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# 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

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Tennessee Valley Authority
Browns Ferry Nuclear Plant, Units 1, 2, and 3
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## 1.0 BACKGROUND

Following the events at the Fukushima Dai-ichi nuclear power plant on March 11, 2011, the U.S. Nuclear Regulatory Commission (NRC) established a senior-level agency task force referred to as the Near-Term Task Force (NTTF). The NTTF was tasked with conducting a systematic, methodical review of NRC regulations and processes to determine if the agency should make additional improvements to these programs in light of the events at Fukushima Dai-ichi. As a result of this review, the NTTF developed a comprehensive set of recommendations, documented in SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated July 12, 2011. These recommendations were enhanced by the NRC staff following interactions with stakeholders. Documentation of the staff's efforts is contained in SECY-11-0124, "Recommended Actions to be Taken without Delay from the Near-Term Task Force Report," dated September 9, 2011, and SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," dated October 3, 2011.

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

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

On February 17, 2012, the NRC staff provided SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," to the Commission, including the proposed order to implement the enhanced mitigation strategies. As directed by SRM-SECY-12-0025, the NRC staff issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events."

Guidance and strategies required by the Order would be available if a loss of power, motive force and normal access to the ultimate heat sink 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 29, 2013 from Jack R. Davis, Director, Mitigating Strategies Directorate (ADAMS Accession No. ML13234A503).

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

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

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

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

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

Additionally, for the purpose of this evaluation and the NRC staff's interim staff evaluation (ISE), licensee statements, commitments, and references to existing programs that are subject to routine NRC oversight (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. ML13064A465), and as supplemented by the first six-month status report in letter dated August 28, 2013 (ADAMS Accession No. ML13247A284), Tennessee Valley Authority (the licensee or TVA) provided the Integrated Plan for Compliance with Order EA-12-049 for Browns Ferry Nuclear Plant (BFNP), Units 1, 2 and 3. 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.

In their integrated plan, the licensee identified the Design Basis Earthquake (DBE) / Safe Shutdown Earthquake (SSE) to be the maximum rock acceleration of 0.2g horizontal and 0.133g vertical, which is consistent with their UFSAR, section 2.5. The licensee confirmed on page 1 of their Integrated Plan that the site screens in for an assessment for the seismic hazard. In addition, the licensee stated, on page 5 of their Integrated Plan, that the reevaluation of the seismic hazard, as required by 10CFR50.54(f), has not yet been completed and therefore was not assumed in their Integrated Plan. The licensee also stated that as the re-evaluations are completed, appropriate issues would be entered into the corrective action program (CAP) and addressed. In the licensee's six-month update (dated August 28, 2013), this re-evaluation has not yet started.

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

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

### 3.1.1.1 Protection of FLEX Equipment – Seismic Hazard

NEI 12-06, Section 5.3.1 states:

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

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

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

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

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

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

On pages 32, 47, 57, and 72 of the Integrated Plan regarding the strategies for maintaining core cooling, maintaining containment, SFP cooling and for Safety Systems Support, respectively, the licensee stated that protection of associated portable equipment from seismic hazards in the transition phase (Phase 2) would be provided. In addition, the licensee stated that portable equipment and connection materials required to implement their FLEX strategies would be maintained in the Flexible Equipment Storage Building (FESB), which would be designed to meet or exceed the site's design basis SSE protection requirements.

During the audit process, the licensee stated that large portable FLEX equipment would be secured in the FESB. In addition, the licensee stated that the FESB would be evaluated to ensure that unsecured and/or non-seismic components would not damage the stored FLEX equipment.

In their Integrated Plan, the licensee did not provide a discussion of the protection to be afforded deployment vehicles/trailers from seismic hazards. During the audit process, the licensee stated that the deployment equipment would reside in a building that meets the NEI 12-06 protection requirements.

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 storage of FLEX equipment from seismic hazards 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.

On page 1 of their Integrated Plan, the licensee stated the liquefaction potential of all FLEX deployment routes would be addressed in a future assessment. According to the licensee's six-month update (dated August 28, 2013), this activity has not yet started. Therefore, the licensee's plans for deployment provided insufficient information regarding soil liquefaction associated with the deployment routes for equipment. This has been identified as Confirmatory Item 3.1.1.2.A in Section 4.2.

On page 5 of the Integrated Plan, the licensee stated that margin would be added to the design of FLEX components and hard connection points to address future requirements as re-evaluation warrants. The design of hardened connections shall be protected against external events or are established at multiple and diverse locations. On page 33 of the Integrated Plan, the licensee stated that the connection points would be installed on piping that would be located in a seismically designed structure and not impacted by outside hazards.

NEI 12-06 consideration 3 is not applicable since the site does not rely on a water source that is not seismically robust, e.g., a down stream dam.

In their Integrated Plan, the licensee did not identify any means to deploy equipment (deployment vehicles and/or trailers). During the audit process, the licensee stated that there were several options under review to deploy FLEX equipment. The options included a heavy-duty truck or compact track loaders or both. The options would include a sufficient number to deploy the necessary FLEX equipment in the time required. Based on the licensee's response, Confirmatory Item 3.1.1.2.B in Section 4.2 has been identified relative to the confirmation of sufficient deployment vehicles available to deploy the equipment in the time 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 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 deployment of FLEX equipment following a seismic event if these requirements are implemented as described.

3.1.1.3 Procedural Interfaces – Seismic Hazard

NEI 12-06, Section 5.3.3 states:

> There are four procedural interface considerations that should be addressed.
>
> 1. Seismic studies have shown that even seismically qualified electrical equipment can be affected by BDB seismic events. In order to address these considerations, each plant should compile a reference source for the plant operators that provides approaches to obtaining necessary instrument readings to support the implementation of the coping strategy (see Section 3.2.1.10). This reference source should include control room and non-control room readouts and should also provide guidance on how and where to measure key instrument readings at containment penetrations, where applicable, using a portable instrument (e.g., a Fluke meter). Such a resource could be provided as an attachment to the plant procedures/guidance. Guidance should include critical actions to perform until alternate indications can be connected and on how to control critical equipment without associated control power.
>
> 2. Consideration should be given to the impacts from large internal flooding sources that are not seismically robust and do not require ac power (e.g., gravity drainage from lake or cooling basins for non-safety-related cooling water systems).
>
> 3. For sites that use ac power to mitigate ground water in critical locations, a strategy to remove this water will be required.
>
> 4. Additional guidance may be required to address the deployment of FLEX for those plants that could be impacted by failure of a not seismically robust downstream dam.

On pages 24 and 39 of their Integrated Plan, the licensee identified that instrumentation relative to RPV level, drywell pressure, suppression pool level (after modification to power source), suppression pool temperature, and drywell temperature (after modification to power source) would be available during the event since this instrumentation would be powered from station batteries. The licensee did not identify instrumentation regarding RPV pressure or suppression chamber air temperature. In addition, there was no indication of whether the instruments listed are local or powered, and if powered, whether these instruments could be impacted by circumstances described in NEI 12-06, Section 5.3.3 consideration 1 noted above. The Integrated Plan did not include consideration of critical actions to perform until alternate indications could be connected nor did it address guidance to include instructions on how to control critical equipment without control power. During the audit process, the licensee stated that the instrumentation list was being reevaluated for expansion and any changes would be included in future six-month plan updates. In addition, the licensee stated that a primary and backup means to read required instrument variables would be defined as part of the procedures effort. The backup method to obtain instrument readings would be proceduralized and would address the use of portable measuring and test equipment (M&TE) to take readings from either the transmitter, or a process reading in the field in accordance with the guidance in NEI 12-06 section 5.3.3 consideration 1.

The licensee did not provide a discussion in their Integrated Plan regarding implementation of the mitigating strategies with respect to the procedural interface considerations for seismic hazards associated with large internal flooding sources that are not seismically robust and do not require ac power and the use of ac power to mitigate ground water in critical locations as specified in NEI 12-06 Section 5.3.3 considerations 2 and 3. During the audit process, the licensee stated that the plant procedure for flooding (0-AOI-100-3) would be revised to address procedural direction given a BDBEE. This has been identified as Confirmatory Item 3.1.1.3.A in Section 4.2.

On pages 24 and 39 of the Integrated Plan, there where no Unit identification for instruments (Unit 1, 2 or 3) nor was it stated that all three units would have the same instrumentation identification with the exception of Unit Number. During the audit process, the licensee stated that the instrumentation would have the same unique identification on all three units, except for the unit identifier and that this would be clarified in the next six-month update.

On page 5 of the Integrated Plan, the licensee stated that the deployment strategies and deployment routing are yet to be determined. On page 19 of the Integrated Plan, the licensee stated that BFNP would develop procedures and programs to address storage structure requirements and deployment/haul path requirements relative to the hazards applicable to BFNP. This has been identified as Confirmatory Item 3.1.1.3.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 procedural interfaces for coping with a seismic hazard if these requirements are implemented as described.

3.1.1.4 Considerations in Using Offsite Resources – Seismic Hazard

NEI 12-06, Section 5.3.4 states:

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

1. The FLEX strategies will need to assess the best means to obtain resources from off-site following a seismic event.

On page 20 of their Integrated Plan, the licensee provided information regarding the use of the offsite resources through the industry Strategic Alliance for FLEX Emergency Response (SAFER) program, but has not identified local staging areas and method(s) of transportation per the guidance of NEI 12-06, Section 5.3.4, consideration 1, Section 6.2.3.4, considerations 1 and 2, Section 7.3.4, considerations 1 and 2, and Section 8.3.4. During the audit process, the licensee provided preliminary staging areas A (onsite), B, C and D locations along with their proposed deployment/access routes. This 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 use of off-site resources following seismic events, 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 2 of their Integrated Plan, the licensee stated that the site is susceptible to flooding via two sources: local intense precipitation and river flooding. The Probable Maximum Flood (PMF) would reach a maximum still-water elevation of 572.5 feet, per UFSAR section 2.4A. A maximum flood elevation of 578 feet at BFNP results from a combination of the PMF and wind wave run-up on a vertical wall per UFSAR. Site structures, located in the flood plain which house equipment important to safety are designed to remain watertight by utilizing both permanently installed and temporary barriers.

On page 5 of their Integrated Plan, the licensee stated that the reevaluation of the flooding hazard, as required by 10 CFR 50.54(f), has not yet been completed and therefore was not assumed in their Integrated Plan. The licensee also stated that as the re-evaluations are completed, appropriate issues would be entered into the CAP and addressed. According to the licensee's six-month update (dated August 28, 2013), this re-evaluation has not yet started.

The Integrated Plan identified the source of flooding as either local intense precipitation or river flooding. However, the applicable flooding hazard was not characterized in terms of persistence. During the audit process, the licensee stated that the maximum duration flood at the site would be 10.5 days above plant grade. In addition, the licensee confirmed that the site is a “wet” site as delineated in NEI 12-06 Section 6.2.1.

The licensee’s screening for flood hazards, as presented in their Integrated Plan, has appropriately screened this external hazard and identified the hazard levels for reasonable protection of portable equipment.

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

3.1.2.1 Protection of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.1 states:

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

On page 32 of the Integrated Plan, the licensee stated that portable equipment required to implement their FLEX strategy would be maintained in the FESB, which would be in a location that is above the PMF level and as such would not be susceptible to flooding from any source. In addition, FLEX equipment deployment paths maintain a minimum elevation of 565' for which the plant will have over 4 days to deploy FLEX equipment based on plant response to a flooding event in 0-AOI-100-3.

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 storage and protection of portable equipment during a flooding hazard if these requirements are implemented as described.

3.1.2.2 Deployment of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.2 states:

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

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

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

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

On page 9 of the Integrated Plan, the licensee stated that plant staff would deploy the FLEX pumps in preparation for the design basis flood. New procedure guidance is to be developed as part of the FLEX Support Guidelines (FSGs). For floods, plant shutdown begins when river level reaches 558 feet per 0-AOI-100-3. This is more than 4 days before floodwaters would reach plant grade level (565', based on UFSAR Section 2.4). Deployment of FLEX Pumping Systems must be complete before flood waters reach the transport path, which shall be at plant grade or higher. FLEX Pumping System deployment has been estimated by walkthrough to take 8 hours (to be confirmed during the design/staffing evaluation process). A Beyond-Design-Basis Flood (BDBF) would not exceed the maximum flood height for which Emergency Core Cooling System (ECCS) equipment is qualified for at least another 36 hours. The startup of the 4 kV and 480 V FLEX Diesel Generators (DGs) (3 MWe and 225 kVA) can be performed after the normal emergency diesel generators (EDGs) are lost.

The Integrated Plan stated that the FLEX strategies developed for the site would include documentation ensuring that any storage locations, deployment routes, and connection points will meet the FLEX flooding criteria or are at an elevation not susceptible to flooding (except for those strategy elements not credited for flooding). However, the locations, deployment routing, and the administrative program are yet to be determined. This information is needed to ensure that the considerations of NEI 12-06, Section 6.2.3.2 would be met. This has been combined with Confirmatory Item 3.1.1.2.A in Section 4.2.

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

3.1.2.3 Procedural Interfaces – Flooding Hazard

NEI 12-06, Section 6.2.3.3 states:

> The following procedural interface considerations should be addressed.
>
> 1. Many sites have external flooding procedures. The actions necessary to support the deployment considerations identified above should be incorporated into those procedures.

2. Additional guidance may be required to address the deployment of FLEX for flooded conditions (i.e., connection points may be different for flooded vs. non-flooded conditions).

3. FLEX guidance should describe the deployment of temporary flood barriers and extraction pumps necessary to support FLEX deployment.

On page 5 of the Integrated Plan, the licensee stated that the deployment strategies and deployment routing are yet to be determined. On page 17 of the Integrated Plan, the licensee stated that the deployment routes and location for some equipment will be different for flood conditions and the identified paths may be inundated after deployment, in case of a beyond-design-basis flood. This deployment strategy would be included within an administrative program in order to keep pathways clear or to clear the pathways. On page 19 of the Integrated Plan, the licensee stated that BFNP would develop procedures and programs to address storage structure requirements and deployment/haul path requirements relative to the hazards applicable to BFNP. This has been combined with Confirmatory Item 3.1.1.3.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 Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedural interfaces coping with the flooding hazard if these requirements are implemented as described.

3.1.2.4 Considerations in Using Offsite Resources – Flooding Hazard

NEI 12-06, Section 6.2.3.4 states:

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

The licensee is developing procedures and strategies for delivery of offsite FLEX equipment during Phase 3, which considers regional impact from flooding. On page 20 of their Integrated Plan, the licensee provided information regarding the use of the offsite resources through the industry SAFER program, but has not identified local staging areas and method(s) of transportation per the guidance of NEI 12-06, Section 6.2.3.4, considerations 1 and 2. During the audit process, the licensee provided preliminary staging areas A (onsite), B, C and D locations along with their proposed deployment/access routes. This 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 use of off-site resources during flooding events, 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 of their Integrated Plan, the licensee stated that the site is susceptible to hurricanes, as the plant is within the contour lines shown in NEI 12-06 Figure 7-1. The licensee also determined that the site has the potential to experience damaging winds caused by tornado exceeding 130 mph. Figure 7-2 of NEI 12-06 indicates a maximum wind speed of 200 mph for Region 1 plants, including BFNP. Therefore, high-wind hazards are applicable to BFNP. It should be noted that BFNP was designed to 300 mph wind loads. Therefore, the site is susceptible to severe storms with high winds so the hazard is considered to be credible.

The licensee's screening for high wind hazards, as presented in their Integrated Plan, has appropriately screened this external event and identified the hazard levels for reasonable protection of the FLEX equipment.

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

#### 3.1.3.1 Protection of FLEX Equipment - High Winds Hazard

NEI 12-06, Section 7.3.1 states:

> These considerations apply to the protection of FLEX equipment from high wind hazards:
>
> 1. For plants exposed to high wind hazards, FLEX equipment should be stored in one of the following configurations:
>
>     a. In a structure that meets the plant's design basis for high wind hazards (e.g., existing safety-related structure).

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

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

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

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

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

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

  - Consistent with configuration b., the axis of separation should consider the predominant path of tornados in the geographical location.

  - Consistent with configuration b., stored mitigation equipment should be adequately tied down.

On pages 32, 48, and 72 of their Integrated Plan, the licensee stated that the portable equipment required to implement their FLEX strategies would be maintained in the FESB, which would be designed to meet or exceed the licensing basis high wind hazard for the site. In their six-month updated (dated August 28, 2013), the licensee stated that the 480 V FLEX DGs will only be protected from a tornado with winds up to 230 mph per RG 1.76.

On page 58 of their Integrated Plan regarding the strategies for SFP cooling, the licensee stated that the piping used to provide makeup flow to the SFP would be contained within buildings that are protected from storms and high winds. During the audit process, the licensee stated that the piping that would be used to supply makeup water to the SFP consists of:

- Permanent piping located within the Seismic Class 1 Reactor Building;
- Permanent Emergency Equipment Cooling Water (EECW) piping that that runs from the safety related rooms at the Intake Pumping Station underground, through the Residual Heat Removal Service Water (RHRSW) tunnels and enters the Reactor Building. This system is designed and protected in accordance with site's current design basis; and
- Portable hoses that would be stored in the FESB.

In the Integrated Plan, the licensee differentiated between a tornado and an extreme tornado. During the audit process, the licensee was asked to explain the difference between the two. In their response, the licensee stated that the FLEX strategies would not differentiate between a tornado and an extreme tornado. The licensee stated that all FLEX equipment will be stored in a structure that meets the plant's design basis for high wind hazards (300 mph), with the exception of the 480 V FLEX DGs.

During the audit process, the licensee was asked to explain how the air inlet and exhaust of the FLEX 4 kV DGs would be protected against wind born missiles. In their response, the licensee stated that the FESB design would protect the air inlet and exhaust of the FLEX 4kV DGs from wind born missiles through the use of labyrinth walls and roof structure

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

3.1.3.2 Deployment of FLEX Equipment – High Wind Hazard

NEI 12-06, Section 7.3.2 states:

> There are a number of considerations which apply to the deployment of FLEX equipment for high wind hazards:
>
> 1. For hurricane plants, the plant may not be at power prior to the simultaneous ELAP and LUHS condition. In fact, the plant may have been shut down and the plant configuration could be established to optimize FLEX deployment. For example, the portable pumps could be connected, tested, and readied for use prior to the arrival of the hurricane. Further, protective actions can be taken to reduce the potential for wind impacts. These factors can be credited in considering how the baseline capability is deployed.
>
> 2. The ultimate heat sink may be one of the first functions affected by a

hurricane due to debris and storm surge considerations. Consequently, the evaluation should address the effects of ELAP/LUHS, along with any other equipment that would be damaged by the postulated storm.

3. Deployment of FLEX following a hurricane or tornado may involve the need to remove debris. Consequently, the capability to remove debris caused by these extreme wind storms should be included.

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

5. The ability to move equipment and restock supplies may be hampered during a hurricane and should be considered in plans for deployment of FLEX equipment.

The licensee's Integrated Plan for deployment of portable equipment in the event of a high wind event was questionable regarding the ability to clear debris in the 24-hour period before debris-clearing equipment arrives from offsite. Tornado debris can be substantial. During the audit process, the licensee stated that its plan includes on-site debris cleaning and deployment equipment, stored in a hardened protective structure. The onsite equipment plans being considered include multiple compact track loaders in the protected building. In addition, BFNP has the ability to obtain equipment from a TVA owned facility located about 30 miles from the site within a few hours. In addition, the licensee has other equipment onsite capable of debris removal that is separated by distance to meet protection requirements. These include a backhoe, crawler excavator, and a crawler crane.

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

3.1.3.3 Procedural Interfaces – High Wind Hazard

NEI 12-06, Section 7.3.3, states:

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

On page 5 of the Integrated Plan, the licensee stated that the deployment strategies and deployment routing are yet to be determined. On page 19 of the Integrated Plan, the licensee stated that BFNP would develop procedures and programs to address storage structure requirements and deployment/haul path requirements relative to the hazards applicable to BFNP. This has been combined with Confirmatory Item 3.1.1.3.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 Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedural interfaces during a high wind hazard if these requirements are implemented as described.

3.1.3.4 Considerations in Using Offsite Resources – High Wind Hazard

NEI 12-06, Section 7.3.4 states:

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

On page 20 of their Integrated Plan, the licensee provided information regarding the use of the offsite resources through the industry SAFER program, but has not identified local staging areas and method(s) of transportation per the guidance of NEI 12-06, Section 7.3.4, considerations 1 and 2. During the audit process, the licensee provided preliminary staging areas A (onsite), B, C and D locations along with their proposed deployment/access routes. This 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 use of off-site resources during a high winds hazard, if these requirements are implemented as described.

3.1.4 Snow, Ice and Extreme Cold

As discussed in NEI 12-06, Section 8.2.1:

All sites should consider the temperature ranges and weather conditions for their site in storing and deploying their FLEX equipment consistent with normal design practices. All sites outside of Southern California, Arizona, the Gulf Coast and Florida are expected to address deployment for conditions of snow, ice, and extreme cold. All sites located North of the 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 3 of their Integrated Plan, the licensee stated that BFNP is below the 35th parallel; however, based on historical data collected from both NEI 12-06 Figure 8-1 and the BFNP UFSAR, snowfalls in excess of 6 inches have occurred in the past. UFSAR section 2.3.5.3 references snowfall reports of 17.1, 10.1, and 10.0 inches near BFNP. UFSAR section 2.3.5.1, identifies that in a typical year, Decatur, Alabama (located approximately 10 miles southeast of BFNP) has approximately 57 days per year with minimum temperatures equal to or less than 32 degrees Fahrenheit with an extreme daily temperature record of minus12 degrees Fahrenheit. Therefore, the FLEX strategies will consider the challenges caused by extreme snowfall and extremely cold temperatures. The licensee also stated that the site is located in either ice severity level 4 or 5 region, defined by NEI 12-06 Figure 8-2. Therefore, BFNP FLEX strategies will consider impedances caused by ice storms.

The licensee's screening for snow, ice, and extreme cold hazards, as presented in their Integrated Plan, has appropriately screened this external hazard and identified the hazard levels for reasonable protection of the FLEX equipment.

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

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

NEI 12-06, Section 8.3.1 states:

> These considerations apply to the protection of FLEX equipment from snow, ice, and extreme cold hazards:
>
> 1. For sites subject to significant snowfall and ice storms, portable FLEX equipment should be stored in one of the two configurations.
>
>     a. In a structure that meets the plant's design basis for the snow, ice and cold conditions (e.g., existing safety-related structure).
>
>     b. In a structure designed to or evaluated equivalent to ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures* for the snow, ice, and cold conditions from the site's design basis.
>
>     c. Provided the N sets of equipment are located as described in a. or b. above, the N+1 equipment may be stored in an evaluated storage location capable of withstanding historical extreme weather conditions such that the equipment is deployable.
>
> 2. Storage of FLEX equipment should account for the fact that the equipment will need to function in a timely manner. The equipment should be maintained at a temperature within a range to ensure its likely function when called upon. For example, by storage in a heated enclosure or by direct heating (e.g., jacket water, battery, engine block heater, etc.).

On page 33 of their Integrated Plan, the licensee stated that the FESB would be evaluated for snow, ice, and extreme cold temperature effects. Heating would be provided as required to assure no adverse effects on the FLEX equipment. The FESB would have a stand-alone heating, ventilation, and air conditioning (HVAC) system. On page 33 of their Integrated Plan, the licensee stated that the piping used to provide makeup flow to the SFP is contained within buildings that are protected from snow, ice, and extreme cold.

The licensee did not provide information that the FESB is a structure that meets the plant's design basis for the snow, ice and cold conditions or is a structure designed to or evaluated equivalent to ASCE 7-10, for the snow, ice, and cold conditions from the site's design basis as specified in NEI 12-06 Section 8.3.1 consideration 1.a and 1.b. During the audit process, the licensee stated that the FESB would be designed to or evaluated equivalent to ASCE 7-10, for the snow, ice, and cold conditions from the site's design basis.

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

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

NEI 12-06, Section 8.3.2 states:

> There are a number of considerations that apply to the deployment of FLEX equipment for snow, ice, and extreme cold hazards:
>
> 1. The FLEX equipment should be procured to function in the extreme conditions applicable to the site. Normal safety-related design limits for outside conditions may be used, but consideration should also be made for any manual operations required by plant personnel in such conditions.
>
> 2. For sites exposed to extreme snowfall and ice storms, provisions should be made for snow/ice removal, as needed to obtain and transport FLEX equipment from storage to its location for deployment.
>
> 3. For some sites, the ultimate heat sink and flow path may be affected by extreme low temperatures due to ice blockage or formation of frazil ice. Consequently, the evaluation should address the effects of such a loss of UHS on the deployment of FLEX equipment. For example, if UHS water is to be used as a makeup source, some additional measures may need to be taken to assure that the FLEX equipment can utilize the water.

On page 77 of the Integrated Plan, the licensee did not list any equipment capable of removing ice. On page 79 of the Integrated Plan, the licensee listed debris clearing equipment and a 4-wheel drive tow vehicle, but did not specify whether this equipment would be capable of removing ice. During the audit process, the licensee stated that current considerations are being given to provide compact track loaders for equipment deployment. These loaders would be capable of snow and ice removal from the site storage location and haul pathways to the intended connection point. Internal discussions are underway to include snow and ice removal from site haul pathways and staging areas into the TVA standard program and processes procedures (NPG-SPP). This has been identified as Confirmatory Item 3.1.4.2.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 the deployment of FLEX equipment during a snow, ice and extreme cold hazard, if these requirements are implemented as described.

3.1.4.3 Procedural Interfaces – Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.3, states:

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

On page 5 of the Integrated Plan, the licensee stated that the deployment strategies and deployment routing are yet to be determined. On page 19 of the Integrated Plan, the licensee stated that BFNP would develop procedures and programs to address storage structure requirements and deployment/haul path requirements relative to the hazards applicable to BFNP. This has been combined with Confirmatory Item 3.1.1.3.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 Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedural interfaces during a snow, ice and extreme cold hazard, if these requirements are implemented as described.

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

NEI 12-06, Section 8.3.4, states:

> Severe snow and ice storms can affect site access and can impact staging areas for receipt of off-site material and equipment.

On page 20 of their Integrated Plan, the licensee provided information regarding the use of the offsite resources through the industry SAFER program, but has not identified local staging areas and method(s) of transportation per the guidance of NEI 12-06, Section 8.3.4. During the audit process, the licensee provided preliminary staging areas A (onsite), B, C and D locations along with their proposed deployment/access routes. This 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 using offsite resources during a snow, ice and extreme cold hazard if these requirements are implemented as described.

3.1.5 High Temperatures

NEI 12-06, Section 9 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 3 of their Integrated Plan, the licensee stated that all sites must address high temperatures. As stated in UFSAR section 2.3.5.1, in a typical year, Decatur, Alabama (located approximately 10 miles southeast of BFNP) has approximately 70 days per year with maximum temperatures equal to or greater than 90 degrees Fahrenheit, with an extreme daily temperature record of 108 degrees Fahrenheit.

The licensee's screening for high temperature hazards, as presented in their Integrated Plan, has appropriately screened this external event and identified the hazard levels for reasonable protection of the FLEX equipment.

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

3.1.5.1 Protection of FLEX Equipment – High Temperature Hazard

NEI 12-06, Section 9.3.1, states:

> The equipment should be maintained at a temperature within a range to ensure its likely function when called upon.

On page 3 of their Integrated Plan, the licensee stated that the selection of FLEX equipment would consider the site maximum expected temperatures in their specification, storage, and deployment requirements, including adequate ventilation or supplementary cooling, as required.

On pages 33, 48, and 72 of their Integrated Plan, the licensee stated that the FESB would be evaluated for high temperature effects and ventilation will be provided as required to assure no adverse effects on the FLEX equipment. The FESB will have a stand-alone HVAC system.

On page 58 of their Integrated Plan, the licensee stated that the piping used to provide makeup flow to the SFP is contained within buildings that are protected from high 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 storage and protection of portable equipment from a high temperature hazard if these requirements are implemented as described.

3.1.5.2 Deployment of FLEX Equipment – High Temperature Hazard

NEI 12-06, Section 9.3.2 states:

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

On page 3 of their Integrated Plan, the licensee stated that the selection of FLEX equipment would consider the site maximum expected temperatures in their specification, storage, and deployment requirements, including adequate ventilation or supplementary cooling, as required.

A review was made of the licensee's plans for implementation of the strategies to deploy portable equipment during a high temperature hazard. The licensee discussed equipment deployment on pages 5 and 17 of the Integrated Plan. On page 5 of their Integrated Plan, the licensee stated that portable FLEX components would be procured commercially. The licensee did not discuss the impact of high temperatures on the deployment strategies. As stated in UFSAR section 2.3.5.1, Decatur, Alabama (located approximately 10 miles southeast of BFNP) has an extreme daily temperature record of 108 degrees Fahrenheit. Normal work practices would support deployment of portable/FLEX equipment in this temperature range and that normal maintenance actions would support correcting issues that delay the deployment.

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 equipment during a high temperature hazard if these requirements are implemented as described.

3.1.5.3 Procedural Interfaces – High Temperature Hazard

NEI 12-06, Section 9.3.3 states:

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

On page 5 of the Integrated Plan, the licensee stated that the deployment strategies and deployment routing are yet to be determined. On page 19 of the Integrated Plan, the licensee stated that BFNP would develop procedures and programs to address storage structure requirements and deployment/haul path requirements relative to the hazards applicable to BFNP. This has been combined with Confirmatory Item 3.1.1.3.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 Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedural interfaces from a high temperature hazard 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). This approach is endorsed in NEI 12-06, Section 3, by JLD-ISG-2012-01.

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

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

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

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

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

#### 3.2.1.1. Computer Code Used for ELAP Analysis.

NEI 12-06, Section 1.3 states:

> 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.

In the Integrated Plan, the technical basis for the events on the Sequence of Events timeline was not clearly stated for core cooling or maintaining primary containment. The licensee referenced both NEDC-33771P, "GEH Evaluation of FLEX Implementation Guidelines," Revision 0 analyses and Modular Accident Analysis Program (MAAP) code results for the development of the events timeline for core cooling and containment heat removal. During the audit process, the licensee stated that MAAP was used to ascertain the thermal hydraulic effects of the BDBEE and the effects on core cooling and primary containment. The events simulated were the loss of RCIC, core relocation, core ex-vessel and subsequent drywell spray.

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

The licensee has decided to use the MAAP4 computer code for simulating ELAP event. While the NRC staff acknowledges that MAAP4 has been used many times 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 evaluated its use for performing thermal-hydraulic analyses. Therefore, during the review of licensees' Integrated Plans, the issue of using MAAP4 was raised as a generic concern and was addressed by the NEI in their position paper dated June 2013, entitled "Use of Modular Accident Analysis Program (MAAP4) in Support of Post-Fukushima Applications" (ADAMS Accession No. ML13190A201). After review of this position paper, the NRC staff endorsed a resolution through letter dated October 3, 2013 (ADAMS Accession No. ML13275A318). This endorsement contained five limitations on the MAAP4 computer code's use for simulating the ELAP event for Boiling Water Reactors (BWRs). Those limitations and their corresponding Confirmatory Item numbers for this TER are provided as follows:

(1) From the June 2013 position paper, benchmarks must be identified and discussed which demonstrate that MAAP4 is an appropriate code for the simulation of an ELAP event at your facility. This has been identified as Confirmatory Item 3.2.1.1.A in Section 4.2.

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

(3) MAAP4 must be used in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper. This has been identified as Confirmatory Item 3.2.1.1.C in Section 4.2.

(4) In using MAAP4, the licensee must identify and justify the subset of key modeling parameters cited from Tables 4-1 through 4-6 of the "MAAP4 Application Guidance, Desktop Reference for Using MAAP4 Software, Revision 2" (Electric Power Research Institute Report 1020236). This should include response at a plant-specific level regarding specific modeling options and parameter choices for key models that would be expected to substantially affect the ELAP analysis performed for that licensee's plant.

Although some suggested key phenomena are identified below, other parameters considered important in the simulation of the ELAP event by the vendor / licensee should also be included.

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

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

(5) The specific MAAP4 analysis case that was used to validate the timing of mitigating strategies in the Integrated Plan must be identified and should be available on the ePortal for NRC staff to view. Alternately, a comparable level of information may be included in the supplemental response. In either case, the analysis should include a plot of the collapsed vessel level to confirm that TAF is not reached (the elevation of the TAF should be provided) and a plot of the temperature cool down to confirm that the cool down is within technical specification limits. This has been identified as Confirmatory Item 3.2.1.1.E in Section 4.2.

Regarding item 1, the licensee stated during the audit process that MAAP has been extensively benchmarked against other codes, such as RELAP, as well as experimental data. This benchmarking is documented in several sources including the MAAP User's Guide, and MAAP Applications Guide (TR-1020236). MAAP applicability with respect to Post-Fukushima Applications is documented in TR-3002001785, "Use of Modular Accident Analysis Program (MAAP) in Support of Post-Fukushima Applications." TR-100741 "MAAP Thermal-Hydraulic Qualification Studies," contains studies of several important accident phenomenon for both PWR and BWR accident sequences.

Concerning item 4, the licensee did not provide information relative to the initial condition of all three units being at 100 percent power for at least 100 days or has just been shut down from such a power history as required by plant procedures in advance of the impending event as specified in NEI 12-06 Section 3.2.1.2 consideration 1. During the audit process, the licensee stated that the initial condition of all three units was that the analyzed power level would be at Extended Power Uprate conditions (3,952 megawatt thermal). The decay heat curves are based on ANSI/ANS 5.1, 1979 decay heat standard without uncertainties. All of the analysis was based upon the operating units being at full power for a period of time greater than 100 days.

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

3.2.1.2. Recirculation Pump Seal Leakage Models.

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

The licensee did not Identify or provide justification for the assumptions made regarding primary system leakage from the recirculation pump seals and other sources that addresses the following items:

a. The assumed leakage rate and its predicted pressure dependence relative to test data.
b. Clarification of whether the leakage was determined or assumed to be single-phase liquid, two-phase mixture, or steam at the donor cell.
c. Comparison of design-specific seal leakage testing conditions to code-predicted thermal hydraulic conditions (temperature, void fraction) during an ELAP and justification if predicted conditions are not bounded by testing.
d. Discussion of how mixing of the leakage flow with the drywell atmosphere is modeled.

During the audit process, the licensee was asked to provide details on the assumed pressure-dependence of the leakage rate, and whether the leakage was determined or assumed to be single-phase liquid, two-phase mixture, or steam at the donor cell, and discuss how mixing the leakage flow with the drywell atmosphere is modeled. In their response, the licensee stated that the MAAP analysis used a recirculation pump seal leakage of 61 gallons per minute (total) that started 10 minutes into the event. No other source of leakage was modeled to the drywell. The seal leakage was modeled as a fixed area and the amount of leakage would be dependent on RPV pressure. The process conditions of the leakage would match the pressure temperature curve. The seal leakage is thermally mixed into the drywell atmosphere during the length of the event.

A review was conducted of the licensee's integrated plan and it was determined that there is insufficient information provided to determine the adequacy of the determination of recirculation pump seal or other sources of leakage used in the ELAP analysis. This has been identified as Confirmatory Item 3.2.1.2.A in Section 4.2.

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

3.2.1.3 Sequence of Events

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."

In its integrated plan, the licensee provided a sequence of events (SOE) identifying the time constraints and their applicability. Many of the time constraints were listed as preliminary.

NEDC-33771P/NEDO-33771, "GEH Evaluation of FLEX Implementation Guidelines," Revision 1 (hereinafter NEDC-33771P, ADAMS Accession No. ML130370742), specifies the beginning of the sequence for SBO for BWR/3/4 with Mark 1 Containment as follows:

> BWRs that have RCIC will respond to an SBO with the initiation of RCIC to inject water into the reactor vessel. High Pressure Coolant Injection (HPCI) may respond if RCIC is not available. RCIC and HPCI utilize reactor steam for motive force, exhausting this steam to the suppression pool. This exhaust steam transfers decay heat from the reactor vessel to the suppression pool. In addition to the RCIC steam supply, the [safety-relief valves] SRVs may open automatically to relieve pressure. Also some SRVs under operator control may be manually opened to maintain a reactor pressure band while there is sufficient direct current (DC) power and pneumatic supply. For both cases, SRV steam flow will remove additional reactor decay heat.

The RCIC system is proposed as the primary means by which the licensee will remove decay heat during an ELAP event. The RCIC system consists of a steam-driven turbine pump unit and associated valves and piping capable of delivering makeup water to the reactor vessel. The steam supply to the turbine comes from the reactor vessel. The steam exhaust from the turbine dumps to the torus. The pump can take suction from the demineralized water in the condensate storage tank or from the torus. Following any reactor shutdown, steam generation continues due to heat produced by the radioactive decay of fission products. The steam normally flows to the main condenser through the turbine bypass or if the condenser is isolated, through the relief valves to the torus. The RCIC system turbine pump unit either starts automatically upon a receipt of a reactor vessel low-low water level signal or is started by the operator from the Control Room by remote manual controls. The RCIC system delivers its design flow within 30 seconds after actuation. To limit the amount of fluid leaving the reactor vessel, the reactor vessel low-low water level signal also actuates the closure of the main steam isolation valves. The RCIC system has a makeup capacity sufficient to prevent the reactor vessel water level from decreasing to the level where the core is uncovered without the use of core standby cooling systems.

The ELAP analysis for BFNP generally assumes that the RCIC and HPCI systems will automatically start to recover reactor water into the normal band. When HPCI is secured, operator guidance will be changed to specify transferring HPCI suction to the suppression pool.

The following sequence of events of the ELAP was provided by the licensee, in part, in the description of the strategy to maintain core cooling, maintain containment and in attachment 1A to the integrated plan.

The event starts with all three units in power operation when the initiating event of an instantaneous loss of all ac power is assumed. The main steam isolation valves (MSIVs) close within five seconds. Upon the event initiation, with only dc power available, the main method of RPV level control is RCIC, with HPCI as a backup (it is expected that both will automatically initiate). RCIC takes suction from either the CST (if the CST is available after a BDBEE) or the Suppression Pool and injects water into the RPV. RPV depressurization starts at 30 minutes at a rate of 100 degrees Fahrenheit per hour. One hour into the event, the SBO procedure is exited and FSGs are entered. Cooldown is continued to a final pressure of 150 psig.

At T + 8 hours, the FLEX pumping systems are deployed for service with hoses aligned to:

- “B” and “D” RHRSW headers are charged (FLEX Pumping Systems FPS2 and FPS3)
- EECW headers charged (FLEX Pumping System FPS 1)
- Water is available on the refuel floor for each reactor via lines from FPS 1.

If all three 4 kV FLEX DGs are functioning, a core spray pump would be started to ensure that a low-pressure injection would be available. RCIC would be secured and the RPV would be depressurized sufficiently using MSRVs to inject Core Spray for RPV level control. RHR would be initiated in either the shutdown cooling (or torus cooling) mode to continue cool down. If a 4kV DG did not start, the unit assigned to that DG would be cooled down using an alternate FLEX strategy – venting. (Note: As directed by “Supplemental Staff Guidance for Addressing Order EA-12-049 on Mitigation Strategies for Beyond-Design-Basis External Events” (ML13238A263), traditional single failure criteria are not applied and the alternate FLEX strategy details provided by the licensee are for information only.) The Hardened Containment Vent System (HCVS) would be opened to maintain drywell and torus temperatures below design limits. Containment pressure would be maintained at above the pressure needed to maintain RCIC NPSH.

On page 83 of the Integrated Plan, the licensee described a shallow dc load shed for the scenario that one of the 480V FLEX DGs did not start. On page 11 of the Integrated Plan, which contains the technical basis for the time constraint, it states that the initial load shedding must be complete by T+4 hours to extend battery capability to 12 hours.

On page 10 of the Integrated Plan, the licensee stated that the Main Steam Relief Valve (MSRV) control is maintained from the control room with sufficient dc power and pneumatic pressure to operate the MSRVs throughout Phase 1 and Phase 2. The licensee describes that SRV actuation may require a higher than nominal dc voltage to actuate the MSRVs due to higher containment temperature with a longer duration event than an existing SBO coping time. The SRV pilot solenoid coil electrical resistance will increase due to a higher containment temperature with a longer duration event than an existing SBO coping time. The licensee is planning to evaluate MSRV qualification against the predicted containment response with FLEX implementation to ensure there will be sufficient dc bus voltage during the ELAP event. The licensee also provides that if required, there will be a modification to increase voltage as necessary to achieve the necessary coil current, or modifications will be made to reduce the coil resistance under higher temperature conditions. Because the MSRV control system will be exhausting control gas to the containment and containment pressure will be higher, the licensee is evaluating methods to establish any required increases in pneumatic supply pressure and modifications that may be required to ensure a supply of control gas for the MSRVs over the longer ELAP interval. These two questions were asked during the audit process and the licensee stated that the analysis/evaluation has not yet been completed. This has been identified as Confirmatory Item 3.2.1.3.A in Section 4.2.

During the audit process, a question was asked regarding details on the licensee's plan for termination of RCS cooldown to prevent the loss of RCIC. In their response, the licensee stated that the initial guidance would be provided by the SBO procedure, which is a cooldown of 90 degrees Fahrenheit per hour. Then EOI guidance would be utilized. EPG revision 3, provides guidance to maintain the RPV pressure approximately between 150 to 250 pounds per square inch with MSRVs.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to the computer codes used to perform ELAP analysis 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 5 of the Integrated Plan, the licensee stated that portable FLEX components would be procured commercially. On page 19 of the Integrated Plan, the licensee stated that BFNP would implement an administrative program for implementation and maintenance of the BFNP FLEX strategies in accordance with NEI 12-06 guidance. BFNP would follow the current programmatic control structure for existing processes such as design and procedure configuration. The licensee also stated that BFNP would utilize the standard Electric Power Research Institute (EPRI) industry preventive maintenance process for establishing the maintenance and testing actions for FLEX components. The administrative program will include maintenance guidance, testing procedures and frequencies established based on type of equipment and considerations made within the EPRI guidelines.

FLEX Pumps and/or FLEX pumping systems have been addressed in Section 3.2.1.8, Use of Portable Pump. The 480 V and 4kV DGs have been addressed in Section 3.2.4.8, Electrical Power Sources/Isolations and Interactions.

On page 21 of the Integrated Plan, the licensee stated that when reactor water level reaches – 45 inches, RCIC and HPCI automatically start with normal suction from the CST and inject to the RPV. This HPCI/RCIC injection recovers the reactor level to the normal band. CSTs at BFNP are not qualified for all the BDBEE hazards and therefore, are not credited for Phase 1 coping, but they would be used if available. The licensee was asked to provide a discussion that supports the instrumentation to switch RCIC/HPCI suction from CST to Suppression Pool (SP) would remain operational, the switchover function would be accomplished in a timely manner, and that RCIC injection to RPV would remain uninterrupted in the event ELAP conditions significantly damage the CST. The discussion included whether switchover function during ELAP would be carried out manually or automatically; and if manually, then whether it would be carried out from the MCR, or from the remote control panel, or from any other secured and accessible location. During the audit process, the licensee stated that the Design Criteria Document 50-5071, for RCIC, Section 3.11.1(3); the suppression pool (Primary Containment System) shall be the backup source for the RCIC pump suction (via core spray pump suction line). Alignment to this source requires manual operator action from the main control room. With RCIC taking suction from the condensate storage tank and injecting to the reactor vessel, there is sufficient inventory in the tank such that the high suppression pool level suction transfer would be required before a low condensate header level would be created. Operating Instruction (OI) -71, RCIC Operating Instruction, contains the following guidance to swap the RCIC suction to the suppression pool, (with EOI's also providing guidance): IF ANY of the following conditions occur while RCIC is injecting into the RPV:

- Suppression Pool level reaches +7 inches, OR
- HPCI suction auto transfers to suppression pool, OR
- RCIC Turbine trips on pump low suction pressure, THEN PERFORM steps to transfer RCIC Suction to the Suppression Pool.

This transfer would be performed from the MCR. The suction valves for RCIC CST and Suppression Pool suction valves are provided with safety related dc power. The "RCIC PUMP SUCTION PRESS LOW 1 [2 or 3] -PA-71-21A" alarm is initiated by pressure switches 1 (2 or 3) -PS-071-0021A which are located in Reactor Building Elevation 519. HPCI Suction Pressure Low switches 1 (2 or 3)-PS-73-29 are located in Reactor Building 519 and are safety related. HPCI has a design feature for auto swap-over on low pressure seen by these switches. HPCI suction valves are powered from the safety related dc batteries

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

3.2.1.5 Monitoring Instrumentation and Controls

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

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

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

On pages 24 and 39 of their Integrated Plan, the licensee stated that instrumentation relative to RPV level, drywell pressure, suppression pool level (after plant modification), suppression pool temperature, and drywell temperature (after plant modification) would be available during the event since this instrumentation is powered from station batteries. The licensee did not provide instrumentation regarding RPV pressure or suppression chamber air temperature, which were specified as typical monitoring parameters in NEI 12-06 Section 3.2.1.10. During the audit process, the licensee stated that the instrumentation list was being reevaluated for expansion and any changes would be included in future six-month plan updates. This has been identified as Confirmatory Item 3.2.1.5.A in Section 4.2.

On pages 24 and 39 of their Integrated Plan, the licensee listed the installed instrumentation credited for the coping evaluation, which would be available for all three phases, for maintaining core cooling during ELAP. In addition to the instrumentation already described, the site would have RCIC flow instrumentation and RCIC Steam Flow. The site would also have valve positions and controls for FCV-64-20 and -21, Suppression Chamber Vacuum Relief Valve as well as the Reliable Hardened Vent Radiation (RHVR) Monitor, valve position and effluent temperature.

On page 57 of the Integrated Plan, the licensee noted that new SFP level instrumentation would be addressed under EA-12-051.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and 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 plant instrumentation credited in the ELAP mitigation strategies, 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).

The primary method of pressure control for the RPV during the ELAP is the MSRVs. On page 22 of their Integrated Plan, the licensee stated that for Phase 1, the station batteries supply power for the MSRVs. At event initiation the nitrogen storage tank, with a backup supply from the Containment Atmosphere Dilution system, automatically supplies pneumatic pressure for MSRV operation. However, these nitrogen tanks are not designed to withstand all BDBEE and a modification would be performed to provide a backup nitrogen control station within the Reactor Buildings for BFNP-1, 2 and 3. In addition, each Automatic Depressurization System (ADS) MSRV is provided an accumulator that contains enough pneumatic pressure to operate each valve through five open/close cycles, per the UFSAR. Mechanical SRV operation will also control reactor pressure. On page 24 of the Integrated Plan, the licensee stated that they would install a protected nitrogen control station to provide backup pneumatic supply to the MSRVs. On page 78 of the Integrated Plan, the licensee stated that 480V Air Compressors may be needed for mitigating strategies related to the core. During the audit process, the licensee stated that aside from the identified motive forces of compressed air and a nitrogen control station, BFNP has not, at this time, identified other motive forces that would be necessary to manipulate 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 motive power, valve controls and motive air system, if these requirements are implemented as described.

#### 3.2.1.7 Cold Shutdown and Refueling

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

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

The licensee's Integrated Plan did not discuss providing core cooling if an ELAP occurs during Cold Shutdown or Refueling, Modes 5 and 6.

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

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

The licensee informed the NRC of their plan to abide by this generic resolution.

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

3.2.1.8 Use of Portable Pumps

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

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

NEI 12-06 Section 11.2 states in part:

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

On page 27 of the Integrated Plan, the licensee stated that there would be low pressure pumping units available at the beginning of Phase 2. Each FLEX Pumping System (FPS 1, FPS2, FPS3, and FPS4) consists of a portable diesel pump rated at 5,000 gallons per minute at 150 pounds per square inch discharge head. Suction lift capability is rated at 6 feet. The diesel driver is rated at 600 HP. In the case of extreme low lake level, each Flex Pumping System is deployed with suction lift augmentation. Suction lift augmentation is provided for each of the main pumps (FLPP1, FLPP2, FLPP3, and FLPP4) by a FLEX floating booster pump (FLBP) set aligned to the suction of the main pump. FLEX floating booster pump sets (FLBP 1, FLBP2, FLBP3 and FLBP4) include two pumps in parallel, 2500 gpm each with a 343 HP diesel hydraulic drive system. The pump systems include trailers, lift units, and hoses. TVA is designing deployment locations for the pumps, including ramps, winches or other transfer assemblies as necessary to deploy all pumps and hoses within the 8 hour Phase 1 coping interval. The licensee begins deployment of these pumps as soon as SBO occurs rather than waiting to exhaust all attempts to restore the emergency electric supply system.

FLEX Pumping Systems would be assigned as follows.

FPS1 can be connected to one or more of the following:

- Three Containment Integrated Leak Rate Test (CILRT) penetrations through Reactor Building wall, inside 1A, 2A, 3A RHRSW pipe tunnel (from inside the Reactor Building, connections can be made to condensate and then to the vessel through RHR fill line, or to SFP makeup (normal), or to the torus),
- The EECW South header -hookup outside pipe tunnel (3B & D Service Water (SW) tunnel) (The Emergency DGs would be isolated by manual action if needed to ensure adequate cooling to operating safety systems and components (SSCs)). The South header can be used for SFP makeup, and
- The EECW North Header - same as described (similar to the South Header).

FPS2 is aligned to B RHRSW at one, or more, of the following locations;

- At the intake structure,
- In the tunnel at RHRSW piping and/or
- By drilling a new 16" penetration through Reactor Building wall and connecting to the Heat Exchanger (HTX).
  Note: The B RHRSW can provide standby coolant to any unit, if needed.

(FPS3) - could be connected to D RHRSW at one, or more, of the following locations:

- At the intake structure,
- In the tunnel at RHRSW piping and/or
- By drilling a new 16" penetration through Reactor Building wall and connecting to the HTX.
  Note : The D RHRSW can provide standby coolant to any unit, if needed.

(FPS4) is the N+1 spare.

On page 14 of the integrated plan regarding Portable Equipment to Maintain Core Cooling, the licensee describes the use of portable pumps to provide RPV injection. No supporting analysis was provided for the diesel-driven FLEX pump capabilities considering the pressure within the RPV and the loss of pressure along with details regarding the FLEX pump supply line routes, length of hoses runs, connecting fittings, elevation changes to show that the pump is capable of injecting water into the RPV with a sufficient rate to maintain and recover core inventory for both the primary and alternate flow paths. During the audit process, the licensee stated that the detailed hydraulic analysis has been scoped and a contract would be awarded to perform the design portion.  This has been identified as Confirmatory Item 3.2.1.8.A in Section 4.2.

During the audit process, the licensee was asked to provide a detailed description of the required flow rates for each unit for core cooling, containment integrity, and spent fuel pool cooing.  The description should include primary and alternate strategies and show that sharing of FLEX equipment does not impede the ability to accomplish core cooling, containment integrity, and spent fuel pool cooling on any unit.  In their response, the licensee stated that the FLEX system will be comprised of portable pumps rated for 5,000 gallons per minute at 150 pounds per square inch that would be deployed to an area east of the forebay to supply water to the RHRSW and EECW permanent piping systems.  Hoses would be connected to manifolds designed to NEI 12-06 requirements that would have permanent diverse connections to the piping located in the intake pumping station.  The first priority would be to supply water to the EECW south header to operate room coolers, Unit 3 chillers, and emergency makeup to the spent fuel pool and provide alternative cooling water to the RCIC oil cooler.  The second priority would be to supply water to the RHRSW system via the “B” supply header that would allow a RHR heat exchanger to be placed into service. The operation of the standby coolant supply to the RHR system will provide FLEX water for containment cooling, RPV injection and to supply water to the spent fuel pool via the reactor vessel head spray supply line.  The third priority would be to supply water to the RHRSW system via the “D” supply header that would allow a RHR heat exchanger to be placed into service. The operation of the standby coolant supply to the RHR system will provide FLEX water for containment cooling, RPV injection and to supply water to the spent fuel pool via the reactor vessel head spray supply line.  Analysis will be performed to determine the required FLEX flow based on various scenarios and RPV water level.  This has been combined with Confirmatory Item 3.2.1.8.A in Section 4.2.

The licensee’s approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of 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 equipment if these requirements are implemented as described.

### 3.2.2 Spent Fuel Pool Cooling Strategies

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

As described in NEI 12-06, Section 3.2.1.7 and JLD-ISG-2012-01, Section 2.1, strategies that 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 52 of the Integrated Plan, the licensee stated that the normal Spent Fuel Pool (SFP) water inventory provides sufficient SFP cooling to prevent fuel damage for the entire Phase 1 coping period until Phase 2 (8 hours). RTM-96 Response Technical Manual, Volume 1, was used with a full core recently discharged plus 20 years of accumulated discharges, after 5 days shutdown.

- The time for the SFP to boil is 3.1 hours.
- The required makeup to offset boil off is 81 gallons per minute.
- The SFP must be virtually drained for substantial damage to occur. Pools are considered coolable as long as 20% of the fuel is covered.
- Cladding failure with release of the fission products in the fuel pin gap is possible within 2 hours to several days after the pool is drained.
- The boil dry time is estimated at 49.3 hours.

The licensee stated that the site would develop procedures (as shown on timeline, Attachment 1A) to deploy and secure makeup hoses at the SFP before boiling would occur. This could be required as early as 3.1 hours to avoid having to access the SFP deck while boiling is in progress; however, the site may allow for a longer time period if actual SFP loads are lower (as would normally be expected). At eight hours into the event, more than 40 hours remain before the fuel becomes inadequately cooled.

On page 56 of the Integrated Plan, the licensee stated that if the SFP heat load is high, then the demand for reactor and containment cooling would be lower. In this scenario, the primary strategy would be for an RHR pump, powered by a 4 kV FLEX DG to be aligned to SFP cooling assist mode to provide SFP cooling. RHR could also provide makeup to the SFP (torus temperatures would be maintained below boiling since unit heat load will be low in the RPV). RHR room and seal coolers would be supported by FPS 1 (via EECW system piping). FPS2 or FPS3 would provide river-cooling supply to the RHR heat exchangers. In addition, the Fuel Pool Cooling and Cleanup (FPCCU) system would be operated with power from the 4 kV FLEX DGs. FPS1 provides cooling water for the Reactor Building Closed Cooling Water System (RBCCW) Heat Exchanger (HTX) which, in turn, supplies cooling to the FPCCU HTXs.

As an alternate strategy (N + 1) when the SFP heat load is high (early in cycle after an offload) and an RHR pump is not available (assuming a 4 kV FLEX DG is unavailable), the fuel pool makeup requirements would be met by connecting the EECW makeup line to the SFP through the hoses previously aligned on the refuel floor. The EECW system would be charged using FPS1. A second alternative (N + 2) would be to inject flow from FPS2 or FPS3 (depending on unit) via the RHR standby coolant alignment to RHR SFP makeup.

For strategies when SFP heat load is low (late in core life), SFP cooling is not needed until after Phase 3 begins. If SFP makeup or cooling would be needed before Phase 3, the same strategies listed above would be implemented, only later.

The SOE timeline provided by the licensee on page 84 of the Integrated Plan stated that an elapsed time of T + 3 hours, the action would be to lay-out and secure hoses on the SFP floor to provide supplemental SFP water addition without entering the area. This time can be increased based on actual SFP loading and procedures that would be implemented to maintain staff awareness if actions are needed within the first 24 hours. The SFP would not boil in the first eight hours unless the unit has been shutdown less than 5 days (for a 1/3 core offload) and there is generally enough additional staff immediately after an outage to perform this action without the core team being used for other FLEX actions during the first eight hours.

During the audit process, a question was raised regarding a discussion on pages 70 and 71 of the Integrated Plan of how ventilation would be achieved to avoid overpressurization in the SFP area. However, no analysis was provided to verify the adequacy of the ventilation and/or support the conclusion of habitability in the SFP area. A clarification of whether any actions would be required in the SFP area including additional information relative to the ventilation and/or habitability analyses which provided the bases for concluding that the proposed strategies in this area would be successful as specified in NEI 12-06 Section 3.2.2 consideration 11. The licensee's responses stated that no analysis has been performed to ensure adequacy of the vent path described. Using realistic analysis, none of the spent fuel pools at BFNP have greater than a 3 degree per hour heatup rate immediately following fuel shuffles. Based on being at the Technical Specification limit of 150 degrees, 20 hours are available for action to be taken prior to pool boil. Using administrative limits of 125 degrees, allows 40 hours for actions to be taken (1-AOI-78-1, 2-AOI-78-1 & 3-AOI-78-1 Fuel Pool Cooling Cleanup System Failure). TVA was very conservative in the Integrated Plan using 3.1 hours in accordance with NUREG/BR-150, which assumes a full core discharge plus 20 years of accumulated discharge

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 SFP cooling strategies, if these requirements are implemented as described.

### 3.2.3 Containment Functions Strategies

NEI 12-06, Table 3-1 and Appendix C provide a description of the safety functions and performance attributes for BWR containments which are to be maintained during an ELAP as defined by Order EA-12-049. The safety function applicable to a BWR with a Mark 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.

The licensee's primary strategy to remove heat from containment is to restore the RHR system in the shutdown cooling or torus cooling mode. As discussed in Section 3.2.1.3 above, if all three 4 kV FLEX DGs are functioning, a core spray pump would be started to ensure that a low-pressure injection source is available. RCIC would be secured and the RPV would be depressurized sufficiently using MSRVs to inject Core Spray for RPV level control. RHR would be initiated in either the shutdown cooling (or torus cooling) mode to continue cool down. If a 4kV DG did not start, the unit assigned to that DG would be cooled down using an alternate FLEX strategy – venting. (Note: As directed by "Supplemental Staff Guidance for Addressing Order EA-12-049 on Mitigation Strategies for Beyond-Design-Basis External Events" (ML13238A263), traditional single failure criteria are not applied and the alternate FLEX strategy details provided by the licensee are for information only.) The HCVS would be opened to maintain drywell and torus temperatures below design limits. Containment pressure would be maintained at above the pressure needed to maintain RCIC NPSH.

On page 38 of their Integrated Plan, the licensee stated that during Phase 1, the primary strategy would be to control reactor parameters so as not to challenge containment limits within the first eight hours of the event to give time to deploy FLEX pumps for Phase 2. Reactor pressure would be lowered at near the maximum cooldown rate to ensure that if there were an unplanned rapid depressurization during this interval, the heat rejected from the reactor system to the containment would not exceed the ability of the HCVS to mitigate. Venting is not expected to be required during the first eight hours of the event based on following the operational strategies in NEDC-3371P, "GEH Evaluation of FLEX Implementation Guidelines", and the licensee's preliminary MAAP calculations. Procedures would caution that venting during the first eight hours, if required, must be minimized to avoid an adverse impact on RCIC Net Positive Suction Head (NPSH) (if RCIC must be aligned to the suppression pool rather than the CST). RCIC would only be credited vessel makeup during Phase 1. The licensee has not provided finalized calculations which support the primary strategy timeline by concluding that venting or other heat removal activities will not be required during the first eight hours of the event, maintaining a suppression pool temperature low enough to support continued RCIC operation for this time period. This has been identified as Confirmatory Item 3.2.3.A in Section 4.2

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

As described in Section 3.2.1.8 above, the FLEX Pumping System has three priorities. The first priority would be to supply water to the EECW south header to operate room coolers, Unit 3 chillers, and emergency makeup to the spent fuel pool and provide alternative cooling water to the RCIC oil cooler. The second priority would be to supply water to the RHRSW system via the "B" supply header that would allow a RHR heat exchanger to be placed into service. The operation of the standby coolant supply to the RHR system will provide FLEX water for containment cooling, RPV injection and to supply water to the spent fuel pool via the reactor vessel head spray supply line. The third priority would be to supply water to the RHRSW system via the "D" supply header that would allow a RHR heat exchanger to be placed into service. The operation of the standby coolant supply to the RHR system will provide FLEX water for containment cooling, RPV injection and to supply water to the spent fuel pool via the reactor vessel head spray supply line.

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

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 – water 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.

On page 69 of the Integrated Plan, the licensee stated that for the Engineered Safety Feature (ESF) Switchgear Rooms, for Phase 2, the rooms containing the 480 V ESF switchgear would begin to heat up as the switchgear was energized by the 4 kV FLEX DGs; therefore, they were evaluated for limiting temperatures for equipment survivability. The calculations performed in Loss of HVAC During ELAP indicate that switchgear rooms rise to 90 degrees Fahrenheit at the end of a four-hour coping period. Under ELAP conditions, the units' switchgear would be de-energized at the onset of the ELAP and remain de-energized until Phase 2 when portions of the switchgear were reenergized by the 4 kV FLEX DGs. The rooms would begin to heat up in Phase 2, following the energizing of some 480 V switchgear by the 4 kV FLEX DGs and therefore, a coping period for the duration of Phase 2 must be considered. An acceptable strategy for heat removal from the switchgear rooms would be the establishment of a method to exhaust the heat to the outside by means of portable exhaust fans. Note that the 4160 V switchgear is not energized during the Phase 1 coping period.

On page 70 of the Integrated Plan, the licensee stated that for battery room ventilation, during battery charging operations in Phase 2 and 3, ventilation would be required for the main battery rooms due to hydrogen generation. From a heat load perspective, the battery rooms were evaluated and it was determined that the resultant temperature rise is negligible. Therefore, no ventilation would be needed to reduce the heat load. The calculation of battery room hydrogen generation determined that hydrogen levels would not reach two percent until 29.9 hours assuming charging starts at time 0 and battery room initial temperature is at 110 degrees Fahrenheit with equalizing voltage at 2.33 volts. Hydrogen generation does not occur unless the batteries are on charge. Phase 2 strategies can provide power both for charging and to supply power for room ventilation. There would be two strategies for venting the battery rooms. The primary strategy is to repower the existing emergency exhaust fans that are connected to the Emergency Power bus. This would occur after the 4 kV FLEX DG has been connected to power the 480 V bus. The alternate strategy is to prop open doors and set up portable fans.

The licensee did not provide a discussion on the specific hydrogen gas exhaust pathway or describe how hydrogen concentration in the battery rooms would be maintained below the limits when the batteries are being recharged during Phase 2 and 3. During the audit process, the licensee stated that during the initial portion of the event, the normal supply and exhaust of the battery rooms would be inoperable. Analysis has been performed to determine the hydrogen concentration should remain below 2% for a period greater than 24 hours for the unit battery rooms 1, 2 & 3. It is planned that exhaust air would be available after 8 hours for all of the battery rooms designated to support the ELAP. The flow path will not be different than the existing configuration. Hydrogen generation is predominantly produced during battery float and equalizes time periods. During initial discharge in a BDBEE event, significant Hydrogen would not be produced. Similarly, during periods where the battery is on charge from FLEX DGs, the majority of current from the charger is supporting battery loads and will result in a low charge rate to recover the battery which will produce minimum Hydrogen. IEEE-1365-2012 states that peak Hydrogen production occurs as the battery nears fully charged state. Since available current for battery charging is very low, the time to reach float conditions is in excess of 24 hours. IEEE 484 specifies that the battery room ventilation system shall limit hydrogen accumulation to less than 2% of the total volume of the battery area. IEEE 1635 states that the recommended maximum average concentration in the room (battery room) should be less than two percent by volume.

The licensee did not provide sufficient details of the ventilation provided in the battery room to support a conclusion that there is reasonable assurance that the affects of elevated or lowered temperatures in the battery room, especially if the ELAP is due to a high or low temperature hazard, have been considered. During the audit process, the licensee stated that during the ELAP, all of the battery room temperatures that support the FLEX response would remain below the high temperature design point of 104 degrees Fahrenheit that is used to determine the battery performance. This is based on studies that have been performed. Work is in progress to issue the final calculations. The impact on the performance of the batteries based on low temperatures is minimal. The Unit batteries are located within the Control building interior such that outside air temperature would not impact battery performance. Operator actions will be taken to monitor the temperature and take necessary actions.

The licensee did not provide details regarding the effects of loss of ventilation in the HPCI/RCIC pump rooms to conclude that the equipment in the HPCI/RCIC pump rooms would perform its function and assist in core cooling throughout all Phases of an ELAP. During the audit process, the licensee stated that preliminary analysis has been performed, but the calculations have not been finalized. Based on preliminary analysis, the RCIC room would reach 140 degrees at 32 hours. The electronic governor module (EGM) for RCIC could fail with temperatures at 150 degrees Fahrenheit. RCIC has steam isolation at 165 degrees in the room or torus area. EOI Appendix 5C, Injection System Lineup RCIC, allows bypassing of the high temperature isolation using booted contacts in accordance with EOI Appendix 16K, Bypassing RCIC High Temperature Isolation. Core Spray room cooler strategy is being evaluated to aid in cooling of the Core Spray/RCIC room. A detailed summary of the analysis and/or technical evaluation performed to demonstrate the adequacy of the ventilation provided in the HPCI/RCIC pump rooms to support equipment operation throughout all phases of an ELAP is requested. This has been identified as Confirmatory Item 3.2.4.2.A in Section 4.2.

During the audit process, a question was asked regarding the licensee's plans to override the RCIC isolation and trip signals. Additional information was requested on how this would be accomplished. In their response, the licensee stated that EOI Appendices would be utilized. Some already exist, others will be added by EPG Revision 3. This has been identified as Confirmatory Item 3.2.4.2.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 ventilation – 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.

In the Integrated Plan, the licensee did not discuss the effects of loss of power to heat tracing. During the audit process, the licensee stated that the site's coping strategies for BDBEE do not rely on heat trace availability for any small bore piping.

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

3.2.4.4 Accessibility – Lighting and Communications.

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

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

A review was made of the Integrated Plan for coping strategies discussing plant lighting and communications systems during an ELAP that support personnel access for coping strategies that maintaining core, containment and SFP cooling. The licensee has not discussed coping strategies for portable and emergency lighting necessary to facilitate personnel access into plant locations to implement mitigating strategies. During the audit process, the licensee stated that lighting in the protected area is currently under review without a firm strategy developed. Considerations have been given to LED emergency lighting to extend battery life coupled with individual issued flashlights and headlamps. Lighting stands would be included in the FESB, and powered by small portable generators that would also be included in the FESB. The low-pressure pumps associated with the FLEX pumping system, once deployed and in service have external lights for personnel use. This has been identified as Confirmatory Item 3.2.4.4.A. in Section 4.2.

The NRC staff has reviewed the licensee communications assessment (ADAMS Number ML12311A297) required by in response to the March 12, 2012 50.54(f) request for information letter for BFNP and, as documented in the staff analysis (ML13157A150) 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. This has been identified as Confirmatory Item 3.2.4.4.B. in Section 4.2 for confirmation that upgrades to the site's communications systems have been completed.

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 lighting and communications support for accessibility for operator actions, if these requirements are implemented as described.

3.2.4.5 Protected and Internal Locked Area Access

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

> *Plant procedures/guidance should consider the effects of ac power loss on area access, as well as the need to gain entry to the Protected Area and internal*

*locked areas where remote equipment operation is necessary.*

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

The licensee provided no information regarding local access to the protected areas under ELAP. This has been identified as Open Item 3.2.4.5.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 protected and internal locked area, if these requirements are implemented as described.

3.2.4.6 Personnel Habitability – Elevated Temperature

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

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

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

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

Section 9.2 of NEI 12-06 states,

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

Control Room Habitability

On pages 66 and 68 of the Integrated Plan, the licensee stated that under ELAP conditions with no mitigating actions taken, initial analysis projects the control room to approach 110 degrees Fahrenheit (the assumed maximum temperature for efficient human performance) in a time of approximately 19 hours (U1/U2) and 24 hours (U3). The Phase 1 FLEX strategy is to block open the entrance door to the Main Control Room (MCR) when the MCR temperature reaches 94°F (U1/U2) and 93°F (U3) (the assumed outside temperature at the time of event occurrence). This would establish a flow path for air to flow from the control building (and outside) to the MCR. The preliminary assessment indicates that by employing this strategy the MCR temperature will rise to approximately 101°F (U1/U2) and 99°F (U3) at the 8 hour point by which time Phase 2 actions can be implemented. For Phase 2, the primary strategy for maintaining the environment of the MCR would be through the use of portable fans. For the MCR areas, a breach of the Main Control Room Habitability Zone (MCRHZ) boundary and addition of temporary fans can be utilized to reduce temperatures in the MCR areas. Installation of supply and discharge flexible ductwork on the fans and locating the fans accordingly can reduce noise in the MCR areas.

In the licensee's discussion regarding control room habitability, the temperatures that are provided are based on preliminary analysis. The analysis needs to be finalized. During the audit process, the licensee stated that a new calculation would be issued to formalize the transient temperature study and provide guidance in opening doors and setting up portable fans. This has been identified as Confirmatory Item 3.2.4.6.A in Section 4.2.

RCIC Room Habitability

On pages 66 and 68 of the Integrated Plan, the licensee stated that for the purposes of NEI 12-06, it is not anticipated that continuous habitability would be required in the pump rooms. If personnel entry is required into the pump room, then personal protective measures such as ice vests will be taken in accordance with Site Administrative and Safety Procedures and Processes. Under the SBO case, the temperature remains below 127 degrees Fahrenheit for eight hours into the BDBEE. Based on extrapolation of the heat up curves, temperature in the RCIC room would rise to approximately 151 degrees Fahrenheit in approximately 72 hours. During the audit process, the licensee stated that the strategies are not yet fully developed for personnel access to areas. Personnel protective equipment would be located in the FESB until required for use. Some areas of the Control Bay may see increased room temperatures that would require opening doors or adding portable fans. The operation of the RCIC system during the ELAP event would increase the Northwest quad room temperature that would have an adverse impact on personnel staying in the RCIC room. Further personnel protective measures are being evaluated. Room cooler strategies are being evaluated to lower room temperatures utilizing the EECW system and RHR/CS Room Coolers. This has been identified as Confirmatory Item 3.2.4.6.B in Section 4.2.

RHR/CS Room Habitability

On page 69 of the Integrated Plan, the licensee stated that for the purposes of NEI 12-06, it is not anticipated that continuous habitability would be required in the pump rooms. If personnel entry is required into the pump room, then personal protective measures such as ice vests will be taken in accordance with Site Administrative and Safety Procedures and Processes. Under the SBO case, the temperature remains below 120 degrees Fahrenheit for eight hours into the BDBEE. Based on extrapolation of the heat up curves, temperature in the RCIC room would rise to approximately 145 degrees Fahrenheit in approximately 72 hours. During the audit process, the licensee stated that the strategies are not yet fully developed for personnel access to areas. Personnel protective equipment would be located in the FESB until required for use. Some areas of the Control Bay may see increased room temperatures that would require opening doors or adding portable fans. The operation of the RCIC system during the ELAP event would increase the Northwest quad room temperature that would have an adverse impact on personnel staying in the RCIC room. Further personnel protective measures are being evaluated. Room cooler strategies are being evaluated to lower room temperatures utilizing the EECW system and RHR/CS Room Coolers. This has been combined with Confirmatory Item

3.2.4.6.B in Section 4.2.

Spent Fuel Pool Area

On page 70 of the Integrated Plan, the licensee stated that ventilation of the refuel floor during an ELAP could be established by opening doors to the vent tower and vent tower roof of units 1 and 3. The equipment hatches for each unit would always have a minimum opening area and allow air from the lower floors to rise and be released through the open doors to the vent tower, UFSAR Section 5-5.3.

There is insufficient information provided in the Integrated Plan to demonstrate that potential high temperature /humidity on the refuel floor has been addressed with regard to habitability. This has been identified as Open Item 3.2.4.6.C. 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/Open Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to personnel habitability – elevated temperature 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.

On pages 21 and 29 of their Integrated Plan, the licensee described the sources of water for use in core and SFP cooling. The licensee identified the sources of water being the CST as the preferred source of feed to the RPV for makeup. If the CST were unavailable, then RCIC and HPCI would take suction from the Suppression Pool. An alternate source of water for both the RPV and the SFP is through the use of the FLEX pumping system that takes suction on the Tennessee River.

The sources of water that the licensee has identified as being available are the CST (assumed not available after a BDBEE), the Suppression Pool and the Tennessee River. For the Tennessee River, a discussion of the quality of this water (e.g., suspended solids) and a justification that its use would not result in blockage at the fuel assembly inlets to an extent that would inhibit adequate flow to the core is needed. Alternately, if deleterious blockage at the fuel assembly inlets cannot be precluded, an alternate means for assuring adequate core cooling is needed. During the audit process, the licensee stated that filtration options are currently being evaluated. Additionally, guidance was issued in GEH - 33771P, GE Evaluation of FLEX Mitigation Strategies, Section 7.7 that provided the following: If the plant needs to rely on raw water or seawater for part of the planned response, consideration should be given to performing RPV low pressure injection at a rate that provides core cooling without boiling. This would help prevent heat transfer surface fouling and can be done by bleeding water through the SRVs to the suppression pool. The site-specific evaluation would have to include a determination of how long this can continue before the maximum suppression pool level is reached as well as what flow rate would be required to preclude boiling. When the suppression pool maximum level is reached, other means of core cooling must be provided, or an acceptable method of suppression pool draining must be established. The GEH guidance needs to be evaluated against Emergency Operating Instructions (EOI) guidance for RPV level control. This option is currently under evaluation. This has been identified as Confirmatory Item 3.2.4.7.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 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 26 of the Integrated Plan, the licensee described the three 480 V and three 4kV DGs as follows:

- Three 480 V FLEX DGs are permanently staged on the roof area of the adjacent Diesel Buildings. They are protected for all of the extreme natural events in Section 1 of the Integrated Plan except for tornados. These will be available before Phase 2 to supply battery chargers, Integrated Computer System (ICS) inverters, and other loads. Each of the 480 V FLEX DGs would be able to supply a Unit Distribution Panel to supply a 250 Vdc Unit Battery Charger, a UNIT ICS inverter, a 480 V Unit Shutdown Board and three additional 100 amp spare disconnects. During the audit process, the licensee provided the location of the three 480 V DGs.

- Three 4 kV FLEX DGs are permanently staged in a protected bunker structure. At the beginning of Phase 2 they would be available to support the applicable loads. It should be noted that the 4 kV FLEX DGs could be aligned to battery chargers and are the backup supply in case of failure or tornado hazard loss of one or more of the 480 V FLEX DGs. If any 4 kV FLEX DG is lost, a power supply for a battery charger can be aligned. Each of the 4kV FLEX DGs would be available to support energizing a RHR motor and a CS motor simultaneously.

The Integrated Plan contained insufficient information regarding electrical isolations and interactions. In particular, it was not clear how the 480 V FLEX DGs, 4 kV FLEX DGs and the EDGs are isolated to prevent simultaneously supplying power to the same Class 1E bus. During the audit process, the licensee stated that the four-megawatt FLEX DGs would be isolated from the Safety Related busses by Class 1E qualified breakers. Procedures would be in place to control operation of the breakers. The 480 V FLEX DGs would be isolated from the Battery Chargers by class 1E transfer switches. The 480 V FLEX DGs would be isolated from the 480 volt distribution by a Class 1E breaker. Procedures would be in place to control operation of the transfer switches and class 1E breaker. The BFNP design would be flexible and would allow either the four-megawatt FLEX DG or the 480 V D/G to energize battery chargers and the 480-volt distribution system. Procedures would be in place to control which DG is utilized as a power source for this equipment.

A review of the Integrated Plan regarding local instrumentation determined that information regarding local instrumentation was not adequate. Additional description of the instrumentation that will be used to monitor portable FLEX electrical power equipment including their associated measurement tolerances/accuracy to ensure that: 1) the electrical equipment remains protected (from an electrical power standpoint – e.g., power fluctuations) and 2) the operator is provided with accurate information to maintain core cooling, containment, and SFP cooling. Provide a discussion on the issue of portable electrical equipment instrumentation. This has been identified as Confirmatory Item 3.2.4.8.A in Section 4.2.

The licensee was requested to provide a detailed electrical one-line diagram showing how each FLEX DG (and any portable generators) would/could be connected into the existing electrical distribution system. During the audit process, the licensee stated that one-line diagrams would be prepared and provided. This has been identified as Confirmatory Item 3.2.4.8.B in Section 4.2.

The licensee was requested to provide a discussion on the electrical cable pathway for each FLEX DG with a conceptual sketch of the proposed cable paths. During the audit process, the licensee stated that the cables between the FESB and DG building for the 4-megawatt DG connections would be buried and hardened to meet the protection requirements for FLEX. The buried cable would Okonite type C-L-X with a continuously corrugated welded aluminum sheath and missile protection would be provided over the cable trench. The cable would be designed to be utilized as a feeder cable for utility power distribution systems and to be direct buried in wet or dry locations. The power cables, in this application, would be normally de-energized which significantly reduces potential for cable aging from moisture induced treeing. Once the cables enter the Unit 3 DG building they are within a safety-related structure meeting site design basis protection requirements. Cables from the 480 V DGs would be hardened to meet protection requirements up to the point they enter the DG buildings and are within a safety-related structure meeting site design basis from that point. This has been identified as Confirmatory Item 3.2.4.8.C in Section 4.2 relative to the conceptual sketch of the proposed cable paths.

Further technical basis is needed for the 480 V and 4kV DG capabilities considering the capacity of the equipment. The licensee is requested to provide a summary of the sizing calculation for both the 480 V and 4kV FLEX DGs to show that they could supply the loads assumed in Phases 2 and 3. During the audit process, the licensee stated that a detailed sizing analysis has not been performed. The 4-megawatt DGs were procured to be the minimum size of a Safety Related DG and be able to start the largest anticipated load (RHR motor with 13 MVA starting demand). The 480 V DG (225kva machines) were initially sized at 150kva to feed one battery charger each (charge the Unit battery for one unit). TVA increased the size to 225kva as a fleet decision to provide additional capability.

The licensee was requested to provide a discussion on the N+1 strategy for the 480 V and 4 kV FLEX Diesel Generators (i.e., explain how three 4 kV FLEX Diesel Generators satisfies the guidance in JLD-ISG-12-01) and to explain the maximum capability of each FLEX Diesel Generator (e.g., can each FLEX Diesel Generator only support one unit at a time?). During the audit process, the licensee stated that TVA has implemented multiple strategies to charge batteries for instrumentation and multiple strategies to provide reactor cooling. As specified in NEI 12-06, if multiple strategies are provided, N+1 is not required. Battery charging can be performed by the 4-megawatt DG utilizing the normal shutdown power distribution system and bus tie board (for U3). In addition, if there is a distribution problem, charging can be performed utilizing a direct connection to the safety related battery charger from the 480 V DG through a transfer switch. This transfer switch provides electrical isolation from the safety-related power distribution system. Therefore, multiple strategies were provided to recharge batteries in accordance with NEI 12-06 section 3.2.2 so N+1 does not apply to the 480 V DGs. Multiple strategies to provide water for core cooling have been provided so N+1 does not apply for the 4-megawatt DGs.

The licensee was requested to provide details of the 'power supply' that can be aligned to a battery charger if any 4 kV FLEX Diesel Generator is lost. During the audit process, the licensee stated as discussed in the previous question above, BFNP would install a transfer switch in the power feed from the normal safety related power source to the battery charger. Upon operation of the transfer switch, the safety related power from plant distribution would be disconnected from the battery charger and the 480 Vac feed from the 480 V DG for that unit would be connected to the battery charger. The wiring for the 480 Vac feed from the 480 V DG to the battery charger would be permanently installed to allow prompt restoration of power.

On pages 42 and 54 of the Integrated Plan the licensee has stated that the 480 V FLEX DG and the 4KV FLEX DGs are permanently staged. These FLEX DGs are proposed to be used to supply all FLEX related loads for all three units simultaneously for Phase 2 mitigating strategies.

This use of permanently staged generators appears to be an alternative to NEI 12-06. The licensee has not provided sufficient information to demonstrate that the approach meets the NEI 12-06 provisions for pre-staged portable equipment. Additional information is needed from the licensee to determine whether the proposed approach provides an equivalent level of flexibility for responding to an undefined event as would be provided through conformance with NEI 12-06. Therefore, this is identified as Open Item 3.2.4.8.D in Section 4.1 relative to the flexibility of permanently staged generators.

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 and Confirmatory Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to electrical power sources/isolations and interactions if these requirements are implemented as described.

3.2.4.9 Portable Equipment Fuel.

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

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

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

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

On page 14 of their Integrated Plan, the licensee stated that fuel support for FLEX equipment would be provided after the first 24 hours in accordance with the TVA playbook (the Regional Response Center's plan for coordinating with each utility). TVA will have enough diesel fuel onsite for the first 24 hours. On page 100 of the Integrated Plan, the licensee stated that a diesel fuel storage and refueling plan would need to be developed.

The licensee did not provide a discussion on the diesel fuel oil supply (e.g., fuel oil storage tank volume, supply pathway, etc.) for the diesel driven FLEX pumps and DGs and how continued operation to ensure core and spent fuel pool cooling is maintained indefinitely (i.e., Phase 2 and 3). The licensee also did not explain how fuel quality will be assured if stored for extended periods of time. During the audit process, the licensee stated that the FESB would contain a hardened fuel supply tank (approximately 50,000 gallons) in addition to the individual component fuel tanks. A fuel tanker is planned with a capacity of about 2,800 gallons to refuel site FLEX equipment. The tanker would be stored in an onsite location that meets separation requirements for protection. Periodic fuel sampling would be planned to ensure quality is maintained. Current plans are to allow site usage of portable fuel sources and or change out as indicated by sampling. In addition, each of the eight EDGs has a 7-Day Tank that stores a minimum Technical Specification required volume of 35,280 gallons. The total combined Technical Specification minimum volume for the eight installed EDGs is 282,240 gallons. The licensee also stated that refueling of the 480 V FLEX DGs would be provided by transfer pumps from the safety-related EDG 7-Day Tanks. The 480 V DG would self-power the transfer pump and the transfer pump would start/stop on level in the 480 V DG local tanks.

The NRC staff raised a concern with the licensee's ability to refuel the FLEX equipment during a MPF event which is postulated to persist over 10 days. During the audit process the licensee stated that the longest duration postulated flood event is expected to last about 10 days with the highest elevation reaching 574'6"(includes 5.5' wind wave). The FLEX Equipment Storage Building (FESB) floor elevation will be positioned just above the 578' elevation adjacent to the switchyard inside the protected area and will remain dry in the probable-maximum-flood (PMF) condition. The FLEX equipment deployed to provide cooling water will be staged inside the protected area just above the 578' elevation near the intake pumping station. The travel path to deploy the FLEX pumps is also at or slightly above the 578' elevation except for a short portion as the road transitions from the Dry Cask path and may require minor build up in elevation. As currently planned all FLEX equipment and the protective buildings are above the PMF elevation and therefore are accessible for refueling during the periods that wind wave run up is not impacting the road access. Once the water recedes below the point that wind wave run up is not a factor, all equipment is accessible to be refueled. Access to the site is not impacted by the higher flood elevation as access from the north from Athens, Alabama is and remains above the highest flood elevation, providing a means to receive fuel deliveries. The licensee stated that the full load consumption rate for all FLEX equipment is 828 gallons per hour (gph) and that the total available on-site protected fuel sources is 340,070 gallons. The licensee would be able to be able to run and refuel equipment at full load for approximately 16 days before outside fuel supplies would be necessary.

The NRC staff raised a concern with the licensee's ability to maintain an indefinite supply of fuel oil for FLEX equipment. During the audit process the licensee stated that the full load consumption rate for all FLEX equipment is 828 gph or 19,872 gallons per day. The licensee stated that they will have contracts in place to ensure necessary fuel oil supplies can be delivered to the site to ensure an indefinite supply of fuel oil. This has been identified as Confirmatory Item 3.2.4.9.A in Section 4.2.

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

3.2.4.10 Load Reduction to Conserve DC Power.

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

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

loads down to the minimum equipment necessary and one set of instrument channels for required indications. Credit for load-shedding actions should consider the other concurrent actions that may be required in such a condition.

On page 83 of the Integrated Plan, the licensee described a shallow dc load shed for the scenario that one of the 480V FLEX DGs did not start. On page 11 of the Integrated Plan, which contains the technical basis for the time constraint, it stated that the initial load shedding must be complete by T+4 hours into the BDBEE event to extend battery capability to 12 hours.

The Integrated Plan lacked information regarding battery availability, and lack of availability to review the battery load shed analysis, there is insufficient information presented in the integrated plan to conclude that the requirements of NEI 12-06, Section 3.2.2, consideration 6, regarding load reduction to conserve dc power will be implemented. During the audit process, the licensee provided a listing of the loads that would be part of the initial load shed that extended the battery availability to twelve hours. The licensee also stated that the shedding of these loads was determined to have no detrimental effects on unit safety and that the described load shedding would be included in a future revision to 0-AOI-57-1A, Blackout Station Procedure. This has been identified as Confirmatory Item 3.2.4.10.A in section 4.2.

During the audit process, the following questions were asked: provide the direct current (dc) load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling; and provide the basis for the minimum dc bus voltage that is required to ensure proper operation of all required electrical equipment. In their response, the licensee stated that battery coping analysis would be provided upon completion; and FSAR section 8.6.3 documents final terminal voltage of 210 Vdc. This is the same value that would be utilized for the BDBEE coping analysis.

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 No. 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, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for beyond Design Basis External Events."

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.

The licensee informed the NRC of their plan to abide by this generic resolution, and their plans to address potential plant-specific issues associated with implementing this resolution that were identified during the audit process.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and 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 load reduction to conserve dc power, if these requirements are implemented as described.

## 3.3 PROGRAMMATIC CONTROLS

### 3.3.1 Equipment Maintenance and Testing.

NEI 12-06, Section 3.2.2, 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]

[1] Testing includes surveillances, inspections, etc.

guidance provided in INPO AP 913, Equipment Reliability Process, to verify proper function. The maintenance program should ensure that the FLEX equipment reliability is being achieved. Standard industry templates (e.g., EPRI) and associated bases will be developed to define specific maintenance and testing including the following:

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

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

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

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

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

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

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

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

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

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

On page 19 of the Integrated Plan, the licensee stated that BFNP would implement an administrative program for implementation and maintenance of the BFNP FLEX strategies in accordance with NEI 12-06 guidance.

- *Equipment quality.* The equipment for ELAP will be dedicated to FLEX and will have unique identification numbers. Installed structures, systems and components pursuant to 10 CFR 50.63(a) will continue to meet the augmented quality guidelines of Regulatory Guide *1.155,* Station Blackout.
- *Equipment protection:* BFNP will construct structures to provide protection of the FLEX equipment to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined.
- *Storage and deployment:* BFNP will develop procedures and programs to address storage structure requirements and deployment/haul path requirements relative to the hazards applicable to BFNP.
- *Maintenance and Testing:* BFNP will utilize the standard EPRI industry PM process for establishing the maintenance and testing actions for FLEX components. The administrative program will include maintenance guidance, testing procedures and frequencies established based on type of equipment and considerations made within the EPRI guidelines.
- *Design Control:* BFNP will follow the current programmatic control structure for existing processes such as design and procedure configuration.

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

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

The licensee informed the NRC of their plans to abide by this generic resolution.

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

3.3.2 Configuration Control.

NEI 12-06, Section 11.8 provides that:

1. The FLEX strategies and basis will be maintained in an overall program document. This program document will also contain a historical record of previous strategies and the basis for changes. The document will also contain the basis for the ongoing maintenance and testing programs chosen for the FLEX equipment.
2. Existing plant configuration control procedures will be modified to ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies.
3. Changes to FLEX strategies may be made without prior NRC approval provided:
   a) The revised FLEX strategy meets the requirements of this guideline.
   b) An engineering basis is documented that ensures that the change in FLEX strategy continues to ensure the key safety functions (core and SFP cooling, containment integrity) are met.

On page 19 of the Integrated Plan, the licensee stated that BFNP would implement an administrative program for implementation and maintenance of the BFNP FLEX strategies in accordance with NEI 12-06 guidance.

- *Equipment quality.* The equipment for ELAP will be dedicated to FLEX and will have unique identification numbers. Installed structures, systems and components pursuant to 10 CFR 50.63(a) will continue to meet the augmented quality guidelines of Regulatory Guide *1.155,* Station Blackout.
- *Equipment protection:* BFNP will construct structures to provide protection of the FLEX equipment to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined.
- *Storage and deployment:* BFNP will develop procedures and programs to address storage structure requirements and deployment/haul path requirements relative to the hazards applicable to BFNP.
- *Maintenance and Testing:* BFNP will utilize the standard EPRI industry PM process for establishing the maintenance and testing actions for FLEX components. The administrative program will include maintenance guidance, testing procedures and frequencies established based on type of equipment and considerations made within the EPRI guidelines.
- *Design Control:* BFNP will follow the current programmatic control structure for existing processes such as design and procedure configuration.

Regulatory Guide 1.155, Station Blackout, dated August 1988, Section 3.5, “Quality Assurance and Specification Guidance for Station Blackout Equipment That Is Not Safety-Related,” on page 1.155-7 states:

> Appendices A [Quality Assurance Guidance for Non-Safety Systems and Equipment] and B [Guidance Regarding System and Station Equipment Specifications] provide guidance on quality assurance (QA) activities and specifications respectively for non-safety-related equipment used to meet the requirements of § 50.63 and not already covered by existing QA requirements in Appendix B or R of Part 50. Appropriate activities should be implemented from among those listed in these appendices depending on whether the non-safety

equipment is being added (new) or is existing. This QA guidance is applicable to non-safety systems and equipment for meeting the requirements of § 50.63 of 10 CFR Part 50. The guidance on QA and specifications incorporates a lesser degree of stringency by eliminating requirements for involvement of parties outside the normal line organization. NRC inspections will focus on the implementation and effectiveness of the quality controls described in Appendices A and B. Additionally, the equipment installed to meet the station blackout rule must be implemented such that it does not degrade the existing safety-related systems. This is to be accomplished by making the non-safety-related equipment as independent as practicable from existing safety-related systems. The non-safety systems identified in Appendix B are acceptable to the NRC staff for responding to a station blackout.

The licensee's plans for development and implementation of a configuration control process for the strategies and bases provides reasonable assurance that it will conform to the NEI 12-06 guidance for configuration control.

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

3.3.3 Training.

NEI 12-06, Section 11.6 provides that:

1. Programs and controls should be established to assure personnel proficiency in the mitigation of beyond-design-basis events is developed and maintained. These programs and controls should be implemented in accordance with an accepted training process.[2]

2. Periodic training should be provided to site emergency response leaders[3] on beyond design-basis emergency response strategies and implementing guidelines. Operator training for beyond-design-basis event accident mitigation should not be given undue weight in comparison with other training requirements. The testing/evaluation of Operator knowledge and skills in this area should be similarly weighted.

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

4. "ANSI/ANS 3.5, Nuclear Power Plant Simulators for use in Operator Training" certification of simulator fidelity (if used) is considered to be sufficient for the initial stages of the beyond-design-basis external event scenario until the

[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.

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 20 of the Integrated Plan, the licensee stated that training of general station staff and Emergency Preparedness (EP) personnel would be performed prior to the first BFNP unit design implementation outage. These programs and controls would be implemented in accordance with the Systematic Approach to Training (SAT) process.

During the review of the licensee's submittal, the reviewer did not find information relative to the training of Operations personnel (Operator Training) or a discussion of integrated FLEX drills that would be organized on a team or crew basis and conducted periodically. During the audit process, the licensee stated that training is dependent on Design Change Notification (DCN) Information and Procedural Guidance related to the DCNs. Procedures are identified on the impact sheets related to the DCN and are completed in alignment with the DCN schedule. Draft procedures are approved for development of training, therefore can lead completion of the DCN. All FLEX procedures are listed on a procedures project plan for each site and each procedure is tracked individually through completion. All Drafts are scheduled to be complete (for BFNP Unit 2, 9/30/14), allowing time for development and delivery of Training prior to implementation of FLEX. BFNP FLEX strategies are being developed through the DCN process. The DCN process is linked to the Training Needs Analysis (TNA) to start a Systematic Approach to Training (SAT) in accordance with NPG-SPP-17 series of procedures. The potential target audience has been identified and will be confirmed by the SAT process. The groups receiving training will include:

- Operations (Licensed, Non-licensed, STA)
- Electrical Maintenance
- Instrument Maintenance
- Mechanical Maintenance
- Engineering
- Emergency Preparedness
- Emergency Response Organization
- Fire Operations
- Radiation Protection
- Security

Drills and exercises are implemented in accordance with INPO 88-019, "Emergency Preparedness Drills and Exercise Manual" and TVA's Emergency Preparedness Department Procedure, EPDP-03, "Emergency Plan Exercises and Preparedness Drills".

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 programs, if these requirements are implemented as described.

3.4 OFF SITE RESOURCES

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

1) A capability to obtain equipment and commodities to sustain and backup the 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 20 of their Integrated Plan, the licensee stated that the nuclear industry would establish two Regional Response Centers (RRCs) to support utilities during beyond-design-basis events. Each RRC will hold five sets of equipment, four of which will be able to be fully deployed when requested; the fifth set will have equipment in a maintenance cycle. Equipment will be moved from an RRC to a local Assembly Area, established by the SAFER team and TVA. Communications will be established between BFNP and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of BFNP's playbook, will be delivered to the site within 24 hours from the initial request. In addition, the licensee stated that TVA would establish a contract with the SAFER team.

Based on a review of their Integrated Plan, insufficient information was provided regarding consideration 2 through 10 of NEI 12-06, Section 12.2. During the audit process, the licensee stated that BFNP would receive additional coping equipment from the Regional Response Center that procures and maintains the equipment for the industry. BFNP plans include supplies for 268 people for 7 days that would be stored in the FESB. This would consist of MREs, sleeping bags, cots, water, and other personal requirement commodities. All equipment and commodities are to be included in a preventative maintenance program to ensure availability and address any shelf life concerns. This has been identified as Confirmatory Item 3.4.A. in Section 4.2 regarding considerations 2 through 10 of NEI 12-06, Section 12.2.

On page 78 of their Integrated Plan, the licensee provided a table that listed additional equipment (Medium Voltage and Low Voltage Diesel Generators) for Phase 3; however, this equipment is not discussed in the body of the Integrated Plan. During the audit process, the licensee stated that in Phase 3, it would be intended to utilize the onsite FLEX medium and low voltage generators that were placed in-service during Phase 2. Additional generators would be requested from the RRC to serve as backups.

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

## 4.0 OPEN AND CONFIRMATORY ITEMS

### 4.1 OPEN ITEMS

| Item Number | Description | Notes |
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| 3.2.4.5.A | The licensee provided no information regarding local access to the protected areas under ELAP. | |
| 3.2.4.6.C | There is insufficient information provided in the Integrated Plan to demonstrate that potential high temperature /humidity on the refuel floor has been addressed with regard to habitability. | |
| 3.2.4.8.D | This use of permanently staged generators appears to be an alternative to NEI 12-06. The licensee has not provided sufficient information to demonstrate that the approach meets the NEI 12-06 provisions for pre-staged portable equipment. Additional information is needed from the licensee to determine whether the proposed approach provides an equivalent level of flexibility for responding to an undefined event as would be provided through conformance with NEI 12-06. | |

### 4.2 CONFIRMATORY ITEMS

| Item Number | Description | Notes |
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| 3.1.1.2.A | On page 1 of their Integrated Plan, the licensee stated the liquefaction potential of all FLEX deployment routes would be addressed in a future assessment. In the licensee's six-month update (dated August 28, 2013), this activity has not yet started. Additionally, the locations, deployment routing, and administrative programs are yet to be determined that will meet the FLEX flooding criteria. Therefore, the licensee's plans for deployment provided insufficient information regarding soil liquefaction and flooding associated with the deployment routes for equipment. | |
| 3.1.1.2.B | In their Integrated Plan, the licensee did not identify any means to deploy equipment (deployment vehicles and/or trailers). During the audit process, the licensee stated that there were several options under review to deploy FLEX equipment. The options included a heavy-duty truck or compact track loaders or both. The options would include a sufficient number to deploy the necessary FLEX equipment in the time required. Confirmation is needed. | |
| 3.1.1.3.A | The licensee did not provide a discussion in their Integrated Plan regarding implementation of the mitigating strategies with respect to the procedural interface considerations for seismic hazards associated with large internal flooding sources that are not seismically robust and do not require ac power and the use of ac power to mitigate ground water in critical locations as specified in NEI 12-06 Section 5.3.3 considerations 2 and 3. During the audit process, the | |

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| | licensee stated that the plant procedure for flooding (0-AOI-100-3) would be revised to address procedural direction given a DBDEE. This revision should be confirmed. | |
| 3.1.1.3.B | On page 5 of the Integrated Plan, the licensee stated that the deployment strategies and deployment routing are yet to be determined. On page 19 of the Integrated Plan, the licensee stated that BFNP would develop procedures and programs to address storage structure requirements and deployment/haul path requirements relative to the hazards (seismic, flooding, high winds, cold temperatures/snow/ice, high temperatures) applicable to BFNP. | |
| 3.1.1.4.A | On page 20 of their Integrated Plan, the licensee provided information regarding the use of the offsite resources through the industry Strategic Alliance for FLEX Emergency Response (SAFER) program, but has not identified local staging areas and method(s) of transportation per the guidance of NEI 12-06, Section 5.3.4, consideration 1, Section 6.2.3.4, considerations 1 and 2, Section 7.3.4, considerations 1 and 2, and Section 8.3.4. During the audit process, the licensee provided preliminary staging areas A (onsite), B, C and D locations along with their proposed deployment/access routes. | |
| 3.1.4.2.A | On page 77 of the Integrated Plan, the licensee did not list any equipment capable of removing ice. On page 79 of the Integrated Plan, the licensee listed debris clearing equipment and a 4-wheel drive tow vehicle, but did not specify whether this equipment would be capable of removing ice. During the audit process, the licensee stated that current considerations are being given to provide compact track loaders for equipment deployment. These loaders would be capable of snow and ice removal from the site storage location and haul pathways to the intended connection point. Internal discussions are underway to include snow and ice removal from site haul pathways and staging areas into the TVA standard program and processes procedures (NPG-SPP). Capability for ice removal to support FLEX deployment needs to be confirmed. | |
| 3.2.1.1.A | From the June 2013 position paper, benchmarks must be identified and discussed which demonstrate that MAAP4 is an appropriate code for the simulation of an ELAP event at your facility. | |
| 3.2.1.1.B | The collapsed level must remain above Top of Active Fuel (TAF) and the cool down rate must be within technical specification limits. | |
| 3.2.1.1.C | MAAP4 must be used in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper. | |
| 3.2.1.1.D | In using MAAP4, the licensee must identify and justify the subset of key modeling parameters cited from Tables 4-1 through 4-6 of the "MAAP4 Application Guidance, Desktop Reference for Using MAAP4 Software, Revision 2" (Electric | |

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| | 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. | |
| 3.2.1.1.E | The specific MAAP4 analysis case that was used to validate the timing of mitigating strategies in the integrated plan must be identified and should be available on the ePortal for NRC staff to view. Alternately, a comparable level of information may be included in the supplemental response. In either case, the analysis should include a plot of the collapsed vessel level to confirm that TAF is not reached (the elevation of the TAF should be provided) and a plot of the temperature cool down to confirm that the cool down is within technical specification limits. | |
| 3.2.1.2.A | There is insufficient information provided to determine the adequacy of the determination of recirculation pump seal or other sources of leakage used in the ELAP analysis. | |
| 3.2.1.3.A | On page 10 of the Integrated Plan, the licensee stated that the Main Steam Relief Valve (MSRV) control is maintained from the control room with sufficient dc power and pneumatic pressure to operate the MSRVs throughout Phase 1 and Phase 2. The licensee describes that SRV actuation may require a higher than nominal dc voltage to actuate the MSRVs due to higher containment temperature with a longer duration event than an existing SBO coping time. The SRV pilot solenoid coil electrical resistance will increase due to a higher containment temperature with a longer duration event than an existing SBO coping time. The licensee is planning to evaluate MSRV qualification against the predicted containment response with FLEX implementation to ensure there will be sufficient dc bus voltage during the ELAP event. The licensee also provides that if required, there will be a modification to increase voltage as necessary to achieve the necessary coil current, or modifications will be made to reduce the coil resistance under higher temperature conditions. Because the MSRV control system will be exhausting control gas to the containment and containment pressure will be higher, the licensee is evaluating methods to establish any required increases in pneumatic supply pressure and modifications that may be required to ensure a supply of control gas for the MSRVs over the longer ELAP interval. These two questions were asked during the audit process and the licensee stated that the analysis/evaluation has not yet been completed. | |
| 3.2.1.5.A | On pages 24 and 39 of their Integrated Plan, the licensee stated that instrumentation relative to RPV level, drywell pressure, suppression pool level (after plant modification), suppression pool temperature, and drywell temperature | |

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| | (after plant modification) would be available during the event since this instrumentation is powered from station batteries. The licensee did not provide instrumentation regarding RPV pressure or suppression chamber air temperature, which were specified as typical monitoring parameters in NEI 12-06 Section 3.2.1.10. During the audit process, the licensee stated that the instrumentation list was being reevaluated for expansion and any changes would be included in future six-month plan updates. | |
| 3.2.1.8.A | On page 14 of the integrated plan regarding Portable Equipment to Maintain Core Cooling, the licensee describes the use of portable pumps to provide RPV injection. No supporting analysis was provided for the; the diesel-driven FLEX pump capabilities considering the pressure within the RPV and the loss of pressure along with details regarding the FLEX pump supply line routes, length of hoses runs, connecting fittings, elevation changes to show that the pump is capable of injecting water into the RPV with a sufficient rate to maintain and recover core inventory for both the primary and alternate flow paths. During the audit process, the licensee stated that the detailed hydraulic analysis has been scoped and a contract would be awarded to perform the design portion<br><br>During the audit process, the licensee was asked to provide a detailed description of the required flow rates for each unit for core cooling, containment integrity, and spent fuel pool cooing. The description should include primary and alternate strategies and show that sharing of FLEX equipment does not impede the ability to accomplish core cooling, containment integrity, and spent fuel pool cooling on any unit. In their response, the licensee stated that the FLEX system will be comprised of portable pumps rated for 5,000 gallons per minute at 150 pounds per square inch that would be deployed to an area east of the forebay to supply water to the RHRSW and EECW permanent piping systems. Hoses would be connected to manifolds designed to NEI 12-06 requirements that would have permanent diverse connections to the piping located in the intake pumping station. The first priority would be to supply water to the EECW south header to operate room coolers, Unit 3 chillers, and emergency makeup to the spent fuel pool and provide alternative cooling water to the RCIC oil cooler. The second priority would be to supply water to the RHRSW system via the “B” supply header that would allow a RHR heat exchanger to be placed into service. The operation of the standby coolant supply to the RHR system will provide FLEX water for containment cooling, RPV injection and to supply water to the spent fuel pool via the reactor vessel head spray supply line. The third priority would be to supply water to the RHRSW system via the “D” supply header that | |

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| | would allow a RHR heat exchanger to be placed into service. The operation of the standby coolant supply to the RHR system will provide FLEX water for containment cooling, RPV injection and to supply water to the spent fuel pool via the reactor vessel head spray supply line. Analysis will be performed to determine the required FLEX flow based on various scenarios and RPV water level. | |
| 3.2.3.A | The licensee has not provided finalized calculations which support the primary strategy timeline by concluding that venting or other heat removal activities will not be required during the first eight hours of the event, maintaining a suppression pool temperature low enough to support continued RCIC operation for this time period. | |
| 3.2.4.2.A | The licensee did not provide details regarding the effects of loss of ventilation in the HPCI/RCIC pump rooms to conclude that the equipment in the HPCI/RCIC pump rooms would perform its function and assist in core cooling throughout all Phases of an ELAP. During the audit process, the licensee stated that preliminary analysis has been performed, but the calculations have not been finalized. Based on preliminary analysis, the RCIC room would reach 140 degrees at 32 hours. The electronic governor module (EGM) for RCIC could fail with temperatures at 150 degrees Fahrenheit. RCIC has steam isolation at 165 degrees in the room or torus area.<br>EOI Appendix 5C, Injection System Lineup RCIC, allows bypassing of the high temperature isolation using booted contacts in accordance with EOI Appendix 16K, Bypassing RCIC High Temperature Isolation. Core Spray room cooler strategy is being evaluated to aid in cooling of the Core Spray/RCIC room. A detailed summary of the analysis and/or technical evaluation performed to demonstrate the adequacy of the ventilation provided in the HPCI/RCIC pump rooms to support equipment operation throughout all phases of an ELAP is requested. | |
| 3.2.4.2.B | During the audit process, a question was asked regarding the licensee's plans to override the RCIC isolation and trip signals. Additional information was requested on how this would be accomplished. In their response, the licensee stated that EOI Appendices would be utilized. Some already exist, others will be added by EPG Revision 3. | |
| 3.2.4.4.A | A review was made of the Integrated Plan for coping strategies discussing plant lighting and communications systems during an ELAP that support personnel access for coping strategies that maintaining core, containment and SFP cooling. The licensee has not discussed coping strategies for portable and emergency lighting necessary to facilitate personnel access into plant locations to implement mitigating strategies. During the audit process, the licensee stated that Lighting in the protected area is currently under | |

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| | review without a firm strategy developed. Considerations have been given to LED emergency lighting to extend battery life coupled with individual issued flashlights and headlamps. Lighting stands would be included in the FESB, and powered by small portable generators that would also be included in the FESB. The low-pressure pumps associated with the FLEX pumping system, once deployed and in service have external lights for personnel use. | |
| 3.2.4.4.B | The NRC staff has reviewed the licensee communications assessment (ADAMS Number ML12311A297) required by in response to the March 12, 2012 50.54(f) request for information letter for BFNP and, as documented in the staff analysis (ML13157A150) 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. This is for confirmation that upgrades to the site's communications systems have been completed. | |
| 3.2.4.6.A | In the licensee's discussion regarding control room habitability, the temperatures that are provided are based on preliminary analysis. The analysis needs to be finalized. During the audit process, the licensee stated that a new calculation would be issued to formalize the transient temperature study and provide guidance in opening doors and setting up portable fans. | |
| 3.2.4.6.B | RCIC Room Habitability<br><br>On pages 66 and 68 of the Integrated Plan, the licensee stated that for the purposes of NEI 12-06, it is not anticipated that continuous habitability would be required in the pump rooms. If personnel entry is required into the pump room, then personal protective measures such as ice vests will be taken in accordance with Site Administrative and Safety Procedures and Processes. Under the SBO case, the temperature remains below 127 degrees Fahrenheit for eight hours into the BDBEE. Based on extrapolation of the heat up curves, temperature in the RCIC room would rise to approximately 151 degrees Fahrenheit in approximately 72 hours. During the audit process, the licensee stated that the strategies are not yet fully developed for personnel access to areas. Personnel protective equipment would be located in the FESB until required for use. Some areas of the Control Bay may see increased room temperatures that would require opening doors or adding portable fans. The operation of the RCIC system during the ELAP event would increase the Northwest quad room temperature that would have an | |

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| | adverse impact on personnel staying in the RCIC room. Further personnel protective measures are being evaluated. Room cooler strategies are being evaluated to lower room temperatures utilizing the EECW system and RHR/CS Room Coolers.<br><br>RHR/CS Room Habitability<br><br>On page 69 of the Integrated Plan, the licensee stated that for the purposes of NEI 12-06, it is not anticipated that continuous habitability would be required in the pump rooms. If personnel entry is required into the pump room, then personal protective measures such as ice vests will be taken in accordance with Site Administrative and Safety Procedures and Processes. Under the SBO case, the temperature remains below 120 degrees Fahrenheit for eight hours into the BDBEE. Based on extrapolation of the heat up curves, temperature in the RCIC room would rise to approximately 145 degrees Fahrenheit in approximately 72 hours. During the audit process, the licensee stated that the strategies are not yet fully developed for personnel access to areas. Personnel protective equipment would be located in the FESB until required for use. Some areas of the Control Bay may see increased room temperatures that would require opening doors or adding portable fans. The operation of the RCIC system during the ELAP event would increase the Northwest quad room temperature that would have an adverse impact on personnel staying in the RCIC room. Further personnel protective measures are being evaluated. Room cooler strategies are being evaluated to lower room temperatures utilizing the EECW system and RHR/CS Room Coolers. | |
| 3.2.4.7.A | The sources of water that the licensee has identified as being available are the CST (assumed not available after a BDBEE), the Suppression Pool and the Tennessee River. For the Tennessee River, a discussion of the quality of this water (e.g., suspended solids) and a justification that its use would not result in blockage at the fuel assembly inlets to an extent that would inhibit adequate flow to the core is needed. Alternately, if deleterious blockage at the fuel assembly inlets cannot be precluded, an alternate means for assuring adequate core cooling is needed. During the audit process, the licensee stated that filtration options are currently being evaluated. Additionally, guidance was issued in GEH - 33771P, GE Evaluation of FLEX Mitigation Strategies, Section 7.7 that provided the following: If the plant needs to rely on raw water or seawater for part of the planned response, consideration should be given to performing RPV low pressure injection at a rate that provides core cooling without boiling. This would help prevent heat transfer surface fouling and can be done by | |

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| | bleeding water through the SRVs to the suppression pool. The site-specific evaluation would have to include a determination of how long this can continue before the maximum suppression pool level is reached as well as what flow rate would be required to preclude boiling. When the suppression pool maximum level is reached, other means of core cooling must be provided, or an acceptable method of suppression pool draining must be established. The GEH guidance needs to be evaluated against Emergency Operating Instructions (EOI) guidance for RPV level control. This option is currently under evaluation. | |
| 3.2.4.8.A | A review of the Integrated Plan regarding local instrumentation determined that information regarding local instrumentation was not adequate. Additional description of the instrumentation that will be used to monitor portable FLEX electrical power equipment including their associated measurement tolerances/accuracy to ensure that: 1) the electrical equipment remains protected (from an electrical power standpoint – e.g., power fluctuations) and 2) the operator is provided with accurate information to maintain core cooling, containment, and SFP cooling. Provide a discussion the issue of portable electrical equipment instrumentation. | |
| 3.2.4.8.B | The licensee was requested to provide a detailed electrical one-line diagram showing how each FLEX DG (and any portable generators) would/could be connected into the existing electrical distribution system. During the audit process, the licensee stated that one-line diagrams would be prepared and provided. | |
| 3.2.4.8.C | The licensee was requested to provide a discussion on the electrical cable pathway for each FLEX DG with a conceptual sketch of the proposed cable paths. During the audit process, the licensee stated that the cables between the FESB and D/G building for the 4-megawatt DG connections would be buried and hardened to meet the protection requirements for FLEX. The buried cable would Okonite type C-L-X with a continuously corrugated welded aluminum sheath and missile protection would be provided over the cable trench. The cable would designed to be utilized as a feeder cable for utility power distribution systems and to be direct burried in wet or dry locations. The power cables, in this application, would be normally de-energized which significantly reduces potential for cable aging from moisture induced treeing. Once the cables enter the Unit 3 DG building they are within a safety-related structure meeting site design basis protection requirements. Cables from the 480 V DGs would be hardened to meet protection requirements up to the point they enter the DG buildings and are within a safety-related structure meeting site design basis from that point. The Confirmatory Item is relative to the conceptual sketch of the proposed cable | |

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| | paths. | |
| 3.2.4.9.A | The NRC staff raised a concern with the licensee's ability to maintain an indefinite supply of fuel oil for FLEX equipment. During the audit process the licensee started that the full load consumption rate for all FLEX equipment is 828 gph or 19,872 gallons per day. The licensee stated that they will have contracts in place to ensure necessary fuel oil supplies can be delivered to the site to ensure an indefinite supply of fuel oil. The confirmatory Item is needed to ensure that the licensee meets NEI 12-06, Section 3.2.2, Guideline (13). Specifically, that the licensee has adequately addressed fuel oil delivery capabilities. | |
| 3.2.4.10.A | The Integrated Plan lacked information regarding battery availability, and lack of availability to review the battery load shed analysis, there is insufficient information presented in the integrated plan to conclude that the requirements of NEI 12-06, Section 3.2.2, consideration 6, regarding load reduction to conserve dc power will be implemented. During the audit process, the licensee provided a listing of the loads that would be part of the initial load shed that extended the battery availability to twelve hours. The licensee also stated that the shedding of these loads was determined to have no detrimental effects on unit safety and that the described load shedding would be included in a future revision to 0-AOI-57-1A, Blackout Station Procedure. | |
| 3.4.A | Based on a review of their Integrated Plan, insufficient information was provided regarding consideration 2 through 10 of NEI 12-06, Section 12.2. During the audit process, the licensee stated that BFNP would receive additional coping equipment from the Regional Response Center that procures and maintains the equipment for the industry. BFNP plans include supplies for 268 people for 7 days that would be stored in the FESB. This would consist of MREs, sleeping bags, cots, water, and other personal requirement commodities. All equipment and commodities are to be included in a preventative maintenance program to ensure availability and address any shelf life concerns. This Confirmatory Item relates to considerations 2 through 10 of NEI 12-06, Section 12.2. | |