Mega-Tech Services, LLC

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

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Technical Evaluation Report

Shearon Harris Nuclear Power Plant, Unit 1
Order EA-12-049 Evaluation

1.0 BACKGROUND

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

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

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

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

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

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

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

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

2.0 EVALUATION PROCESS

In accordance with the provisions of Contract NRC-HQ-13-C-03-0039, Task Order No. NRC-HQ-13-T-03-0001, Mega-Tech Services, LLC (MTS) performed an evaluation of each licensee's Integrated Plan. As part of the evaluation, MTS, in parallel with the NRC staff, reviewed the original Integrated Plan and the first 6-month status update, and conducted an audit of the licensee documents. The staff and MTS also reviewed the licensee's answers to the NRC staff's and MTS's questions as part of the audit process. The objective of the evaluation was to assess whether the proposed mitigation strategies conformed to the guidance in NEI 12-06, as endorsed by the positions stated in JLD-ISG-2012-01, or an acceptable alternative had been proposed that would satisfy the requirements of Order EA-12-049. The audit plan that describes the audit process was provided to all licensees in a letter dated August 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 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. ML13112A020), and as supplemented by the first six-month status report in letter dated August 27, 2013 (ADAMS Accession No. ML13239A359, Duke Energy (the licensee or Duke) provided the Shearon Harris Nuclear Power Plant, Unit 1 (HNP) Integrated Plan for compliance with Order EA-12-049. The Integrated Plan describes the strategies and guidance under development for implementation by the licensee for the maintenance or restoration of core cooling, containment, and SFP cooling capabilities following a BDBEE, including modifications necessary to support this implementation, pursuant to Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the NRC staff is conducting audits of their responses to Order EA-12-049. That letter described the process used by the 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.

Attachment 5, “List of Open Items,” of the Integrated Plan contains a listing of the licensee identified Open Items. In cases where the licensee-identified Open Items are referenced in this evaluation, they will be clearly identified

3.1 EVALUATION OF EXTERNAL HAZARDS

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

3.1.1 Seismic Events.

NEI 12-06, Section 5.2 states:

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

On page 2 of HNP Integrated Plan regarding general integrated plan elements, the licensee stated under Seismic Hazard Assessment that the HNP UFSAR states that the operating basis earthquake (OBE) and safe shutdown earthquake (SSE) have ground acceleration design values of 0.075g and 0.15g, respectively (UFSAR, Section 2.5.4.9). Per NEI 12-06, Table 4-2, all sites will consider seismic events.

On page 3 of the Integrated Plan, the licensee stated as a key assumption that the 10 CFR 50.54(f) seismic re-evaluation does not result in changes to the current design basis. Additionally, it is assumed that the seismic re-evaluation does not adversely impact the equipment that forms a part of the HNP FLEX strategy. Any changes to the seismic design basis may require a change to the plans in the HNP response to the Order EA-12-049.

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 SSE (e.g., existing safety-related structure).

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

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

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

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

The Integrated Plan stated that the licensee would harden and protect the Dedicated Shutdown Diesel Generator (DSDG) to provide power to Motor Control Center 1D23. In their six-month update, HNP determined hardening the DSDG will not be performed, therefore the DSDG will not be used as a credited power source for FLEX. During the review of the Integrated Plan, there was a question regarding the power source for and protection of HNP's power distribution system. During the audit process, the licensee stated that a FLEX diesel generator (DG) will serve as the supply for the power distribution system. In addition, licensee stated that Motor Control Center 1D23 would not be used and that a power distribution system will be provided in accordance with licensee-identified Open Item #57.

On page 18 of the Integrated Plan, the licensee stated that a permanent cable and raceway will be installed to make cable deployment directly to the 1A3-SA and 1B3-SB SWGR and MCCs 1A21-SA, 1A31-SA, 1B21-SB, and 1B31-SB feasible (Figures 4, 5, 6, and 26 of the Integrated Plan) (licensee-identified Open Item #44). During the audit process, the licensee was requested to discuss whether the permanent cable and raceway will be seismically qualified. The licensee stated that the engineering design in support of licensee-identified Open Items #44 and #57 is currently in progress; however, the licensee stated that the permanent cable and raceway installed by these modifications will be robust with respect to design basis external events as required by NEI 12-06, section 3.2.

On the updated Figure 1 of the Integrated Plan, the licensee identified the proposed storage location for the FLEX support equipment being west of the Reactor Auxiliary Building. On pages 16, 27, 40, 50 of the Integrated Plan, the licensee stated that the structures used for protection of FLEX equipment will be constructed to meet the requirements identified in NEI 12-06, Section 11. NEI Section 11.3 describes the storage considerations for FLEX equipment.

On Figure 1 of the Integrated Plan, the licensee stated the staging and storage location for FLEX generators, pumps and hardware is the existing Unit 2 Emergency Diesel Generator (EDG) bays. UFSAR Table 3.2.1-1, The EDG building is a seismic category 1 building whose structure is designed to withstand design wind/torado loadings and missile impacts.

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

HNP stated that after the structure design and location are finalized, the deployment routes will be evaluated for external hazards to demonstrate a clear deployment path. Because susceptibility of the site to the effects of soil liquefaction was not discussed in the seismic assessment section of the integrated report, it was not clear that soil liquefaction would be considered for the deployment routes. During the audit process, the licensee stated that the foundation of the plant is hard, sound rock, and has no potential for liquefaction.

Per review of the Figures provided in the Integrated Plan, the licensee identified the location of the FLEX equipment connection points. Plant modifications are required for most of the connection points. The proposed access and connection points were located in seismically robust structures.

On page 14 of the Integrated Plan, the licensee stated that the Auxiliary Reservoir will provide a sustained water supply with the Main Reservoir serving as a backup supply. Per UFSAR Section 2.5.0.6, "Embankments and Dams," and UFSAR Table 3.2.1-1, "Classification of Structures, Systems, and Components Design Information," both the Main Dam and the Auxiliary Dam were designed and constructed to Seismic Category I criteria and to withstand the effects of natural phenomena.

On page 8 of the Integrated Plan, in the section regarding how the strategies will be deployed in all modes, the licensee stated that deployment routes shown in Figure 1 of the Integrated Plan are expected to be utilized to transport FLEX equipment to the deployment areas and identified paths and deployment areas will be accessible during all modes of operation. This deployment strategy will be included within the licensee's administrative program to keep pathways clear or actions to clear the pathways

The Integrated Plan did not address considerations 4 (if power is required to move or deploy the equipment) and 5 (the means to move FLEX equipment should be provided that is also reasonably protected from the event). This information needs to be provided for review. This is identified as Open Item 3.1.1.2.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 deployment of FLEX equipment - seismic hazard, if these requirements are implemented as described.

3.1.1.3 Procedural Interfaces – Seismic Hazard

NEI 12-06, Section 5.3.3 states:

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

until alternate indications can be connected and on how to control critical equipment without associated control power.

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

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

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

The Integrated Plan did not discuss considerations 1, 2 and 3.

During the audit process, the licensee stated that they will develop guidance to provide strategies for alternate means of obtaining necessary instrument readings to support the implementation of the coping strategy. This guidance will provide direction regarding how and where to measure key instrument readings.

For consiseration 2, the licensee stated that they need to determine the impact of internal plant flooding events associated with these hazards (licensee-identified Open Item #37). The licensee's completion of its analysis to determine the impact of internal plant flood events is identified as Confirmatory Item 3.1.1.3.A in Section 4.2.

For consideration 3, the licensee stated that mitigation of groundwater is not an issue for HNP FLEX strategies.

On page 14 of the Integrated Plan, the licensee stated that the Auxiliary Reservoir will provide a sustained water supply with the Main Reservoir serving as a backup supply. Per UFSAR Section 2.5.0.6, "Embankments and Dams," and UFSAR Table 3.2.1-1, "Classification of Structures, Systems, and Components Design Information," both the Main Dam and the Auxiliary Dam were designed and constructed to Seismic Category I criteria and to withstand the effects of natural phenomena.

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 procedural interfaces – 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 10 of the Integrated Plan, the licensee stated that the industry will establish two Regional Response Centers (RRCs) to support utilities during BDBEE 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 staging area, established by the Strategic Alliance of FLEX Emergency Response (SAFER) team and the utility. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request. A contract has been signed between the site and the Pooled Equipment Inventory Company to provide Phase 3 services and equipment. The designation of delivery methods and locations in the playbook is 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 the use of off-site resources – seismic hazard, 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 the Integrated Plan, the licensee stated HNP is a dry site with a nominal plant elevation of 260 feet above mean sea level (MSL) and a maximum water level, due to the probable maximum flood event, of 257.7 feet above MSL. Based on this assessment, the external flood hazard is not applicable for HNP.

On pages 3 of the Integrated Plan, in Item 2 of the key assumptions associated with implementation of FLEX Strategies section, the licensee stated that it is assumed that the 10 CFR 50.54(f) flood re-evaluations do not result in changes to the current design basis and that any changes to the flood design basis may require a change to the plans in the HNP response to the Order.

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

Note: Since HNP is a dry site, Sections 3.1.2.1, 3.1.2.2, 3.1.2.3 and 3.1.2.4 will not be included in this evaluation.

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 the Integrated Plan, the licensee stated that HNP is located at Latitude 35° 38' 0" N, and Longitude 78° 57' 22" W. According to NEI 12-06, Figures 7-1 and 7-2, the location of HNP has a Peak-Gust Wind Speed of 160 miles per hour (mph) and a tornado design wind speed of 200 mph. These values indicate that HNP has the potential to experience severe winds from hurricanes and tornadoes with the capacity to do significant damage, which are generally considered to be winds above 130 mph, as defined in NEI 12-06, Section 7.2.1. Therefore, the high wind hazard is applicable for HNP.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to screening for high wind hazards, 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 Figure 1 of the Integrated Plan, the licensee stated the staging and storage location for FLEX generators, pumps and hardware is the existing Unit 2 EDG bays. UFSAR Table 3.2.1-1, The EDG building is a seismic category 1 building whose structure is designed to withstand design wind/torado loadings and missile impacts.

On the updated Figure 1 of the Integrated Plan, the licensee identified the proposed storage location for the FLEX support equipment being west of the Reactor Auxiliary Building.

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

3.1.3.2 Deployment of FLEX Equipment - High Winds Hazard

NEI 12-06, Section 7.3.2 states:

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

On page 8 of the Integrated Plan, the licensee stated that the deployment routes shown in Figure 1 of the Integrated Plan are expected to be utilized to transport FLEX equipment to the deployment areas. The identified paths and deployment areas will be accessible during all modes of operation. This deployment strategy will be included within an administrative program to keep pathways clear or actions to clear the pathways

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 FLEX deployment considerations in a high wind hazard if these requirement are implemented as described.

3.1.3.3 Procedural Interfaces - High Winds 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 17 of the Integrated Plan, the licensee stated that the HNP procedures and programs are being developed to address storage structure requirements, deployment path requirements, and FLEX equipment requirements relative to the hazards applicable to HNP.

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

3.1.3.4 Considerations in Using Offsite Resources – High Winds Hazard

NEI 12-06, Section 7.3.4 states:

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

On page 10 of the Integrated Plan, the licensee stated that the industry will establish two Regional Response Centers (RRCs) to support utilities during BDBEE 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 staging area, established by the Strategic Alliance of FLEX Emergency Response (SAFER) team and the utility. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request. A contract has been signed between the site and the Pooled Equipment Inventory Company to provide Phase 3 services and equipment. The designation of delivery methods and locations in the playbook is 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 the issue 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 resource during high wind hazards, if these requirement are implemented as described.

3.1.4 Snow, Ice and Extreme Cold

As discussed in NEI 12-06, Section 8.2.1:

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

On page 2 of the Integrated Plan, the licensee stated that the location of HNP at Latitude 35° 38' 0" N and Longitude 78° 57' 22" W, in accordance with NEI 12-06, Figure 8-1, is subject to significant snowfall accumulation and extreme low temperatures. Therefore, HNP must provide the capability to address the impedances caused by extreme snowfall. HNP is also in a region with Level 4 Ice Storm Severity as depicted in NEI 12-06, Figure 8-2, which is characterized as severe damage to power lines and/or the existence of large amounts of ice. Therefore, the extreme cold (including snow and ice) hazard is applicable for HNP.

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

3.1.4.1 Protection 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 Figure 1 of the Integrated Plan, the licensee stated the staging and storage location for FLEX generators, pumps and hardware is the existing Unit 2 EDG bays. UFSAR Table 3.2.1-1, The EDG building is a seismic category 1 building whose structure is designed to withstand design wind/torado loadings and missile impacts.

On the updated Figure 1 of the Integrated Plan, the licensee identified the proposed storage location for the FLEX support equipment being west of the Reactor Auxiliary Building.

the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06, Section 11. However, the potential impact of extreme cold temperatures on storage of equipment will be considered in the structure design. The FLEX equipment will be maintained at a temperature within a range to ensure its likely function when called upon, in accordance with NEI 12-06, Section 8.3.1.2.

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 provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of FLEX equipment from snow, ice and extreme cold hazards.

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 UHS and flow path may be affected by extreme low temperatures due to ice blockage or formation of frazil ice. Consequently, the evaluation should address the effects of such a loss of 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 57 of the Integrated Plan, regarding PWR Portable Equipment Phase 2, for the last item in the list, the licensee the stated that lighting, hoses, cable, fittings, tools, debris/snow removal equipment, portable equipment, transport vehicles will be determined at a later date. The plan did not provide any information in regard to ice removal as needed to obtain and transport equipment from storage to its location for deployment. In addition, none of the equipment listed under phase 2 equipment specifically addressed ice removal. During the audit process, the licensee was requested to provide a discussion that addresses the areas specified in NEI 12-06, Section 8.3.2, such as ice removal, and describe how this will be accomplished. The licensee responded by stating that this question appears to reference requirements of NEI 12-06, Section 8.3.2, Item 2, which recommends considerations for snow/ice removal equipment to support deployment of FLEX equipment. Licensee-identified Open Item #73 (Purchase equipment to fulfill FLEX strategies) that tracks the procurement of equipment to address the considerations listed in NEI-12-06 section 8.3.2 to support deployment of FLEX equipment during snow, ice, and extreme cold conditions. Guidance addressing procedural guidance for operation of the snow/ice removal equipment will be developed by licensee-identified Open Item #72 .

The licensee stated that the potable FLEX diesel-driven pump may take suction from the ESW bay in the intake structure. The Integrated Plan did not address potential blockage of the intake structure (either main reservoir or auxiliary reservoir) due to large snow fall or excessive ice. During the audit process, the licensee stated that the engineering evaluation required to support the modification identified in licensee-identified Open Item #49 will address configuration and operation of the FLEX equipment under extreme cold, snow, or ice conditions. Licensee-identified Open Item #49 should be reviewed during the 6 month update to ensure that the engineering evaluation was added to it. 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 the issue 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 with snow, ice and extreme cold hazards, 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.

The integrated plan did not provide any procedural interfaces that direct ice removal and/or deployment of equipment. During the audit process, the licensee stated that guidance addressing operation of the snow/ice removal equipment to support FLEX equipment deployment will be developed by licensee-identified Open Item #72.

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

On page 10 of the Integrated Plan, the licensee stated that the industry will establish two Regional Response Centers (RRCs) to support utilities during BDBEE 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 staging area, established by the Strategic Alliance of FLEX Emergency Response (SAFER) team and the utility. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request. A contract has been signed between the site and the Pooled Equipment Inventory Company to provide Phase 3 services and equipment. The designation of delivery methods and locations in the playbook is 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 the issue related to the Confirmatory Item provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to considerations in using offsite resources during snow, ice and extreme cold hazards, if these requirement are implemented as described.

3.1.5 High Temperatures

NEI 12-06, Section 9.2 states:

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

On page 3 of the Integrated Plan, the licensee stated that HNP is located at Latitude 35° 38' 0" N and Longitude 78° 57' 22" W. NEI 12-06, Section 9.2 states that virtually every state in the lower 48 contiguous United States has experienced temperatures in excess of 110 degrees Fahrenheit and many in excess of 120 degrees Fahrenheit. In accordance with NEI 12-06, Section 9.2, all sites will address high temperatures. Therefore, the extreme high temperature hazard is applicable for HNP.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to screening for high temperature, 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 18 of the Integrated Plan, the licensee stated that storage/protection of equipment from high temperature hazard would be provided as follows:

On the updated Figure 1 of the Integrated Plan, the licensee identified the proposed storage location for the FLEX support equipment being west of the Reactor Auxiliary Building. However, the potential impact of high temperatures on storage of equipment will be considered in the structure design. The FLEX equipment will be maintained at a temperature within a range to ensure its likely function when called upon, in accordance with NEI 12-06, Section 9.3.1.

On Figure 1 of the Integrated Plan, the licensee stated the staging and storage location for FLEX generators, pumps and hardware is the existing Unit 2 EDG bays. UFSAR Table 3.2.1-1, The EDG building is a seismic category 1 building whose structure is designed to withstand design wind/torado loadings and missile impacts.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of FLEX equipment from the effects of high temperature, 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 pages 17 and 18 of the Integrated Plan, the licensee stated that deployment path requirements of equipment from high temperature hazard would be provided by developing HNP procedures and programs to address storage structure requirements, deployment path requirements, and FLEX equipment requirements relative to the hazards applicable to HNP.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to deployment of FLEX equipment from the effects of high temperature, 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 pages 17 and 18 of the Integrated Plan, the licensee stated that storage/protection of equipment from high temperature hazard would be provided by developing HNP procedures and programs to address storage structure requirements, deployment path requirements, and FLEX equipment requirements relative to the hazards applicable to HNP.

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

3.2 PHASED APPROACH

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

To meet these EA-12-049 requirements, Licensees will establish a baseline coping capability to prevent fuel damage in the reactor core or SFP and to maintain containment capabilities in the context of a BDBEE that results in the loss of all ac power, with the exception of buses supplied by safety-related batteries through inverters, and loss of normal access to the UHS.

As discussed in NEI 12-06, Section 1.3, plant specific analysis will determine the duration of each phase.

3.2.1 RCS Cooling and Heat Removal, and RCS Inventory Control Strategies

NEI 12-06, Table 3-2 and Appendix D summarize one acceptable approach for the reactor core cooling strategies. This approach uses the installed auxiliary feedwater (AFW)/emergency feedwater (EFW) system to provide steam generator (SG) makeup sufficient to maintain or restore SG level in order to continue to provide core cooling for the initial phase. This approach relies on depressurization of the SGs for makeup with a portable injection source in order to provide core cooling for the transition and final phases. This approach accomplishes reactor coolant system (RCS) inventory control and maintenance of long-term subcriticality through the use of low leak reactor coolant pump (RCP) seals and/or borated high pressure RCS makeup with a letdown path.

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) prevention of recriticality as discussed in Appendix D, Table D-1.

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 UHS for an extended period (the ELAP event).

Section 3.2 of WCAP-17601 discusses the PWROG's recommendations that cover the following subjects for consideration in developing FLEX mitigation strategies: (1) minimizing RCP seal leakage rates; (2) adequate shutdown margin; (3) time initiating cooldown and depressurization; (4) prevention of the RCS overfill; (5) blind feeding an SG with a portable pump; (6) nitrogen injection from safety injection tanks (SITs), and (7) asymmetric natural circulation cooldown (NCC). The licensee should provide a discussion of their position on each of the recommendations discussed above for developing the FLEX mitigation strategies. Specifics of this discussion should include a listing of the recommendations that are applicable to the plant, providing rationale for the applicability, addressing how the applicable recommendations are considered in the ELAP coping analysis, discussing the plan to implement the recommendations, and providing the rationale for each of the recommendations that are determined to be not applicable to the plant. This has been identified as Confirmatory Item 3.2.1.A. in Section 4.2.

During the audit process, the licensee was requested to discuss the following areas:

a) Specify the size of the SG/power operated relief valve (PORV)/ atmospheric relief valve (ARV)/ atmospheric dump valve (ADV) backup nitrogen supply source and the required time for its use as motive force to operate the SG PORV/ARV/ADV for mitigating an ELAP event.
b) Discuss the analysis determining the size of the subject nitrogen supply to show that the nitrogen sources are available and adequate, lasting for the required time.
c) Discuss the electrical power supply that is required for operators to throttle steam flow through the SG PORV/ARV/ADVs within the required time and show that the power is

available and adequate for the intended use before the operator takes actions to manually operate the SG PORV/ARV/ADVs.

d) Discuss the operator actions that are required to operate SG PORV/ARV/ADVs manually and show that the required actions can be completed within the required time.

The licensee responded by stating:

> For a) and b) above, nitrogen is not the motive force for the SG PORVs. The SG PORVs motive force is hydraulic pressure. Each PORV actuator is equipped with a hydraulic accumulator, which can provide at least one full stroke of the valve. The SG PORVs are Safety Class 2, Seismic Category I components.
>
> For c), operation of the SG PORVs is from the main control board. HNP is planning a modification (licensee-identified Open Item #45) which will provide control power to all SG PORV servos from the safety related instrument busses via safety related inverters and safety related 125 VDC batteries. Local recharging of SG PORV hydraulic accumulators by aligning and operating an installed hand pump will be required periodically until FLEX ac power is aligned to the SG PORV hydraulic pump motors per licensee-identified Open Items #44 and #79.
>
> For d) an existing operating procedure provides steps to support local operation of the SG PORVs. This action is directed by the emergency operating procedure for loss of all AC power.

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 Section 3.2 of WCAP-17601 Recommendations, if these requirements are implemented as described.

3.2.1.1 Computer Code Used for the ELAP Analysis

NEI 12-06, Section 1.3 states:

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

During the audit process, the licensee was requested to specify which analysis performed in WCAP-17601-P, "Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering and Babcock & Wilcox NSSS Designs," is being applied to HNP. Additionally, the licensee was requested to justify the use of that analysis by identifying and evaluating the important parameters and assumptions demonstrating that they are representative of your site and appropriate for simulating the ELAP transient. The licensee responded by stating that a vendor resource will assist in determining which WCAP-17601-P analyses applies to HNP. The licensee was requested to include and update in the 6-month update. This is identified as Confirmatory Item 3.2.1.1.A in Section 4.2.

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. Since WCAP-17601-P was specified as the reference for the SOE, it is assumed that the SOE was based on an analysis using the industry-developed NOTRUMP computer code. NOTRUMP was written to simulate the response of pressurized water reactors (PWRs) to small break loss of coolant accident (LOCA) transients for licensing basis safety analysis. Although NOTRUMP has been reviewed and approved for performing small break LOCA analysis for PWRs, the NRC staff had not previously examined its technical adequacy for simulating an ELAP event. In particular, the ELAP scenario is differentiated from typical design-basis small-break LOCA scenarios in several key respects, including the absence of normal ECCS injection and the substantially reduced leakage rate, which places significantly greater emphasis on the accurate prediction of primary-to-secondary heat transfer, natural circulation, and two-phase flow within the RCS. As a result of these differences, concern arose associated with the use of the NOTRUMP code for ELAP analysis for modeling of two-phase flow within the RCS and heat transfer across the SG tubes as single-phase natural circulation transitions to two-phase flow and the reflux condensation cooling mode. This concern resulted in the following Confirmatory Item:

> Reliance on the NOTRUMP code for the ELAP analysis of Westinghouse plants is limited to the flow conditions prior to reflux condensation initiation. This includes specifying an acceptable definition for reflux condensation cooling. This is identified as Confirmatory Item 3.2.1.1.B in Section 4.2.

On page 33 of the Integrated Plan under maintain containment for Phase 1, the licensee stated that the containment building is designed for an internal pressure of 45.0 psig (UFSAR, Table 6.2.1-3). Four station blackout (SBO) with RCP seal LOCA scenarios, were evaluated in Progress Energy HNP Calculation HNP-F/PSA-0054, "HNP PRA - Appendix F -Thermal-Hydraulic Analyses," Revision 2, Section 4.2. None of the evaluated scenarios exceeded containment pressure rise of 10.5 pounds per square inch gauge (psig) during the first 24 hours following an SBO event. The licensee noted that the SBO analyses discussed above stated that no challenge to containment integrity is expected and therefore no Phase 1 actions are required. The NRC staff noted that a plant specific ELAP containment atmosphere analysis using approved analytical tools must be performed to confirm no action is required to maintain containment and potentially affected instrumentation (licensee-identified Open Item #31). The NRC staff also noted that the SBO analyses discussed above used Modular Accident Analysis Program (MAAP) Version 3 for an analytical tool. Justification for the appropriateness of MAAP3 for containment analyses should be provided. This has been identified as Confirmatory Item 3.2.1.1.C. in Section 4.2.

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

3.2.1.2 RCP Seal Leakage Rates

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.

During an Extended Loss of ac Power (ELAP) event, cooling to the RCPs seal packages will be lost and water at high temperatures may degrade seal materials leading to excess seal leakage from the RCS. Without ac power available to the emergency core cooling system, inadequate core cooling may eventually result from the leakage out of the seals. The ELAP analysis credits operator actions to align the high pressure RCS makeup sources and replenish the RCS inventory in order to ensure the core is covered with water, thus precluding inadequate core cooling. The amount of high pressure RCS makeup needed is mainly determined by the seal leakage rate, therefore the seal leakage rate is of primary importance in an ELAP analysis as greater values of the leakage rates will result in a shorter time period for the operator action to align the high pressure RCS makeup water sources.

The licensee provided an SOE in their Integrated Plan, which included the time constraints and their technical basis for the site. The SOE is based on an analysis using specific RCP seal leakage rates. The issue of RCP seal leakage rates was identified as a Generic Concern and was addressed by the NEI in the following submittals:

- WCAP-17601-P, Revision 1, “Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering and Babcock & Wilcox NSSS Designs” dated January 2013 (ADAMS Accession No. ML13042A011 and ML13042A013 (Non-Publically Available)).

- A position paper dated August 16, 2013, entitled “Westinghouse Response to NRC Generic Request for Additional Information (RAI) on Reactor Coolant Pump (RCP) Seal Leakage in Support of the Pressurized Water Reactor Owners Group (PWROG)” (ADAMS Accession No. ML13235A151 (Non-Publicly Available)).

After review of these submittals, the NRC staff has placed certain limitations for Westinghouse designed plants. Those limitations and their corresponding Confirmatory Item numbers for this TER are provided as follows:

(1) For the plants using Westinghouse RCPs and seals that are not the SHIELD shutdown seals, the RCP seal initial maximum leakage rate should be greater than or equal to the upper bound expectation for the seal leakage rate for the ELAP event (21 gpm/seal) discussed in the PWROG position paper addressing the RCP seal leakage for Westinghouse plants. If the RCP seal leakage rates used in the plant-specific ELAP analyses are less than the upper bound expectation for the seal leakage rate discussed in the position paper, justification should be provided. If the seals are changed to non-Westinghouse seals, the acceptability of the use of non-Westinghouse seals should be addressed, and the RCP seal leakage rates for use in the ELAP analysis should be provided with acceptable justification. This is identified as Confirmatory Item 3.2.1.2.A in Section 4.2

(2) In some plant designs, such as those with 1200 to 1300 psia SG design pressures and no accumulator backing of the main steam system power-operated relief valve (PORV) actuators, the cold legs could experience temperatures as high as 580 degrees Fahrenheit before cooldown commences. This is beyond the qualification temperature (550 degrees Fahrenheit) of the O-rings used in the RCP seals. For those Westinghouse designs, a discussion of the information (including the applicable analysis and relevant seal leakage testing data) should be provided to justify that (1) the integrity of the associated O-rings will

be maintained at the temperature conditions experienced during the ELAP event, and (2) the seal leakage rate of 21 gpm/seal used in the ELAP is adequate and acceptable. This is identified as Confirmatory Item 3.2.1.2.B in Section 4.2.

On page 23 of the Integrated Plan, the licensee stated that HNP does not have low leakage seals installed in their RCPs. In addition, during the audit process, the licensee stated that HNP is not installing safe shutdown/low leakage seals.

During the audit process, the licensee was requested to provide the following information:

a. Provide the value of the maximum leak-off for each RCP seal in gpm assumed in the ELAP analysis.

b. Discuss how the pressure-dependent RCP seal leakage rates are calculated. If the analysis uses the equivalent size of the break area based on the initial total RCP leakage rate and a specific flow model to calculate the pressure-dependent RCP seal leakage rates during the ELAP, discuss and justify the flow rate model used. Discuss whether the size of the break area is changed or not in the analysis for the ELAP event. If the size is changed, discuss the changed sizes of the break area and address the adequacy of the sizes. If the break size remains unchanged, address the adequacy of the unchanged break size throughout the ELAP event in conditions with various pressure, temperature (considering that the seal material may fail due to an increased stress induced by cooldown) and flow conditions that may involve two-phase flow which is different from the single phase flow modeled for the RCP seal tests that are used to determine the initial total RCP seal leakage rate assumed in the ELAP analysis.

c. Section 4.4.1 of WCAP-17601 states, in part, that, "The NRC Information Notice (IN) 2005-14 has accepted the use of a 21 gpm assumption in deterministic analyses to develop coping analyses to show compliance with Appendix R. Given that the 50.63 SBO transient is similar with regard to seal performance, the 21 gpm should also be acceptable for developing ELAP strategies; this has not been called into question by the NRC in inspections (e.g., Component Design Basis Inspections)."

   It is stated in IN 2005-14 that, "For the Westinghouse RCP seals, as discussed in a recently submitted document on RCP seal performance, a leakage rate of 21 gpm per RCP may be assumed in the licensee's safe shutdown assessment following the loss of all RCP seal cooling. Assumed leakage rates greater than 21 gpm are only warranted if the increase seal leakage is postulated as a result of deviations from seal vendor recommendations." It is also stated in IN 2005-14 that, "Even if seal cooling is not reestablished, degradation of the seals for leakage rate to significantly increase is not expected for an indefinite period of time if the RCPs are secured before the seal temperature exceeds 235 degrees F. Restoration of seal cooling may result in cold thermal shock of the seal and possibly cause increased seal leakage."
   Address the applicability of the above statements from IN to the ELAP analysis.

d. Section 4.4.1.1 of WCAP-17601 states that "… In some plant designs, such as those with 1200 to 1300 psia SG design pressures and no accumulator backing of the main steam system PORV actuators, the cold legs could experience temperatures as high as 580 degrees F before cooldown commences". It further states that "this is beyond the qualification temperature [550 degrees F] of the O-rings but it is judged that the O-rings will remain intact for at least several hours at this temperature and normal operating pressure." Address the applicability of the above statements to the ELAP analysis, and justify that the integrity of the associated O-rings will remain for a specified time period.

e. Section 5.7.1 of WCAP-17601 discusses the analyses for the RCS response with RCP safe shutdown/low leakage seals. In the analyses, the assumed RCS leakage is reduced to one gpm/seal plus one gpm of unidentified allowable Tech. Spec. leakage. Discuss the analysis used to determine the RCP seal leakage of one gpm/seal for the safe shutdown/low leakage seals, and address adequacy of the analysis including computer code/methodology and assumptions used, and supporting testing data applicable to the ELAP conditions. The NRC staff noted that the NRC previously reviewed and approved the use of the Westinghouse SHIELD shutdown seal data for the Model 93A RCP in the plant PRA model. If the Model 93A RCP is used, address the compliance of Sections 3.5 and 4.0 of the NRC safety evaluation (ADAMS Nos.: ML110880122 and ML110880131) approving the use of the shutdown seal with Model 93A RCP in the plant PRA model. If different RCP models are used, specify the RCP models for each applicable plant, and address the acceptability of using the SHIELD shutdown seal with these RCP models in the plant PRA model, since the NRC has not yet issued a safety evaluation approving the use of the SHIELD shutdown seal with other models in the plant PRA model. Westinghouse has issued a 10 CFR Part 21 report, "Notification of the Potential Existence of Defects Pursuant to 10 CFR Part 21," dated July 26, 2013 (ADAMS No. ML13211A168). Discuss how this Part 21 Report impacts the use of a seal leakage of one gpm in the ELAP analysis.

f. Provide the manufacturer's name and model number for the reactor coolant pumps and the reactor coolant pump seals. Discuss whether or not the reactor coolant pump and seal combination complies with a seal leakage model described in WCAP-17601.

g. Confirm that the primary ELAP strategy is to perform a symmetric cooldown using all RCS loops.

During the audit process, the licensee responded by stating that for items a, b, c and d, above, a vendor will assist HNP in addressing these items. For item e, HNP is not installing safe shutdown flow leakage seals. For Item f, RCPs are Westinghouse model 93A with a Westinghouse 93ACS seal package. The licensee stated that a vendor will assist HNP in addressing whether or not the reactor coolant pump and seal combination complies with a seal leakage model described in WCAP-17601 and for Item g, HNP intends to conduct a symmetric cooldown in response to ELAP. A licensee-identified Open Item has been generated to track items a, b, c, d, and f. The time table, details of licensee's actions and Open Item number needs to be provided and updated in the 6 month status report. This has been identified as Confirmatory Item 3.2.1.2.C. in Section 4.2.

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

3.2.1.3 Decay Heat

NEI Section 3.2.1.2 states in part:

The initial plant conditions are assumed to be the following:

(1) Prior to the event the reactor has been operating at 100 percent rated thermal 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.

The licensee was requested to address the applicability of assumption 4 from WCAP Section 4.2.1 Input Assumptions - Common to All Plant Types on page 4-13 of WCAP-17601, which states that “Decay heat is per ANS 5.1-1979 + 2 sigma, or equivalent,” and to provide a discussion regarding the following key parameters used to determine the decay heat: (1) initial power level, (2) fuel enrichment, (3) fuel burnup, (4) effective full power operating days per fuel cycle, (5) number of fuel cycles, if hybrid fuels are used in the core, and (6) fuel characteristics are based on the beginning of the cycle, middle of the cycle, or end of the cycle. If a different decay heat model is used, the licensee was also requested to address the specific model and the acceptability of the model. This has been identified as Open Item 3.2.1.3.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 decay heat, if these requirements are implemented as planned.

3.2.1.4 Initial Values for Key Plant Parameters and Assumptions

NEI 12-06, Section 3.2 provides a series of assumptions to which initial key plant parameters (core power, RCS temperature and pressure, etc.) are required to conform. When considering the code used by the licensee and its use in supporting the required event times for the SOE, it is important to ensure that the initial key plant parameters not only conform to the assumptions provided in NEI 12-06, Section 3.2, but that they also represent the starting conditions of the code used in the analyses and that they are included within the code’s range of applicability.

Page 3 of the Integrated Plan provided key site assumptions. The assumptions are consistent with the initial values listed in NEI 12-06 Section 3.2.1.2 and 3.2.1.3.

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 or provides an acceptable alternative to the guidance to NEI 12-06, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to initial plant conditions and initial conditions, if these requirements are implemented as described.

3.2.1.5 Monitoring Instrumentation and Controls

NEI 12-06, Section 3.2.1.10 states in part:

> 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:
>
> - SG Level

- SG Pressure
- RCS Pressure
- RCS Temperature
- Containment Pressure
- 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 page 12 of the Integrated Plan, the licensee stated that the essential instrumentation to maintain core cooling and heat removal during Phase 1 is included in the Instrumentation Table in Attachment 6. This was also the instrumentation used for Phase 2 and 3 and for Inventory Control, Maintaining Containment and SFP Cooling.

The following were the essential instrumentation listed in Attachment 6 of the Integrated Plan: RCS Hot Leg Temperature (Thot), RCS Cold Leg Temperature (Tcold), RCS Wide Range (WR) Pressure , SG Narrow Range (NR) Level, SG Wide Range (WR) Level, Core Exit Thermocouple Temperatures, Pressurizer Level, Reactor Vessel Level Indicating System (RVLIS), AFW Pump Flow, SG Pressure, CST Level, 125 VDC Battery/DC Bus Voltage, Safety Related Battery Charger Voltage, Safety Related Battery Charger Amperage, Neutron Flux, Containment Pressure, and Fuel Pool Level. This list is consistent with the essential instrumentation presented in NEI 12-06 Section 3.2.1.10.

The levels in the RWST and BAT are critical information when determining boron concentration. It was unclear if these water level instruments are identified as critical instruments, and since the water levels in the RWST and BAT are required to determine the boron concentration in the RPV, the licensee was requested to provide a discussion to explain why the water level instrumentation for RWST and BAT is not essential Instrumentation. During the audit process, the licensee stated that mitigation strategies utilize level instrumentation for the RWST and BAT. The power for these instruments is maintained during an ELAP event. The RWST and BAT level instrumentation will be added to the essential equipment list. This is identified as Confirmatory Item 3.2.1.5.A in Section 4.2.

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

3.2.1.6 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, in part, 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.

The licensee provided a SOE on pages 6, 7 and 8 and in Attachment 1A on pages 60, 61 and 62 of the Integrated Plan. The action items listed are consistent with the details and sequence of the FLEX strategies described in the Integrated Plan.

According to the description of licensee-identified Open Items in the Integrated Plan, the time constraints presented in Attachment 1A are based primarily on analyses that have not been completed. Hence, most of the timeline are estimates. The final SOE information when analyses have been completed, including the licensee's validation that defined actions from the FLEX strategies can be completed within the time constraints is needed for review. This is identified as Confirmatory Item 3.2.1.6.A in Section 4.2.

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

3.2.1.7 Cold Shutdown and Refueling

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

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

The NRC staff reviewed the licensee's Integrated Plan and determined that the Generic Concern related to shutdown and refueling 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.

During the audit process, the licensee stated that HNP plans to comply with the NEI position paper entitled "Shutdown/Refueling Modes."

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 cold shutdown and refueling, if these requirements are implemented as described.

3.2.1.8 Core Sub-Criticality

NEI 12-06 Table 3-2 states in part:

> All plants provide means to provide borated RCS makeup.

On page 8 of the Integrated Plan, on item 17 in the Discussion of new time constraints identified in Attachment 1A, the licensee stated that at 42 hours, the makeup to RWST should occur. The RWST normally contains approximately 435,000 gallons of at least 2400 ppm borated water. It can be refilled from the Auxiliary Reservoir via SSE Fire Protection (FP) hose stations cross-tied to an ESW header pressurized by a portable diesel driven pump (Figure 10 of the Integrated Plan). Boron crystals can be added via the RWST upper manway (licensee-identified Open Item #26). When refilling the RWST from the Auxiliary Reservoir when the screens are removed, there is a possibility that significant debris can enter the RWST and/or BAT. It is unclear if this debris will inhibit the boron effectiveness and/or the effectiveness of the pumps. During the audit process, the licensee was requested to provide an assessment of the boron effectiveness when significant debris, which may contain different minerals and chemicals and is part of the water that is being mixed with the boron to get the proper concentration of water/boron mix that will be pumped in to the reactor. The licensee was also asked to assess if the debris will affect the pump and the design water flow and/or the water flow through the piping, valves and the core; and since this unfiltered water will be sent directly to the reactor vessel and core inlet, to discuss the possibility that debris could block the core inlet and impede core flow.

The licensee responded by stating that the design input for licensee-identified Open Item #49 requires a strainer to be installed in the FLEX ESW pump discharge line. The strainer's capability is consistent with the permanently installed ESW pump strainer, which is sized smaller than the installed emergency core cooling system (ECCS) sump strainers. Therefore, blockage of the core inlet is not expected. However, the response from the licensee did not provide an answer for the assessment of the boron effectiveness when significant debris, which may contain different minerals and chemicals and is part of the water that is being mixed with the boron to get the proper concentration. The licensee was requested to provide an assessment of the potential loss of effectiveness of the boron due the addition of debris with different minerals and chemicals. This is identified as Confirmatory Item 3.2.1.8.A in Section 4.2.

On page 26 of the Integrated Plan, under maintain RCS inventory control, the licensee stated that modifications to add FLEX RCS make-up pump suction and discharge connections on the A and B train CVCS headers, provide the capability to inject inventory (borate) from a FLEX pump to the RCS from the BAT or RWST (Figure 13 of the Integrated Plan)

During the audit process, the licensee was requested to provide a calculation to determine, for events when the BAT is used instead of the RWST, the concentration of boron for the BAT as a function of time that considers different water levels when the BAT is refilled. The function of time calculation should address the refilling at different initial water levels in the BAT when refilling starts. The licensee was also asked to provide a discussion of how the boron will be added to the BAT and identify the appropriate procedure that provides the direction to accomplish that activity. The licensee responded by stating that guidance for replenishing borated inventory of the BAT is under development with licensee-identified Open Item #66. Refill of the tank while in use will be prohibited unless from a controlled batch process. This guidance will ensure borated water sources meet or exceed the boron concentration requirement to maintain at least a 1% subcritical condition. The BAT will be refilled using existing batching equipment, or from another borated water source, via a hose connection to be installed as part of modification that is identified in licensee-identified Open Item #42.

On page 97 of the Integrated Plan, in Attachment 5 under licensee-identified Open Item #12, the licensee stated that RCS boron concentration and boration in gallons to maintain inventory control and core cooling in regards to keeping the core subcritical with RCS cooldown strategy in PWROG Core Cooling Position Paper (withheld from public disclosure due to proprietary content), Attachment 3 and for licensee-identified Open Item #26.

The licensee stated that a calculation will be performed to determine pounds of boron versus RWST tank level percent to achieve desired boron concentration. Since the tank will be refilled many times and new boron will be added for new levels of water, it is unclear how the boron concentration will be tracked as a function of time. If boron crystals are added to the RWST, there is no way to determine what the concentration of boron is in the tank at any given time. If the concentration is too low, then the correct amount of negative reactivity will not be achieved. During the audit process, the licensee was requested to provide the calculation that provides the pounds of boron that are required to be added to the RWST as a function of time to ensure that the reactor remains subcritical. The calculation should include that the boron concentration varies in the RWST depending on the level in the RWST when the boron is added. If not available, the licensee should indicate when the calculation will be completed. The licensee responded by stating that, as in the case for the BAT, the guidance for replenishing borated inventory of the RWST is under development and is being tracked in licensee-identified Open Item #66. Refill of the tank while in use will be prohibited unless from a controlled batch process. This guidance will ensure borated water sources meet or exceed the boron concentration requirement to maintain at least a 1% subcritical condition.

NEI 12-06 Section 1.3 considerations include providing a means to prevent re-criticality in all conditions following an ELAP. During the audit process, the licensee was requested to provide the information (or specify when the analyses will be completed):

a) Discuss whether the uniform boron mixing model was used in the ELAP analysis. If the uniform boron mixing model was used, address the compliance with the recommendations discussed in a PWROG whitepaper related to the boron mixing model. If a different model was used, address the adequacy of the use of the boron mixing model in the ELAP analysis with support of an analysis and/or boron mixing test data applicable to the ELAP conditions, where the RCS flow rate is low and the RCS may involve two-phase flow.

b) Discuss how the boron concentration in the borated water added to the RCS is considered in the cooldown phase of the ELAP analysis, considering that it needs time for the added borated water to mix with water in the RCS.

c) Discuss the results of the ELAP analysis and show that the core will remain sub-critical during an ELAP.

The licensee responded by stating that analyses addressing recriticality is in progress and is tracked by licensee-identified Open Item #12. When these calculations are completed, a summary report discussing the results of these analyses need to be made available for review. This is identified as Confirmatory Item 3.2.1.8.B in Section 4.2.

The NRC staff reviewed the licensee's Integrated Plan and determined that the generic concern associated with the modeling of the timing and uniformity of the mixing of a liquid boric acid solution injected into the RCS under natural circulation conditions potentially involving two-phase flow was applicable to HNP.

The Pressurized Water Reactor Owners Group (PWROG) submitted a position paper, dated August 15, 2013 (withheld from public disclosure due to proprietary content), which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlined applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available. In an endorsement letter dated January 8, 2014, the NRC staff concluded that the August 15, 2013, position paper constitutes an acceptable approach for addressing boric acid mixing under natural circulation during an ELAP event, provided that the following additional conditions are satisfied:

(1) The required timing for providing borated makeup to the primary system should consider conditions with no reactor coolant system leakage and with the highest applicable leakage rate for the reactor coolant pump seals and unidentified reactor coolant system leakage.

(2) For the condition associated with the highest applicable reactor coolant system leakage rate, two approaches have been identified, either of which is acceptable to the staff:

    a. Adequate borated makeup should be provided such that the loop flow rate in two-phase natural circulation does not decrease below the loop flow rate corresponding to single-phase natural circulation.

    b. If loop flow during two-phase natural circulation has decreased below the single-phase natural circulation flow rate, then the mixing of any borated primary makeup added to the reactor coolant system is not to be credited until one hour after the flow in all loops has been restored to a flow rate that is greater than or equal to the single-phase natural circulation flow rate.

(3) In all cases, credit for increases in the reactor coolant system boron concentration should be delayed to account for the mixing of the borated primary makeup with the reactor coolant system inventory. Provided that the flow in all loops is greater than or equal to the corresponding single-phase natural circulation flow rate, the staff considers a mixing delay period of one hour following the addition of the targeted quantity of boric acid to the reactor coolant system to be appropriate.

At the time the audit was conducted, the licensee had neither (1) committed to abide by the generic approach discussed above, including the additional conditions specified in the NRC's endorsement letter, nor (2) identified an acceptable alternate approach for justifying the boric acid mixing assumptions in the analyses supporting its mitigating strategy. As such, resolution of this concern for HNP is identified as Open Item 3.2.1.8.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 Open and Confirmatory Items provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to boron mixing, if these requirements are implemented as described.

3.2.1.9 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 14 of the Integrated Plan, the licensee stated that the electric motor driven FLEX pump suction can be aligned to a pressurized ESW header via installed ESW valves (Figure 9 of the Integrated Plan) when the CST inventory is depleted. An ESW header will be pressurized by a portable diesel-driven pump taking suction from an ESW pump bay in the intake structure. The ESW pump bay is gravity fed with water via existing ESW piping from the screening structure. The licensee stated that if necessary, the traveling screens will be bypassed by use of an additional portable diesel-driven pump taking suction from the auxiliary reservoir intake canal and discharging to the applicable bay in the screening structure (Figure 10 of the Integrated Plan). The auxiliary reservoir will provide a sustained water supply with the main reservoir serving as a backup supply.

When the screens are removed, a potential for a significant amount of debris may enter the pump suction causing the pump to degrade and limit the amount of water to the appropriate tanks that will ultimately provide water to the core. Significant debris could be present from an ELAP event. During the audit process, the licensee stated that the portable pump suction line drawing from the Auxiliary Reservoir Intake Canal will have a strainer that will protect the FLEX equipment. Pump performance will be monitored and, if necessary, action will be taken to preclude significant degradation.

The Integrated Plan did not address the transition to portable pumps and did not provide guidance on proactive transition from installed equipment to portable, nor reactive transitions in the event installed equipment degrades or fails. During the audit process, the licensee stated that procedural guidance associated with FLEX equipment strategies is being developed for use during an ELAP. These FLEX Support Guidelines (FSGs) will direct the operator with regard to transition to FLEX equipment (e.g. transition from TDAFW pump to FLEX motor driven AFW pump). These actions are being tracked under licensee-identified Open Item #66.

The licensee also stated as described on page 7 of the Integrated Plan, that HNP will establish plant conditions as a contingency action, which will allow the FLEX motor driven AFW pump to be utilized to provide defense in depth for maintaining an adequate heat sink should the TDAFW pump fail. The portable pump phase 2 strategy will be effective only after the SG depressurizes to below the shutoff head of the pump. The safety-related TDAFW pump is credited to operate as designed at the beginning of the event with primary and alternate suction sources.

During the audit process, the licensee stated that based on reviews conducted per licensee-identified Open Item #65, the Alternate Seal Injection (ASI) system will not be credited in the mitigation strategies as had been described on page 25 of the Integrated Plan. The licensee stated that it would make use of a portable motor-driven FLEX RCS makeup pump, with a spare available, for the RCS inventory control strategy.

Discussion of the licensee's use of portable pumps for maintaining SFP cooling is documented in Section 3.2.2 of this Technical Evaluation.

It was identfied that licensee-identified Open Item #9 is associated with an analysis to determine specific FLEX FW pump capacity requirements (discharge pressure and flow) to support phase 2 of maintaining core cooling and heat removal. In addition licensee-identified Open Item #14 is associated with an analysis to determine HNP specific high pressure make up pump minimum performance rating necessary to support phase 2 of maintaining RCS inventory control. Licensee-identified Open Item #19 is associated with an analysis to determine minimum pump performance rating to support ESW delivery to all FLEX usage point simultaneously and prevent pump run-out. Completion of these analyses to determine adequate performance criteria of FLEX portable pumps to support the licensee's phase 2 FLEX strategies is identified as Confirmatory Item 3.2.1.9.A in Section 4.2.

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

3.2.2 Spent Fuel Pool Cooling Strategies

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

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

On page 39 of the Integrated Plan, the licensee described the makeup requirements for the SFPs under normal operations and emergency core offload conditions, and further described the primary and alternate FLEX strategies for providing pool makeup. This description stated that the licensee plans to use the fuel pool cooling pumps to transfer water from the RWST to the SFP. During the audit process, the licensee was requested to confirm that the fuel pool cooling pumps are seismically qualified, or justify why they can be credited to perform as FLEX pumps. The licensee stated that the Fuel Pool Cooling System pumps, piping, and valves are Seismic Category I. The components are housed within the Fuel Handling Building (FHB) which is a Seismic Category I structure. In addition, the fuel pool cooling pumps would be available once the 480 VAC switchgear 1A3-SA or 1B3-SB has been energized. The licensee’s alternate strategy for Phase 2, as described on Page 39 of the Integrated Plan, will use a FLEX portable diesel driven pump to supply makeup water from the ESW discharge canal. The Integrated Plan also stated that this is the alternate strategy to provide spray cooling and the makeup rate will be in excess of 250 gpm as specified in NEI 12-06, Table D-3.

On pages 39 and 40 of the Integrated Plan, the licensee stated that HNP will verify that the piping bounded by valves 1CT-23, 1SF-10, 2SF-10, and 1SF-193 is seismically qualified. This allows HNP to credit SFP make-up from the RWST via the installed Fuel Pool Cooling Pumps which may be powered from a FLEX DG (Figures 11 and 12 of the Integrated Plan)

During the audit process, the licensee was requested to provide a description on how the fluid piping and connecting valves with full water flow between the RWST and the fuel pool pumps will be installed and connected during phase 2. It was unclear if the temperature in the fuel pool pump room is within accessibility limits during the ELAP event. The licensee was also asked to discuss the evaluation of maximum temperatures in the fuel pool pump room during an ELAP event and confirm that the room will be habitable and equipment qualification temperature limits will not be exceeded. The licensee stated that licensee-identified Open Item #52 tracks the seismic upgrade modification of piping bounded by 1CT-23, 15F-10, 25F-10, and 1SF-193. Piping between the RWST and the fuel pool cooling pumps is permanently installed. No installation or connection of piping is required during the Phase 2 strategy. Flow through this piping is initiated by opening valve 1CT-23, which is accessible from the Reactor Auxiliary Building. Licensee-identified Open Item #20 tracks the environmental assessment of the fuel pool cooling pump room to determine necessary actions, if needed.

In NEI 12-06, Table D-3, "Summary of Performance Attributes for PWR SFP cooling functions," "Base Line Capability for Fuel Pool Cooling," included a vent pathway for steam and condensate from SFP

The Integrated Plan did not discuss that a vent pathway would be established. During the audit process, the licensee stated that venting the FHB can be accomplished by implementing existing strategies contained in the Incident Stabilization Guidelines (10 CFR 50.54(hh)(2)). This is accomplished by opening exterior doors on the north (elevation 261‘) and south (elevation 286') ends of the Fuel Handling Building.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and 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 3-2 and Appendix D provide some examples of acceptable approaches for demonstrating the baseline capability of the containment strategies to effectively maintain containment functions during all phases of an ELAP. For example: containment pressure control/heat removal utilizing containment spray or repowering hydrogen igniters for ice condenser containments.

A review of the licensee's approach to maintaining containment seems reasonable; however, the containment evaluation is not finished. A plant specific ELAP containment atmosphere analysis must be performed to confirm that no action is required to maintain containment and the potentially affected instrumentation (licensee-identified Open Item #31). During the audit process, the licensee was requested to provide the completed analysis of the ELAP containment response as specified in licensee-identified Open Item #33 - Containment Pressure and Temperature Analysis at extended time periods when available, and to discuss whether or not the containment spray is needed as a coping action. The licensee stated that licensee-identified Open Item #31 is tracking completion of Containment analysis as stated. Once the Containment analyses are completed, the licensee was requested to address the questions provided above and provide a summary report of the Containment Analysis for review. This is identified as Confirmatory Item 3.2.3.A in Section 4.2.

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

3.2.4 Support Functions

3.2.4.1 Equipment Cooling – Cooling Water

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

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

During the audit process, the licensee was requested to provide a discussion regarding equipment functionality can be maintained when considering NEI 12-06, Section 3.2.2. In its response, the licensee stated that portable mitigation equipment will either be air cooled or water cooled with a self-contained closed cooling system utilizing a radiator to transfer heat to the environment. The licensee confirmed that none of the portable mitigation equipment will require external cooling sources. The licensee's portable mitigation equipment cooling requirements do not rely on an external cooling system, or ac power, or normal access to the UHS.

The TDAFW pump is the only permanently installed pump at the plant being used for several FLEX strategies, so it is imperative that the support systems for the turbine and pump are working. It is unclear how the turbine and pump bearings are being cooled. It appears that water is diverted from the TDAFW pump discharge, routed through a filter, routed to the bearing for cooling and then returned to the pump suction. Due to the potential of significant debris in the water traveling to the TDAFW pump suction and discharge, it appears the debris in the water diverted from the pump discharge to the pump bearings could plug the filter in that line and ultimately the bearings could overheat and fail the pump. During the audit process, the licensee was asked to provide a discussion concerning the cooling requirements for the TDAFW pump and the pump bearings, and to explain why debris is not a concern. Additionally, it is unclear if the TDAFW turbine and pump are seismically and environmentally qualified for FLEX operation. The licensee was also requested to provide evidence that the TDAFW system is seismically and environmentally qualified for an ELAP event.

In its response, the licensee stated that the TDAFW pump bearings are slinger ring type and are oil bath air cooled while the turbine bearings use the oil cooler that is supplied by the TDAFW pump discharge. The licensee clarified that the TDAFW pump, piping and valves are Seismic Category I and the pump is located in a large open area inside the Reactor Auxiliary Building. Licensee-identified Open Items #1 and #20 will evaluate the environmental conditions impact on TDAFW pump operation under ELAP conditions. An alternate suction source for the TDAFW pump is the ESW system. The design input for licensee-identified Open Item #49 requires a strainer to be installed in the FLEX ESW pump discharge line. The FLEX strainer's capability is consistent with the permanently installed ESW pump strainer. Therefore, the licensee stated significant debris in the water traveling to the TDAFW pump suction is not expected. The licensee's completion of its analyses for expected duration of TDAFW pump operation under ELAP conditions is identified as Confirmatory Item 3.2.4.1.A. in Section 4.2.

As part of the licensee response during the audit process, the following additional information was provided. The TDAFW pump discharge recirculation line (mini-flow) is Seismic Category I. The line resides within the Reactor Auxiliary Building and the Tank Building and is protected from external hazards. Moisture is removed from the TDAFW pump turbine steam supply line by two steam traps. The steam trap outlets are routed to a floor drain. The steam supply line and the moisture traps are Seismic Category 1. These components reside within the Reactor Auxiliary Building and are protected from external hazards. Based on the licensee's clarification of its TDAFW pump design for the recirculation line, steam traps and steam supply line, there is no concern associated with continued operation and long term reliability of the TDAFW pump during an ELAP event.

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

3.2.4.2 Ventilation – Equipment Cooling

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

> *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 AFW pump room, 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 … 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.

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 6 of the Integrated Plan, in the discussion of time constraints identified in Attachment 1A, Item 7, the licensee will provide power to provide forced air flow, using portable or installed plant equipment by 6.0 hours into the event and the ventilation equipment will be ready to use by 8 hours into the event Therefore, 8 hours from the initiation of the event allows time to perform Heating Ventilation and Air Conditioning (HVAC) systems alignments and/or deploy portable equipment to support forced air flow. Analysis will determine plant areas requiring ventilation and timeline to initiate/deploy forced or natural air flow (Figures 2, 3, 4 and 7 of the Integrated Plan) (licensee-identified Open Items #10, 21, 22, 23, 24, 66 and 73).

During the audit process, the licensee was requested to provide a detailed summary of the analysis and/or technical evaluation performed to demonstrate the adequacy of the ventilation provided in the TDAFW pump room to support equipment operation throughout all phases of an ELAP. The licensee responded by stating that the TDAFW pump is in a large open area inside the Reactor Auxiliary Building. Licensee-identified Open Items #22 and #23 will evaluate the environmental conditions to determine expected duration of TDAFW pump operation under ELAP conditions. This is identified as Confirmatory Item 3.2.4.2.A in Section 4.2.

The licensee was also requested to provide information on the adequacy of the ventilation provided in the battery room to protect the batteries from the effects of extreme hi and low temperatures. The licensee responded by stating that licensee-identified Open Item #20 will be used to determine support equipment and/or actions required to protect the batteries from extreme temperatures. HNP plans to use the normal ventilation configuration by powering existing exhaust fans, should the analysis indicate this is required. This is identified as Confirmatory Item 3.2.4.2.B in Section 4.2.

During the audit process, the licensee was requested to provide a discussion of battery room ventilation to prevent hydrogen accumulation during charging batteries during Phase 2 and 3. The licensee responded by stating that licensee-identified Open Item #32 will evaluate hydrogen accumulation and removal. This is identified as Confirmatory Item 3.2.4.2.C in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Items, and 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.

On page 97 of the Integrated Plan regarding the description of licensee-identified Open Item #17, the licensee stated that analysis of BAT and RWST during ELAP without heat tracing during cold weather conditions is required.

The Integrated Plan did not adequately address the loss of heat tracing. During the audit process, the licensee stated that licensee-identified Open Items #17 and #20 will evaluate the loss of heat tracing for equipment required to implement the FLEX strategies. The licensee's completion of its analysis to evaluate the loss of heat tracing for equipment required to implement its FLEX strategies is identified as Confirmatory Item 3.2.4.3.A in Section 4.2.

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

3.2.4.4 Accessibility – Lighting and 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.

On pages 45 and 46 of the Integrated Plan, for safety functions support for PWR Installed equipment phase I for lighting and communication, the licensee stated that sufficient lighting will be available for manual actions. DC lighting in the control room is powered by the 125V non-Class 1 E battery capable of coping for four (4) hours when loads are stripped within the first 60 minutes of an SBO event (Progress Energy HNP Calculation E4-0009, "125VDC Non-IE Battery Load Data and Duty Cycle," Revision 7, Section 4.2.1). Preliminary analysis (EC 88887, "FLEX Strategies and Implementation Plan," Revision 1, AOO and Attachments Z06, Z07, and Z08) has determined the ELAP load shedding scheme, when performed by two (2) hours ("Preliminary ELAP (Extended Loss of AC Power) Load Shed Time Validation" (NTM 582920, licensee-identified Open Item #67) into the event, will extend coping time for the 125V non-Class 1 E battery to the RAB, a Seismic Category I structure, however, the battery itself is not Seismic Category I. Therefore, lighting as described below would be credited during a seismic event.

The licensee further stated that two light equipped safe shutdown hard hats are currently staged in the MCR. Flashlights, batteries, and hard hats with lights are located in the auxiliary control panel tool locker below the main control room (MCR) (Progress Energy HNP Operations Reliability Test ORT-1407, "ACP/Safe Shutdown Materials Audit Semiannual Interval Modes 1 - 6"). Self-contained dc emergency lighting units are switched on after the loss of ac power to support SBO response. The units have a coping time of 8 hours (Progress Energy HNP Design Basis Document DBD-203, "Plant Lighting System"). A planned modification to install Light Emitting Diode (LED) lamps in the Self-Contained DC Emergency Lighting units will extend the coping time. Analysis will be performed to determine and address lighting needs to support implementation of FLEX strategies (licensee-identified Open Item #33).

On page 47 of the Integrated Plan, licensee stated that a FLEX diesel generator will be used to supply power to a FLEX electrical distribution system. The system will power installed FLEX power panels and these panels will power portable lighting.

On pages 48 and 49 of the Integrated Plan, the licensee stated that analysis will be performed to determine and address lighting needs to support implementation of FLEX strategies (licensee-identified Open Item #33). Additional lighting, if needed, will be powered by a FLEX DG via installed FLEX power panels with electrical outlets (Figures 2, 3, and 4 of the Integrated Plan). Portable self-contained lighting units and flashlights will be available to support ELAP activities throughout the plant site (licensee-identified Open Item #33).

During the audit process, the licensee was requested to provide a discussion that addresses lighting for other areas of the plant such as TDAFW pump room, the battery room and other locations that may require emergency lighting to support implementation of FLEX strategies. The licensee responded by stating that licensee-identified Open Item #33 evaluates lighting throughout the plant during ELAP conditions. This is identified as Confirmatory Item 3.2.4.4.A in Section 4.2.

The NRC staff has reviewed the licensee communications assessment (ADAMS Accession Nos. ML12311A299 and ML13058A045) in response to the March 12, 2012 50.54(f) request for information letter for HNP and, as documented in the staff analysis (ADAMS Accession No. ML13105A402) 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 (8) regarding communications capabilities during an ELAP. This has been identified as Confirmatory Item 3.2.4.4.B. in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to accessibility – lighting and communications, 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 Integrated Plan did not discuss the access to protected and internal locked areas. During the audit process, the licensee stated that procedures are in place to control access to these areas and procedures will be revised or developed as necessary to include appropriate actions required by FLEX strategies.

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

3.2.4.6 Personnel Habitability – Elevated Temperature

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

> *Plant procedures/guidance should consider accessibility requirements at locations where operators will be required to perform local manual operations.*
>
> Due to elevated temperatures and humidity in some locations where local operator actions are required (e.g., manual valve manipulations, equipment connections, etc.), procedures/guidance should identify the protective clothing or other equipment or actions necessary to protect the operator, as appropriate.
>
> FLEX strategies must be capable of execution under the adverse conditions (unavailability of installed plant lighting, ventilation, etc.) expected following a BDBE resulting in an ELAP/LUHS. Accessibility of equipment, tooling, connection points, and plant components shall be accounted for in the development of the FLEX strategies. The use of appropriate human performance aids (e.g., component marking, connection schematics, installation sketches, photographs, etc.) shall be included in the FLEX guidance implementing the FLEX strategies.

Section 9.2 of NEI 12-06 states,

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

On pages 45 and 48 of the Integrated Plan, the licensee stated that an analysis will be performed to determine ELAP effects upon equipment performance and habitability (licensee-identified Open Items #1, 20, 21, 22, 23 and 35 of the Integrated Plan). Additionally, an alternate strategy is to place portable ventilation blower units and ducting in areas identified by the ELAP equipment performance and habitability analysis (Figures 2, 3, 4 and 7 of the Integrated Plan). A FLEX diesel generator will be used to supply power to installed FLEX power panels with electrical outlets inside the RAB (Figures 2, 3, 4 and 7 of the Integrated Plan). Portable electrical carts with cables will connect to these boxes and run power to portable blower units.

On page 98 of the Integrated Plan, in the licensee-identified Open Item description in Attachment 5 for #21 and #22, the licensee stated that habitability analyses are needed for local manual control of SG PORVs in the Steam Tunnel under ELAP conditions and for local manual control of TDAFW pump at RAB 236 Elevation.

On page 45 of the Integrated Plan, the licensee stated that room heat-up evaluation for the control room upon a loss of HVAC has been performed for only a total duration of 4-hours. On page 6 of the Integrated Plan, the licensee stated that power to provide forced air cooling will not be available at 6 hours following an ELAP. At the time of this review, neither calculations nor evaluations beyond 4 hours were available discussing the habitability of various areas requiring cooling.

Without ventilation the main control room will heat up. If temperatures approach a steady-state condition of 110 degrees Fahrenheit, the environmental conditions within the main control room would remain at the uppermost habitability temperature limit defined in NUMARC 87-00 for efficient human performance. NUMARC 87-00 provides the technical basis for this habitability standard as MIL-STD-1472C, which concludes that 110 degrees Fahrenheit is tolerable for light work for a 4 hour period while dressed in conventional clothing with a relative humidity of ~30%. During the audit process, the licensee was requested to include a discussion of the above considerations regarding any expected high temperatures affecting MCR habitability in the appropriate update to the integrated plan. The licensee was also asked to address the effect of humidity along with high temperatures because higher humidity makes the environment very oppressive even at same or a lower temperature.

During the audit process, the licensee responded by stating that HNP is performing an evaluation of the environmental conditions in various areas/compartments related to an ELAP event (licensee-identified Open Item #20). The results of the evaluation will be used to determine if any specific actions are required to cope with extreme temperatures. These evaluations, once completed, need to be available for review. This is identified as Confirmatory Item 3.2.4.6.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 personnel habitability at elevated temperatures, 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 SG/nuclear boiler and identify backup water sources in order of intended use. Additionally, plant procedures/guidance should specify clear criteria for transferring to the next preferred source of water.*
>
> Under certain beyond-design-basis conditions, the integrity of some water sources may be challenged. Coping with an ELAP/LUHS may require water supplies for multiple days. Guidance should address alternate water sources and water delivery systems to support the extended coping duration. Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles are assumed to be available in an ELAP/LUHS at their nominal capacities. Water in robust UHS piping may also be available for use but would need to be evaluated to ensure adequate NPSH can be demonstrated and, for example, that the water does not gravity drain back to the UHS. Alternate water delivery systems can be considered available on a case-by-case basis. In general, all CSTs should be used first if available. If the normal source of makeup water (e.g., CST) fails or becomes exhausted as a result of the hazard, then robust demineralized, raw, or borated water tanks may be used as appropriate.
>
> Heated torus water can be relied upon if sufficient [net positive suction head] NPSH can be established. Finally, when all other preferred water sources have been depleted, lower water quality sources may be pumped as makeup flow using available equipment (e.g., a diesel driven fire pump or a portable pump drawing from a raw water source). Procedures/guidance should clearly specify the conditions when the operator is expected to resort to increasingly impure water sources.

The licensee addressed water sources for coping strategies in its integrated plan for RCS core cooling and heat removal. Makeup flow is immediately established to the SG during the initial phase of the ELAP strategies.

On page 11 of the Integrated Plan, with regards to maintaining RCS cooling and heat removal during the initial phase, the licensee stated that the CST, with a volume of 415,000 gallons (UFSAR, Section 9.2.6.2), is the water source to the TDAFW pump. A preliminary calculation (licensee-identified Open Item #66) indicates approximately 235,000 gallons of water would be needed to cope for 24 hours, and approximately 342,000 gallons is needed to cope for 40 hours. Due to the presence of a non-seismic condensate transfer pump suction line nozzle (Figure 9 of the Integrated Plan), the available CST volume for ELAP coping is limited to approximately 238,000 gallons (Progress Energy HNP Calculation TANK-0020, "CST Minimum Useable and Maximum Required Inventory Analysis," Attachment A). The non-seismic nozzle will be upgraded to seismic qualification, which will increase the available CST volume to at least 80% stated level or 345,000 gallons, and extend ELAP coping time to 40 hours (licensee-identified Open Item #5).

During the audit process, the licensee was requested to discuss whether the attached piping also needs to be seismically qualified. The licensee stated that HNP has determined not to pursue the CST non-seismic piping modification. As a result, only 238,000 gallons can be credited following a seismic event. The licensee was asked how long the CST can be relied upon assuming the reduced water capacity. The licensee stated that licensee-identified Open Item #5 is being evaluated with vendor assistance. Completion of the analysis determines the amount of time that the CST can be relied upon is identified as Confirmatory Item 3.2.4.7.A in Section 4.2.

On page 12 of the Integrated Plan, the licensee stated that if the ELAP occurs when the RCS is depressurized (i.e. SGs not available as heat sink), the RWST will be used to gravity feed the RCS as the core cooling strategy (Progress Energy HNP Abnormal Operating Procedure AOP-020, "Loss of RCS Inventory or Residual Heat Removal While Shutdown," Section 3.1, Step 10). On page 12 of the Integrated Plan, with regards to maintaining RCS cooling and heat removal during the initial phase, the licensee stated that HNP will establish plant conditions to allow transition from using the TDAFW pump to an electric motor driven FLEX pump to provide defense in depth for maintaining an adequate heat sink should the TDAFW pump fail.

The electric motor driven FLEX pump suction can be aligned to a pressurized ESW header via installed ESW valves (Figure 9 of the Integrated Plan) when the CST inventory is depleted. An ESW header will be pressurized by a portable diesel-driven pump taking suction from an ESW pump bay in the Intake Structure. The ESW pump bay is gravity fed with water via existing ESW piping from the screening structure. If necessary, the traveling screens will be bypassed by use of an additional portable diesel-driven pump taking suction from the auxiliary reservoir intake canal and discharging to the applicable bay in the screening structure (Figure 10 of the Integrated Plan). The auxiliary reservoir will provide a sustained water supply with the main reservoir serving as a backup supply. UFSAR Table 3.2.1-1 identifies that the Emergency Service Water System structures and channels, the auxiliary dam and main dam are designed to Seismic Category I requirements and to withstand design wind/tornado loadings and missile impacts.

On page 25 of the Integrated Plan, it states that the licensee's FLEX strategies rely on the ASI tank, BAT and RWST as the borated water sources. In response to an audit question related to the use of the ASI system for FLEX, the licensee stated that the Alternate Seal Injection system will no longer be credited in its mitigation strategies. Thus, only the BAT and RWST would be the credited sources of borated water. UFSAR, Table 3.8.4-3 indicates that the RWST is a seismic Category I tank, which is housed in the Tank Building. UFSAR Table 3.5.1-2 indicates that the refueling water storage tank storage enclosures are not provided with a roof; thus, the the tank is not currently classified as being robust with respect to high wind events and associated missiles. The licensee stated on page 8 of the Integrated Plan that credit for partial protection of the RWST from tornado missiles is pending further analysis, which is tracked by licensee-identified Open Item #13. The completion of this analysis and the determination of the volume that can be credited for a borated water source from the RWST are identified as Confirmatory Item 3.2.4.7.B in Section 4.2.

It was unclear if the BAT is seismic qualified. During the audit process, the licensee was requested to provide information that indicates that the BAT is seismically qualified. The licensee responded by stating that the BAT is a Safety Class 3, Seismic Category I component. The BAT is housed in the Reactor Auxiliary Building and UFSAR Tables 3.5.1-1 and 3.5.1-2 identifies that this building is protected from tornado missiles.

Plant procedures/guidance should ensure that a flow path is promptly established for makeup flow to the SG/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. During the audit process, the licensee was requested to describe how operators will ensure that a flow path is promptly established for makeup flow to the SG/nuclear boiler. Additionally, the licensee was requested to describe the conditions under which the operator is expected to resort to increasingly impure water sources, such as when the traveling screens are bypassed by use of an alternative portable diesel-driven pump taking suction from the auxiliary reservoir intake canal and discharging to the applicable bay in the screening structure. The licensee responded by stating that operator compliance with the existing emergency operating procedure for a loss of all AC power ensures that the TDAFW pump is running and required minimum flow is delivered to the SGs. Analyses, tracked by licensee-identified Open Items #5, 6, 7, 8, 29, and 39, are in progress to determine conditions under which the operator is expected to resort to increasingly impure water sources. Guidance will be provided in the FSGs and is tracked by licensee-identified Open Item #66.

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 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.

During the audit process, the licensee was requested to describe how electrical isolation will be maintained such that (a) Class 1E equipment is protected from faults in portable/FLEX equipment and (b) multiple sources do not attempt to power electrical buses. The licensee responded by stating that licensee-identified Open Items #44 and #57 track design considerations associated with FLEX power distribution. FLEX power distribution will be designed to protect Class 1E equipment from faults. Administrative controls for alignment and operation of the FLEX distribution network will be provided to prevent energizing a bus from multiple sources. This is identified as Confirmatory Item 3.2.4.8.A in Section 4.2.

During the audit process, the licensee was also requested to provide Single Line Diagrams showing the proposed connections of Phase 2 and 3 electrical equipment. The diagrams should show protection information (breaker, relay, etc.) and rating of the equipment. The licensee responded by stating that licensee-identified Open Items #44 and #57 track the design of the FLEX electrical distribution.

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, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to electrical power sources/isolation 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 pages 48 and 49 of the Integrated Plan regarding safety function support for PWR Portable Equipment phase 2, the licensee stated that to support the implemented strategies used during Phase 2, all fuel consuming FLEX equipment will be refueled as needed. Since the emergency diesel generators are assumed to not be available during the BDBEE, the two diesel fuel oil storage tanks (DFOSTs) can be used to replenish the fuel tanks of the FLEX equipment used during Phase 2. The DFOSTs can provide a total of 200,000 gallons (Progress Energy HNP Operating Procedure OP-155, "Diesel Generator Emergency Power System") of fuel since the tanks are located underground, designed to Seismic Category I, and flood protected. Extracting fuel from the fuel oil storage tanks will be done using a portable pump connected to a modified flanged connection (Figure 28 of the Integrated Plan). In addition, an analysis will be performed to determine the FLEX equipment total fuel consumption rate (licensee-identified Open Item #25). Thus, completion of fuel consumption rate analyses that calculate the total fuel usage for each piece of FLEX equipment and thus determine if sufficient fuel exists on-site until offsite resources arrive for replenishment is identified as Confirmatory Item 3.2.4.9.A in Section 4.2.

During the review, the licensee stated that two FLEX diesel pumps are specified to be used to transfer fuel oil from the DFOSTs, but it was unclear how the fuel would be transferred to all of the various FLEX diesel generators at the plant. These diesel engines appear to be long distances apart, so transfer would most likely by a fuel truck, but that is not clear in the Integrated Plan. Additionally, Figure 1 of the Integrated Plan has been identified as showing the deployment routes for the fuel, but it is not clear. During the audit process, the licensee stated that the equipment for transport of fuel onsite has not been purchased and is tracked by licensee-identified Open Item #73. HNP intends to use a trailer to transport fuel. The trailer will be stored in the FLEX storage facility, which is protected from all applicable hazards. Licensee-identified Open Item #36 tracks this task. This is identified as Confirmatory Item 3.2.4.9.B in Section 4.2

The licensee was also requested to provide plans for supplying fuel oil to the FLEX equipment (i.e., fuel oil storage tank volume, supply pathway, etc.). In addition, the licensee was requested to explain how fuel quality will be assured if stored for extended periods of time. The licensee responded by stating that since the emergency diesel generators will not be available during the BDB Event, the two DFOSTs can be used to replenish the fuel tanks of the FLEX equipment. These safety-related tanks can provide a minimum of 200,000 gallons of fuel. These Seismic Category I tanks are underground and flood protected. An updated Figure 1 of the Integrated Plan provides a site plan showing both a primary and alternate delivery path from the DFOSTs to the staged FLEX equipment. Licensee-identified Open Item #36 (Analysis of delivery path for fuel and equipment) tracks this task. DFOST fuel quality is assured by Technical Specification surveillances. Preventive Maintenance will assure quality of fuel stored in tanks 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 subject to the successful closure of issues related to the Confirmatory Items, 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 6 of the Integrated Plan, in the section of its integrated plan describing the SOE and time constraints, the licensee stated that at 2 hours, ELAP Load Shedding will be performed. This action removes additional noncritical loads from batteries beyond those already shed in the SBO load shedding. Preliminary validation of the load shed activity using a licensed operator confirms 30 minutes is adequate to complete the action. These actions extend battery life beyond initial 4.4 hours (Progress Energy HNP Calculation E4-0008, "125VDC 1E Battery Sizing and Battery/Panel Voltages for Station Black-Out") (licensee-identified Open Items #10, 27, 28 and 66).

On page 11 of the Integrated Plan, in the section of its integrated plan describing maintain core cooling and heat removal, PWR Installed Equipment Phase 1, the licensee stated that the TDAFW pump control is available in the control room for 4.4 hours from the 125V Class 1 E Battery 1 B-SB, after which TDAFW pump control can be performed locally/manually. To extend the control of the TDAFW pump from the control room, an ELAP load shedding strategy will be utilized to extend the coping time of Battery 1B-SB (licensee-identified Open Items #27 and 28). The SBO dc bus load shedding should be completed by one (1) hour into the event (Progress Energy HNP Emergency Operating Procedure EOP-ECA-0.0, "Loss of All AC

Power"), and the ELAP load shedding will subsequently be completed by two (2) hours into the event. The ELAP load shedding will extend the coping time for Battery 1 B-SB to approximately 19.5 hours, which extends the availability to control the TDAFW pump from the Main Control Room (licensee-identified Open Items #27 and 28).

During an ELAP event, only SG PORV C can be controlled from the Main Control Room for 4.4 hours from the 125V Class 1E Battery 1A-SA. The ELAP load shedding strategy would extend the coping time for Battery 1A-SA to approximately 13 hours which extends the availability to control SG PORV C from the main control room (licensee-identified Open Items #27 and 28). SG PORVs A and B lose power to control solenoids upon loss of all ac power. A modification will power controls for SG PORVs A and B from a dc powered Instrument Bus (Figures 16 and 17 of the Integrated Plan). All SG PORVs (A, B, and C) can be operated locally/manually using existing procedures through Steam Tunnel access (Progress Energy HNP Operating Procedure OP-126, "Main Steam, Extraction Steam, and Steam Dump System").

On page 45 of the Integrated Plan, the licensee stated that the phase 1 strategy consists of performing a two part load shed which would extend battery coping times and allow for continued monitoring of key reactor parameters. The SBO DC bus load shedding will be completed by one hour into the event and the ELAP load shedding will be subsequently completed by two hours into the event (licensee-identified Open Item #67). Preliminary analysis has determined that a ELAP load shedding would extend the coping time for Battery 1A-SA to approximately 13 hours and Battery 1B-SB to approximately 19.5 hours (licensee-identified Open Items #10, 27, 28 and 66). This is identified as Confirmatory Item 3.2.4.10.A in Section 4.2.

The NRC staff reviewed the Integrated Plan for HNP and determined that the generic concern related to battery duty cycles beyond 8 hours is applicable to the plant. The generic concern related to extended battery duty cycles, 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 Order Integrated Plan submittals in a timely manner and on a generic basis, to the extent possible, and provide a consistent review by the NRC. 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 intent of Order EA-12-049.

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

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

During the audit process, the licensee stated that HNP intends to comply with the NEI white paper entitled "Battery Life Issue" (ADAMS Accession No. ML13241A186) as endorsed by the NRC (ADAMS Accession No. ML13241A188). The licensee should provide a summary description of how HNP will conform to the NEI position paper. This is identified as Confirmatory Item 3.2.4.10.B in Section 4.2.

During the audit process, the licensee was requested to provide the direct current (dc) load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and SFP cooling. The licensee responded by stating that licensee-identified Open Item #27 (Detailed analysis of DC load shed) tracks this evaluation.

In addition, the licensee was requested to provide the basis for the minimum dc bus voltage that is required to ensure proper operation of all required electrical equipment. The licensee responded by stating that each of the two Class 1E 125V DC station batteries is sized to carry its expected shutdown loads following a plant trip and a loss of all AC power for a period of four hours without battery voltage falling below the minimum system operating voltage. Calculation E4-0008, Attachment S, specifies the minimum system operating voltage components tied to the Safety Related DC bus. A minimum of 107 volts assures proper operation of the 125V DC system connected loads.

Also during the audit process, the license was requested to discuss which components change state when loads are shed and actions needed to mitigate resultant hazards (for example, allowing hydrogen release from the main generator, disabling credited equipment via interlocks, etc.). The licensee responded that licensee-identified Open Item #27 will identify the consequences of dc load shed. With respect to the main generator hydrogen issue in an ELAP event, HNP has an existing operating procedure that provides steps to vent hydrogen from the main generator.

The licensee was also requested to provide a detailed discussion on the loads that will be shed from the dc bus, the equipment location (or location where the required action needs to be taken), and the required operator actions needed to be performed and the time to complete each action. Furthermore, the licensee was requested to explain which functions are lost as a result of shedding each load and discuss any impact on defense in depth and redundancy. The licensee responded by stating that licensee-identified Open Item #27 tracks the assessment of the impact of dc loads to be shed. The Phase 1 strategy consists of a two-part load shed to extend safety related battery coping times. The existing emergency operating procedure directs dc bus load shedding be completed by one hour into the event. The proposed subsequent ELAP load shedding is to be completed by two hours into the event. Breakers opened to support the two-part dc load shed are located in switchgear rooms on the Reactor Auxiliary Building 286' elevation and adjacent to the MCR on the Reactor Auxiliary Building 305' elevation. A preliminary walkthrough confirmed the ELAP load shed can be performed within 30 minutes. This is identified as Open Item 3.2.4.10.C in Section 4.1.

The licensee was also requested to provide a summary of the sizing calculations for the FLEX generators to show that they can supply the loads assumed in phase 2 and 3. The licensee responded by stating that licensee-identified Open Item #24 tracks this analysis. Preliminary results show a FLEX load associated with an ELAP event at 584kW for A-train or 581kW for B-train. This is identified as Confirmatory Item 3.2.4.10.D 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 and Open Items, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to load reduction to conserve dc power, if these requirements are implemented as described.

3.3 PROGRAMMATIC CONTROLS

3.3.1 Equipment Maintenance and Testing.

NEI 12-06, Section 3.2.2, 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 and cables, etc. It is also acceptable to have a single resource that is sized to support the required functions for multiple units at a site (e.g., a single pump capable of all water supply functions for a dual unit site). In this case, the N+1 could simply involve a second pump of equivalent capability. In addition, it is also acceptable to have multiple strategies to accomplish a function (e.g., two separate means to repower instrumentation). In this case the equipment associated with each strategy does not require N+1. The existing 50.54(hh)(2) pump and supplies can be counted toward the N+1, provided it meets the functional and storage requirements outlined in this guide. The N+1 capability applies to the portable FLEX equipment described in Tables 3-1 and 3-2 (i.e., that equipment that directly supports maintenance of the key safety functions). Other FLEX support equipment only requires an N capability.

NEI 12-06, Section 11.5 states:

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

2. Portable equipment that directly performs a FLEX mitigation strategy for the core, containment, or SFP should be subject to maintenance and testing[1] guidance provided in INPO AP 913, Equipment Reliability Process, to verify proper function. The maintenance program should ensure that the FLEX equipment reliability is being achieved. Standard industry templates (e.g., EPRI) and associated bases will be developed to define specific maintenance and testing including the following:

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

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

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

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

    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.

Review of the Integrated Plan for HNP revealed that the generic concern related to maintenance and testing of FLEX equipment is applicable to the plant. This generic concern has been resolved generically through the NRC endorsement of the EPRI technical report on preventive maintenance of FLEX equipment, submitted by NEI by letter dated October 3, 2013 (ADAMS Accession No. ML13276A573). The endorsement letter from the NRC staff is dated October 7, 2013 (ADAMS Accession No. ML13276A224).

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

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

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 states:

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

On page 9 of the Integrated Plan the licensee stated equipment associated with the FLEX strategies will be procured as commercial equipment with design, storage, maintenance, testing, and configuration control in accordance with NEI 12-06, Section 11.1 (licensee-identified Open Item #71). Installed SSCs pursuant to 10 CFR 50.63(a) will continue to meet the augmented guidelines of Regulatory Guide 1.155, Station Blackout (SBO). The unavailability of equipment and applicable connections that directly performs a FLEX mitigation strategy will be managed using plant equipment control guidelines developed in accordance with NEI 12-06, Section 11.5 (licensee-identified Open Item #66).

In addition, the licensee stated that programs and processes will be established to assure personnel proficiency in the mitigation of BDBEEs is developed and maintained in accordance with NEI 12-06, Section 11.6 (licensee-identified Open Item #67).

Also, the licensee stated that the FLEX strategies and basis will be maintained in overall FLEX basis documents (licensee-identified Open Item #68). 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 in accordance with NEI 12-06, Section 11.8 (licensee-identified Open Item #69).

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

3.3.3 Training.

NEI 12-06, Section 11.6 provides that:

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

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

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

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

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

On page 10 of the Integrated Plan with regards to training, the licensee stated that training will be initiated through the Systematic Approach to Training (SAT) process. Training will be developed and provided to all involved plant personnel based on any procedural changes or new procedures developed to address and identify FLEX activities. Applicable training will be completed prior to the implementation of FLEX (licensee-identified Open Item #70).

The licensee's approach described above, as currently understood, is consistent with 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.

guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to training, if these requirements are implemented as described.

3.4 OFFSITE 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 10 of the Integrated Plan, the licensee stated that the industry will establish two RRCs to support utilities during BDBEEs. Each RRC will hold five sets of equipment, four of which will be able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle. Equipment will be moved from an RRC to a local staging area, established by the SAFER team and the utility. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of the nuclear site's playbook (licensee-identified Open item #75), will be delivered to the site within 24 hours from the initial request. A contract has been signed between the site and the Pooled Equipment Inventory Company to provide Phase 3 services and equipment.

Based on a review of their Integrated Plan, insufficient information was provided regarding consideration 2 through 10 of NEI 12-06, Section 12.2. 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.

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

4.0 OPEN AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number	Description	Notes
3.1.1.2.A	The Integrated Plan did not address NEI 12-06 Section 5.3.2 considerations 4 (if power is required to move or deploy the equipment) and 5 (the means to move FLEX equipment should be provided that is also reasonably protected from the event). This information needs to be provided for review.	
3.2.1.3.A	The licensee was requested to address the applicability of assumption 4 from WCAP Section 4.2.1 Input Assumptions - Common to All Plant Types on page 4-13 of WCAP-17601, which states that "Decay heat is per ANS 5.1-1979 + 2 sigma, or equivalent," and to provide a discussion regarding the following key parameters used to determine the decay heat: (1) initial power level, (2) fuel enrichment, (3) fuel burnup, (4) effective full power operating days per fuel cycle, (5) number of fuel cycles, if hybrid fuels are used in the core, and (6) fuel characteristics are based on the beginning of the cycle, middle of the cycle, or end of the cycle. If a different decay heat model is used, the licensee was also requested to address the specific model and the acceptability of the model.	
3.2.1.8.C	At the time the audit was conducted, the licensee had neither (1) committed to abide by the generic approach discussed above, including the additional conditions specified in the NRC's endorsement letter, nor (2) identified an acceptable alternate approach for justifying the boric acid mixing assumptions in the analyses supporting its mitigating strategy. As such, resolution of this concern for HNP is needed.	
3.2.4.10.C	The licensee was also requested to provide a detailed discussion on the loads that will be shed from the dc bus, the equipment location (or location where the required action needs to be taken), and the required operator actions needed to be performed and the time to complete each action. Furthermore, the licensee was requested to explain which functions are lost as a result of shedding each load and discuss any impact on defense in depth and redundancy. Licensee-identified Open Item #27 (Detailed analysis of consequences of DC load shed) tracks the assessment of the impact of dc loads to be shed. The results of licensee-identified Open Item #27 need to be provided for review along with which functions are lost as a result of shedding each load and discuss any impact on defense in depth and redundancy.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.3.A	Internal Plant Flooding events - Completion of analysis to determine the impact of internal plant flood events.	
3.1.1.4.A	Off-Site Resources – Confirm RRC local staging area, evaluation of access routes, and method of transportation to the site.	
3.1.4.2.A	The licensee stated that the engineering evaluation required to support the modification identified in licensee-identified Open Item #49 will address configuration and operation of the FLEX equipment under extreme cold, snow, or ice conditions. Licensee-identified Open Item #49 should be reviewed during the 6-month update to ensure that the engineering evaluation was added to it.	
3.2.1.A	Section 3.2 of WCAP-17601 discusses the PWROG's recommendations that cover the following subjects for consideration in developing FLEX mitigation strategies: (1) minimizing RCP seal leakage rates; (2) adequate shutdown margin; (3) time initiating cooldown and depressurization; (4) prevention of the RCS overfill; (5) blind feeding an SG with a portable pump; (6) nitrogen injection from safety injection tanks (SITs), and (7) asymmetric natural circulation cooldown (NCC). The licensee should provide a discussion of their position on each of the recommendations discussed above for developing the FLEX mitigation strategies. Specifics of this discussion should include a listing of the recommendations that are applicable to the plant, providing rationale for the applicability, addressing how the applicable recommendations are considered in the ELAP coping analysis, discussing the plan to implement the recommendations, and providing the rationale for each of the recommendations that are determined to be not applicable to the plant.	
3.2.1.1.A	During the audit process, the licensee was requested to specify which analysis performed in WCAP-17601-P, "Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering and Babcock & Wilcox NSSS Designs," is being applied to HNP. Additionally, the licensee was requested to justify the use of that analysis by identifying and evaluating the important parameters and assumptions demonstrating that they are representative of your site and appropriate for simulating the ELAP transient. The licensee responded by stating that a vendor resource will assist in determining which WCAP-17601-P analyses applies to HNP. The licensee was requested to include and update in the 6-month update.	
3.2.1.1.B	Reliance on the NOTRUMP code for the ELAP analysis of Westinghouse plants is limited to the flow conditions prior to reflux condensation initiation. Provide an acceptable definition for reflux	

	condensation cooling.	
3.2.1.1.C	The NRC staff noted that a plant specific ELAP containment atmosphere analysis using approved analytical tools must be performed to confirm no action is required to maintain containment and potentially affected instrumentation (licensee-identified Open Item #31). The NRC staff also noted that the SBO analyses discussed above used Modular Accident Analysis Program (MAAP) Version 3 for an analytical tool. Justification for the appropriateness of MAAP3 for containment analyses should be provided.	
3.2.1.2.A	For the plants using Westinghouse RCPs and seals that are not the SHIELD shutdown seals, the RCP seal initial maximum leakage rate should be greater than or equal to the upper bound expectation for the seal leakage rate for the ELAP event (21 gpm/seal) discussed in the PWROG position paper addressing the RCP seal leakage for Westinghouse plants. If the RCP seal leakage rates used in the plant-specific ELAP analyses are less than the upper bound expectation for the seal leakage rate discussed in the position paper, justification should be provided. If the seals are changed to non-Westinghouse seals, the acceptability of the use of non-Westinghouse seals should be addressed, and the RCP seal leakage rates for use in the ELAP analysis should be provided with acceptable justification.	
3.2.1.2.B	In some plant designs, such as those with 1200 to 1300 psia SG design pressures and no accumulator backing of the main steam system power-operated relief valve (PORV) actuators, the cold legs could experience temperatures as high as 580 degrees Fahrenheit before cooldown commences. This is beyond the qualification temperature (550 degrees Fahrenheit) of the O-rings used in the RCP seals. For those Westinghouse designs, a discussion of the information (including the applicable analysis and relevant seal leakage testing data) should be provided to justify that (1) the integrity of the associated O-rings will be maintained at the temperature conditions experienced during the ELAP event, and (2) the seal leakage rate of 21 gpm/seal used in the ELAP is adequate and acceptable.	
3.2.1.2.C	During the audit process, the licensee responded by stating that for items a, b, c and d, above, a vendor will assist HNP in addressing these items. For item e, HNP is not installing safe shutdown flow leakage seals. For Item f, RCPs are Westinghouse model 93A with a Westinghouse 93ACS seal package. The licensee stated that a vendor will assist HNP in addressing whether or not the reactor coolant pump and seal combination complies with a seal leakage model described in WCAP-17601 and for Item g, HNP intends to conduct a symmetric cooldown in response to ELAP. A licensee-identified Open Item has been generated to track items a, b, c, d, and f. The time table, details of licensee's actions and Open Item number needs to be provided and updated in the 6 month status report.	
3.2.1.5.A	Confirm RWST and BAT level instrumentation is added to the	

	essential equipment list.	
3.2.1.6.A	The final SOE information when analyses have been completed, including the licensee's validation that defined actions from the FLEX strategies can be completed within the time constraints is needed for review.	
3.2.1.8.A	The licensee was requested to provide an assessment of the potential loss of effectiveness of the boron due the addition of debris with different minerals and chemicals.	
3.2.1.8.B	The licensee responded by stating that analyses addressing recriticality is in progress and is tracked by licensee-identified Open Item #12 (Boration to keep core subcritical). When these calculations are completed, a summary report discussing the results of these analyses need to be made available for review.	
3.2.1.9.A	Completion of analyses to determine adequate performance criteria of FLEX portable pumps to support the licensee's phase 2 FLEX strategies.	
3.2.3.A	The licensee was requested to provide the completed analysis of the ELAP containment response as specified in licensee-identified Open Item 33 - Containment Pressure and Temperature Analysis at extended time periods when available, and to discuss whether or not the containment spray is needed as a coping action. The licensee stated that licensee-identified Open Item #31 is tracking completion of Containment analysis as stated. Once the Containment analyses are completed, the licensee was requested to address the questions provided above and provide a summary report of the Containment Analysis for review.	
3.2.4.1.A	Confirm completion of analyses demonstrating the expected duration of TDAFW pump operation under ELAP conditions.	
3.2.4.2.A	Confirm analysis for loss of HVAC on TDAFW equipment.	
3.2.4.2.B	Confirm analysis of adequacy of the ventilation provided in the battery room to protect the batteries from the effects of extreme high and low temperatures.	
3.2.4.2.C	Confirm analysis of battery room ventilation to prevent hydrogen accumulation during charging batteries during Phase 2 and 3.	
3.2.4.3.A	Confirm analysis to evaluate the loss of heat tracing for equipment required to implement licensee FLEX strategies.	
3.2.4.4.A	Confirm analysis of lighting needs throughout the plant during ELAP conditions.	
3.2.4.4.B	Communications. Confirm that upgrades to the site's communications systems have been completed.	
3.2.4.6.A	The licensee responded by stating that HNP is performing an evaluation of the environmental conditions in various areas/compartments related to an ELAP event (licensee-identified Open Item #20). The results of the evaluation will be used to determine if any specific actions are required to cope with extreme temperatures. These evaluations, once completed, need to be available for review.	
3.2.4.7.A	The licensee stated that HNP has determined not to pursue the CST non-seismic piping modification. As a result, only 238,000 gallons can be credited following a seismic event. The licensee	

	was asked how long the CST can be relied upon assuming the reduced water capacity. The licensee stated that licensee-identified Open Item #5 is being evaluated with vendor assistance. Completion of the analysis determines the amount of time that the CST can be relied upon. The results need to be available for review.	
3.2.4.7.B	The licensee stated that credit for partial protection of the RWST from tornado missiles is pending further analysis. Confirm analysis that determines the volume that can be credited for a borated water source from the RWST.	
3.2.4.8.A	Electrical Isolation - confirm administrative controls for alignment and operation of the FLEX distribution network will be provided to prevent energizing a bus from multiple sources.	
3.2.4.9.A	Completion of fuel consumption rate analyses that calculate the total fuel usage for each piece of FLEX equipment and thus determine if sufficient fuel with margin exists on-site until offsite resources arrive for replenishment. Confirm FLEX equipment total fuel consumption rate.	
3.2.4.9.B	Confirm delivery path to equipment from fuel oil storage tanks and FLEX storage facility.	
3.2.4.10.A	Confirm analysis of consequences from performing DC deep load shed and calculation needed to validate the coping time that will be added to station batteries to provide needed margin to the plant's installed equipment's coping time.	
3.2.4.10.B	The NRC staff concluded that the NEI 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 licensee was requested if HNP plans to comply with recommendations presented in the Nuclear Energy Institute (NEI) position paper entitled "Battery Life Issue" (ADAMS Accession no ML13241A186 (position paper)? During the audit process, the licensee stated that HNP intends to comply with the NEI white paper entitled "Battery Life Issue" (ADAMS Accession No. ML13241A186) as endorsed by the NRC (ADAMS Accession No. ML13241A188). The licensee should provide a summary description of how HNP will conform to the NEI position paper.	
3.2.4.10.D	Confirm sizing calculations for the FLEX DGs to show that they can supply the loads assumed in phase 2 and 3.	
3.4.A	Confirm information is provided on how conformance with NEI 12-06, Section 12.2 guidelines 2 through 10 will be met.	