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

January 15, 2014

PPL Susquehanna, LLC
Susquehanna Steam Electric Station, Units 1 and 2
Docket Nos. 50-387 and 50-388

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 Nos. MF0888 and MF0889

Prepared by:

Mega-Tech Services, LLC
11118 Manor View Drive
Mechanicsville, Virginia 23116

11118 Manor View Drive • Mechanicsville, Virginia 23116
804.789.1577 • Fax: 804.789.1578
www.mega-techservices.biz

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 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 to 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 29, 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 (TE) 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 (Final Safety Analysis Report (FSAR) program, procedure program, quality assurance program, modification configuration control program, etc.) will generally be accepted. For example, references to existing FSAR 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 28, 2013, (ADAMS Accession No. ML13060A357), and as supplemented by the first six-month status report in letter dated August 28, 2013 (ADAMS Accession No. ML13240A214), PPL Susquehanna, LLC (the licensee or PPL) provided Susquehanna Steam Electric Station (SSES) Integrated Plan for Compliance with Order EA-12-049. The Integrated Plan describes the strategies and guidance under development for implementation by the licensee for the maintenance or restoration of core cooling, containment, and SFP cooling capabilities following a BDBEE, 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 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) electric power and loss of normal access to the ultimate heat sink (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 Events.

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.

A review was made of the licensee’s screening process for the seismic hazard.

On page 1 of the Integrated Plan, the licensee stated that seismic hazards are applicable to SSES and that seismic considerations will include protection of FLEX equipment, deployment of FLEX equipment, procedural interfaces and considerations in using off-site resources. In the Integrated Plan, the licensee did not address the specific seismic criteria used as the basis for protection and deployment strategies of the FLEX equipment.

During the audit process, the licensee stated that the design basis for protecting FLEX equipment will be double the safe shutdown earthquake (SSE) FSAR ground response spectra.

The SSES FSAR, Section 2.5.2.6 defined the SSE as 0.15g applied at the foundation level (0.1g for rock-founded structures and 0.15g for soil-founded structures), the seismic design response spectrum is presented in FSAR Figure 2.5-27 and the SSES seismic design is discussed in Section 3.7. As stated above, the licensee will use twice the SSE ground response spectra.

On page 7 of the Integrated Plan, the licensee stated that they have not yet completed the seismic re-evaluation pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 and therefore did not include the results in their Integrated Plan.

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 seismic hazards 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 Safe Shutdown Earthquake (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., Safe Shutdown Earthquake (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.

A review was made of the licensee's plans for protection and storage of portable/FLEX equipment during the seismic hazard.

On page 1 of the Integrated Plan, the licensee stated that FLEX equipment will be stored in a structure that meets one or more of the configurations identified in Section 5.3.1.1 of NEI 12-06, but that the final building seismic design requirements will be determined later. The licensee further states that large portable FLEX equipment, such as pumps and power supplies, will be secured to protect them during a SSE and that stored equipment will be protected from seismic interactions to ensure that unsecured and/or non-seismic components do not damage the equipment.

During the audit process, the licensee stated that SSES plans to use a single hardened structure to store FLEX portable equipment. The licensee stated that the structure's design basis will use double the safe shutdown earthquake (SSE) FSAR ground response spectra.

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 storage and protection of portable equipment during 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 FLEX equipment should be provided that is also reasonably protected from the event.

A review was made of the licensee’s plans for implementation of the strategies to deploy portable/FLEX equipment during a seismic hazard, protection of connection points, water sources and the means and power requirements to deploy portable/FLEX equipment.

On page 1 of the Integrated Plan, the licensee stated that, as discussed in Section 2.5 of the SSES FSAR, soil liquefaction analysis determined that adequate safety margin against liquefaction is present and therefore, soil liquefaction does not need to be considered for deployment of FLEX equipment.

On page 1 of the Integrated Plane, the licensee stated that at least one connection point for the FLEX equipment will be accessed through a seismically robust structure.

On page 1 of the Integrated Plan, the licensee stated that the SSES ultimate heat sink (UHS) is seismically qualified, and that the UHS will be available during Extended Loss of AC Power (ELAP) conditions.

As stated in Section 3.1.1.1 of this evaluation, the licensee has not completed the design of the storage facility for SSES. However, on page 1 of the Integrated Plane, the licensee stated that if electric power is required to move or deploy FLEX equipment, for example opening the door from a storage location, then power supplies will be provided as part of FLEX deployment.

Although the licensee stated that the deployment of FLEX equipment will conform to NEI 12-06, Section 5.3.2 and that adequate safety margin against liquefaction is present, the reviewer noted, however that the discussion in the SSES FSAR, Section 2.5 on liquefaction potential is limited to soil supporting the spray pond, Engineered Safeguards Service Water (ESSW) pump house, diesel generator 'E' fuel storage tank and Seismic Category I pipelines. Additionally, the licensee has not yet determined the location of FLEX equipment storage buildings and has not yet evaluated FLEX equipment deployment pathways. Therefore, the information available, at this time, is not sufficient to conclude that the specifications of NEI 12-06, Section 5.3.2 the deployment of portable/FLEX equipment during the seismic hazard will be met. The item tracking this issue has been combined with Confirmatory Item 3.1.1.2.A. in Section 4.2, below.

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 portable equipment during a seismic hazard 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 BDB 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 control room and non-control room 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 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 FLEX for those plants that could be impacted by failure of a not seismically robust downstream dam.

On page 2 of the Integrated Plan, the licensee stated that they will compile a reference source for the plant operators that provide approaches to obtaining necessary instrument readings to support the implementation of the coping strategy. This reference source will include control room and non-control room readouts and will provide guidance on how and where to measure key instrument readings.

The licensee provided additional information about proposed content of the reference source during the audit process, stating that, where applicable, the operators will be provided with guidance related to critical actions to perform until alternate indications can be connected, and on how to control critical equipment without associated control power to support implementation of the coping strategy.

In the Integrated Plan, the licensee does not address the impacts from large internal flooding sources that are not seismically robust and do not require ac power. During the audit process, the license was asked to discuss any procedural interfaces considerations for seismic hazards associated with large internal flooding sources that are not seismically robust and do not require ac power. In response, the licensee provided additional information concerning an analysis of flooding critical plant areas during a BDBEE due to the rupture of cooling tower basins, turbine building circulating water piping, the condensate storage (CST) and refueling water storage (RWST) tanks. The licensee concluded that safety related areas and components that are important to safety would not be affected by the resultant flooding.

The licensee stated that two flooding scenarios were evaluated, the first considered the failure of both cooling tower basins where water is directed toward the Unit 1 and 2 Turbine Buildings. The second flooding scenario considered the failure of the Unit 1 cooling tower basin where water is directed toward the ESSW pump house. In the first scenario flooding of the turbine building and the control structure occurs, however, equipment located in flooded areas is not credited for safe shutdown. In the second scenario flood water would momentarily buildup against the ESSW pump house walls but would dissipate due to the steep site grading in this area. The licensee stated that flood barriers were designed to prevent the intrusion of flood water into safety related structures.

On page 2 of the Integrated Plan, the licensee stated that SSES does not credit ac power to mitigate ground water in critical locations.

On page 2 of the Integrated Plan, the licensee stated that SSES is not impacted by the failure of a non-seismically robust downstream dam

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.

A review was made of the licensee's plans for the use of offsite resources.

On Page 2 of the Integrated Plan, the licensee stated that alternate routes to the station will be established to ensure off-site resources can be obtained.

On page 12 of the Integrated Plan, the license states that equipment initially will be moved from a regional response center (RRC) established by the nuclear power industry to a local staging area, established by the Strategic Alliance for FLEX Emergency Response (SAFER) team and the utility and that the equipment will be prepared at the staging area prior to transportation to the site.

However, the licensee has not yet completed plans for the transportation of RRC FLEX equipment and has identified this as an incomplete item in the integrated plan. The plan has not identified the local staging area(s) for the RRC FLEX equipment and has not described the methods to be used to deliver the equipment to the site. Therefore, the information available, at this time, is not sufficient to conclude that the specifications of NEI 12-06, Section 5.3.4 concerning considerations in using off-site resources during a seismic hazard will be met. The item tracking this issue has been combined with Confirmatory Item 3.1.1.4.A. in Section 4.2, below.

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 use of off-site resources if these requirements are implemented as described.

3.1.2 Flooding

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.

A review was made of the licensee's screening process for the flood hazard.

The SSES FSAR Section 2.4.1.1, "Site and Facilities" states that SSES is located approximately 3000 feet (ft) from the banks of the Susquehanna River at a lowest site grade of 670 ft mean sea level (msl); 175 ft above the Susquehanna River flood plain.

The SSES FSAR, Section 2.4.1.2.1, "Rivers and Streams," characterizes SSES as a "dry" site because SSES is not susceptible to river induced flooding. However, on page 2 of the Integrated Plan the licensee stated that SSES is susceptible to external flooding events, in accordance with NEI 12-06 Section 6.2.1. The licensee stated that the most significant long term external flooding event of 24 hours or greater is the probable maximum precipitation (PMP) flooding event. The licensee stated that the PMP flooding event results in approximately 30 inches of rain in a 24 hour period and results in some local ponding around safety related buildings or structures with no significant water accumulation against any safety related buildings. The licensee stated that because the PMP flooding event bounds any postulated severe weather external flooding event at the station, no external flood mitigating actions are required in response to these external flooding events.

On page 2 of the Integrated Plan, the licensee stated SSES is subject to short term external flooding from postulated external flooding events such as a cooling tower basin rupture or a site storage tank rupture, and that these external flooding events can result in a buildup of water around safety related buildings. The licensee stated that, because of the short duration of these events no mitigating actions are required.

On page 7 of the Integrated Plan, the licensee stated that the flooding re-evaluation pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 had not been completed and therefore was not assumed in their Integrated Plan.

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 evaluation 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.

A review was made of the licensee's plans for protecting portable/FLEX equipment during the flooding hazard.

On pages 2 and 3 of the Integrated Plan, the licensee stated that the SSES flood protection features, such as doors and penetrations within the exterior flood barriers, are designed to prevent water from entering safety related buildings during all postulated external flooding events. The licensee stated that although flooding protection requirements are not required for these external flooding events, FLEX equipment must be located outside the flow path of these on-site water sources. The licensee stated that FLEX equipment will be stored in a structure(s) that meets one or more of the configurations identified in Section 6.2.3.1.1 of NEI 12-06, but that the final storage area and design will be determined later. The licensee stated that procedures and programs are being developed to address storage structure requirements and that the schedule to construct the structures is still to be determined.

During the audit, the licensee was asked to provide specific design requirements of the structures used to protect FLEX equipment. In response, the licensee stated that SSES plans to use a single hardened structure to store FLEX portable equipment. The licensee stated that the structure will be chosen according to the SSES FSAR design basis flooding criteria .

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2013-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to storage and protection of portable equipment during a flooding hazard if these requirements are implemented as described.

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 FLEX 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, isolating accumulators, isolating RCP 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 LUHS, 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.

A review was made of the licensee's plans for implementation of the strategies to deploy portable/FLEX equipment during the flood hazard.

On page 3 of the Integrated Plan, the licensee stated that SSES does not anticipate that deployment of FLEX equipment would be required during the short term external flooding events, that is a failure of the cooling tower basins or storage tank. Even though resulting flooding may not necessitate deployment of FLEX equipment, the primary initiating event might. As a result, FLEX equipment may need to be deployed during or shortly after an external flooding event resulting from the rupture of the cooling tower basin or storage tanks.

During the audit, the licensee was asked to provide information on the duration of flooding from failure of external structures and the impact of debris from those structures on the deployment of FLEX equipment. In response, the licensee stated that short-term flooding is postulated to last less than 10 minutes and that the short-term flooding will not impact the deployment strategy. However, the licensee stated that debris from a cooling tower basin rupture could impact the deployment pathway to the east of the towers, between the towers and the turbine building. The licensee stated that an alternate deployment path would be available as well as debris removal equipment. The licensee also stated that short term flooding events resulting from on-site tank ruptures would not impact equipment deployment since water would be contained within the berm areas provided around the CSTs and the RWST.

On page 3 of the Integrated Plan, the licensee stated that deployment of FLEX equipment during or after a PMP flooding event may be required. The licensee stated that they will evaluate Considerations 1 thru 9 in NEI 12-06, Section 6.2.3.2, and incorporate the consideration into the FLEX equipment deployment strategy, as applicable. However, on page 11 of the Integrated Plan the licensee stated that deployment routes have not been identified, but will be identified and reported in a future 6-month update. Therefore, the information available, at this time, is not sufficient to conclude that the specifications of NEI 12-06, Section 6.2.3.2 will be met concerning the deployment of portable/FLEX equipment during the flooding hazard. The item tracking this issue has been combined with Confirmatory Item 3.1.1.2.A. in Section 4.2, below.

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 portable equipment during a flooding hazard if these requirements are implemented as described.

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.

A review was made of the licensee's procedural interfaces addressing the flood hazard.

On page 3 of the Integrated Plan, the licensee stated that SSES has procedures in place to prepare the station for severe weather operation that may coincide with external flooding such as hurricanes. The preparatory actions in the procedures include establishing manpower needs, topping off vehicles with fuel, tying-down equipment, setting-up sleeping accommodations and ensuring storm drains are clear. The licensee stated that although actions to prepare for severe weather operation are necessary, there are no credited time-dependent actions associated with external flooding events or specific mitigating actions required to protect against the ingress of water into structures, systems and components (SSCs) important to safety during any PMP flooding event. The licensee stated that the actions necessary to support the FLEX equipment deployment considerations in NEI 12-06, Section 6.2.3.2 will be identified in the applicable external flooding procedures. In addition, the licensee stated that temporary flood barriers or extraction pumps are not expected to be required to support deployment of FLEX equipment.

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 procedural interfaces coping with the flooding hazard if these requirements are implemented as described.

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.

A review was made of the licensee's plans for use of offsite resources from the RRC during the flood hazard.

On page 3 of the Integrated Plan, the licensee stated that SSES will review site access routes to determine the best means to obtain resources from off-site during or following a worst case site flooding event (PMP), and that staging areas will be established to support deployment of Phase 3 equipment.

On page 12 of the Integrated Plan, the license states that equipment initially will be moved from an RRC to a local staging area, established by the SAFER team and the utility and that the equipment will be prepared at the staging area prior to transportation to the site.

The licensee has not yet completed plans for the transportation of RRC FLEX equipment and has identified this as an incomplete item in the integrated plan. The plan has not identified the local staging area(s) for the RRC FLEX equipment and has not described the methods to be used to deliver the equipment to the site. Therefore, the information available, at this time, is not sufficient to conclude that the specifications of NEI 12-06, Section 6.2.3.4 concerning considerations in using off-site resources during a flooding hazard will be met. The item tracking this issue has been combined with Confirmatory Item 3.1.1.4.A. in Section 4.2, below.

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 use of off-site resources if these requirements are implemented as described.

3.1.3 High Winds

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 mile per hour (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 3 of the Integrated Plan, the licensee stated that based on NEI 12-06, Figure 7-1, SSES could experience hurricane winds in excess of 130 mph. The licensee stated that the severe storm with high wind hazards associated with hurricanes are applicable to SSES.

On page 4 of the Integrated Plan, the licensee stated that based on NEI 12-06, Figure 7-2, SSES is located in Region 2 and could experience tornado force winds exceeding 160 mph. The licensee stated that severe storm with high wind hazards associated with tornadoes including tornado missiles are applicable to SSES.

The licensee's screening for severe storms with high winds hazard as presented in their Integrated Plan has appropriately screened in this external hazard and identified the hazard levels for reasonable protection of the portable equipment.

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 severe storms with high winds hazard if these requirements are implemented as described.

3.1.3.1 Protection of FLEX Equipment - High Winds 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 FLEX basis 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.

A review was made of the licensee's plans for protection and storage of portable/FLEX equipment during the severe storm with high winds hazard.

On page 4 of the Integrated Plan, the licensee stated that FLEX equipment will be stored in a structure that meets one or more of the configurations identified in Section 7.3.1 of NEI 12-06 and that the final building design requirements are under development.

During the audit, the licensee was asked to provide specific design requirements of the structures used to protect FLEX equipment. In response, the licensee stated that SSES plans to use a single hardened structure to store FLEX portable equipment. The licensee stated that SSES will use the SSES FSAR design basis load criteria for wind, tornadoes, and tornado missiles.

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 protection and storage of portable equipment during the severe storm with high wind hazard 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 ultimate heat sink 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.

On Page 4 of the Integrated Plan, the licensee stated that high winds may delay deployment of FLEX equipment. As a contingency, the licensee stated that FLEX strategies will include consideration for deployment of equipment prior to anticipate high wind events with significant warning time, such as hurricanes. Since tornadoes may not have warning time available, and because tornadoes typically short term events, the licensee stated that deployment of equipment during a tornado would not be anticipated.

On Page 4 of the Integrated Plan, the licensee stated that SSES will evaluate the high wind hazard Considerations 1 through 5 listed in NEI 12-06, Section 7.3.2 and incorporate them into the SSES FLEX equipment deployment strategy, as applicable. In addition, on page 11 of the Integrated Plan the licensee stated FLEX equipment deployment routes have not been identified, but will be identified and reported in a future 6-month update. Therefore, the information available, at this time, is not sufficient to conclude that the specifications of NEI 12-06, Section 7.3.2 the deployment of portable/FLEX equipment during the severe storm with high winds hazard will be met. The item tracking this issue has been combined with Confirmatory Item 3.1.1.2.A. in Section 4.2, below.

On page 4 of the Integrated Plan, the licensee stated that following a hurricane or tornado, debris removal may be required to deploy FLEX equipment and that path clearing equipment will be available to support deployment of equipment.

On page 53 of the Integrated Plan, the licensee stated that the fire pumper would be deployed within five (5) hours and that the FLEX electrical generator would be deployed and supplying electrical loads within six (6) hours.

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 portable equipment during a severe storm high winds hazard if these requirements are implemented as described.

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.

A review was made of the licensee's plans for the development of procedures and programs regarding the deployment of portable equipment during severe storms with high wind hazard.

On page 4 of the Integrated Plan, the licensee stated that SSES will incorporate the actions necessary to support the deployment Considerations 1 thru 5 of NEI 12-06 Section 7.3.2 into SSES procedures, as applicable.

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 the severe storm with 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.

A review was made of the licensee's plans for the use of offsite resources during the severe storm with high wind hazard.

On page 4 of the Integrated Plan, the licensee stated that SSES will review site access routes to determine the best means to obtain resources from off-site following a hurricane, and that staging areas will be established to support receipt of equipment under these adverse weather conditions.

On page 12 of the Integrated Plan, the license states that equipment initially will be moved from an RRC to a local staging area, established by the SAFER team and the utility, and that the equipment will be prepared at the staging area prior to transportation to the site.

The licensee has not yet completed plans for the transportation of RRC FLEX equipment and has identified this as an incomplete item in the integrated plan. The plan has not identified the local staging area(s) for the RRC FLEX equipment and has not described the methods to be used to deliver the equipment to the site. Therefore, the information available, at this time, is not sufficient to conclude that the specifications of NEI 12-06, Section 7.3.4 concerning considerations in using off-site resources during a severe storm with high wind hazard will be met. The item tracking this issue has been combined with Confirmatory Item 3.1.1.4.A. in Section 4.2, below.

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 and storage of portable equipment during the severe storm with high wind hazard if these requirements are implemented as described.

3.1.4 Snow, Ice and Extreme Cold

As discussed 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.

A review was made of the licensee's screening process for snow, ice, and extreme cold hazard.

On page 4 of the Integrated Plan, the licensee stated that snow, ice and extreme cold hazards are applicable to SSES and that hazard considerations include protection of FLEX equipment, deployment of FLEX equipment, procedural interfaces and considerations in using off-site resources.

A review was made of the licensee's screening process for the snow, ice, and extreme cold hazard and it was determined that the licensee has appropriately screened in this external hazard and identified the hazard levels for reasonable protection of the portable equipment.

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 the snow, ice and extreme cold hazard 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 N+1 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.).

A review was made of the licensee's plans for the storage and protection of portable equipment from snow, ice, and extreme cold.

On pages 4 and 5 of the integrated Plan, the licensee stated that FLEX equipment will be stored in a structure that meets the requirements identified in NEI 12-06, Section 8.3.1, but that the final building design requirements will be determined later. In addition the licensee stated that the equipment will be maintained at a temperature within the range to ensure its likely function when called upon.

On page 21 of the Integrated Plan, the licensee stated that the storage structure would be constructed to meet the requirements of NEI 12-06, Section 11.

During the audit, the licensee was asked to provide specific design requirements of the structures used to protect FLEX equipment. In response, the licensee stated that SSES plans to use a single hardened structure to store FLEX portable equipment and that the structure for protection of FLEX equipment will be designed to SSES design-basis criteria for snow and 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 storage and protection of equipment from 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 FLEX equipment from storage to its location for deployment.

3. For some sites, the ultimate heat sink 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 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.

A review was made of the licensee's plans for implementation of the strategies to deploy portable equipment during a snow, ice, and extreme cold hazard.

On Page 5 of the Integrated Plan, the licensee stated that SSES will evaluate snow, ice and extreme cold Hazard Considerations of NEI 12-06 Section 8.3.2 and incorporate the considerations listed in the SSES FLEX equipment deployment strategy, as applicable. In addition, on page 11 of the Integrated Plan the licensee stated FLEX equipment deployment routes have not been identified, but will be identified and reported in a future 6-month update.

On Page 5 of the Integrated Plan the licensee stated that path clearing equipment will be available to support deployment of FLEX equipment. In addition the licensee stated that since the UHS may be affected by extreme low temperatures due to ice buildup, the FLEX strategy will include provisions for minimizing ice buildup in the UHS when sufficiently cold weather conditions are forecast to ensure the FLEX equipment can utilize the UHS inventory.

However the licensee has not yet completed plans for storage buildings and has listed the deployment pathways as an incomplete item in the integrated plan. Additionally, on page 53 of the Integrated Plan the licensee identified that the FLEX electrical generator should be installed and supplying critical electrical loads within six (6) hours.

The licensee has stated that deployment routes will be identified once storage locations for FLEX equipment have been established. The licensee has identified the need to provide additional information regarding storage and deployment routes. Therefore, the information available, at this time, is not sufficient to conclude that the specifications of NEI 12-06, Section 8.3.2 the deployment of portable/FLEX equipment during the snow, ice and extreme cold hazard will be met. The item tracking this issue has been combined with Confirmatory Item 3.1.1.2.A. in Section 4.2, below.

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 portable equipment during 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 the FLEX equipment. This includes both access to the transport path, e.g., snow removal, and appropriately equipped vehicles for moving the equipment.

A review was made of the licensee's plans for procedural enhancements that address the effects of snow and ice on transportation equipment.

On page 5 of the Integrated Plan, the licensee stated that procedure enhancements will be required to address the effects of snow and ice on transport of the FLEX equipment, including both access to the transport path, for example snow removal, and appropriately equipped vehicles for moving the equipment.

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 enhancements that address the effects of snow and ice on transport equipment, including snow and ice removal during a 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 off-site material and equipment.

A review was made of the licensee's plans for the use of offsite resources during the snow, ice and extreme cold hazard.

On page 5 of the Integrated Plan, the licensee stated that they will review site access routes to determine the best means to obtain resources from off-site under snow, ice and extreme cold conditions and staging areas will be established to support receipt of equipment under these adverse weather conditions. The licensee also stated that snow and ice removal may be required to deploy FLEX equipment and that path clearing equipment will be available to support deployment of FLEX equipment.

On page 12 of the Integrated Plan, the license states that equipment initially will be moved from an RRC to a local staging area, established by the SAFER team and the utility and that the equipment will be prepared at the staging area prior to transportation to the site.

The licensee has not yet completed plans for the transportation of RRC FLEX equipment and has identified this as an incomplete item in the integrated plan. The plan has not identified the local staging area(s) for the RRC FLEX equipment and has not described the methods to be used to deliver the equipment to the site. Therefore, the information available, at this time, is not sufficient to conclude that the specifications of NEI 12-06, Section 8.3.4 concerning considerations in using off-site resources during a snow ice and extreme cold hazard will be met. The item tracking this issue has been combined with Confirmatory Item 3.1.1.4.A. in Section 4.2, below.

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 using offsite resources during a snow, ice and extreme cold hazard if these requirements are implemented as described.

3.1.5 High Temperatures

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˚F. Many states have experienced temperatures in excess of 120˚F.
>
> In this case, sites should consider the impacts of these conditions on deployment of the FLEX equipment.

A review was made of the licensee's screening process for the high temperature hazard that was discussed on page 5 of the Integrated Plan. The licensee stated that they will address the impact of high temperatures on protection and deployment of FLEX equipment that FLEX equipment must be capable of functioning under high temperature conditions and that for SSES; maximum outside air temperatures is 101 degree Fahrenheit per FSAR, section 2.3.1.1.

The licensee has appropriately screened in for the high temperature hazard and has identified the hazard levels for reasonable protection of the portable equipment.

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.

A review was made of the licensee's plans for protection and storage of portable/FLEX equipment during the high temperature hazard.

On page 5 of the Integrated Plan, the licensee stated that FLEX equipment will be stored in a structure that meets the specifications identified in Section 9.3.1.1 of NEI 12-06 that the FLEX equipment will be maintained within temperature range to ensure its likely function when called upon and that the final building design requirements are under development. The licensee also stated on page 21 that the storage structure would be constructed to meet the requirements of NEI 12-06, Section 11.

During the audit, the licensee was asked to provide specific design requirements of the structures used to protect FLEX equipment. In response, the licensee stated that SSES plans to use a single hardened structure to store FLEX portable equipment and that the structure will be designed to SSES FSAR design-basis temperature criteria.

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 protection and storage of portable equipment during the high temperature 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 5 of the Integrated Plan, the licensee stated that the SSES FLEX equipment will be procured to function in extreme high temperature conditions applicable to SSES and that the potential impact on storage of equipment due to high temperatures will be considered.

Therefore, the information available, at this time, is not sufficient to conclude that the specifications of NEI 12-06, Section 9.3.2 the deployment of portable/FLEX equipment during the high temperature hazard will be met. The item tracking this issue has been combined with Confirmatory Item 3.1.1.2.A. in Section 4.2, below.

The current understanding of the licensee's approach, as described above, 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 equipment during a high temperature 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 enhancements that would be expected to apply involve addressing the effects of high temperatures on the FLEX equipment.

A review was made of the licensee's plans for the development of procedures and programs regarding the deployment of portable equipment during severe storms with high wind hazard.

As discussed in Section 3.1.5.1 of this evaluation, the licensee will procure FLEX equipment that will function in extreme high temperature conditions applicable to SSES and that the potential impact of high temperatures on storage of equipment will be considered.

On page 5 of the Integrated Plan, the licensee stated that SSES will initiate procedure enhancements will be, if required, to address the effects of high temperatures on transportation and operation of the FLEX equipment.

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 that address the effects of high temperature on portable/FLEX equipment 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 these EA-12-049 requirements, 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) makeup in order to restore core or SFP capabilities as described in NEI 12-06, Section 3.2.2 Guideline (13). This approach is endorsed in NEI 12-06, Section 3, by 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 SSCs as a result of the beyond-design-basis initiating event.

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 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 alternating current (ac) power and loss of normal access to the ultimate heat sink for an extended period (the ELAP event).

3.2.1.1. Computer Code Used for ELAP Analysis.

NEI 12-06, Section 1.3 states in part:

> 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 offsite.

The licensee provided a Sequence of Events (SOE) Timeline on pages 52 through 54 of their Integrated Plan, which included the time constraints and the technical basis for the site. The time constraints, which were identified in the SOE Timeline, were discussed on pages 8 through 10 of the Integrated Plan. The licensee stated that GE-Hitachi (GEH) NEDO-33771/NEDC-33771P, "GEH Evaluation of the FLEX Implementation Guidelines," Revision 1, ADAMS Accession No. ML130370742 (hereinafter NEDC-33771P), would be reviewed and compared to the coping strategies for core and containment cooling. The licensee referenced their Modular Accident Analysis Program (MAAP) analysis in their discussion of the time constraints identified in the sequence of events timeline, in their discussion of coping strategies to maintain containment cooling and in the sequence of events timeline on pages 9, 26 through 29 and 53 of the Integrated Plan.

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.

While the NRC staff does acknowledge 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 Plan, 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). Those limitations and their corresponding Confirmatory Item number for this TER are provided as follows:

(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. This has been identified as Confirmatory Item 3.2.1.1.A in Section 4.2, below.

(2) The collapsed level must remain above Top of Active Fuel (TAF) and the cool down rate must be within technical specification limits. This has been identified as Confirmatory Item 3.2.1.1.B in Section 4.2, below.

(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. This has been identified as Confirmatory Item 3.2.1.1.C in Section 4.2, below.

(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 (EPRI) 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.)

   This has been identified as Confirmatory Item 3.2.1.1.D in Section 4.2, below.

(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 specifications limits. This has been identified as Confirmatory Item 3.2.1.1.E in Section 4.2, below.

During the audit process the licensee stated that they had reviewed the NRC letter to NEI dated October 3, 2013 and that the licensee would abide by the generic resolution described therein.

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 the computer code used for ELAP analysis if these requirements are implemented as described.

3.2.1.2 Recirculation Pump Seal Leakage Models

Conformance 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 SBO event and contribute to beyond normal system leakage.

A review was made of the SSES Integrated Plan to verify that the recirculation pump seal leakage models specified by NEI 12-06, Section 3.2.1.5 had been adopted by the licensee in their analysis.

On page 29 of the Integrated Plan the licensee stated that the assumed leakage rate into the containment through the reactor recirculation pump seals is 100 gallons per minute (gpm), which is 50 gpm per pump at rated RPV pressure. The licensee also stated that actions are taken to isolate this leak by energizing and closing the reactor recirculation pump discharge, discharge bypass, and suction valves to isolate the leakage into the containment, then re-open the breakers. Power to the valves is supplied by the two 480 Vac FLEX DGs. However, the MAAP analysis did not credit isolation of this leakage. In discussing the coping strategies for maintaining core and containment cooling, the licensee stated in the sequence of events timeline that operators would begin depressurizing the RPV using the safety relief valves (SRVs) within one (1) hour event time and that the RPV pressure would be maintained between 150 and 300 psig within 2.8 hours event time to reduce pressure dependent leakage. The licensee also discussed the effect of recirculation pump seal leakage on FLEX strategies in the audit process. Seal leakage was modeled as a small break LOCA with isoenthalpic expansion from the recirculation system at saturation temperature into the drywell atmosphere as a two-phase mixture. Seal leakage was varied between zero and 100 gpm and was assumed to vary linearly with RPV pressure.

As indicated above, the licensee stated that recirculation pump seal leakage is included in the ELAP analysis of containment cooling, but the details of the seal qualification tests, the seal leakage rate models and supporting test data and any conservative margin are not described within the mitigation plan or supplied with it. Therefore, the information available, at this time, is not sufficient to conclude that the specifications of NEI 12-06, Section 3.2.1.5 concerning recirculation pump seal leakage models and reactor coolant inventory loss in the ELAP analysis will be met. This has been identified as Confirmatory Item 3.2.1.2.A in Section 4.2, below.

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 reactor coolant inventory loss in the ELAP analysis if these requirements are implemented as described.

3.2.1.3 Sequence of Events

NEI 12-06 discusses an event timeline and time constraints in several sections of the document, for example Section 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.”

A review was made of the sequence of events and the discussion of time constraints identified in the sequence of events. The sequence of events, Attachment 1A, Sequence of Events Timeline, was included on pages 52 through 54 by the licensee in the Integrated Plan. Additionally the time constraints identified in the sequence of events timeline are discussed on pages 8 through 10 and the coping strategies for maintaining core cooling during the initial, transition and final phases are discussed on pages 13 through 15, 18, 19 and 24 of the Integrated Plan.

The licensee discussed NEDC-33771P in the Integrated Plan and during the audit process. NEDC-33771P was not used to develop the coping strategies for maintaining core and containment cooling. The licensee stated that the results of their ELAP analysis will be compared to the analysis published in NEDC-33771P to complete the data in Attachment 1B of the Integrated Plan. As discussed by the licensee in the six-month update dated August 28, 2013, the licensee has started but has not yet completed that comparison at this time.

The RCIC system is proposed as the primary means by which the licensee will remove decay heat during an ELAP event. The RCIC system consists of a steam-driven turbine pump unit and associated valves and piping capable of delivering makeup water to the reactor vessel. The steam supply to the turbine comes from the reactor vessel. The steam exhaust from the turbine dumps to the suppression pool. The pump can take suction from the demineralized water in the condensate storage tank or from the suppression pool. Following any reactor shutdown, steam generation continues due to heat produced by the radioactive decay of fission products. The steam normally flows to the main condenser through the turbine bypass system or if the condenser is isolated, through the relief valves to the suppression pool. The RCIC system turbine pump unit either starts automatically upon a receipt of a reactor vessel low-low water level signal or is started by the operator from the Control Room by remote manual controls. To limit the amount of fluid leaving the reactor vessel, the reactor vessel low-low water level signal also actuates the closure of the main steam isolation valves. The RCIC system has a makeup capacity sufficient to prevent the reactor vessel water level from decreasing to the level where the core is uncovered without the use of core emergency cooling systems. The normal RCIC pump suction source is the condensate storage tank (CST). The suction path will automatically transfer to drawing from the suppression pool on low level in the CST.

Steam will be drawn off through the SRVs, which discharge into the suppression pool. The SRVs will be manually controlled from the main control room (MCR). The steam turbine driven RCIC pump also exhausts into the suppression pool. In addition to the turbine steam supply, RCIC operation is dependent on direct current (dc) electric power for control, instrument and motor operated valve power.

The licensee clarified the plant design during the audit, explaining that the switchover of the RCIC pump suction from the CST to the suppression pool is dependent on dc power only and that the components are located within seismically qualified structures. This includes the instrumentation, logic and motor-operated valves. The licensee stated that if the CSTs are completely destroyed, there is a potential for the CST level instruments to be impacted such that the automatic RCIC suction path swap from the CST to the suppression pool could fail. The licensee stated that plant operators could manually realign the suction path remotely from the MCR and that procedural guidance currently exists for performing the manual suction transfer for both HPCI and RCIC. However, the licensee also clarified during the audit process that the use of HPCI or the station fire protection system is not part of their ELAP coping strategy for maintaining core cooling.

Reactor pressure control is accomplished by operating the main steam SRVs. In addition to main steam pressure, the SRVs require dc power and a pneumatic supply to operate. At one (1) hour event time, MCR operators will reduce RPV pressure by manually opening the SRVs and will maintain RPV pressure in a range between 150 and 300 psig. The RPV will be depressurized to within this pressure range at approximately 2.8 hours event time.

The licensee also clarified another aspect of RCIC operation during an ELAP in the audit process. A calculation was presented that evaluated RCIC net positive suction head (NPSH) conditions and confirmed that adequate NPSH would be available to support RCIC operation under the conditions described in the baseline coping strategy. The licensee also provided clarifying information during the audit process stating that the RCIC high area temperature isolation logic would be bypassed in accordance with procedural guidance and that cooling water supplied by a FLEX pump would be supplied to the RCIC lubricating oil cooler through a hose connection.

The licensee intends to complete load shedding from dc electrical buses at approximately forty-five (45) minutes event time. As stated by the licensee on page 9 of the Integrated Plan, the load shedding is intended to increase the station battery lifetime to over seven (7) hours. The licensee plans to deploy two portable/FLEX electrical generators that will supply power to 480 Vac electrical buses to charge the station batteries and maintain control power for RCIC, ADS SRVs and instrumentation. The two FLEX generators are to be in place and supplying electrical power to a portion of the electrical distribution system in six (6) hours event time.

The licensee also plans to deploy a portable/FLEX pump, a fire pumper that will be used to supply water to the suppression chamber or for direct injection into the RPV through the residual heat removal (RHR) system. Water supplied to the RHR system can be directed either to the RPV or to the containment through valve operation. The pump is planned to take suction on the spray pond, which is the ultimate heat sink, at the ESSW pump house. Water will be supplied to the residual heat removal (RHR) service water (RHRSW) system at the ESSW pump house. The RHRSW systems are cross-tied to the RHR systems, which will allow water to be supplied to the suppression chamber or directly to the RPV when depressurized. The fire pumper is to be in place supplying water to the RHRSW system at five (5) hours event time. Water will be supplied to the RCIC lubricating oil cooler at that time from the RHRSW system through a temporary hose jumper.

The licensee intends to open the Hardened Containment Vent System (HCVS) at approximately five (5) hours event time. As stated in the sequence of events time line on page 53 of the Integrated Plan, the suppression pool temperature will be at approximately 200 degrees Fahrenheit at that time. Water will be pumped into the suppression chamber through the RHR system at approximately six (6) hours event time to cool the suppression pool and replace the water lost through evaporative boiling.

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 sequence of events 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.

A review was made of the mitigation strategies discussed in the Integrated Plan. The RCIC pump provides water for core cooling during the initial and transition phases of the ELAP. The RCIC pump can take suction from either the CST or from the suppression pool. If the CST is unavailable due to low water level or because of tank failure, suction will be transferred to the suppression pool. In responding to an audit question, the licensee provided additional information concerning the CST to suppression pool switchover logic, instrumentation and motor operated valves. The licensee stated that in the event that the CSTs are completely destroyed, there is a potential for the CST level instrumentation to be impacted such that the automatic swap over of RCIC suction path to the suppression pool could fail. However, as stated by the licensee, the MCR operator can manually transfer the RCIC suction from the CST to the suppression pool from the MCR and that procedural guidance currently exists for performing this manual suction transfer.

The transition phase coping strategies include using onsite portable/FLEX equipment to maintain core cooling with the RCIC pump. A FLEX electrical generator will supply power to a portion of the dc distribution system through the station battery charger, thus maintaining RCIC system control power and power to critical instruments.

The licensee discussed the operation of the RCIC pump with elevated suction temperature during the audit process. On page 9 of the Integrated Plan the licensee stated that peak suppression pool temperature of 226 degree Fahrenheit would occur at 16.1 hours event time. Calculation EC-050-1032 provided an evaluation of RCIC NPSH conditions during an ELAP. The calculation demonstrated that there would be adequate NPSH to support RCIC operation during an ELAP. The licensee determined that at 226 degree Fahrenheit suction temperature, 2433 rpm turbine speed and 400 gpm flow the available NPSH is 19.04 feet and that the required NPSH is 15.7 feet.

A fire pumper will be used as a portable/FLEX pump and will supply water to the RHR system through crosstie valves from the RHRSW system. The fire pumper is to be located at the ESSW pump house and pump water from the SSES spray pond into the RHRSW system. Water may be supplied to the suppression chamber, the RPV or the SFP by opening RHR system valves. Water may also be supplied directly to the SFP through flexible hose to either flood or spray the SFP. Cooling water is also to be supplied to the RCIC lubricating oil cooler from the RHRSW system through a temporary hose jumper.

The licensee provided a preliminary overview of the hydraulic calculations that support the coping strategy during the audit process. Calculation EC-013-1896 provides the performance requirements for the FLEX pump and concluded that the pump must be capable of supplying 1340 gpm at a head of approximately 485 feet or approximately 210 psi. This includes 500 gpm spray to the two (2) SFPs, 315 gpm to each of the two (2) RPVs, 50 gpm to compensate for leakage from each of the four (4) recirculation pump seals and 10 gpm total to the two RCIC pump lubricating oil coolers. The licensee also provided calculation EC-016-1043 during the audit process. That calculation established the basis for the hydraulic models for makeup using the fire pumper to the RPV, suppression pool and SFP. The licensee also discussed their preliminary load analysis for the FLEX electrical generators size calculations during the audit process.

The Integrated Plan identifies the spray pond as the water source for strategies for maintaining core and SFP cooling. The licensee discussed the water quality from this source during the audit process.

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 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 Emergency Operating Procedures and FLEX Support Guidelines or within the SAMGs. Typically these parameters would include the following:
>
> - RPV Level
> - RPV Pressure

- Containment Pressure
- Suppression Pool Level
- Suppression Pool 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.

A review was made of the identified instrumentation necessary for successful completion of mitigation strategies. The licensee listed the installed instrumentation credited for the coping evaluation for maintaining core cooling and containment during ELAP on pages 16, 17, 28 and 34 of the Integrated Plan. The following instrumentation was included: RPV water level and pressure, drywell pressure and temperature, suppression chamber pressure, water level and temperature, RCIC flow and SFP level.

On page 34 of the Integrated Plan, the licensee stated that a modification will be made to the SFP level instrumentation per NRC Order EA-12-051.

The reactor and containment parameters discussed in the Integrated Plan appear to provide adequate instrumentation to implement the coping strategies for maintaining core and containment cooling.

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 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 & regulators (if required by plant strategy).

A review was made of pneumatic systems associated with the mitigation strategies identified by the licensee in the Integrated Plan. The SRVs are used for the ADS function at SSES. As discussed by the licensee on pages 13, 14 and 18 of the Integrated Plan, although the normal pneumatic supply is lost due to loss of power, the Containment Instrument Gas (CIG) 90 psi accumulator automatically supplies backup pneumatic pressure for SRV operation. Additionally, each valve is provided with safety related accumulator that will provide enough pneumatic volume at sufficient pressure to cycle open each valve two (2) times.

On page 63 of the integrated plan, the licensee stated that high pressure backup nitrogen cylinders are stored in the reactor building and that the backup cylinders are protected from all BDBEEs. The licensee identified the need to evaluate a means to assure continued long term gas supply for ADS/SRVs. The licensee referenced their ongoing analysis for long term nitrogen supply for ADS/SRVs in the six-month update dated August 28, 2013. During the audit process the licensee stated that to ensure a reliable post-accident nitrogen source, each instrument gas 150 psig header backed up by a 2,200 psig nitrogen bank. Each unit has 26 nitrogen cylinders, 13 cylinders on each division 150 psig header. The design basis is to supply operating gas to ADS SRVs for three days post-accident. The licensee stated that they intend to supply one division of ADS SRVs of each Unit with a remote pneumatic supply using a high pressure supply hose through seismically qualified structures.

The licensee has self-identified the need to complete analysis that would assure long term gas supply to the ADS/SRVs. The integrated plan does not yet include coping strategies and methods for recharging the CIG from backup sources. Also missing is a discussion of the robustness of those backup sources and interconnecting piping, the discussion of access pathways and also the seismic robustness of structures that need to be accessed. Therefore, there is insufficient detail in the integrated plan to evaluate the coping strategies to sustain the operation of the SRVs during an ELAP. This has been identified as Confirmatory Item 3.2.1.6.A, in Section 4.2, below.

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 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:

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

A review was made of the coping strategies to maintain core cooling during an ELAP with LUHS that occurs when the reactor is in Cold Shutdown or Refueling. On pages 14 and 15 of the Integrated Plan, the licensee stated that the time to boil during refueling is less than one hour and that the time for fuel to uncover is approximately 6.7 hours after boiling begins. If an ELAP occurs during Cold Shutdown, water in the vessel will heat up and will begin to pressurize the RPV. RCIC can be returned to service to provide injection flow and pressure controlled with the SRVs.

The Generic Concern related to shutdown and refueling requirements is applicable to the plant. This 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 process.

The licensee informed the NRC of their plans to abide by this generic 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 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 in part:

> 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.

A review was made of the use of portable pumps for FLEX mitigation strategies. On pages 18 and 19 of the Integrated Plan, the licensee stated that SSES will use a fire pumper as a portable/FLEX pump to pressurize the RHRSW system at the ESSW pump house. The RHRSW system will supply water to the RHR system through cross-tie valves. Water can be supplied either to replenish the suppression pool or to inject directly into the RPV and into the

SFP.

The licensee also discussed these strategies during the audit process. The suction source for the FLEX pump is the spray pond, which is the UHS. The licensee has provided an overview of the hydraulic calculations for RPV injection and SFP fill during the audit process. Calculation EC-016-1043 provided an analysis of the hydraulic model for supplying water to support coping strategies for maintaining core, containment and SFP cooling. Calculation EC-013-1896 established the FLEX pump performance requirements. Protection and storage of portable/FLEX pumps during a BDBEE is discussed in Section 3.1, above.

The licensee assumed a total flow rate of 500 gpm supplied to the two SFPs by the fire pumper. The makeup flow to each of the RPVs is 415 gpm through the RHR system. That flow rate includes 100 gpm reactor recirculation pump seal leakage for each Unit or 50 gpm per pump seal. The makeup flow to each suppression pool is 175 gpm. The licensee assumed that simultaneous makeup was not required to both the RPVs and the suppression pools. Therefore, the maximum flow required to maintain core and SFP cooling of both Units is 1330 gpm. In addition, there is an additional 10 gpm required to cool the RCIC lubricating oil coolers. The licensee assumed that five (5) inch diameter flexible hose would be used for FLEX pump suction and discharge. The pump curve that the licensee supplied during the audit process confirmed that the FLEX pump can supply 1330 gpm at 210 psid taken at 1700 rpm engine speed. Since the engine is rated to operate at 2100 rpm, the pump has adequate margin.

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 portable pumps 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 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 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 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.

A review was made of the discussions in the licensee's Integrated Plan for maintaining SFP cooling during an ELAP.

On page 35 of the Integrated Plan the licensee stated that the SSES Unit 1 and Unit 2 fuel pools are normally cross-tied. This ties the volume of the two pools together through the open transfer gates. The licensee stated that the normal water level in each pool is at least 22 feet above the top of stored fuel. The SSES FSAR, Section 9.3.1 design basis maximum heat load for each SFP pool is based on a full core offload 250 hours after reactor shutdown and the remainder of the SFP completely filled with previously discharged assemblies. Based on the design basis heat load, the SFP will heat up from 115 to 212 degree Fahrenheit in 13.6 hours event time for the condition where the Unit 1 and 2 SFPs are cross-tied. The boil-off rate for design basis condition is 93 gpm. The licensee also stated that the typical SFP heat loads result in the time to heat the SFP from 115 to 212 degrees Fahrenheit of approximately 36 hours with a boil-off make-up rate of 31 gpm.

On pages 35 and 36 of the Integrated Plan, the licensee discussed three coping strategies for maintaining SFP cooling. In the first method the FLEX pump pressurizes the RHRSW system at the ESSW pump house. Water in the RHRSW is supplied to the RHR system through the system crosstie valves. Water from RHR can be supplied directly to SFP by opening RHR to SFP cooling assist valves. This method will allow the FLEX pump to supply at least 93 gpm to the SFP through seismically qualified piping. The spray pond is the pump suction source.

The second method utilizes a new fire hose connection installed on the RHRSW piping to allow pressurizing a flexible hose that is routed to the refueling floor where it will supply at least 93 gpm each of the two (2) SFPs. An alternate to this second method is discussed on page 36 of the Integrated Plan. In this alternate method the flexible hose will supply 250 gpm to spray nozzles located on the refueling floor at each of the two (2) SFPs. In addition, the licensee stated that the Division I or Division II RHRSW connections in the ESSW pump house can be used to provide the required SFP spray flow.

The licensee provided an additional discussion of the coping strategies to maintain SFP cooling during the audit process. Calculation EC-16-1043 provided an analysis of the hydraulic model for supplying water to support coping strategies for maintaining core, containment and SFP cooling. Calculation EC-013-1896 established the FLEX pump performance requirements. Protection and storage of portable/FLEX pumps during a BDBEE is discussed in Section 3.1, above.

NEI 12-06, Table C-3 specifies that plant specific strategies should be considered for establishing a vent pathway for steam and condensate from the boiling SFP to allow access and prevent equipment problems.

A review was made of the discussions in the licensee's Integrated Plan for maintaining access to and habitability of the SFP area during an ELAP.

On page 43 of the Integrated Plan the licensee stated that in their evaluation of vent pathway for steam and condensate from the SFP, the east wall of the reactor refueling floor is equipped with hatches that open into an equipment area for HVAC ductwork that is outside secondary containment. This equipment area has a roof hatch that opens to the atmosphere. These hatches could be opened manually to provide a vent path for spent fuel pool steam and condensation. However, the licensee has stated that their evaluation of a refueling floor ventilation strategy remains in-progress. The licensee will evaluate the effectiveness of this strategy.

The licensee also discussed the removable gates are provided at the transfer canal of the SFP. These gates are opened to facilitate movement of fuel during refueling operations. The gates have pneumatic seals that prevent water from leaking out of the SFP when water on the reactor cavity side of the gate is lower than that of the SFP. The seals are supplied by the instrument air system with a backup supply from stored nitrogen bottles. Since the instrument air system would be inoperable during an ELAP, SFP gate seals are pressurized by nitrogen cylinders that are located in an equipment storage area of the refuel floor. The licensee stated that an evaluation will be done to determine if the storage area needs to be relocated below the refuel floor due to habitability concerns.

The licensee has identified that additional analysis and actions need to be completed in regard to vent pathways and habitability of the SFP. Therefore, the information available, at this time, is not sufficient to conclude that the Integrated Plan will conform to the specifications of NEI 12-06, Table C-3 regarding a vent pathway for SFP steam and condensation. This is identified Confirmatory Item 3.2.2.A, in Section 4.2, below.

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 SFP cooling strategies if these requirements are implemented as described.

3.2.3 Containment Functions 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 II 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. Furthermore, the performance attributes listed in Table C-2 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.

The licensee discussed the coping strategies for maintaining the containment on pages 26 through 30 of the Integrated Plan. The licensee also discussed the coping strategies for maintaining the containment in the six-month update and during the audit process. A review was made of the licensee's plans for maintaining containment during an ELAP.

The licensee's strategy is to utilize the guidance of Revision 3 of the Boiling Water Reactor Owner's Group (BWROG) Emergency Procedures Guidelines (EPG) Severe Accident Guidelines (SAG) to open the Hardened Containment Vent System (HCVS) and remove decay heat from the primary containment following an ELAP event. To analytically demonstrate the effectiveness of this strategy, the licensee performed calculations using the MAAP4 computer program to model the containment response (see Section 3.2.1.1 for details on the acceptability of MAAP4).

On page 53 of the Integrated Plan, the analysis showed that, if the HCVS is opened when the suppression pool (SP) reaches approximately 200 degrees Fahrenheit, the peak pressure and temperature in the SP were calculated to be 22 psia and 228 degrees Fahrenheit, respectively. In the drywell, the peak pressure and temperature values were calculated to be 24.6 psia and approximately 252 degrees Fahrenheit. Table 6.2-1 of the licensee's FSAR indicates that the design pressure for both the SP and the drywell is 53 psig. It also indicates that the drywell design temperature is 340 degrees Fahrenheit while the SP design temperature is 220 degrees Fahrenheit.

Clearly, the analysis shows that the design pressure for both the SP and drywell is not exceeded, nor is the design temperature for the drywell exceeded when the HCVS is opened as modeled. However, the calculated temperature of the SP exceeds by approximately 8 degrees Fahrenheit, the design temperature of the SP, which is 220 degrees Fahrenheit as indicated in Table 6.2-1 of the FSAR. The licensee has not yet presented a technical justification for the acceptability of exceeding this limit. This issue is identified as Confirmatory Item 3.2.3.A in Section 4.2, below.

The NRC staff also considers the adoption of Revision 3 to the BWROG EPG/SAG by licensees to be a Generic Concern (and thus an open item) because the BWROG has not addressed the potential for the revised venting strategy to increase the likelihood of detrimental effects on containment response relative to currently accepted venting strategies for events in which the venting strategy is invoked. In particular it has not been shown that the potential for negative pressure transients, hydrogen combustion, or loss of containment overpressure (as needed for pump NPSH) is not significantly different when implementing Revision 3 of the EPG/SAG as compared to Revision 2 of the EPG/SAG. Revision 3 provides for earlier venting than previous revisions. The BWR procedures are structured such that the new venting strategy is not limited to use during the BDBEEs that are the subject of EA-12-049, but could also be implemented during a broad range of events. Acceptance of EPG/SAG, Revision 3, including any associated plant-specific evaluations, is identified as Open Item 3.2.3.B in Section 4.1, below.

Preliminary calculations demonstrating the cooling water flow rate delivered through the RHR system were also discussed during the audit process. The licensee stated on page 9 of the Integrated Plan that preliminary analysis indicates that the peak suppression pool temperature will be 226 degrees Fahrenheit at 16.1 hours event time and that a second peak temperature of 228 degrees Fahrenheit at 37.2 hours event time. The same portable/FLEX pump that is used for RPV injection will be used to fill the suppression pool, although not concurrently. The flow path for both is through the RHR system and the suction source is spray pond.

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the approach is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, will be met with respect to containment functions strategies. These questions are identified as Confirmatory Item 3.2.3.A in Section 4.2 and Open Item 3.2.3.B in Section 4.1, below.

3.2.4 Support Functions

3.2.4.1 Equipment Cooling – Cooling Water

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

> *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.

A review was made of coping strategies for cooling portable/FLEX equipment deployed during an ELAP. The licensee made no reference in the Integrated Plan regarding the need for or use of, additional cooling systems necessary to assure that coping strategy functionality can be maintained. Nonetheless, the only coping strategy equipment identified in the Integrated Plan that would require some form of cooling are portable pumps and generators. These self-contained commercially available units would not be expected to require an external cooling system nor would they require ac power or normal access to the UHS.

The licensee discussed directing approximately 5 gpm of cooling water to each RCIC pump lubricating oil cooler through a hose jumper from the RHRSW system. The FLEX pump, a fire pumper will pressurize the RHRSW system, pumping water from the spray pond.

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 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:

> *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 control room, and logic cabinets. Air flow 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 air flow 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°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.

NEI 12-06, Section 3.2.1.8 states that:

> The effects of loss of HVAC in an extended loss of ac power event can be addressed consistent with NUMARC 87-00 or by plant-specific thermal hydraulic calculations, e.g., GOTHIC calculations.

A review was made of the SSES integrated Plan for discussions of coping strategies addressing the impact on critical equipment and components caused by the loss of ventilation and cooling during an ELAP. The licensee has discussed their pending review of steam and condensate from the SFP area that is also on the refueling floor level of the Reactor Building.

The licensee discussed the habitability and the temperature profile of the RCIC room on pages 40 and 42 of the Integrated Plan and during the audit process. The RCIC room temperature calculation shows that the room will reach 120 degree Fahrenheit at event time 24 hours assuming an initial temperature of 104 degree Fahrenheit. The peak room temperature of 128 degree Fahrenheit will occur at 72 hours event time under the worst conditions.

The licensee referenced a technical report GENSTP3-001 that indicates that electrical equipment in the RCIC room can experience temperature excursions up to120 degrees Fahrenheit for an indefinite period and up to 135 degrees Fahrenheit for up to 100 days. The licensee concluded that the components located within the RCIC room would not be adversely impacted by this worst case temperature excursion during an ELAP.

However, the licensee has an ongoing analysis to evaluate the impact of seal leakage on RCIC room temperature in the event of a seal failure. Page 62 of the Integrated Plan cites a finding of GEH Report 0000-0155-1545, "RCIC Pump and Turbine Durability Evaluation- Pinch Point Study" which evaluated RCIC durability at elevated suppression pool temperatures. The report, which has not been submitted for NRC review, is discussed in the Integrated Plan as postulating that RCIC pump seal failures will likely occur under these circumstances. The completion of the analysis associated with the RCIC room temperature profile in the event of a RCIC pump seal failure, and the confirmation that its results do not impact the current strategies, is identified as Confirmatory Item 3.2.4.2.A in Section 4.2, below.

During the audit process, the licensee stated that the temperature analysis did not consider the effect of opening the RCIC room door. However, procedural guidance is being developed to open the RCIC room door as well as other doors in the Reactor Building early in the event to facilitate natural circulation cooling. During the audit process the licensee also stated that the licensee’s evaluation of worst case cold weather conditions indicated that the RCIC room remained above 60 degrees Fahrenheit for greater than 72 hours event time.

During the audit process, the licensee stated that the RCIC steam line isolation logic is powered from the dc distribution system and will cause RCIC system isolation in the event that the area temperature reaches approximately 167 degrees Fahrenheit. Although RCIC room temperature is not expected to exceed 130 degrees Fahrenheit in the first 24 hours of an ELAP, the licensee stated that procedural guidance would be developed to bypass this isolation. As discussed previously, the licensee has identified a coping strategy to supply cooling water to the RCIC pump lubricating oil cooler.

The licensee discussed the habitability and the temperature profile of the Engineered Safety Features (ESF) Switchgear Rooms on pages 42 and 43 of the Integrated Plan. The ESF switchgear rooms are expected to remain below 120 degrees Fahrenheit for greater than the first 72 hours of an ELAP. The licensee referenced a technical report GENSTP3-001 that indicates that electrical equipment in the RCIC room can experience temperature excursions up to 120 degrees Fahrenheit for an indefinite period. The licensee’s evaluation of worst case cold weather conditions indicated that the ESF switchgear rooms are expected to remain above 60 degrees Fahrenheit for greater than 72 hours event time.

The licensee discussed the expected hydrogen concentration and the temperature profile of the Station Battery Rooms on page 43 of the Integrated Plan and during the audit process. Calculation EC-088-0526 evaluated the Battery Room hydrogen concentration during a loss of ventilation for each of the station battery rooms where 24, 125 and 250 V battery banks are located. Hydrogen generation rates were calculated for each type of battery either on float or equalizing charge at worst case temperature conditions. Calculations were made for the time to reach a battery room hydrogen concentration of 2% at various conditions that included a continuous equalizing charge and an equalizing charge that was interrupted and switched to a float charge after one (1), two (2) or six (6) hours for each of the SSES twelve (12) battery rooms. The licensee stated on page 43 of the integrated plan that hydrogen concentrations remained below 2% for up to 102 hours in 125 V battery rooms and for up to 54 hours in 250 V battery rooms. The calculation assumed linear hydrogen generation during a one (1) hour equalizing charge and then a second lesser linear generation rate of hydrogen at a float charge. The licensee discussed mitigation strategies to open battery room doors and deploy portable ventilation fans or to reenergize battery room exhaust fans powered by FLEX electrical generators within 54 hours event time.

The licensee also stated on page 43 of the Integrated Plan that both cold and warm weather conditions, the battery room temperatures remain within design limits; therefore, no manual actions are required for maintaining battery room temperatures.

During the audit process, the licensee stated that the strategy for ventilation of the 125 V and 250 V Battery Rooms located in the Control Structures is to restart one of the two redundant Room exhaust fans during Phase 2. These fans draw air from the battery rooms and discharge directly to the Standby Gas Treatment System vent stack. Makeup air to the battery rooms is supplied from the general area of the Control Structure. Therefore, general ambient temperatures in the battery rooms are expected to preclude extreme summer and winter temperatures.

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 ventilation support function if these requirements are implemented as described.

3.2.4.3 Heat Tracing.

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

> *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.

A review was made of the SSES Integrated Plan for coping strategies discussing freeze protection.

On page 43 of the Integrated Plan the licensee provided a discussion of coping strategies to provide portable heaters to maintain the ESSW pump house temperature above freezing during extreme cold conditions. The licensee also provided a discussion for the need for heat tracing during the audit process. The licensee stated that there were no conditions identified that required heat tracing to successfully complete FLEX strategies during an ELAP.

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 and freeze protection if these requirements are implemented as described.

3.2.4.4 Accessibility – Lighting and Communications.

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.

A review was made of the Integrated Plan for coping strategies discussing plant lighting and communications systems during an ELAP that support personnel access for coping strategies that maintaining core, containment and SFP cooling.

On page 20 of the Integrated Plan, the licensee stated that modification to provide a FLEX connection to provide power to Control Room lighting had been identified.

During the audit process, the licensee stated that the emergency lighting system is comprised of two subsystems. The first subsystem is the 125V DC Station Battery Lighting System. This subsystem provides emergency lighting system throughout the plant. However, in remote areas not served by the station battery system, the emergency lighting is provided by self-contained battery powered units of which there are four types: Exist lights and stair lights which are each 2-1/2 hour rated, and emergency lighting centers and emergency lighting units each 8-hour rated.

The licensee further stated that the emergency lighting units provides emergency lighting instantaneously and automatically upon the failure or interruption of the essential lighting power supply. Emergency lighting units exist in the Control Room, operating areas that include the Reactor Building, diesel generator area, Control Structure, and ESSW Pump house, stairways and major walkways, building exits, and the Technical Support Center. In addition, members of the operating staff are equipped with flashlights.

The licensee provided its communications assessment in letters dated November 25, 2012, and June 28, 2013 (ADAMS Accession Nos. ML12332A073 and ML13179A449) in response to the NRC March 12, 2012 10 CFR 50.54(f) request for information letter for SSES. As documented in the staff analysis provided by letter dated July 10, 2013 (ADAMS Accession No.

ML13130A364), 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. The NRC staff will follow up to confirm that upgrades to the site's communication systems have been completed. This has been identified as Confirmatory Item 3.2.4.4.A. in Section 4.2, below.

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 communications support for accessibility for operator actions 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.

A review was made of the Integrated Plan for coping strategies discussing personnel access to plant protected and locked areas during an ELAP to support strategies for maintaining core, containment and SFP cooling. The licensee provided a discussion of area access in the audit process that sufficiently addressed access to plant perimeter and interior areas during an ELAP. The discussion included the administrative authority and methods for gaining plant access.

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 (9) regarding entry to protected and interior plant areas during an ELAP.

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 access to protected and locked internal plant areas if these requirements are implemented as described.

3.2.4.6 Personnel 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°F. Many states have experienced temperatures in excess of 120°F.

A review was made of the Integrated Plan for coping strategies discussing habitability of plant locations during an ELAP to allow personnel access to support strategies for maintaining core, containment and SFP cooling.

The licensee discussed their coping strategies for MCR habitability on pages 40 and 42 of the Integrated Plan. The licensee stated that their current analysis projects the control room temperature is not expected to exceed 108 degrees Fahrenheit in the first 72 hours of an ELAP and that they were continuing to evaluate control room habitability. The licensee stated that in cold weather conditions the MCR is not expected to drop below 60 degrees Fahrenheit in the first 72 hours. The licensee stated in the six-month update dated August 28, 2013, and during the audit process that the temperature calculations in progress but not yet completed. The finalization of the calculation demonstrating MCR habitability through all phases of an ELAP event is identified as Confirmatory Item 3.2.4.6.A in Section 4.2, below.

The licensee addressed the habitability of the RCIC room during the audit process. They stated that the only operator action which was postulated in the RCIC room was the connection of a hose to the oil cooler of the RCIC pump. At the time when the action was assumed to take place, the temperature of the RCIC room was conservatively, that is with no doors open, calculated to be 114 degrees Fahrenheit. The licensee stated that the FLEX procedures would be written to instruct that the RCIC room doors be opened early in an ELAP event. Furthermore, the licensee stated that the FLEX pumps which supply the cooling water to the oil cooler are the same pumps which would be able to provide injection to the RPV. Thus, if the room was inaccessible due to temperature and humidity concerns, there is no impact on the core cooling strategy because the injection pumps which take up the function after RCIC is no longer functional are already in place.

The licensee also provided additional information during the audit process and stated that no engine driven FLEX equipment would be operated inside buildings and structures.

The licensee discussed the SFP area habitability on page 43 of the Integrated Plan and stated that they had not yet completed their evaluation of the SFP area for steam and condensation during an ELAP. The results of this evaluation and the vent path strategy, if needed, will be provided in a future six-month update. This was discussed in Section 3.2.2, above.

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 accessibility for operator actions 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, raw, or borated water tanks 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.

A review was made of the Integrated Plan for discussion of water sources used for mitigating strategies for core, containment and SFP cooling. The licensee discussed coping strategies for maintaining core cooling on pages 13 through 15, 18 and 19 of the Integrated Plan. The normal RCIC pump suction source is the CST. The suction path will automatically transfer to drawing from the suppression pool on low level in the CST. The licensee discussed the instrumentation, logic and power to motor operated valves that perform the automatic transfer during the audit process. The instrumentation, logic and motor operated valves are classified as safety related, seismically qualified and powered by the dc distribution system. The licensee stated that if the CST were destroyed by a BDBEE there is a possibility that the instrumentation may fail. Because of this, the licensee has developed procedural guidance for MCR operators to remotely transfer the RCIC suction path from the CST to the suppression pool.

The licensee discussed the coping strategies for core, containment and SFP cooling during the audit process. The portable/FLEX pump will supply water to the suppression chamber, the SFP and the RPV through the RHRSW and RHR systems. Makeup water will be drawn from the ultimate heat sink, the spray pond. The licensee discussed the calculations demonstrating the required flow rates considering system back pressure, pipe and flexible hose resistance and elevation changes for phase 2 of the postulated event. The licensee indicated that similar calculations for phase 3 are planned.

On page 63 of the Integrated Plan the licensee identified ongoing analysis to evaluate the effects of injecting spray pond water into the RPV over a long period of time. The six-month update dated August 28, 2013 stated that this analysis was ongoing. Therefore, the information available at this time is not sufficient to determine that the licensee will conform to the guidance of NEI 12-06, Section 3.2.2 Guideline (5) regarding the availability of water sources during an ELAP. This has been identified as a Confirmatory Item 3.2.4.7.A., in Section 4.2, below.

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 makeup 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:

> 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.

A review was made of the Integrated Plan for coping strategies and discussion of electrical isolations, interactions and protection of station electrical distribution equipment. The licensee discussed deployment of portable/FLEX electrical generators during the transition phase on page 18 of the Integrated Plan and discussed the use of portable/FLEX RRC generators during the final phase on page 24. The licensee also provided preliminary information detailing the portions on the electrical distribution system that would be reenergized using portable/FLEX electrical generators to be used during the transition and the final phases of the ELAP. The licensee discussed preliminary information of the electrical loads that were intended to be reenergized by those generators.

During the audit process, the licensee stated that administrative controls will be used to ensure multiple sources do not attempt to simultaneously power electrical buses. FLEX generators will not be connected to any permanent electrical equipment during normal operation. The design will be based on protecting the station emergency diesel generators, station electrical switchgear, and electrical components from damage when energized by the portable/FLEX electrical generators. The licensee stated that additional details would be provided as the design process continued and submitted in a future six-month update. Therefore, the information available at this time is not sufficient to determine that protection schemes will be adequate to prevent damage to installed electrical equipment when energized by FLEX electrical generators. This is identified as Confirmatory Item 3.2.4.8.A., in Section 4.2, below.

During the audit process, the licensee further stated that FLEX generators are being sized with margin to provide for plant instrumentation, battery chargers, battery room exhaust fans, valve power, and the electrical distribution loads. This work is being done in accordance with the Engineering Change Process. FLEX Generator sizing results will be provided in future six-month update. This is identified as Confirmatory Item 3.2.4.8.B., in Section 4.2, below.

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 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.

A review was made of the Integrated Plan for the coping strategies addressing the fuel supply for portable/FLEX equipment. The licensee has not provided a discussion of fuel supply for portable/FLEX equipment. The licensee identified an action in progress on page 63 of the integrated plan. Both the six-month update dated August 28, 2013 and in the audit process, the licensee stated that this analysis and additional coping strategies remain in progress. The licensee stated that additional information will be provided in a future six-month update. Therefore, the information available is not sufficient to conclude the procedures and coping strategies to maintain a fuel supply for FLEX equipment will meet the guidance of NEI 12-06, Section 3.2.2, Guideline (13) and Section 3.2.1.3, initial condition (5). This has been identified as a Confirmatory Item 3.2.4.9.A., in Section 4.2, below.

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 and MOVs. 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, 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.

A review was made of the coping strategies to extend station battery lifetime or coping time by reducing dc bus electrical load. The licensee discussed station battery coping time and dc bus load shedding on pages 8, 9, 14, 16, 18, 27, 52 and 53 of the Integrated Plan. As discussed in the sequence of events timeline and also the discussion of time constraints identified in the timeline, load shedding is expected to be completed within 45 minutes event time. The licensee has identified the station battery coping time as 7 hours on pages 9 and 17 of the Integrated Plan and established a coping strategy to energize station battery chargers within 6 hours event time.

During the audit process, the licensee provided minimum coping times of Unit 1 batteries as 7 hours and 6 minutes, and of Unit 2 batteries as 7 hours and 45 minutes. The licensee also stated that the initial ELAP Phase 1 battery load profiles were developed by extending the SBO battery load profiles beyond 4 hours and making load adjustments as appropriate for ELAP scenario. The load sheds credited for ELAP initial phase are already in the place for SBO and are addressed in existing Calculation EC-SBOR-501, "Coping assessment for the SSES Station Blackout." There are no new load shedding coping strategies identified for ELAP identified at this time. The licensee stated that the minimum design bus voltage is 104 Vdc at the 125 Vdc Class 1E distribution panel and 210 Vdc at the 250 Vdc required control centers to ensure adequate voltage for operation of required electrical equipment.

As discussed above in Section 3.2.4.2, the licensee discussed the effect of high and low temperature extremes on station battery capacity during the audit process and stated that additional information would be available during a future six-month update.

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 load reduction to conserve 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, the paragraph following 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 & 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[1] 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.

[1] Testing includes surveillances, inspections, etc.

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.

A review was made of the licensee's plans for development and implementation of a program for equipment maintenance, testing and unavailability control. On page 11 in the section of its Integrated Plan regarding programmatic controls, the licensee stated that SSES will implement an administrative program for portable/FLEX equipment to establish responsibilities, and testing & maintenance requirements. The equipment for FLEX will have unique identification numbers. Installed structures, systems and components pursuant to 10 CFR 50.63 (a) will continue to meet the augmented quality guidelines of Regulatory Guide 1.155, SBO. Preventive Maintenance procedures will be established for all components and testing procedures will be developed with frequencies established based on type of equipment, original equipment manufacturer recommendations and considerations made within EPRI guidelines.

The NRC staff reviewed the Integrated Plan for SSES 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 endorsement letter from the NRC staff 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 maintaining FLEX equipment in a ready-to-use status.

The licensee informed the NRC of their plans to abide by this generic resolution and of the licensee's plans to address potential plant specific issues associated with implementing this 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 provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to 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.

A review was made of the licensee's plans for development and implementation of a program for configuration control. On page 11 in the section of its Integrated Plan regarding programmatic controls, the licensee stated that SSES will implement an administrative program for FLEX to establish responsibilities. The licensee stated that they will assess the addition of a program description into the FSAR and Technical Requirements Manual and will comply with Section 11 of NEI 12-06.

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]

2. Periodic training should be provided to site emergency response leaders[3] 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.

A review was made of the licensee's plans for development and implementation of a training program addressing FLEX. On page 12 in the section of its Integrated Plan regarding the training plan, the licensee stated that training elements of the Mitigation Strategy order will be performed using a systematic approach to training and that all required common and Unit 2 training will be completed prior to startup from the Unit 2 refueling outage in 2015. The Unit 1 specific training will be completed prior to startup from the Unit 1 refueling outage in 2016. The licensee stated that they would comply with Section 11.6 of NEI 12-06.

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 OFF SITE RESOURCES

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

[2] The Systematic Approach to Training (SAT) is recommended.
[3] Emergency response leaders are those utility emergency roles, as defined by the Emergency Plan, for managing emergency response to design basis and beyond-design-basis plant emergencies.

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).

A review was made of the licensee's plans for interface with the RRC during the final phase of an ELAP

On page 12 of the Integrated Plan, the license states that the industry will establish two RRCs to support utilities in response to BDBEEs. Each RRC will hold five (5) sets of equipment, four (4) of which will be able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle. The licensee states that communications will be established between the SSES and the SAFER team and required equipment will be mobilized as needed. The licensee states that equipment initially will be moved from an RRC to a local staging area, established by the SAFER team and the utility and that the equipment will be prepared at the staging area prior to transportation to the site. The licensee states that first arriving equipment will be delivered to the site within 24 hours from the initial request.

In addition, on pages 24 and 32 of the Integrated Plan the licensee discusses the equipment provided by the RRC for maintaining core and containment cooling during the final phase. The licensee listed this equipment and commodities on pages 50 and 51. The licensee also discussed the calculations used to size the FLEX RRC equipment during the audit process.

However, the licensee does not address Considerations 2 thru 10 of NEI 12-06, Section 12.2. Therefore the information available at this time is not sufficient to conclude that the specifications of NEI 12-06, Section 12.2 will be met. This has been combined with Confirmatory Item 3.1.1.4.A in Section 4.2, below.

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 offsite resources if these requirements are implemented as described.

4.0 OPEN AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number	Description	Notes
3.2.3.B	Revision 3 to the BWROG EPG/SAG is a Generic Concern because the BWROG has not addressed the potential for the revised venting strategy to increase the likelihood of detrimental effects on containment response for events in which the venting strategy is invoked.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.2.A	FLEX equipment deployment – The licensee's FLEX deployment plans are still under development. Confirm that the final FLEX deployment plans conform to the guidance in NEI 12-06, Sections Section 5.3.2, 6.2.3.2, 7.3.2, 8.3.2, and 9.3.2	
3.1.1.4.A	Considerations in Using Offsite Resources – The licensee does not identify primary or secondary deployment paths and staging areas, or discuss the effects of BDBEE on deployment strategies for receiving offsite resources, or any applicable contingency plans. Confirm that the final strategies for receiving offsite resources conform to the guidance in NEI 12-06, Sections 5.3.4, 6.2.3.4, 7.3.4, 8.3.4, and 12.2.	
3.2.1.1.A	From the June 2013 position paper, benchmarks must be identified and discussed which demonstrate that MAAP is an appropriate code for the simulation of an ELAP event at your facility.	
3.2.1.1.B	The collapsed level must remain above Top of Active Fuel (TAF) and the cool down rate must be within technical specifications limits.	
3.2.1.1.C	MAAP must be used in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper.	
3.2.1.1.D	In using MAAP, the licensee must identify and justify the subset of key modeling parameters cited from Tables 4-1 through 4-6 of the "MAAP Application Guidance, Desktop Reference for Using MAAP Software, Revision 2" (EPRI 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.)	
3.2.1.1.E	The specific MAAP 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 specifications limits.	
3.2.1.2.A	There was no discussion of the assumed recirculation system leakage rates including the recirculation pump seal leakage rates that were used in the ELAP analysis.	
3.2.1.6.A	The analysis and actions to provide a long-term supply of operating gas for the ADS/SRVs has not yet been completed.	
3.2.2.A	Confirm that that the refueling floor ventilation strategy and evaluation is adequately address SFP area ventilation.	
3.2.3.A	The calculated temperature of the SP exceeds the design temperature of the SP indicated in Table 6.2-1 of the FSAR by approximately 8 degrees Fahrenheit. A technical justification for the acceptability of exceeding this limit must be provided by the licensee.	
3.2.4.2.A	The completion of the analysis associated with the RCIC room temperature profile in the event of a RCIC pump seal failure, and the confirmation that its results do not impact the current strategies, is identified as a Confirmatory Item.	
3.2.4.4.A	Plant communications during an ELAP was not discussed in the Integrated Plan or the audit process. Follow-up of commitments made in the communications assessment (ML12306A199) is required.	
3.2.4.6.A	The finalization of the preliminary calculation demonstrating main control room habitability through all phases of an ELAP event is a Confirmatory Item.	
3.2.4.7.A	Licensee to complete analysis of spray pond water for long term use in RPV direct injection and SFP and suppression pool makeup.	
3.2.4.8.A	Licensee to complete protection scheme to prevent damage to installed electrical equipment when energized by FLEX electrical generators.	
3.2.4.8.B	Licensee to provide FLEX electrical generator sizing information.	
3.2.4.9.A	Licensee to complete procedures and coping strategy to maintain an adequate fuel supply for portable/FLEX equipment.	