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

Revision 1

February 15, 2014

Entergy Nuclear Northeast
Entergy Nuclear Operations, Inc.
James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333

Prepared for:

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

Contract NRC-HQ-13-C-03-0039
Task Order No. NRC-HQ-13-T-03-0001
Job Code: J4672
TAC No. MF1077

Prepared by:

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

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 with the guidance of NEI 12-06, or provide an acceptable alternative to demonstrate compliance with the requirements of Order EA-12-049.

2.0 EVALUATION PROCESS

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

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

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

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

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

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

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

3.0 TECHNICAL EVALUATION

By letter dated February 28, 2013, (ADAMS Accession No. ML13063A287), and as supplemented by the first six-month status report in a letter dated August 28, 2013 (ADAMS Accession No. ML13241A204), Entergy Nuclear Northeast, Entergy Nuclear Operations, Inc. (the licensee or Entergy) provided the James A. FitzPatrick Nuclear Power Plant (JAF) 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) power (ELAP) 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.

On page 1 of the Integrated Plan, in the section regarding determination of applicable extreme external hazards, the licensee stated that the seismic design for Class I structures and equipment is based on dynamic analysis using acceleration response spectrum curves normalized to a ground motion of 0.08g for the Operating Basis Earthquake and 0.15g for the Design Basis Earthquake. The NRC also refers to the Design Basis Earthquake as the Safe Shutdown Earthquake (SSE). The basis for these criteria is presented in the JAF Final Safety Analysis Report [JAF Final Safety Analysis Report, updated 2011] Section 2.6.

The licensee stated that in accordance with NEI 12-06, all sites will consider the seismic hazard and that the seismic hazard is applicable to JAF.

The licensee also stated on page 3 that the seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 had not been completed and therefore were not assumed in their Integrated Plan. As the re-evaluations are completed, appropriate issues will be entered into the corrective action system and addressed.

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

3.1.1.1 Protection of FLEX Equipment – Seismic Hazard

NEI 12-06, Section 5.3.1 states:

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

    a. In a structure that meets the plant's design basis for the 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.

On pages 19, 26, 34, and 41 in the sections of the Integrated Plan regarding the strategies for maintaining core cooling, containment, spent fuel cooling and for safety systems support, respectively, the licensee stated that protection of associated portable equipment from seismic hazards will be provided by constructing structures that meet the guidelines of NEI 12-06 Section 11 which references Sections 5 through 9 for more detailed guidance for protection of FLEX equipment during specific external events. With respect to consideration (1), during the audit process, the licensee stated that two storage facilities are planned. The selected locations are in the northeast area of the protected area just east of the radwaste building and outside the protected area to the south and east of the protected area near the off-site wellness center. The storage buildings will be designed for seismic criteria equivalent to ASCE 7-10, and local building codes.

With respect to considerations 2 and 3, the licensee stated during the audit process that storage of large FLEX equipment will take into consideration protection of the equipment by location or securing the equipment to ensure that there are no seismic interactions between the FLEX equipment during a seismic event.

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 of FLEX equipment considering the 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.

Two locations for storage of the FLEX equipment have been selected and haul routes of the FLEX equipment to the staging areas have been identified as shown in Figure 3, page 55, in the Integrated Plan. During the audit process, the licensee stated that potential for soil liquefaction along the deployment routes has not yet been evaluated. This is identified as Confirmatory Item 3.1.1.2.A in Section 4.2.

On page 3, in the section of the Integrated Plan discussing key site assumptions to implement NEI 12-06 strategies, Entergy stated that the designed hardened connections are protected against external events or are established at multiple and diverse locations. On pages 19, 22, 23, 33, and 40 in the Integrated Plan, Entergy provided details on the new connections required to support the FLEX strategies. Furthermore during the audit the licensee stated that FLEX equipment connection points will be located in seismically qualified or seismically robust structures. At least one connection point will only require access through seismic structures. If located outside a structure, connection points will be evaluated for seismic interactions, extreme cold, high wind and high temperature.

With regard to consideration 4 above, the Integrated Plan did not address whether power would be required to move or deploy equipment. During the audit process, the licensee stated that design details of the structures have not been completed. This is identified as Confirmatory Item 3.1.1.2.B in Section 4.2.

On page 45 of the Integrated Plan, the licensee identified four super duty pickup trucks and two flatbed trailers as portable FLEX equipment. However, it is not clear where this equipment is stored and how it is protected from the seismic event. This is identified as Confirmatory Item 3.1.1.2.C in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Items provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to deployment of FLEX equipment considering the 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 [alternating current] power (e.g., gravity drainage from lake or cooling basins for non-safety-related cooling water systems).
>
> 3. For sites that use ac power to mitigate ground water in critical locations, a strategy to remove this water will be required.
>
> 4. Additional guidance may be required to address the deployment of FLEX for those plants that could be impacted by failure of a not seismically robust downstream dam.

On pages 15, 16 and 25 of the Integrated Plan, the licensee listed the installed instrumentation credited for monitoring the effectiveness of the FLEX coping strategies. These instruments are discussed in more detail in Section 3.2.1.5. The licensee's Integrated Plan with regard to procedural interface (seismic) did not address 1) reference sources for the plant operators that provide approaches to obtaining necessary instrument readings using a portable instrument and 2) guidance for critical actions to perform until alternate indications can be connected and on how to control critical equipment without associated control power. During the audit process, the licensee stated that the FLEX support guidelines (FSGs) and supporting procedures will be developed addressing the guidance in NEI 12-06 Section 5.3.3.

The licensee's Integrated Plan does not address large internal flooding sources. During the audit process, the licensee addressed this consideration by stating that the evaluation has not yet been performed. This is identified as Open Item 3.1.1.3.A in Section 4.1.

The licensee's Integrated Plan does not address the use of alternating current (ac) power to mitigate ground water in critical locations. During the audit process, the licensee addressed this consideration by stating that the levels in the perimeter pits will be monitored and temporary power will be provided to the perimeter drain pumps as needed.

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

3.1.1.4 Considerations in Using Offsite Resources – Seismic Hazard

NEI 12-06, Section 5.3.4 states:

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

On page 10, in the section of the Integrated Plan discussing the Regional Response Center (RRC), Entergy stated that the industry has selected a vendor to manage two RRCs to provide large equipment in support of the response to BDBEEs. Each RRC will store and maintain five sets of equipment, four of which are expected to be fully deployable upon request. The fifth set is provided to account for equipment that may be unavailable due to its maintenance and testing cycle.

The licensee stated that JAF will utilize the industry RRCs for Phase 3 equipment. In an ELAP event, communications would be established between JAF and the industry Strategic Alliance for FLEX Emergency Response (SAFER) team and required equipment mobilized as needed. JAF will enter into a contractual agreement with the SAFER team. Equipment will initially be moved from an RRC to a local staging area, established by the SAFER team and JAF. The equipment will be prepared at the staging area prior to transport to the site. First arriving equipment, as established during development of the SAFER Response Plan (RRC playbook), will be delivered to the site within 24 hours from the initial request.

On page 22, in the section of the Integrated Plan discussing coping strategies to maintain core cooling during Phase 3, Entergy stated that equipment transported to the site will be either immediately staged at the point of use or temporarily stored at the lay down area. The lay down area is located outside the protected area on the south side of the plant near the main entrance.

Entergy has not yet identified the local offsite staging area(s) for the RRC FLEX equipment nor evaluated the methods for delivery of equipment from the offsite staging area to the site under various conditions such as seismic, flooding, high winds, and snow, ice and extreme cold. The identification of local offsite staging areas and evaluation of delivery methods following a seismic event has been identified as Confirmatory Item 3.1.1.4.A in Section 4.2.

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

On page 1, in the section of the Integrated Plan discussing the external flood hazard assessment, Entergy stated that JAF is built above the design basis flood level. Per JAF FSAR (JAF Final Safety Analysis Report, updated 2011, Sections 2.4.3.2 and 2.4.3.7), the Probable Maximum Flood (PMF) elevation at the screenwell is 255 ft. This is based on a maximum lake level of Elevation 250 feet, and considers the setup (4.1 feet) and maximum precipitation (0.35 feet).

In this section of the Integrated Plan, the licensee stated that the maximum probable flood lake level is determined considering the maximum lake level, a maximum wind setup of 4.1 feet, the maximum rainfall of 0.35 feet and a maximum wave run-up height of 7.5 feet; this results in a maximum probable flood lake level of just under 262'. The grade elevation at JAF is 272 ft (JAF FSAR 2011, Section 2.4.3.7). Therefore, JAF is built above the design basis flood level and is considered a "dry" site by the NEI guidance (NEI 12-06, Section 6.2.1) and "dry" sites are not required to evaluate flood-induced challenges.

The licensee stated that the external flood hazard screens out as not applicable to JAF.

On page 3, in the section of the Integrated Plan discussing key assumptions to implement NEI 12-06 strategies, the licensee stated that the flooding re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 had not been completed and therefore were not assumed in the Integrated Plan. As the re-evaluations are completed, appropriate issues will be entered into the corrective action system and addressed.

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

On pages 19, 26, 34, and 41 in the sections of the Integrated Plan regarding the strategies for maintaining core cooling, containment, spent fuel cooling and for safety systems support, respectively, the licensee stated that protection of associated portable equipment from flooding hazards is not applicable since the flooding hazard has been screened out as discussed in Section 3.1.2.1 above. During the audit process, the licensee restated that because JAF is a "dry" site per NEI guidance, no further evaluation of the flood hazard is required.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of FLEX equipment considering the 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 [reactor coolant system], isolating accumulators, isolating RCP [reactor coolant pump] seal leak off, obtaining dewatering pumps, creating temporary flood barriers, etc. These factors can be credited in considering how the baseline capability is deployed.
>
> 2. The ability to move equipment and restock supplies may be hampered during a flood, especially a flood with long persistence. Accommodations along these lines may be necessary to support successful long-term FLEX deployment.
>
> 3. Depending on plant layout, the ultimate heat sink may be one of the first functions affected by a flooding condition. Consequently, the deployment of the FLEX equipment should address the effects of LUHS [loss of ultimate heat sink], as well as ELAP.
>
> 4. Portable pumps and power supplies will require fuel that would normally be obtained from fuel oil storage tanks that could be inundated by the flood or above ground tanks that could be damaged by the flood. Steps should be considered to protect or provide alternate sources of fuel oil for flood conditions. Potential flooding impacts on access and egress should also be considered.
>
> 5. Connection points for portable equipment should be reviewed to ensure that they remain viable for the flooded condition.
>
> 6. For plants that are limited by storm-driven flooding, such as Probable Maximum Surge or Probable Maximum Hurricane (PMH), expected storm conditions should be considered in evaluating the adequacy of the baseline deployment strategies.

7. Since installed sump pumps will not be available for dewatering due to the ELAP, plants should consider the need to provide water extraction pumps capable of operating in an ELAP and hoses for rejecting accumulated water for structures required for deployment of FLEX strategies.

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

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

As discussed in Section 3.1.2.1, the JAF site is designated a "dry site." During the audit process, the licensee restated that because JAF is a “dry” site per NEI guidance, no further evaluation of the flood hazard is required. Therefore, considerations 1 through 9 related to deployment during a flood are not applicable to JAF.

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

As discussed in section 3.1.2.1 above, the licensee screens as a dry site and as such, no evaluation of the above considerations is required.

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

On page 10, in the section of the Integrated Plan discussing the RRCs, Entergy stated that the industry has selected a vendor to manage two RRCs to provide large equipment in support of the response to BDBEEs. Each RRC will store and maintain five sets of equipment, four of which are expected to be fully deployable upon request. The fifth set is provided to account for equipment that may be unavailable due to its maintenance and testing cycle.

JAF will utilize the industry RRCs for Phase 3 equipment. In an ELAP event, communications would be established between JAF and the SAFER team and required equipment mobilized as needed. JAF will enter into a contractual agreement with the SAFER team. Equipment will initially be moved from an RRC to a local staging area, established by the SAFER team and JAF. The equipment will be prepared at the staging area prior to transport to the site. First arriving equipment, as established during development of the RRC playbook, will be delivered to the site within 24 hours from the initial request.

On page 22, in the section of the Integrated Plan discussing coping strategies to maintain core cooling during Phase 3, the licensee stated that equipment transported to the site will be either immediately staged at the point of use or temporarily stored at the lay down area. The lay down area is located outside the protected area on the south side of the plant near the main entrance.

Entergy has not yet identified the local offsite staging area(s) for the RRC FLEX equipment nor evaluated the methods for delivery of equipment from the offsite staging area to the site under various conditions such as seismic, flooding, high winds, and snow, ice and extreme cold. The identification of local offsite staging areas and evaluation of delivery methods during a flooding event has been combined with Confirmatory Item 3.1.1.4.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to offsite 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 mph exceeds 10^{-6} per year, the site should address hazards due to extreme high winds associated with hurricanes.

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

On page 2, in the section of the Integrated Plan discussing severe storms with high wind assessment, the licensee stated that as indicated in NEI 12-06 Figure 7-1, hurricane winds in excess of 130 mph are not expected to occur at JAF. However, per the NEI 12-06 Figure 7-2, a recommended design tornado wind speed of 169 mph is identified. The licensee stated that the high wind hazard (169 mph tornado winds) is applicable to JAF.

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 high wind screening 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.

On pages 20, 27, 34, and 41 in the sections of the Integrated Plan regarding the strategies for maintaining core cooling, containment, spent fuel cooling and for safety systems support, respectively, the licensee stated that protection of associated portable equipment from the high wind hazards would be provided by constructing structures that meet the guidelines of NEI 12-06, Section 11, which references Sections 5 through 9 for more detailed guidance for protection of FLEX equipment during specific external events. During the audit process, the licensee stated that the two storage facilities in geographically separate locations with the selected locations in the northeast area of the protected area just east of the radwaste building and outside the protected area to the south and east of the protected area near the off-site wellness center. However, the licensee did not provide the separation distance of the storage buildings or the relation of the axis of separation to the predominant path of tornados in the geographic area to demonstrate that at least N sets of FLEX equipment would remain deployable following the high wind event. This is identified as Open Item 3.1.3.1.A in Section 4.1.

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, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of FLEX equipment considering the high wind hazard. This concern is identified as Open Item 3.1.3.1.A above and in Section 4.1.

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.

Consideration 1, 2 and 5 are not applicable to JAF since the plant is not susceptible to the hurricane hazard as noted in Section 3.1.3 of this technical evaluation report.

The Integrated Plan did not address potential impacts from wind generated debris nor identify any debris removal equipment to be available on site to facilitate deployment of FLEX equipment in Phase 2. This is identified as Confirmatory Item 3.1.3.2.A in Section 4.2.

The protection of the means to move FLEX equipment from the high wind hazard has not been addressed in the Integrated Plan. This is identified as Confirmatory Item 3.1.3.2.B in Section 4.2.

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

On page 8, in the section of the Integrated Plan discussing how strategies will be deployed in all modes, the licensee stated that the identified paths and deployment areas will be accessible during all modes of operation. In addition the clearing of these paths following any significant external event or hazard will be handled on a priority basis. This deployment strategy will be included within an administrative program in order to keep pathways clear or implement actions to clear the pathways.

On page 15, in the section of the Integrated Plan discussing procedures, strategies and guidelines for maintaining core cooling during the initial phases, the licensee stated that JAF will utilize the industry-developed guidance from the Owners Groups, the Electric Power Research Institute (EPRI), and NEI Task team to develop site-specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current emergency operating procedures (EOPs).

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

3.1.3.4 Considerations in Using Offsite Resources – High Wind Hazard

NEI 12-06, Section 7.3.4 states:

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

On page 10, in the section of the Integrated Plan discussing the RRCs, Entergy stated that the industry has selected a vendor to manage two RRCs to provide large equipment in support of the response to BDBEEs. Each RRC will store and maintain five sets of equipment, four of which are expected to be fully deployable upon request. The fifth set is provided to account for equipment that may be unavailable due to its maintenance and testing cycle.

JAF will utilize the industry RRCs for Phase 3 equipment. In an ELAP event, communications would be established between JAF and the industry SAFER team and required equipment mobilized as needed. JAF will enter into a contractual agreement with the SAFER team. Equipment will initially be moved from an RRC to a local staging area, established by the SAFER team and JAF. The equipment will be prepared at the staging area prior to transport to the site. First arriving equipment, as established during development of the RRC playbook, will be delivered to the site within 24 hours from the initial request.

On page 22, in the section of the Integrated Plan discussing coping strategies to maintain core cooling during Phase 3, the licensee stated that equipment transported to the site will be either immediately staged at the point of use or temporarily stored at the lay down area. The lay down area is located outside the protected area on the south side of the plant near the main entrance.

Entergy has not yet identified the local offsite staging area(s) for the RRC FLEX equipment nor evaluated the methods for delivery of equipment from the offsite staging area to the site under various conditions such as seismic, flooding, high winds, and snow, ice and extreme cold. The identification of local offsite staging areas and evaluation of delivery methods following high wind events has been combined with Confirmatory Item 3.1.1.4.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to offsite resources 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 35^{th} Parallel should provide the capability to address extreme snowfall with snow removal equipment. Finally, all sites except for those within Level 1 and 2 of the maximum ice storm severity map contained in Figure 8-2 should address the impact of ice storms.

On page 1 of the Integrated Plan, in the section regarding the determination of applicable extreme external hazards, the licensee stated that the JAF site is located above the 35th parallel and is subject to the extreme cold hazards, including snow and ice. The site is located within the region characterized by NOAA as subject to significant accumulations during three-day snowfalls. The site is located within the region characterized by EPRI as ice severity level 5. As such, the JAF site is subject to severe icing conditions that could also cause catastrophic destruction to electrical transmission lines.

The licensee stated that the extreme cold hazard, including snow and ice, is applicable to JAF.

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

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

NEI 12-06, Section 8.3.1 states:

> These considerations apply to the protection of FLEX equipment from snow, ice, and extreme cold hazards:
>
> 1. For sites subject to significant snowfall and ice storms, portable FLEX equipment should be stored in one of the two configurations.
>
>   a. In a structure that meets the plant's design basis for the snow, ice and cold conditions (e.g., existing safety-related structure).
>
>   b. In a structure designed to or evaluated equivalent to ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures* for the snow, ice, and cold conditions from the site's design basis.
>
>   c. Provided the N sets of equipment are located as described in a or b above, the 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.).

On page 3, in the section of the Integrated Plan discussing the key assumptions that were considered in the development and implementation of FLEX strategies, the licensee stated that Phase 2 FLEX components stored at the site will be protected against the applicable hazards in accordance with NEI 12-06.

On pages 20, 27, 34, and 41 in the sections of the Integrated Plan regarding the strategies for maintaining core cooling, containment, spent fuel cooling and for safety systems support, respectively, the licensee stated that protection of associated FLEX portable equipment from snow, ice and extreme cold hazards would be provided by constructing structures that meet the guidelines of NEI 12-06, Section 11, which references Sections 5 through 9 for more detailed guidance for protection of FLEX equipment during specific external events. During the audit process, the licensee provided additional information stating that the storage facilities will be heated as necessary in accordance with manufacturer recommendations and that the FLEX storage structures have to meet ASCE 7-10 for snow and ice loading and cold conditions or otherwise meet the site design basis snow and ice loading.

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 of FLEX equipment considering the 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.

On page 8, in the section of the Integrated Plan discussing how strategies will be deployed in all modes, the licensee stated that the identified paths and deployment areas will be accessible during all modes of operation. In addition, the clearing of these paths following any significant external event or hazard will be handled on a priority basis. This deployment strategy will be included within an administrative program in order to keep pathways clear or actions to clear the pathways. However, the Integrated Plan did not address the means for snow removal and does not list snow removal equipment in the table on page 45 which shows the portable FLEX equipment for Phase 2. This is identified as Confirmatory Item 3.1.4.2.A in Section 4.2.

The licensee had not addressed the potential impact on the UHS due to ice blockage or formation of frazil ice as a result of extreme cold. This is identified as Open Item 3.1.4.2.B in Section 4.1.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory and Open Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to deployment of FLEX equipment considering the 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 transporting the FLEX equipment. This includes both access to the transport path, e.g., snow removal, and appropriately equipped vehicles for moving the equipment.

As discussed in Section 3.1.4.2 of this report, the licensee has committed to develop an administrative program to ensure pathways remain clear or compensatory actions will be implemented to ensure all strategies can be deployed during all modes of operation.

Entergy has not discussed changes to station procedures relative to an ELAP during a snow, ice and extreme cold hazard. However, the licensee has stated that they have not yet completed plans for storage buildings and deployment paths for portable/FLEX equipment, but will use industry developed guidance to develop specific site procedures.

On page 15, in the section of the Integrated Plan discussing procedures, strategies and guidelines for maintaining core cooling during the initial phases, the licensee stated that JAF will utilize the industry-developed guidance from the Owners Groups, EPRI and NEI Task team to develop site-specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.

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

3.1.4.4 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.

On page 10, in the section of the Integrated Plan discussing the RRCs, Entergy stated that the industry has selected a vendor to manage two RRCs to provide large equipment in support of the response to BDBEEs. Each RRC will store and maintain five sets of equipment, four of which are expected to be fully deployable upon request. The fifth set is provided to account for equipment that may be unavailable due to its maintenance and testing cycle.

JAF will utilize the industry RRCs for Phase 3 equipment. In an ELAP event, communications would be established between JAF and the industry SAFER team and required equipment mobilized as needed. JAF will enter into a contractual agreement with the SAFER team. Equipment will initially be moved from an RRC to a local staging area, established by the SAFER team and JAF. The equipment will be prepared at the staging area prior to transport to the site. First arriving equipment, as established during development of the RRC playbook, will be delivered to the site within 24 hours from the initial request.

On page 22, in the section of the Integrated Plan discussing coping strategies to maintain core cooling during Phase 3, the licensee stated that equipment transported to the site will be either immediately staged at the point of use or temporarily stored at the lay down area. The lay down area is located outside the protected area on the south side of the plant near the main entrance.

Entergy has not yet identified the local offsite staging area(s) for the RRC FLEX equipment nor evaluated the methods for delivery of equipment from the offsite staging area to the site under various conditions such as seismic, flooding, high winds, and snow, ice and extreme cold. The identification of local offsite staging areas and evaluation of delivery methods following a snow, ice and extreme cold event has been combined with Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.5 High Temperatures

NEI 12-06, Section 9 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.

On page 2, in the section of the Integrated Plan discussing the determination of applicable extreme external hazards, the licensee noted that per NEI 12-06 Section 9.2, all sites will address high temperatures. Extreme high temperatures are not expected to impact the utilization of off-site resources or the ability of personnel to implement the required FLEX strategies. Site industrial safety procedures currently address activities with a potential for heat stress to prevent adverse impacts on personnel. The licensee stated that the high temperature hazard is applicable to JAF.

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 high temperature hazards 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.

On pages 20, 27, 34, and 41 in the sections of the Integrated Plan regarding the strategies for maintaining core cooling, containment, spent fuel cooling and for safety systems support, respectively, the licensee stated that protection of associated portable equipment from high temperature hazards would be provided in structures constructed to meet the guidelines of NEI 12-06, Section 11, which references Sections 5 through 9 for more detailed guidance for protection of FLEX equipment during specific external events. During the audit process, the licensee stated that due to the plant's location on the southern shore of Lake Ontario, extreme high temperatures are not expected. FLEX equipment maintained in the FLEX storage structures will be provided with adequate ventilation.

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 of FLEX equipment considering 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.

There was insufficient information provided in the Integrated Plan to demonstrate that the impact of high temperature has been addressed for the deployment of equipment per the guidance of NEI 12-06. The licensee addressed this issue during the audit process by stating that temperatures will be determined in the areas where portable equipment is stored and at points of deployment where the equipment will operate (and therefore the temperature for which the equipment needs to be procured). Heat and exhaust dissipated from the FLEX equipment during operation will be accounted for in the location where the FLEX equipment will be operated and on the requirements for the equipment.

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

In the Integrated Plan, the licensee has discussed the effect of high area temperatures resulting from an ELAP on accessibility to several rooms and facility locations. However, there is no discussion of the potential effects of high temperatures at the location where the portable/FLEX equipment would be stored or operated in the event of high temperatures. During the audit process, the licensee stated that the new storage buildings housing the FLEX equipment will be provided with ventilation to cope with the high ambient 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 procedural interfaces if these requirements are implemented as described.

3.2 PHASED APPROACH

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

To meet 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)/reactor makeup in order to restore core or SFP capabilities as described in NEI 12-06, Section 3.2.2, Guideline (13). The NRC endorsed this approach with JLD-ISG-2012-01.

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

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

On pages 7, 12, 14, and 24 of the Integrated Plan, the licensee identified the industry-developed Modular Accident Analysis Program (MAAP) code as the analysis method for determining plant response to the ELAP event. The plant response and FLEX implementation strategies are shown in the Integrated Plan in Attachment 1A "Sequence of Events (SOE) Timeline" which includes the time constraints and the technical basis for the site. During the audit the licensee stated that MAAP version 4.0.5 was used, using site-specific inputs; and the site-specific analysis followed as a guide the generic analysis done by GE Hitachi Nuclear Energy (GEH) in NEDC-33771P/NEDO-33771 "GEH Evaluation of FLEX Implementation Guidelines," Revision 0 (hereinafter referred to as NEDC-33771P). (Revision 1 of this document was submitted to the NRC for information and has a publicly available version at ADAMS Accession No. ML130370742.)

MAAP 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 acknowledges that MAAP4 has been used many times over the years and in a variety of forums for severe and beyond design basis analysis, MAAP4 is not an NRC-approved code, and the NRC staff has not examined its technical adequacy for performing thermal hydraulic analyses. Therefore, during the review of licensees' Integrated Plan, the issue of using MAAP4 was raised as a Generic Concern and was addressed by 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 numbers for this report are provided as follows:

(1) 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. This is Confirmatory Item 3.2.1.1.A in Section 4.2.

(2) The collapsed level must remain above Top of Active Fuel (TAF) and the cool down rate must be within technical specifications limits. This is Confirmatory Item 3.2.1.1.B in Section 4.2.

(3) 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. This is Confirmatory Item 3.2.1.1.C in Section 4.2.

(4) 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" (Electric Power Research Institute Report 1020236). This should include response at a plant-specific level regarding specific modeling options and parameter choices for key models that would be expected to substantially affect the ELAP analysis performed for that licensee's plant. Although some suggested key phenomena are identified below, other parameters considered important in the simulation of the ELAP event by the vendor / licensee should also be included.

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

   This is Confirmatory Item 3.2.1.1.D in Section 4.2.

(5) 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. This is Confirmatory Item 3.2.1.1.E in Section 4.2.

The concern regarding the MAAP limitations was addressed during the audit process. The licensee stated that JAF will provide an updated MAAP analysis which will conform to the limitations identified in the NRC staff's endorsement letter.

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 use of computer codes 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 station blackout (SBO) event and contribute to beyond normal system leakage.

Entergy has not discussed reactor coolant inventory loss including normal system leakage and losses due to BWR recirculation pump seal leakage that is included in the ELAP analysis. There is no discussion of the details of seal leakage rates, the details of the seal qualification tests, the seal leakage rate models and supporting test data, and leakage rate pressure-dependence.

During the audit process, the licensee stated that the current MAAP analysis will be updated to address the code limitations as indicated in Section 3.2.1.1 of this technical evaluation report. Information regarding the seal leakage rates will also be provided when the reanalysis is completed. This is identified as Confirmatory Item 3.2.1.2.A in Section 4.2.

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

The Integrated Plan includes a discussion of time constraints on pages 5 and 6 and in the "Sequence of Events Timeline", Attachment 1A, on pages 48 and 49.

In describing the technical basis for the SOE timeline, on page 6 of the Integrated Plan the licensee stated that GEH, on behalf of the Boiling Water Reactor Owners Group (BWROG), developed document NEDC-33771P to supplement the guidance in NEI 12-06 by providing additional BWR-specific information regarding the individual plant response to an ELAP event. The document includes the identification of the generic event scenario and expected plant response, the associated analytical bases and recommended actions for performance of a site-specific gap analysis. In the document, GEH utilized the NRC-accepted SUPERHEX (SHEX) computer code methodology for the BWR long-term containment analysis for the ELAP analysis. As part of this document, a generic BWR 4/Mark I containment nuclear steam supply system (NSSS) evaluation was performed. The generic BWR 4/Mark I containment analysis is generally applicable to the JAF (a BWR 4/Mark I plant) coping strategy because it supplements the guidance in NEI 12-06 by providing BWR-specific information regarding plant response for core cooling and containment integrity. The Integrated Plan states that the guidance provided in the BWROG report was utilized as appropriate to develop coping strategies and for prediction of the plant's response.

During the audit process, the licensee stated that site-specific analyses were performed to develop the SOE timeline for the JAF plant. NEDC-33771P was not used to develop the JAF site-specific coping strategies for maintaining core and containment cooling but used as a guide.

The SOE timeline presented in the Integrated Plan is based on analyses using the MAAP code as discussed in Section 3.2.1.1 of this report. The licensee stated that the site-specific reanalysis will be performed considering the code limitations identified in Section 3.2.1.1. This reanalysis may affect the time constraints identified in the SOE. This is identified as Confirmatory Item 3.2.1.3.A in Section 4.2.

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

3.2.1.4 Systems and Components for Consequence Mitigation

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

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

And,

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

NEI 12-06, Section 3.2.1.12 states:

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

On page 3 of the Integrated Plan, the licensee stated that the portable FLEX components will be procured commercially and will be designed to be capable of performing in response to the screened in hazards in accordance with NEI 12-06.

On pages 9 and 10, in the section of the Integrated Plan discussing program controls, the licensee stated that JAF will utilize the standard EPRI industry preventive maintenance (PM) process for establishing the maintenance actions for FLEX components. PM procedures will be established for portable components that directly perform in the mitigation strategy for the key FLEX safety functions (i.e., core cooling, containment integrity, and spent fuel cooling). These procedures will consider NEI 12-06 guidance, vendor recommendations, and applicable industry standards. Testing procedures will be developed and performed at frequencies established based on type of equipment and considerations made within EPRI guidelines.

On page 45 of the Integrated Plan, the design requirements for the FLEX equipment are shown in the table listing required equipment for Phase 2 mitigation strategies. During the audit process, the licensee stated that the sizing of the pumps are bounding values based on conceptual design calculations and may change slightly when the detailed design is completed. The licensee further stated that the loading calculations for the 600 Vac generators for Phase 2 and the 4160 Vac generator(s) for Phase 3 have not been completed. This is identified as Confirmatory Item 3.2.1.4.A in Section 4.2.

The licensee’s approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to 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 [Severe Accident Management Guidelines]. 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.

On pages 15 and 16, in the section of the Integrated Plan discussing instrumentation credited for supporting the coping strategy to maintain core cooling during the initial phase, the licensee listed the following instruments:

Reactor Vessel Essential Instrumentation:
- RPV Level
- RPV Pressure

Containment Essential Instrumentation:
- Drywell Pressure
- Torus Pressure
- Drywell Temperature
- Torus Temperature
- Drywell Water Level
- Torus Water Level

Spent Fuel Pool Essential Instrumentation: SFP Level

In addition, the licensee stated that JAF will have the following key instrument remain available following load stripping due to its power source: Condensate Storage Tank (CST) Level.

On page 25, in the section of the Integrated Plan discussing instrumentation credited for supporting the coping strategy to maintain containment during the initial phase, the licensee listed additional instrumentation as follows:

- RHV (Reliable Hardened Vent) System Radiation Monitor
- RHV Valve Position Indication
- RHV System Pressure
- RHV Effluent Temperature

On page 15, in the section of the Integrated Plan discussing modifications to support coping strategies to maintain core cooling during the initial phase, the licensee stated that a modification will be implemented to change the power supply of ac-powered critical instrumentation (e.g., torus temperature, pressure and level, drywell temperature and pressure) to move it from the ac instrument bus to a station battery-backed source. This will provide continuous power to critical instruments so that critical containment parameters can be monitored throughout the event. During the audit process, the licensee further clarified that the power will be from the 125 volt dc power system and the instrumentation will be available to the operators from time of ELAP initiation. Other critical instrumentation is powered from the 125 volt dc power system and will be available without the need for a modification. Completion of the modification is identified as Confirmatory Item 3.2.1.5.A in Section 4.2.

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

3.2.1.6 Motive Power, Valve Controls and Motive Air System

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

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

And,

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

Table 12-1 includes “Portable air compressor or nitrogen bottles & regulators (if required by plant strategy).

On page 13, in the section of the Integrated Plan discussing coping strategies for maintaining core cooling during the initial phase, the licensee stated that the primary method of reactor pressure control is by operation of the safety/relief valves (SRVs). The licensee stated that all SRVs can be either automatically actuated by excess steam pressure or the valves can also be opened manually through remote switches and that the SRVs are equipped with nitrogen accumulators. The licensee stated that in addition to the accumulators, a pneumatic supply system for the SRVs that are part of the automatic depressurization system (ADS) provides a reliable, safety-related, seismically qualified, 100-day supply following a design basis accident to enable long-term cooling. A FLEX air compressor is listed in the table on page 45 as equipment available for coping in Phase 2.

On page 21 of the Integrated Plan, discussing coping strategies for maintaining core cooling during the Phase 3, the licensee stated that the reactor core cooling strategy is to place one loop of the residual heat removal (RHR) system into the shutdown cooling mode. This will be accomplished by powering up a Division I or II RHR pump from the Class 1E emergency bus utilizing a 4160 Vac FLEX portable diesel generator supplied by the RRC. Re-powering either bus can power an RHR pump that can provide flow to either RHR heat exchanger (HX). A modification will be implemented to provide a cross-connection between the fire protection system and one train of the residual heat removal service water (RHRSW) system. The seismically qualified diesel-driven fire pump will be used to provide lake water to the tube side of the appropriate RHR heat exchangers. The diesel-driven fire pump provides 2500 gallons per minute at a nominal discharge pressure of 125 psig. The licensee stated that the 4160 Vac RRC FLEX diesel generator will be capable of carrying approximately 2000 kW load which is sufficient to carry all of the loads on either of the two Class 1E 4160 Vac buses necessary to support the Phase 3 FLEX strategies which includes an RHR pump and its support equipment.

On pages 26 and 28 of the Integrated Plan, discussing maintaining containment during Phases 2 and 3, the licensee stated that the primary strategy to maintain containment integrity utilizes the reliable hardened vent system (RHVS), which is permanently installed plant equipment. The RHVS is expected to rely on dc power, which may require implementation of the FLEX strategies during Phase 2 to re-power a battery charger. The battery charger can be repowered by the 600 Vac FLEX diesel generator stored on site or during Phase 3 by the 4160 Vac diesel generator (DG) supplied by the RRC.

On page 32 of the Integrated Plan, discussing maintaining SFP cooling during Phase 2, the licensee stated that the portable FLEX diesel driven pump taking suction from Lake Ontario will supply makeup water to the SFP. On page 36, the licensee stated that for Phase 3 the strategy for maintaining SFP cooling will be the same as in Phase 2.

On page 45 of the Integrated Plan the licensee listed portable equipment required to provide motive power to support the coping strategies during Phase 2. The equipment includes diesel driven portable air compressors and diesel driven electric generators. On page 46 the licensee listed a diesel driven generator, supplied by the RRC, to provide motive power during Phase 3.

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

The NRC staff reviewed the licensee's Integrated Plan and determined that the Generic Concern related to shutdown and refueling guidelines is applicable to the plant. This Generic Concern has been resolved generically through the NRC's 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. During the audit process, the licensee informed the NRC staff of its plans to abide by this generic resolution. The NRC staff will evaluate the licensee's resulting program through the audit and inspection processes.

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 shutdown and refueling modes 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.

On page 12 of the Integrated Plan in the section describing core cooling in Phase 1, the licensee stated that the existing installed RCIC pump will draw water from either the suppression pool or the CST and inject water into the reactor pressure vessel. Based on the initial volume in the CSTs (200,000 gallons), in conjunction with the volume of water in the torus used during hours 1 through 5 of the event, this will enable RCIC to provide make-up for at least 35 hours without replenishment of the CSTs.

On page 17 of the Integrated Plan in the section describing core cooling in Phase 2, the licensee stated that prior to the depletion of the CST, the flow path will be established from the existing seismically-qualified, diesel-driven fire pump to provide make up to the reactor pressure vessel. A pre-staged hose will be used to connect the fire protection system to the RHR service water (RHRSW) system. RHRSW system is then cross connected to the RHR system allowing makeup flow into the reactor pressure vessel.

Also on page 1 of the Integrated Plan in the section describing core cooling in Phase 2, the licensee stated that a portable FLEX pump can be used to draw water from the intake bay and pump it through a temporary hose connected to the RHRSW system. The FLEX pump would be lowered through a hatch at El 255' of the screenwell and pump into a temporary hose to the RHRSW connection to provide make up to the reactor pressure vessel by cross connecting to the RHR system as described above. This portable FLEX pump can also be used to provide makeup water to the CST. Replenishment of the CST will be accomplished either through a new underground pipe or above ground through approximately 600' of hose. This same pump is also used to provide the make up to the spent fuel pool, which will be discussed below in the Maintain Spent Fuel Pool Cooling function. Four FLEX diesel driven pumps will be stored on site. Each pump is rated at 450 gpm at 400 ft. head.

The Integrated Plan described the use of FLEX pumps taking suction from the Lake Ontario, but did not address the impact of water quality on entrained debris potentially resulting in a restriction of coolant flow across the fuel assemblies to an extent that would inhibit adequate flow to the core. During the audit process, the licensee stated that FLEX support guidelines will contain guidance on prioritizing water sources from the most to least pure. The current strategy, as presented in the Integrated Plan, includes transitioning to shutdown cooling in Phase 3 for long term cooling thus reducing the need to supply water for RCS makeup. Long term cooling strategies, including the evaluation of raw water, will be finalized during the detailed design process. This is identified as Confirmatory Item 3.2.1.8.A in Section 4.2.

Fuel for the portable FLEX equipment is discussed in Section 3.2.4.9 of this report.

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 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 gallons per minute (gpm) per unit (250 gpm to account for overspray). This approach will also provide a vent pathway for steam and condensate from the SFP.

As described in NEI 12-06, Section 3.2.1.7 and JLD-ISG-2012-01, Section 2.1, strategies that 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.

On page 30, in the section of the Integrated Plan discussing maintaining SFP cooling during the initial phase, the licensee stated that there are no Phase 1 actions required for more than 35 hours. Fuel in the SFP is cooled by the existing water inventory requirements of at least 21 feet-7 inches of water normally maintained over the top of the fuel. Using the design basis heat load, the SFP water inventory will heat up from an initial 114 degrees Fahrenheit to 212 degrees Fahrenheit during the first 37.9 hours and there would be approximately 305 hours before any uncovering of the fuel would occur. These values consider the decay heat from a fresh reload batch in the pool upon startup from a 30-day refueling outage.

SFP level monitoring is accomplished using the instrumentation installed per NRC Order EA-12-051.

The licensee also stated that the maximum heat load situation in the pool could occur if a full-core was off- loaded into the pool. The time to boil in this scenario could be as little as 8.1 hours. Even with this time to boil the fuel is expected to be protected for a substantial amount of time: the time to uncover the fuel is 65 hours and the peak required make up rate is approximately 60 gpm. The licensee stated that this indicates there is time to deploy the planned FLEX equipment. The licensee stated that this scenario occurs during an outage at the plant and that more staffing resources would be available to implement the mitigation strategy (i.e., increased staffing is planned during outages to support the outage initiatives).

On pages 32 and 33, in the section of the Integrated Plan discussing maintaining SFP cooling during the transition phase, the licensee stated that the transition from Phase 1 to Phase 2 for SFP cooling function will occur at approximately 37 hours in the normal condition in which fuel has been transferred to the pool after a refueling. SFP makeup connections can be established using portable FLEX equipment. The FLEX pump used to provide the SFP makeup function is the same FLEX pump described in Section 3.2.1.8 in this report which provides make up to the reactor pressure vessel and the CST. Portable equipment (i.e., provisions for makeup to the SFP) is expected to be in place for utilization at approximately 24 hours. Makeup to the SFP will be provided by one of three baseline capabilities.

Method 1 - Makeup via permanent piping
The first method uses an existing diesel driven fire pump taking suction from Lake Ontario aligned to the fire protection system header. A staged hose will be connected between the fire protection system and the RHRSW system. Flow can then be directed to the fuel pool cooling assist piping to the spent fuel pool cooling system. This provides make up flow to the SFP through seismically qualified piping to spargers located near the floor of the pool. The fire pump is capable of pumping 2500 gpm at 125 psig discharge pressure; the required flow rate for pool make up is less than 35 gpm.

Method 2 – Makeup via hose
The second method to provide water to the SFP utilizes the portable diesel driven FLEX pump. This pump will discharge into piping or hose and flow from the screenhouse around to near the truck bay of the reactor building, and up to the operating floor of the reactor building. At that point, a hose long enough to reach the SFP is connected to allow filling of the SFP utilizing lake water.

Method 3 – Makeup via spray
The third method is a flow path ending in spray nozzles at the pool. The third method of providing water to the SFP utilizes the diesel driven FLEX pump and flow path described in Method 2. The hose connection at the operating floor, however, is connected to two monitor spray nozzles rather than supplying make up directly into the pool. Two 100 gpm nozzles, which satisfy the JAF 10 CFR 50.54(hh)(2) commitment, are currently stored in the reactor building. The FLEX pump will be capable of supplying 200 gpm to the refuel floor at a pressure sufficient for the spray nozzles.

During the audit process, the licensee clarified that the method of cooling the spent fuel during Phase 3 will be to use the same means as in Phase 2 and that water to the SFP can be added indefinitely using the portable diesel driven FLEX pump. The licensee also clarified conformance to the NEI guidance that the spray flow rate be 250 gpm to account for overspray. The licensee stated that during the detailed design, considerations will include nozzle locations, the spray angle, and pattern selected and the required flow rate to ensure that with any anticipated overshoot or undershoot of the SFP the required minimum of 200 gpm to the SFP is provided.

On page 40, in the section of the Integrated Plan discussing the SFP area ventilation during the transition phase, the licensee stated that a vent pathway for steam and condensate from the SFP can be established by opening the truck bay doors (at grade elevation) and opening the airlock on El. 369’-6” to the outside of the reactor building. The SBO/FLEX strategy is to establish this ventilation flow path early in the event response period, e.g., before the pool begins to boil, or prior to about 37 hours. Ventilation can be enhanced by re-powering a standby gas treatment system (SGTS) fan. A modification to provide new connection points for a portable diesel generator unit to re-power a SGTS fan will be considered. A FLEX 600 Vac, 200 kW DG will be connected as conditions warrant. A 200 kW, 600Vac FLEX DG can power a SGTS fan and its valve.

During the audit process, the licensee clarified that there are several potential locations to establish a vent path to accommodate boiling in the SFP. The method of ventilation, including any power requirements, for the SFP will be addressed in the detailed design phase. This is identified as Confirmatory Item 3.2.2.A in Section 4.2.

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

On page 24, in the section of the Integrated Plan discussing maintaining containment integrity during the initial phase, the licensee stated that during Phase 1, containment integrity is maintained using the normal installed design features of the containment such as the containment isolation valves and the RHVS. In accordance with NEI 12-06, the containment is assumed to be isolated following the event. As the torus heats up and the water begins to boil, the containment will begin to heat up and pressurize. Additionally, the water level in the torus rises due to the transfer of inventory from the CST to the torus (via RCIC and SRVs). According to the JAF site specific event response analysis, the limiting containment parameter will be the torus design pressure. The licensee stated that the rise in drywell pressure can be reversed before the design pressure limit is reached. This is accomplished by venting the containment. The licensee further stated that the containment design pressure is 56 psig. The event response analysis assumed that the containment is vented at about 23 hours into the event. This timing was derived from the timing of the containment response of the drywell pressure approaching the design pressure; this venting assumption was made to ensure that the containment pressure limit is not challenged. During the audit process, the licensee stated that the decision to vent will be based on the installed torus pressure instrumentation. The torus pressure instrumentation, as discussed in section 3.2.1.5 of this report, is identified as containment essential instrumentation and will be available throughout the ELAP event.

On page 6 of the Integrated Plan, the licensee stated that the venting action will be accomplished in accordance with EOPs to maintain containment parameters within acceptable limits and within the limits that support continued use of the RCIC system. The operators will open the wetwell vent and the RHVS to relieve pressure conditions in the wetwell/drywell. Operation of RHVS is performed from the relay room and can be accomplished because the RHVS is seismically rugged, dc-powered (backed by batteries), and provided with adequate nitrogen from the containment atmospheric dilution (CAD) system, backed up by portable gas bottles for the ELAP event. Critical instruments associated with containment and the RHVS are dc-powered and can be read in the relay room.

After opening the containment vent system, the non-condensable atmosphere will be removed which makes the containment considerably more vulnerable to overcooling/negative pressure transients and vacuum breaker actuation. This may ultimately result in the loss of inert conditions when air enters the containment to replace the volume vacated by steam condensing out of drywell atmosphere. During the audit process, the licensee addressed the effects of overcooling/negative pressure transients by stating that it is not a concern early in the event. The licensee additionally stated that the strategy does not utilize drywell or torus sprays; it utilizes containment venting. The evaluation of the effect of overcooling/negative pressure transients during the later stages of the event will be performed during the final design / procedure development process. The licensee stated that Entergy will be following the industry's early venting position paper.

On pages 26 and 28, in the section of the Integrated Plan discussing maintaining containment integrity during the transition and the final phases, the licensee stated that the primary strategy to maintain containment integrity utilizes only permanently installed plant equipment (i.e., RHVS) as described for Phase 1. The RHVS is expected to rely on dc power, which may require implementation of the FLEX strategies to re-power a battery charger.

In an endorsement letter dated January 9, 2014 (ADAMS Accession No. ML13358A206), the NRC staff concluded that the changes to the BWR venting strategy, as described in the

November 21, 2013, position paper submitted by NEI on behalf of the Boiling Water Reactor Owners Group (BWROG), are acceptable, subject to each licensee addressing the plant-specific implementation of the guidance. The letter stated,

> The NRC staff agrees that the changes to the containment venting strategies as described in the BWROG information report are acceptable for use as part of strategies proposed in response to Order EA-12-049, provided that licensee implementation is in compliance with normal change processes for plant emergency procedures and provided that plant-specific evaluations support the use of the revised strategies. The BWROG paper addresses the venting strategy on a generic basis, but plant-specific implementation relies on such items as the capabilities of the installed vent path, net positive suction head for the reactor coolant system injection pumps, and guidance to prevent negative pressure in containment. The NRC staff will evaluate a licensee's application of containment venting strategies in its development of the final Safety Evaluation documenting compliance with NRC Order EA-12-049.

With regard to maintaining containment, the implementation of Boiling Water Reactor Owners Group (BWROG) Emergency Procedure Guideline (EPG)/Severe Accident Guideline (SAG), Revision 3, including any associated plant-specific evaluations, must be completed in accordance with the provisions of NRC letter dated January 9, 2014. This is identified as Open Item 3.2.3.A in Section 4.1.

A hardened containment vent system is currently installed at JAF but will be enhanced in accordance with NRC Order EA-13-109 on BWR containment vents. In the first six-month status report updating JAF's Integrated Plan, the licensee stated that JAF will implement requirements of Phase 1 of Order EA-13-109 and that Phase 1 of Order EA-13-109 currently requires implementation in 2016 at JAF.

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

3.2.4 Support Functions

3.2.4.1 Equipment Cooling - Cooling Water

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

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

or provide a technical justification for continued functionality without the support system.

The 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 diesel powered 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'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.

In the Integrated Plan the licensee discussed the ventilation and cooling requirements for plant areas during the ELAP event. The applicable areas of interest are discussed below.

Main Control Room (MCR)

On page 37, in the section of the Integrated Plan discussing main control room habitability during the initial phase, the licensee stated that under ELAP conditions with only simple mitigating actions taken, an analysis projects the temperature in the control room will not exceed 105 degrees Fahrenheit considering a loss of ventilation for three days. This is below the assumed maximum temperature for efficient human performance (110 degrees Fahrenheit) as described in NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," Revision 1. The calculation credited heat escaping through a damper in the floor of the kitchen. The Phase 1 FLEX strategy is to confirm the damper is open as well as to block open the entrance air lock when the MCR temperature reaches about 90 degrees Fahrenheit. Additionally, plant procedures require opening all MCR panel doors in the control room within 30 minutes of the beginning of an SBO to minimize heatup of the components contained in the MCR panels. The licensee stated that during Phase 2, portable fans powered from portable FLEX diesel generators will be provided to improve the heat removal from the MCR and maintain temperatures below 104 degrees Fahrenheit for personnel accessibility and equipment availability. The licensee stated that during the final phase, the strategies for cooling the MCR are the same as for Phase 2. However, the power for the MCR chillers and air-handling units may be powered from the 4160 Vac emergency bus if the bus is re-energized by the RRC FLEX 4160 Vac DG.

RCIC Room

On pages 37, in the section of the Integrated Plan discussing RCIC room accessibility during the initial phase, the licensee stated that the RCIC room will have a large heat load under ELAP conditions, as the steam-driven RCIC pump is utilized during the event as the primary source of core cooling. Current analysis demonstrates that the RCIC room remains at acceptable levels for the four-hour SBO scenario. A preliminary evaluation of the room temperature response for the FLEX scenario indicates the room temperature will be elevated. The strategy for the RCIC room is to ensure room doors are open or utilize portable fans to ventilate the area. The licensee stated that JAF does not anticipate that continuous accessibility would be required in the RCIC room. If personnel entry is required into the RCIC room, then supplemental ventilation and personnel protective measures (such as ice vests) will be taken. The licensee stated that during the transition phase, the primary strategy for maintaining the environment of the RCIC room will use the same strategy as in the Phase 1. Further evaluation of RCIC room temperature will be performed to confirm an acceptable environment is maintained. This is identified as Confirmatory Item 3.2.4.2.A in Section 4.2.

Battery Room

On page 39 in the section of the Integrated Plan discussing battery room ventilation during the transition phase, the licensee stated that hydrogen generation rate during charging is such that the hydrogen concentration in the room does not reach 2% for more than 5 days and that this is well into the Phase 3 deployment period. The licensee stated that battery room ventilation is not a concern for the general Phase 2 strategy period of from 8 hours to 72 hours.

On page 43, in the section of the Integrated Plan discussing battery room ventilation during the final phase, the licensee stated that while the rate of hydrogen generation at JAF does not result in hydrogen concentrations of greater 2% for more than five days, the rooms will have to be ventilated during Phase 3. There are two strategies for venting the battery rooms. The primary strategy is to repower the existing battery room exhaust fans. The licensee stated that this could occur after the FLEX DG has been connected to power the Class 1E 600 volt bus, but will more likely not be performed until the larger portable diesel generators are delivered from the RRC. The licensee stated that the second option is to prop open doors and set up portable fans that will exhaust into an adjacent corridor that communicates with a roll up door to the outside.

The Integrated Plan did not address the room temperature effects on battery performance. During the audit process the licensee stated that charging batteries during high room temperatures may require additional forced air flow during Phase 2 and 3. The licensee stated that additional calculations will be developed. This is identified as Confirmatory Item 3.2.4.2.B in Section 4.2.

During the audit process, the licensee further stated that during cold weather the electrolyte in the cells is not expected to drop to a limiting temperature due to the battery room's interior location within the plant. The licensee stated that it is reasonable to assume that the room will remain near its pre-event temperature during the relatively short period of time until the FLEX generators are deployed and have energized the battery chargers. Additional details on adequacy of battery room ventilation for extreme temperature protection will be available later in the design/procedure development process. This is combined with Confirmatory Item 3.2.4.2.B above.

DC Equipment Room

On page 39, in the section of the Integrated Plan discussing dc equipment room ventilation during the transition phase, the licensee stated that the dc equipment rooms contain the battery chargers which are energized in Phase 2 to recharge the batteries. The method to ventilate the dc equipment rooms is to prop open doors and set up portable fans that will exhaust into an adjacent corridor that communicates with a roll up door to the outside. During the audit process, the licensee stated that detail design to determine the required ventilation flow or the size of the portable fans has not been determined. This is identified as Confirmatory Item 3.2.4.2.C in Section 4.2.

RHR Room

On page 43, in the section of the Integrated Plan discussing RHR room accessibility during the final phase, the licensee stated that as part of Phase 3 strategies, an RHR pump is placed into service in order to perform shutdown cooling. This results in heat addition to the RHR pump area due to heat generated by the RHR pump motor as well as heat dissipated from the associated piping. For long term RHR pump operation, the RHR pump area must be cooled to maintain area temperatures within acceptable ranges (limited by maximum allowable RHR pump motor requirements). The licensee stated that mitigating actions can be accomplished by ensuring that cooling support is also powered when the RRC 4160 Vac FLEX DG is connected to the Class 1E 4160 Vac bus to power the RHR pump and that the room cooler can be energized and cooling water supplied via the connections provided between the fire protection system piping and ESW cooling water supply piping. The licensee stated that an alternate means of cooling the RHR rooms if the RHR pump room coolers are not available is to use portable exhaust fans and hose trunks to exhaust hot RHR room air to outside the reactor building.

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 ventilation for equipment cooling 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.

The Integrated Plan does not address heat tracing for freeze protection of piping, instrument lines and equipment. The need for heat tracing and freeze protection during an ELAP may include permanent plant equipment and also portable/FLEX equipment that is deployed outdoors during periods of cold weather. During the audit process, the licensee stated that the need for heat tracing will be addressed later in the design/procedure development phase and that walkdowns will be conducted to identify areas where heat tracing for freeze protection may be required. This is identified as Confirmatory Item 3.2.4.3.A in Section 4.2

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

3.2.4.4 Accessibility - Lighting and Communication

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

> *Plant procedures/guidance should identify the portable lighting (e.g., flashlights or headlamps) and communications systems necessary for ingress and egress to plant areas required for deployment of FLEX strategies.*
>
> Areas requiring access for instrumentation monitoring or equipment operation may require portable lighting as necessary to perform essential functions.
>
> Normal communications may be lost or hampered during an ELAP. Consequently, in some cases, portable communication devices may be required to support interaction between personnel in the plant and those providing overall command and control.

The Integrated Plan does not discuss portable, emergency and hand held lighting available to operators for implementing mitigation strategies during an ELAP. The licensee addressed this concern during the audit process by stating that current plant procedures define flashlights as standard gear/equipment of operators with duties in the plant. The dc portion of the lighting system receives power from the 125 volt dc power system. Also, light towers are available for exterior lighting. The licensee stated that need for additional portable lighting, such as portable dc powered lights, is still being evaluated. This is identified as Confirmatory Item 3.2.4.4.A in Section 4.2.

During the audit process the licensee stated that although not credited, in addition, self-contained emergency lighting units with an 8-hour power supply are located in many areas. These lights were installed per 10 CFR 50, Appendix R to provide adequate lighting for operators to access, operate, and then egress from safe shutdown equipment.

The NRC staff has reviewed the licensee communications assessment (ADAMS Accession Nos. ML12306A244 and ML13063A048) in response to the March 12, 2012 50.54(f) request for information letter for JAF and, as documented in the staff analysis (ADAMS Accession No. ML13123A203), has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by the licensee will conform to the guidance of NEI 12-06 Section 3.2.2, Guideline (8) regarding communications capabilities during an ELAP. Confirmation will be required that upgrades to the site's communications systems have been completed. This has been identified as Confirmatory Item 3.2.4.4.B in Section 4.2.

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

3.2.4.5 Protected and Internal Locked Area Access

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

> *Plant procedures/guidance should consider the effects of ac power loss on area access, as well as the need to gain entry to the Protected Area and internal locked areas where remote equipment operation is necessary.*
>
> At some plants, the security system may be adversely affected by the loss of the preferred or Class 1E power supplies in an ELAP. In such cases, manual actions specified in ELAP response procedures/guidance may require additional actions to obtain access.

There is no discussion in the Integrated Plan of the guidance and strategies with regard to the effects of ac power loss on area access to the protected area and internal locked areas to demonstrate conformance with NEI 12-06. During the audit process, the licensee stated that procedures exist and FSGs will be developed to ensure that operators can access required areas in the event of loss of power. The licensee stated that additional details on controls for access to security controlled or internal locked areas where extended loss of all power would disable normal controlled access will be contained in the FSGs or associated procedures.

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

3.2.4.6 Personnel Habitability - Elevated Temperature

NEI 12-06, Section 3.2.2, Paragraph (11) provides that:

> *Plant procedures/guidance should consider accessibility guidelines 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.

During the audit process, the licensee stated that long term habitability of the main control room will be assured by monitoring control room conditions, heat stress countermeasures, and rotation of personnel to the extent feasible. The licensee stated that impact to habitability would be primarily from elevated temperatures and that FSGs will provide guidance for control room staff to evaluate the control room temperature and take actions as necessary. The licensee stated that Entergy already uses passive cooling technologies for response personnel in high temperature environments. The maximum expected temperature in the control room and planned measures for providing ventilation cooling is discussed in section 3.2.4.2 of this report.

During the audit process, the licensee also stated that it's not anticipated that accessibility of the RCIC room will be required; however if personnel access is necessary to implement the FLEX strategy the method of assuring RCIC habitability will be addressed in the detailed design phase. This is combined with Confirmatory Item 3.2.4.2.A in Section 4.2.

During the audit process, the licensee stated that operators are trained on working in high temperature areas of the plant and that entry into high temperature environments is governed by Entergy's industrial safety procedures with controls for heat stress situations. The licensee stated that continuous standby in the RCIC room is not required and operators can cycle in and out of the room as necessary to adjust flow and maintain operation of the RCIC pump. Also, as stated on page 37 of the Integrated Plan, if personnel entry is required into the RCIC room, then supplemental ventilation and personnel protective measures (such as ice vests) will be taken.

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 personnel habitability if these requirements are implemented as described.

3.2.4.7 Water Sources.

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

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

The licensee has identified three water sources for use in the FLEX strategies. These are the suppression pool, the CST and the ultimate heat sink, Lake Ontario. As described on page 12 of the Integrated Plan, JAF's primary coping strategy to prevent core damage during an ELAP is through the use of the RCIC pump. The licensee stated that the CSTs, with a minimum capacity of 200,000 gallons, are the normal pump suction supply to RCIC. The suction supply for the RCIC pump will automatically transfer from the CSTs to the suppression pool (SP) on low CSTs level. The licensee stated that during an ELAP, at approximately 1 hour event time, operators will manually transfer RCIC suction to the SP. The RCIC suction path will remain aligned to the SP until the SP temperature reaches about 170 degrees Fahrenheit. This is expected to occur at approximately 5 hours event time. Operators will then shift the RCIC suction path back to the CSTs. The licensee stated that the combined water volumes of the SP and the CSTs are expected to provide core cooling for approximately 35 hours without refilling the CSTs.

During the audit process, the licensee stated that the lower half of each CST is below ground level for tornado and seismic protection of the tank's 100,000 gallons storage capacity. The licensee stated that the CSTs are considered robust and available following the BDBEEs. During the audit process, the licensee further stated that switchover between the suppression pool and the CSTs is done manually by the operators from the control room and that automatic controls are not relied upon to align water sources to the RCIC pump for core cooling.

As described on page 17 of the Integrated Plan, prior to depletion of the CSTs, the licensee plans to transition from the steam driven RCIC pump to using the installed seismically qualified diesel driven fire pump to supply makeup water from Lake Ontario to the RPV. This is accomplished by connecting a temporary hose from the fire protection header to the RHRSW system. RHRSW can be cross tied to the RHR system allowing water injection into the RPV. In the event that the station diesel firewater pump is not available, the licensee has established an alternate strategy to lower a portable diesel-driven FLEX pump into the screenwell area and makeup to the RPV by the same flow path. The portable diesel driven FLEX pump can also supply water to the SFP and refill the CSTs.

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

3.2.4.8 Electrical Power Sources/Isolations and Interactions

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

> 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.

On pages 17 and 18 of the Integrated Plan the licensee provided a description of the electrical support strategy during Phase 2. The 125 Vdc batteries are available for up to 10 hours without recharging. A modification will provide new connection points for a portable diesel generator unit to re-power the battery chargers which charge the batteries and supply dc loads. The FLEX 600 Vac, 200 kW DG will be connected at approximately 6 hours and is sized to power the battery charger and fans (about 90 kW). As an alternate strategy to that of powering the battery chargers from their Class 1E 600 volt electrical buses, connections will be provided to enable power to be provided directly to the battery chargers. This will enable the use of a 90 kW FLEX 600 Vac DG to power the battery charger. Permanently installed cables will be run to facilitate the use of this alternative power arrangement.

On page 21 of the Integrated Plan, the licensee provided a description of the electrical support strategy to be used during Phase 3. For Phase 3, the reactor core cooling strategy is to place one loop of RHR into the shutdown cooling mode. This will be accomplished by powering up a Division I or II RHR pump from the respective Class 1E emergency bus, utilizing a 4160 Vac FLEX portable diesel generator supplied by the RRC. The licensee stated that the 4160 Vac RRC FLEX diesel generator will be capable of carrying approximately 2000 kW load which is sufficient to carry all of the loads necessary to support the Phase 3 FLEX strategies which includes an RHR pump and its support equipment. The licensee stated that an alternate means of providing power to the RHR pumps for SDC operation is to run cable from the 4160 Vac RRC FLEX DG directly to the component by connecting either at the switchgear end of the component's power cable or locally at the pump end of the power cable.

During the audit process, the licensee addressed the issues associated with electrical isolations and interactions. The licensee stated that connection points and other permanent modifications will be designed in accordance with approved design practices to assure no adverse effects during normal operation. The licensee stated that at the onset of the ELAP, Class 1E emergency diesel generators are assumed unavailable to supply the Class 1E busses. Portable generators are used in response to an ELAP in FLEX strategies for Phases 2 and 3. The licensee stated that at the point when ELAP mitigation activities require tie-in of FLEX generators, in addition to existing electrical interlocks, procedural controls such as inhibiting EDG start circuits and breaker rack-outs (e.g., EDG breakers, offsite feeder breakers, etc) will be employed to prevent simultaneous connection of both the FLEX generators and Class 1E EDG to the same ac distribution system or component. Additionally, repowering the Class 1E electrical busses from either the FLEX generators or subsequently the Class 1E EDGs (should they become available) will be accomplished manually and controlled by procedure; no automatic sequencing or automatic repowering of the busses will be utilized.

The Integrated Plan did not provide information regarding the technical basis for the selection and size of the FLEX generators to be used in support of the coping strategies. Supporting information should be provided to address both Phase 2 and 3 power requirements. The licensee addressed the topic of generator sizing during the audit process by stating that the information would be provided in a future 6-month update. This is identified as Confirmatory Item 3.2.4.8.A in Section 4.2.

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

3.2.4.9 Portable Equipment Fuel

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

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

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

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

On page 18, in the section of the Integrated Plan discussing coping strategies for maintaining core cooling during the transition phase, the licensee stated that diesel fuel to support operation of the portable Phase 2 FLEX equipment for at least 15 hours will be stored with the FLEX equipment. The licensee stated that additional diesel fuel is available in the underground emergency diesel generator (EDG) fuel storage tanks and that the Division I & II EDG fuel oil storage tanks contain more than 128,000 gallons of fuel oil. The licensee stated that underground EDG fuel oil storage tanks contain sufficient fuel oil to support all Phase 2 strategies. The licensee stated that if the normal procedure for transferring fuel from the underground storage tanks is not possible, the fuel oil can be obtained from the underground storage tanks using a manual, air, or battery operated pump to pump the fuel into a transfer tank. Two trailers with fuel tank and portable containers are provided as part of the Phase 2 FLEX equipment as indicated in the table on page 45 of the Integrated Plan.

During the audit process, the licensee stated that the quality of the fuel in the EDG fuel oil storage tanks is maintained in accordance with JAF's diesel fuel oil testing program and that fuel oil in the fuel tanks of the portable diesel driven FLEX equipment will be maintained in the preventative maintenance program in accordance with the EPRI maintenance template.

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 fuel oil supplies 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.

On page 5, in the section of the Integrated Plan discussing time constraints identified in the sequence of events time line, the licensee stated that at 90 minutes after an ELAP, dc load shed is completed and that FLEX response procedures will detail the actions necessary. The licensee stated that the dc buses are readily available for operator access and breakers will be appropriately identified (labeled) to show which are required to be opened to implement a deep load shed. The Integrated Plan states that that based on engineering judgment, it is reasonable to expect that operators can complete the shedding of loads from the dc bus in approximately 30 minutes. The licensee noted that existing station blackout procedure (AOP-49) includes direction to depressurize and vent the main generator within 30 minutes of a station blackout. During the audit the licensee stated that the load shed list will be refined during the design process and that the potential adverse impacts of shedding these additional loads will be evaluated. This is identified as Confirmatory Item 3.2.4.10.A in Section 4.2.

On page 5 of the Integrated Plan, the licensee stated that at 10 hours a battery charger is re-powered to maintain the dc power system. Deployment of the FLEX DG will be initiated shortly after the BDBEE is declared in recognition of the potential for battery depletion. The licensee stated that the event is time critical at battery depletion and that both the A and the B batteries have been calculated to last more than 10 hours in the FLEX scenario. During the audit process, the licensee stated that the 10 hour runtime is based on the minimum battery voltage (111.6 volts for battery A and 110.26 volts for battery B) and expected electrical loading. The minimum voltage is the acceptance criteria for the SBO minimum battery voltage as stated in existing battery calculations. The dc load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel cooling is still in the design/development phase. The licensee stated that the finalized minimum battery voltages will be available later in the design phase. This is identified as Confirmatory Item 3.2.4.10.B in Section 4.2.

During the audit process, the licensee stated that the FLEX 600 Vac DGs will be connected within 6 hours after the ELAP, whereas on page 48 of the Integrated Plan, the sequence of events table indicates that the station battery chargers will be re-powered at 10 hours. The sequence of events timeline needs to be reconfirmed or updated to address this apparent change in strategy. This is identified as Confirmatory Item 3.2.4.10.C in Section 4.2.

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

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

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

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

During the audit process, the licensee stated that the FLEX strategy battery run time was determined in accordance with the IEEE 485 methodology.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to load reduction 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 [Electric Power Research Institute]) and associated bases will be developed to define specific maintenance and testing including the following:

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

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

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

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

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

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

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

[1] Testing includes surveillances, inspections, etc.

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.

On pages 9 and 10, in the section of the Integrated Plan discussing programmatic controls, the licensee stated that JAF will implement an administrative program for implementation and maintenance of the FLEX strategies in accordance with NEI 12-06 guidance.

- Installed structures, systems and components currently designed and installed meet augmented quality guidelines (e.g., equipment installed to address 10CFR50.48, Fire Protection, or 10CFR50.63, Station Blackout) will continue to meet the augmented quality guidelines.

- JAF will utilize the standard EPRI industry PM process for establishing the maintenance actions for FLEX components. Preventive maintenance procedures will be established for portable components that directly perform in the mitigating strategy for the key FLEX safety functions (i.e., core cooling, containment integrity, and spent fuel cooling.) These procedures will consider NEI 12-06 guidance, vendor recommendations, and applicable industry standards.

- Testing procedures will be developed and performed at frequencies established based on type of equipment and considerations made within EPRI guidelines.

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

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

During the audit process, the licensee informed the NRC of JAF's plans to abide by this generic resolution. The NRC staff will evaluate the resulting program through the audit and inspection processes.

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 states:

1. The FLEX strategies and basis will be maintained in an overall program document. This program document will also contain a historical record of previous strategies and the basis for changes. The document will also contain the basis for the ongoing maintenance and testing programs chosen for the FLEX equipment.

2. Existing plant configuration control procedures will be modified to ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies.

3. Changes to FLEX strategies may be made without prior NRC approval provided:
    a) The revised FLEX strategy meets the requirements of this guideline.
    b) An engineering basis is documented that ensures that the change in FLEX strategy continues to ensure the key safety functions (core and SFP cooling, containment integrity) are met.

On pages 9, in the section of the Integrated Plan discussing programmatic controls, the licensee stated that JAF will implement an administrative program for implementation and maintenance of the FLEX strategies in accordance with NEI 12-06 guidance.

On page 15, in the section of the Integrated Plan discussing procedures and guidance, the licensee stated that JAF will utilize the industry-developed guidance from the Owners Groups, EPRI and NEI Task team to develop site-specific procedures and guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.

On page 19, in the section of the Integrated Plan discussing storage and protection of equipment, the licensee stated that locations / structures to provide protection of the FLEX equipment will be fabricated / constructed to meet the requirements identified in NEI 12-06, Section 11. JAF procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to JAF.

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 states:

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.

On page 10, in the section of the Integrated Plan discussing the general plan elements and the training plan, the licensee stated the new training of general station staff and the Emergency Response Organization will be performed prior to design implementation. The licensee stated that these programs and controls will be implemented in accordance with the Systematic Approach to Training and NEI 12-06 guidance.

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.

---

[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.

3.4 <u>OFF SITE RESOURCES</u>

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

1) A capability to obtain equipment and commodities to sustain and backup the site's coping strategies.

2) Off-site equipment procurement, maintenance, testing, calibration, storage, and control.

3) A provision to inspect and audit the contractual agreements to reasonably assure the capabilities to deploy the FLEX strategies including unannounced random inspections by the Nuclear Regulatory Commission.

4) Provisions to ensure that no single external event will preclude the capability to supply the needed resources to the plant site.

5) Provisions to ensure that the off-site capability can be maintained for the life of the plant.
6) Provisions to revise the required supplied equipment due to changes in the FLEX strategies or plant equipment or equipment obsolescence.

7) The appropriate standard mechanical and electrical connections need to be specified.

8) Provisions to ensure that the periodic maintenance, periodic maintenance schedule, testing, and calibration of off-site equipment are comparable/consistent with that of similar on-site FLEX equipment.

9) Provisions to ensure that equipment determined to be unavailable/non-operational during maintenance or testing is either restored to operational status or replaced with appropriate alternative equipment within 90 days.

10) Provision to ensure that reasonable supplies of spare parts for the off-site equipment are readily available if needed. The intent of this provision is to reduce the likelihood of extended equipment maintenance (requiring in excess of 90 days for returning the equipment to operational status).

On page 10, in the section of the Integrated Plan discussing the RRC in the general Integrated Plan elements, the licensee stated that the industry has selected a vendor to manage two RRC to provide large equipment in support of the response to BDBEE. Each RRC will store and maintain five sets of equipment, four of which are expected to be fully deployable upon request. The fifth set is provided to account for equipment that may be unavailable due to its maintenance and testing cycle. As currently envisioned, the two RRC facilities will be located in Memphis, TN and Phoenix, AZ.

JAF will utilize the industry RRC for Phase 3 equipment. In an ELAP event, communications would be established between JAF and the industry SAFER team and required equipment mobilized as needed. JAF will enter into a contractual agreement with the SAFER team. Equipment will initially be moved from an RRC to a local staging area, established by the SAFER team and JAF. The equipment will be prepared at the staging area prior to transportation to the site. The licensee stated that first arriving equipment, as established during development of the RRC playbook, will be delivered to the site within 24 hours from the initial request.

The licensee's use of off-site resources, as described above, conforms to the guidance found in NEI 12-06, Section 12.2, with regard to the capability to obtain equipment and commodities to sustain and backup the site's coping strategies (Guideline 1). However, insufficient information has been included to provide reasonable assurance that guidance will be established to conform to the remaining items of NEI 12-06, Section 12.2 (Guidelines 2 through 10). This has been identified as Open Item 3.4.A, in Section 4.1.

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

4.0 OPEN ITEMS AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number	Description	Notes
3.1.1.3.A	Procedural Interface (Seismic Hazard) – Evaluate the impacts from large internal flooding sources.	
3.1.3.1.A	Protection of FLEX Equipment (High Wind Hazard) – Evaluate the separation distance and the axis of separation considering the predominant path of tornados in the geographic area to demonstrate that at least N sets of FLEX equipment would remain deployable in the context of a tornado missile hazard.	Significant
3.1.4.2.B	Deployment of FLEX Equipment (Snow, Ice and Extreme Cold) – Evaluate the potential impact on the UHS due to ice blockage or formation of frazil ice as a result of extreme cold.	
3.2.3.A	Containment- Confirm that the implementation of Boiling Water Reactor Owners Group (BWROG) Emergency Procedure Guideline (EPG)/Severe Accident Guideline (SAG), Revision 3, including any associated plant-specific evaluations, will be completed in accordance with the provisions of NRC letter dated January 9, 2014	
3.4.A	Off-site Resources- Review how conformance with NEI 12-06, Section 12.2 guidelines 2 through 10 is being met.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.2.A	Deployment of FLEX Equipment -Review the potential for soil liquefaction that might impede vehicle movement following a seismic event.	
3.1.1.2.B	Deployment of FLEX Equipment –Confirm final design features of the new storage building including the susceptibility to the loss of ac power. Reliance on ac power, if any, to deploy equipment is to be evaluated.	
3.1.1.2.C	Deployment of FLEX Equipment- Verify the storage locations and means of protection against the seismic hazard of the super duty pickup trucks and the two flatbed trailers used for deployment of FLEX equipment.	
3.1.1.4.A	Offsite Resources- Confirm location of offsite staging area(s), access routes and methods of delivery of equipment to the site considering the seismic, flood, high wind, snow, ice and extreme cold hazards.	
3.1.3.2.A	Deployment of FLEX Equipment (High Wind Hazard) – Confirm availability of debris removal equipment to facilitate deployment of FLEX equipment.	
3.1.3.2.B	Deployment of FLEX Equipment (High Wind Hazard) – Confirm protection of the means to move FLEX equipment.	
3.1.4.2.A	Deployment of FLEX Equipment (Snow, Ice and Extreme Cold) – Confirm availability of snow removal equipment to facilitate deployment of FLEX equipment.	
3.2.1.1.A	Computer Code Used for ELAP Analysis-Benchmarks need to be identified and discussed which demonstrate that MAAP is an appropriate code for the simulation of an ELAP event at JAF.	
3.2.1.1.B	Computer Code Used for ELAP Analysis –Confirm that the collapsed level remains above Top of Active Fuel (TAF) and the cool down rate is within technical specifications limits.	
3.2.1.1.C	Computer Code Used for ELAP Analysis- Confirm that MAAP was used in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper (ADAMS Accession No. ML13190A201).	
3.2.1.1.D	Computer Code Used for ELAP Analysis- Confirm that the licensee, in using MAAP, identified and justified 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" (Electric Power Research Institute Report 1020236).	

3.2.1.1.E	Computer Code Used for ELAP Analysis – Confirm that the specific MAAP analysis case that was used to validate the timing of mitigating strategies in the Integrated Plan has been identified and is available for NRC staff to review. Alternately, a comparable level of information has been 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	Recirculation Pump Seal Leakage Models-Confirm the seal leakage model used in the updated MAAP analysis (which will address the MAAP code limitations when used for ELAP analysis). Evaluate the seal leakage rate model used, the details of the seal qualification tests and supporting test data, and leakage rate pressure-dependence.	
3.2.1.3.A	Sequence of Events- Confirm the sequence of events timeline after reanalysis using the MAAP code which will address the limitations when used for the ELAP analysis.	
3.2.1.4.A	Systems and Components for Consequence Mitigation – Confirm sizing of the FLEX pumps and 600 Vac FLEX DG and the 4160 Vac generator to be obtained from the RRC.	
3.2.1.5.A	Monitoring Instrumentation and Controls –Confirm ac powered torus temperature, pressure and level and drywell temperature and pressure instrumentation is modified to remain powered during an ELAP.	
3.2.1.8.A	Use of Portable Pumps- Evaluate impacts of using raw water from Lake Ontario for long term core and spent fuel pool cooling strategies.	
3.2.2.A	Spent Fuel Pool Cooling-Confirm the method of ventilation and power requirements, if any, of the spent fuel pool area.	
3.2.4.2.A	Ventilation (Equipment Cooling) - Confirm that additional evaluations of the RCIC room temperature demonstrate that an acceptable environment is maintained during the transition phase both for equipment in the room and habitability for operators who may need to enter the room.	
3.2.4.2.B	Ventilation (Equipment Cooling) - Confirm that evaluations of the battery room temperature demonstrate that an acceptable environment, during both high ambient temperature and during extreme cold ambient temperature, is maintained during Phases 2 and 3.	
3.2.4.2.C	Ventilation (Equipment Cooling) –Confirm the required ventilation flow or the size of the portable fans to maintain acceptable environmental conditions in the DC equipment room.	
3.2.4.3.A	Heat Tracing- Confirm completion of walkdowns and evaluation of where heat tracing may be needed for freeze protection of equipment or instruments used in the ELAP mitigation strategies.	

3.2.4.4.A	Lighting- Confirm need for additional portable lighting, such as dc powered lights.	
3.2.4.4.B	Communications – Confirm that upgrades to the site's communication system have been completed.	
3.2.4.8.A	Electrical Power Sources- Confirm the technical basis for the selection and size of the FLEX generators to be used in support of the coping strategies.	
3.2.4.10.A	Load Reduction to Conserve DC Power- Confirm final load shed list and the evaluation of any potential adverse effects of shedding those loads.	
3.2.4.10.B	Load Reduction to Conserve DC Power- Confirm the final dc load profile with the required loads and the finalized minimum battery voltage.	
3.2.4.10.C	Load Reduction to Conserve DC Power- Confirm time after the ELAP for connecting the FLEX DG to the battery chargers.	