Mega-Tech Services, LLC

Technical Evaluation Report Related to Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, EA-12-049

Revision 1

February 12, 2014

Entergy Operations, Inc
Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416

Prepared for:

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Contract NRC-HQ-13-C-03-0039
Task Order No. NRC-HQ-13-T-03-0001
Job Code: J4672
TAC No. MF0954

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1.0 BACKGROUND

Following the events at the Fukushima Dai-ichi nuclear power plant on March 11, 2011, the U.S. Nuclear Regulatory Commission (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, methodical review of NRC regulations and processes to determine 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. These recommendations were enhanced by the NRC staff following interactions with stakeholders. Documentation of the staff's efforts is contained in SECY-11-0124, "Recommended Actions to be Taken without Delay from the Near-Term Task Force Report," dated September 9, 2011, and SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," dated October 3, 2011.

As directed by the Commission's staff requirement memorandum (SRM) for SECY-11-0093, the NRC staff reviewed the NTTF recommendations within the context of the NRC's existing regulatory framework and considered the various regulatory vehicles available to the NRC to implement the recommendations. SECY-11-0124 and SECY-11-0137 established the staff's prioritization of the recommendations.

After receiving the Commission's direction in SRM-SECY-11-0124 and SRM-SECY-11-0137, the NRC staff conducted public meetings to discuss enhanced mitigation strategies intended to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities following beyond-design-basis external events (BDBEEs). At these meetings, the industry described its proposal for a Diverse and Flexible Mitigation Capability (FLEX), as documented in Nuclear Energy Institute's (NEI) letter, dated December 16, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML11353A008). FLEX was proposed as a strategy to fulfill the key safety functions of core cooling, containment integrity, and spent fuel cooling. Stakeholder input influenced the NRC staff to pursue a more performance-based approach to improve the safety of operating power reactors relative to the approach that was envisioned in NTTF Recommendation 4.2, SECY-11-0124, and SECY-11-0137.

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, including the proposed order to implement the enhanced mitigation strategies. As directed by SRM-SECY-12-0025, the NRC staff issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events."

Guidance and strategies required by the Order would be available if a loss of power, motive force and normal access to the ultimate heat sink (UHS) needed to prevent fuel damage in the reactor and SFP affected all units at a site simultaneously. The Order requires a three-phase approach for mitigating BDBEEs. The initial phase requires the use of installed equipment and resources to maintain or restore key safety functions including core cooling, containment, and SFP cooling. 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 offsite. The final phase requires obtaining sufficient offsite resources to sustain those functions indefinitely.

NEI submitted its document NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" in August 2012 (ADAMS Accession No. ML12242A378) to provide specifications for an industry-developed methodology for the development, implementation, and maintenance of guidance and strategies in response to Order EA-12-049. The guidance and strategies described in NEI 12-06 expand on those that industry developed and implemented to address the limited set of BDBEEs that involve the loss of a large area of the plant due to explosions and fire required pursuant to paragraph (hh)(2) of 10 CFR 50.54, "Conditions of licenses."

As described in Interim Staff Guidance (ISG), JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," the NRC staff considers that the development, implementation, and maintenance of guidance and strategies in conformance with the guidelines provided in NEI 12-06, Revision 0, subject to the clarifications in Attachment 1 of the ISG are an acceptable means of meeting the requirements of Order EA-12-049.

In response to Order EA-12-049, licensees submitted Overall Integrated Plans (hereafter, the Integrated Plan) describing their course of action for mitigation strategies that are to conform with the guidance of NEI 12-06, or provide an acceptable alternative to demonstrate compliance with the requirements of Order EA-12-049.

2.0 EVALUATION PROCESS

In accordance with the provisions of Contract NRC-HQ-13-C-03-0039, Task Order No. NRC-HQ-13-T-03-0001, Mega-Tech Services, LLC (MTS) performed an evaluation of each licensee's Integrated Plan. As part of the evaluation, MTS, in parallel with the NRC staff, reviewed the original Integrated Plan and the first 6-month status update, and conducted an audit of the licensee documents. The staff and MTS also reviewed the licensee's answers to the NRC staff's and MTS's questions as part of the audit process. The objective of the evaluation was to assess whether the proposed mitigation strategies conformed to the guidance in NEI 12-06, as endorsed by the positions stated in JLD-ISG-2012-01, or an acceptable alternative had been proposed that would satisfy the requirements of Order EA-12-049. The audit plan that describes the audit process was provided to all licensees in a letter dated August 28, 2013 from Jack R. Davis, Director, Mitigating Strategies Directorate (ADAMS Accession No. ML13234A503).

The review and evaluation of the licensee's Integrated Plan was performed in the following areas consistent with NEI 12-06 and the regulatory guidance of JLD-ISG-2012-01:

- Evaluation of External Hazards
- Phased Approach
  - Initial Response Phase
  - Transition Phase
  - Final Phase
- Core Cooling Strategies

- SFP Cooling Strategies
- Containment Function Strategies
- Programmatic Controls
  - Equipment Protection, Storage, and Deployment
  - Equipment Quality

The technical evaluation in Section 3.0 documents the results of the MTS evaluation and audit results. Section 4.0 summarizes Confirmatory Items and Open Items that require further evaluation before a conclusion can be reached that the Integrated Plan is consistent with the guidance in NEI 12-06 or an acceptable alternative has been proposed that would satisfy the requirements of Order EA-12-049. For the purpose of this evaluation, the following definitions are used for Confirmatory Item and Open Item.

> Confirmatory Item – an item that is considered conceptually acceptable, but for which resolution may be incomplete. These items are expected to be acceptable, but are expected to require some minimal follow up review or audit prior to the licensee's compliance with Order EA-12-049.
>
> Open Item – an item for which the licensee has not presented a sufficient basis to determine that the issue is on a path to resolution. The intent behind designating an issue as an Open Item is to document items that need resolution during the review process, rather than being verified after the compliance date through the inspection process.

Additionally, for the purpose of this evaluation and the NRC staff's interim staff evaluation (ISE), licensee statements, commitments, and references to existing programs that are subject to routine NRC oversight (Updated Final Safety Analysis Report (UFSAR) program, procedure program, quality assurance program, modification configuration control program, etc.) will generally be accepted. For example, references to existing UFSAR information that supports the licensee's overall mitigating strategies plan, will be assumed to be correct, unless there is a specific reason to question its accuracy. Likewise, if a licensee states that they will generate a procedure to implement a specific mitigating strategy, assuming that the procedure would otherwise support the licensee's plan, this evaluation accepts that a proper procedure will be prepared. This philosophy for this evaluation and the ISE does not imply that there are any limits in this area to future NRC inspection activities.

3.0 TECHNICAL EVALUATION

By letter dated February 27, 2013, (ADAMS Accession No. ML13059A316), and as supplemented by the first six-month status report in a letter dated August 28, 2013 (ADAMS Accession No. ML13240A264), Entergy Operations, Inc. (the licensee or Entergy) provided Grand Gulf Nuclear Station's (GGNS's) Unit 1 Integrated Plan for Compliance with Order EA-12-049. The Integrated Plan describes the strategies and guidance under development for implementation by GGNS for the maintenance or restoration of core cooling, containment, and SFP cooling capabilities following BDBEEs, including modifications necessary to support this implementation, pursuant to Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC staff notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049. That letter described the process used by the NRC staff in its review, leading to the issuance of an interim staff evaluation and audit report. The purpose of the staff's audit is to determine the extent to which the licensees are proceeding on a path towards successful implementation of the actions needed to achieve full compliance with the Order.

3.1 EVALUATION OF EXTERNAL HAZARDS

Sections 4 through 9 of NEI 12-06 provide the NRC-endorsed methodology for the determination of applicable extreme external hazards in order to identify potential complicating factors for the protection and deployment of equipment needed for mitigation of BDBEEs leading to an extended loss of all alternating current (ac) power (ELAP) and loss of normal access to the UHS. These hazards are broadly grouped into the categories discussed below in Sections 3.1.1 through 3.1.5 of this evaluation. Characterization of the applicable hazards for a specific site includes the identification of realistic timelines for the hazard; characterization of the functional threats due to the hazard; development of a strategy for responding to events with warning; and development of a strategy for responding to events without warning.

3.1.1 Seismic Hazard

NEI 12-06, Section 5.2 states:

> All sites will address BDB [beyond-design-basis] seismic considerations in the implementation of FLEX strategies, as described below. The basis for this is that, while some sites are in areas with lower seismic activity, their design basis generally reflects that lower activity. There are large, and unavoidable, uncertainties in the seismic hazard for all U.S. plants. In order to provide an increased level of safety, the FLEX deployment strategy will address seismic hazards at all sites.
>
> These considerations will be treated in four primary areas: protection of FLEX equipment, deployment of FLEX equipment, procedural interfaces, and considerations in utilizing off-site resources.

On page 1 of the Integrated Plan, GGNS stated that per the GGNS UFSAR, Section 2.5, the seismic criteria for GGNS include two design basis earthquake spectra, the Operating Basis Earthquake (OBE) and the Design Basis Earthquake (DBE) (also referred to as the Safe Shutdown Earthquake [SSE]). The DBE and the OBE are 0.15 g and 0.075 g, respectively. In addition, the licensee stated that per NEI 12-06 Section 5.2, all sites will consider the seismic hazard.

The licensee stated, on page 3 of their Integrated Plan, that the reevaluation of the seismic hazard as required by the 10 CFR 50.54(f) letter of March 12, 2012, has not yet been completed and therefore was not assumed in the Integrated Plan. The licensee also stated that as the re-evaluations are completed, appropriate issues would be entered into the corrective action program (CAP) and addressed.

The licensee’s approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to seismic screening if these requirements are implemented as described.

3.1.1.1 Protection of FLEX Equipment – Seismic Hazard

NEI 12-06, Section 5.3.1 states:

1. FLEX equipment should be stored in one or more of following three configurations:

    a. In a structure that meets the plant's design basis for the SSE (e.g., existing safety-related structure).

    b. In a structure designed to or evaluated equivalent to [American Society of Civil Engineers] ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures*.

    c. Outside a structure and evaluated for seismic interactions to ensure equipment is not damaged by non-seismically robust components or structures.

2. Large portable FLEX equipment such as pumps and power supplies should be secured as appropriate to protect them during a seismic event (i.e., SSE level).

3. Stored equipment and structures should be evaluated and protected from seismic interactions to ensure that unsecured and/or non-seismic components do not damage the equipment.

On page 3 of the Integrated Plan, in the section discussing the plan elements, the licensee indicated that Phase 2 FLEX components stored at the site will be protected against the "screened in" hazards in accordance with NEI 12-06.

The licensee stated that GGNS storage buildings for portable/FLEX equipment are being designed to conform to NEI 12-06, Section 11. The licensee was requested to provide a description for the protection of FLEX equipment that is consistent with NEI 12-06, Sections 5.3.1 for protection from a seismic hazard.

During the audit process, the licensee described that the design of the storage buildings have not been initiated. GGNS is planning to have two pre-engineered metal buildings. The buildings will be designed for seismic per NEI 12-06, Section 5.3.1 consideration 1.b (ASCE 7-10 and local building code).

Also during the audit, the licensee stated that the FLEX generators will be stored in the FLEX storage buildings. The method of storage of the FLEX generators will take into consideration protection of the equipment due to a seismic event, i.e., the equipment will be located or secured to protect them during the seismic event and to ensure that there is no seismic interaction between the FLEX generators and the other stored FLEX equipment.

Although the preceding paragraph addresses consideration 2 for the FLEX generators, the licensee did not address this consideration for other stored equipment such as pumps and vehicles. Similarly, the licensee has not addressed consideration 3. The need to verify the method of conformance with consideration 2 and 3 is identified as Confirmatory Item 3.1.1.1.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of FLEX equipment for coping with a seismic hazard if these requirements are implemented as described.

3.1.1.2 Deployment of FLEX Equipment – Seismic Hazard

NEI 12-06, Section 5.3.2 states:

> The baseline capability requirements already address loss of non-seismically robust equipment and tanks as well as loss of all AC. So, these seismic considerations are implicitly addressed.
>
> There are five considerations for the deployment of FLEX equipment following a seismic event:
>
> 1. If the equipment needs to be moved from a storage location to a different point for deployment, the route to be traveled should be reviewed for potential soil liquefaction that could impede movement following a severe seismic event.
>
> 2. At least one connection point for the FLEX equipment will only require access through seismically robust structures. This includes both the connection point and any areas that plant operators will have to access to deploy or control the capability.
>
> 3. If the plant FLEX strategy relies on a water source that is not seismically robust, e.g., a downstream dam, the deployment of FLEX coping capabilities should address how water will be accessed. Most sites with this configuration have an underwater berm that retains a needed volume of water. However, accessing this water may require new or different equipment.
>
> 4. If power is required to move or deploy the equipment (e.g., to open the door from a storage location), then power supplies should be provided as part of the FLEX deployment.
>
> 5. A means to move the FLEX equipment should be provided that is also reasonably protected from the event.

On page 1 of the Integrated Plan, the licensee stated that the GGNS UFSAR was reviewed to perform a limited evaluation of the liquefaction potential outside the power block area for a design basis earthquake (DBE) event. There are margins of safety for liquefaction susceptible soils within the areas of the principle structures for a DBE event with a maximum horizontal acceleration equal to 0.15 g, according to GGNS UFSAR Section 2.5. Therefore, the likelihood of liquefaction at the site for a DBE event with a maximum horizontal acceleration equal to 0.15 g appears to be low based on the information presented in the GGNS UFSAR. Since the FLEX storage locations have not been finalized, evaluation of storage locations and deployment routes to confirm the absence of adverse impacts due to liquefaction must be performed.

On page 3 of the Integrated Plan, in the section discussing key assumptions associated with the implementation of FLEX strategies, the licensee indicated that deployment strategies and deployment routes are assessed for hazards impact.

During the audit process, the licensee stated that the design for GGNS FLEX implementation has not begun at this time; therefore, the final storage locations have not been finalized. As part of the design process the storage locations and appropriate haul routes will be evaluated for acceptability per NEI 12-06. The licensee indicated that if existing geologic information does not exist, soil bores for the storage locations and haul routes will be taken and analyzed to determine the potential for liquefaction before the haul routes and storage locations are finalized.

With regard to consideration 2 above, the licensee stated, again on page 3, that the designed hardened connections are protected against external events or are established at multiple and diverse locations. In addition, during the audit process, the licensee stated that FLEX pumps will only be connected to seismic piping, and FLEX generators will be connected through new penetrations in the auxiliary and control buildings.

During the audit process, the licensee addressed considerations 3, 4, and 5 as follows:

> For consideration 3 - FLEX strategies do not rely on a water source that is not seismically robust. The water sources credited by the Phase 2 coping strategies are the UHS basins that are seismically qualified. The licensee indicated that there are no downstream dams on the Mississippi River (note that the Mississippi River is not the credited UHS).
>
> For consideration 4 - GGNS FLEX equipment does not require power to move or deploy equipment (e.g., opening a storage building door). Therefore, power supplies do not need to be provided as part of the FLEX deployment.
>
> For consideration 5 - Appropriate equipment will be provided for moving FLEX equipment and protected, as required.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to deployment if these requirements are implemented as described.

3.1.1.3 Procedural Interfaces – Seismic Hazard

NEI 12-06, Section 5.3.3 states:

> There are four procedural interface considerations that should be addressed.
>
> 1. Seismic studies have shown that even seismically qualified electrical equipment can be affected by beyond-design-basis seismic events. In order to address these considerations, each plant should compile a reference source for the plant operators that provides approaches to obtaining necessary instrument readings to support the implementation of the coping strategy (see Section 3.2.1.10). This reference source should include main control room (MCR) and non-MCR readouts and should also provide guidance on how and where to measure key instrument readings at containment penetrations, where applicable, using a portable instrument (e.g., a Fluke meter). Such a resource could be provided as an attachment to

the plant procedures/guidance. Guidance should include critical actions to perform until alternate indications can be connected and on how to control critical equipment without associated control power.

2. Consideration should be given to the impacts from large internal flooding sources that are not seismically robust and do not require ac [alternating current] power (e.g., gravity drainage from lake or cooling basins for non-safety-related cooling water systems).

3. For sites that use ac power to mitigate ground water in critical locations, a strategy to remove this water will be required.

4. Additional guidance may be required to address the deployment of equipment for those plants that could be impacted by failure of a not seismically robust downstream dam.

Consideration 1 above states that each plant should compile a reference source for the plant operators that provide approaches to obtaining necessary instrument readings to support the implementation of the coping strategy. The licensee was requested to provide information to address the guidance of NEI 12-06, Section 5.3.3, consideration 1.

During the audit process, the licensee responded by stating that FLEX Support Guidelines (FSGs) and supporting procedures developed in accordance with NEI 12-06, Section 5.3.3 will contain reference sources for operators to obtain necessary instrument readings to support implementation of the coping strategy, and how and where to measure key readings at containment penetrations (where applicable) using a portable instrument; critical actions that may be necessary to perform until alternate indications can be measured; and instructions on how to control critical equipment without control power, if required. Discussion of the plans for conforming to Section 5.3.3 consideration 1 is anticipated to be included in the fourth six month update report (February, 2015).

Considerations 2, 3 and 4 discuss strategies to mitigate large internal flooding sources, ground water in critical locations and the failure of downstream dams. The licensee was requested to address the guidance of NEI 12-06, Section 5.3.3, considerations 2, 3, and 4.

During the audit process, the licensee responded by stating that with regard to consideration 2, in the extremely unlikely event of the failure to shut off the circulating water delivery system during a butterfly valve failure or an expansion joint rupture in the turbine building, the resulting water level in the turbine building (Unit 1 and the abandoned Unit 2 turbine building), control building, radwaste pipe tunnels, and radwaste building could rise to elevation 104 feet (UFSAR 10.4.5.3). All safety-related equipment in the control building that is essential in attaining and maintaining a cold safe shutdown is located above elevation 111 feet-0 inches. Continuing, the licensee stated that the auxiliary building is watertight up to elevation 114 feet to prevent entry of water into the building due to a postulated circulating water system failure. Therefore, flooding due to circulating water system failure will not functionally degrade any equipment essential to attaining and maintaining a cold safe shutdown.

The licensee further stated that access for actions required to implement the FLEX strategies is not impeded by the flooding of the turbine or control buildings described above. The condensate and refueling water storage tanks are located outside and the tanks are located within a reinforced concrete retaining basin. The retaining dike is sized to retain the full capacity of both tanks (UFSAR Section 9.2.6). The licensee stated that firewater storage tanks are also located outside Category I buildings. Flooding as a result of failure of these outside tanks would not jeopardize safety-related equipment. In addition, the licensee stated that based on the design of the fire protection, as discussed in the UFSAR, failure of a fire protection water system pipe in conjunction with a spurious start of a diesel driven fire pump is not an internal flooding concern.

With regard to consideration 3, the licensee responded by stating that plant grade is 132.5 feet above mean sea level (MSL). (UFSAR Section 11.2.1.3 and Table 3.4-1) The design ground water level at the GGNS site is at elevation 114.5 feet MSL, which will not be exceeded by the regional ground water level or the perched water table at the site. Analyses have been conducted, which demonstrate that this ground water level has no effect on safe operation of GGNS Unit 1 (UFSAR Section 2.4.13.5). Currently, ac power is not required for ground water mitigation at GGNS and will not be required by FLEX strategies.

And finally, with regard to consideration 4, the licensee responded by stating that there are no downstream dams on the Mississippi River, and noted that the Mississippi River is not the credited UHS.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedural interfaces for coping with a seismic hazard if these requirements are implemented as described.

3.1.1.4 Considerations in Using Offsite Resources – Seismic Hazard

NEI 12-06, Section 5.3.4 states:

> Severe seismic events can have far-reaching effects on the infrastructure in and around a plant. While nuclear power plants are designed for large seismic events, many parts of the Owner Controlled Area and surrounding infrastructure (e.g., roads, bridges, dams, etc.) may be designed to lesser standards. Obtaining off-site resources may require use of alternative transportation (such as air-lift capability) that can overcome or circumvent damage to the existing local infrastructure.
>
> 1. The FLEX strategies will need to assess the best means to obtain resources from off-site following a seismic event.

On page 11 of the Integrated Plan, the licensee stated that GGNS will utilize the industry Regional Response Center (RRC) for Phase 3 equipment. GGNS has contractual agreements in place with the Strategic Alliance for FLEX Emergency Response (SAFER). The two RRCs will be established to support utilities in response to BDBEE. Each RRC will hold five sets of equipment, four of which will be able to be fully deployed when requested; the fifth set will have equipment in a maintenance cycle. Communications will be established between the affected nuclear site and the SAFER team and required equipment mobilized as needed. Equipment will initially be moved from an RRC to a local staging area, established by the SAFER team and the utility. The equipment will be prepared at the staging area prior to transportation to the site. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request.

The licensee has not yet identified the local staging area(s) for the RRC FLEX equipment and has not yet described the methods to be used to deliver the equipment to the site. The licensee was requested to provide an explanation of the delivery of equipment from the RRC and the local staging areas. The licensee was also requested to discuss methods for the removal of debris from these areas prior to delivery.

During the audit process, the licensee responded by reiterating that the onsite pre-staging areas have not been finalized for GGNS. In all cases, plans are to deliver equipment from offsite sources via truck or airlift. 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. Vehicles will follow multiple pre-selected routes (one method to circumvent the effects of seismic events, floods, etc.) directly to the plant site staging area or to an intermediate staging area to be selected within approximately 25 miles of the site. The delivery of equipment from the intermediate staging area will use the same methodology. The staging areas will consist of large hard surfaced areas. Helicopter landing considerations will be accounted for in selection of the areas. These areas are designed to accommodate the equipment being delivered from the RRC.

The licensee also responded by stating that the same equipment used to clear debris for the Phase 2 deployment can be used to clear debris for staging areas near the site. Additionally, the Emergency Response Organization (ERO) will be in operation by the time RRC deliveries begin and can coordinate with local county and state officials to provide assistance in clearing of the staging areas as necessary. The SAFER Site-specific "Grand Gulf Response Plan" will contain information on the specifics of generic and site specific equipment obtained from the RRC. It will also contain the logistics for transportation of the equipment, staging area set up, and other needs for ensuring the equipment and commodities sustain the site's coping strategies. A SAFER walkdown is scheduled for completion in February 2015, and the "Grand Gulf Response Plan" development is scheduled for completion by August 2015.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect off-site resources if these requirements are implemented as described.

3.1.2 Flooding Hazard

NEI 12-06, Section 6.2 states:

> The evaluation of external flood-induced challenges has three parts. The first part is determining whether the site is susceptible to external flooding. The second part is the characterization of the applicable external flooding threat. The third part is the application of the flooding characterization to the protection and deployment of FLEX strategies.

NEI 12-06, Section 6.2.1 states in part:

> Susceptibility to external flooding is based on whether the site is a "dry" site, i.e., the plant is built above the design basis flood level (DBFL). For sites that are not "dry", water intrusion is prevented by barriers and there could be a potential for those barriers to be exceeded or compromised. Such sites would include those that are kept "dry" by permanently installed barriers, e.g., seawall, levees, etc.,

> and those that install temporary barriers or rely on watertight doors to keep the design basis flood from impacting safe shutdown equipment.

On page 1 of Integrated Plan, the licensee stated that for the external flood hazard assessment, per the GGNS UFSAR, the plant site is at a grade elevation of 132.5 feet. This elevation is well above the water levels of the Mississippi River, which has a 100 year flood elevation of 93.1 feet. Site flooding is driven by Probable Maximum Precipitation (PMP). The licensee further stated that evaluation of the PMP event demonstrates that the maximum floodwater elevations near the power block do not exceed elevation 133.25 inches, and that per the guidance in NEI 12-06, Section 6.2.1 and NRC Regulatory Guide (RG) 1.102, "Flood Protection for Nuclear Power Plants," Revision 1, September 1976, GGNS is classified as a dry site since it is built above the design basis flood level. As a result, the licensee stated that the GGNS site screens out for an assessment for external flooding.

The licensee stated, on page 3 of their Integrated Plan, that the reevaluation of the flood hazard as required by the 10 CFR 50.54(f) of March 12, 2012, has not yet been completed and therefore was not assumed in the Integrated Plan. The licensee also stated that as the re-evaluations are completed, appropriate issues would be entered into the corrective action program (CAP) and addressed.

As noted above, the plant site is at a grade elevation of 132.5 feet and the PMP maximum is 133.25 feet. The reviewer concluded that since the maximum PMP floodwater is at a greater height than the grade elevation, it appears that the site could be flooded and it is not a “dry” site. The licensee was requested to provide a technical basis that the GGNS is a dry site and explain why it is acceptable to have the Probable Maximum Precipitation (PMP) maximum flood elevation higher than the GGNS grade elevation.

During the audit process, the licensee responded by stating that the GGNS grade elevation is 132 feet- 6 inches with a slope up to existing door thresholds and floor elevations of 133 feet. The licensing basis PMP is 133.25 feet. A flood elevation based on preliminary Fukushima evaluations to address new local intense precipitation (LIP) criteria would result in an addition of approximately 3". Therefore the new PMP will likely be 133.5 feet. GGNS recently performed an engineering change that revised the GGNS design basis to use sand bag dikes for most PMP doors. The sandbag dikes will be able to prevent water intrusion 1.5 feet above the grade elevation. This engineering change specifically included an additional 6 inches of margin in the dike height to allow for potential increase due to the finalization of Fukushima evaluations. The sandbags will be placed near their intended use location and will be deployed in the event of an expected rainfall in the amount of 12 inches or more in the 24 hour weather forecast. Thus the structures relied upon for the FLEX will be protected from floodwater intrusion. With the current design PMP flood, the water is above 133 feet for only seven hours. It is expected that this time will not increase significantly with the updated PMP elevation. The new PMP flooding level will not impact the operation or deployment of FLEX equipment because it is mounted on trailers. GGNS was designated a "dry site" based on the design basis river flooding PMF of 93.1 feet, which is below the site grade elevation of 132 feet-6 inches.

The NRC staff noted that on page 1.102-4 of RG 1.102, states:

> Local PMP may produce flooding at sites otherwise considered immune from flooding. The intensity of this rainfall and the usual design of the drainage system may result in ponding in the plant yard that could produce the DBFL. Also, roofs may receive more precipitation than the roof drains are designed to discharge.

This indicates that DBFL may be based on PMP. Since the GGNS PMP is greater than the grade elevation and sandbags are needed to protect against flooding, it is unclear how GGNS can be designated as a “dry” site. This is identified as Open Item 3.1.2.A in Section 4.2 below. Since the licensee identified GGNS as a dry site, licensee information related to NEI 12-06 guidelines identified in Sections 3.1.2.1, 3.1.2.2, and 3.1.2.3 of this report (storage, deployment, and procedural interfaces, respectively) are not discussed. If the resolution of the Open Item above results in GGNS not being categorized as a "dry" site, the guidelines of the NEI 12-06 Sections related to these report sections will need to be addressed by the licensee as part of that resolution.

The licensee’s approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Open Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to screening of the flooding hazard if these requirements are implemented as described.

3.1.2.1 Protection of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.1 states:

> These considerations apply to the protection of FLEX equipment from external flood hazards:
>
> 1. The equipment should be stored in one or more of the following configurations:
>
>   a. Stored above the flood elevation from the most recent site flood analysis. The evaluation to determine the elevation for storage should be informed by flood analysis applicable to the site from early site permits, combined license applications, and/or contiguous licensed sites.
>
>   b. Stored in a structure designed to protect the equipment from the flood.
>
>   c. FLEX equipment can be stored below flood level if time is available and plant procedures/guidance address the needed actions to relocate the equipment. Based on the timing of the limiting flood scenario(s), the FLEX equipment can be relocated [footnote 2 omitted] to a position that is protected from the flood, either by barriers or by elevation, prior to the arrival of the potentially damaging flood levels. This should also consider the conditions on-site during the increasing flood levels and whether movement of the FLEX equipment will be possible before potential inundation occurs, not just the ultimate flood height.
>
> 2. Storage areas that are potentially impacted by a rapid rise of water should be avoided.

Since the licensee identified GGNS as a dry site, no licensee information regarding NEI 12-06 Section 6.2.3.1 will be discussed in this report. If the resolution of the Open Item 3.1.2.A above results in GGNS not being categorized as a "dry" site, the guidelines of the NEI 12-06 Section 6.2.3.1 above will need to be addressed by the licensee as part of that resolution.

3.1.2.2 Deployment of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.2 states:

> There are a number of considerations which apply to the deployment of FLEX equipment for external flood hazards:
>
> 1. For external floods with warning time, the plant may not be at power. In fact, the plant may have been shut down for a considerable time and the plant configuration could be established to optimize deployment. For example, the portable pump could be connected, tested, and readied for use prior to the arrival of the critical flood level. Further, protective actions can be taken to reduce the potential for flooding impacts, including cooldown, borating the RCS [Reactor Coolant System], isolating accumulators, isolating RCP [Reactor Coolant Pump] seal leak off, obtaining dewatering pumps, creating temporary flood barriers, etc. These factors can be credited in considering how the baseline capability is deployed.
>
> 2. The ability to move equipment and restock supplies may be hampered during a flood, especially a flood with long persistence. Accommodations along these lines may be necessary to support successful long-term FLEX deployment.
>
> 3. Depending on plant layout, the ultimate heat sink may be one of the first functions affected by a flooding condition. Consequently, the deployment of the FLEX equipment should address the effects of loss of LUHS [loss of ultimate heat sink], as well as ELAP.
>
> 4. Portable pumps and power supplies will require fuel that would normally be obtained from fuel oil storage tanks that could be inundated by the flood or above ground tanks that could be damaged by the flood. Steps should be considered to protect or provide alternate sources of fuel oil for flood conditions. Potential flooding impacts on access and egress should also be considered.
>
> 5. Connection points for portable equipment should be reviewed to ensure that they remain viable for the flooded condition.
>
> 6. For plants that are limited by storm-driven flooding, such as Probable Maximum Surge or Probable Maximum Hurricane (PMH), expected storm conditions should be considered in evaluating the adequacy of the baseline deployment strategies.
>
> 7. Since installed sump pumps will not be available for dewatering due to the ELAP, plants should consider the need to provide water extraction pumps capable of operating in an ELAP and hoses for rejecting accumulated water for structures required for deployment of FLEX strategies.

8. Plants relying on temporary flood barriers should assure that the storage location for barriers and related material provides reasonable assurance that the barriers could be deployed to provide the required protection.

9. A means to move FLEX equipment should be provided that is also reasonably protected from the event.

Since the licensee identified GGNS as a dry site, no licensee information regarding NEI 12-06 Section 6.2.3.2 will be discussed in this report. If the resolution of the Open Item 3.1.2.A above results in GGNS not being categorized as a "dry" site, the guidelines of the NEI 12-06 Section 6.2.3.2 above will need to be addressed by the licensee as part of that resolution.

3.1.2.3 Procedural Interfaces – Flooding Hazard

NEI 12-06, Section 6.2.3.3 states:

> The following procedural interface considerations should be addressed.
>
> 1. Many sites have external flooding procedures. The actions necessary to support the deployment considerations identified above should be incorporated into those procedures.
>
> 2. Additional guidance may be required to address the deployment of FLEX for flooded conditions (i.e., connection points may be different for flooded vs. non-flooded conditions).
>
> 3. FLEX guidance should describe the deployment of temporary flood barriers and extraction pumps necessary to support FLEX deployment.

Since the licensee identified GGNS as a dry site, no licensee information regarding NEI 12-06 Section 6.2.3.3 will be discussed in this report. If the resolution of the Open Item 3.1.2.A above results in GGNS not being categorized as a "dry" site, the guidelines of the NEI 12-06 Section 6.2.3.3 above will need to be addressed by the licensee as part of that resolution.

3.1.2.4 Considerations in Using Offsite Resources – Flooding Hazard

NEI 12-06, Section 6.2.3.4 states:

> Extreme external floods can have regional impacts that could have a significant impact on the transportation of off-site resources.
>
> 1. Sites should review site access routes to determine the best means to obtain resources from off-site following a flood.
>
> 2. Sites impacted by persistent floods should consider where equipment delivered from off-site could be staged for use on-site.

Even though the plant site may not experience flooding conditions, (i.e. a "dry" site) the off-site facilities and the transport routes could be subject to flooding. However, transportation from the off-site location to the site was previously discussed in this report in Section 3.1.1.4. As noted in that section, the licensee has stated that plans are to deliver equipment from offsite sources via truck or airlift. Vehicles will follow pre-selected routes directly to the plant site staging area or to an intermediate staging area to be selected within approximately 25 miles of the site. The delivery of equipment from the intermediate staging area will use the same methodology. The staging areas will consist of large hard surfaced areas. Helicopter landing considerations will be accounted for in selection of the areas. These areas are designed to accommodate the equipment being delivered from the RRC.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to off-site resources if these requirements are implemented as described.

3.1.3 High Winds Hazard

NEI 12-06, Section 7, provides the NRC-endorsed screening process for evaluation of high wind hazards. This screening process considers the hazard due to hurricanes and tornadoes. The first part of the evaluation of high wind challenges is determining whether the site is potentially susceptible to different high wind conditions to allow characterization of the applicable high wind hazard.

The screening for high wind hazards associated with hurricanes should be accomplished by comparing the site location to NEI 12-06, Figure 7-1 (Figure 3-1 of U.S. NRC, "Technical Basis for Regulatory Guidance on Design Basis Hurricane Wind Speeds for Nuclear Power Plants," NUREG/CR-7005, December, 2009); if the resulting frequency of recurrence of hurricanes with wind speeds in excess of 130 mph exceeds 10^{-6} per year, the site should address hazards due to extreme high winds associated with hurricanes.

The screening for high wind hazard associated with tornadoes should be accomplished by comparing the site location to NEI 12-06, Figure 7-2, from U.S. NRC, "Tornado Climatology of the Contiguous United States," NUREG/CR-4461, Rev. 2, February 2007; if the recommended tornado design wind speed for a 10^{-6}/year probability exceeds 130 mph, the site should address hazards due to extreme high winds associated with tornadoes.

On page 2 of the Integrated Plan, the licensee stated that for the high wind hazard assessment, the GGNS plant site is located below the 35th parallel (GGNS Nuclear Plant UFSAR Revised 11/12, Section 2.1.1.1). Per NEI 12-06, guidance hurricanes and tornado hazards are applicable to GGNS. NEI 12-06 Figures 7-1 and 7-2 were used for this assessment. Thus the GGNS site screens in for an assessment for High Wind Hazard.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to screening for the high winds hazard.

3.1.3.1 Protection of FLEX Equipment - High Wind Hazard

NEI 12-06, Section 7.3.1 states:

> These considerations apply to the protection of FLEX equipment from high wind hazards:

1. For plants exposed to high wind hazards, FLEX equipment should be stored in one of the following configurations:

    a. In a structure that meets the plant's design basis for high wind hazards (e.g., existing safety-related structure).

    b. In storage locations designed to or evaluated equivalent to ASCE 7-10, Minimum Design Loads for Buildings and Other Structures given the limiting tornado wind speeds from Regulatory Guide 1.76 or design basis hurricane wind speeds for the site.

        - Given the limiting tornado or hurricane wind speeds, building loads would be computed in accordance with requirements of ASCE 7-10. Acceptance criteria would be based on building serviceability requirements not strict compliance with stress or capacity limits. This would allow for some minor plastic deformation, yet assure that the building would remain functional.

        - Tornado missiles and hurricane missiles will be accounted for in that the FLEX equipment will be stored in diverse locations to provide reasonable assurance that N sets of FLEX equipment will remain deployable following the high wind event. This will consider locations adjacent to existing robust structures or in lower sections of buildings that minimizes the probability that missiles will damage all mitigation equipment required from a single event by protection from adjacent buildings and limiting pathways for missiles to damage equipment.

        - The axis of separation should consider the predominant path of tornados in the geographical location. In general, tornadoes travel from the West or West Southwesterly direction, diverse locations should be aligned in the North-South arrangement, where possible. Additionally, in selecting diverse FLEX storage locations, consideration should be given to the location of the diesel generators and switchyard such that the path of a single tornado would not impact all locations.

        - Stored mitigation equipment exposed to the wind should be adequately tied down. Loose equipment should be in protective boxes that are adequately tied down to foundations or slabs to prevent protected equipment from being damaged or becoming airborne. (During a tornado, high winds may blow away metal siding and metal deck roof, subjecting the equipment to high wind forces.)

    c. In evaluated storage locations separated by a sufficient distance that minimizes the probability that a single event would damage all FLEX mitigation equipment such that at least N sets of FLEX equipment would remain deployable following the high wind event. (This option is not applicable for hurricane conditions).

- Consistent with configuration b., the axis of separation should consider the predominant path of tornados in the geographical location.
- Consistent with configuration b., stored mitigation equipment should be adequately tied down.

On pages 23, 33, 41 and 50 of the Integrated Plan, the licensee stated that protection of associated portable equipment from the high wind hazard would be provided in locations or structures fabricated/constructed to meet the requirements identified in NEI 12-06 section 11. The licensee further stated that GGNS procedures and programs are being developed to address storage location/structure requirements relative to the hazards applicable to GGNS.

Because the licensee has not yet completed plans for storage and protection of portable/FLEX equipment from external hazards, the licensee was requested to provide additional information regarding the storage and protection of portable/FLEX equipment from high wind hazard and satisfies specifications provided in NEI 12-06, Section 7.3.1.

During the audit process, the licensee responded by stating that the design of storage facilities, specification of FLEX equipment, protection of FLEX equipment, control of FLEX equipment, implementation of FLEX strategies, and protection of safety related plant structures from FLEX equipment will be determined during the design development and procedure development phase. The licensee stated that GGNS is planning to have two pre-engineered metal buildings. GGNS intends to site the FLEX equipment storage buildings in accordance with NEI 12-06, Section 7.3.1 consideration 1 b and c (ASCE 7-10 and local building codes) to address high wind design criteria. Additionally, to ensure that at least one of the storage buildings would not be damaged by tornado missiles, the two buildings are separated to meet the intent of NEI FAQ 2013-01, which requires a minimum separation of 1,200 feet. A site-specific evaluation will be performed to ensure the selected building separation is bounding based on historical tornado size in the surrounding area of the GGNS site. This is identified as Confirmatory Item 3.1.3.1.A in Section 4.2 below.

The licensee was requested to describe how the underground fuel oil vents are protected from external hazards, and will be accessible during flooded conditions.

During the audit process, the licensee responded by stating that the current licensed design of the underground safety related fuel oil tanks ensures the vents are above the PMP flood level. However, due to the vents susceptibility to high wind missile hazards, the strategy for accessing the fuel oil in the underground safety related fuel oil tanks has changed. The new strategy for all applicable hazards is now to repower the normal fuel oil transfer pumps and access fuel oil from the standby diesel generator day tanks. These pumps are located internal to the underground tanks and are therefore missile protected. If the storage tank vent were to collapse or be pinched by a missile hitting it, a vent path, which requires no operator action, would be available through the fuel oil day tank vent (located in the diesel bay) via the fuel oil day tank overflow line (routed below grade.

The licensee’s approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to equipment storage protection from high winds to if these requirements are implemented as described.

3.1.3.2 Deployment of FLEX Equipment – High Wind Hazard

NEI 12-06, Section 7.3.2 states:

> There are a number of considerations which apply to the deployment of FLEX equipment for high wind hazards:
>
> 1. For hurricane plants, the plant may not be at power prior to the simultaneous ELAP and LUHS condition. In fact, the plant may have been shut down and the plant configuration could be established to optimize FLEX deployment. For example, the portable pumps could be connected, tested, and readied for use prior to the arrival of the hurricane. Further, protective actions can be taken to reduce the potential for wind impacts. These factors can be credited in considering how the baseline capability is deployed.
>
> 2. The UHS may be one of the first functions affected by a hurricane due to debris and storm surge considerations. Consequently, the evaluation should address the effects of ELAP/LUHS, along with any other equipment that would be damaged by the postulated storm.
>
> 3. Deployment of FLEX following a hurricane or tornado may involve the need to remove debris. Consequently, the capability to remove debris caused by these extreme wind storms should be included.
>
> 4. A means to move FLEX equipment should be provided that is also reasonably protected from the event.
>
> 5. The ability to move equipment and restock supplies may be hampered during a hurricane and should be considered in plans for deployment of FLEX equipment.

The Integrated Plan did not address potential impacts from wind generated debris in the ultimate heat sink per the guidance of consideration 2 above. While the licensee has stated that procedures and programs will be developed relative to the hazards applicable to GGNS, it is not clear that these procedures will address UHS access when wind generated debris is present. Further review of these procedures is needed to verify consideration 2 guidance is addressed. This is identified as Confirmatory Item 3.1.3.2.A in Section 4.2 below.

With regard to consideration 2, the licensee did not discuss debris removal strategy in the Integrated Plan but did list two front-end loaders on page 55, for debris removal to support the transition phase of the Integrated Plan. The licensee was requested to provide information regarding where this equipment will be stored.

During the audit process, the licensee reiterated that the current plan is for the site to use heavy-duty type equipment such as a large construction-type 4-wheel front-end loader. In addition, the licensee stated that a transport vehicle will be stored in each location to deploy the equipment along with a large piece of debris removal equipment (e.g., heavy equipment with multiple attachments).

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to deployment of FLEX equipment in a high wind hazard if these requirements are implemented.

3.1.3.3 Procedural Interfaces – High Wind Hazard

NEI 12-06, Section 7.3.3 states:

> The overall plant response strategy should be enveloped by the baseline capabilities, but procedural interfaces may need to be considered. For example, many sites have hurricane procedures. The actions necessary to support the deployment considerations identified above should be incorporated into those procedures.

On page 9 of the Integrated Plan, the licensee stated that the identified deployment paths and areas will be accessible during all modes of operation. The administrative program will have elements that ensure pathways will be kept clear or will require actions to clear the pathways.

On page 10 of the Integrated Plan, in the section discussing programmatic controls, the licensee stated that GGNS will implement an administrative program for implementation and maintenance of the GGNS FLEX strategies in accordance with NEI 12-06 guidance and GGNS will follow the current programmatic control structure for existing processes such as design and procedure configuration.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedural interfaces related to a high wind hazard if these requirements are implemented as described.

3.1.3.4 Considerations in Using Offsite Resources – High Wind Hazard

NEI 12-06, Section 7.3.4 states:

> Extreme storms with high winds can have regional impacts that could have a significant impact on the transportation of off-site resources.
>
> 1. Sites should review site access routes to determine the best means to obtain resources from off-site following a hurricane.
>
> 2. Sites impacted by storms with high winds should consider where equipment delivered from off-site could be staged for use on-site.

On page 11 of the Integrated Plan, the licensee stated that GGNS will utilize the industry RRC for Phase 3 equipment. GGNS has contractual agreements in place with the SAFER. The two RRCs will be established to support utilities in response to BDBEEs. Each RRC will hold five sets of equipment, four of which will be able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle.

Transportation from the off-site location to the site was previously discussed in this report in Section 3.1.1.4. As noted in that section, the licensee has stated that plans are to deliver equipment from offsite sources via truck or airlift. Vehicles will follow pre-selected routes directly to the plant site staging area or to an intermediate staging area to be selected within approximately 25 miles of the site. The delivery of equipment from the intermediate staging area will use the same methodology. The staging areas will consist of large hard surfaced areas. Helicopter landing considerations will be accounted for in selection of the areas. These areas are designed to accommodate the equipment being delivered from the RRC.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to off-site resources if these requirements are implemented as described.

3.1.4 Snow, Ice and Extreme Cold Hazard

As discussed in part in NEI 12-06, Section 8.2.1:

All sites should consider the temperature ranges and weather conditions for their site in storing and deploying their FLEX equipment consistent with normal design practices. All sites outside of Southern California, Arizona, the Gulf Coast and Florida are expected to address deployment for conditions of snow, ice, and extreme cold. All sites located north of the 35th Parallel should provide the capability to address extreme snowfall with snow removal equipment. Finally, all sites except for those within Level 1 and 2 of the maximum ice storm severity map contained in Figure 8-2 should address the impact of ice storms.

On pages 1 and 2 of the Integrated Plan, the licensee stated for the extreme cold hazard assessment as provided in NEI 12-06, Section 8.2.1), generally excludes the need to consider extreme snowfall at plant sites in the southeastern U.S. below the 35th parallel. The GGNS plant site is located below the 35th parallel at 32°0' 27" N and 91°2' 53" W (GGNS UFSAR, Section 2.1.1.1) and thus the capability to address extreme snowfall is not required.

GGNS is located within the region characterized by ice severity level 4 per NEI 12-06, Figure 8-2. Ice storms in the general area surrounding the plant site have occurred with accumulated ice coatings in excess of 0.5 inches. As such, GGNS is subject to severe icing conditions that could also cause catastrophic destruction to electrical transmission lines. Thus, GGNS screens in for an assessment for the extreme cold hazard for ice only.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to screening for snow, ice and extreme cold if these requirements are implemented as described.

3.1.4.1 Protection of FLEX Equipment – Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.1 states:

> These considerations apply to the protection of FLEX equipment from snow, ice, and extreme cold hazards:

1. For sites subject to significant snowfall and ice storms, portable FLEX equipment should be stored in one of the two configurations.

    a. In a structure that meets the plant's design basis for the snow, ice and cold conditions (e.g., existing safety-related structure).

    b. In a structure designed to or evaluated equivalent to ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures* for the snow, ice, and cold conditions from the site's design basis.

    c. Provided the N sets of equipment are located as described in a. or b. above, the spare (N+1) set of equipment may be stored in an evaluated storage location capable of withstanding historical extreme weather conditions such that the equipment is deployable.

2. Storage of FLEX equipment should account for the fact that the equipment will need to function in a timely manner. The equipment should be maintained at a temperature within a range to ensure its likely function when called upon. For example, by storage in a heated enclosure or by direct heating (e.g., jacket water, battery, engine block heater, etc.).

The licensee has stated that the GGNS storage buildings for portable/FLEX equipment are being designed to conform to NEI 12-06, Section 11. The licensee was requested to provide a description for the protection of FLEX equipment that is consistent with NEI 12-06, Sections 8.3.1 for protection from a seismic hazard.

During the audit process, the licensee responded by stating that design for the storage buildings has not been initiated. However, GGNS is planning to have two pre-engineered metal buildings. The storage buildings will be designed to meet NEI 12-06, Section 8.3.1 consideration 1.b (ASCE 7-10 and local building codes) for ice. The site's design basis temperature will be used for the extreme cold considerations. Local block heaters, water jackets, etc. may be provided for equipment such that the entire storage building will not have to be heated.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to storage and protection of FLEX equipment during a snow, ice, and extreme cold hazard, if these requirements are implemented as described.

3.1.4.2 Deployment of FLEX Equipment – Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.2 states:

> There are a number of considerations that apply to the deployment of FLEX equipment for snow, ice, and extreme cold hazards:
>
> 1. The FLEX equipment should be procured to function in the extreme conditions applicable to the site. Normal safety-related design limits for outside conditions may be used, but consideration should also be made for any manual operations required by plant personnel in such conditions.

2. For sites exposed to extreme snowfall and ice storms, provisions should be made for snow/ice removal, as needed to obtain and transport equipment from storage to its location for deployment.

3. For some sites, the UHS and flow path may be affected by extreme low temperatures due to ice blockage or formation of frazil ice. Consequently, the evaluation should address the effects of such a loss of the UHS on the deployment of FLEX equipment. For example, if UHS water is to be used as a makeup source, some additional measures may need to be taken to assure that the FLEX equipment can utilize the water.

On page 3 of the Integrated Plan, the licensee stated that deployment strategies and deployment routes are assessed for hazards impact.

With regard to considerations 1 and 2 above, on page 9 of the Integrated Plan, the licensee stated that the GGNS deployment strategy will be included within an administrative program. GGNS procedures and programs are being developed in accordance with NEI 12-06 to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to GGNS. The licensee further stated that Figure 5 of the Integrated Plan identifies the proposed deployment paths onsite for the transportation of FLEX equipment to the deployment areas. The identified paths and deployment areas will be accessible during all modes of operation. The administrative program will have elements that ensure pathways will be kept clear or will require actions to clear the pathways.

Although the licensee did not discuss consideration 3, ice blockage and frazil ice, the reviewer concluded that due to the local climate at GGNS, these hazard conditions would not pose an undue risk at this site.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to deployment of FLEX equipment with a snow, ice, and extreme cold hazard if these requirements are implemented as described.

3.1.4.3 Procedural Interfaces – Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.3 states:

> The only procedural enhancements that would be expected to apply involve addressing the effects of snow and ice on transport [of] FLEX equipment. This includes both access to the transport path, e.g., snow removal, and appropriately equipped vehicles for moving the equipment.

On various pages of the Integrated Plan, the licensee stated that GGNS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current emergency operating procedures (EOPs).

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedural interfaces regarding snow, ice, and extreme cold hazard if these requirements are implemented as described.

3.1.4.4 Considerations in Using Offsite Resources – Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.4 states:

> Severe snow and ice storms can affect site access and can impact staging areas for receipt of offsite materials and equipment.

On page 27 and 28 of the Integrated Plan, in the section discussing deployment of RRC equipment to maintain core cooling during the final phase, the licensee stated that Phase 3 equipment will be provided by the RRC which is to be located in Memphis, TN. Adequate transport has already been addressed in this report, and includes truck transport and if necessary, air-lift from the regional area to the site.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to use of off-site resources considering snow, ice and extreme cold hazards if these requirements are implemented as described.

3.1.5 High Temperatures Hazard

NEI 12-06, Section 9.2 states:

> All sites will address high temperatures. Virtually every state in the lower 48 contiguous United States has experienced temperatures in excess of 110 degrees F [Farenheit]. Many states have experienced temperatures in excess of 120 degrees F.
>
> In this case, sites should consider the impacts of these conditions on deployment of the FLEX equipment.

On page 2 of the Integrated Plan, the licensee stated that for the extreme high temperature hazard assessment, per NEI 12-06 Section 9.2, all sites will address high temperatures. Mississippi summers are warm and humid, with limited periods of extremely hot weather over 100 degrees F (GGNS UFSAR, Section 2.3.2.1.2). Thus the GGNS site screens in for an assessment for extreme High Temperature.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to screening for the high temperature hazard if these requirements are implemented as described.

3.1.5.1 Protection of FLEX Equipment – High Temperature Hazard

NEI 12-06, Section 9.3.1 states:

> The equipment should be maintained at a temperature within a range to ensure

> its likely function when called upon.

The licensee has stated that GGNS storage buildings for portable/FLEX equipment are being designed to conform to NEI 12-06, Section 11. The licensee was requested to provide a description for the protection of FLEX equipment that is consistent with the guidance of NEI 12-06, Sections 9.3.1 for high temperatures.

During the audit process, the licensee responded by stating that design for the storage buildings has not been initiated. However, GGNS is planning to have two pre-engineered metal buildings. The storage buildings will be designed to maintain the inside temperature within the FLEX equipment manufacturer's recommended storage temperatures to satisfy NEI 12-06, Section 9.3.1.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to the protection of FLEX equipment from high temperatures hazard if these requirements are implemented as described.

3.1.5.2 Deployment of FLEX Equipment – High Temperature Hazard

NEI 12-06, Section 9.3.2 states:

> The FLEX equipment should be procured to function, including the need to move the equipment, in the extreme conditions applicable to the site. The potential impact of high temperatures on the storage of equipment should also be considered, e.g., expansion of sheet metal, swollen door seals, etc. Normal safety-related design limits for outside conditions may be used, but consideration should also be made for any manual operations required by plant personnel in such conditions.

On page 3 of the Integrated Plan, the licensee stated that deployment strategies and deployment routes are assessed for hazards impact.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to the deployment of FLEX equipment from high temperatures hazard if these requirements are implemented as described.

3.1.5.3 Procedural Interfaces – High Temperature Hazard

NEI 12-06, Section 9.3.3 states:

> The only procedural enhancement that would be expected to apply involves addressing the effects of high temperatures on the FLEX equipment.

There was no discussion provided in the Integrated Plan regarding the potential effects of high temperatures at the location where the portable/FLEX equipment would actually operate in the event of high temperatures. The licensee was requested to provide a discussion of the effects of high temperatures on the FLEX equipment being stored and deployed.

During the audit process, the licensee responded by stating that procedures will address the effects of high area temperatures on FLEX equipment and will meet the requirements of NEI 12-06, Section 9.3.3. GGNS will consider the temperatures in the areas where equipment will be stored and operated and will procure the FLEX equipment accordingly and have procedures in place to control the operation (protection of the FLEX equipment). Additionally, heat and exhaust dissipated from the FLEX equipment during operation will be accounted for in the location where the FLEX equipment will be operated and on the requirements for the equipment. The equipment specifications for procurement of this equipment will specify these extreme conditions.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedural interfaces if these requirements are implemented as described.

3.2 PHASED APPROACH

Attachment (2) to Order EA-12-049 describes the three-phase approach required for mitigating BDBEEs in order to maintain or restore core cooling, containment and SFP cooling capabilities. The phases consist of an initial phase using installed equipment and resources, followed by a transition phase using portable onsite equipment and consumables and a final phase using offsite resources.

To meet the requirements of Order EA-12-049, Licensees will establish a baseline coping capability to prevent fuel damage in the reactor core or SFP and to maintain containment capabilities in the context of a BDBEE that results in the loss of all ac power, with the exception of buses supplied by safety-related batteries through inverters, and loss of normal access to the UHS. As described in NEI 12-06, Section 1.3, "[p]lant-specific analyses will determine the duration of each phase." This baseline coping capability is supplemented by the ability to use portable pumps to provide reactor pressure vessel (RPV)/reactor makeup in order to restore core or SFP capabilities as described in NEI 12-06, Section 3.2.2, Guideline (13). The NRC endorsed this approach with JLD-ISG-2012-01.

3.2.1 Reactor Core Cooling, Heat Removal, and Inventory Control Strategies

NEI 12-06, Table 3-1 and Appendix C summarize one acceptable approach for the reactor core cooling strategies. This approach uses the installed reactor core isolation cooling (RCIC) system, or the high pressure coolant injection (HPCI) system to provide core cooling with installed equipment for the initial phase. This approach relies on depressurization of the RPV for injection with a portable injection source with diverse injection points established to inject through separate divisions/trains for the transition and final phases. This approach also provides for manual initiation of RCIC/HPCI/IC as a contingency for further degradation of installed systems, structures, and components (SSCs) as a result of the BDBEE.

As described in NEI 12-06, Section 3.2.1.7 and JLD-ISG-2012-01, Section 2.1, strategies that have a time constraint to be successful should be identified and a basis provided that the time can be reasonably met. NEI 12-06, Section 3 provides the performance attributes, general criteria, and baseline assumptions to be used in developing the technical basis for the time constraints. Since the event is a beyond-design-basis event, the analysis used to provide the technical basis for time constraints for the mitigation strategies may use nominal initial values (without uncertainties) for plant parameters, and best-estimate physics data. All equipment used for consequence mitigation may be assumed to operate at nominal setpoints and capacities. NEI 12-06, Section 3.2.1.2 describes the initial plant conditions for the at-power mode of operation; Section 3.2.1.3 describes the initial conditions; and Section 3.2.1.4 describes boundary conditions for the reactor transient.

Acceptance criteria for the analyses serving as the technical basis for establishing the time constraints for the baseline coping capabilities described in NEI 12-06, which provide an acceptable approach, as endorsed by JLD-ISG-2012-01, to meeting the requirements of Order EA-12-049 for maintaining core cooling are 1) the preclusion of core damage as discussed in NEI 12-06, Section 1.3 as the purpose of FLEX; and 2) the performance attributes as discussed in Appendix C.

As described in NEI 12-06, Section 1.3, plant-specific analyses determine the duration of the phases for the mitigation strategies. In support of its mitigation strategies, the licensee should perform a thermal-hydraulic analysis for an event with a simultaneous loss of all ac power and loss of normal access to the UHS for an extended period (the ELAP event).

3.2.1.1 Computer Code Used for ELAP Analysis

NEI 12-06, Section 1.3 states:

> To the extent practical, generic thermal hydraulic analyses will be developed to support plant-specific decision-making. Justification for the duration of each phase will address the on-site availability of equipment, the resources necessary to deploy the equipment consistent with the required timeline, anticipated site conditions following the beyond-design-basis external event, and the ability of the local infrastructure to enable delivery of equipment and resources from off-site.

The licensee has provided a Sequence of Events (SOE) in their Integrated Plan, which included the time constraints and the technical basis for the site. That SOE is based on an analysis using the industry-developed Modular Accident Analysis Program (MAAP) Version 4 computer code. MAAP4 was written to simulate the response of both current and advanced light water reactors to Loss of Coolant Accident (LOCA) and non-LOCA transients for probabilistic risk analyses as well as severe accident sequences. The code has been used to evaluate a wide range of severe accident phenomena, such as hydrogen generation and combustion, steam formation, and containment heating and pressurization.

The licensee has decided to use the MAAP4 computer code for simulating the ELAP event. While the NRC staff acknowledges that MAAP4 has been used many times over the years and in a variety of forums for severe and beyond design basis analysis, MAAP4 is not an NRC-approved code, and the NRC staff has not examined its technical adequacy for performing thermal-hydraulic analyses. Therefore, during the review of the licensees' Integrated Plans, the issue of using MAAP4 was raised as a generic concern and was addressed by the NEI in their position paper dated June 2013, entitled "Use of Modular Accident Analysis Program (MAAP4) in Support of Post-Fukushima Applications" (ADAMS Accession No. ML13190A201). After review of this position paper, the NRC staff endorsed a resolution through letter dated October 3, 2013 (ADAMS Accession No. ML13275A318). This endorsement contained five limitations on the MAAP4 computer code's use for simulating the ELAP event for Boiling Water Reactors (BWRs). The NRC staff requested that the licensee discuss each of the MAAP4 limitations for GGNS identified below.

(1) From the June 2013 position paper, benchmarks must be identified and discussed which demonstrate that MAAP4 is an appropriate code for the simulation of an ELAP event at your facility.

(2) The collapsed level must remain above Top of Active Fuel (TAF) and the cool down rate must be within technical specification limits.

(3) MAAP4 must be used in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper.

(4) In using MAAP4, the licensee must identify and justify the subset of key modeling parameters cited from Tables 4-1 through 4-6 of the “MAAP4 Application Guidance, Desktop Reference for Using MAAP4 Software, Revision 2” (Electric Power Research Institute Report 1020236). This should include response at a plant-specific level regarding specific modeling options and parameter choices for key models that would be expected to substantially affect the ELAP analysis performed for that licensee’s plant. Although some suggested key phenomena are identified below, other parameters considered important in the simulation of the ELAP event by the vendor / licensee should also be included.

   a. Nodalization
   b. General two-phase flow modeling
   c. Modeling of heat transfer and losses
   d. Choked flow
   e. Vent line pressure losses
   f. Decay heat (fission products / actinides / etc.)

(5) The specific MAAP4 analysis case that was used to validate the timing of mitigating strategies in the Integrated Plan must be identified and should be available on the ePortal for NRC staff to view. Alternately, a comparable level of information may be included in the supplemental response. In either case, the analysis should include a plot of the collapsed vessel level to confirm that TAF is not reached (the elevation of the TAF should be provided) and a plot of the temperature cool down to confirm that the cool down is within technical specification limits.

During the audit process, the licensee responded by stating that a preliminary MAAP4 analysis has been performed and is available on the e-Portal. However, the analysis will be revised to reflect potential changes in strategies. The MAAP4 analysis revision will conform to the NEI position paper dated June 2013, entitled “Use of Modular Accident Analysis Program (MAAP) in Support of Post-Fukushima Applications" (Accession Number ML13190A201). The revised MAAP4 analysis will conform to the MAAP4 limitations 1 through 5, described above, and will provide the relevant information for review. GGNS will address the five MAAP4 limitations utilizing the industry developed template. The revised MAAP4 analysis is scheduled to be available no later than the fourth sixth month update report (February, 2015). This has been identified as Confirmatory Item 3.2.1.1.A in Section 4.2.

On page 8 of the Integrated Plan, in the section discussing the time constraints identified in Attachment 1A table, Technical Basis Support information, the licensee stated that environmental conditions within the station areas were evaluated utilizing methods and tools in NUMARC 87-00, “Guidelines and Technical Bases for Nuclear Utility Management and Resources Council (NUMARC) Initiatives Addressing Station Blackout at Light Water Reactors,” Revision 1, or GOTHIC 7.2b (EPRI software, GOTHIC Containment Analysis Package User Manual, Version 7.2b(QA), March 2009). The licensee used GOTHIC to perform room heat-up calculations. However, it is unclear how MAAP and GOTHIC were used since both were apparently used to perform heat-up calculations for the drywell/containment and rooms. Therefore, the licensee was requested to explain how MAAP and GOTHIC were used for GGNS analyses of the containment/suppression pool (SP) simulation and room heat-up.

During the audit process, the licensee responded by stating that the GGNS containment response is analyzed using the MAAP4 code. In the preliminary analysis, the MAAP4 inputs for UHS basin temperature were obtained from a GOTHIC model of the UHS basin heat up. In addition, the licensee stated that GOTHIC is a more appropriate engineering tool for modeling general thermal hydraulic behavior such as the temperature rise in a cooling tower basin and as discussed previously, the MAAP4 analysis will be revised to reflect possible changes to the strategy and will comply with the NEI position paper dated June 2013. GOTHIC is also used to analyze the loss of HVAC in plant areas containing credited FLEX equipment (i.e. RCIC room, etc.).

As noted above, the licensee used GOTHIC 7.2b to perform heat-up analyses for the GGNS ELAP event. However, it is unclear if GOTHIC 7.2b has been validated for room heat-up calculations. Therefore, the licensee was requested to provide a discussion concerning the validation of GOTHIC 7.2b for room heat-up calculations.

During the audit process, the licensee responded by stating that although GOTHIC 7.2b has not been reviewed and approved specifically for room heat-up calculations at GGNS by the NRC staff, it is recognized as one the best thermal-hydraulic codes for containment and building heat up analyses and has been used widely in the nuclear industry. In addition, the licensee stated that GOTHIC 7.2b is currently maintained under the Entergy Software Quality Assurance Program for safety related applications and that GOTHIC has been used at several Entergy sites for performing room heat up analyses for compliance with 10 CFR 50.63. Additionally, several Safety Evaluation Reports have been issued by the NRC for GOTHIC related applications to other utilities, but not GGNS specifically.

On pages 7 and 8 of the Integrated Plan, the licensee stated that NEDC-33771P, "Project Task Report BWROG [Boiling Water Reactors Owner's Group] GEH [General Electric Hitachi] Evaluation of FLEX Implementation Guidelines," Revision 0, was developed to supplement the guidance in NEI 12-06 by providing additional BWR-specific information regarding the individual plant response to the ELAP and LUHS events. The document includes identification of the generic event scenario and expected plant response, the associated analytical bases and recommended actions for performance of a site-specific gap analysis. The licensee further stated that, in the document, GEH utilized the NRC-accepted SUPERHEX (SHEX) computer code methodology for BWR's long term containment analysis for the ELAP analysis. As part of this document, a generic BWR 6/Mark III containment nuclear steam supply system (NSSS) evaluation was performed. The BWR 6/Mark III containment analysis is applicable to the GGNS (a BWR 6 Mark III plant) coping strategy because it supplements the guidance in NEI 12-06 by providing BWR 6-specific information regarding plant response for core cooling and containment integrity. The guidance provided was utilized as appropriate to develop coping strategies and for prediction of the plant's response. The licensee also stated that they and the BWROG have ongoing analyses that may develop additional strategies that are not stated in the integrated plan at this time.

Although the licensee has presented coping strategies to maintain core and containment cooling during BDBEEs, these strategies may be modified as the result of BWROG review and analysis. Based on the possible use of the BWROG analyses by GGNS to establish additional strategies, it is unclear if MAAP, GOTHIC or the BWROG analyses will be used to make decisions for actions and timelines for the Integrated Plan. The licensee was requested to clarify which analytical tools are being used and why these analytical tools are being used for this particular analysis.

During the audit process, the licensee responded by stating that relevant portions of NEDC-33771P, Revision 0 were considered in the development of the GGNS FLEX strategy. Revision 2 of NEDC-33771P includes additional analysis for BWR-6's with Mark III containments, which contains additional options for BWR-6/Mark III FLEX mitigation. The additional analyses in NEDC-33771P, Revision 2, have not resulted in any significant change to the GGNS FLEX strategy except those related to the bleed and feed strategy. A combination of plant specific MAAP4 and GOTHIC analyses was used to identify required actions and establish timelines for the submitted Integrated Plan strategy. MAAP4 was used to evaluate RPV and containment responses. GOTHIC was used to evaluate room heat up and heat up of the ultimate heat sink. The final design of the FLEX strategy will include new analyses or revisions to these analyses to reflect the final strategy. The strategy for Phase 2 core cooling and maintaining containment integrity presented in the GGNS Integrated Plan is under review.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to the computer code used for ELAP analysis if these requirements are implemented as described.

3.2.1.2 Recirculation Pump Seal Leakage Models

Consistency with the guidance of NEI 12-06, Section 3.2.1.5, Paragraph (4) includes consideration of recirculation pump seal leakage. When determining time constraints and the ability to maintain core cooling, it is important to consider losses to the RCS inventory as this can have a significant impact on the SOE. Special attention is paid to the recirculation pump seals because these can fail in a station blackout (SBO) event and contribute to beyond normal system leakage.

The licensee did not discuss reactor coolant inventory loss such as normal system leakage and losses due to BWR recirculation pump seal leakage that would be expected to be included in the ELAP analysis. There is no discussion of the details of seal leakage rates, the details of the seal qualification tests, the seal leakage rate models and supporting test data, leakage rate pressure-dependence, and any conservative margin are not described within the Integrated Plan or supplied with it. The licensee was requested to provide the amount of seal leakage that was used in the GGNS NSSS simulation for ELAP coping analyses and explain how the seal leakage was determined. The licensee was requested to include the technical basis for the assumptions made regarding the leakage rate through the recirculation pump seals and also other sources and to provide additional details on the assumed pressure-dependence of the leakage rate. In addition, further clarification is needed on whether the leakage was determined or assumed to be single-phase liquid, two-phase mixture, or steam at the donor cell, and discuss how mixing of the leakage flow with the drywell atmosphere is modeled.

During the audit process, the licensee responded by stating that in the preliminary MAAP4 analysis for the Integrated Plan, recirculation pump leakage was modeled as a postulated break in the reactor coolant system simulating a leak of approximately 20 gallons per minute (gpm) early in the accident sequence. The leakage flow drops as reactor pressure is decreased in accordance with the FLEX strategy. A sensitivity case was also run simulating an increased leakage area that produced a 100-184 gpm early in the sequence. The licensee further stated there was almost no resulting change in containment and drywell pressures and temperatures. As noted earlier in this report in Section 3.2.1.1, the MAAP4 analysis will be revised to reflect possible changes to the strategy and will comply with the NEI position paper dated June 2013 and the limitations imposed by NRC staff in the October 3, 2013 letter. The licensee stated that the amount of recirculation pump seal leakage included in the revised MAAP analysis will be reviewed and revised to be consistent with the NEDC-33771P. The final analysis should be provided on the ePortal for NRC staff review. This has been identified as Confirmatory Item 3.2.1.2.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to recirculation pump seal leakage models and other sources of RCS leakage if these requirements are implemented as described.

3.2.1.3 Sequence of Events (SOE)

NEI 12-06 discusses an event timeline and time constraints in several sections of the document, for example Sections 1.3, Section 3.2.1.7 principle (4) and (6), Section 3.2.2 Guideline (1) and Section 12.1.

NEI 12-06, Section 3.2.2 addresses the minimum baseline capabilities:

> Each site should establish the minimum coping capabilities consistent with unit-specific evaluation of the potential impacts and responses to an ELAP and LUHS. In general, this coping can be thought of as occurring in three phases:
>
> - Phase 1: Cope relying on installed plant equipment.
> - Phase 2: Transition from installed plant equipment to on-site FLEX equipment.
> - Phase 3: Obtain additional capability and redundancy from off-site equipment until power, water, and coolant injection systems are restored or commissioned.

In order to support the objective of an indefinite coping capability, each plant will be expected to establish capabilities consistent with Table 3-1 (BWRs). Additional explanation of these functions and capabilities are provided in NEI 12-06 Appendix C, "Approach to BWR Functions."

The sequence of events was presented on pages 5 through 7, and again on pages 58 through 61 in Attachment 1A, "Sequence of Events", in the Integrated Plan. These pages describe the actions and timing involved in responding to an ELAP/LUHS event. The timing and sequence of these actions are dependent upon the thermal hydraulic analyses previously discussed in Section 3.2.1.1 of this report. As noted in that section of the report, a revised MAAP4 analysis is scheduled to be available by the licensee no later than the fourth sixth month update report (February, 2015). The final Sequence of Events will need to reflect the results of that analysis and the licensee will need to provide reasonable assurance by some means (e.g. by walkthrough) that the timing of the actions in the Sequence of Events is achievable. Updating and validation of the Sequence of Events is identified as Confirmatory Item 3.2.1.3.A in Section 4.2 below.

On page 6 of the Integrated Plan, the licensee indicated that after 4 hours, prior to when the SP heats up to 200 degrees F, operators will initiate use of the modified containment vent to control containment parameters within the limits that allow continued use of RCIC. Based on MAAP4 analysis, the SP is expected to reach 212 degrees F in approximately 6.5 hours. The licensee stated that the constraint can be met because the containment cooling system 20 inch vent path will be modified to be able to be opened during ELAP conditions and qualified to be seismically rugged. The reviewer was not familiar with the meaning of seismically rugged. The licensee was requested to provide more clarity in the definition of the containment venting system with respect to withstanding an earthquake.

During the audit process, the licensee responded by stating that seismically rugged was intended to mean seismically robust as defined in NEI 12-06 and while the FLEX design process has not been started at this time, the vent path will be evaluated to assess its seismic capability with regard to the design basis seismic requirements to ensure that it is seismically robust. In addition, if that evaluation indicates the need for hardware modifications, those will be incorporated into the FLEX design. The licensee further stated that the proposed vent path is the same path that is used in the EOPs to depressurize the containment.

Additionally, the license indicated that at 4 hours, operators will initiate reactor pressure control to keep from entering the unsafe region of the Heat Capacity Temperature Limit (HCTL) Curve. Using manual control of safety relief valves (SRVs), the RPV will be depressurized in accordance with EOPs, to approximately 200 to 400 pounds per square inch gauge (psig), to keep in the safe region of the HCTL curve. SRV control is maintained from the MCR with sufficient dc power and pneumatic pressure to operate the SRVs throughout Phase 1. The NRC staff was concerned about the control of this situation with respect to emergency depressurization. During this situation, the RPV could be at 200 to 400 psig when RCIC is shut down and the RPV would have to be depressurized to carry out feed and bleed activities. It is noted that the Integrated Plan identifies that the upper containment pool (UCP)/steam separator storage volume would be drained to the SP to cool the SP. The licensee was requested to address the following questions related to this action:

a) Is this cooling effect enough to allow the complete depressurization of the RPV into the SP without significantly heating the SP and possibly pressurizing the drywell/containment?
b) Has an analysis been performed to simulate the depressurization, SP heat up, containment response and reactor response?
c) How much time do you have to perform this action before the core is uncovered?

During the audit process, the licensee responded as follows:

> Both RCIC suction swap from the SP to the UCP at 2 hours and containment venting at 4 hours are required to support the strategy and continued operation of RCIC. Suction from the UCP maintains adequate net positive suction head (NPSH), while venting the containment ensures that containment parameters that drive the EOP to emergency depressurize the RPV and thereby remove the steam supply to RCIC are prevented or delayed. The RCIC suction swap will be performed manually in a manner similar to the

> current swap from SP to CST [condensate storage tank]; therefore, the pump will continue to operate during the swap. The ability to perform these actions in the specified time will be confirmed as part of the detailed design, procedure development and the subsequent validation/demonstration tasks. The need for capability to reclose the containment vent will also be considered during the detailed design. As previously indicated, a new MAAP4 calculation will be performed as part of the detailed FLEX design to reflect the planned revised strategy and to conform to the NEI MAAP white paper. These have the potential to modify the timing of planned actions.

Results of the final analyses per the new MAAP4 calculation will need to be reviewed to determine that the timing has been reflected in the SOE. This has been previously identified as Confirmatory Item 3.2.1.3.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of the issues associated with the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to the sequence of events timeline, if these requirements are implemented as described.

3.2.1.4 Systems and Components for Consequence Mitigation

NEI 12-06, Section 11 provides details on the equipment quality attributes and design for the implementation of FLEX strategies. It states:

> Equipment associated with these strategies will be procured as commercial equipment with design, storage, maintenance, testing, and configuration control as outlined in this section [Section 11]. If the equipment is credited for other functions (e.g., fire protection), then the quality attributes of the other functions apply.

and,

> Design requirements and supporting analysis should be developed for portable equipment that directly performs a FLEX mitigation strategy for core, containment, and SFP that provides the inputs, assumptions, and documented analysis that the mitigation strategy and support equipment will perform as intended.

NEI 12-06, Section 3.2.1.12 states:

> Equipment relied upon to support FLEX implementation does not need to be qualified to all extreme environments that may be posed, but some basis should be provided for the capability of the equipment to continue to function.

On page 3 of the Integrated Plan, the licensee stated that FLEX components will be designed to be capable of performing in response to screened in hazards in accordance with NEI 12-06. Portable FLEX components will be procured commercially. Margin will be added to the design of the FLEX components and hard connection points to address future requirements as re-evaluation warrants. This margin will be determined during the detailed design or evaluation process.

On page 12 of the Integrated Plan, in the section discussing time constraints identified in the sequence of events timeline, the licensee indicated that at the initiation of the BDBEEs, MSIVs automatically close, feedwater is lost, and SRVs automatically open to control pressure, causing reactor water level to decrease. When reactor water level reaches its low level set point (level 2), RCIC actuates, with suction from the non-seismic condensate storage tank (CST). The licensee stated that this injection recovers the reactor level to the normal band.

Continuing, the licensee stated that the CST is the normal standby lineup for the RCIC system. If prior to or during the initiating events the CST inventory becomes unavailable, the RCIC suction is automatically transferred to the suppression pool (SP). The SRVs, cycling in low-low set mode, control reactor pressure between approximately 930-1100 psig (GGNS UFSAR, Table 5.2-2). RCIC provides all makeup flow to the reactor vessel.

The reviewer noted that the Integrated Plan stated that at some point in time, the UCP is drained to the SP using the suppression pool makeup dump valves. It was unclear if the SP overflows during this process. Also, it was unclear if this high water level in the SP violates EOP requirements. The licensee was requested to provide a discussion regarding SP temperature and water level as a function of time during the use of the UCP and to clarify whether EOP and Tech Spec requirements are maintained. Specifically, the NRC staff requested that following questions be answered: If the SP overflows, where does the water go? And, does it impact drains, instruments or other critical items in the containment?

During the audit process, the licensee responded by stating that in the planned revised strategy, when RCIC suction from the UCP is terminated, the remaining available volume in the UCP is no longer dumped to the suppression pool; thus the SP would not be overfilled from the UCP water source. In a design basis accident where the upper pool dumps, final SP level is about 4 inches below the top of the weir wall, and thus in that case the SP does not overflow. The licensee further stated that given the planned revised strategy of continuous containment venting and feeding the reactor vessel from the standby service water (SSW) basin using the diesel driven FLEX pump after RCIC injection from the UCP is terminated, the SP level will likely rise until the weir wall is overtopped and water flows into the drywell. Current design basis analyses for postulated LOCA events indicate that a "drywell pool" is formed as a result of water flowing out the break into the drywell. Within the region of possible drywell pool formation, there is no equipment in the drywell that is credited for the FLEX mitigation strategies. Therefore, this will not damage any equipment or instrumentation credited during BDBEEs.

Continuing, the licensee stated that the limits on SP high level in the EOPs are related to an entry point for emergency depressurization of the reactor vessel in an accident situation to allow the use of the residual heat removal (RHR) shutdown cooling mode and to facilitate restoration of reactor vessel water level. A recent revision to the BWROG EPGs allows operation at high SP levels if RCIC is the only method of core cooling. Also, as noted in Integrated Plan Attachment IA, the reactor vessel is depressurized to between 200 to 400 psig at approximately 4 hours into the event, and at 24 hours the reactor is further depressurized to facilitate use of the diesel driven FLEX pump. Therefore, the higher SP level would not be a concern from an EOP perspective. FLEX FSGs, to the extent possible, will provide pre-planned FLEX strategies for accomplishing specific tasks in support of EOPs and Abnormal Operating Procedures (AOPs) functions to improve the capability to cope with BDBEEs. FSGs will be developed in accordance with the objectives given in NEI 12-06 Section 11.4. The licensee further stated that FSGs will be used to supplement (not replace) the existing procedure structure that establishes command and control for the event (e.g., AOP, EOP, and severe accident management guidelines (SAMGs)). When FLEX equipment is needed to supplement EOP/AOP strategies, the EOP/AOP will direct the entry into and exit from the appropriate FSG procedure. As such, existing AOP and EOPs will be revised to the extent necessary to include appropriate portions of or reference to FSGs.

In the previous paragraph, the licensee stated that a recent revision to the BWROG Emergency Procedure Guidelines (EPGs) and Severe Accident Guidelines (SAGs) allows operation at high SP levels if RCIC is the only method of core cooling. BWROG EPG/SAG, Revision 3, allows the temperature limit of the suppression pool to be exceeded. The licensee should provide confirmation that exceeding this temperature limit does not adversely impact FLEX strategies at GGNS. This is identified as Confirmatory Item 3.2.1.4.A in Section 4.2.

The licensee was requested to provide a summary of non-safety-related installed equipment that is used in the mitigation strategies and to include a discussion of whether the equipment is qualified to survive all ELAP events.

During the audit process, the licensee responded by stating that any non-safety related equipment credited in the GGNS FLEX strategy will be evaluated against applicable hazards to ensure that it will function properly. The design and analysis for FLEX implementation has not started at this time. Therefore, a complete list of credited non-safety related plant installed systems and equipment is not available.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to systems and components for consequence mitigation if these requirements are implemented as described.

3.2.1.5 Monitoring Instrumentation and Controls

NEI 12-06, Section 3.2.1.10 provides information regarding instrumentation and controls necessary for the success of the coping strategies. NEI 12-06 provides the following guidance:

> The parameters selected must be able to demonstrate the success of the strategies at maintaining the key safety functions as well as indicate imminent or actual core damage to facilitate a decision to manage the response to the event within the EOPs and FSGs or within the SAMGs. Typically these parameters would include the following:
>
> - RPV Level
> - RPV Pressure
> - Containment Pressure
> - SP Level
> - SP Temperature
> - SFP Level

The plant-specific evaluation may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance, or to indicate imminent or actual core damage.

On pages 15 and 30 of the Integrated Plan, the licensee listed the following instrument channels for monitoring:

RPV wide range water level,
Shutdown and Fuel Range water Level
RPV pressure,
Containment pressure,
Drywell Pressure,
Containment Air Temperature,
SP water level,
SP temperature

On page 37 of the Integrated Plan, the licensee identified a modification would be installed for SFP water level instrumentation per NRC Order EA-12-051.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to monitoring instrumentation and controls, if these requirements are implemented as described.

3.2.1.6 Motive Power, Valve Controls and Motive Air System

NEI 12-06, Section 12.1 provides guidance regarding the scope of equipment that will be needed from off-site resources to support coping strategies. NEI 12-06, Section 12.1 states that:

> Arrangements will need to be established by each site addressing the scope of equipment that will be required for the off-site phase, as well as the maintenance and delivery provisions for such equipment.

and,

> Table 12-1 provides a sample list of the equipment expected to be provided to each site from off-site within 24 hours. The actual list will be specified by each site as part of the site-specific analysis.

Table 12-1 includes portable air compressor or nitrogen bottles and regulators (if required by plant strategy).

On page 18 of the Integrated Plan, the licensee discussed that the transition to Phase 2 core cooling using the diesel driven FLEX pump, with suction from the SSW basin, to feed the RPV and have the water flow to the suppression pool without boiling requires the RPV to be depressurized to allow maintaining the SRVs open to allow sufficient water flow through the SRVs. If necessary, emergency nitrogen bottles may be connected to the SRV accumulators prior to exhaustion in accordance with Procedure 05-1-02-I-4, "Loss of AC Power."

There was insufficient detail in the Integrated Plan to evaluate the coping strategies with regard to sustaining the operation of the SRVs during an ELAP by recharging the accumulators from backup air sources, the robustness of those backup sources and interconnecting piping. In addition, no discussion was provided in the Integrated Plan regarding the rate of compressed air use by the SRV's, and the capacity of stored compressed air cylinders. The Integrated Plan does not describe the amount of compressed air stored on site, the storage locations or method of transportation to the area needed. The licensee was requested to provide additional information regarding the rate of compressed air use by the SRV's, the capacity of stored compressed air cylinders, the amount of compressed air stored on site, and the storage locations and method of transportation.

During the audit process, the licensee provided information indicating that there are eight ADS SRV's and one non-ADS SRV. The licensee stated that the accumulators and receiver tanks for the SRVs contain enough pneumatic pressure for 200 open/close cycles. Per calculation ENTGGG111-CALC-006, only 126 SRV actuations are needed for the 72 hour period after BDBEEs. Therefore, the licensee stated that there were no actions are required in Phases 1 and 2 related to supplying backup air to the SRVs.

The licensee also indicated that although not needed in Phases 1 and 2, for conservatism, GGNS will have eight nitrogen bottles stored on site and available for use during an ELAP, four in each storage building. If needed after the initial 72 hours, four nitrogen bottles may be connected before the SRV accumulators are exhausted in accordance with the Off-Normal Event Procedure 05-1-02-I-4, Loss of AC Power. The licensee also stated that the Loss of AC Power procedure directs the operators to have the maintenance department install four gas bottles at the ADS system air supply line test connection in order to provide makeup air/nitrogen to the ADS receivers. The licensee further stated that tools to perform ADS nitrogen installation are located in a tool box in the area of the test connection against the southwest wall. The nitrogen bottles are currently stored in a rack behind the Unit I warehouse (Chemical Storage Facility). These bottles can be transported by hand trucks, or motorized vehicles.

In addition, the licensee was requested to provide additional details on the feed and bleed methodology for maintaining core cooling, especially the process of bleeding through the SRVs at 2000 gpm and to provide an evaluation on how to maintain the SRVs open.

During the audit process, the licensee responded by stating that based on a proposed change in the coping strategy, the "bleed" portion of the feed and bleed copying strategy is no longer being utilized. However, the SRVs are still being credited and will be used in a similar fashion to the alternate shutdown cooling mode described in Section 5.4.7.1.5 in the UFSAR. The licensee further stated that the alternate shutdown cooling mode is part of the design and licensing basis for GGNS and that individual SRVs can be manually opened and maintained open by the use of hand switches in the MCR.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to motive power, valve controls and motive air system, if these requirements are implemented as described.

3.2.1.7 Cold Shutdown and Refueling

NEI 12-06, Table 1-1, lists the coping strategy requirements as presented in Order EA-12-049. Item (4) of that list states:

> Licensees or CP holders must be capable of implementing the strategies in all modes.

The NRC staff reviewed the licensee's Integrated Plan and determined that the Generic Concern related to shutdown and refueling guidelines is applicable to the plant. This Generic Concern has been resolved generically through the NRC endorsement of NEI position paper entitled “Shutdown/Refueling Modes” (ADAMS Accession No. ML13273A514); and has been endorsed by the NRC in a letter dated September 30, 2013 (ADAMS Accession No. ML13267A382).

The position paper describes how licensees will, by procedure, maintain equipment available for deployment in shutdown and refueling modes. The NRC staff concluded that the position paper provides an acceptable approach for demonstrating that the licensees are capable of implementing mitigating strategies in all modes of operation. The NRC staff will evaluate the licensee’s resulting program through the audit and inspection processes.

During the audit process, Entergy stated that GGNS will incorporate the supplemental guidance provided in the NEI position paper entitled "Shutdown/Refueling Modes" to enhance the shutdown risk process and procedures. The need for hydrogen control during shutdown and refueling will be addressed as part of that effort.

The licensee’s approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to the analysis of an ELAP during Cold Shutdown or Refueling, if these requirements are implemented as described.

3.2.1.8 Use of Portable Pumps

NEI 12-06, Section 3.2.2, Guideline (13) states that:

> Regardless of installed coping capability, all plants will include the ability to use portable pumps to provide RPV/RCS/SG makeup as a means to provide diverse capability beyond installed equipment. The use of portable pumps to provide RPV/RCS/SG makeup requires a transition and interaction with installed systems. For example, transitioning from RCIC to a portable FLEX pump as the source for RPV makeup requires appropriate controls on the depressurization of the RPV and injection rates to avoid extended core uncovery. Similarly, transition to a portable pump for SG makeup may require cooldown and depressurization of the SGs in advance of using the portable pump connections. Guidance should address both the proactive transition from installed equipment to portable and reactive transitions in the event installed equipment degrades or fails. Preparations for reactive use of portable equipment should not distract site resources from establishing the primary coping strategy. In some cases, in order to meet the time-sensitive required actions of the site-specific strategies; the FLEX equipment may need to be stored in its deployed position.
>
> The fuel necessary to operate the FLEX equipment needs to be assessed in the plant specific analysis to ensure sufficient quantities are available as well as to address delivery capabilities.

NEI 12-06, Section 11.2 states in part:

> Design requirements and supporting analysis should be developed for portable equipment that directly performs a FLEX mitigation strategy for core, containment, and SFP that provides the inputs, assumptions, and documented analysis that the mitigation strategy and support equipment will perform as

intended.

The Integrated Plan provided descriptions of several mitigation strategies using various pumps and flow path configurations, but insufficient information was provided to substantiate that the required flow rates and pressures could be achieved. The licensee was requested to provide supporting information to confirm the ability of the portable/FLEX pumps to deliver the required flows at the rated pressures.

During the audit process, the licensee stated that Calculations ENTGGG111-CALC-008 and ENTGGG111-CALC-010 provided the required water flow rates, the portable/FLEX pump complete head/flow characteristics, suction and discharge losses, system backpressure, elevation differences and piping losses. However, the licensee noted that new hydraulic calculations may be performed if required by changes to the mitigation strategies. The licensee further stated that it is anticipated this activity will be completed no later than the fourth six-month update report (February, 2015). The new hydraulic analyses should be provided for review. This has been identified as Confirmatory Item 3.2.1.8.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of the issue associated with the Confirmatory Item provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to use of portable equipment if these requirements are implemented as described.

3.2.2 Spent Fuel Pool Cooling Strategies

NEI 12-06, Table 3-1 and Appendix C summarize one acceptable approach for the SFP cooling strategies for BWRs. This approach uses a portable injection source to provide 1) makeup via hoses on the refuel deck/floor capable of exceeding the boil-off rate for the design basis heat load; 2) makeup via connection to SFP cooling piping or other alternate location capable of exceeding the boil-off rate for the design basis heat load; and alternatively 3) spray via portable monitor nozzles from the refueling deck/floor capable of providing a minimum of 200 gallons per minute (gpm) per unit (250 gpm to account for overspray). This approach will also provide a vent pathway for steam and condensate from the SFP.

As described in NEI 12-06, Section 3.2.1.7 and JLD-ISG-2012-01, Section 2.1, strategies that require a time constraint to be successful should be identified and a basis provided that the time can be reasonably met. NEI 12-06, Section 3 provides the performance attributes, general criteria, and baseline assumptions to be used in developing the technical basis for the time constraints. Since the event is a beyond-design-basis event, the analysis used to provide the technical basis for time constraints for the mitigation strategies may use nominal initial values (without uncertainties) for plant parameters, and best-estimate physics data. All equipment used for consequence mitigation may assume to operate at nominal setpoints and capacities. NEI 12-06, Section 3.2.1.2 describes the initial plant conditions for the at-power mode of operation; Section 3.2.1.3 describes the initial conditions; and Section 3.2.1.6 describes SFP conditions.

NEI 12-06, Section 3.2.1.1 provides the acceptance criterion for the analyses serving as the technical basis for establishing the time constraints for the baseline coping capabilities described in NEI 12-06, which provide an acceptable approach to meeting the requirements of EA-12-049 for maintaining SFP cooling. This criterion is keeping the fuel in the SFP covered.

NEI 12-06, Section 3.2.1.6 provides the initial boundary conditions for SFP cooling.

1. All boundaries of the SFP are intact, including the liner, gates, transfer canals, etc.
2. Although sloshing may occur during a seismic event, the initial loss of SFP inventory does not preclude access to the refueling deck around the pool.
3. SFP cooling system is intact, including attached piping.
4. SFP heat load assumes the maximum design basis heat load for the site.

On pages 37 through 44 of the Integrated Plan, the licensee provided descriptions of various strategies to maintain spent fuel pool cooling for Phases 1, 2 and 3. Using the worst case design basis heat load and worst case full core offload timing, the SFP water temperature will heat up to 212 degrees F in 5.17 hours. At least 90 gpm of makeup will be required for the makeup strategy and at least 250 gpm of spray will be required for spray. Using the design basis heat load and a normal refueling outage time of 20 days, the SFP will start boiling in 11.91 hours with a boil off rate of 39 gpm. For a full core offload into the UCP, the pool will start boiling in 3.54 hours with a boil off rate of 60 gpm.

In Phase 1, personnel actions include deployment of pre-staged hoses and opening ventilation pathways. The timing for these actions is dependent on SFP conditions and the timing for the BDBEE.

For Phase 2, the licensee stated that based on NEI 12-06 guidance, three methods of providing makeup flow are provided to meet the baseline capability for SFP cooling. These three methods are direct fill via a hose, makeup via spray into the pool, and makeup via permanently installed piping that would not require access to the SFP area.

For Phase 3, the licensee stated that the FLEX cooling strategy is reliant on the transition from SFP and UCP makeup to the use of the permanently installed SFP equipment. FLEX diesel generators would provide power for the pump and room cooler fan. To satisfy the NPSH requirements of the SFP cooling pumps, and to initiate the strategy of cooling the SFP with the SFP cooling pump and SFP heat exchanger, the SFP/UCP water temperature must be reduced to 190 degrees F or less and the fuel pool drain tank must be filled. Phase 2 cooling will continue until the water temperature is lowered to below 190 degrees F.

The NRC staff noted that for this strategy to work, and as stated by the licensee, the temperature in the fuel pool suction must be below 190 degrees F because of the NPSH concerns. The NRC reviewer noted that since this temperature measurement is imperative for the Phase 3 cooling strategy to work, it seems that the temperature of the fuel pool at the suction would be a key SFP parameter to measure. The licensee was requested to provide a discussion why the fuel pool temperature is not considered a key parameter. Also, the licensee indicated that boiling (boiloff) in the UCP could take place during Phase 2 and Phase 3. This implies that the UCP is either connected to the SFP or the UCP has fuel in it during normal operation. If either of these situations occurred, the UCP may not be available to provide suction to RCIC during Phases 1 and 2. The licensee was requested to provide a discussion on the use of the UCP for SFP cooling.

During the audit process, the licensee responded by stating that the intended strategy is to continue the Phase 2 fuel pool cooling strategy of makeup and boiloff until sufficient Phase 3 resources and equipment are available to implement the Phase 3 strategy. There are no time constraints for the transition period from the Phase 2 strategy to the Phase 3 strategy. The licensee stated that per NEI 12-06 Section 3.2.1.10, "The plant-specific evaluation may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance (e.g., isolation condenser (IC) level), or to indicate imminent or actual core damage." Because the transition from Phase 2 to Phase 3 cooling is not a key action and because it is assumed that the fuel pool temperature can be measured using a portable means during Phase 3, classifying fuel pool temperature as a key parameter is not required. The UCP can store fuel during refueling operations and is connected to the SFP via the transfer canal. The UCP does not store fuel during normal operation so there are no cases in which the UCP contains fuel and the UCP water would be credited for RCIC suction.

On page 49 of the Integrated Plan, the licensee discussed that on-site personnel actions for venting the SFP area include blocking open door 1A601 to the Auxiliary Building northwest stairwell on the 208' elevation and blocking open the Auxiliary Building southwest stairwell door 1A605 to the roof on the 229' elevation. The licensee stated that additional analysis and/or modification to door 1A605 must be performed to confirm that missiles cannot prevent this door from opening after the BDBEE; and additional analysis must be performed to demonstrate this ventilation strategy and confirm there is no need for portable ventilation. The licensee was requested to provide a schedule and completion date for performing a calculation to demonstrate that the SFP area ventilation strategy is adequate and there is no need for portable ventilation.

During the audit process, the licensee responded by stating that the SFP area ventilation calculation to confirm that portable ventilation is not required, is anticipated to be completed no later than the fourth six-month update (February, 2015). The licensee should provide the calculations to the NRC staff for review. This is identified as Confirmatory Item 3.2.2.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to spent fuel pool cooling if these requirements are implemented as described.

3.2.3 Containment Function Strategies

NEI 12-06, Table 3-1 and Appendix C provide a description of the safety functions and performance attributes for BWR containments which are to be maintained during an ELAP as defined by Order EA-12-049. The safety function applicable to a BWR with a Mark III containment listed in Table 3-1 is Containment Pressure Control/Heat Removal, and the method cited for accomplishing this safety function is Containment Venting or Alternative Containment Heat Removal. The performance attributes listed in Table C-2 also denote the containment's function is to provide a reliable means to assure containment heat removal. JLD-ISG-2012-01, Section 5.1 is aligned with this position stating, in part, that the goal of this strategy is to relieve pressure from the containment.

Furthermore, Tables 3-1 and C-2 both include a Containment Integrity safety function for BWRs with Mark III containments. Specifically, the guidance of NEI 12-06 directs licensees with Mark III containments to re-power the permanently installed containment hydrogen igniters as a part of their strategy.

On page 29 of the Integrated Plan, the licensee stated that during Phase 1, normal design features of the containment, such as the containment isolation valves, SP and the modified containment vent, maintain containment integrity. The licensee further states that since, in accordance with NEI 12-06, no non-mechanical valve failures need be assumed, the containment is isolated following the event. As the SP heats up, the containment will begin to heat up and pressurize. The strategy is to open the current EOP containment vent path prior to the SP reaching 200 degrees F (approximately 4 hours) to control containment pressurization and to limit the SP temperature. Without a heat removal mechanism for containment, the SP is expected to reach 212 degrees F in approximately 6.5 hours (ENERCON Calculation ENTGGGIII-CALC-006, Containment Analysis of FLEX Strategies (MAAP Calculation), Revision 0). Continuing, the licensee stated that because preventing core damage is initially a higher priority consideration than containment integrity, venting will be initiated once adequate core cooling is established using the RCIC system with the RCIC pump suction aligned to the UCP. In this case, the modified containment cooling system 20" vent path is used to vent containment in a controlled manner.

The licensee stated that to determine the containment response, MAAP analysis modeling assessed the use of a 16" vent to account for line losses in the 20" vent pathway. The results of the MAAP analysis demonstrate that, if a 16" containment vent is opened, containment remains only slightly above atmospheric pressure and that the SP temperature is maintained below 220 degrees F. The licensee noted that the current GGNS analyzed limit of the SP structure is 215°F (Calculation CC-Q1M10-10001 (EC31524), Revision 000, Evaluation of Containment Wall for Extended Power Uprate). An alternative strategy for the containment during Phase 1 is not provided, because containment integrity is maintained by the plant's design features.

The licensee indicated that the SP water is maintained below 220 degrees F, but the analyzed limit of the SP structure is 215 F. Since the SP temperature can remain above 215 degrees F for a significant period of time, the NRC staff requested the licensee to provide information that demonstrates that the SP structure does not fail.

During the audit process, the licensee responded by stating that the containment shell, drywell shell, and containment base mat are extremely stiff steel-lined reinforced concrete structures which form the SP boundary. The structural integrity of the existing containment wall was examined for the increased design temperature of 210 degrees F for the extended power uprate (EPU) condition. The calculation that established the acceptability of the revised design temperature of 210 degrees F (Calculation CC-QIMIO-IOOOI (EC31524), Revision 000, Evaluation of Containment Wall For Extended Power Uprate) concluded that the containment wall can withstand a maximum design temperature of 215 degrees F. Design limits for the containment structure may be exceeded, but based on the analyses done to date, structural failure such that the containment function would not be maintained is not expected. The licensee stated that an analysis is planned to ensure the integrity of the containment wall during extended operation with water temperature above the current analyzed temperature limit. The licensee expects this analysis to be completed by the fourth six-month update report (February, 2015). The licensee stated that exceeding this SP temperature limit of 215 degrees F would be allowed by incorporation of Revision 3 of the BWROG's Emergency Procedure Guideline/Severe Accident Guideline document. The NRC staff has yet to review the technical justification for this new allowance and its applicability to GGNS. This is combined with Confirmatory Item 3.2.1.4.A in Section 4.2.

The licensee provided a discussion of the coping strategy for deployment of a portable/FLEX electrical generator to provide power to the containment hydrogen igniters. However, the licensee did not include a discussion of strategies to maintain containment during the initial phase. The licensee was requested to provide a prioritized plan for the igniters, which include Phase 1 coping activities.

During the audit process, the licensee responded by stating that containment integrity in the initial phase of BDBEEs is provided by the design of the containment. Successful implementation of core cooling via RCIC will preclude the possibility of hydrogen generation and is considered to be the highest priority. As part of the development of FSGs and related procedures, guidance for the deployment of a portable generator for hydrogen igniters will be developed. These procedures will be similar to that provided in the “Alternate Strategies" procedure (05-S-01-STRATEGY) and are expected to provide direction on when to stage the generators so that the time for connecting and powering the igniters is minimized. This could be performed following initial response when resources become available. The procedure will also identify the parameters that will provide the cues to power the igniters (e.g., water level below top of active fuel for a period of time).

During the audit process, the licensee stated that the strategy for Phase 2 core cooling and maintaining containment integrity presented in the Integrated Plan is under review. The strategy as described in the Integrated Plan is a “feed and bleed” type strategy which addresses both the core cooling and containment functions. The planned revised strategy removes the “bleed” portion and relies on feeding coolant to the vessel for core cooling where it is then released to the suppression pool through the SRVs as described for alternate shutdown cooling in USFAR Section 5.4.7.1.5. Heat removal from the containment is performed by boiling of the suppression pool and venting of steam through the proposed modified containment vent path that is used in the EOPs to similarly depressurize containment, if required. The licensee's final strategy for maintaining containment integrity needs to be reviewed. This is identified as Confirmatory Item 3.2.3.A in Section 4.2.

The licensee’s approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of the issue associated with the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to maintaining containment if these requirements are implemented as described.

3.2.4 Support Functions

3.2.4.1 Equipment Cooling – Cooling Water

NEI 12-06, Section 3.2.2, Guideline (3) states that:

> *Plant procedures/guidance should specify actions necessary to assure that equipment functionality can be maintained (including support systems or alternate method) in an ELAP/LUHS or can perform without ac power or normal access to the UHS.*
>
> Cooling functions provided by such systems as auxiliary building cooling water, service water, or component cooling water may normally be used in order for equipment to perform their function. It may be necessary to provide an alternate means for support systems that require ac power or normal access to the UHS, or provide a technical justification for continued functionality without the support system.

The Integrated Plan did not provide information regarding conformance with the guidance found in NEI 12-06, Section 3.2.2, Guideline 3 above. The licensee was requested to provide a discussion that presents information concerning equipment cooling support systems conforming to the guidance provided in NEI 12-06, Section 3.2.2, Guideline 3.

During the audit process, the licensee responded by stating that detailed design work for GGNS has not started at this time and therefore the procedural guidance required by NEI 12-06, Section 3.2.2, Guideline 3 has not begun. Additional details on procedural controls for ventilation cooling for equipment protection will be available later in the design/procedure development process. This has been identified as Confirmatory Item 3.2.4.1.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of the issue associated with the Confirmatory Item provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to equipment cooling, if these requirements are implemented as described.

3.2.4.2 Ventilation – Equipment Cooling

NEI 12-06, Section 3.2.2, Guideline (10) states that:

> *Plant procedures/guidance should consider loss of ventilation effects on specific energized equipment necessary for shutdown (e.g., those containing internal electrical power supplies or other local heat sources that may be energized or present in an ELAP.*
>
> ELAP procedures/guidance should identify specific actions to be taken to ensure that equipment failure does not occur as a result of a loss of forced ventilation/cooling. Actions should be tied to either the ELAP/LUHS or upon reaching certain temperatures in the plant. Plant areas requiring additional air flow are likely to be locations containing shutdown instrumentation and power supplies, turbine-driven decay heat removal equipment, and in the vicinity of the inverters. These areas include: steam driven [auxiliary feedwater] AFW pump room, HPCI and RCIC pump rooms, the CR, and logic cabinets. Airflow may be accomplished by opening doors to rooms and electronic and relay cabinets, and/or providing supplemental air flow.
>
> Air temperatures may be monitored during an ELAP/LUHS event through operator observation, portable instrumentation, or the use of locally mounted thermometers inside cabinets and in plant areas where cooling may be needed. Alternatively, procedures/guidance may direct the operator to take action to provide for alternate airflow in the event normal cooling is lost. Upon loss of these systems, or indication of temperatures outside the maximum normal range of values, the procedures/guidance should direct supplemental air flow be provided to the affected cabinet or area, and/or designate alternate means for monitoring system functions.
>
> For the limited cooling requirements of a cabinet containing power supplies for instrumentation, simply opening the back doors is effective. For larger cooling loads, such as HPCI, RCIC, and AFW pump rooms, portable engine-driven blowers may be considered during the transient to augment the natural

> circulation provided by opening doors. The necessary rate of air supply to these rooms may be estimated on the basis of rapidly turning over the room's air volume.
>
> Temperatures in the HPCI pump room and/or steam tunnel for a BWR may reach levels which isolate HPCI or RCIC steam lines. Supplemental air flow or the capability to override the isolation feature may be necessary at some plants. The procedures/guidance should identify the corrective action required, if necessary.
>
> Actuation setpoints for fire protection systems are typically at 165-180 degrees F. It is expected that temperature rises due to loss of ventilation/cooling during an ELAP/LUHS will not be sufficiently high to initiate actuation of fire protection systems. If lower fire protection system setpoints are used or temperatures are expected to exceed these temperatures during an ELAP/LUHS, procedures/guidance should identify actions to avoid such inadvertent actuations or the plant should ensure that actuation does not impact long term operation of the equipment.

On page 45 of the Integrated Plan, the licensee stated that the design area temperature limit in the RCIC room for equipment qualification is 212 degrees F for a 12 hour period. The licensee further stated that information provided in calculation GGNS-ME-12-00009 indicates the temperature of the RCIC room to be 175 degrees F at 4 hours into the ELAP event using conservative NUMARC 87-00 methodology. Because the RCIC pump and turbine need to be functional for longer than 4 hours, an additional analysis (ENERCON Calculation ENTGGG111-CALC-007, Revision 000, GGNS RCIC Heatup for ELAP) was performed to confirm functionality. Results of this calculation indicate that the RCIC pump room temperature remains below 150 degrees F during the 72 hour period following BDBEEs with no operator actions needed to provide portable ventilation. For the core cooling strategies at GGNS, after approximately 24 hours, RCIC will not be required due to the Phase 2 diesel driven FLEX pump being put into service.

The reviewer performed a review of ENERCON Calculation ENTGGG111-CALC-007, Revision 000, GGNS RCIC Heat up for ELAP, that was referenced in the Integrated Plan. Information in the calculation indicated that the GOTHIC model used was a simplistic model built using GOTHIC version 7.2b to examine the scenario of temperature increase in the RCIC room. In the calculation, a Bechtel calculation was referenced.

During the audit process, the licensee was requested to clarify if the Bechtel calculation is adequate since a simplistic model was used. The licensee was also requested to explain why the Bechtel calculation was not referenced, and not provided as part of the Integrated Plan. The licensee responded by stating that Bechtel Calculation M3.8.041 Rev. 0, RCIC Room Heat-Up during Station Blackout, was used for several design inputs, but was not referenced in the Integrated Plan because it only analyzed RCIC room heat-up for 6 hours after SBO. Calculation ENTGGG111-CALC-007 is currently being revised based on updated heat loads. It is anticipated this update will be completed no later than the fourth six-month update report (February, 2015). This is identified as Confirmatory Item 3.2.4.2.A in Section 4.2.

The licensee provided additional information by stating that it is not anticipated that access will be required in the RCIC room, and if access were necessary, the stay times would be for short durations.

On page 18 of the Integrated Plan, in the section discussing deployment of portable/FLEX equipment for coping strategies to maintain Core Cooling, BWR Portable Equipment Phase 2, the licensee stated that the battery chargers for the 125 VDC Division I and Division II batteries are available for up to approximately 12 hours based upon recommended load shedding. Once a 480 VAC, FLEX DG is connected to repower the installed Class IE battery chargers, the batteries will be available long term. The licensee stated that one portable FLEX 200 KW DG will be deployed to power the battery room exhaust fan to remove hydrogen gas produced while the batteries recharge.

During the audit process, the licensee was requested to provide information on the adequacy of the ventilation provided in the battery room to protect the batteries from the effects of extreme high and low temperatures. The licensee responded by stating that during battery charging operations in Phases 2 and 3, ventilation may be required in the battery rooms for cooling. The primary strategy for cooling the rooms is to repower the existing battery room exhaust fans and utilize the existing design basis flow path. Per GGNS UFSAR Section 9.4.5.5.5, a hydrogen evolution calculation shows that the hydrogen evolution of these batteries is not rapid and the lower explosive limit is 4 percent of the volume of rooms. By ventilating the rooms, hydrogen concentration will be maintained below the lower explosive limit.

The licensee also stated that preliminarily, the control building ESF switchgear heatup during the BDBEEs is addressed by existing calculation MC-QSZ77-09004 that discusses what doors to open to establish an air flow path for the Division II switchgear room, if all ventilation is secured during normal operation. For the BDBEEs, Division I switchgear room doors will also be opened to provide an airflow path for the Division I switchgear room and Division I and II battery rooms. Opening these doors leads to adequate ventilation for keeping these rooms below 120 degrees F indefinitely. This calculation used normal heat loads and determined that the time available for personnel to open these doors is a little more than one hour. Since the ELAP battery and switchgear room heat loads will be less than normal operation heat loads, opening the required doors at one hour after the loss of AC power is anticipated to maintain these rooms below 120 degrees F. The licensee further stated that during the detailed design phase, all assumptions and inputs for this calculation will be reviewed to ensure the results are accurate for an ELAP, including the one hour time to open the required doors. It is anticipated that this information will be submitted no later than the fourth six-month update report (February, 2015).

With regard to cold temperatures, the licensee stated that GGNS is located in the deep south and does not experience extreme cold temperatures. Also, the battery rooms would be at their normal operating temperature at the onset of the any cold weather event and the temperature of the electrolyte in the cells would build up due to the heat generated by the batteries discharging and during re-charging. In addition, the licensee stated that the battery rooms are located internal to the control building, in an environment without normal plant cooling systems running, and would not be exposed to extreme low temperatures.

On pages 54 and 55 of the Integrated Plan, the licensee has identified a range of portable/FLEX pumps and electrical generators to be used to support coping strategies in the event of an ELAP. Although the licensee provided a site plan on page 69, it cannot be determined that all of the engine powered portable/FLEX equipment will be located outside of facility buildings.

During the audit process, the licensee was requested to provide details of their plans for placement of diesel powered portable/FLEX equipment and their plans to ventilate indoor locations and monitor air quality in building locations that may be affected by the exhaust. The licensee responded by stating that consideration of the need for ventilation and monitoring of air quality in locations that may be affected by exhaust from portable/FLEX pumps and diesel generators will be included in the design process for the implementation of FLEX modifications and in the development of procedures and FLEX support guidelines. At this time, the strategy deploys all engine powered equipment to areas outside of buildings.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to equipment cooling - ventilation if these requirements are implemented as described.

3.2.4.3 Heat Tracing

NEI 12-06, Section 3.2.2, Guideline (12) provides that:

> *Plant procedures/guidance should consider loss of heat tracing effects for equipment required to cope with an ELAP. Alternate steps, if needed, should be identified to supplement planned action.*
>
> Heat tracing is used at some plants to ensure cold weather conditions do not result in freezing important piping and instrumentation systems with small diameter piping. Procedures/guidance should be reviewed to identify if any heat traced systems are relied upon to cope with an ELAP. For example, additional condensate makeup may be supplied from a system exposed to cold weather where heat tracing is needed to ensure control systems are available. If any such systems are identified, additional backup sources of water not dependent on heat tracing should be identified.

On page 2 of the Integrated Plan, in the section regarding the determination of applicable extreme external hazards, the licensee stated that the GGNS does not expect impacts from extreme cold due to the physical location of the plant. The Integrated Plan did not address any need for heat tracing.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to heat tracing, if these requirements are implemented as described.

3.2.4.4 Accessibility – Lighting and Communication

NEI 12-06, Section 3.2.2, Guideline (8) states:

> *Plant procedures/guidance should identify the portable lighting (e.g., flashlights or headlamps) and communications systems necessary for ingress and egress to plant areas required for deployment of FLEX strategies.*
>
> Areas requiring access for instrumentation monitoring or equipment operation may require portable lighting as necessary to perform essential functions.
>
> Normal communications may be lost or hampered during an ELAP.

Consequently, in some cases, portable communication devices may be required to support interaction between personnel in the plant and those providing overall command and control.

On page 45 of the Integrated Plan, in the section discussing MCR accessibility during the initial phase, the licensee stated that the MCR accessibility will be maintained for the duration of the ELAP. During the ELAP, some main MCR vital electronics, instrumentation and emergency lighting remain energized from emergency DC power sources. Although the licensee has proposed a coping strategy to power MCR lighting during the initial phase, the Integrated Plan does not discuss portable, emergency and hand held lighting available to operators for implementing other coping strategies.

During the audit process, the licensee was requested to provide additional information regarding portable, emergency and hand held lighting available to operators for implementing other coping strategies in Phase 2 and Phase 3. The licensee responded by stating that part of the standard gear/equipment of operators with duties in the plant (outside the MCR) includes flashlights. This requirement is currently in procedure EN-OP-115-01, Operator Rounds. Additionally, battery powered lanterns are stored in the MCR. Procedures will be revised if necessary to reflect the lighting requirements for ELAP events. Lighting for the MCR will be maintained throughout the event by lighting powered from an uninterruptible power supply (UPS) that has battery backup. Although not credited, in addition, emergency dc lights and Appendix R lights are provided in the MCR, standby diesel generator areas, standby switchgear rooms, standby service water (SSW) pump house, Class 1E battery rooms, standby motor control centers and load centers, remote shutdown panel rooms, and areas required for egress and exit of buildings. The lighting provides for emergency lighting in select areas of the plant, where operators or maintenance personnel may need to perform actions during loss of power conditions. The battery packs are designed to sustain the illumination level for a period of 8 hours.

The licensee provided a communications assessment in its letters dated October 3, 2012, and February 21, 2013 (ADAMS Accession Numbers ML12306A245 and ML13053A091), in response to the NRC March 12, 2012 50.54(f) request for information letter for GGNS. As documented in the staff analysis provided by letter dated May 28, 2013 (ADAMS Accession Number ML13129A132), the NRC staff has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by the licensee will conform to the guidance of NEI 12-06 Section 3.2.2, Guideline (8) regarding communications capabilities during an ELAP. Verification of required upgrades has been identified as Confirmatory Item 3.2.4.4.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to lighting and communication, if these requirements are implemented as described.

3.2.4.5 Protected and Internal Locked Area Access

NEI 12-06, Section 3.2.2, Guideline (9) states:

Plant procedures/guidance should consider the effects of ac power loss on area *access, as well as the need to gain entry to the Protected Area and internal locked areas where remote equipment operation is necessary.*

At some plants, the security system may be adversely affected by the loss of the preferred or Class 1E power supplies in an ELAP. In such cases, manual actions specified in ELAP response procedures/guidance may require additional actions to obtain access.

There was no discussion provided in the Integrated Plan with regard to the effects of ac power loss on area access as well as the need to gain entry to the protected area and internal locked areas where remote equipment operation is necessary. The licensee was requested to provide additional information regarding the effects of ac power loss on area access as well as the need to gain entry to the protected area and internal locked areas where remote equipment operation is necessary during an ELAP.

During the audit process, the licensee responded by stating that FSGs will be developed to ensure that operators can access the required areas in the event of a loss of power. Additional details on controls for access to security controlled or internal locked areas where an ELAP would disable normal controlled access will be contained in the FSGs or associated procedures.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protected and internal locked area access, if these requirements are implemented as described.

3.2.4.6 Personal Habitability – Elevated Temperature

NEI 12-06, Section 3.2.2, Guideline (11) states:

Plant procedures/guidance should consider accessibility requirements at locations where operators will be required to perform local manual operations.

Due to elevated temperatures and humidity in some locations where local operator actions are required (e.g., manual valve manipulations, equipment connections, etc.), procedures/guidance should identify the protective clothing or other equipment or actions necessary to protect the operator, as appropriate.

FLEX strategies must be capable of execution under the adverse conditions (unavailability of installed plant lighting, ventilation, etc.) expected following a BDBE resulting in an ELAP/LUHS. Accessibility of equipment, tooling, connection points, and plant components shall be accounted for in the development of the FLEX strategies. The use of appropriate human performance aids (e.g., component marking, connection schematics, installation sketches, photographs, etc.) shall be included in the FLEX guidance implementing the FLEX strategies.

Section 9.2 of NEI 12-06 states:

Virtually every state in the lower 48 contiguous United States has experienced temperatures in excess of 110 degrees F. Many states have experienced temperatures in excess of 120 degrees F.

On page 58 of the Integrated Plan, in the section discussing time constraints identified in the sequence of events timeline, at action item 5 at 2 hours elapsed time, the licensee stated that open doors to the MCR are used to minimize heatup of the MCR during Phase 1. The licensee stated that analysis indicates that opening these doors will help to maintain MCR temperature below 110 degrees F. The licensee was requested to provide more information concerning the analysis performed. The additional information should address the continued habitability of the MCR including; postulated outside air temperature, the heat loads from personnel in the MCR, and any additional relief efforts for the MCR staff (e.g. short stay time cycles, use of ice vests/packs, supplies of bottled water, etc.), that meets the NUMARC 87-00 habitability standard.

During the audit process, the licensee responded by stating that long term habitability of the MCR will be assured by monitoring MCR conditions, heat stress countermeasures, and rotation of personnel to the extent feasible. The impact to habitability would be primarily from elevated temperatures. Calculation ENTGGG111-CALC-005, has determined the MCR temperature can be maintained below 110 degrees F for 72 hours with doors OC504 and OC505 opened at two hours after ELAP initiation, and forced flow ventilation from a minimum of 6000 standard cubic feet per minute (SCFM) fan supplied from corridor OC509 at ten hours after initiation of ELAP. FSGs will provide guidance for MCR staff to evaluate the MCR temperature and take actions as necessary. The licensee further stated that bottled water is stored on site and current general site training includes a module on the recognition of dehydration along with methods to cope. The licensee already uses passive cooling technologies for response personnel in high temp environments.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to habitability if these requirements are implemented as described.

3.2.4.7 Water Sources.

NEI 12-06, Section 3.2.2, Guideline (5) states:

> *Plant procedures/guidance should ensure that a flow path is promptly established for makeup flow to the steam generator/nuclear boiler and identify backup water sources in order of intended use. Additionally, plant procedures/guidance should specify clear criteria for transferring to the next preferred source of water.*
>
> Under certain beyond-design-basis conditions, the integrity of some water sources may be challenged. Coping with an ELAP/LUHS may require water supplies for multiple days. Guidance should address alternate water sources and water delivery systems to support the extended coping duration. Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles are assumed to be available in an ELAP/LUHS at their nominal capacities. Water in robust UHS piping may also be available for use but would need to be evaluated to ensure adequate NPSH can be demonstrated and, for example, that the water does not gravity drain back to the UHS. Alternate water delivery systems can be considered available on a case-by-case basis. In general, all CSTs should be used first if available. If the normal source

> of makeup water (e.g., CST) fails or becomes exhausted as a result of the hazard, then robust demineralized or raw water may be used as appropriate.
>
> Heated torus water can be relied upon if sufficient [net positive suction head] NPSH can be established. Finally, when all other preferred water sources have been depleted, lower water quality sources may be pumped as makeup flow using available equipment (e.g., a diesel driven fire pump or a portable pump drawing from a raw water source). Procedures/guidance should clearly specify the conditions when the operator is expected to resort to increasingly impure water sources.

The Integrated Plan identifies the SSW Cooling Tower Basins, which are the GGNS UHS, as the water source for strategies for maintaining core cooling and SFP cooling. The plan does not discuss the quality of this water (e.g., suspended solids) given potential hazards that could deliver debris from outside the water source. The licensee was requested to provide a discussion of water quality that addresses suspended solids, debris from the containment (if the SP overflows), and debris from external hazards such as high winds and tornados. The licensee was also requested to provide justification that the use of water with debris will not result in blockage at the fuel assembly inlets to an extent that would inhibit adequate flow to the fuel assemblies.

During the audit process, the licensee responded by stating that normal makeup for each SSW cooling tower basin is provided automatically by a connection with the plant service water radial wells system which provides naturally filtered water (through the alluvial sediments surrounding the well laterals) from wells adjacent to the Mississippi River. Chemical treatment is used to prevent biological fouling and scaling, and system corrosion. The licensee further stated that the pump that draws water from the SSW cooling tower basins (to be deposited in the SFP and the reactor vessel) is fitted with a strainer to prevent large debris from entering the pumps. Final design will determine the strainer requirements.

Continuing, the licensee stated that procedures will be developed to monitor and perform maintenance on all FLEX equipment as necessary including cleaning the FLEX pump suction strainers while being utilized. Spare swappable strainers will be provided for the FLEX pumps. Therefore, it is highly unlikely that any debris large enough to inhibit adequate flow through a fuel assembly will be deposited in the SFP or the RPV. The licensee further stated that GGNS's foreign materials exclusion program ensures that the containment remains free of large sources of debris during normal operations and outages. Additionally, consistent with the planned revised Phase 2 strategy, water from the containment/SP will not be returned directly to the RPV; therefore, containment debris is not a concern. The license noted that the RRC Engineering Information Record, Document 51-9199717-001, "Regional Response Center Generic and Site-Specific Equipment," addresses suction strainers for RRC supplied FLEX pumps. Any changes to the methods of ensuring that adequate cooling to fuel assemblies in the SFP and RPV would be reflected in a future six-month update report.

On page 12 of the Integrated Plan, the licensee stated that when reactor water level reaches its low level set point (level 2), RCIC, with suction from the non-seismic condensate storage tank (CST), automatically starts and operates to inject makeup/cooling water to the reactor vessel. The CST is the normal standby lineup for the RCIC system. If prior to or during the initiating events, the CST inventory becomes unavailable, the RCIC suction is automatically transferred to the suppression pool.

Insufficient information was provided in the Integrated Plan to substantiate that the instrumentation to switch RCIC suction from CST to SP would remain operational, that the switchover function would be accomplished in a timely manner, and that RCIC injection to RPV will remain uninterrupted. The licensee was requested to address these concerns and to address whether the switchover function during ELAP will be carried out manually or automatically; and if manually, then whether it is carried out from the MCR, or from the remote control panel, or from any other secured and accessible location. The licensee was also requested to include in the discussion whether the switchover function is fail-safe, and the function logic, software, hardware, related piping, valves, SSCs, and CST water level instrumentations to support the switchover function, either manually or automatically, are of safety grade and are qualified for all potential ELAP events including seismic, tornado/high winds, flooding and missiles.

During the audit process, the licensee responded by stated that the valves, piping and instrumentation utilized to switch RCIC suction from the CST to the SP are safety related and are located in the Seismic Category I Auxiliary Building. The valves and associated logic are dc powered from the same safety related dc source as RCIC. The switchover will be performed automatically on low CST level or manually from the MCR, if necessary.

The licensee’s approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to water sources, if these requirements are implemented as described.

3.2.4.8 Electrical Power Sources/Isolations and Interactions

NEI 12-06, Section 3.2.2, Guideline (13) states in part that:

> The use of portable equipment to charge batteries or locally energize equipment may be needed under ELAP/LUHS conditions. Appropriate electrical isolations and interactions should be addressed in procedures/guidance.

The Integrated Plan provided discussions regarding the use of FLEX generators to provide power for mitigation strategies but it was not clear that analyses had been performed to determine the sizing of the generators to support the required loads.

During the audit process, the licensee was requested to provide a summary of the sizing calculations for the FLEX generators to show that they can supply the loads assumed in Phases 2 and 3. The licensee responded by stating that the loading calculation for FLEX generators has not yet been completed. This calculation will generate critical performance characteristics (kW, KVAR, and kVA demands for starting, stopping, and maintaining loads with margin) that must be met by the portable generators. It will be developed in accordance with approved design processes that utilize appropriate design inputs for calculating electrical loads and the necessary considerations for use in sizing generators and their drivers (e.g., load starting requirements, voltage and frequency recovery requirements between applied loads, etc.). Loading and unloading of the generators will be controlled by procedure, based on vendor recommendations, to prevent overloading or tripping of the generators. It is anticipated this activity will be completed no later than the fourth six-month update report (February, 2015). The licensee needs to provide supporting analyses relating to the size/loading of FLEX generators. This has been identified as Confirmatory Item 3.2.4.8.A in Section 4.2.

On page 6 of the Integrated Plan, the licensee stated that at eleven hours after a ELAP is initiated, both divisions of station Class IE battery chargers are powered up using a FLEX 480 VAC diesel generator (DG) to supply power to both divisions of Class 1E emergency 480 VAC Load Centers (LC) 15BA6 and 16BB6.

During the audit process, the licensee was requested to provide a discussion in the integrated plan of divisional separation and of measures to prevent inadvertent closure of cross-tie circuit breakers and or switches. The licensee responded by stating that Class IE LCs 15BA6 and I6BB6 that supply power to the battery chargers have spare breakers that will be connected to new seismically supported cables routed to the LCs from a connection point located outside the Control Building. The 200 KW DG will connect to the new cables at the outside location. Divisional separation will be maintained during normal operation by administratively controlling the breakers and disconnect switches will be used to make the connections to the FLEX DG. The load center will be repowered via the spare breaker connected to the FLEX DG in accordance with plant procedures, and the spare breaker will be administratively taken out-of-service during normal plant operation. The licensee further stated that prior to connection of loads to the load centers from the FLEX DG, normal supply breakers would be opened for LCs 158A6 and 16BB6 and all loads will be stripped from the load centers.

During the audit process, the licensee also provided following information relating to the electrical isolation and interaction between the FLEX equipment and plant Class 1E emergency diesel generators (EDGs):

(a) The appropriate controls for the equipment will be implemented in procedures to ensure compliance with NEI 12-06 Section 3.2.2 Guideline 13. Connection points and other permanent modifications will be designed in accordance with approved design practices to ensure no adverse effects during normal operation.
(b) At the onset of the ELAP, Class 1E EDGs are assumed to be unavailable to supply the Class 1E buses. Portable generators are used in response to an ELAP in FLEX strategies for Phases 2 and 3. At the point when ELAP mitigation activities require tie-in of FLEX generators, in addition to existing electrical interlocks, procedural controls such as inhibiting EDG start circuits and breaker rack-outs (e.g., EDG breakers, offsite feeder breakers, etc.), will be employed to prevent simultaneous connection of both the FLEX generators and Class 1E EDGs to the same AC distribution system or component. Additionally, repowering the Class 1E electrical buses from either FLEX generators or subsequently the Class 1E EDGs (should they become available) will be accomplished manually and controlled by procedure; no automatic sequencing or automatic repowering of the buses will be utilized. FLEX strategies, including the transition from installed sources to portables sources (and vice versa), will be addressed in the FLEX procedures and guidance, which are in the development stage.
(c) Final Single Line Diagrams showing the proposed connections of Phase 2 and 3 electrical equipment to permanent plant equipment have not been completed at this time. They are anticipated to be included in the fourth six-month update report (February, 2015).

The licensee needs to provide Final Single Line Diagrams showing the proposed connections of FLEX Phase 2 and 3 electrical equipment to the permanent plant equipment. This has been identified as Confirmatory Item 3.2.4.8.B in Section 4.2.

The licensee’s approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to electrical power sources/isolations and interactions if these requirements are implemented as described.

3.2.4.9 Portable Equipment Fuel

NEI 12-06, Section 3.2.2, Guideline (13) states in part:

> The fuel necessary to operate the FLEX equipment needs to be assessed in the plant specific analysis to ensure sufficient quantities are available as well as to address delivery capabilities.

NEI 12-06, Section 3.2.1.3, initial condition (5) states:

> Fuel for FLEX equipment stored in structures with designs which are robust with respect to seismic events, floods and high winds and associated missiles, remains available.

On page 20 of the Integrated Plan, the licensee stated that sufficient diesel fuel for the Phase 2 FLEX equipment will be stored with the FLEX equipment to minimize refueling evolutions. Additional diesel fuel is available in the underground EDG fuel storage tanks and the EDG day tanks. The Division I and II EDG fuel oil storage tanks contain a minimum of 68,744 gallons of fuel oil; the high pressure core spray (HPCS) DG fuel oil storage tank contains a minimum of 44,616 gallons of fuel oil; and the EDG and HPCS DG day tanks contain a minimum of 220 gallons of fuel oil. The underground EDG fuel oil storage tanks contain sufficient fuel oil to support all Phase 2 strategies. The licensee further stated that the day tanks are located in the EDG Building and can be easily accessed. If the normal procedure for transferring fuel from the underground storage tanks is not possible due to flooding, the fuel oil can be obtained from the underground storage tanks by removing the screens covering the tank vents and using a manual, air, or battery operated pump to pump the fuel into a transfer tank.

During the audit process, the licensee provided the following information relating to FLEX diesel driven equipment: The FLEX tank/trailers will be available for use for transporting fuel between the emergency diesel generator storage tanks and the FLEX diesel driven equipment. At least one connection point for FLEX equipment will require access through only seismically robust structures. This includes both the connection point and any areas that plant personnel will have to access to deploy or control the capability. After existing plant sources of fuel are exhausted, fuel will be required to be provided by offsite sources. Plans for delivery of fuel oil will be developed. The FLEX equipment has not been purchased yet and therefore the fuel consumption rates have yet been identified. Specific equipment needs will dictate how often the fuel tanks need to be refilled. It is anticipated this information will be available by the fourth six-month update (February, 2015).

The licensee further stated that fuel oil in the fuel tanks of portable diesel engine driven FLEX equipment will be maintained in the Preventive Maintenance program in accordance with the EPRI maintenance templates being developed for FLEX equipment by the industry.

The licensee needs to provide details relating to fuel oil consumption of FLEX diesel driven equipment. This has been identified as Confirmatory Item 3.2.4.9.A in Section 4.2.

The licensee’s approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to portable equipment fuel, if these requirements are implemented as described.

3.2.4.10 Load reduction to conserve dc power.

NEI 12-06, Section 3.2.2, Guideline (6) states:

> *Plant procedures/guidance should identify loads that need to be stripped from the plant dc buses (both Class 1E and non-Class 1E) for the purpose of conserving dc power.*
>
> DC power is needed in an ELAP for such loads as shutdown system instrumentation, control systems, and dc backed AOVs [air operated valves] and MOVs [motor operated valves]. Emergency lighting may also be powered by safety-related batteries. However, for many plants, this lighting may have been supplemented by Appendix R and security lights, thereby allowing the emergency lighting load to be eliminated. ELAP procedures/guidance should direct operators to conserve dc power during the event by stripping nonessential loads as soon as practical. Early load stripping can significantly extend the availability of the unit's Class 1E batteries. In certain circumstances, auxiliary feedwater (AFW)/HPCI /RCIC operation may be extended by throttling flow to a constant rate, rather than by stroking valves in open-shut cycles.
>
> Given the beyond-design-basis nature of these conditions, it is acceptable to strip loads down to the minimum equipment necessary and one set of instrument channels for required indications. Credit for load-shedding actions should consider the other concurrent actions that may be required in such a condition.

On page 18 of the Integrated Plan, the licensee stated that the 125 VDC Division I and Division II batteries are available for up to approximately twelve hours based upon recommended load shedding and will be available long term when a 480 VAC FLEX DG is connected to repower the installed Class 1E battery chargers associated with the batteries. However, the licensee did not provided the basis and supporting details for load shedding analyses such as the dc system load profiles, and minimum dc bus voltage.

During the audit process, the licensee provided following additional information:

a) The dc load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and SFP cooling is still in the design/development phase. The profile is anticipated to be completed no later than the fourth six-month update report (February, 2015).
b) Preliminary loads to be shed are identified in Table 5-1, Recommended DC Load Shed in the Grand Gulf Conceptual Design Report ENTGGG111-PR-002 Rey. 0. The load shed list will be refined during the design process. Actions will be taken to determine the time frame to complete the proposed load shed, including walkthroughs. Walkthrough results will be utilized in the battery coping calculation methodology. NEI 12-06 Section 3.2.2 paragraph 6 states: "Given the beyond-design-basis nature of these conditions, it is acceptable to strip loads

down to the minimum equipment necessary and one set of instrument channels for required indications"; therefore, redundancy is not required.

c) A conservative minimum battery voltage of 106.75V is identified in ENTGGG111-CALC-004, Final Calculation- Station Division 1 Battery 1A3 and Division II Battery 1B3 Discharge Capacity during ELAP. This value was calculated based on a minimum cell voltage of 1.75V (61 cells total).

During the audit process, the licensee also provided the following additional information relating to the battery deep load shed operations on the equipment operations: The GGNS RCIC system uses a gland seal compressor for seal leakage. The gland seal system is de-energized 30 minutes after the loss of all ac power (per Loss of All AC Power procedure, 05-1-U2-I-4), which could result in steam leakage from the system into the RCIC room. Per Project Task Report 0000-0155-1541 completed by GEH, "failure of the air compressor gland seal system, as installed in later BWR 5 and 6 plants, will have no effect on system operation. Leakage from the gland seals can be expected to be small and have minimum effect on overall room temperatures." The licensee further stated that because the leakage from the gland seals is expected to be small, it is not likely to cause flooding of the RCIC room significant enough to jeopardize operation of the RCIC system. The detailed FLEX design will include an evaluation of the acceptability of RCIC operation without the gland seal compressor. The dc oil pumps for the main generator seal oil are powered from a non-safety related dc bus and not load shed as part of the FLEX response. The plant procedure for loss of all ac power includes instructions for purging hydrogen from the main generator.

The licensee needs to provide the evaluation of the acceptability of RCIC operation without the gland seal compressor (de-energized 30 minutes after loss of all ac power). This has been identified as Confirmatory Item 3.2.4.10.A in Section 4.2.

According to the SOE Timeline, Attachment 1A of the Integrated Plan, at 11 hour, the transition will be initiated from Phase 1 installed equipment to Phase 2 FLEX portable equipment by placing the FLEX 480 VAC DG in service to supply power to Class 1E load centers 15BA6 and 16BB6 and power up the station battery chargers. Therefore, the batteries are required to be sized for at least 11 hours considering the load shedding.

The NRC staff reviewed the licensee’s Integrated Plan and determined that the Generic Concern related to battery duty cycles beyond 8 hours is applicable to the plant. This Generic Concern has been resolved generically through the NRC endorsement of NEI position paper entitled “Battery Life Issue” (ADAMS Accession Nos. ML13241A186 (position paper) and ML13241A188 (NRC endorsement letter)).

The purpose of the Generic Concern and associated endorsement of the position paper was to resolve concerns associated with Integrated Plan submittals in a timely manner and on a generic basis, to the extent possible, and provide a consistent review by the NRC staff. Position papers provided to the NRC by industry further develop and clarify the guidance provided in NEI 12-06 related to industry’s ability to meet the requirements of Order EA-12-049.

The Generic Concern related to extended battery duty cycles required clarification of the capability of the existing vented lead-acid station batteries to perform their expected function for durations greater than 8 hours throughout the expected service life of the battery. The position paper provided sufficient basis to resolve this concern by developing an acceptable method for demonstrating that batteries will perform as specified in a plant’s Integrated Plan. The methodology relies on the licensee’s battery sizing calculations developed in accordance with the Institute of Electrical and Electronics Engineers (IEEE) Standard 485, "Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations," load shedding schemes, and manufacturer data to demonstrate that the existing vented lead-acid station batteries can perform their intended function for extended duty cycles (i.e., beyond 8 hours).

The NRC staff concluded that the position paper provides an acceptable approach for licensees to use in demonstrating that vented lead-acid batteries can be credited for durations longer than 8 hours. The NRC staff will evaluate a licensee's application of the guidance (calculations and supporting data) in its development of the final Safety Evaluation documenting review of the licensee's Integrated Plan.

During the audit response, the licensee confirmed that the FLEX strategy station battery run-time will be calculated in accordance with IEEE-485 methodology using manufacturer discharge test data applicable to GGNS FLEX strategy as outlined in the NEI white paper on Extended Battery Duty Cycles. The NRC staff will review these calculations. This has been identified as Confirmatory Item 3.2.4.10.B in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to load reduction to conserve dc power, if these requirements are implemented as described.

3.3 PROGRAMMATIC CONTROLS

3.3.1 Equipment Maintenance and Testing.

NEI 12-06, Section 3.2.2, Guideline (15) states in part:

> In order to assure reliability and availability of the FLEX equipment required to meet these capabilities, the site should have sufficient equipment to address all functions at all units on-site, plus one additional spare, i.e., an N+1 capability, where "N" is the number of units on-site. Thus, a two-unit site would nominally have at least three portable pumps, three sets of portable ac/dc power supplies, three sets of hoses and cables, etc. It is also acceptable to have a single resource that is sized to support the required functions for multiple units at a site (e.g., a single pump capable of all water supply functions for a dual unit site). In this case, the N+1 could simply involve a second pump of equivalent capability. In addition, it is also acceptable to have multiple strategies to accomplish a function (e.g., two separate means to repower instrumentation). In this case the equipment associated with each strategy does not require N+1. The existing 50.54(hh)(2) pump and supplies can be counted toward the N+1, provided it meets the functional and storage requirements outlined in this guide. The N+1 capability applies to the portable FLEX equipment described in Tables 3-1 and 3 2 (i.e., that equipment that directly supports maintenance of the key safety functions). Other FLEX support equipment only requires an N capability.

NEI 12-06, Section 11.5 states:

1. FLEX mitigation equipment should be initially tested or other reasonable means used to verify performance conforms to the limiting FLEX requirements. Validation of source manufacturer quality is not required.

2. Portable equipment that directly performs a FLEX mitigation strategy for the core, containment, or SFP should be subject to maintenance and testing guidance provided in INPO AP 913, Equipment Reliability Process, to verify proper function. The maintenance program should ensure that the FLEX equipment reliability is being achieved. Standard industry templates (e.g., EPRI) and associated bases will be developed to define specific maintenance and testing including the following:

    a. Periodic testing and frequency should be determined based on equipment type and expected use. Testing should be done to verify design requirements and/or basis. The basis should be documented and deviations from vendor recommendations and applicable standards should be justified.

    b. Preventive maintenance should be determined based on equipment type and expected use. The basis should be documented and deviations from vendor recommendations and applicable standards should be justified.

    c. Existing work control processes may be used to control maintenance and testing. (e.g., PM Program, Surveillance Program, Vendor Contracts, and work orders).

3. The unavailability of equipment and applicable connections that directly performs a FLEX mitigation strategy for core, containment, and SFP should be managed such that risk to mitigating strategy capability is minimized.

    a. The unavailability of installed plant equipment is controlled by existing plant processes such as the Technical Specifications. When installed plant equipment which supports FLEX strategies becomes unavailable, then the FLEX strategy affected by this unavailability does not need to be maintained during the unavailability.

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

    c. Connections to permanent equipment required for FLEX strategies can be unavailable for 90 days provided alternate capabilities remain functional.

    d. Portable equipment that is expected to be unavailable for more than 90 days or expected to be unavailable during forecast site specific external events (e.g., hurricane) should be supplemented with alternate suitable equipment.

    e. The short duration of equipment unavailability, discussed above, does not constitute a loss of reasonable protection from a diverse storage location protection strategy perspective.

f. If portable equipment becomes unavailable such that the site FLEX capability (N) is not maintained, initiate actions within 24 hours to restore the site FLEX capability (N) and implement compensatory measures (e.g., use of alternate suitable equipment or supplemental personnel) within 72 hours.

The NRC staff reviewed the Integrated Plan for GGNS and determined that the Generic Concern related to maintenance and testing of FLEX equipment is applicable to the plant. This Generic Concern has been resolved generically through the NRC endorsement of the EPRI technical report on preventive maintenance of FLEX equipment, submitted by NEI by letter dated October 3, 2013 (ADAMS Accession No. ML13276A573). The NRC staff's endorsement letter is dated October 7, 2013 (ADAMS Accession No. ML13276A224).

This Generic Concern involves clarification of how licensees would maintain FLEX equipment such that it would be readily available for use. The technical report provided sufficient basis to resolve this concern by describing a database that licensees could use to develop preventative maintenance programs for FLEX equipment. The database describes maintenance tasks and maintenance intervals that have been evaluated as sufficient to provide for the readiness of the FLEX equipment. The NRC staff has determined that the technical report provides an acceptable approach for developing a program for maintaining FLEX equipment in a ready-to-use status. The NRC staff will evaluate the resulting program through the audit and inspection processes.

The licensee was requested to state if the licensee commits to comply with the NRC endorsement of the generic concern, if applicable, for the Maintenance and Testing (ML13276A224). During the audit process, the licensee responded by stating that GGNS will utilize the EPRI Report 3002000623 and database, and therefore will be following the generic resolution as endorsed.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to equipment maintenance and testing, if these requirements are implemented as described.

3.3.2 Configuration Control

NEI 12-06, Section 11.8 provides that:

1. The FLEX strategies and basis will be maintained in an overall program document. This program document will also contain a historical record of previous strategies and the basis for changes. The document will also contain the basis for the ongoing maintenance and testing programs chosen for the FLEX equipment.
2. Existing plant configuration control procedures will be modified to ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies.
3. Changes to FLEX strategies may be made without prior NRC approval provided:
   a) The revised FLEX strategy meets the requirements of this guideline.

b) An engineering basis is documented that ensures that the change in FLEX strategy continues to ensure the key safety functions (core and SFP cooling, containment integrity) are met.

On page 10 of the Integrated Plan, in the section discussing programmatic controls, the licensee stated that GGNS will implement an administrative program for implementation and maintenance of the GGNS FLEX strategies in accordance with NEI 12-06 guidance. The licensee provided the following information:

- The equipment for ELAP will have unique identification numbers. Installed structures, systems and components pursuant to 10 CFR50.63(a) will continue to meet the augmented quality guidelines of Regulatory Guide 1.155, Station Blackout.
- GGNS will utilize the standard EPRI industry Preventative Maintenance (PM) process for establishing the maintenance and testing actions for FLEX components. The administrative program will include maintenance guidance, testing procedures and frequencies established based on type of equipment and considerations made within the EPRI guidelines.
- GGNS will follow the current programmatic control structure for existing processes such as design and procedure configuration.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to configuration control, if these requirements are implemented as described.

3.3.3 Training

NEI 12-06, Section 11.6 provides that:

1. Programs and controls should be established to assure personnel proficiency in the mitigation of beyond-design-basis events is developed and maintained. These programs and controls should be implemented in accordance with an accepted training process.

2. Periodic training should be provided to site emergency response leaders on beyond design-basis emergency response strategies and implementing guidelines. Operator training for beyond-design-basis event accident mitigation should not be given undue weight in comparison with other training requirements. The testing/evaluation of Operator knowledge and skills in this area should be similarly weighted.

3. Personnel assigned to direct the execution of mitigation strategies for beyond-design basis events will receive necessary training to ensure familiarity with the associated tasks, considering available job aids, instructions, and mitigating strategy time constraints.

4. "ANSI/ANS 3.5, Nuclear Power Plant Simulators for use in Operator Training" certification of simulator fidelity (if used) is considered to be sufficient for the initial stages of the beyond-design-basis external event scenario until the current capability of the simulator model is exceeded. Full scope simulator models will not be upgraded to accommodate FLEX training or drills.

5. Where appropriate, the integrated FLEX drills should be organized on a team or crew basis and conducted periodically; with all time-sensitive actions to be evaluated over a period of not more than eight years. It is not the intent to connect to or operate permanently installed equipment during these drills and demonstrations.

On page 11 of the Integrated Plan, in the section discussing the general plan elements and the training plan, the licensee stated that new training of station staff and emergency response personnel will be performed in 2015, prior to the GGNS design implementation. These programs and controls will be implemented in accordance with the Systematic Approach to Training.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to training, if these requirements are implemented as described.

3.4 <u>OFFSITE RESOURCES</u>

NEI 12-06, Section 12.2 lists the following minimum capabilities for offsite resources for which each licensee should establish the availability of:

1) A capability to obtain equipment and commodities to sustain and backup the site's coping strategies.
2) Off-site equipment procurement, maintenance, testing, calibration, storage, and control.
3) A provision to inspect and audit the contractual agreements to reasonably assure the capabilities to deploy the FLEX strategies including unannounced random inspections by the Nuclear Regulatory Commission.
4) Provisions to ensure that no single external event will preclude the capability to supply the needed resources to the plant site.
5) Provisions to ensure that the off-site capability can be maintained for the life of the plant.
6) Provisions to revise the required supplied equipment due to changes in the FLEX strategies or plant equipment or equipment obsolescence.
7) The appropriate standard mechanical and electrical connections need to be specified.
8) Provisions to ensure that the periodic maintenance, periodic maintenance schedule, testing, and calibration of off-site equipment are comparable/consistent with that of similar on-site FLEX equipment.
9) Provisions to ensure that equipment determined to be unavailable/non-operational during maintenance or testing is either restored to operational status or replaced with appropriate alternative equipment within 90 days.
10) Provision to ensure that reasonable supplies of spare parts for the off-site equipment are readily available if needed. The intent of this provision is to reduce the likelihood of extended equipment maintenance (requiring in excess of 90 days for returning the equipment to operational status).

On page 11 of the Integrated Plan, the licensee stated that GGNS will utilize the industry RRC for phase 3 equipment. GGNS has contractual agreements in place with the SAFER. The two

RRCs will be established to support utilities in response to BDBEE. Each RRC will hold five sets of equipment, four of which will be able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle. Communications will be established between the affected nuclear site and the SAFER team and required equipment mobilized as needed. Equipment will initially be moved from an RRC to a local staging area, established by the SAFER team and the utility. The equipment will be prepared at the staging area prior to transportation to the site.

In addition, the licensee stated that the first arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request. The licensee's plans for delivery of equipment cannot be substantiated due to the lack of detail in the integrated plan regarding when the RRC would be contacted and what administrative procedure or program would trigger the initial request for assistance with offsite resources. The licensee was requested to provide addition information regarding when the RRC would be contacted. Additionally, the licensee was requested to provide information regarding the administrative procedure or program that initiates the first request for assistance with offsite resources.

The licensee responded by stating that GGNS has contractual agreements in place with the SAFER. Communications will be established between the affected nuclear site and the SAFER team and required equipment mobilized as needed. Based on the SAFER contract, the "Grand Gulf Response Plan" and implementing procedures will be developed that will address means of contacting the SAFER Control Center, timing of SAFER Control Center notification and equipment required from the RRC given site and plant conditions. The "Grand Gulf Response Plan" is currently in the schedule to be completed by August 2015.

The reviewer determined that insufficient information was provided in the Integrated Plan to substantiate that the Phase 3 equipment will support strategies due to the absence of details on equipment capacities and ratings. The licensee was requested to provide additional information regarding Phase 3 equipment capacities and ratings.

During the audit process, the licensee responded by stating that final design along with detailed design calculations will define the capacities and ratings for the GGNS specific equipment needs, and will ensure the RRC equipment is compatible with GGNS equipment connections and bounds the capacities and ratings required for GGNS strategies.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to use of off-site resources, if these requirements are implemented as described.

4.0 OPEN AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number	Description	Notes
3.1.2.A	Since the GGNS PMP is greater than the grade elevation and sandbags are needed to protect against flooding, it is unclear how GGNS can be designated as a “dry” site. Since the licensee identified GGNS as a dry site, licensee information related to NEI 12-06 guidelines identified in this report, Sections 3.1.2.1, 3.1.2.2, and 3.1.2.3 (storage, deployment, and procedural interfaces, respectively) are not discussed. If the resolution of this Open Item results in GGNS not being categorized as a "dry" site, the guidelines of the NEI 12-06 Sections related to these report sections will need to be addressed by the licensee as part of that resolution.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.1.A	Confirm that the storage facilities and plans will conform to the guidance in NEI 12-06, Section 5.3.1, for protection from seismic events.	
3.1.3.1.A	Confirm that at least one of the two FLEX equipment storage buildings would not be damaged by tornado missiles, based on the guidance in NEI 12-06, Section 7.3.1.	
3.1.3.2.A	Confirm that procedures address UHS usability when wind generated debris is present in the UHS.	
3.2.1.1.A	Confirm that the final MAAP4 analysis of the RCS response conforms to the NEI position paper dated June 2013, entitled “Use of Modular Accident Analysis Program (MAAP) in Support of Post-Fukushima Applications" (Accession Number ML13190A201) and the MAAP4 limitations of the NRC endorsement letter, dated October 3, 2013 (ADAMS Accession No. ML13275A318).	
3.2.1.2.A	Confirm that the MAAP4 analysis includes appropriate recirculation pump seal leakage consistent with NEDC-33771P.	
3.2.1.3.A	Confirm that the final Sequence of Events reflects the results of the final MAAP4 analysis of the RCS response and the licensee provides reasonable assurance by some means (e.g. by walkthrough) that the timing of the actions in the Sequence of Events is achievable.	
3.2.1.4.A	Confirm that operation with the suppression pool temperature at its calculated maximum temperature will not impact the mitigation strategies, especially RCIC operation and structural integrity of the suppression pool.	
3.2.1.8.A	Confirm that the hydraulic calculations for the FLEX pumps	

	demonstrate that the required flow rates can be achieved.	
3.2.2.A	Confirm that the SFP area ventilation calculation demonstrates that portable ventilation is not required in the SFP area, or that the licensee provides a strategy to use portable ventilation.	
3.2.3.A	Confirm that the licensee's strategy for maintaining containment integrity considers the results of the final MAAP4 analysis for RCS leakage and the containment venting strategy.	
3.2.4.1.A	Confirm that the licensee complies with the procedural guidance stated in NEI 12-06, Section 3.2.2, Guideline 3, by developing the necessary procedures.	
3.2.4.2.A	Confirm that the RCIC room heat up calculation (ENTGGG111-CALC-007) for ELAP uses appropriate heat loads and shows an acceptable room temperature.	
3.2.4.4.A	Confirm that any required upgrades to the site's communications systems have been completed, as noted in the NRC's review of the GGNS communications assessment (ADAMS Accession No. ML13129A132).	
3.2.4.8.A	Confirm that the licensee's analyses for size and loading of FLEX generators shows acceptable results.	
3.2.4.8.B	Confirm that the licensee's final Single Line Diagrams showing the proposed connections of FLEX Phase 2 and 3 electrical equipment to the permanent plant equipment are acceptable.	
3.2.4.9.A	Confirm that the licensee has plans to refuel FLEX equipment based on the fuel oil consumption rates.	
3.2.4.10.A	Confirm the acceptability of RCIC operation without the gland seal compressor (de-energized 30 minutes after loss of all ac power).	
3.2.4.10.B	Confirm that the calculations regarding battery sizing which show that Vital Batteries can provide required loads for at least 11 hours (considering load shedding) are acceptable.	