INTERIM STAFF EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO ORDER EA-12-049

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VOGTLE ELECTRIC GENERATING PLANT UNITS 3 AND 4

DOCKET NOS. 52-025 AND 52-026

1.0 INTRODUCTION

The earthquake and tsunami at the Fukushima Dai-ichi nuclear power plant in March 2011 highlighted the possibility that extreme natural phenomena could challenge the prevention, mitigation and emergency preparedness defense-in-depth layers already in place in nuclear power plants in the United States. At Fukushima, limitations in time and unpredictable conditions associated with the accident significantly challenged attempts by the responders to preclude core damage and containment failure. During the events in Fukushima, the challenges faced by the operators were beyond any faced previously at a commercial nuclear reactor and beyond the anticipated design-basis of the plants. The U.S. Nuclear Regulatory Commission (NRC) determined that additional requirements needed to be imposed at United States commercial power reactors to mitigate such beyond-design-basis external events (BDBEEs).

On March 12, 2012, the NRC issued Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12054A736). This order directed licensees to develop, implement, and maintain guidance and strategies to maintain or restore core, containment, and spent fuel pool (SFP) cooling capabilities in the event of a BDBEE. Order EA-12-049 applies to all power reactor licensees and all holders of construction permits for power reactors.

2.0 REGULATORY EVALUATION

Following the events at the Fukushima Dai-ichi nuclear power plant on March 11, 2011, the NRC established a senior-level agency task force referred to as the Near-Term Task Force (NTTF). The NTTF was tasked with conducting a systematic and methodical review of the NRC regulations and processes and determining if the agency should make additional improvements to these programs in light of the events at Fukushima Dai-ichi. As a result of this review, the

NTTF developed a comprehensive set of recommendations, documented in SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated July 12, 2011 (ADAMS Accession No. ML11186A950). Following interactions with stakeholders, these recommendations were enhanced by the NRC staff and presented to the Commission.

On February 17, 2012, the NRC staff provided SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," to the Commission (ADAMS Accession No. ML12039A103). This paper included a proposal to order licensees to implement enhanced BDBEE mitigation strategies. As directed by the Commission in staff requirements memorandum (SRM)-SECY-12-0025 (ADAMS Accession No. ML120690347), the NRC staff issued Order EA-12-049.

Order EA-12-049 requires that operating power reactor licensees and construction permit holders use a three-phase approach for mitigating BDBEEs. The initial phase requires the use of installed equipment and resources to maintain or restore core, containment, and SFP cooling capabilities. The transition phase requires providing sufficient, portable, onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from off site. The final phase requires obtaining sufficient offsite resources to sustain those functions indefinitely. Order EA-12-049, Attachment 3, provides the following requirements for Vogtle Electric Generating Plant (VEGP) Units 3 and 4:

> *The design bases of Vogtle Units 3 and 4 includes passive design features that provide core, containment and SFP cooling capability for 72 hours, without reliance on alternating current (ac) power. These features do not rely on access to any external water sources since the containment vessel and the passive containment cooling system serve as the safety-related ultimate heat sink. The AP1000 design also includes equipment to maintain required safety functions in the long term (beyond 72 hours to 7 days) including capability to replenish water supplies. Connections are provided for generators and pumping equipment that can be brought to the site to back up the installed equipment. The staff concluded in its final safety evaluation report for the AP1000 design that the installed equipment (and alternatively, the use of transportable equipment) is capable of supporting extended operation of the passive safety systems to maintain required safety functions in the long term. As such, this Order requires Vogtle Units 3 and 4 to address the following requirements relative to the final phase.*
>
> *(1) Licensees shall develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment and SFP cooling capabilities following a beyond-design-basis external event.*
>
> *(2) These strategies must be capable of mitigating a simultaneous loss of all ac power and loss of normal access to the normal heat sink and have adequate capacity to address challenges to core cooling, containment, and SFP cooling capabilities at all units on a site subject to this Order.*

(3) Licensees must provide reasonable protection for the associated equipment from external events. Such protection must demonstrate that there is adequate capacity to address challenges to core cooling, containment, and SFP cooling capabilities at all units on a site subject to this Order.

(4) Licensees must be capable of implementing the strategies in all modes.

(5) Full compliance shall include procedures, guidance, training, and acquisition, staging, or installing of equipment needed for the strategies.

On December 12, 2016, following submittals and discussions in public meetings with NRC staff, the Nuclear Energy Institute (NEI) submitted document NEI 12-06, Revision 4, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," (ADAMS Accession No. ML16354B421) to the NRC to provide revised specifications for an industry-developed methodology for the development, implementation, and maintenance of guidance and strategies in response to the Mitigation Strategies order. Appendix F of NEI 12-06 provides guidance for the AP1000 design. The NRC staff reviewed NEI 12-06, Revision 4, and on February 8, 2017, issued Japan Lessons-Learned Division (JLD) Interim Staff Guidance (ISG) JLD-ISG-2012-01, Revision 2, "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. ML17005A188) endorsing NEI 12-06, Revision 4, with clarifications, as an acceptable means of meeting the requirements of Order EA-12-049.

The Order requires a combined operating license (COL) holder to submit an Overall Integrated Plan (OIP) describing how compliance with NEI 12-06 will be achieved. The OIP should include a complete description of the FLEX strategies, including important operational characteristics. The level of detail contained in the OIP should be consistent to the level of detail contained in the licensee's Final Safety Analysis Report (FSAR). NEI 12-06, Section 13.1, "Overall Integrated Plan Submittal," provides guidance for the submittal of the OIP. The licensee will submit to the NRC for review and approval the OIP. Following implementation, the final strategies and bases will be submitted to the NRC in the Final Integrated Plan (FIP).

In 2019 the NRC promulgated Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.155, "Mitigation of beyond-design-basis events," to, among other things, make the requirements of Order EA-12-049 generically applicable, taking into account lessons learned during the implementation of the order and input from stakeholders. Regulatory Guide 1.226, "Flexible Mitigation Strategies for Beyond-Design-Basis Events," (ADAMS Accession No. ML19058A012) dated June 2019, endorses, with clarifications, NEI 12-06, Revision 4, as a process the NRC considers acceptable for meeting, in part, the regulations in 10 CFR 50.155.

3.0 TECHNICAL EVALUATION

By letter dated August 22, 2013, Southern Nuclear Operating Company (SNC or the licensee) submitted an OIP for VEGP Units 3 and 4 in response to Order EA-12-049 (ADAMS Accession No. ML13235A260). Between February 2014 and August 2020, SNC submitted 14 six-month status reports as required by Section IV.C.2 of the Order. During a June 12, 2019, Category 1 public meeting (ADAMS Accession No. ML19171A022), SNC and the NRC staff discussed SNC's proposed plan for implementation of EA-12-049 and the associated 10 CFR 50.155

rulemaking for VEGP Units 3 and 4. As discussed with the NRC staff during this public meeting, SNC provided an updated OIP, in a format similar to that of the FIP for the SNC fleet, in a letter dated May 15, 2020 (ADAMS Accession No. ML20136A453). The updated OIP supplements and expands on the August 2013 OIP submittal and contains guidance on VEGP Units 3 and 4 compliance with NRC Order EA-12-049 requirements.

3.1 Overall Mitigation Strategy

Attachment 3 to Order EA-12-049 describes the approach required for mitigating BDBEEs for VEGP Units 3 and 4.

While the initiating event is undefined, it is assumed to result in an extended loss of ac power (ELAP) with a loss of ultimate heat sink makeup (LUHS). Thus, the ELAP with LUHS is used as a surrogate for a BDBEE. The initial conditions and assumptions for the analyses are stated in NEI 12-06, Section 3.2.1, and include the following:

1. The reactor is assumed to have safely shut down with all rods inserted (subcritical).
2. The dc power supplied by the plant batteries is initially available, as is the ac power from inverters supplied by those batteries; however, over time the batteries may be depleted.
3. There is no core damage initially.
4. There is no assumption of any concurrent event.
5. Because the loss of ac power presupposes random failures of safety-related equipment (emergency power sources), there is no requirement to consider further random failures.

VEGP Units 3 and 4 are Westinghouse Electric Company (Westinghouse) AP1000 pressurized-water reactors (PWRs) with dry ambient pressure containments. The principles of extension of the passive systems operation indefinitely during an ELAP and the LUHS have been applied during the design and development of the AP1000 design. Therefore, extended coping strategies are accomplished with existing passive safety and coping systems within the standard design and using existing connection points for FLEX equipment. Specifically, coping with extended loss of ac power in the AP1000 is covered by design and post 72-hour procedures described in Section 1.9.5.4 of the AP1000 Design Control Document, Revision 19 and Section 1.9.5.4 of the Final Safety Analysis Report (hereinafter described as the DCD/FSAR).

The passive safety systems have the ability to have their operation extended indefinitely. The standard design licensing basis demonstrates safety-related means of providing core, containment, and SFP cooling for at least 72 hours. The standard design also demonstrates primary and alternate means of extending passive safety system cooling indefinitely as part of the baseline capability assessment as described in Section 1.9.5.4 of the DCD/FSAR.

By nature of the passive safety approach and its licensing basis, AP1000 is designed to provide a significant coping period for a station blackout. Hence, the focus of Order EA-12-049 is to define the required review of the AP1000 design relative to the transition from passive systems operation and their initial coping capabilities (i.e., 72 hour), to indefinite, long term operation of the passive cooling systems with support using off-site equipment and resources (i.e., the third and final phase only).

3.1.1 AP1000 Three Phase Approach (OIP Section 2.4)

Passive 0-72 Hours (OIP Section 2.4.1)

The AP1000 Standard passive nuclear power plant design includes safety-related passive systems and equipment that automatically establish and maintain safe shutdown conditions following a prolonged station blackout with the most limiting single failure. For the first 72 hours after an accident, the Class 1E batteries provide power for post-accident monitoring. The Class 1E direct current (DC) and uninterruptible power supply (UPS) System (IDS) is designed with four independent, Class 1E 250 VDC divisions (A, B, C, and D). All four divisions have one 24-hour battery bank. Divisions B and C also each have one 72-hour battery bank. Passive heat sinks provide cooling of the main control room (MCR) and the instrumentation and controls (I&C) rooms. The initial water supply in the passive containment cooling water storage tank (PCCWST) provides for at least 3 days of passive containment cooling system (PCS) cooling. The initial water volume in the spent fuel pool normally provides for at least 3 days of spent fuel cooling without requiring makeup. Core cooling is provided by the passive core cooling system (PXS) and specifically the passive residual heat removal heat exchanger (closed loop cooling). No FLEX equipment or strategies are directly required for core cooling in the first 72 hours.

The AP1000 design provides coping capabilities for an extended loss of ac power for core, containment, and spent fuel cooling through the PXS, PCS, and spent fuel pool cooling system. The BDBEE response capabilities of each of these systems are described in the respective system specifications documents.

3-7 Days (OIP Section 2.4.2)

Following the 72-hour passive system coping time, support is required to continue passive system cooling. This support can be provided by installed plant ancillary equipment or by off-site equipment connected to installed connections provided in the AP1000 design. The installed ancillary equipment is capable of supporting passive system cooling from day 3 through day 7.

Permanently installed plant equipment is available for use as directed in a series of post 72-hour procedures. The installed ancillary plant equipment (or alternately offsite equipment) maintains the following functions:

- Supply power to the post-accident monitoring instrumentation for the reactor, containment, and the spent fuel pool
- Provide makeup water supply to the PCCWST or PCS distribution bucket for containment cooling water flow
- Provide makeup water to the spent fuel pool to maintain shielding and cooling of the spent fuel
- Provide MCR and I&C room ventilation
- Provide a vent path from the fuel handling area to the outside environment to vent water vapor generated by the spent fuel pool

The primary post 72 hour FLEX strategy is to use the permanently installed ancillary equipment. Two ancillary diesels per unit are provided for the loss of power to Class 1E 72-hour battery loads. These diesels are in the annex building and provide ac power for Class 1E post-accident monitoring, MCR lighting, MCR and I&C room ventilation, and PCS recirculation pump power to refill the PCCWST and the SFP when all other power sources are not available. A fuel tank is in

the same room as the ancillary diesels to allow operation from hour 72 through day 7 after the initiating BDBEE. The primary connection for use of the ancillary diesel generators is through a distribution panel located in the same room. The annex building is classified as seismic Category II.

Power to the ancillary fans to provide post 72-hour ventilation of the MCR and the I&C rooms is supplied from Divisions B and C regulating transformers through two series fuses for isolation.

One passive containment cooling ancillary water storage tank (PCCAWST) is provided per unit for filling the PCCWST, SFP or PCS water distribution bucket using the PCS recirculation pumps during an extended loss of both offsite and onsite ac power sources for more than 72 hours. The PCCAWST contains adequate water volume using the recirculation pumps (two per unit) to provide required flow from hour 72 through day 7 after the initiating BDBEE. The PCCAWST and recirculation pumps are seismic Category II to ensure their ruggedness and availability. The PCCAWST is in the yard adjacent to the auxiliary building. Additional evaluations for FLEX tornado missile generation were performed and demonstrate the PCCAWST will remain intact and available. The recirculation pumps are located inside the seismic Category I auxiliary building.

The post-accident monitoring system (PAMS) is powered by the ancillary diesels. PAMS monitors the following key parameters: neutron flux (source range); reactor coolant system (RCS) pressure and temperature, containment water level and pressure; pressurizer and hot leg levels; core exit temperature; passive residual heat removal flow and temperatures; PCCWST level; PCS flow; and SFP level.

Sequence of Events Timeline

The sequence of events timeline in Attachment 1 of APP-GW-GLR-170, “AP1000 FLEX Integrated Plan,” (ADAMS Accession No. ML13235A229) states that the post 72-hour procedures are initiated approximately 24 hours after event initiation and makeup to both the PCCWST and SFP is initiated at approximately 70 hours after event initiation. Once long-term makeup has been initiated, only minimal actions are required to maintain AP1000 plants in a safe state. The only actions required are to monitor SFP and PCCWST tank levels continuously, monitor portable pump performance including fuel levels, monitor diesel generator performance including fuel levels, and attempt to recover the plant. Should automatic depressurization system (ADS) actuation become necessary to support open-loop core cooling, battery power for actuation is preserved by actions taken in the first 24 hours. These actions will be driven by the conditions in the field and not by the sequence of events timeline.

Beyond 7 Days – Off-site Support (OIP Section 2.4.3)

To extend the key safety functions for an indefinite period of time, provisions have been made for off-site support equipment. This equipment includes portable diesel generators; portable pumps; diesel fuel oil; and required hoses, couplings, and electrical cabling to connect the offsite equipment. The PCS has a safety-related connection on the exterior of the auxiliary building for a portable pump connection, and a non-safety connection on the PCCAWST drain/overflow line. The non-safety related connection was added as a modification by APP-PCS-GEF-152, Revision 0, “Modification to PCCAWST Drain/Overflow Line for Post-72 Hour FLEX Equipment Connection.” Offsite support will be provided by equipment delivery from SAFER (Strategic Alliance for FLEX Emergency Response). The SAFER plan details the deployment of SAFER equipment to the VEGP site for use. According to the licensee’s OIP, it includes contingencies

and alternate deployment paths to ensure equipment can be delivered within 24 hours from the initial SAFER notification. This delivery time ensures resources will be available for VEGP Units 3 and 4 use when required after the initial 72-hour passive coping phase. Protected connections for SAFER equipment have been included at VEGP Units 3 and 4 to support containment pressure and temperature control, spent fuel pool water level and power for required I&C and ventilation.

Core cooling can be continued for an indefinite time by the ADS and in-containment refueling water storage tank injection (open loop cooling). Containment makeup to support open loop cooling may be needed, based on containment leakage rates. It is conservatively estimated that the earliest need for containment makeup is one month after event initiation.

3.1.2 Interface with Units 1 and 2 (OIP Section 2.2.1)

VEGP Units 3 and 4 are being constructed in close proximity to the currently operating VEGP Units 1 and 2. As VEGP Units 3 and 4 are completed, the protected area (PA) will be extended from just VEGP Units 1 and 2, to encompass Unit 3 and then Unit 4, to form one single PA for all four operating units. Thus, VEGP Units 3 and 4 will be combined with VEGP Units 1 and 2 to form one single site for FLEX classification and response. SNC submitted the FIP for VEGP Units 1 and 2, by letter dated May 23, 2016 (ADAMS Accession No. ML16146A607). The NRC staff documented its safety evaluation regarding implementation of the Mitigation Strategies in a letter dated November 14, 2016 (ADAMS Accession No. ML16301A419). The FIP describes the FLEX deployment for VEGP Units 1 and 2, including access to all the equipment contained within the onsite FLEX storage building. The VEGP Units 3 and 4 haul paths for FLEX equipment are a continuation of the VEGP Units 1 and 2 haul paths.

3.2 Reactor Core, Containment, and Spent Fuel Pool Cooling Strategies

Enclosure 2 of SNC's May 15, 2020, letter provides an update to the OIP submitted on August 22, 2013. The original OIP submittal contained proprietary (APP-GW-GLR-170 at ADAMS Accession No. ML13235A229) and non-proprietary (APP-GW-GLR-171 ADAMS Accession No. ML13235A228) versions of a Westinghouse report titled "AP1000 FLEX Integrated Plan." SNC is providing an updated OIP, in a format similar to that of the FIP for the SNC fleet, containing specific guidance on VEGP Units 3 and 4 compliance with NRC Order EA-12-049 Phase 3 requirements. Since this updated OIP is a supplement to SNC's August 22, 2013 OIP, the original OIP may be needed for reference for certain information. The reactor core, containment and SFP cooling strategies remains consistent with the original OIP submittal, which includes Westinghouse report APP-GW-GLR-170. This Westinghouse report is based on the guidance from JLD-ISG-2012-01, Revision 0 and NEI 12-06, Revision 0. NRC staff compared the updated version of these guidance documents to their original issuances and found that the technical content regarding the AP1000 is unchanged. Accordingly, the NRC staff determined that Westinghouse Report APP-GW-GLR-170 is based on guidance that is current.

3.2.1 Phase 1 and 2

As identified in Order EA-12-049 and NEI 12-06, Appendix F, Phase 1 and Phase 2 strategies are covered by the design basis of the AP1000.

The design basis of the AP1000 plant includes passive design features that provide core, containment, and spent fuel cooling capability for 72 hours, without reliance on ac power. These features do not rely on access to any external water sources since the containment vessel and

the passive containment cooling system serve as the safety-related ultimate heat sink. The NRC staff reviewed these design features prior to issuance of the COL for VEGP Units 3 and 4 and certification of the AP1000 design referenced therein. The AP1000 design also includes equipment to maintain the required safety functions in the long term (beyond the 72 hours to 7 days timeframe), including capability to replenish water supplies. Connections are provided for generators and pumping equipment that can be brought to the site to back up the installed equipment. The NRC staff concluded in its final safety evaluation report for the AP1000 design that the installed equipment (and alternatively, the use of transportable equipment) is capable of supporting extended operation of the passive safety systems to maintain required safety functions in the long term. Therefore, further consideration of Phase 1 and 2 is not required.

3.2.2 Phase 3

Table F.3.2-1 of NEI-12-06, Revision 4, identifies the passive residual heat removal heat exchanger (PRHR HX) as the primary means of providing long term core cooling with ADS actuation and establishment of open loop cooling as backup. Section 6.3.7.7 of the DCD/FSAR discusses the ADS timer and the operator action to de-energize all loads on the 24-hour batteries, blocking ADS actuation and allowing for its actuation later should plant conditions degrade. NRC staff has previously evaluated this evolution and associated factors (e.g., duration of PRHR HX heat removal, equipment qualification, ADS actuation, long term safe shutdown, and post 72-hour actions) during the review of License Amendment Request (LAR) 16-026, “Passive Core Cooling System (PXS) Condensate Return,” (ADAMS Accession No. ML16319A120). NRC staff’s review of LAR 16-026 found reasonable assurance that open loop cooling can be actuated during an extended station blackout event and that the safety injection function of the passive core cooling system is retained (ADAMS Accession No. ML17024A307).

Section 6.3.4 of the DCD/FSAR states that the only post 72-hour action that may be required to provide long term core cooling is a potential need for containment inventory makeup. There is no requirement to provide makeup to the IRWST to maintain PRHR HX operability. If the PRHR HX is used for decay heat removal and the IRWST level drops below that required to maintain the RCS below the desired temperature, procedures direct the operators to depressurize the RCS and establish open-loop cooling by actuating ADS and eventual containment recirculation. The need for makeup to support containment recirculation is directly related to the leak rate from the containment. With the maximum allowable containment leak rate, makeup to containment is not needed for about one month. If the containment leak rate is less than the design value, the required makeup time frame is substantially longer.

In the long term, containment makeup may be required due to expected containment leakage. A safety-related connection is available through the manual containment isolation test connection valve in the discharge of the normal residual heat removal system (RNS). This capability is described in Section 5.4.7.5 of the DCD/FSAR.

The licensee provided the following primary and alternate strategies of extending passive safety system cooling indefinitely as part of the long-term strategies for VEGP 3 and 4.

Primary Strategy

The primary Phase 3 strategy is to continue to use the installed PCS recirculation pumps through installed piping per post 72-hour procedures. Additional inventory for the PCS and SFP is supplied from the PCCAWST using the onsite PCS recirculation pumps, powered either by the

ancillary diesel generators or offsite replacement generators provided by SAFER. The installed components are rugged components installed in at least seismic Category II structures with seismic Category II anchorage and are likely to be available or easily repairable following a BDBEE. For indefinite coping, the Phase 3 equipment includes a self-powered PCCAWST makeup pump and appropriate connections to refill the PCCAWST from the Savannah River.

Alternate Strategy

If neither PCS recirculation pump is available, a SAFER-provided self-powered pump, equivalent to the PCS recirculation pump, can take a suction from the PCCAWST via a 5-inch Storz connection on the overflow/drain line. A separate SAFER-provided pump (PCCAWST makeup pump) is provided to draw water from the Savannah River and provide makeup to the PCCAWST. The minimum required head and maximum pump discharge head is documented in Table 3-1, Section 11, of SVO-GW-GLR-724, Revision 0, "APP-GW-GLR-170 Compliance Assessment for Vogtle 3 & 4 AP1000 Units," dated March 2019. Per the licensee's OIP, SAFER pumps will meet these criteria. The staff evaluation of the pump capacity and performance is provided later in this section of the interim staff evaluation (ISE).

3.2.3 Staff Evaluations

The passive safety systems have the ability to have their operation extended indefinitely. The standard design licensing basis demonstrates safety-related means of providing core, containment, and SFP cooling for at least 72 hours. The standard design also demonstrates primary and alternate means of extending passive safety system cooling indefinitely as part of the baseline capability assessment as described in Section 1.9.5.4 of the DCD/FSAR. The passive safety systems are considered robust with respect to design-basis external events. Per the endorsed guidance of NEI 12-06, plant equipment that is designed to be robust with respect to design basis external events is assumed to be fully available.

In LAR 16-026, the NRC determined that there is reasonable assurance that open loop cooling can be actuated during an extended station blackout event and that the safety injection function of the passive core cooling system is retained. Long term open loop cooling may result in the need for makeup water to be supplied to the containment to makeup for containment leakage. A safety-related connection outside containment is available to the normal residual heat removal system, which is discussed in Section 5.4.7.5 of the DCD/FSAR. It is conservatively estimated that containment makeup will not be needed until at least one month after event initiation. The strategy to provide this makeup water is not specified in the updated OIP. However, VEGP Units 3 and 4 do have a post 72-hour procedure that addresses the issue. Procedure 3-RNS-P72-001, "Post 72-Hour Operations of Containment Makeup," provides instructions for emergency makeup to containment using a temporary pump. The purpose of this procedure is to provide instructions for emergency makeup to containment during an extended loss of offsite power and normal makeup methods are unavailable. Based on this the NRC staff is able to conclude that the licensee should be able to supply the required makeup water from the Savannah River to provide makeup to the containment, if required. However, the strategy to be used should be provided in the FIP.

NRC staff has reviewed and approved thermal-hydraulic analyses for open and closed loop modes of core, containment, and SFP cooling during design certification. No further analysis is necessary. Similarly, the staff determined that shutdown margin analyses are addressed by the standard design basis of the AP1000 and no further analysis is necessary.

As identified in Section 5.1.3.3 of the DCD/FSAR, the AP1000 design uses canned reactor coolant pumps, therefore, RCP leakage is not plausible in the AP1000 design.

Plant Instrumentation

Table 2.4-1 of the updated OIP provides the list of plant parameters monitored and identifies the associated instrumentation. NRC staff compared this table with post-accident monitoring system information provided in Section F.3.2 of NEI 12-06, Revision 4 and found the information to be consistent. Appendix F of NEI-12-06, Revision 4 was endorsed by NRC in JLD-ISG-2012-1, Revision 2. Accordingly, NRC staff finds the availability of plant instrumentation acceptable because the information provided in the updated OIP is consistent with NRC endorsed guidance.

FLEX Pumps and Water Supplies

The licensee indicated that PCSAWST makeup pump with 300 gallons per minute (gpm) capacity will take suction from Savannah River and discharge water in the PCSAWST. PCSAWST makeup pump will be shared by both units. The PCS/SFP makeup pump provided by SAFER will have a minimum capacity similar to installed PCS recirculation pumps. Section 2.16 of the updated OIP describes the on-site makeup water sources, which credits the Savanah River as a continuous source. Additional details regarding the capabilities of the pumps supplied by SAFER are provided in Section 11 of APP-GW-GLR-171 (ADAMS Accession No. ML13235A228) and Table F.3.2-1 of NEI-12-06, Revision 4. Based on the information provided by licensee, NRC finds that the SAFER supplied pumps and water supplies, as described in the OIP, should be able to support post 72-hour actions to maintain core, containment, and SFP cooling because a continuous supply of on-site makeup water is available and SAFER supplied pumps are available to supply adequate makeup water to the PCCWST, to replace the PCS recirculation pumps, and to provide makeup to the containment, if required.

Electrical Support Analyses

Per Table F.3.2-1 of NEI 12-06, one FLEX generator is required to provide post-accident monitoring and emergency lighting. A capacity of 15 kilowatts (kW) and 480 volts is sufficient assuming the FLEX pump is self-powered. Per Section 2.9 of the licensee's OIP, for indefinite coping beyond 7 days, Phase 3 equipment includes a self-powered pump for PCCAWST makeup. In addition, as an alternate strategy, Phase 3 equipment will include a self-powered PCS recirculation pump equivalent. The licensee indicated that FLEX generator with 150 kW and 480 volts capacity will be available for each unit and one additional spare generator will be available per the N+1 requirement. Based on the use of self-powered pumps, the NRC finds that a FLEX generator with a capacity of 150 kW and 480 volts ac should be sufficient to meet the needs for indefinite cooling.

Discussion of Requests for Information

During the early phase of review of the original OIP, the NRC staff requested some additional information. Responses to some of these requests for information have changed in the updated OIP and may not be applicable. The licensee indicated that other responses may still be relevant. The NRC staff determined that these responses should be used as applicable but they do not change the conclusion of this interim staff evaluation.

Confirmatory Items to Include in the FIP

Confirmatory Item 1: The design efforts related to the modifications noted in the OIP related to FLEX are complete. However, SNC should confirm that the construction and testing of the described modifications will be completed prior to implementation of OIP.

Confirmatory Item 2: In the original OIP, SNC provided simplified sketches depicting flow paths and FLEX connections. These sketches should be updated and provided in appropriate program documents, including the FIP.

Confirmatory Item 3: SNC should provide an approved equipment list to delineate required FLEX equipment (pumps, generators, fans, etc.), capacities, need for spares, and associated support (hoses, cables, connections, ducting, etc.) similar to the information provided in original OIP and NEI 12-06. The list should include the required critical performance criterion.

Confirmatory Item 4: SNC should provide a strategy to provide makeup water to containment as discussed in DCD/FSAR Section 5.4.7.5.

3.2.4 Conclusion

Based on the information discussed above, the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that, if implemented as described, including satisfactory resolution of the confirmatory items, the licensee has developed guidance that should maintain or restore core, containment, and SFP cooling during an ELAP event for an indefinite time, consistent with NEI 12-06 guidance, as endorsed by JLD-ISG-2012-01, and should adequately address the requirements of the order. This is based on: (1) Phase 1 and Phase 2 of core, containment and SFP cooling are covered by the standard design basis of the AP1000, (2) appropriate operator actions have been identified to address Phase 3 (indefinite cooling), (3) plant SSCs are available to perform their associated tasks, (4) thermal-hydraulic and shutdown margin analyses are addressed by the standard design basis of the AP1000, and (5) FLEX pumps and water supplies will be available to address potential post 72-hour actions to maintain core, containment and SFP cooling for an indefinite time.

3.3 Characterization of External Hazards (OIP Section 2.5)

For AP1000, the approach is to perform a generic assessment of the capability of a standard plant design licensed under 10 CFR 52. Appendix F of NEI 12-06 details an approach which is based on the concept of evaluating the design to a specified beyond design basis review level hazard to verify the robustness of the design against threshold effects.

For the survivability and deployment of the FLEX equipment, if the equipment is stored at a sufficient distance from the site such that it would not reasonably be subject to the same hazards, it would not need to be stored in a nuclear seismic building and would be expected to be operational following the 72-hour coping period. FLEX Equipment for VEGP Units 3 and 4 will be stored at the Phoenix, Arizona National Strategic Response Centers (NSRC) and will not reasonably be subject to the same hazards and is expected to be operational following the 72-hour coping period.

The licensee stated that there is an evaluation completed for Units 3 and 4 titled, FLEX Deployment Route Debris Assessment, which is Attachment 2 to procedure NMP-GM-038-004, VEGP 3-4 Diverse and Flexible Coping Strategies (FLEX) Program Document. That attachment

looks at the effects of applicable extreme external hazards on the deployment paths. The attachment is based on the following reports:

- 23162-000-30R-M10R-00003, Version 1.0, "VEGP Units 3 and 4 FLEX Debris Removal Assessment"
- 23162-000-30R-M10R-00004, Version 1.0, "VEGP Units 3 and 4 FLEX External Hazards Evaluation

3.3.1 Seismic (OIP Section 2.5.1)

For the AP1000 standard design, the Seismic Margin Assessment (SMA) demonstrates the robustness of the passive safety systems and the associated structures to beyond-design-basis conditions and is already included in the AP1000 licensing basis for design certification. The SMA demonstrated margin over the safe shutdown earthquake of 0.3g through confirmation that the plant high confidence, low probability of failures (HCLPFs) is at least 0.5g peak ground acceleration.

The Vogtle Ground Motion Response Spectra (GMRS), geotechnical conditions, and ground material have differences from the design analyses performed for the AP1000 seismic analyses so that a site-specific analysis was required.

SNC submitted updated GMRS and foundation input response spectra for VEGP Units 3 and 4 on December 5, 2014 (ADAMS Accession No. ML14339A849) in response to a request from the NRC dated November 5, 2014 (ADAMS Accession No. ML14302A180). By letter dated August 12, 2015 (ADAMS Accession No. ML15139A516) the NRC staff approved SNC's request to use the VEGP Units 1 and 2 GMRS for VEGP Units 3 and 4 given the proximity and similarity of subsurface conditions. The NRC staff concluded that no changes in seismic licensing basis are necessary for VEGP Units 3 and 4 to satisfy the latest guidance on seismic requirements.

3.3.2 Flooding (OIP Section 2.5.2)

In its OIP SNC stated that VEGP Units 3 and 4 are built above the design-basis flood level. The limiting design-basis flood-causing mechanism is upstream dam failures. The design basis flood level derived from this event, including wave set up, is over 40 feet below the site grade elevation. In accordance with NEI 12-06, VEGP Units 3 and 4 are considered a dry site and would not be adversely affected by external flooding.

In the OIP, SNC asserts that VEGP Units 3 and 4 is a dry site, including consideration of the probable maximum precipitation event. Because of the passive cooling features of the AP1000 design, any potential ponding of excessive rainwaters on the VEGP Unit 3 and 4 site will have no impact on the long-term cooling strategies that will be supported by SAFER equipment.

SNC also completed an analysis of the interim time where Unit 3 is operational and Unit 4 is still under construction (Reference: SY0-0000-X7C-800002, Version 1.0 Vogtle Units 3 and 4 Local Probable Maximum Precipitation Flood Analysis -Interim Construction Condition - Unit 3 Operational). The calculation determined that the maximum flood level remains below the site grade and has no impact on Unit 3 operation.

3.3.3 Severe Storms with High Winds (OIP Section 2.5.3)

The approved design of the AP1000 envelope the VEGP Units 3 and 4 site-specific BDBEE values for the post 72-hour passive coping period.

3.3.4 Snow, Ice, and Extreme Cold (OIP Section 2.5.4)

The approved design of the AP1000 envelope the VEGP Units 3 and 4 site-specific BDBEE values for the post 72-hour passive coping period. The guidelines provided in NEI 12-06 generally exclude the need to consider extreme snowfall at plant sites in the southeastern U.S. below the 35th parallel. VEGP Units 1, 2, 3, and 4 are located at approximately 33° N latitude. In the unlikely event that an ELAP event occurred concurrent with a BDBEE snowfall, snow removal could be accomplished with debris removal equipment stored in the FLEX dome. FLEX support equipment stored in the FLEX dome is able to deploy along the haul paths in snowy or icy conditions. VEGP Units 3 and 4 UFSAR Section 2.4.7.1 states, "it is very unlikely that surface or frazil ice formation would occur in the Savannah River in the vicinity of the proposed VEGP Units 3 and 4 river intake structure."

Confirmatory Item 5: SNC updated the "Cold Weather Checklist" procedure for VEGP Units 1 and 2 to incorporate a check of roads and access routes in the OCA and protected area for icing conditions. The checklist designated a sand procurement location and to deploy ice melt from a storage warehouse. SNC needs to confirm that this checklist has been extended to cover the FLEX deployment routes for VEGP Units 3 and 4.

3.3.5 Extreme Heat (OIP Section 2.5.5)

The approved design of the AP1000 envelope the VEGP Units 3 and 4 site-specific BDBEE values for the post 72-hour passive coping period. VEGP Units 3 and 4 SAFER equipment is specified to operate up to 110°F, which envelopes the normal maximum temperatures of 97°F. The FLEX Dome is not used for storing VEGP Units 3 and 4 Phase 3 major equipment with one exception, the RapidCom trailer. The rest of the equipment will be housed at the NSRC in Phoenix, Arizona.

Extreme high temperatures are not expected to impact the ability of personnel to implement the required FLEX strategies and deploy support equipment from the FLEX dome to VEGP Units 3 and 4. For equipment deployment activities required within the auxiliary building, licensee analysis determined that temperatures will remain below 110°F. Site industrial safety procedures address activities with a potential for heat stress to prevent adverse impacts on personnel.

3.3.6 Conclusions

Based on a review of SNC's plan, including the six-month update dated August 28, 2020, and satisfactory resolution of the confirmatory item noted, the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that, if implemented as described including satisfactory resolution of the confirmatory item, the licensee has developed a characterization of external hazards that is consistent with NEI 12-06 guidance, as endorsed by JLD-ISG-2012-01, and should adequately address the requirements of the order in regard to the characterization of external hazards.

3.4 Planned Deployment of FLEX Equipment (OIP Section 2.6)

VEGP Units 1, 2, 3 and 4 are considered one site. All four units will enter FLEX response procedures following established protocols. The VEGP Units 3 and 4 haul paths are a continuation of the VEGP Units 1 and 2 haul paths. SNC submitted the FIP for VEGP Units 1 and 2, by letter dated May 23, 2016 (ADAMS Accession No. ML16146A607). The NRC staff documented its safety evaluation regarding implementation of the Mitigation Strategies in a letter dated November 14, 2016 (ADAMS Accession No. ML16301A419). The FIP describes the FLEX deployment for VEGP Units 1 and 2, including access to all the equipment contained within the onsite FLEX storage building. The VEGP Units 1 and 2 FLEX response requires no additional evaluations to support VEGP Units 3 and 4.

FLEX haul routes used for VEGP Units 1 and 2 will be cleared within 4 hours with equipment stored in the FLEX dome following the BDBEE and be available for use to access VEGP Units 3 and 4. All required equipment for VEGP Units 1 and 2 response for clearing haul paths and transporting trailers and refueling activities will be made available for VEGP Units 3 and 4 once Units 1 and 2 activities are complete. The appropriate haul routes for Units 3 and 4 have been evaluated for access as discussed in NEI 12-06 (including liquefaction).

3.4.1 Means of Deployment (OIP Section 2.6)

In its OIP, SNC stated that the equipment used to transport equipment for Phase 3 strategies will be the same vehicles used for VEGP Units 1 and 2. Equipment will be towed by a heavy duty pickup truck and a small semi-tractor. The wheeled loader can also be used to tow equipment. The tires for these vehicles and trailers are designed to withstand small debris punctures and razor wire cuts/penetration (i.e., large commercial/military grade, run-flat, non-pneumatic tires). Debris clearing equipment is stored in the FLEX storage building. This provides the equipment with direct access to the critical travel paths providing timely debris removal.

The licensee determined that all haul paths for VEGP Units 3 and 4 can support a minimum of two lanes of normal vehicular traffic. This will decrease the likelihood of a path being completely blocked, as well as reduce the time it will take to clear any debris. The possibility exists to move off of the roadway to avoid debris along a majority of the deployment route paths. Alternative routes into the power block area exists that can be utilized. A seismic event could cause a complete building 302 collapse in a north direction which could result in a large debris pile on the primary haul path. Because of the low likelihood of the haul routes being completely blocked by debris, and the substantial time delay from the initiating BDBEE to placement of additional FLEX equipment (72 hours), any debris required to be removed to allow passage of tow vehicles and trailers can be accomplished with the onsite debris removal equipment such that a single passable lane is established.

In the OIP, SNC states that the VEGP Units 3 and 4 haul paths have been analyzed for liquefaction, similar to VEGP Units 1 and 2 haul paths. Analyses indicate that there are potentially liquefiable soils below the design groundwater level, and that some settlement may occur along the travel paths following an earthquake. The magnitude of the settlement expected to occur is not anticipated to make the road impassable for the selected haul vehicles and wheeled loader.

The licensee performed a debris assessment for the site to determine debris removal equipment requirements. It was determined that the debris removal equipment should be capable of moving large debris such as automobiles, trees, pieces of buildings, switchyard structures, and

concrete barriers, in addition to general assorted small debris. Based on this assessment, it was determined that a medium wheeled loader with the appropriate blade and horsepower can move the postulated debris in a single maneuver which simplifies and speeds the debris removal effort. This is because of its articulated steering and the capability of using a variety of tools which can be specific to the task. Various tools make this wheeled loader: a fork lift; a hoist; a modified version of a bulldozer; or a bucket lift. All debris removal tools are stored in the FLEX storage building.

SNC has evaluated the potential impact of ice buildup on FLEX equipment deployment in Attachment 2 to procedure NMP-GM-038-004, the FLEX program document. Ice buildup could conceivably affect the integrity of a non-robust structure with ice buildup on roof tops, etc. Although partial structural collapses may occur from ice buildup, there are no buildings in the travel path that would adversely affect transportation. Extreme cold and ice buildup could conceivably result in downed power lines and trees. Any downed lines can be removed with the onsite debris removal equipment. VEGP Units 1 and 2 have a more urgent requirement for using the haul paths to stage FLEX equipment. However, VEGP Units 3 and 4 doesn't stage FLEX equipment for the first 72 hours ensuring adequate time to address possible icy roadways and/or debris.

3.4.2 Deployment Strategies (OIP Sections 2.6.1 and 2.20.1)

During an ELAP, when a loss of all ac occurs due to an external event, the VEGP Units 3 and/or 4 operating crew would need to determine if there is confidence in restoration of power within 72 hours. If not, an ELAP should be declared as soon as possible and the Emergency Offsite Facility notified to contact SAFER. The sooner this call is made, the sooner equipment begins to travel to site. If VEGP Units 1 and/or 2 are affected as well, the ELAP determination is made within the first hour. Once SAFER is contacted, all of the equipment for the site (VEGP Units 1, 2, 3 and 4) will be dispatched per the VEGP SAFER Response Plan.

For the Vogtle site, the local assembly area (Staging Area "C") is the Barnwell Regional Airport, South Carolina. From there, equipment can be delivered to the Vogtle site by helicopter if ground transportation routes are not available. Communications will be established between the Vogtle plant site and the SAFER team via satellite phones. For Units 3 and 4, the equipment will be delivered to the site within 24 hours from the initial site request. The order at which equipment is delivered for all four units is identified in the VEGP SAFER Response Plan.

Typically, deliveries will go by truck using preselected routes and with any necessary escort capabilities to ensure timely arrival at the plant site staging area. The use of helicopter delivery is typically considered when routes to the plant are impassable and time considerations for delivery will not be met with ground transportation. Multiple pre-selected routes are one method to circumvent the effects of seismic events, floods, etc., and these routes will consider potentially impassible areas such as bridges, rivers, heavily wooded areas and towns. The drivers will have the routes marked and will be in communication with the NSRC to ensure that the equipment arrives on time.

SAFER equipment deployment will take advantage of the earlier VEGP Units 1 and 2 deployment plan and path clearing due to the substantial coping time allotted by the 72-hour passive coping period. Evaluations of the acceptability of the haul paths have been performed per References 63 and 64 of the OIP.

Confirmatory Item 6: OIP References 63 and 64 are noted in Section 2.20.1 as an evaluation of the haul paths for Units 3 and 4. These references are not included in the OIP list of references.

3.4.3 Connection Points

Mechanical Connection Points

After the initial safety-related cooling period of 72 hours, the AP1000 standard passive design includes both onsite equipment in the form of the ancillary diesel generators and connections for interfacing with transportable emergency equipment. The connections are designed to provide cooling water and address the needs of required plant functions. For Phase 3, there is a primary and alternate strategy to use offsite equipment to maintain the key safety functions indefinitely.

A design change was developed to add an engineered means of using the PCCAWST as a water source for the PCS/SFP makeup pump. A 5" Storz connection will be added to the drain/overflow line to allow for an easy connection for the portable PCS/SFP makeup pump (APP-PCS-GEF-152). This change is included in Confirmatory Item 1.

PCCAWST Makeup Pump [OIP Section 2.9.2.1]

For indefinite coping after 7 days, the licensee credits a diesel driven self-powered pump (PCCAWST makeup pump) and appropriate connection materials to refill the PCCAWST from the Savannah River. A non-safety related connection on the PCCAWST drain/overflow line is provided to refill the PCCAWST. The pump and appropriate connection materials are provided by SAFER.

Self-powered PCS/SFP Makeup Pump (PCS recirculation pump equivalent) [OIP Section 2.9.2.2]

In the unlikely event that both PCS recirculation pumps are unavailable, the SAFER provided self-powered PCS/SFP makeup pump, will take suction from the PCCAWST via the 5-inch Storz connection added to the overflow/drain line. The discharge from the self-powered PCS/SFP makeup pump is connected to a safety related, seismically qualified flange in the yard using fire hose. This arrangement (see Figure 2 of the original OIP) provides a minimum of 135 gpm of makeup flow to the SFP and the PCCWST. The PCCAWST makeup pump (discussed above) will be used to provide makeup to the PCCAWST. This arrangement is provided in lieu of the self-powered portable pump supply coming from the Savannah River and discharging directly in to the safety-related, seismically qualified flange.

Electrical Connection Points (OIP Section 2.10.2.2)

Electrical connection points are only applicable for Phase 3 of the mitigation strategies for a BDBEE.

The primary strategy is to use the onsite ancillary diesel generators in accordance with post-72 hour procedures. Provisions are available to use offsite portable generators if the permanently installed ancillary diesel generators are unavailable. The AP1000 design does not require that the ancillary diesel generators be safety-related. Their operation is not required following a loss of all ac power for 72 hours. They are easily replaced with offsite portable generators, which are

capable of being connected to the distribution panel in the same room or to a safety-related connection as described in Section 1.9.5.4 of the DCD/FSAR.

In the alternate strategy to provide power for post-accident monitoring, and for ventilation in the MCR and other areas, some plant modifications are required as discussed in the proprietary portion of the updated OIP. The completion of modification is included in Confirmatory Item 1.

3.4.4 Accessibility and Lighting (OIP Section 2.14)

Power to normal and emergency lighting in the MCR is supplied from the redundant divisions of Class IE DC and UPS system through two series fuses for isolation. The fuses protect the batteries from failures of the non-1E lighting circuits. The Class 1E batteries provided in the Class IE DC and UPS system are capable of powering the emergency lighting for 72 hours when the normal ac sources are not available.

The primary strategy following the 72-hour period after a loss of all ac power sources is to supply power to lighting in the MCR from the ancillary ac generators. Provisions are also made to power the post-accident monitoring systems and the main control room lighting loads in divisions B and C from ancillary ac generators during the post 72-hour period as described in DCD/FSAR Subsection 8.3.2.1.1.2. As noted in Section 3.4.3, the ancillary generators are easily replaced by temporary generators provided by SAFER as an alternate strategy.

In order to validate the adequacy of supplemental lighting and the adequacy and practicality of using portable lighting to perform FLEX strategy actions, all operators are required to have flashlights. In addition, the MCR and Maintenance Shop include a stock of flashlights and batteries to further assist the staff responding to a BDBEE event during low light conditions.

3.4.5 Access to Protected and Vital Areas

The licensee did not provide information in this area in the updated OIP. However, no additional FLEX equipment are identified for access to protected areas in Order EA-12-049. Access to protected areas during loss of offsite power is addressed in physical security plan.

3.4.6 Fueling of FLEX Equipment

In its FIP for Units 1 and 2, SNC stated that the four underground diesel fuel oil storage tanks (DFOSTs) are seismically qualified and have a nominal capacity of 80,000 gallons each. The VEGP Units 1 and 2 technical specifications require that each DFOST contains at least 68,000 gallons of fuel. The stored quantity of fuel in any selected DFOST will meet the fuel demand for all of the diesel driven FLEX equipment well past 72 hours. The Phase 2 support strategy includes repowering an existing diesel fuel oil transfer pump to refill a FLEX fuel tanker from the chosen DFOST. Hoses are connected to vent connections in the existing pump discharge piping. Temporary FLEX cables with quick connect terminations will supply power from a 480V FLEX diesel generator to the existing pump motor cables. A FLEX fuel tanker will be towed to each diesel-driven FLEX component that needs refueling. An on board dc powered pump will dispense fuel oil from the tanker. The haul routes for transporting fuel are the same haul routes for deployment of the FLEX equipment, which are evaluated for accessibility following screened in external hazards.

All four DFOSTs have been sampled to determine sulfur content and all were found to be in excess of 200 parts per million (ppm). At the current usage rate of fuel oil, it will be years before

the sulfur content in the DFOSTs reaches 15 ppm ultra low sulfur diesel (ULSD) fuel. For the first 72 hours, the debris removal equipment, tow vehicles and diesel lights are the only FLEX equipment that require ULSD. Because of how long it will take to reduce the sulfur content in the DFOST's a sufficient quantity of ultra-low sulfur fuel oil will be maintained to operate the equipment listed above for a minimum of 72 hours. A FLEX fuel tanker, stored in the FLEX storage building, is used to keep the equipment, requiring ULSD fueled. The 500 gallon capacity fuel tanker is sufficient to keep the FLEX equipment requiring ultra-low sulfur fueled for at least 72 hours. Post 72 hours, the ancillary diesels will be operating and will also need to be refueled with ULSD at periodic intervals. The NMP-OS-019-367 procedure provides direction for resupply of fuel oil supply volume. SNC indicates that this volume is sufficient for all debris clearing and equipment towing needs. SNC indicated that above procedure will be used to coordinate the supply of diesel fuel for all four VEGP units.

3.4.7 Communications

By letter dated August 16, 2019 (ADAMS Accession No. ML19240A068), SNC provided an assessment of its communications capabilities in response to NRC's March 12, 2012, request for information regarding the NTTF Recommendation 9.3 on emergency preparedness communications. In letter dated January 30, 2020, the NRC staff concluded that SNC's assessment for communications is reasonable, and the proposed enhancements will help ensure that communications are maintained (ADAMS Accession No. ML20022A056).

3.4.8 Plant Modifications to Support FLEX Strategies

Two design changes were developed by SNC to enhance the Phase 3 strategies and have been incorporated into the strategies as presented in the OIP.

The licensee has proposed modifications (APP-FSAR-GEF-043, Revision 0, "Connection Addition to IDS for Post 72-Hour FLEX") to ensure power will be provided to the MCR and equipment room using portable equipment. This change added additional defense-in-depth to ensure adequate power for FLEX response post 72 hours.

The second design change, APP-PCS-GEF-152 added a 5-inch Storz connection to the drain/overflow line for the PCCAWST. This change adds an engineered means of using the PCCAWST as a water source for the PCS recirculation pump equivalent.

SNC has indicated that the design changes are completed. However, construction activities, may not have been physically completed. SNC intends to verify that each piece of FLEX equipment is capable of making up to the provided plant connection points. This is part of Confirmatory Item 1.

3.4.9 Conclusions

The NRC staff concludes that the licensee has developed guidance that, if implemented appropriately with satisfactory resolution of Confirmatory Items, should allow deploying the FLEX equipment following a BDBEE consistent with NEI 12-06 guidance as endorsed by JLD-ISG-2012-01, and should adequately address the requirements of the order.

3.5 Considerations in Using Offsite Resources (OIP Sections 2.20 and 2.10.2.2)

3.5.1 FLEX Capabilities – SAFER Equipment List (OIP Sections 2.19.5 and 2.19.6)

The updated OIP does not contain a FLEX equipment list. The equipment necessary for the implementation of the FLEX strategies in response to a BDBEE at VEGP Units 3 and 4 will be developed based on the final sizing and selection of the FLEX generator, pumps and associated cabling, hoses connectors, fittings, etc. Due to the design of the AP1000, no phase 1 or backup phase 2 equipment will be stored on-site.

SNC should provide an approved equipment list to delineate required FLEX equipment (pumps, generators, fans, etc.), capacities, need for spares, and associated support (hoses, cables, connections, ducting, etc.). The list should include the required critical performance criterion. This is included in Confirmatory Item 3.

3.5.2 Protection of FLEX Equipment

Consistent with NEI 12-06, 3.2.2.16, the site (for AP1000, SAFER) should have sufficient equipment to address all functions at all units on-site, plus one additional spare. This is called an "N+1 capability". N+1 will be procured for a single response center. SNC addressed N+1 by stating that 3 pieces of portable equipment will be provided when a separate train is needed for each unit and two pieces will be provided when a single train can supply both units. NRC staff has reviewed the licensee's preliminary list of portable equipment needs. If procured and available as described, the portable equipment should meet the N and N+1 requirement specified in NEI 12-06.

This equipment will be stored at the regional response center in Phoenix, Arizona. For an AP1000, a single response center is acceptable per NEI 12-06, Appendix F.3.2: "Use of more than one storage location is not necessary as long as the storage site is far enough away from the site(s) such that the same extreme hazard could not affect both the plant(s) and the storage location." VEGP Units 3 and 4 FLEX equipment will be stored in the Phoenix, Arizona NSRC. Staff considers it reasonable to conclude that the same extreme hazard cannot affect both the site and the NSRC based on the approximately 1,700-mile distance between locations.

3.5.3 FLEX Equipment Unavailability Tracking (OIP Section 2.19.8)

See Section 3.12 of this ISE

3.5.4 VEGP SAFER Plan

The industry has collectively established the needed off-site capabilities to support FLEX Phase 3 equipment needs via the SAFER Team. SAFER consists of the Pooled Equipment Inventory Company (PEICo) and AREVA Inc. and provides FLEX Phase 3 management and deployment plans through contractual agreements with every commercial nuclear operating company in the United States.

There are two National SAFER Response Centers (NSRCs), located near Memphis, Tennessee and Phoenix, Arizona, established to support nuclear power plants in the event of a BDBEE. For non-AP1000 sites, each NSRC holds five sets of equipment, four of which will be able to be fully deployed to the plant when requested. The fifth set allows removal of equipment from

availability to conduct maintenance cycles. In addition, the plant's FLEX equipment hose and cable end fittings are standardized with the equipment supplied from the NSRC.

By letter dated September 26, 2014 (ADAMS Accession No. ML14265A107), and subsequently by letter dated September 20, 2018 (ADAMS Accession No. ML18157A014), the NRC staff issued its assessment of the NSRCs established in response to Order EA-12-049. In its assessment, the NRC staff concluded that SAFER has procured equipment, implemented appropriate processes to maintain the equipment, and developed plans to deliver the equipment needed to support site responses to BDBEEs, consistent with NEI 12-06 guidance; therefore, the NRC staff concluded in its assessment that licensees can reference the SAFER program and implement their SAFER response plans to meet the Phase 3 requirements of Order EA-12-049.

For an AP1000, a single response center is acceptable per NEI 12-06, Appendix F.3.2: "Use of more than one storage location is not necessary as long as the storage site is far enough away from the site(s) such that the same extreme hazard could not affect both the plant(s) and the storage location." VEGP Units 3 and 4 FLEX equipment will be stored in the Phoenix, Arizona NSRC.

SNC stated that on-site FLEX equipment hose and cable end fittings are standardized with the equipment supplied from the NSRC. In the event of an ELAP and LUHS event, equipment will be moved from an NSRC to a local assembly area established by the SAFER team. FLEX strategy requests to the NSRC will be directed by FLEX procedures.

The licensee indicated that the SAFER contract will be in place by October 2020 for VEGP Units 3 and 4. However, due to recent change in the fuel load date for Unit 3, SNC expects to implement SAFER contract one month before fuel load date for Unit 3.

3.5.5 Staging Areas

In general, up to four staging areas for NSRC supplied Phase 3 equipment are identified in the SAFER Response Plans for each reactor site. The VEGP site uses two onsite staging areas (A and B) and one primary offsite local assembly area (Staging Area "C").

SNC stated that the local assembly area (Staging Area "C") is the Barnwell Regional Airport, South Carolina. From there, equipment can be delivered to the VEGP site by helicopter if ground transportation routes are not available. Communications will be established between the VEGP plant site and the SAFER team via satellite phones and required equipment moved to the site as needed. For Units 3 and 4, the Phase 3 equipment will be delivered to the site within 24 hours from the initial request. The order at which equipment is delivered is identified in the VEGP SAFER Response Plan.

From Staging Areas C and/or an intermediate staging area approximately 25 miles from the site, the SAFER team will transport the Phase 3 equipment to the on-site Staging Area B for interim staging prior to it being transported to the final location in the plant (Staging Area A) for use in Phase 3.

SNC further stated that NSRC personnel will commence delivery of a pre-selected equipment set from the NSRC upon notification by the plant site. Plans are to deliver equipment from offsite sources via truck or air lift. Typically, deliveries will go by truck using preselected routes and with any necessary escort capabilities to ensure timely arrival at the plant site staging area

or to an intermediate staging area approximately 25 miles from the site. The delivery of equipment from the intermediate staging area will use the same methodology. These areas are designed to accommodate the equipment being delivered from the NSRC. Depending on time constraints, equipment can be flown commercially to a major airport near the plant site and trucked or air lifted from there to the staging areas. The use of helicopter delivery is typically considered when routes to the plant are impassable and time considerations for delivery will not be met with ground transportation. Multiple pre-selected routes are one method to circumvent the effects of seismic events, floods, etc., and these routes will take into account potentially impassible areas such as bridges, rivers, heavily wooded areas and towns. The drivers will have the routes marked and will be in communication with the NSRC to ensure that the equipment arrives on time.

The NRC staff considers it reasonable that the SAFER plan for VEGP Units 3 and 4 will be incorporated into the SAFER plan for VEGP Units 1 and 2. If implemented as described, the NRC staff concludes that there is reasonable assurance that SAFER equipment can be delivered to the site when needed.

3.5.6 Conclusions

Based on a review of SNC's plan, including the six-month update dated August 28, 2020, the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that the licensee has developed guidance that, if implemented appropriately, should allow use of offsite resources following a BDBEE consistent with NEI 12-06 guidance, as endorsed by JLD-ISG-2012-01, and should adequately address the requirements of the order.

3.6 Safety Function Support – I&C (OIP Section 2.10)

3.6.1 Phase 1 and 2

The design basis of the AP1000 plant includes passive design features that provide core, containment, and spent fuel cooling capability for 72 hours, without reliance on ac power sources. Installed plant equipment is available to extend this capability through 7 days. Connections are provided for off-site generators and pumping equipment that can be brought to the site to back up the installed equipment. Further consideration of Phases 1 and 2 is not necessary.

3.6.2 Phase 3

Beyond the initial 72 hours, instrument power can be supplied by the use of onsite permanently installed ancillary diesel generators or offsite portable generators with quick and accessible connection points. This capability is described in DCD/FSAR Section 8.3.1.1.1.

The primary strategy is to use the onsite ancillary diesel generators, in accordance with post 72-hour procedures if they are available post event or offsite portable generators if the permanently installed ancillary diesel generators are unavailable. The offsite portable generators are capable of being connected to the distribution panel in the same room or to a safety-related connection using quick and accessible connection points.

The licensee also provided an alternative strategy to ensure that power is provided for the following using portable generators and diverse connection points:

- post accident monitoring instrument power,
- MCR lighting, and
- ventilation in the MCR and B and C I&C rooms

This will require some plant modifications. The licensee provided this information in the proprietary portion of the updated OIP. The NRC staff reviewed the information provided in the proprietary portions of the OIP submittal related to the alternate strategies to provide instrument power, MCR lighting, and ventilation using portable generators and equipment. If implemented as described by the licensee, this provides an important defense in depth capability to maintain these functions.

3.6.3 Conclusions

Based on a review of SNC's plan, the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that the licensee has developed guidance that, if implemented appropriately, should maintain power for Class 1E post-accident monitoring, MCR lighting, MCR and I&C room ventilation, and power to refill the PCCWST using the PCS recirculation pumps.

3.7 Habitability and Operations

3.7.1 MCR and I&C Room Ventilation (OIP Section 2.11)

The staff reviewed ventilation related strategies in the updated OIP. The review guidelines, outlined in NEI-12-06, Section 3.2.1.8, “Effects of Loss of Ventilation,” are to verify that the effects of loss of HVAC in an extended loss of ac power event can be addressed consistent with NUMARC 87-00 or by plant-specific thermal hydraulic calculations. NUMARC 87-00, Section 2.7, “Effects of Loss of Ventilation,” discussed technical bases on equipment operability outside containment and control room habitability. The staff’s review concentrated on the MCR and I&C rooms.

According to the DCD/FSAR, Section 6.4.2.2, MCR habitability is maintained by the MCR emergency habitability system, without reliance on ac power sources. The heat sinks in the MCR are designed to limit the temperature rise. In the event that power is unavailable for more than 72 hours, MCR habitability is maintained by operating one of the two MCR ancillary fans (powered by the ancillary generator) to supply outside air to the MCR. Power to the ancillary fans to provide post 72-hour ventilation of the control room and I&C rooms is supplied from divisions B and C regulating transformers through two series fuses for isolation.

According to the DCD/FSAR, Section 9.4.1.2.3.2, the heat sinks in I&C rooms provide area temperature control if the plant ac power sources are unavailable. After 72 hours, I&C room temperature is maintained by operating their respective ancillary fans (powered by the ancillary generator).

Because the design basis of the AP1000 plant includes design features to provide necessary temperature control for 72 hours by installed plant equipment, without reliance on ac power sources, further consideration of Phase 1 and 2 is not necessary.

The updated OIP provided the following strategies for Phase 3.

Primary Strategy Beyond Initial 72 Hours [OIP Section 2.11.2.1]

Beyond the initial 72 hours, MCR habitability and I&C room cooling is maintained using ancillary fans powered by the ancillary diesels. In addition there are offsite replacement fans and portable generators available (see above I&C strategy). Ancillary diesel generators located in the annex building are capable of providing power for MCR and I&C room ancillary fans. This capability is described in Section 8.3.1.1.1 of the DCD/FSAR. The onsite, installed ancillary fans located in the Division B and C I&C rooms can maintain room temperature below the qualification temperature of the I&C equipment. The post 72-hour procedures include provisions to replace, start, and connect the ancillary diesel generators and initiate the respective ancillary fans as a primary strategy for post 72-hour ventilation.

Alternate Strategy Beyond 72 hours [OIP Section 2.11.2.2]

The licensee also provided an alternate strategy for providing capability for MCR habitability and I&C room ventilation by using offsite portable generators and fans as necessary. This is discussed in the proprietary portion of the updated OIP. The NRC staff reviewed the information provided in the proprietary portions of the OIP submittal related to the alternate strategies to provide ventilation using portable generators and equipment. If implemented as described by the licensee, this provides an important defense in depth capability to maintain these functions.

The staff reviewed the OIP against NEI-12-06, Section 3.2.1.8, and concluded that the ventilation related strategies can maintain MCR habitability and I&C room cooling during extended loss of ac power conditions.

3.7.2 Equipment Operating Conditions (OIP Section 2.12)

Loss of Ventilation (OIP Section 2.12.1)

Following a BDBEE and subsequent ELAP event at VEGP Units 3 and 4, ventilation providing cooling to occupied areas and areas containing FLEX strategy equipment will be lost. As discussed in NEI 12-06, FLEX strategies must be capable of execution under the adverse conditions expected following a BDBEE resulting in an ELAP and LUHS event. The primary concern with ventilation is the heat buildup that occurs with the loss of forced ventilation in areas that continue to have heat loads.

The key areas identified for all execution of the FLEX strategy activities are the MCR and Divisions B and C I&C rooms. The AP1000 design provides habitability systems with the capability to maintain the MCR environment suitable for occupancy for at least 72 hours, as well as provisions for maintaining appropriate temperatures in the MCR, and Division B and C I&C rooms beyond 72 hours.

Alternate strategies using portable fans or opening doors in the auxiliary building were evaluated in APP-GW-GLR-726, Revision 0, “Auxiliary Building Best Estimate Temperatures during a Loss of AC Power Results.”

A loss of ventilation analyses was performed to quantify the maximum steady state temperatures expected in specific areas related to FLEX implementation to ensure the environmental

conditions remain acceptable for personnel habitability or accessibility and within equipment limits. (APP-GW-GLR-726)

Containment

The PCS is designed to maintain the containment pressure and temperature within containment design-basis limits as specified in DCD/FSAR Section 6.2.2. With containment pressure and temperature maintained within the design limits, the NRC staff finds that the required electrical equipment in the containment will not be adversely impacted as a result of an ELAP event.

Heat Tracing/Freeze Protection (OIP Section 2.12.2)

Freeze protection of the PCCWST, the PCCWST recirculation lines, the supply line to the water distribution bucket, piping between the PCCAWST and the auxiliary building is discussed by the licensee in the OIP. This equipment is all described in the DCD/FSAR, and freeze protection, as necessary, is required by existing plant procedures and processes. According to the licensee's OIP, the PCCWST is constructed to prevent freezing and ensure water delivery to the containment following system activation. Provisions are available to either maintain flow in the PCCWST recirculation lines during freezing conditions, or to drain them as necessary while they are not in use. The PCCAWST is located in the yard adjacent to the auxiliary building. The supply line to the water distribution bucket from the post 72-hour makeup flanged connection is maintained dry by layout requirements and leaving drain valve V015 open. Also, the non-safety piping between the PCCAWST and the Auxiliary Building is maintained dry by layout requirements. Heat tracing is applied as needed between the PCCAWST and the tank isolation valves. The PCCAWST is insulated such that, should the heater fail, the insulation and thermal inertia of the tank and contents will assure that the contents will prevent freezing for 7 days.

Hydrogen Gas Control in Vital Battery Rooms

The licensee's strategy does not rely on charging the safety related batteries. Therefore, there is no source of hydrogen buildup in the vital battery rooms to consider.

3.7.3 Personnel Habitability (OIP Section 2.13)

The desired limit for environmental conditions related to FLEX scenarios is temperatures in accessed areas remaining below 110°F. This is based on the assumed maximum temperature for efficient human performance as described in NUMARC 87-00. This is not an acceptance criteria for the analysis, but is used as a comparison.

Summary: Temperatures within rooms requiring entry during FLEX scenarios with a loss of ac power are expected to be habitable for an indefinite period of time (30 days) when opening the Auxiliary Building room doors listed in Appendix A of APP-GW-GLR-726, Revision 0, "Auxiliary Building Best Estimate Temperatures during a Loss of AC Power Results," to the atmosphere.

Main Control Room

The AP1000 design provides habitability systems with the capability to maintain the MCR environment suitable for occupancy for at least 72 hours, as well as provisions for maintaining appropriate temperatures in the Division B and C I&C rooms. Passive heat sinks provide cooling of the MCR and I&C rooms. Post 72-hour procedures utilize the ancillary generators and fans to

maintain MCR and I&C room ventilation. This capability is described in DCD/FSAR Section 8.3.1.1.1. An alternate strategy is available to provide this power from a SAFER supplied portable generator (OIP Section 2.10.2.2, and 2.11.2.2). In addition, provisions are available for using offsite portable fans, and offsite portable ducting and cables. The portable fans will be comparable to the ancillary fans described in DCD/FSAR Section 9.4.1.2.2.

During cold weather, the ventilation flow can be limited to keep the MCR at a habitable temperature.

Spent Fuel Pool Area

Procedure 3/4-SFS-P72-00 I (Operations of Spent Fuel Pool Cooling), provides instructions for makeup to the Spent Fuel Pool with electrical power unavailable due to volume loss caused by a loss of SFP cooling. The procedure also provides instructions on operation of the Fuel Handling Area Relief Damper to limit SFP Area temperature increases.

Division B and C I&C Rooms (OIP Section 2.11.2)

See discussion above concerning the MCR, which also discusses the I&C rooms

3.7.4 Communications (OIP Section 2.15)

See Section 3.4.7 of this report.

3.7.5 Conclusions

The staff reviewed the OIP against NEI-12-06, Section 3.2.1.8, and concluded that the ventilation related strategies can maintain MCR habitability and I&C room cooling during extended loss of ac power conditions. The NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that the licensee has developed guidance that, if implemented appropriately, should maintain or restore equipment and personnel habitability conditions following a BDBEE consistent with NEI 12-06 guidance as endorsed by JLD-ISG-2012-01 and should adequately address the requirements of the order.

3.8 Water Sources (OIP Section 2.16)

Makeup water for the PCCAWST will be required for the beyond 7 days coping period. Table 2.16-1 of the OIP provides a comprehensive list of on-site makeup water sources considered for PCCAWST makeup. This includes each source's design robustness with respect to seismic events, floods, high winds, and associated missiles and each source's water quality (relative to reactor water chemistry requirements). Only the Savannah River meets the qualification guidelines of NEI 12-06 for an injection source that can be credited for the ELAP/LUHS event. Other tanks and basins are included in the table to provide a comprehensive list of site water sources. These non-creditable water sources, depending on the cause of the event, may be available for injection and although are not credited, could be considered for use during an actual event.

Strategies to refill the PCCAWST from the Savannah River are contained in Section 3.2. For long-term open loop cooling, containment makeup may be required after 30 days or more. The NRC has been able to conclude that the licensee will have the ability to provide makeup water to

the containment, if needed, after 30 days. The strategy should be included in the FIP. This is included in Confirmatory Item 4.

3.8.1 Conclusions

Based on a review of SNC's plan, including the six-month update dated August 28, 2020, the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that the licensee has developed guidance that, if implemented appropriately, should maintain satisfactory water sources following a BDBEE consistent with NEI 12-06 guidance, as endorsed by JLD-ISG-2012-01, and should adequately address the requirements of the order.

3.9 Shutdown and Refueling Analyses (OIP Section 2.17)

Order EA-12-049 requires that licensees must be capable of implementing the mitigation strategies in all modes. In general, the discussion above focuses on an ELAP occurring during power operations. This is appropriate, as plants typically operate at power for 90 percent or more of the year. The basic strategies are identical for all modes with minor differences in parameters (e.g., required passive containment cooling system and spent fuel pool makeup flow depending on location of fuel). The license refers to APP-PCS-M3-001, Revision 11, “Passive Containment Cooling System — System Specification Document,” November 2018, for Reactor Decay Heat Loads, Spent Fuel Pool Decay Heat Loads, Containment Cooling Makeup Water Source Requirements and Spent Fuel Pool Makeup Water Source Requirements. Plant procedures provide the necessary instructions to provide core/containment and SPF cooling during all modes of operation including Shutdown and Refueling.

Based on a review of SNC's plan, including the six-month update dated August 28, 2020, the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that the licensee has developed procedures to provide core/containment and SFP cooling during all modes of operation and should adequately address the requirements of the order.

3.10 Programmatic Elements (OIP Section 2.19)

3.10.1 Programmatic Documents (OIP Section 2.19.1)

SNC's program for FLEX in response to a BDBEE is described in two documents:

- The program description - for common elements applicable to all SNC sites NMP-GM-038
- A program document specific for VEGP Units 3 and 4 is provided as NMP-GM-038-004

Together, the two documents describe the FLEX program for VEGP Units 3 and 4.

3.10.2 Procedural Interface (OIP Section 2.19.2)

The AP1000 design and licensing basis as described in Section 1.9.5.4 of the DCD/FSAR provides a set of procedures (referred to as 'Post-72 Hour Procedures’) that address the actions that would be necessary 72 hours subsequent to an extended loss of all ac power (extended

station blackout) to maintain core, containment, and spent fuel cooling for an indefinite period of time. VEGP Units 3 and 4 have incorporated the generic AP1000 procedures into site specific post 72-hour procedures.

Vogtle 3-4 AOP-302, is the controlling procedure for entry into the post 72-hour procedures. The Post 72-hour procedures are independent of the severe accident management guidelines.

The Post 72-hour procedures provide directions for mitigating an ELAP event that includes the potential for depletion of the 24- and 72-hour batteries and maintaining the following required functions:

- The critical safety functions of subcriticality, core cooling, heat sink, and containment
- The function of MCR habitability
- The function of SFP cooling
- Post accident monitoring from the MCR

After the initial safety-related cooling period of 72 hours, the AP 1000 standard passive design includes both onsite equipment in the form of the ancillary diesel generators designed to continue to provide cooling water and address required plant functions through at least 7 days. The Post 72 hour procedures provide the option of continuing the use of the ancillary diesels to meet these functions or use offsite transportable equipment delivered from SAFER and connect it to installed plant connections to maintain these functions indefinitely.

During an ELAP, when a loss of all ac occurs due to an external event, the operating crew would need to determine if there is confidence in restoration of power within 72 hours, if not, an ELAP should be declared as soon as possible and the Emergency Offsite Facility notified to contact SAFER. Once SAFER is contacted, all of the equipment for the site (VEGP Units 1 – 4) will be dispatched as directed in the VEGP SAFER Response Plan.

Per the licensee, SNC has developed three FLEX Support Guidelines (FSGs) and three Strategy Implementing Guidelines (SIGs) as follows:

FSGs:

- FSG 5 – Initial Assessment and FLEX Equipment Staging – Provides actions for assessment of plant equipment, plant system status, and staging of FLEX equipment
- FSG 7 – Loss of Vital Instrumentation – Provides actions to establish alternate monitoring capabilities
- FSG 13 Transition from FLEX Equipment – Provides actions to transition from the use of FLEX equipment to normal installed plant equipment

SIGs:

- SIG 7 – Diesel Fuel Oil Transfer – Includes diesel sources and transfer in support of FLEX equipment
- SIG 9 – Communications – Includes setup and operation of handheld satellite phones, RapidCase, and RapidCom mobile communications capabilities
- SIG 10 – Ventilation – Provides directions on setting up natural air circulation in the auxiliary building by opening doors

The NRC staff reviewed the information provided in Section 2.19.2 of the licensee's OIP. The licensee's proposed operating procedure hierarchy is described in the OIP. The licensee's hierarchy scheme is consistent with that described in NEI 12-06, Appendix F, Figure F.11-1. If implemented as described, the operating procedure hierarchy and procedural interfaces are consistent with NEI 12-06, Appendix F, Section F.11. The procedures will be in place by October 2020.

3.11.1 Staffing (OIP Section 2.19.3)

SNC needs to complete the staffing study per NEI 12-01 and submit to the NRC for review. This will be reviewed under separate correspondence.

3.11.2 Training (OIP Section 2.19.4)

Training has been developed and delivered to the target populations (Operations, Maintenance, Security, and Emergency Response Organization (ERO) staff) using the systematic approach to training (SAT) process. The licensee's training satisfies the applicable requirements of NEI 12-06, Section 11.6. The SNC general population is trained using the National Academy of Nuclear Training electronic Learning (NANTeL) courses provided by the Emergency Response Training Development (ERTD) Working Group (INPO facilitated). The ERTD conducted a job analysis to identify common training topics and coordinated the design and development of common training materials. The licensee staff responsible for the implementation of the FSGs also complete additional NANTeL training provided by the ERTD working group. The ERO decision makers receive additional training on directing actions and implementing strategies following a BDBEE.

3.11.3 Conclusions

Based on a review of SNC's plan, including the six-month update dated August 28, 2020, the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that appropriate procedures will be issued in accordance with NEI 12-06, Section 11.4, and a training program has been established and will be maintained in accordance with NEI 12-06, Section 11.6. As described in the OIP, the procedural hierarchy and relationships to the post 72 hours procedures provide reasonable assurance that, if implemented as described, sufficient guidance is available to maintain the critical functions indefinitely following a BDBEE.

3.12 Maintenance and Testing of FLEX Equipment (OIP Sections 2.19.7 and 2.19.8)

Consideration (2) of NEI 12-06, Section 12.2 pertains to procurement, maintenance, testing, calibration, storage, and control of the offsite (NSRC) equipment. By letter dated September 11, 2014 (ADAMS Accession No. ML14259A222), supplemented on May 24, 2018, by Addenda I and II (ADAMS Accession No. ML18150A658), NEI provided a white paper titled "National SAFER Response Centers," which provides the programmatic aspects and implementation plans for the SAFER program. As stated in the white paper, "the Program Manager Organization (PMO) acts as an agent of PEICo for designated activities. The PMO manages the nuclear industry sponsored, joint inventory storage and maintenance facility for capital spares (referred to collectively as Pooled Inventory Management or "PIM")." The PMO is "responsible for developing warehouse storage and maintenance procedures, and monitoring and directing

contractor support activities to ensure that detailed storage and maintenance requirements are implemented." The PMO's maintenance instructions were developed in accordance with the Electric Power Research Institute (EPRI) template for Phase 2 and Phase 3 equipment and/or vendor recommendations, as applicable. While the NSRC equipment is not required per Order EA-12-049 to be maintained under 10 CFR Part 50, Appendix B approved quality assurance program, PIM maintains the NSRC equipment under PEICo's existing Appendix B quality assurance program. SAFER equipment is procured, tested, and maintained in accordance with the SAFER services agreement.

In letters dated September 26, 2014 (ADAMS Accession No. ML14265A107) and September 20, 2018 (ADAMS Accession No. ML18157A014), the staff concluded that licensees can reference the SAFER program and implement their SAFER Response Plans to meet the Phase 3 requirements of Order EA-12-049.

The unavailability of FLEX equipment and connections that support a FLEX mitigation strategy for core, containment, and SFP cooling is managed such that risk to mitigating strategy capability is minimized. The maintenance and risk guidance conforms to the guidance of NEI 12-06, Section 11.5. The unavailability of FLEX connections is controlled using the tracking application in the Shift Operations Management System as discussed in Procedure NMP-OS-019-013, "Beyond Design Basis Equipment Unavailability Tracking," Version 1.0. FLEX equipment and connections will not normally be used for purposes other than emergency response. It is permissible, however, to pre-stage and/or use FLEX equipment and connections provided the following requirements are met:

- Permission is received from the Shift Manager or Emergency Director.
- The proper action to restore the equipment to an available status is determined and the status of the affected equipment and/or connection is tracked.

The NRC staff has previously concluded that that licensees can reference the SAFER program and implement their SAFER Response Plans to meet the Phase 3 requirements of Order EA-12-049. SAFER equipment is maintained as required by the SAFER services agreement. Based on a review of SNC's plan, including the six-month update dated August 28, 2020, the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that the licensee has developed guidance that, if implemented appropriately, should maintain a satisfactory maintenance and testing program consistent with NEI 12-06 guidance, as endorsed by JLD-ISG-2012-01, and should adequately address the requirements of the order.

3.13 Alternatives to NEI 12-06

The licensee did not propose any alternatives to NEI 12-06, Revision 4.

3.14 Conclusions for Order EA-12-049

Based on a review of SNC's plan, including the six-month update dated August 28, 2020, the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that the plan, when properly implemented, will meet the requirements of Order EA-12-049 at VEGP Units 3 and 4. This conclusion is based on the assumption that the licensee will implement the plan as described, including the satisfactory resolution of the open and confirmatory items.

4.0 CONCLUSIONS

As required by Order EA-12-049, the licensee is developing, and will implement and maintain, guidance and strategies to restore or maintain core, containment, and SFP cooling capabilities in the event of a beyond-design-basis external event. These new requirements provide a greater mitigation capability consistent with the overall defense-in-depth philosophy, and, therefore, greater assurance that the challenges posed by beyond-design-basis external events to power reactors do not pose an undue risk to public health and safety.

The NRC's objective in preparing this interim staff evaluation is to provide a finding to the licensee on whether or not their integrated plan, if implemented as described, provides a reasonable path for compliance with the order. For areas where the NRC staff has insufficient information to make this finding (identified above in Section 3), the staff may review these areas as they become available or address them as part of the inspection process. The staff notes that the licensee has the ability to modify their plans as stated in NEI 12-06, Section 11.8. However, additional NRC review and/or inspection may be necessary to verify compliance.

The NRC staff has reviewed the licensee's plans for additional defense-in-depth measures. With the exception of the items noted in Section 3 above, the staff finds that the proposed measures, if properly implemented, will meet the intent of Order EA-12-049, thereby enhancing the licensee's capability to mitigate the consequences of a beyond-design-basis external event that impacts the availability of ac power and the LUHS. Full compliance with the order will enable the NRC to have reasonable assurance of adequate protection of public health and safety. The staff will issue a safety evaluation confirming compliance with the order at VEGP Units 3 and 4, and may conduct inspections to verify proper implementation of the licensee's proposed measures.

5.0 REFERENCES

1. Order EA-12-049, “Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” March 12, 2012 (ADAMS Accession No. ML12054A736).

2. SECY-11-0093, “Recommendations for Enhancing Reactor Safety in the 21st Century, the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident,” dated July 12, 2011 (ADAMS Accession No. ML11186A950).

3. SECY-12-0025, “Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami,” dated February 17, 2012 (ADAMS Accession No. ML12039A103).

4. SRM-SECY-12-0025, “Staff Requirements - SECY-12-0025 - Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami,” dated March 9, 2012 (ADAMS Accession No. ML120690347).

5. Nuclear Energy Institute document NEI 12-06, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” Revision 4, dated December 2016 (ADAMS Accession No. ML16354B421).

6. 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," Revision 2, dated February 2017 (ADAMS Accession No. ML17005A188).

7. Regulatory Guide 1.226, "Flexible Mitigation Strategies for Beyond-Design-Basis Events," Revision 0, dated June 2019 (ADAMS Accession No. ML19058A012).

8. Letter from B. L. Ivey, (SNC) to U.S. Nuclear Regulatory Commission, "Vogtle Electric Generating Plant Units 3 and 4 Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," dated August 22, 2013 (ADAMS Accession No. ML13235A260).

9. U.S. Nuclear Regulatory Commission, "Summary of Public Meeting with Southern Nuclear Operating Company on June 13, 2019," dated June 26, 2019, (ADAMS Accession No. ML19171A022).

10. Letter from Michael J. Yox, (SNC) to U.S. Nuclear Regulatory Commission, "Vogtle Electric Generating Plant Units 3 and 4 Updated Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," May 15, 2020 (ADAMS Accession No. ML20136A453).

11. AP1000 Design Control Document, Revision 19, dated June 13, 2011 (ADAMS Accession No. ML11171A500).

12. Vogtle Electric Generating Plant Units 3 and 4, Updated Final Safety Analysis Report, June 2020 (ADAMS Accession No. ML20181A311).

13. Westinghouse, APP-GW-GLR-170, "AP1000 FLEX Integrated Plan," PROPRIETARY (ADAMS Accession No. ML13235A229).

14. Westinghouse APP-GW-GLR-171, "AP1000 FLEX Integrated Plan," (ADAMS Accession No. ML13235A228).

15. Letter from C.R. Pierce (SNC) to U.S. Nuclear Regulatory Commission, "Vogtle Electric Generating Plant Units 1 and 2 Notification of Full Compliance of Required Action for NRC Order EA-12-049 Mitigation Strategies for Beyond-Design-Basis External Events," dated May 23, 2016 (ADAMS Accession No. ML16146A607).

16. U.S. Nuclear Regulatory Commission, "Vogtle Electric Generating Plant, Units 1 and 2 – Safety Evaluation Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049 and EA-12-051 (CAC Nos. MF0714, MF0715, MF0723, and MF0724)," dated November 14, 2016 (ADAMS Accession No. ML16301A419).

17. Letter from B.H. Whitley (SNC) to U.S. Nuclear Regulatory Commission, "Request for License Amendment and Exemption Regarding Passive Core Cooling System (PXS) Condensate Return (LAR-16-026)," dated November 4, 2016 (ADAMS Accession No. ML16319A120).

18. U.S. Nuclear Regulatory Commission, "Vogtle Electric Generating Plant, Units 3 and 4 – Issuance of Amendment and Granting of Exemption RE: Passive Core Cooling

System (PXS) Condensate Return (LAR 16-026) (CAC No. RP9604)," dated February 27, 2017 (ADAMS Accession No. ML17024A317).

19. Letter from B.H. Whitley (SNC) to U.S. Nuclear Regulatory Commission, "Vogtle Electric Generating Plant – Units 3 and 4 Response to Request for Submittal of Updated Ground Motion Spectra and Foundation Input Response Spectra," dated December 5, 2014 (ADAMS Accession No. ML14339A849).

20. U.S. Nuclear Regulatory Commission, "Request for Submittal of Updated Ground Motion Spectra and Foundation Input Response Spectra," dated November 5, 2014 (ADAMS Accession No. ML14302A180).

21. U.S. Nuclear Regulatory Commission, "Vogtle Electric Generating Plant Units 3 and 4 Updated Ground Motion Response Spectra (TAC No. RP0411)," dated August 12, 2015 (ADAMS Accession No. ML15139A516).

22. Letter from Michael J. Yox (SNC) to U.S. Nuclear Regulatory Commission, "Vogtle Electric Generating Plant - Units 3 and 4 Emergency Preparedness Communications Assessment Requested by NRC Letter, Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident dated March 12, 2012," dated August 16, 2019 (ADAMS Accession No. ML19240A068).

23. U.S. Nuclear Regulatory Commission, "Vogtle Electric Generating Plant Units 3 and 4 - Staff Assessment in Response to Recommendation 9.3 of the Near-Term Task Force Related to the Fukushima Dai-ichi Nuclear Power Plant Accident (EPID L-2019-LRQ-0002)," dated January 30, 2020, (ADAMS Accession No. ML20022A056).

24. U.S. Nuclear Regulatory Commission , "Staff Assessment of National Safer Response Centers Established in Response to Order EA-12-049," dated September 26, 2014 (ADAMS Accession No. ML14265A107).

25. U.S. Nuclear Regulatory Commission, "Updated Staff Assessment of National Safer Response Centers Established in Response to Order EA-12-049," dated September 20, 2018 (ADAMS Accession No. ML18157A014).

26. Letter from Michael J. Yox (SNC) to U.S. Nuclear Regulatory Commission, "Vogtle Electric Generating Plant - Units 3 and 4 Fourteenth Six-Month Status Report of the Implementation of the Requirements of the Commission Order with Regard to Mitigation Strategies for Beyond-Desiqn-Basis External Events (EA-12-049)," dated August 28, 2020 (ADAMS Accession No. ML20244A156)

27. NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," dated November 1987

28. Letter from J. Pollock (NEI) to Jack R. Davis (NRC), "National Safer Response Center Operational Status," dated September 11, 2014 (ADAMS Accession No. ML14259A222)

29. Letter from David L. Crawley (PEICO) to Louise Lund (NRC), dated May 24, 2018

(ADAMS Accession No. ML18150A658)

30. E-mail from N. Kellenberger (SNC) to C. Patel (NRC), “Follow up on Updated FLEX OIP Conference Call,” dated September 13, 2020 (ADAMS Accession No. ML20257A013)