Diagram, 480V FLEX Switchboard 1NB30, 1-1805-S3-B30," Revision 1.0
- 1X3D-AA-A01A, "Main One Line, Unit 1," Revision 29
- 1X3D-AA-G01A, "Main One Line, Class 1E 125V DC And, 120V Vital AC Systems," Rev. 10.0
- 1X3D-AA-G02A, "One Line Diagram, 120V AC Class 1E, Vital Instrument Dist PNLs, 1AY1A, 1BY1B, 1CY1A, 1DY1B," Revision 29
- AX3D-AA-E14A, "One Line Diagram, 480V FLEX Switchboard ANB14, A-1805-S3-B14," Revision 10
- 1X3D-CA-H01G, "Wiring Diagram, Electrical System 125V DC Inverter &, Battery Charger Train A," Revision 9

- 1X3D-CA-H02G, "Wiring Diagram, Electrical System 125V DC INV, & BAT CHGR Train B," Revision 8
- 1X3D-CA-H04G, "Wiring Diagram, Electrical System 125V DC Inverter, & Battery Charger Train C," Revision 8
- 1X3D-CA-H05E, "Wiring Diagram, Electrical System 125V DC INV, & BAT CHGR Train D," Revision 10
- AX3AF01K-00018, "480V FLEX Switchboard, 1NB30 2NB30 Key Interlock Scheme," Revision XX
- NMP-OS-17, "Severe Weather," Version 1.1
- 11889-C, "Severe Weather Checklist," Version 23
- Calculation, AX4DT106, "FLEX Portable System Evaluation for On-site FLEX Equipment Fuel Consumption," Version 2.0
- AX4DT105, "FLEX Portable System Beyond Design Basis External Event Sizing Criteria For The Diesel Fuel Oil Transfer Pump," Version 1.0
- Document No. AX4DT100, "Calculation Sizing Criteria for the Boron Injection Pump," Version 1.0
- Document No. AX4DT109, "FLEX Portable System Phase 2 Core Cooling Subsystem CST Cross-Connect Evaluation," Version 1.0
- Document No. AX4DT112, "FLEX Portable System Phase 2 Tank Makeup Subsystem CST Makeup Sizing Criteria for the CST FLEX Pump," Version 1.0
- Document No. AX4DT113, "FLEX Portable System Phase 2 Tank Makeup Subsystem, CST Makeup Sizing Criteria for the NSCW Sump Pump," Version 1.0
- Document No. AX4DT118, "FLEX Portable System: Phase 2 Spent Pool Cooling Pump Sizing Using NSCW Basin as Primary Source and CST or RMWST as Alternate Source," Version 1.0
- Document No. AXDT005, "FLEX Portable System Phase 2 Core Cooling Subsystem Operating Modes 1-5 with Steam Generators Available," Version 2.0
- Document No. AX4DT108, "FLEX Portable System Phase 2 Core Cooling Subsystem Sizing Criteria for the Steam Generator FLEX Pump," Version 2.0
- NMP-OS-019-318, Vogtle Unit 1 FSG-8, "Alternate RCS Boration," Version 1.0

C. Pierce

- 3 -

If you have any questions, please contact me at 301-415-1544 or by e-mail at Stephen.Monarque@nrc.gov.

Sincerely,

/RA/

Stephen R. Monarque, Project Manager
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Docket Nos.: 50-424 and 50-425

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