Mega-Tech Services, LLC

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

Revision 1

February 10, 2014

Nebraska Public Power District
Cooper Nuclear Station
Docket No. 50-298

Prepared for:

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

Contract NRC-HQ-13-C-03-0039
Task Order No. NRC-HQ-13-T-03-0001
Job Code: J4672
TAC No. MF0972

Prepared by:

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

1.0 BACKGROUND

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

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

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

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

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

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

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

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

2.0 EVALUATION PROCESS

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

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

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

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

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

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

Additionally, for the purpose of this evaluation and the NRC staff's interim staff evaluation (ISE), licensee statements, commitments, and references to existing programs that are subject to routine NRC oversight (Updated Safety Analysis Report (USAR) program, procedure program, quality assurance program, modification configuration control program, etc.) will generally be accepted. For example, references to existing USAR information that supports the licensee's overall mitigation 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 mitigation 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. ML130730488), and as supplemented by the first six-month status report in letter dated August 27, 2013 (ADAMS Accession No. ML13247A283), Nebraska Public Power District (hereinafter referred to as the licensee or NPPD) provided Cooper Nuclear Station's (CNS's or Cooper's) Integrated Plan for Compliance with Order EA-12-049. The Integrated Plan describes the strategies and guidance under development for implementation by NPPD 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 staff notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049. That letter described the process used by the NRC staff in its review, leading to the issuance of an interim staff evaluation and audit report. The purpose of the staff's audit is to determine the extent to which the licensees are proceeding on a path towards successful implementation of the actions needed to achieve full compliance with the Order.

3.1 EVALUATION OF EXTERNAL HAZARDS

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

3.1.1 Seismic Events

NEI 12-06, Section 5.2 states:

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

On page 1 of the Integrated Plan, the licensee stated that in accordance with CNS's Updated Safety Analysis Report (USAR) Section II-5, the seismic criteria for CNS include two design basis earthquake spectra: (1) the operating basis earthquake (OBE) at 0.1g (where g is the acceleration of gravity), and (2) the safe shutdown earthquake (SSE) at 0.2g. The licensee stated that in accordance with NEI 12-06, all sites will consider the seismic hazard.

The licensee's screening has appropriately determined that the seismic event hazard is applicable at CNS. However, on page 3 of the Integrated Plan, the licensee stated that the seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012, are not complete and not assumed in CNS's evaluations.

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

3.1.1.1 Protection of FLEX Equipment – Seismic Hazard

NEI 12-06, Section 5.3.1 states:

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

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

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

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

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

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

On page 3 of the Integrated Plan, the licensee stated that all Phase 2 components (i.e., FLEX equipment) are stored at the site and available after the event they were designed to protect against. The licensee identified a related open item by stating that primary and secondary storage locations have not been selected and that after storage locations are finalized, implementation routes will be defined. On page 4 of the Integrated Plan, the licensee stated that full conformance with JLD-ISG-2012-01 and NEI 12-06 is expected. On pages 16, 25, 30, and 36 of the Integrated Plan, the licensee stated that structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06, Section 11, and that the schedule to construct the structures is still to be determined.

CNS's Integrated Plan expresses a general intention to follow the guidance in NEI 12-06; however, it did not directly address the guidance in NEI 12-06, Section 5.3.1. During the audit, the licensee was asked to explain how the guidance in NEI 12-06, Section 5.3.1 will be implemented by CNS. In response the licensee stated that CNS proposes to install two FLEX equipment storage facilities to be designed in accordance with the 2009 International Building Code (the adopted building code for the State of Nebraska). In addition, the licensee stated that the buildings' design will, at a minimum, meet the load combinations specified in ASCE 7-10, Minimum Design Loads for Buildings and Other Structures, Section 2.4 "Allowable Stress Design Load Combinations," and that the proposed FLEX equipment storage facilitys' design thus meets the standards recommended in NEI 12-06, Section 5.3.1.1.b. The licensee stated that no portable ELAP mitigation equipment will be stored outside and that all portable mitigation equipment will be stored in the new FLEX equipment storage facilities and will be secured to prevent damage to the equipment and/or storage facility.

During the audit, when requested to discuss the location of the FLEX storage buildings, the licensee stated that one will be inside the protected area (PA) north of the multipurpose facility (MPF) building and one outside the PA on the southwest corner of the low level radwaste (LLRW) pad.

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 during a seismic event 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:

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

On page 7 of the Integrated Plan, the licensee stated that once storage locations have been determined, deployment routes will be designated to transport the FLEX equipment to the staging areas and that an administrative program will be developed to keep the routes and staging areas clear during all modes of operation. On page 15 of the Integrated Plan, the licensee stated that several potential modifications related to connection of deployed FLEX equipment are being evaluated. These include (1) an external connection point on the exterior of the control building for connection of FLEX equipment, (2) residual heat removal service water (RHRSW) tie-in to external connection points, (3) battery charger tie-in to an external connection point, (4) safety-relief valve (SRV) pneumatic tie-in to the external connection point, and (5) 480 volt FLEX generator tie-ins to 480 volt buses.

On page 18 of the Integrated Plan, the licensee stated that the external connection point structure for FLEX equipment will house all of the external connections to plant systems with the exception of the larger FLEX 480 volt (V) alternating current (ac) generator and that the structure will be designed to withstand the applicable hazards. The licensee stated that the connection points for the FLEX 480 volt ac generator will be inside existing Class I critical switch gear rooms and that pre-staged cables will be used to connect the generator to the connections. The licensee stated that new FLEX piping will be installed to meet necessary seismic requirements. The licensee's statements are consistent with the guidance in NEI 12-06, Section 5.3.2, consideration 2.

The licensee's description of water sources includes a new on-site well, with the Missouri River as an alternative water source, as described in Section 3.2.4.7 of this Technical Evaluation Report. The licensee's planned water sources, together with CNS's USAR Section 4.1 statement that there are no dams or similar structures on the Missouri River downstream of the CNS plant site, adequately address the guidance in NEI 12-06, Section 5.3.2, consideration 3.

During the audit, the licensee was asked to provide additional information describing its considerations and implementation of the guidance in NEI 12-06, Section 5.3.2. In response the licensee stated that the new external FLEX connection structure will be built consistent with the plant's design basis for Seismic Class I structures and will house both the piping and electrical connections necessary for hooking up the portable equipment. The licensee stated that these connections will be consistent with the equipment supplied from the Regional Response Center (RRC). The licensee stated that the electrical connections are low voltage (480 Vac) and are ingress protection (IP) rated IP69K, meaning that the connections are in dust-tight enclosures and protected against powerful, high temperature water jets, and are pull-tested to 2000 pounds. The licensee stated that the modification process will determine if any additional considerations are needed.

During the audit, the licensee stated that CNS has determined the location for the two FLEX storage buildings (FSBs). The licensee stated that FSB #1 will be located on the low level radwaste pad and that location is not subject to soil liquefaction. The licensee stated that FSB #2 will be located inside the protected area on the structural fill for the site and it and the deployment path are not subject to soil liquefaction. The licensee stated that the deployment path from FSB #1 will be developed to accommodate the possibility of soil liquefaction. Based on its response, the licensee has adequately addressed the guidance in NEI 12-06, Section 5.3.2, consideration 1.

During the audit, the licensee stated that no on-site electrical power will be required to support portable equipment deployment and that the FSB's roll-up doors are manually operated. The licensee stated that towing vehicles will be dedicated for the portable equipment and will be stored in the FSBs with the equipment. Based on its response, the licensee has adequately addressed the guidance in NEI 12-06, Section 5.3.2, consideration 4.

During the audit, the licensee was asked to explain how the towing vehicles and trailers needed to deploy Phase 2 equipment will be protected during external hazards applicable at CNS's site. The licensee clarified that the towing vehicles and trailers will be stored in the FSBs and the two FSBs will house identical sets of equipment. In addition, the licensee stated that debris removal equipment has not been determined yet and that the final location for the storage buildings impacts what equipment is required. Identification of the final storage locations and the required debris removal equipment, including its protection from applicable external events such that it is likely to remain functional and deployable to clear obstructions from the pathway between the FLEX storage location and its deployment location, is identified as Confirmatory Item 3.1.1.2.A in Section 4.2.

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

3.1.1.3 Procedural Interfaces – Seismic Hazard

NEI 12-06, Section 5.3.3 states:

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

On pages 13, 16 and 20 of the Integrated Plan, the licensee provided lists of parameters and associated instrumentation credited for implementation of its Phase 1, Phase 2 and Phase 3 core cooling strategies.

On pages 16, 25, 30, and 36 of the Integrated Plan, the licensee stated that CNS's procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to CNS.

On pages 23 and 25 of the Integrated Plan, the licensee provided lists of parameters and associated instrumentation credited for implementation of its Phase 1 and Phase 2 strategies to maintain containment; and on page 27 of the Integrated Plan, the licensee stated that its Phase 3 instrumentation is the same as its Phase 2 instrumentation for its containment strategy.

On pages 28, 30, and 32 of the Integrated Plan, the licensee stated that its SFP level instrumentation will be in accordance with NRC Order EA 12-051, "*Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation*," issued March 12, 2012 (ADAMS Accession No. ML12056A044).

The licensee did not provide any discussion addressing the four considerations in NEI 12-06, Section 5.3.3. During the audit, the licensee was asked to further describe how its procedural interfaces include the considerations in NEI 12-06, Section 5.3.3. In response, the licensee stated CNS's current Station Blackout (SBO) Procedure provides guidance for obtaining necessary instrument readings to support ELAP coping strategies and provides guidance on how to measure key instrument readings using a portable instrument. The licensee also stated that CNS's procedures include guidance on how to control critical equipment, such as the reactor core isolation cooling (RCIC) system and the SRVs, without associated control power.

The licensee addressed its considerations related to internal flooding sources that do not require ac power by stating that CNS's fire protection system has a diesel fire pump that has its own direct current (dc) source and will auto start on low pressure in the system. The licensee stated that the fire protection piping is not Seismic Class I throughout the plant; however, as described in CNS's USAR Chapter X, Section 8.2.8.1, the fire protection piping is supported and restrained in the control building corridor to withstand a Seismic Class I event without loss of structural or pressure boundary integrity. The licensee stated that these design features effectively preclude failure of the piping during a seismic event from affecting the 125 V and 250 V battery rooms (which communicate with the control building corridor). With regard to need for mitigation of ground water, the licensee stated that CNS does not credit any safety-related active ac powered dewatering systems for mitigating ground water intrusion into the portions of the plant which contain systems, structures and components (SSCs) credited in the FLEX strategies or that require access for personnel during the BDBEE. The licensee also stated that CNS does have non-safety related sumps, but operation of these sumps is not credited for implementation of the FLEX mitigation 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 procedural interfaces related to a seismic event 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 3 in the Integrated Plan, the licensee identified an open item by stating that the staging area for the RRC equipment has not been determined. On page 9 of the Integrated Plan, the licensee stated that NPPD has entered into a contract with Pooled Equipment Management Company to obtain, maintain and deliver the equipment specified by NPPD to a designated staging area within 24 hours; and on page 21 of the Integrated Plan, the licensee stated that Phase 3 mitigation equipment will be provided by the RRC which is to be located in Memphis, Tennessee, and the equipment transported to the site will be either immediately staged at the point of use location (pumps and generators) or at a staging area yet to be determined.

During the audit, the licensee was asked to explain whether CNS's considerations related to obtaining off-site resources from the RRC will include addressing ways to circumvent or overcome damage that might occur in existing local or regional infrastructure that might be damaged by a design basis or BDB seismic event. In response, the licensee stated that CNS has not yet determined the location(s) of the staging area(s) and routes to the plant and that the recommendations of NEI 12-06, Sections 5.3.4, 7.3.4 and 8.3.4 will be considered in their development.

CNS's statement provides general confirmation of the licensee's intention to follow the guidance in NEI 12-06. However, after the licensee finalizes the location(s) of the staging area(s) for equipment from the RRC, the licensee's plans should be reviewed to confirm that they include adequate consideration of the guidance in NEI 12-06, Section 5.3.4, or provide an acceptable alternative to that guidance. This 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 considerations of using offsite resources following a seismic event 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.

CNS's USAR, Section 4.2.2.2, states that the station site grade level of 903 feet mean sea level (msl) has been raised 13 feet above the natural grade level of 890 feet msl. On page 1 of the Integrated Plan, the licensee stated that in accordance with CNS's USAR Chapter II, Section 4, the design basis flood is a value of 903.0 feet msl for the probable maximum flood (PMF). The licensee stated that the finished floor elevation of all Class I structures is placed at elevation 903.5 feet msl, or 1/2 foot above the PMF event. The licensee stated that the station's site grade level of 903 feet msl has been raised 13 feet above the natural grade level of 890 feet msl, in order to bring final grade one foot above the existing 902 feet msl levee constructed by the Corps of Engineers. The licensee stated that this levee was raised above its original design level and presently has a three foot minimum free board over the 1952 flood of record (899 feet msl). The licensee stated that flooding of the station is considered to be extremely unlikely due to the combination of upstream Missouri River flood control and the high final site grade and that with respect to the 1,000 year, 10,000 year, and 1,000,000 year (PMF) floods, these water levels will provide 3-1/2 feet, 1-1/2 feet, and 6 inches of freeboard respectively below the 903.5 feet msl grade floor elevation of the principle structures. The licensee stated that CNS is considered to be a dry site because the plant is built above the design basis flood level and that in accordance with NEI 12-06 the external flooding hazard need not be considered.

On page 3 of the Integrated Plan, the licensee stated that the flood re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012, are not complete and not assumed in CNS's evaluations.

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 a flooding hazard if these requirements are implemented as described.

3.1.2.1 Protection of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.1 states:

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

As discussed earlier in Section 3.1.2, CNS screened as a dry site in accordance with NEI 12-06, Section 6.2.1; and the licensee's Integrated Plan does not provide any additional discussion related to protection of FLEX equipment with consideration of a flooding hazard.

During the audit, the licensee was asked to describe CNS's considerations to ensure adequate drainage for the FLEX equipment storage buildings and to describe how any FLEX equipment that may be stored outside will be protected from the potential effects of precipitation runoff during a precipitation event of exceptionally high intensity or long duration.

In response, the licensee stated that CNS's proposed two FLEX equipment storage facilities will have a minimum floor elevation of 903.5 feet msl; which is equal to the finished floor elevation of all Class I structures, or 0.5 foot above the 1,000,000 years PMF event specified in CNS's USAR Chapter II, Section 4.2.2.1. The licensee stated that Class I and Class II buildings are protected from the effects of precipitation through the use of roof drains and overflow scuppers and that the remaining local site drainage is designed such that any excess rainfall not immediately absorbed into the ground will flow away from the buildings to be discharged into drywells or low lying areas adjacent to the plant site. The licensee stated that these designs can safely remove the accumulated water from the probable maximum precipitation rate described in CNS's USAR Chapter II, Section 3.1.3, and can also accommodate the estimated maximum one-hour rainfall rate of 9.7 inches per hour stated in CNS's USAR Chapter II, Section 3.2.3, without adverse effects on the safety-related systems necessary for safe shutdown. The licensee stated that based on these considerations the proposed FLEX equipment storage facility design meets the standards recommended in NEI 12-06, Section 6.2.3.1, consideration 1.b. The licensee stated that no portable FLEX equipment will be stored outside.

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 during a flooding event if these requirements are implemented as described.

3.1.2.2 Deployment of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.2 states:

> There are a number of considerations which apply to the deployment of FLEX equipment for external flood hazards:
>
> 1. For external floods with warning time, the plant may not be at power. In fact, the plant may have been shut down for a considerable time and the plant configuration could be established to optimize FLEX deployment. For example, the portable pump could be connected, tested, and readied for use prior to the arrival of the critical flood level. Further, protective actions can be taken to reduce the potential for flooding impacts, including cooldown, borating the RCS, isolating accumulators, isolating RCP seal leak off, obtaining dewatering pumps, creating temporary flood barriers, etc. These factors can be credited in considering how the baseline capability is deployed.
>
> 2. The ability to move equipment and restock supplies may be hampered during a flood, especially a flood with long persistence. Accommodations along these lines may be necessary to support successful long-term FLEX deployment.

3. Depending on plant layout, the UHS may be one of the first functions affected by a flooding condition. Consequently, the deployment of the equipment should address the effects of LUHS [loss of normal access to the ultimate heat sink], as well as ELAP.

4. Portable pumps and power supplies will require fuel that would normally be obtained from fuel oil storage tanks that could be inundated by the flood or above ground tanks that could be damaged by the flood. Steps should be considered to protect or provide alternate sources of fuel oil for flood conditions. Potential flooding impacts on access and egress should also be considered.

5. Connection points for portable equipment should be reviewed to ensure that they remain viable for the flooded condition.

6. For plants that are limited by storm-driven flooding, such as Probable Maximum Surge or Probable Maximum Hurricane (PMH), expected storm conditions should be considered in evaluating the adequacy of the baseline deployment strategies.

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

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

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

As discussed earlier in Section 3.1.2, CNS screened as a dry site in accordance with NEI 12-06, Section 6.2.1; and the licensee's Integrated Plan does not provide any additional discussion related to deployment of FLEX equipment with consideration of a flooding hazard.

During the audit, the licensee was asked to describe CNS's considerations related to moving equipment and restocking supplies during a regional flood, to explain how potential flooding is prevented from affecting fuel oil storage tanks and sources of fuel for portable equipment, and to explain whether water extraction pumps are expected to be needed during a flooding event because installed sump pumps will not be available.

In response, the licensee stated that for CNS regional floods are typically the result of prolonged precipitation or melting of the upstream "snowpack", both of which are slow developing, predictable events with ample time to pre-stage portable equipment in deployment locations. The licensee stated that CNS's procedure for an external flooding event already has directions to arrange for the most critical supply (diesel fuel) to be delivered and that because of the slow development of the hazard, other supplies (food, water, personnel) can be arranged as needed. The licensee stated that during the prolonged flood of 2011 CNS was able to maintain 100 percent power with no loss of ability to restock supplies.

The licensee stated that the primary source of fuel oil to the portable equipment is the installed fuel oil storage tanks and that the two storage tanks are buried and their appendages are protected by a substantial cover. The licensee stated that manholes providing access to the capped fill connections and the tank vents are all located above 906 feet msl.

The licensee stated that CNS does not credit any safety-related active ac powered dewatering systems for mitigating ground water intrusion into the portions of the plant which contain SSCs credited in the FLEX strategies or that require access for personnel during the BDBEE.

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 during a flooding event if these requirements are implemented as described.

3.1.2.3 Procedural Interfaces – Flooding Hazard

NEI 12-06, Section 6.2.3.3 states:

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

As discussed earlier in Section 3.1.2, CNS screened as a dry site in accordance with NEI 12-06, Section 6.2.1; and the licensee's Integrated Plan does not provide any additional discussion related to procedural interfaces with consideration of a flooding hazard.

During the audit, the licensee was asked to clarify whether CNS currently has any external flooding procedures that will be affected by considerations related to deployment of FLEX mitigation equipment during an external flood event. In response, the licensee stated that CNS's current external flooding procedure will need to be revised to include deployment of FLEX mitigation equipment.

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

3.1.2.4 Considerations in Using Offsite Resources – Flooding Hazard

NEI 12-06, Section 6.2.3.4 states:

> Extreme external floods can have regional impacts that could have a significant

impact on the transportation of offsite resources.

1. Sites should review site access routes to determine the best means to obtain resources from off-site following a flood.

2. Sites impacted by persistent floods should consider where equipment delivered from offsite could be staged for use on-site.

As discussed earlier in Section 3.1.2, CNS screened as a dry site in accordance with NEI 12-06, Section 6.2.1; and the licensee's Integrated Plan does not provide any additional discussion related to using offsite resources with consideration of a flooding hazard.

In its external flooding hazard assessment on page 1 of the Integrated Plan, the licensee stated that the CNS station site grade level of 903 feet msl has been raised 13 feet above the natural grade level of 890 feet msl. During the audit, the licensee was asked to describe how CNS's plans related to transport and staging of off-site resources has included consideration of a regional flood with long persistence that might affect the lower-lying areas around the CNS site. In response the licensee stated that consideration of regional flooding will be included in the development of staging areas and the deployment of equipment to and from those areas.

CNS's statement provides general confirmation of the licensee's intention to follow the guidance in NEI 12-06. However, after the licensee finalizes the location(s) of the staging area(s) for equipment from the RRC, the licensee's plans should be reviewed to confirm that they include adequate consideration of the guidance in NEI 12-06, Section 6.3.4, or provide an acceptable alternative to that guidance. This is included in 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 considerations of using offsite resources during a flooding event if these requirements are implemented as described.

3.1.3 High Winds

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

The screening for high wind hazards associated with hurricanes should be accomplished by comparing the site location to NEI 12-06, Figure 7-1 (Figure 3-1 of U.S. NRC, "Technical Basis for Regulatory Guidance on Design Basis Hurricane Wind Speeds for Nuclear Power Plants," NUREG/CR-7005, December, 2009); if the resulting frequency of occurrence 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 hazards 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.

The reviewer noted that in accordance with NEI 12-06, Figure 7-1, high winds associated with hurricanes are not applicable at the CNS site, which is located in southeastern Nebraska.

On page 2 of the Integrated Plan, the licensee stated that the CNS site is located in an area characterized as having tornado design wind speeds greater than 130 mph in accordance with NEI 12-06, Figure 7.2, and that the tornado hazard will be considered applicable for CNS.

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 Wind Hazard

NEI 12-06, Section 7.3.1 states:

> These considerations apply to the protection of FLEX equipment from high wind hazards:
>
> 1. For plants exposed to high wind hazards, FLEX equipment should be stored in one of the following configurations:
>
>   a. In a structure that meets the plant's design basis for high wind hazards (e.g., existing safety-related structure).
>
>   b. In storage locations designed to or evaluated equivalent to ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures* given the limiting tornado wind speeds from Regulatory Guide 1.76 or design basis hurricane wind speeds for the site.
>
>   - Given the 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 page 3 of the Integrated Plan, the licensee described a CNS open item by stating that primary and secondary storage locations have not yet been selected.

On pages 17, 26, 30, and 37 of the Integrated Plan, in a description of how CNS's portable mitigation equipment is protected from the effects of severe storms with high winds, the licensee stated, that structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 Section 11, and CNS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable at CNS.

During the audit, the licensee was asked to describe the design and construction standards that will be used for CNS's FLEX equipment storage building and to describe how the locations of those buildings will be established with consideration of potential high wind (tornado) hazards. In response, the licensee stated that CNS proposes to install two FLEX equipment storage facilities designed in accordance with the 2009 International Building Code (the adopted building code for the State of Nebraska) and to use load combinations that, as a minimum, meet those specified in ASCE 7-10, Minimum Design Loads for Buildings and Other Structures, Section 2.4 "Allowable Stress Design Load Combinations." The licensee stated that the main wind-force resisting system (MWFRS) and all components and cladding (C&C) of the FLEX equipment storage facilities shall be designed and constructed to resist the wind loads determined in accordance with ASCE 7-10, Chapters 26 through 31 and that the proposed FLEX equipment storage facility design meets the standards recommended in NEI 12-06, Section 7.3.1, consideration 1.b.

The licensee stated that CNS proposes to install two FLEX equipment storage facilities: one inside the protected area (PA) north of the multipurpose facility (MPF) building, and one outside the PA at the southwest corner of the low level radwaste pad. The licensee stated that the anticipated north-south distance between the two storage facilities exceeds 1/3 of a mile and that the proposed FLEX equipment storage facility design meets the standards recommended in NEI 12-06, Section 7.3.1, consideration 1.c. When FLEX equipment storage building locations are finalized, separation distance and axis of separation should be reviewed to confirm that the building locations are consistent with the recommendations in NEI 12-06, Section 7.3.1. This is identified as Confirmatory Item 3.1.3.1.A in Section 4.2.

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

3.1.3.2 Deployment of FLEX Equipment – High Wind Hazard

NEI 12-06, Section 7.3.2 states:

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

As stated earlier in Section 3.1.3 of this evaluation, only the tornado high wind hazard is applicable at CNS; and on this basis NEI 12-06, Section 7.3.2, considerations 1, 2, and 5 are not applicable.

On page 41 of the Integrated Plan, the licensee listed two tow vehicles capable of towing pumps, diesel generators, and compressors; however, the licensee did not include discussion of the protection to be afforded these vehicles from high winds. On page 43 of the Integrated Plan, the licensee included "heavy equipment – debris clearing equipment" in its list of Phase 3 response equipment; however, the licensee failed to address considerations of the potential Phase 2 need to remove debris that might be scattered by a high wind event.

During the audit, the licensee was asked to explain whether debris clearing equipment will be available following a tornado event to support CNS's Phase 2 equipment deployment strategy and how the towing vehicles and trailers needed to deploy Phase 2 equipment will be protected during a large tornado event or other hazards applicable at CNS's site. In response, the licensee stated that appropriate debris clearing equipment will be available, however the exact equipment needed and the storage of that equipment has not been determined. The licensee also stated that the towing vehicles and trailers will be stored in the FSBs and the two FSBs will house identical sets of equipment. Identification of the final storage locations and the required debris removal equipment, including its protection from applicable external events such that it is likely to remain functional and deployable to clear obstructions from the pathway between the FLEX storage location and its deployment location(s), is included with Confirmatory Item 3.1.1.2.A in Section 4.2.

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

3.1.3.3 Procedural Interfaces – High Wind Hazard

NEI 12-06, Section 7.3.3, states:

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

As noted previously in this evaluation, on multiple pages of the Integrated Plan, the licensee stated that CNS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable at CNS. However, the Integrated Plan does not include reference to existing tornado procedures, and does not describe any expected changes to such procedures.

During the audit, the licensee was asked to explain whether CNS has existing high-wind procedures and whether they will be modified to include guidance for deployment of portable mitigation equipment. In response, the licensee stated that CNS's procedure "Weather" has a section for tornado watch and tornado warning and that both sections will be evaluated for modification.

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

3.1.3.4 Considerations in Using Offsite Resources – High Wind Hazard

NEI 12-06, Section 7.3.4 states:

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

The licensee's considerations related to obtaining and using offsite resources have been discussed earlier in Sections 3.1.1.4 of this evaluation. The licensee did not provide any additional information specifically considering utilization of offsite resources during or following a high wind event. Because the applicable high wind event at CNS's site is a tornado, and a hurricane event is not applicable, region-wide effects on transportation cause by high wind events are not reasonably expected. Potential issues related to tornado wind effects on CNS's staging area(s) for receipt of off-site resources are included in Confirmatory Item 3.1.1.4.A.

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 considerations of using offsite resources following a high wind event if these requirements are implemented as described.

3.1.4 Snow, Ice and Extreme Cold

As discussed in NEI 12-06, Section 8.2.1:

All sites should consider the temperature ranges and weather conditions for their site in storing and deploying their FLEX equipment consistent with normal design practices. All sites outside of Southern California, Arizona, the Gulf Coast and Florida are expected to address deployment for conditions of snow, ice, and extreme cold. All sites located north of the 35th Parallel should provide the capability to address extreme snowfall with snow removal equipment. Finally, all sites except for those within Level 1 and 2 of the maximum ice storm severity map contained in Figure 8-2 of NEI 12-06 should address the impact of ice storms.

On page 2 of the Integrated Plan, the licensee stated that in accordance with CNS's USAR Chapter II, Section 3, the design low outside temperature is minus 5 degrees Fahrenheit dry bulb with temperatures below this value only 1 percent of the time during the winter. The licensee stated that the CNS site is located within the region characterized by the National Oceanic and Atmospheric Administration as having a 3-day snowfall of up to 18 inches, as shown on NEI 12-06, Figure 8-1, and that CNS will need to consider snow removal in the deployment of the FLEX strategy. The licensee stated that the CNS site is also located within the region characterized by Electric Power Research Institute (EPRI) as ice severity level 4, as shown on NEI 12-06, Figure 8-2, and that the CNS site is subject to severe damage to power lines and/or existence of large amounts of ice. The licensee stated that in accordance with NEI

12-06, CNS considers snow, ice and extreme cold temperatures to be applicable hazards.

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 cold, ice, and extreme cold hazards if these requirements are implemented as described.

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

NEI 12-06, Section 8.3.1 states:

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

On page 3 of the Integrated Plan, the licensee described a CNS self-identified open item by stating that primary and secondary storage locations have not been selected yet, and once locations are finalized implementation routes will be defined.

On pages 17, 26, 31, and 37 of the Integrated Plan, in a description of how CNS's portable mitigation equipment is protected from the effects of snow, ice and extreme cold, the licensee stated that structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06, Section 11, and CNS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable at CNS.

The licensee did not provide any additional discussion directly addressing the storage considerations discussed in NEI 12-06, Section 8.3.1, regarding significant snowfall and ice storms.

During the audit, the licensee was asked to explain how CNS will implement the guidance in

NEI 12-06, Section 8.3.1. In response, the licensee stated that CNS proposes to install two FLEX equipment storage facilities designed in accordance with the 2009 International Building Code (the adopted building code for the State of Nebraska); utilizing the load combinations specified in ASCE 7-10, Minimum Design Loads for Buildings and Other Structures, Section 2.4 "Allowable Stress Design Load Combinations" whichever load case produces the most unfavorable effect on the building, foundation, or structural member being considered for the specific environmental conditions. The licensee stated that the entire facility will be heated with thermostatically controlled electric unit heaters for each special zone (storage area) to protect FLEX equipment from the effects of extreme cold and that the proposed FLEX equipment storage facility design meets the standards recommended in NEI 12-06, Section 8.3.1, consideration 1.c.

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

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

NEI 12-06, Section 8.3.2 states:

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

On pages 17, 26, 31, and 37 of the Integrated Plan, in its discussion of how equipment will be protected from the effects of snow, ice, and extreme cold, the licensee stated that CNS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to CNS.

On page 41 of the Integrated Plan, in a list of Phase 2 portable equipment, the licensee identified two tow vehicles capable of towing pumps, diesel generators, and compressors; and on page 43 of the Integrated Plan, in a list of Phase 3 response equipment and commodities, the licensee identified heavy equipment, transportation equipment, and debris clear equipment.

However, the licensee did not specifically address snow or ice removal equipment that might be needed to support transportation of equipment from its storage location(s) to points of deployment. The licensee also did not address any considerations made for manual operations that may be needed to support its mitigation strategy in conditions of snow, ice, or extreme cold.

During the audit, the licensee was asked to describe the snow and ice removal equipment that will be available on site to support portable equipment deployment and whether any special considerations are needed to protect plant personnel performing manual operations to implement CNS's ELAP strategy during extreme cold weather conditions. In response, the licensee stated that because CNS is located in southeastern Nebraska, the site routinely deals with snow, ice and cold and has numerous pieces of equipment available including, skid-steer loaders, front-end loaders and dump trucks with blades. Ice melting chemicals are also available for use. The licensee stated that special considerations related to performing manual operations are not needed because CNS's personnel routinely deal with snow, ice, and extreme cold. CNS provided its current snow and ice removal plan for review and that plan was found to contain a list of on-site equipment available for snow and ice removal and to include cautions for personnel working outside to protect themselves from dangerous cold weather conditions. CNS's responses adequately address NEI 12-06, Section 8.3.2, considerations 1 and 2.

As described on page 14 of the Integrated Plan, CNS's primary strategy for Phase 2 core cooling will use a yet-to-be-installed on-site well to replenish the water in the Emergency Condensate Storage Tanks (ECSTs), and the well will be hardened against applicable site hazards, including extreme cold. An alternate method for ECST makeup is to pump water from the Missouri River through a series of portable strainers, filters, and demineralizers, and an alternative strategy for core cooling will be to pump water from the Missouri River into the RHRSW crosstie to the residual heat removal (RHR) injection flow path. As described on page 29 of the Integrated Plan, CNS's strategy for Phase 2 SFP makeup will use the same water sources that are used for core cooling.

The licensee's Integrated Plan does not discuss CNS's considerations related to the potential for ice blockage or formation of frazil ice that might affect availability of makeup water from the Missouri River under ELAP conditions. When more fully developed, CNS's procedures or guidance for obtaining makeup water from the Missouri River during an ELAP event should be reviewed to ensure that NEI 12-06, Section 8.3.2, consideration 3 is adequately addressed. This is identified as Confirmatory Item 3.1.4.2.A in Section 4.2.

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

3.1.4.3 Procedural Interfaces – Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.4, 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.

As discussed in Section 3.1.4.2 above, the licensee stated that CNS routinely deals with snow, ice and cold and has numerous pieces of equipment available to support snow removal, and CNS's current procedure for snow and ice removal plan includes a list of on-site equipment available for snow and ice removal. On multiple pages of the Integrated Plan, the licensee stated that CNS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to CNS.

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

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

NEI 12-06, Section 8.3.4, states:

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

The licensee's considerations related to obtaining and using offsite resources have been discussed earlier in Sections 3.1.1.4 and 3.1.2.4 of this evaluation. The licensee did not provide any additional information specifically considering utilization of offsite resources during an event involving snow, ice, or extreme cold. Potential issues related to effects of snow, ice and extreme cold on CNS's staging area(s) for receipt of off-site resources are included in Confirmatory Item 3.1.1.4.A.

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 considerations of using offsite resources during an event involving snow, ice and extreme cold if these requirements are implemented as described.

3.1.5 High Temperatures

NEI 12-06, Section 9 states:

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

On page 2 of the Integrated Plan, the licensee stated that in accordance with CNS's USAR, Chapter II, Section 3, the CNS design high outside temperature is 97 degrees Fahrenheit dry bulb (79 degrees Fahrenheit wet bulb) and that based on historical records, this temperature is only expected to be exceeded 1 percent of the time during the summer. The licensee stated that CNS will consider high temperatures to be one of external hazards at its site.

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

3.1.5.1 Protection of FLEX Equipment – High Temperature Hazard

NEI 12-06, Section 9.3.1, states:

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

On multiple pages 17, 26, 31, and 37 of the Integrated Plan, the licensee described how FLEX equipment is protected from the effects of high ambient temperatures by stating that structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06, Section 11, and that CNS procedures and programs are being developed to address storage structure requirements and FLEX equipment requirements relative to the hazards applicable at CNS.

The licensee's Integrated Plan did not provide any additional discussion related to storage and protection of its portable mitigation equipment from the potential effects of extreme high temperature.

During the audit, the licensee was asked to describe CNS's considerations related to the potential impact of high temperatures on the storage of portable equipment. In response, the licensee stated that the entire FLEX equipment storage facility will be ventilated to protect FLEX equipment from the effects of extreme heat and that the facility will use a thermostatically controlled forced draft roof exhausting ventilation system that is designed to maintain the interior structure at close to outside ambient air temperatures for which the FLEX equipment is design to operate. The licensee stated that the proposed FLEX equipment storage facility design meets the standards recommended in NEI 12-06, Section 9.3.1.

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

In multiple locations the licensee's Integrated Plan stated that CNS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to CNS.

During the audit, the licensee was asked whether procedural changes would be needed to address manual operations required by plant personnel in extreme high temperature conditions. In response, the licensee stated that no changes are required to address this issue.

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 during conditions of high outside 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 portable equipment.

The licensee's Integrated Plan does not include a discussion of procedural enhancements that might be affected by an extreme high temperature event. During the audit, the licensee was asked to describe whether any procedural enhancements will be needed to address potential effects of high ambient temperatures on deployment or use of the portable mitigation equipment. In response, the licensee stated that procedural enhancements are not needed to address these considerations.

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 related to a high temperature hazard if these requirements are implemented as described.

3.2 PHASED APPROACH

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

To meet these EA-12-049 requirements, licensees will establish a baseline coping capability to prevent fuel damage in the reactor core or SFP and to maintain containment capabilities in the context of a BDBEE that results in the loss of all ac power, with the exception of buses supplied by safety-related batteries through inverters, and loss of normal access to the UHS. As described in NEI 12-06, Section 1.3, "[p]lant-specific analyses will determine the duration of each phase." This baseline coping capability is supplemented by the ability to use portable pumps to provide RPV makeup in order to restore core or SFP cooling capabilities as described in NEI 12-06, Section 3.2.2, Guideline (13). This approach, described in NEI 12-06, Section 3, is endorsed by JLD-ISG-2012-01.

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

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

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

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

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

3.2.1.1 Computer Code Used for ELAP Analysis

NEI 12-06, Section 1.3 states in part:

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

On pages 6 and 7 of the Integrated Plan, the licensee provided technical basis support information about computer codes used in CNS's ELAP analysis. As part of that discussion, the licensee stated that CNS containment integrity for Phases 1 through 3 was evaluated by use of the Modular Accident Analysis Program (MAAP) Version 4.05 computer code.

On page 22 of the Integrated Plan, the licensee described use of the MAAP computer code, saying that CNS has performed a “probabilistic risk assessment level” MAAP analysis to validate the strategy in the Boiling Water Reactor Owners Group (BWROG) analysis and will perform additional calculations to establish the exact timing and duration of containment venting.

MAAP4 was written to simulate the response of both current and advanced light water reactors to loss-of-coolant accident (LOCA) and non-LOCA transients for probabilistic risk analyses as well as severe accident sequences. The code has been used to evaluate a wide range of severe accident phenomena, such as hydrogen generation and combustion, steam formation, and containment heating and pressurization.

The licensee has decided to use the MAAP4 computer code for simulating the ELAP event. While the NRC staff does acknowledge that MAAP4 has been used many times over the years and in a variety of forums for severe and beyond design basis analysis, MAAP4 is not an NRC-approved code, and the NRC staff has not examined its technical adequacy for performing thermal-hydraulic analyses. Therefore, during the review of licensees’ Integrated Plans, the issue of using MAAP4 was raised as a Generic Concern and was addressed by NEI in a position paper dated June 2013, entitled “Use of Modular Accident Analysis Program (MAAP4) in Support of Post-Fukushima Applications” (ADAMS Accession No. ML13190A201). After review of this position paper, the NRC staff endorsed a resolution through letter dated October 3, 2013 (ADAMS Accession No. ML13275A318). This endorsement contained five limitations on the MAAP4 computer code’s use for simulating the ELAP event for Boiling Water Reactors (BWRs). Those limitations and their corresponding confirmatory item numbers for this TER are provided as follows:

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

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

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

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

    a. Nodalization
    b. General two-phase flow modeling

c. Modeling of heat transfer and losses
d. Choked flow
e. Vent line pressure losses
f. Decay heat (fission products / actinides / etc.)

This is Confirmatory Item 3.2.1.1.D, in Section 4.2.

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

During the audit, the licensee's use of the MAAP computer code was discussed. The licensee acknowledged the NRC-endorsed resolution of Generic Concerns regarding use of the MAAP code in mitigation strategies and stated that CNS will be performing an ELAP analysis using the MAAP code to determine the parameters and actions necessary to respond to the ELAP. The licensee stated that CNS will follow the guidance in the letter from the NRC to NEI concerning the use of MAAP and that, when completed, the results of CNS's MAAP analyses will be made available for review.

During the audit, the licensee was asked to describe the quality assurance process to be used by CNS for using the MAAP code to model the ELAP event. In response, the licensee stated that the MAAP calculations to evaluate BDB events will be classified as non-safety related. The licensee stated that engineers performing the calculations have attended MAAP training programs conducted by a qualified MAAP mentor and are certified in accordance with the "MAAP4 Analyst Certification Guide" in Appendix D of the "MAAP4 Applications Guide." The licensee stated that MAAP calculations will be reviewed in accordance with applicable quality assurance requirements and the record of the calculation will be retained.

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

3.2.1.2 Recirculation Pump Seal Leakage Models

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

CNS's Integrated Plan includes relatively little information about reactor recirculation (RR) pump seals or overall RCS system leakage. On page 6 of the Integrated Plan, the licensee stated that the ELAP analysis uses an RPV leakage rate of 66 gallons per minute (gpm) which consists of the Technical Specification maximum total leakage of 30 gpm and 18 gpm for each RR pump seal.

During the audit, the licensee was asked to provide additional justification for the RPV leakage and RR pump seal leakage rates used in CNS's ELAP analysis. In response, the licensee stated that RR pump seal leakage was modeled as a constant break area for an equivalent leak rate 66 gpm at operating RPV pressure. The licensee stated that this leakage is modeled as a constant break area at the RR suction nozzle bottom elevation discharging into the drywell at the elevation of the recirculation pumps and that, since RR pump seal leakage is modeled as a constant small LOCA break area, the corresponding break flow is dependent upon RPV pressure/temperature conditions, as well as, containment conditions.

The reviewer noted that 18 gpm leakage from each RR pump seal is consistent with the BWR RR pump seal leakage value for SBO analysis stated in NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," Appendix J, Question/Answer J.3.2.1, and that NUMARC 87-00 is endorsed by Regulatory Guide (RG) 1.155, "Station Blackout." However, the licensee provided no technical justification that the BWR RR pump seal leakage for the 4 hour SBO event will not increase for the longer-duration ELAP event. The licensee should provide technical justification that during a long-duration ELAP event the RR pump seal leakage value is not expected to exceed the value used in analysis of a 4-hour SBO event. This is identified as Confirmatory Item 3.2.1.2.A in Section 4.2.

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

3.2.1.3 Sequence of Events

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

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

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

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

NEDO-33771/NEDC-33771P, Revision 1, "GEH Evaluation of the FLEX Implementation Guidelines," ADAMS Accession No. ML130370742, (hereinafter NEDC-33771P) is a report prepared by the BWROG to supplement the guidance in NEI 12-06 by providing additional BWR-specific information regarding individual plant response to ELAP/LUHS events. The report includes identification of generic event scenarios and expected plant responses, the associated analytical bases, and recommended actions for performance of a site-specific gap analysis.

NEDC-33771P provides a description of anticipated systems responses to an SBO event that develops into an indefinite-duration ELAP event. The sequence of events for a BWR4 with Mark I containment is applicable to CNS. NEDC-33771P states that BWRs that have a RCIC system will respond to an SBO with the initiation of RCIC to inject water into the reactor vessel and that the HPCI system may respond if RCIC is not available. RCIC and HPCI both use reactor steam for motive force, exhausting this steam to the suppression pool. The exhaust steam transfers decay heat from the reactor vessel to the suppression pool. In addition to the RCIC steam supply, the SRVs may open automatically to relieve pressure. Also some SRVs under operator control may be manually opened to maintain a reactor pressure band while there is sufficient dc power and pneumatic supply. For both cases, SRV steam flow will remove additional reactor decay heat.

On page 6 of the Integrated Plan, the licensee referenced NEDC-33771P as technical basis support information. The licensee stated that CNS used the guidance in NEDC-33771P to develop coping strategies and to help predict the plant’s response to an ELAP event.

On pages 10 and 11 of the Integrated Plan, the licensee described CNS’s Phase 1 core cooling strategy. The licensee’s primary strategy is to supply high quality makeup water to the RPV through the RCIC system, with suction from the ECSTs. The licensee stated that two 50,000 gallon ECSTs are installed for the exclusive use of the RCIC and HPCI systems and that an additional 80,625 gallons of water is available from the main condenser hotwells. The licensee stated that the hotwells have been evaluated to be available after a seismic event, and the combined capacity of the ECSTs, hotwells, and suppression pool is sufficient to support RPV makeup for at least 24 hours without external makeup sources.

The licensee stated that at the initiation of the BDBEE, MSIVs automatically close, feedwater is lost and SRVs automatically cycle to control pressure, causing reactor water level to decrease. When reactor water level reaches -42 inches, HPCI and RCIC automatically start with suction from the ECST and operate to inject makeup water to the reactor vessel. This injection recovers the reactor level to the high level HPIC and RCIC turbine trip set point of 54 inches. The licensee stated that the SRVs will be used to control reactor pressure between approximately 800 and 1000 psig in accordance with CNS’s Emergency Operating Procedure (EOP) 1A, RPV Control. The licensee stated that in a typical SBO event, and in the longer-duration ELAP event, RCIC is able to provide makeup and maintain RPV level, and HPCI is secured after one cycle or 10 minutes of operation.

The licensee stated that after determining that emergency diesel generators cannot be restarted, the operating crew will determine that CNS is in a BDB event and, at 1 hour into the event, will anticipate a loss of power for an extended period of time. The RCIC system will continue feeding the reactor vessel with suction from the ECSTs. The licensee stated that trip and isolation signals that could prevent RCIC operation when needed during the ELAP will be overridden in accordance with current EOPs and that the automatic depressurization system (ADS) will be either placed in "inhibit" or closely monitored to prevent automatic initiation of the ADS and that this is necessary to ensure that reactor pressure is not reduced to a pressure which would prevent operation of the RCIC system.

The licensee stated that the primary method for reactor pressure control is by operation of the SRVs, and control of reactor pressure using the SRVs requires dc control power and pneumatic pressure, supplied by the station batteries and the drywell pneumatics system. The licensee stated that for Phase 1, the power for the SRVs is supplied by the station batteries and that at event initiation, the normal pneumatic supply to the SRVs is lost due to loss of power (to the drywell pneumatics air compressor). However, each SRV is provided with an accumulator which contains enough pneumatic pressure to operate each valve for multiple open/close cycles. The licensee stated that the two SRVs associated with Low-Low-Set (LLS) are sized to allow 14 cycles of each valve and that 27 individual SRV actuations in LLS and manual mode are required for a 4 hour SBO event. In addition, for an ELAP event, after 4 hours the six SRVs associated with ADS will be used to control RPV pressure and that the accumulators for the ADS valves are sized for five cycles and are credited for operation for approximately 40 hours after an SSE seismic event. The licensee stated that the combined capacity of the accumulators is sufficient to allow operation of the SRVs until Phase 2 when drywell pneumatics will be restored with FLEX equipment.

In Attachment 1A of the Integrated Plan, the licensee provided a sequence of events (SOE) timeline for key actions in CNS's mitigation strategy, and on pages 5 and 6 of the Integrated Plan, the licensee provided a discussion of the ELAP SOE timeline.

With the loss of off-site power (LOOP) and on-site ac power occurring at time zero, the licensee stated that the HPCI and RCIC systems will start on low level in a time range of 1-3 minutes as part of the expected, normal plant response to a LOOP and that operator action to secure HPCI will be taken after 10 minutes or one cycle of HPCI operation. The licensee stated that at 30 minutes operators will open the dc switchgear room doors and main control room (MCR) panel doors for panels without open backs to allow cooling. The licensee stated that at 1 hour, Operations will designate the SBO event as an ELAP event, with one hour being considered a reasonable amount of time to diagnose the event. The licensee stated that notification to the RRC is expected to take place at approximately this time, but the exact timing will be determined during development of the site's RRC playbook.

The licensee stated that at 1 hour, action is taken to secure the main turbine emergency lube oil pump (MTELOP) and that this action is required to support 250 V dc Division II battery duration. The licensee stated that the actions to secure the MTELOP consist of verifying the main turbine has stopped rotating locally and then placing the MTELOP control switch in the MCR into the pull-to-lock position.

The licensee stated that additional personnel will begin arriving on site at 6 hours and that when additional personnel arrive, it will be necessary to align and commence filling the ECSTs with water from the condenser hotwells. The licensee stated that the procedure/method for transferring water from the hotwells has not yet been developed and that CNS will develop a method and associated procedure to accomplish this activity. During the audit, the licensee was asked to provide an additional description of CNS's method for transferring water from the main condenser hotwells to the ECSTs and clarify whether this will be implemented using currently installed equipment or a system modification. The licensee stated that CNS is developing a modification to allow pumping the water in the hotwells to the ECSTs and details of the specific flow path, valves, pumps, and related equipment are not yet available. During the audit, the licensee stated that the hotwell transfer piping will be located in the Turbine and Control buildings. The licensee stated that the Control Building is a Class I structure. The licensee further explained that the Turbine Building is a Class II structure of reinforced concrete up to the operating floor and the concrete portion has been evaluated to survive the SSE without major structural failure. The hotwell is located below grade within the concrete structure and the transfer piping will be located below grade and is not subject to the other ELAP considerations. When developed, the licensee's method for transferring water from the hotwells to the ECSTs, including flow path, valves, pumps, and related equipment, should be reviewed to confirm acceptability of the process. This is identified as Confirmatory Item 3.2.1.3.A in Section 4.2.

The licensee stated that at 6 hours, personnel will begin aligning the severe accident management guideline (SAMG) diesel generator (DG) to battery chargers; and at 6 to 8 hours into the event, when the ECST level no longer supports continued RCIC operation because of low level, operators will transfer RCIC pump suction to the suppression pool (torus).

The licensee stated that at 7 hours, as suppression pool temperature rises to near the heat capacity temperature limit (HCTL), Operators will lower RPV pressure as low as possible while still maintaining RCIC in service in accordance with the EOPs.

The licensee stated that at 8 hours, actions will be taken to begin makeup to the ECSTs from the main condenser hotwells, with a makeup to the ECST of at least 120 gpm required. Also, at 8 hours torus venting will begin. The licensee stated that in accordance with NEDC-33771P, containment venting is assumed to start at 4 or 8 hours, that CNS is upgrading the existing 10-inch hard pipe vent to a 12-inch reliable hardened containment vent (RHCV), and that with a 12-inch RHCV, drywell and wetwell (suppression pool) parameters are maintained within limits.

The licensee stated that at 9 hours the SAMG DG will be placed into service because at that time batteries will start to reach the end of their capabilities and placing the SAMG DG into service will preserve the Division I batteries.

The licensee stated that at 18 hours CNS will begin aligning raw water sources for makeup and described changes in suppression pool inventory by stating that initially suppression pool water level will rise because of injection from the ECST. The licensee stated that when containment venting is started, torus water level will steady out and remain constant until RCIC suction is transferred to the suppression pool, at which time suppression pool level will begin to decrease. The licensee stated that approximately 3 feet of level in the suppression pool is vaporized during a 24 hour period through containment venting. The primary raw water source for makeup will be a new in-ground well installed at the CNS site, and the licensee stated that this new well will be sized for the makeup requirements 24 hours after shutdown and be hardened against the appropriate external hazards. The licensee stated that the backup raw source will be the Missouri River and the use of portable strainers, filters, and demineralizers will be procured and used to assure the river water is acceptable for use in the reactor as an emergency makeup water source. The licensee stated that at 24 hours CNS will begin makeup to the ECSTs to maintain RCIC availability while Phase 3 resources are being placed into service.

On pages 14 and 15 of the Integrated Plan, the licensee described CNS's Phase 2 core cooling strategy. The licensee stated that its primary strategy is to continue using the RCIC system as in Phase 1, described above. The licensee stated that an alternate strategy is to use a FLEX pump deployed at the river to provide RPV injection via the normal RHRSW crosstie to the RHR injection flow path. The licensee stated that piping will be installed to a connection point to the exterior of the control building and RPV pressure will be reduced to below the shutoff head of the FLEX pump, after which the RHRSW to RHR flow path is established by positioning appropriate valves in the RHRSW and RHR systems to allow flow into the 24-inch line to the low pressure coolant injection (LPCI) valves.

On page 19 of the Integrated Plan, the licensee described CNS's Phase 3 core cooling strategy. The licensee stated that the Phase 3 reactor core cooling strategy is to place one loop of RHR into the shutdown cooling mode and that this will be accomplished by powering a Division I or Division II RHR pump from the Class 1E 4160 VAC emergency F or G bus using a 4160 VAC FLEX portable DG from the RRC and supplying the RHR heat exchanger with river water using a large portable FLEX pump from the RRC, taking suction from the Missouri River and pumping into the RHRSW system piping through an external connection point. The licensee stated that the 4160 VAC RRC FLEX DG will be capable of carrying approximately 3250 kilowatts (kW) load and that this is sufficient to carry all of the loads on the 4160 VAC bus F or G necessary to support the Phase 3 FLEX strategies, including an RHR pump and its support equipment, such as motor operated valves, jockey pump, and room coolers. The licensee stated that in order to prevent pipe damage due to water hammer, the reactor building auxiliary condensate pump will be repowered to allow proper venting prior to RHR shutdown cooling operation and that the primary strategy is provided by one loop of the RHR system and the secondary strategy is provided by the alternate loop of the RHR system. The licensee stated that alternate means of core cooling can be provided by connecting to and using the opposite division of RHR and RHRSW as that used for the primary function. The licensee stated that an alternate means of providing power to the RHR pumps for shutdown cooling operation is to run cable from the 4160 VAC FLEX DG directly to the component by connecting either at the switchgear end of the component's power cable or locally at the pump end of the power cable.

During the audit, minor discrepancies were noted between the SOE timeline provided by the licensee in Attachment 1A of the Integrated Plan and the discussion of Attachment 1A on pages 5 and 6 of the Integrated Plan. The licensee provided revised pages correcting the discrepancies and stated that a complete revision of the Integrated Plan will be provided in the next six-month update.

During the audit, it was noted that much of the discussion in CNS's Integrated Plan credits the analysis in NEDC-33771P as the basis for determining CNS's SOE timeline, and the principal site-specific ELAP event analysis, identified on page 7 and 22 on CNS's Integrated Plan, is NEDC 13-004, "CNS Evaluation of Diverse and Flexible Coping Strategies for Extended Loss of AC Power." The licensee was asked to explain the purpose of calculation NEDC 13-004, to clarify whether CNS will perform additional site specific core response evaluations, and to provide a copy of NEDC 13-004 for review. In response, the licensee stated that the purpose of NEDC 13-004 is to verify that the calculation NEDC-33771P is applicable for CNS and that CNS will be performing additional site-specific core response evaluations. The completion of these additional site-specific core response evaluations to verify that the calculation NEDC-33771P is applicable for CNS was described earlier in Section 3.2.1.1, where Confirmatory Item 3.2.1.1.E was identified. The licensee also provided a copy of NEDC 13-004 for review.

During the audit, the licensee was asked to explain how a determination is made when to inhibit the ADS system from auto-initiating; the licensee was also asked to provide technical justification to support CNS's statement that with a 12-inch RHCV line, drywell and wetwell parameters are maintained within limits. In response, the licensee stated that in accordance with CNS's EOPs, ADS is inhibited when RPV water level can no longer be maintained above minus 150 inches. The licensee further clarified that minus150 inches is the setpoint below which ADS auto initiation will occur after a predetermined time delay.

With regard to the 12-inch RHCV, the licensee stated that calculation NEDC 13-004 performed an initial analysis to confirm that CNS's response to an ELAP agrees with the conclusions of the generic analysis NEDC-33771P. The licensee stated that in NEDC 13-004, a 10-inch wetwell vent was modeled with a discharge coefficient of 0.75 and that this analysis showed that containment parameters stayed within limits. The licensee stated that at the time of CNS's Integrated Plan submittal, CNS intended to install a 12-inch vent to accommodate a potential power uprate. The licensee stated that CNS will perform additional site-specific analysis to confirm the correct size for the wetwell vent. The completion of this additional site-specific analysis to confirm the correct size for the wetwell vent is included with Confirmatory Item 3.2.3.A, which is discussed further in Section 3.2.3 of this Technical Evaluation Report and listed in Section 4.2.

Section 7.1 of NEDC-33771P includes five recommendations for site-specific gap analyses applicable for ELAP strategies where RCIC suction is aligned to the CST or an alternate water source and that these recommendations are applicable for CNS. During the audit, the licensee was asked to provide information describing how CNS has addressed the NEDC-33771P recommendation for site-specific gap analyses. In response, the licensee provided the following information: (1) CNS will perform a site-specific RCIC room heatup evaluation; (2) CNS has a planned modification for a new in-ground well specifically to fill the ECSTs; (3) CNS will perform a site-specific RCIC room flooding time evaluation; (4) Actions to administratively control the ECST level above minimum levels required by Technical Specifications have been determined to have a negligible effect on the ability to keep RCIC aligned to the CST; and (5) At CNS the RCIC pump suction does not auto-swap to the suppression pool on high level in the CST. Review of the information provided by the licensee determined that the licensee has adequately addresses the gap analyses recommended in NEDC-33771P, Section 7.1. The completion of site-specific RCIC room heatup evaluation and RCIC room flooding time evaluation is identified as Confirmatory Item 3.2.1.3.B in Section 4.2.

The licensee was asked to clarify the extent to which CNS's mitigation strategies are based on the information contained in NEDC-33771P and the extent to which the time constraints are based on plant-specific analyses. The licensee was also asked to provide CNS's plant-specific analysis information commensurate with the level of detail contained in NEDC-33771P. In response, the licensee stated that NEDC 13-004 was used to verify/justify the applicability of NEDC-33771P to CNS and that no time constraints were based on NEDC-33771P. The licensee provided a copy of NEDC 13-004 for review and stated that CNS will be performing an ELAP analysis using the MAAP code to determine the parameters and actions necessary to respond to the ELAP, as described earlier in Section 3.2.1.1 of this Technical Evaluation Report. In Section 3.2.1.1 of this Technical Evaluation Report several confirmatory items related to CNS's ELAP analysis were identified and included in Section 4.2.

Additional questions asked during the audit elicited the following information from the licensee. The licensee stated that CNS's calculation NEDC 13-004 assumed 100 percent steady state power and that CNS will evaluate whether additional power history is appropriate when the additional site-specific ELAP analyses are performed. The licensee stated that the ECSTs are Seismic Class IS tanks and are located in a seismically robust structure.

The licensee was requested to make CNS's Engineering Evaluation 01-147, "Summary of Main

Steam Isolation Valve (MSIV) Leakage Pathway to the Condenser Seismic Qualification," available for review. This calculation is credited to support availability of water from the main condenser hotwells following a seismic event. The licensee provided a copy as requested.

The reviewer noted in the Integrated Plan that the licensee has not completed its Staffing Assessment. In addition, it is noted that the completion of this staffing assessment should include the licensee's validation that proposed actions from the FLEX strategies can be completed within the specified time constraints. This is identified as Confirmatory Item 3.2.1.3.C in Section 4.2.

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

3.2.1.4 Systems and Components for Consequence Mitigation

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

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

And,

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

NEI 12-06, Section 3.2.1.12 states:

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

On page 8 of the Integrated Plan, the licensee stated that CNS's FLEX equipment will be categorized as Quality Augmented (QA) and that the QA characteristics will be based on selected 10 CFR 50, Appendix B guidance. The licensee stated that the equipment for ELAP will be dedicated and will have unique identification numbers.

On pages 40 and 41 of the Integrated Plan, the licensee listed the key FLEX equipment that CNS is crediting for Phase 2 core cooling, containment, and SFP cooling. The list includes two self-priming diesel-driven flex pumps (925 gpm, 378 feet head), two temporary water storage tanks or bladders (20,000 gallons, with small portable heaters), two portable diesel-driven air compressors (300 cubic feet per minute at 200 psi), two 480 VAC diesel generators (175 kW) –

with one of the two being CNS's existing SAMG DG, two 240/120 VAC diesel generators (12 kW), three 240/120 VAC diesel generators (6 kW for battery room and RCIC room fans), two refueling trailers (100 gallons), two monitor spray nozzles for SFP spray and required hoses (sized for 250 gpm), two tow vehicles (capable of towing pumps, diesel generators, and compressors).

Calculations have not been provided to demonstrate that the Phase 2 FLEX equipment performance criteria listed on pages 40 and 41 of the Integrated are adequate. Based on discussions during the audit, it is understood that the stated values are estimated nominal values to be validated by future calculations. When calculations are completed to validate or adjust the Phase 2 FLEX equipment performance criteria, results should be reviewed to confirm adequacy of the specified equipment to support the licensee's mitigation strategies. This is identified as Confirmatory Item 3.2.1.4.A in Section 4.2.

Based on information obtained during the audit, one of the two 480 VAC diesel generators listed above is understood to be CNS's current SAMG DG. During the audit, the licensee was asked to provide additional discussion of the SAMG DG and its use as one of the Phase 2 FLEX power sources. The licensee stated that use of the SAMG DG is consistent with NEI 12-06 because it is a portable generator (not a permanently installed generator). The licensee stated that the SAMG DG is currently stored in the turbine building truck bay and its installation is controlled by station procedures (i.e., Procedure 2.2.100, SAMG Diesel Generator System). The licensee stated that when the FLEX storage building construction is completed, the SAMG DG will be stored in one of the storage buildings, and station procedures will be revised accordingly.

During the audit, the licensee was asked to provide a summary of non-safety-related installed equipment (e.g., piping and piping components, valves, and water sources) used in the mitigation strategies and to discuss whether the equipment is qualified to survive all ELAP events. In response, the licensee listed three items:

(1) Reactor building reliable air header piping, located in the reactor and control buildings, which are Class I structures.
(2) Hotwell transfer piping, which will be located in the turbine building and the control building. The licensee stated that the turbine building is a Class II structure of reinforced concrete up to the operating floor and the concrete portion has been evaluated to survive an SSE seismic event without major structural failure. The licensee stated that the hotwell is located below grade within the concrete structure and the transfer piping will be located below grade and is not subject to the other ELAP considerations. Based on these considerations, the licensee stated that the hotwell and transfer piping will be available.
(3) Main condenser hotwells. The licensee referred to the turbine building discussion in (2), above. Also, on page 10 of the Integrated Plan, the licensee stated that the main condenser hotwells have been evaluated to be available after a seismic event.

The reviewer noted that since these components are or will be located in areas that are robust with respect to the extreme external hazards applicable to CNS, they are considered available for a BDBEE in accordance with NEI 12-06, Section 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 and, subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to systems and components for consequence mitigation if these requirements are implemented as described.

3.2.1.5 Monitoring Instrumentation and Controls

NEI 12-06, Section 3.2.1.10 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:
>
> - RPV Level
> - RPV Pressure
> - Containment Pressure
> - Suppression Pool Level
> - Suppression Pool Temperature
> - SFP Level

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

On pages 13, 16, and 20 of the Integrated Plan, the licensee listed the installed instrumentation credited in the coping evaluations for maintaining core cooling, containment, and SFP level during ELAP. The following instrumentation was listed by the licensee: RPV narrow range level instruments, RPV wide range level instruments, RPV fuel zone level instruments, RPV pressure, drywell pressure, torus (suppression pool) pressure, drywell temperature, torus temperature, torus level, ECST level, SFP level, SFP temperature (using measurement and test equipment).

Control room indicators are available for specific RPV narrow range level instruments, RPV pressure instruments, and drywell temperature instruments. Indicators for other instruments are available at local instrument racks or locally in the auxiliary shutdown room. A wide range containment/torus level instrument indicator is also available in the control room. SFP level and temperature instruments are available locally at the SFP, with additional SFP level instrumentation to be installed in accordance with NRC Order EA-12-051.

The instrumentation identified by the licensee encompasses all of the instrument types recommended in NEI 12-06, Section 3.2.1.10. On multiple pages of the Integrated Plan, the licensee stated that CNS will utilize the industry developed guidance from the Owners Groups, EPRI, and NEI task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06 and that these procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.

The licensee was asked to provide additional information clarifying the qualification and reliability of instrumentation required to support swapping RCIC or HPCI pump suctions from the ECSTs to the suppression pool, either manually or automatically. The licensee provided the requested information, stating which instrumentation is environmentally qualified, which instrumentation is classified as essential or non-essential, and described the reliability of the instrumentation with regard to conformance to single failure criteria. The information provided by the licensee is consistent with descriptions in CNS's USAR, Chapter IV, Section 7.5, and is acceptable.

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

3.2.1.6 Motive Power, Valve Controls and Motive Air System

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

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

And,

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

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

On page 11 of the Integrated Plan, the licensee stated that the primary method for reactor pressure control is by operation of the SRVs, and that operator control of reactor pressure using SRVs requires dc control power and pneumatic pressure to open the valves, with dc power being supplied by the station batteries and pneumatic pressure being supplied by the drywell pneumatic system. The licensee stated that for Phase 1, the dc power for the SRVs is supplied by the station batteries. The licensee further stated that at event initiation the normal pneumatic supply is lost due to loss of power to the drywell pneumatic compressor; however each SRV is provided an accumulator which contains enough pneumatic pressure to operate each valve for multiple open/close cycles. The licensee stated that the two SRVs associated with the low-low-set (LLS) relief logic system are sized to allow 14 cycles of each valve and that 27 individual SRV actuations in LLS and manual mode are required for a 4 hour SBO event. The licensee stated that for an ELAP event, after 4 hours the six SRVs associated with ADS will be used to control pressure and that the accumulators for the ADS valves are sized for five cycles and are credited for operation for approximately 40 hours after an SSE seismic event. The licensee stated that the combined capacity of the accumulators is sufficient to allow operation of the SRVs until Phase 2 when pneumatics will be restored with FLEX equipment.

During the audit, the licensee was asked to describe CNS's plans for an SRV pneumatic tie-in to an external connection point and to clarify whether piping from the connection point to the SRV accumulators will be designed to seismic Class I requirements. The licensee was also asked to discuss whether CNS's portable diesel-driven air compressors listed as part of the Phase 2 equipment will be the sole method to replenish the pneumatic supply to the SRVs. In response, the licensee stated that CNS's current plans are to pressurize the reactor building reliable air header from the portable air compressor and that the connection will be at the external connection point outside the control building. The licensee stated that the piping will be contained within the control building, which is a seismic Class I structure. The licensee stated that the portable diesel-driven air compressor will be the sole means for pressurizing the air header; the licensee noted, however, that in pressurizing the air header, the SRV accumulators will also be pressurized and provide some defense in depth for the diesel driven air compressor.

During the audit, the licensee was asked to clarify how many total SRVs are credited in CNS's ELAP strategy for RPV pressure control and how many of the SRVs have accumulators and associated check valves designed to seismic Class I requirements. The licensee was also asked to describe the actions necessary to restore pneumatic pressure to SRVs following a seismic event when non-seismic piping on the compressor side of the seismic Class I accumulator and check valve arrangement may no longer be intact. In response, the licensee stated that all eight SRVs are credited for RPV pressure control during an ELAP event, and all of the SRVs have accumulators and check valves designed to seismic Class I requirements. The licensee stated that a manual isolation valve will be closed in the control building, isolating the majority of the non-seismic piping. The licensee stated that the remaining piping from the isolation valve to the accumulator/check valve will be evaluated as part of the Expedited Seismic Evaluation Process required in response to NRC 50.54(f) request 2.1, Seismic Hazard Reevaluation and that, if necessary, modifications will be implemented to ensure that supply is available following a seismic event.

The licensee was asked to explain whether electrical power for motor operated valves (MOVs) will be needed to establish the RPV injection flow path in CNS's Phase 2 alternate core cooling strategy. In response, the licensee stated that the MOVs in the reactor building will be manually positioned early in the event to allow only needing to position the manual valves in the control building in the event this strategy is required. The licensee stated that the control building MOV is the RHR loop cross-tie valve and the other MOVs required for this strategy are the RHR outboard injection valves, which are dc powered and will be available. The licensee stated that actions to establish the appropriate valve lineup will be procedurally controlled.

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

On pages 11 and 12 of the Integrated Plan, the licensee provided a discussion of core cooling in Cold Shutdown and Refueling. The licensee stated that the overall strategy for core cooling in Cold Shutdown and Refueling (Modes 4 and 5, respectively) is generally similar to the strategy for Power Operation, Startup, and Hot Shutdown. 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 mitigation strategies in all modes of operation. During the audit, the licensee informed the NRC of CNS's plans to abide by this generic resolution. The NRC staff will evaluate the licensee's resulting program through the audit and inspection process.

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

3.2.1.8 Use of Portable Pumps

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

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

NEI 12-06 Section 11.2 states in part:

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

Phase 2 of the licensee's mitigation strategy includes use of on-site portable FLEX pumps to support and maintain RPV makeup and core cooling. On page 14 of the Integrated Plan, the licensee described CNS's primary and alternate Phase 2 core cooling strategies. In the primary strategy CNS will continue to inject makeup water to the RPV using the RCIC system, swapping suction from the ECSTs to the suppression pool when ECST level drops below a predefined minimum level. Water inventory in the ECSTs will be replenished, first by transferring water from the main condenser hotwells, and then by raw-water makeup from a yet to be installed on-site well. An alternate method for providing makeup to the ECSTs is with use of a diesel-engine-drive FLEX pump taking suction from the Missouri River and processing the raw water through a series of portable strainers, filters and demineralizers. The licensee stated that if the RCIC system is not available for RPV injection, a FLEX pump will be deployed at the Missouri River and can provide RPV injection through the normal RHRSW crosstie to the RHR injection flow path. The licensee stated that for RPV injection using a FLEX pump, the RPV pressure will be reduced to below the shutoff head of the FLEX pump, and the FLEX pump will supply water to the connection point through hose and strainer/filter/demineralizer to assure water quality.

During the audit, the licensee was asked to clarify several details of CNS's Phase 2 core cooling strategy: (1) to explain whether the FLEX pumps used in Phase 2 are diesel engine driven pumps or diesel generator driven pumps; (2) to discuss the performance criteria for these pumps; and (3) to explain how water will be removed or let-down from the reactor at the low RPV pressures that may be needed to implement CNS's alternate Phase 2 core cooling strategy. In response, the licensee stated that (1) the Phase 2 FLEX pumps are all diesel engine driven pumps; (2) an engineering evaluation will be performed to determine the performance requirements for all portable equipment; and (3) water will be removed from the RPV by low-pressure steaming.

After engineering evaluations to determine the performance requirements for FLEX pumps are completed, results should be reviewed to confirm that the specified equipment has capability to support the licensee's mitigation strategies under anticipated ELAP conditions. This is included as part of Confirmatory Item 3.2.1.4.A in Section 4.2.

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

3.2.2 Spent Fuel Pool Cooling Strategies

NEI 12-06, Table 3-1 and Appendix C summarize one acceptable approach for the SFP cooling strategies for BWRs. This approach uses a portable injection source to provide 1) makeup via hoses on the refuel deck/floor capable of exceeding the boil-off rate for the design basis heat load; 2) makeup via connection to SFP cooling piping or other alternate location capable of exceeding the boil-off rate for the design basis heat load; and alternatively 3) spray via portable monitor nozzles from the refueling deck/floor capable of providing a minimum of 200 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 reasonably be 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 3.2.1.6 describes SFP conditions.

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

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

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

On page 28 of the Integrated Plan, the licensee stated that there are no Phase 1 actions required to maintain SFP cooling and that fuel in the SFP is cooled by maintaining 21 feet of water over the top of the fuel. The licensee stated that the normal SFP water level at the event initiation provides for at least 21 feet, 6 inches of water inventory above the top of the stored spent fuel and that the most limiting time to fuel uncovery is 45.67 hours, resulting from a full-core offload, 5 days after shutdown, with the fuel pool gates installed and an initial SFP temperature of 150 degrees Fahrenheit. The licensee stated that for other modes, 200.56 hours (8.36 days) are available resulting from a partial core off-load of 160 bundles, 30 days after shutdown, the fuel pool gates installed and an initial SFP temperature of 150 degrees Fahrenheit.

On page 29 of the Integrated Plan, the licensee stated that Phase 2 equipment will be staged at approximately 8 to 12 hours into the event. The licensee stated that a minimum of 45.67 hours is available prior to uncovery of fuel and that the strategy in Phase 2 will be to supply makeup water to the SFP at rates greater that the SFP boil off rate using the methods described below:

(1) The first method uses the same FLEX pump used for RPV injection, pumping from the raw water source into the RHR or RHRSW systems through the external connection points installed for RPV injection. The RHR to fuel pool cooling (FPC) crosstie valve (FPC-83) is opened to allow injection into the FPC system.
(2) The second method uses the same FLEX pump as above, but will tie into a FPC chemical decontamination connection at the external connection point.
(3) The third method is the method CNS uses to satisfy the 10 CFR 50.54(hh)(2) commitment and uses a portable fire pump through hoses and nozzles to spray water into the SFP.

The licensee stated that the FLEX pump is rated at 925 gpm and the portable fire pump is rated at 4000 gpm. The licensee stated that the maximum boil off rate from the SFP is 70 gpm. On page 41 of the Integrated Plan, the licensee identified two spray monitor spray nozzles for SFP spray and the associated hoses sized for 250 gpm, which is consistent with NEI 12-06, Table C-3.

On page 32 of the Integrated Plan, the licensee stated that CNS's Phase 3 strategy to maintain

SFP cooling is the same as its Phase 2 strategy.

On page 35 of the Integrated Plan, the licensee provided additional discussion related to CNS's SFP cooling strategy. The licensee stated that NEI 12-06 guidance describes a baseline capability for the SFP cooling strategy to provide a vent pathway for steam and condensate from the SFP. The licensee stated that CNS's FLEX strategy to cope with pressurization of the refueling floor and prevent buildup of steam and condensation is to open the reactor building roof hatch and that in order to establish flow of air through the SFP area, it is also necessary to open the reactor building heating and ventilation room doors on the 3rd floor or the railroad doors on the ground level. On page 36 of the Integrated Plan, the licensee stated that CNS will evaluate a potential modification to the reactor building roof hatch to allow remote operation without having to access the refueling floor.

On page 20 of the Integrated Plan, the licensee listed instrumentation credited for implementation of CNS's ELAP mitigation strategies. The list of instrumentation includes SFP level and temperature indication available locally at the SFP, and SFP level indication to be installed in accordance with NRC Order EA 12-051, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation."

During the audit, the licensee was asked to clarify the time limit to establish ventilation to the SFP area and whether operation of the reactor building roof hatch is affected by heat and humidity from the SFP. The licensee was also asked whether the hatch can be accessed and opened prior to the local environment becoming too hot for operator action. In response, the licensee stated that the time limit has not yet been established because the intention is to operate the hatch from outside the reactor building. The licensee stated that the reactor building roof hatch is operated manually and will not be affected by heat and humidity from the SFP. The licensee stated that the current plan is to operate the roof hatch from outside the reactor building using a cable, pulley, and lever arrangement based on similar devices used at some foreign plants and that the modification has not yet been developed. Verification of the ability to provide adequate SFP area ventilation is identified as Confirmatory Item 3.2.2.1.A in Section 4.2.

During the audit, the licensee was asked to clarify whether CNS has considered re-establishing SFP cooling during Phase 3. The licensee responded that CNS has not considered restoring cooling to the SFP as part of the mitigation strategy at this time. The licensee stated that in the interest of simplifying the strategy, restoration of shutdown cooling was not pursued because the proposed cooling strategy of allowing SFP boil off and providing SFP makeup works for all events, and to restore SFP cooling would require use of additional power and cooling water sources.

CNS's mitigation strategies to maintain SFP cooling, as described in the Integrated Plan, conform to the guidance in NEI 12-06 by providing SFP makeup sufficient to exceed the boil-off rate for the SFP and keep the fuel covered, by providing a vent path for steam and condensate from the SFP area, by providing a means to supply SFP makeup without accessing the refueling floor, and by providing SFP level instrumentation in accordance with NRC Order EA 12-051.

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

3.2.3 Containment Functions Strategies

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

On page 22 of the Integrated Plan, the licensee described CNS's Phase 1 strategy to maintain containment during an ELAP event. The licensee stated that during Phase 1, containment integrity is maintained by normal design features of the containment, such as the containment isolation valves and the RHCV. The licensee stated that in accordance with NEI 12-06, the containment is assumed to be isolated following the event. As the suppression pool (torus) heats up and the water begins to boil, the containment will begin to heat up and pressurize. Additionally, the suppression pool level rises due to the transfer of inventory from the ECSTs to the torus (via RCIC and SRVs). The licensee stated that according to BWROG analysis (NEDC-33771P) containment parameters (temperature and pressure) can be controlled within design limits by utilization of the RHCV and venting the containment. The licensee stated that in this case, the RHCV is used as implemented per EA-12-050, Reliable Hardened Containment Vents and Interim Staff Guidance JLD-ISG-2012-02 with control from the MCR. The licensee stated that CNS has performed a "probabilistic risk assessment level" MAAP analysis to validate the strategy in the BWROG analysis and will perform additional calculations to establish the exact timing and duration of containment venting. (Issues related to MAAP analysis are discussed earlier in Section 3.2.1.1 of this report.) The licensee stated that CNS's containment design pressure is 62 psig and that containment pressure limits are not expected to be reached during the ELAP event as indicated by site-specific MAAP analysis, because the RHCV will be opened prior to exceeding any containment pressure limits. The licensee stated that Phase 1 (using permanently installed plant equipment/features) of containment integrity will be maintained throughout the duration of the ELAP event and that no non-permanently installed equipment will be required to maintain containment integrity. The licensee stated that there is no defined end time for the Phase 1 coping period for maintaining containment integrity and an alternative strategy for containment during Phase 1 is not provided, because containment integrity is maintained by the plant's design features.

In CNS's August 2013 six-month status report, the licensee stated that the FLEX strategies in the overall Integrated Plan currently rely on the conceptual design of the RHCV that was developed in response to NRC Order EA 12-050. The licensee stated that NRC Order EA-13-109 rescinds the requirements of Order EA 12-050 and that compliance with the requirements of Order EA 12-050 is no longer required. The licensee stated that because of the new order, the design of CNS's hardened containment vent is being reevaluated and that any design changes resulting from the revised hardened vent order will be reflected in future six-month status report updates.

On page 23 of the Integrated Plan, the licensee stated that CNS will utilize the industry guidance from the Owners Groups, EPRI, and NEI Task team to develop site-specific procedures or guidelines to address the criteria in NEI 12-06 and that these procedures and/or guidelines will support the existing symptom-based command and control strategies in the current EOPs

During the audit, the licensee was asked to explain how an operator will determine that conditions are appropriate to begin suppression chamber venting and to explain whether, and on what condition, containment venting will be terminated at any time after it has been initiated and before shutdown cooling and suppression pool cooling are reestablished using Phase 3 equipment. In response, the licensee stated that at this time CNS envisions that venting will commence based on containment parameters and that site-specific MAAP evaluations will be used to determine the specific values to initiate venting. The licensee stated that at this time the exact station strategy for vent operation has not been determined, but that CNS envisions that a pressure band will be maintained with containment parameters determining the upper end of the band and RCIC NPSH considerations determining the lower end. The licensee stated that one possibility being considered is a pressure control valve that could be isolated if conditions degrade. The licensee stated the existing wetwell vent was modeled based on maintaining containment parameters within limits. The licensee stated that it intends to install a 12-inch vent to accommodate a power uprate. However, evaluations were not available to confirm that the 12-inch vent will pass the required flow to maintain wetwell pressures required to support RCIC operation following the power uprate. When CNS's containment venting strategy is finalized and related evaluations are completed, the strategy should be reviewed to confirm that it is acceptable both for containment protection and to support proposed RCIC and Phase 2 FLEX pump operation. This is identified as Confirmatory Item 3.2.3.A in Section 4.2.

The reference to maintaining the wetwell lower pressure band operating point based on RCIC operation indicates the licensee may be proposing venting in accordance with the override allowed by Revision 3 of the BWROG Emergency Procedure Guidelines (EPG)/Severe Accident Guidelines (SAG) as part of its mitigation strategy. In an endorsement letter dated January 9, 2014 (ADAMS Accession No. ML13358A206), the NRC staff concluded that the changes to the BWR venting strategy, as described in the November 21, 2013, position paper submitted by NEI on behalf of the BWROG (ADAMS Accession No. ML13352A057), are acceptable, subject to each licensee addressing the plant-specific implementation of the guidance. During the audit, the licensee indicated its intent to implement its containment venting strategy consistent with Revision 3 of the BWROG Emergency Procedure Guideline (EPG)/Severe Accident Guideline (SAG). With regard to maintaining containment, the implementation of BWROG EPG/SAG, Revision 3, including any associated plant-specific evaluations, must be completed in accordance with the provisions of NRC letter dated January 9, 2014. This is identified as Confirmatory Item 3.2.3.B in Section 4.2.

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

CNS's Integrated Plan includes limited discussion of procedures, guidance or strategies to ensure adequate cooling for equipment credited in the ELAP mitigation strategies.

On page 10 of the Integrated Plan, the licensee described considerations related to the RCIC system, stating that RCIC trip signals and isolation signals that could possibly prevent RCIC operation when needed during the ELAP will be overridden in accordance with EOPs. On page 11 of the Integrated Plan, the licensee provided additional discussion related to RCIC equipment temperature. The licensee stated that based on experience derived from Fukushima, the RCIC system can run at a much higher lubricating oil temperature and suction source temperature than originally assumed for the operation of RCIC. The licensee stated that the BWROG is developing a RCIC study which will allow operation of RCIC at a lubricating oil temperature of greater than 230 degrees Fahrenheit and that CNS will take the actions necessary to allow RCIC operation at elevated temperatures. Regarding NPSH for RCIC, the licensee stated that CNS will perform a site-specific calculation to determine the available NPSH at elevated temperatures and that if the analysis determines that adequate NPSH is not available, CNS will revise its core cooling strategy and use the water in the suppression pool first, preserving the ECST water into Phase 2 when makeup sources are available with FLEX equipment. During the audit, the licensee was asked to provide a status update for the RCIC NPSH evaluation. In response, the licensee stated that this analysis has not yet been completed and that it is intended to be a part of the MAAP analysis (described earlier in Section 3.2.1.1 of this Technical Evaluation Report).

On page 38 of the Integrated Plan, the licensee provided a discussion related to both RHR room cooling and equipment cooling. The licensee stated that as part of Phase 3 strategies, an RHR pump will be placed into service in order to perform suppression pool cooling and shutdown cooling. This results in heat addition to the RHR pump room due to heat generated by the RHR pump motor as well as heat dissipated from the associated piping and RHR heat exchanger. The licensee stated that for long term RHR pump operation, the RHR pump room must be cooled to maintain room temperatures within acceptable ranges (limited by maximum allowable RHR pump motor requirements) and that this can be accomplished after the RRC 4160 VAC FLEX DG is connected to the 4160 VAC critical bus. The licensee stated that at this time the normal reactor building heating and ventilation can be restored. The licensee stated that this will also restore power to the RHR room cooler; however no cooling water is available due to the loss of service water (SW) cooling to the reactor equipment cooling (REC) system. The licensee stated that CNS will modify the SW supply to REC to allow cooling water to be supplied from the FLEX pump via the external connection point. The licensee stated that an alternate means of cooling the RHR rooms if the room coolers are not available will be to use portable exhaust fans and hose trunks to exhaust RHR room air to outside the reactor building.

On pages 40, 41 and 42 of the Integrated Plan, the licensee provided lists of portable equipment that CNS expects to use in Phase 2 and Phase 3 of the mitigation strategies. The list for Phase 2 includes diesel-driven pumps, diesel-driven air compressors, several diesel generators, and two towing vehicles. In addition, the licensee stated that CNS expects to obtain a 4160 VAC diesel generator and large FLEX pump from the RRC to support the Phase 3 mitigation strategies. Most of this equipment would require some form of cooling. However, except for the large equipment obtained from the RRC, the listed equipment is typical of commercially available units and would not be expected to require an external cooling system, nor would it require AC power or normal access to the UHS. For the larger equipment from the RRC a need for external cooling, if required, is expected to be identified as CNS's mitigation strategies are further developed.

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

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

rooms may be estimated on the basis of rapidly turning over the room's air volume.

Temperatures in the HPCI pump room and/or steam tunnel for a BWR may reach levels which isolate HPCI or RCIC steam lines. Supplemental air flow or the capability to override the isolation feature may be necessary at some plants. The procedures/guidance should identify the corrective action required, if necessary.

Actuation setpoints for fire protection systems are typically at 165-180°F. It is expected that temperature rises due to loss of ventilation/cooling during an ELAP/LUHS will not be sufficiently high to initiate actuation of fire protection systems. If lower fire protection system setpoints are used or temperatures are expected to exceed these temperatures during an ELAP/LUHS, procedures/guidance should identify actions to avoid such inadvertent actuations or the plant should ensure that actuation does not impact long term operation of the equipment.

On pages 33, 35, and 38 of its Integrated Plan, the licensee provided a discussion related to MCR environmental conditions during Phases 1, 2, and 3, respectively, of CNS's ELAP strategy. The licensee stated that MCR habitability must be maintained for the duration of the ELAP. The licensee stated that during the ELAP, some MCR vital electronics, instrumentation and emergency lighting remain energized from emergency dc power sources. The licensee stated that the current CNS calculation for MCR heat up documents the loss of ventilation analysis for the MCR and determined that the MCR temperature quickly rose to about 92 degrees Fahrenheit around 30 minutes into the transient and then slows to a gradual increase toward equilibrium thereafter. The licensee stated that maximum MCR temperature at the end of 4 hours was determined to be 100.3 degrees Fahrenheit and that the heatup rate between hours 3 and 4 is 1.05 degrees Fahrenheit per hour. The licensee stated that extrapolating this rate out to 8 hours results in a maximum temperature after 8 hours of 104.5 degrees Fahrenheit. The licensee stated that MCR temperature remains less than 110 degrees Fahrenheit, which is the assumed maximum temperature for efficient human performance as described in NUMARC 87-00, Revision 1, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors." The licensee stated that Phase 2 MCR cooling will consist of the use of portable fans powered from portable diesel generators to draw in outside air and provide circulation within the room and improve the heat removal to maintain lower temperatures. The licensee stated that CNS will perform a calculation to determine the appropriate size fan to maintain acceptable temperature. The licensee stated that the primary and alternate strategies for cooling the MCR are the same in Phase 3 as for Phase 2; however, the power for the MCR supply fans, exhaust fans and air conditioning (A/C) unit will be from the 4160 VAC critical bus when the bus is re-energized by the RRC FLEX 4160 VAC DG. Verification of adequacy of fan sizing analysis is identified as Confirmatory Item 3.2.4.2.A in Section 4.2.

During the audit, the licensee was asked to provide additional discussion of the calculations used as a basis for CNS's estimate of maximum MCR temperature during an ELAP event. In response, the licensee stated that CNS's calculation NEDC 89-1948, Revision 0C5, "NED Review of SBO Control Room Heatup," and an additional CNS calculation, NEDC 93-054, were used to determine the MCR temperatures. NEDC 89-1948, Revision 0C5, states that it provides a MCR temperature profile for a 4-hour SBO event, and the licensee stated that NEDC 93-054 determined that MCR temperatures will not exceed 110 degrees Fahrenheit within 24 hours upon a loss of MCR air conditioning. The licensee stated that the two calculations are intended to illustrate that the MCR temperature rise after a few hours becomes relatively linear and starts to level off, giving ample time to establish portable ventilation. The licensee stated that portable ventilation is intended to be supplied to the MCR by a blower and portable diesel generator and that the sizing of this portable ventilation will be determined by a planned analysis. The licensee stated that additional measures such as short stay times, cooling vests, and bottled water will be evaluated for inclusion in CNS's procedures.

On pages 33 and 35 of the Integrated Plan, the licensee provided a discussion related to RCIC room environmental conditions during Phases 1 and 2, respectively, of CNS's ELAP strategy. The licensee stated that the RCIC room will have a continuous heat load under ELAP conditions in Phases 1 and 2 of the BDBEE because RCIC is utilized throughout Phases 1 and 2 of the event as the primary source of core cooling. The licensee stated that CNS's current calculation for RCIC room heat up determined that the RCIC room temperature reached a maximum of 145.1 degrees Fahrenheit at 12 hours and that in accordance with CNS's USAR, Chapter IV, Section 7.5, the RCIC System is designed for continuous operation at a temperature of 148 degrees Fahrenheit and 100 percent relative humidity. The licensee stated that Phase 2 RCIC room cooling will consist of the use of portable fans powered from portable diesel generators to draw in outside air and provide circulation within the room and improve the heat removal to maintain lower temperatures. The licensee stated that CNS will perform a calculation to determine the appropriate size fan to maintain temperature. This is included as part of Confirmatory Item 3.2.4.2.A in Section 4.2.

On page 35 of the Integrated Plan, the licensee provided a discussion related to battery room ventilation during an ELAP event. The licensee stated that during battery charging operations in Phase 2, ventilation is required in the main battery rooms because of hydrogen generation. The licensee stated that portable ventilation fans are deployed with the deployment of the SAMG DG. The licensee also stated that the fans that will be deployed for room cooling will be stored in the FLEX storage building and deployed via identified and evaluated haul routes to the power block and their staging area.

Additional information included in CNS's Integrated Plan that is related to ventilation and room environments during an ELAP event has been provided earlier in this report. Information related to RHR room accessibility is in Section 3.2.4.1; and information related to ventilation in the SFP area is in Section 3.2.2.

During the audit, the licensee was asked to discuss the impact of the RCIC room elevated temperature, resulting from the loss of ventilation, on equipment credited for operation of the RCIC pump. In response, the licensee stated that currently the RCIC vacuum and condensate pump stay available and that a RCIC room heat up calculation is planned to determine the limiting conditions. The licensee stated that temporary ventilation will be supplied to the RCIC with portable fans.

During the audit, it was noted that portable fans are not included in CNS's list of portable Phase 2 equipment on pages 40 and 41 of the Integrated Plan, but that the licensee's discussion of battery room ventilation states that portable ventilation fans are deployed with the SAMG diesel generators. The licensee was asked to provide clarification of how many portable fans will be deployed and whether other key Phase 2 equipment is not included in the Integrated Plan's Phase 2 portable equipment list. The licensee also was asked to provide additional discussion of battery room ventilation during an ELAP event.

In response, the licensee stated that three fans are included with the SAMG equipment and that additional fans will be used to cool the room that the battery chargers are in. The licensee stated that the fans are the only key equipment omitted from the Phase 2 equipment list. The licensee stated that of the three fans included with the SAMG equipment, one is placed in each of two battery room doors blowing inward from the corridor and the third is placed in the door at the end of the same corridor blowing out into the turbine building. The licensee stated that this fan positioning provides ventilation for heat removal, and the discharge/charge/float cycle of the battery should maintain the battery sufficiently warm. The licensee stated that the same fan setup described above provides for hydrogen gas removal and that this exhaust path is the same path used for the current SBO strategy. The licensee stated that the plant's current design has a normal ventilation flow rate of 1100 cubic feet per minute (cfm) with the battery room exhaust fans running and 360 cfm with the essential ventilation running and the battery room exhaust fans secured. The licensee stated that the portable fans included with the SAMG diesel generator are rated at 2800 cfm minimum and 4000 cfm maximum (low and high speeds, respectively) and that this is more than double the plant's design ventilation flow rate. The licensee stated that additionally, the procedure that implements SAMG diesel generator installation and operation also installs portable explosive gas monitoring instrumentation.

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 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.

The licensee's Integrated Plan contains no specific mention of heat tracing.

The licensee's core cooling mitigation strategy uses water stored in the emergency condensate storage tanks as the initial water source for RPV coolant makeup. The ECSTs are located in the basement of CNS's control building and would not be exposed to cold weather conditions requiring heat tracing. The licensee's proposed initial make-up water source to the ECST's is water from the main condenser hotwells which are located in the turbine building and are not exposed to cold conditions. After water from these sources is exhausted, CNS proposes to provide make up water to the ECSTs from a yet-to-be-installed well that will be designed to withstand external hazard conditions applicable at the CNS site; those hazard conditions include conditions of extreme cold, ice and snow. If heat tracing is needed to harden CNS's makeup well and associated piping against a hazard of extreme cold, then heat tracing is expected to be included in the design of the well and in the procedures for its use.

During the audit, the licensee was asked to describe CNS's considerations related to NEI 12-06, Section 3.2.2, Guideline (12). In response, the licensee stated that heat tracing associated with the elevated release point (ERP) and components associated with the sump for the ERP will be necessary to implement the strategies for an ELAP. The licensee stated that because CNS is using the wetwell vent, this item will be addressed in CNS's response to NRC Order EA-13-109.

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

3.2.4.4 Accessibility – Lighting and Communications

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

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

CNS's Integrated Plan does not include any discussion of the development of guidance and strategies to include provisions for portable lighting and communications devices to facilitate personnel access to areas necessary for instrumentation monitoring or equipment operation.

During the audit, the licensee was asked to explain how CNS is addressing the recommendations in NEI 12-06, Section 3.2.2, Guideline (8), related to portable lighting. The licensee stated that CNS's current SBO procedure has appropriate steps and necessary equipment including the use of portable lighting (lanterns). The licensee stated that part of the standard gear/equipment for operators with duties in the plant includes flashlights, and that lighting for the MCR will be maintained throughout the event by the dc powered control room emergency lighting system for the first 8 hours and portable lighting (either lanterns or temporary lighting powered by a portable generator) thereafter.

The NRC staff has reviewed the licensee communications assessment (ADAMS Accession Nos. ML12312A131 and ML13057A028) in response to the March 12, 2012, 50.54(f) request for information letter for CNS and, as documented in the staff analysis (ADAMS Accession No. ML13143A345) has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by the licensee will conform to the guidance of NEI 12-06 Section 3.2.2, Guideline (8) regarding communications capabilities during an ELAP.

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 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) provides that:

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

The licensee's Integrated Plan does not include any discussion of the development of procedures or guidance considering the effects of ac power loss on the need to gain entry to the protected area or internal locked areas.

During the audit, the licensee was asked to describe CNS's considerations related to NEI 12-06, Section 3.2.2, Guideline (9). In response, the licensee stated that CNS's current SBO procedure includes actions and equipment necessary for operators to access all areas of the plant. The licensee stated that CNS's current security procedure for compensatory measures includes actions to allow ingress and egress of personnel in the event of loss of all ac power, and CNS's current security procedure for vehicle entry and exit has actions to manually operate the vehicle barrier system in the event of a 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 protected and internal locked area access if these requirements are implemented as described.

3.2.4.6 Personnel Habitability – Elevated Temperature

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

> *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.

The licensee's considerations related to accessibility and habitability of the MCR and the RCIC room are discussed in Section 3.2.4.2 of this Technical Evaluation Report; and considerations related to accessibility of the RHR room are discussed in Section 3.2.4.1. Ventilation for the SFP area is discussed in Section 3.2.3.

The licensee did not provide any additional descriptions of considerations related to accessibility conditions or requirements in other areas where operators may be required to perform local manual actions.

During the audit, the licensee was asked to identify whether any other plant areas, in addition to the MRC, the RCIC room, the RHR pump room, and the SFP area may require special considerations of elevated temperatures and/or humidity with regard to operators performing actions to implement CNS's ELAP strategies. In response, the licensee stated that no other areas have been identified that require special considerations. As earlier noted in Section 3.2.4.2 of this report, the licensee stated that protective measures related to habitability, such as short stay times and cooling vests, will be evaluated for inclusion in CNS's procedures.

During the audit, the licensee stated that new calculations are planned for both the RCIC room heat up and the reactor building, as a whole. The licensee stated that one of these calculations will evaluate the available natural circulation ventilation with the reactor building roof hatch and railroad airlock door open and the resulting effects on heat up.

Information provided in the licensee's Integrated Plan is generally consistent with guidance in NEI 12-06, Section 3.2.2, Guideline (11). However, analyses addressing heat up in areas that might have personnel habitability issues are still in progress and procedures providing more detailed instructions for some mitigation actions are still under development. When analyses are completed, they should be reviewed to confirm acceptability of the results. 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 – elevated temperature if these requirements are implemented as described.

3.2.4.7 Water Sources

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

> *Plant procedures/guidance should ensure that a flow path is promptly established for makeup flow to the steam generator/nuclear boiler and identify backup water sources in order of intended use. Additionally, plant procedures/guidance should specify clear criteria for transferring to the next preferred source of water.*
>
> Under certain beyond-design-basis conditions, the integrity of some water

sources may be challenged. Coping with an ELAP/LUHS may require water supplies for multiple days. Guidance should address alternate water sources and water delivery systems to support the extended coping duration. Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles are assumed to be available in an ELAP/LUHS at their nominal capacities. Water in robust UHS piping may also be available for use but would need to be evaluated to ensure adequate NPSH can be demonstrated and, for example, that the water does not gravity drain back to the UHS. Alternate water delivery systems can be considered available on a case-by-case basis. In general, all CSTs [condensate storage tanks] 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 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.

In its Integrated Plan the licensee described the following water sources for implementation of its core cooling and SFP cooling strategies during an ELAP event.

On page 6 of the Integrated Plan, the licensee described a planned modification to provide a new supply for makeup water. The licensee stated that the primary raw water source will be a well installed at the site and this new well will be sized for the makeup requirements 24 hours after shutdown and will be hardened against the appropriate external hazards. The licensee stated that the backup raw water source will be Missouri River. The licensee stated that portable strainers, filters, and demineralizers will be procured and used to assure the river water is acceptable to use in the reactor as an emergency makeup source.

On page 10 of the Integrated Plan, the licensee stated that CNS's primary strategy for core cooling is to supply high quality water with the RCIC system taking suction from the ECSTs. The licensee stated that two 50,000 gallon ECSTs are installed for the exclusive use of the RCIC and HPCI systems and that an additional 80,625 gallons is available in the main condenser hotwells which have been evaluated to be available after a seismic event. The licensee stated that the combined capacity of the ECSTs, hotwells and suppression pool is sufficient to support RPV makeup for at least 24 hours without external makeup sources.

On page 14 of the Integrated Plan, the licensee stated that in Phase 2 of CNS's ELAP strategy, when ECST grade water becomes depleted, the ECSTs will be refilled from a yet-to-be-installed on-site well and that well water will be pumped to the ECST connection point through hose. The licensee stated that, alternatively, makeup for the ECST will be provided from the Missouri River through a series of portable strainers/filters/demineralizers to ensure sufficient water quality. The licensee stated that an alternate strategy, providing defense in depth for RCIC, is a FLEX pump deployed at the river that can provide RPV injection through the normal RHRSW crosstie to the RHR injection flow path.

On page 48 of the Integrated Plan, the licensee provided a "Simplified FLEX Connection

Diagram" showing water from both the in-ground well and the river being pumped through a water treatment skid. The diagram shows that water pumped from the river is processed through an additional strainer before it gets to the water treatment skid. After being processed through the water treatment skid, the water enters a portable water storage tank before being pumped into either the ECSTs (if RCIC is still available) or into the RPV (if RCIC is not available).

During the audit, the licensee was asked to clarify whether the water treatment skid and storage tanks are associated with Phase 2 activities and to describe the protection for this equipment during all extreme external hazards. In response, the licensee stated that CNS has not yet finalized the treatment requirements for the well water and that, if treatment is required, it will be protected similar to the other portable equipment.

During the audit, the licensee was asked to clarify whether the ECSTs are robust with respect to high winds and associated missiles. In response, the licensee stated that the ECSTs are located in the basement of the control building and that the control building is a Seismic Class I structure and is designed to withstand the plant's design basis winds, tornados and missiles.

Discussions in CNS's Integrated Plan show that the licensee is appropriately including considerations related to promptly establishing makeup flow to the nuclear boiler and is identifying backup water sources in order of intended use. However, the licensee has not finalized design and operational or protection requirements for the new on-site well or the water treatment equipment used for Phase 2 water sources. When the design, including operational and protection requirements, are finalized, they should be reviewed to ensure that these water sources and the associated pumping and delivery system adequately support CNS's proposed ELAP strategies. This is identified as Confirmatory Item 3.2.4.7.A in Section 4.2.

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

3.2.4.8 Electrical Power Sources/Isolations and Interactions

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

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

The licensee's Integrated Plan includes limited information describing electrical connections for portable generators, and it includes no discussion addressing considerations related to electrical isolation requirements or potential adverse electrical interactions of the portable generators with installed electrical buses or other installed plant equipment.

On page 18 of the Integrated Plan, the licensee stated that connection points for the FLEX 480 VAC generator will be inside the existing Class I critical switchgear room and that pre-staged cables will be used to connect the generator to the connections

On page 19 of the Integrated Plan, the licensee stated that for Phase 3, the reactor core cooling strategy is to place one loop of RHR into the shutdown cooling mode and that this will be accomplished by powering up a Division I or II RHR pump from the Class 1E emergency F or G 4160 VAC bus utilizing a 4160 VAC RRC FLEX portable diesel generator. The licensee stated that the 4160 VAC RRC FLEX diesel generator will be capable of carrying approximately 3250 kW load which is sufficient to carry all of the loads on 4160 VAC bus F or G necessary to support the Phase 3 FLEX strategies which includes an RHR pump and its support equipment (i.e., motor operated valves, jockey pump, room coolers, etc.).

The Integrated Plan also describes an alternate means of providing power to the RHR pumps for SDC operations. The plan is to run cable from the 4160 VAC RRC DG directly to the component by connecting either at the switchgear end of the component's power cable or locally at the pump end of the power cable.

During the audit, the licensee was asked to describe how electrical isolation will be maintained such that Class 1E equipment is protected from faults in portable FLEX equipment and multiple sources do not attempt to power electrical buses. In the response, the licensee stated that the portable FLEX equipment will be procured commercial grade and come with standard protection features, such as under voltage, over current, reverse power, and over speed. The licensee stated that procedures used to install and operate the equipment will control the plant lineup such that multiple sources do not power the same electrical bus and that these procedures currently are under development. When the procedure that will be used to install, operate and control the FLEX electrical equipment is developed, it should be reviewed to confirm that issues related to electrical interaction and isolation are adequately addressed. This is identified as Confirmatory Item 3.2.4.8.A in Section 4.2.

During the audit, the licensee was asked to provide a summary of the sizing calculations for the FLEX DGs to show that they can supply the loads assumed in Phase 2 and Phase 3 of CNS's mitigation strategy. In response, the licensee stated that sizing calculations have not been completed and that CNS has developed an engineering work order to determine the sizing of all the portable equipment. When the licensee completes engineering work to determine the sizing of portable FLEX DGs, results should be reviewed to confirm that the specified equipment adequately supports CNS's ELAP mitigation strategy. This is identified as Confirmatory Item 3.2.4.8.B in Section 4.2.

During the audit, the licensee was asked to provide single-line diagrams showing the proposed connections of Phase 2 and Phase 3 electrical equipment and showing protection information (e.g., breaker, relay, or fuse) and rating for the equipment used. The licensee stated that the requested information has not yet been developed, but that it will be provided when it becomes available. This is identified as Confirmatory Item 3.2.4.8.C in Section 4.2.

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

3.2.4.9 Portable Equipment Fuel

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

> The fuel necessary to operate the FLEX equipment needs to be assessed in the

> plant specific analysis to ensure sufficient quantities are available as well as to address delivery capabilities.

NEI 12-06, Section 3.2.1.3, consideration (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 41 of the Integrated Plan, the licensee described the use of two 100 gallon capacity refueling trailers; and on page 42, the licensee described the use of two diesel generator fuel oil transfer pumps and hoses.

However, the licensee failed to include any discussion of its source(s) of fuel for FLEX equipment used in Phase 2 and Phase 3 of its mitigation strategies.

During the audit, the licensee was asked to provide additional information describing how CNS has addressed NEI 12-06, Section 3.2.2, Guideline (13), and Section 3.2.1.3, consideration (5).

The licensee stated that CNS has two bunkered, Seismic Class I fuel oil storage tanks with two additional day tanks located in Seismic Class I structures and that all tanks are protected from winds, floods, tornados, and missiles. The licensee stated that these tanks will be the initial source of diesel fuel and that all together, these tanks contain 52,500 gallons of available fuel oil. The licensee stated that CNS has not finalized the portable equipment, so the amount and frequency of refueling requirements for each deployed portable pump or generator has not been determined. The licensee stated that of the current equipment, the SAMG DG is the most critical because it supplies the battery chargers. The licensee stated that the SAMG DG has enough on-board fuel storage to run continuously for 24 hours without refueling. The licensee stated that each FLEX storage building will house a refueling trailer equipped with a 100 gallon tank and two transfer pumps and that each refueling trailer is capable of maintaining the portable equipment refueled. The licensee stated that one refueling trailer and the procedures to refuel the SAMG DG are currently available. With regard to critical time needed to access the seven-day tanks or to resupply the seven-day tanks, the licensee stated that the time will be determined once the portable equipment is finalized.

The licensee stated that the quality of the fuel oil stored on site is controlled by site procedures and that any additional fuel brought onto the site for use will be stored in portable containers used strictly for fuel storage. The licensee stated that CNS currently intends to use fuel bladders provided from the RRC and that fuel stored in the portable equipment will be maintained acceptable by the periodic testing (running of the equipment) that will be required by EPRI's periodic maintenance guides. The licensee stated that fuel oil available from on-site storage is estimated to last for over 60 days and that this estimate is based on the current list of portable equipment, but could change if the equipment changes. Based on the licensee's current fuel consumption assessment, the reviewer noted that sufficient fuel is available on-site with margin and the licensee has the means to transport and refuel portable FLEX equipment until off-site resources arrive.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to portable 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 5 of the Integrated Plan, the licensee identified an SOE activity related to dc load stripping. The licensee stated that at 1 hour after start of the ELOP event, action will be taken to secure the main turbine emergency lube oil pump (MTELOP) and that this action is required to support 250 VDC Division II Battery duration. The licensee stated that the actions to secure the MTELOP consist of verifying that the main turbine has stopped rotating locally and then placing the control switch for the MTELOP in pull-to-lock in the MCR.

The licensee listed CNS's Division I and Division II batteries and their average loads as follows:
(1) 125 VDC Division I – 131 Amperes
(2) 125 VDC Division II – 120 Amperes
(3) 250 VDC Division I – 166 Amperes
(4) 250 VDC Division II – 144 Amperes

The licensee stated that in accordance with CNS's Technical Specification Surveillance Requirement 3.8.4.8, each battery must have at least 90% of capacity at all times and that based on the average loads, and assuming an end-of-discharge value of 1.85 volts-per-cell, the batteries are estimated to be capable of supplying all required loads for at least the following time periods:
(1) 125 VDC Division I – 12 hours
(2) 125 VDC Division II – 13 hours
(3) 250 VDC Division I – 9 hours
(4) 250 VDC Division II – 10 hours

On page 14 of the Integrated Plan, the licensee provided a discussion related to recharging batteries. The licensee stated that the 125 VDC Division I batteries are available for approximately 9 hours without recharging and that connecting the SAMG DG to motor control center (MCC) LX or TX provides the ability to power battery chargers 125 VDC 'C' and 250 VDC 'C' which charge the 125 VDC Division I battery, the 250 VDC Division 1 battery and supply dc loads. The licensee stated that the SAMG 480 VAC, 175 kW DG will be connected at approximately 9 hours and is sized to power two 125/250 VDC battery chargers and the associated dc buses. The licensee stated that permanently installed cables will be installed from a point near the MCC to the exterior of the control building and that the deployment area of the SAMG 480 VAC DG powering the 480 V MCC will be located near the turbine building. The licensee stated that cables from the generators are run to a connection point on the exterior of the control building.

As described in the Integrated Plan, the licensee proposed to perform a limited dc load shed, with only the MTELOP specifically identified to be secured.

The NRC staff reviewed the licensee's Integrated Plan and determined that the Generic Concern related to battery duty cycles beyond 8 hours is applicable to the plant. This Generic Concern has been resolved generically through the NRC endorsement of NEI's position paper entitled "Battery Life Issue" (ADAMS Accession No. ML13241A186 (position paper) and ML13241A188 (NRC endorsement letter)).

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

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

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

During the audit, the licensee informed the NRC of CNS's plan to abide by this generic resolution.

During the audit, the licensee was asked to provide the complete dc load profile with the required loads for the mitigation strategies to maintain core cooling, containment, and SFP cooling. The licensee also was asked to provide the basis for the minimum dc bus voltage that is required to ensure proper operation of all required electrical equipment. In response, the licensee stated that the dc load profile for the ELAP has not been determined and that the information in CNS's Integrated Plan was based on continuing the current SBO load throughout the ELAP event. The licensee stated that a new calculation will be performed for the ELAP. The licensee stated that the minimum dc bus voltage will be determined in conjunction with the dc load profile associated with the ELAP and that battery capability will be determined in accordance with the NEI battery life position paper described above. When the dc load profile for the ELAP has been determined, the minimum dc bus voltage and the associated load profile should be reviewed to confirm that results are acceptable for CNS's proposed ELAP mitigation strategy. This is identified as Confirmatory Item 3.2.4.10.A in Section 4.2.

During the audit, the licensee was asked to discuss which components change state when loads are shed and to describe the actions needed to mitigate resultant hazards (for example, allowing hydrogen release from the main generator or disabling credited equipment interlocks). In response, the licensee stated that currently the MTELOP is the only component that is load shed. The licensee stated that the dc powered main generator air side seal oil backup pump continues to run. The licensee stated that if the air side seal oil backup pump is required to be secured, the current SBO procedure contains the instructions necessary to vent the main generator and that if any future evaluations determine more equipment is to be load shed, the resulting effects will be evaluated.

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 battery 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, in the paragraph following Guideline (15) provides that:

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

NEI 12-06, Section 11.5 provides that:

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.

On page 8 of 50 in its Integrated Plan description of programmatic controls, the licensee stated that:

[1] Testing includes surveillances, inspections, etc.

CNS will implement an administrative program. A program owner will be assigned with responsibility for configuration control, maintenance, and testing. The equipment for ELAP will be dedicated and will have unique identification number. CNS FLEX equipment will be categorized as Quality Augmented (QA). The QA will be based on selected Appendix B similar to Appendix K and SBO guidance. Standard industry preventive maintenance (PM) will be established for all components and testing procedures will be developed and frequencies established based on type of equipment and considerations made within EPRI guidelines. CNS will assess the addition of program description into USAR and Technical Requirements Manual.

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

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

On pages 40 and 41 of the Integrated Plan, the licensee stated that with regard to equipment maintenance CNS will follow EPRI template requirements.

During the audit, the licensee informed the NRC of CNS's plans to abide by the generic resolution as described above.

Based on the information described above, the licensee has provided reasonable assurance that its mitigation strategy conforms to the recommendations in NEI 12-06, Section 3.2.2, the paragraph following Guideline (15), and Section 11.5.

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 equipment maintenance and testing, if these requirements are implemented as described.

3.3.2 Configuration Control

NEI 12-06, Section 11.8 provides that:

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

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

On page 4 of the Integrated Plan, the licensee stated that CNS expects full conformance with JLD-ISG-2012-01 and NEI 12-06. The licensee described CNS's programmatic controls on page 8 of the Integrated Plan. The licensee stated that CNS will implement an administrative program and that a program owner will be assigned with responsibility for configuration control, maintenance and testing. The licensee stated that the equipment for ELAP mitigation will be dedicated and will have unique identification numbers. The licensee stated that CNS will assess the addition of program descriptions into the USAR and Technical Requirements Manual.

Based on the licensee's statement that CNS expects full conformance with JLD-ISG-2012-01 and NEI 12-06, and the description of how ELAP programmatic controls will be met, the licensee has provided reasonable assurance that CNS will conform to the guidance of NEI 12-06, Section 11.8.

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

[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.

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 9 of the Integrated Plan, the licensee stated that new training of general station staff and Emergency Preparedness personnel will be performed in 2016 prior to design implementation. The licensee stated that simulator and licensed operator training will not be impacted and that the Systematic Approach to Training will be used to implement this training.

The licensee's description of its proposed plan for training on FLEX strategies conforms to the recommendations in NEI 12-06, Section 11.6.

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

3.4 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 9 of the Integrated Plan, the licensee provided a discussion of CNS's RRC plan. The licensee stated that the industry is establishing two RRCs to support utilities during beyond design basis events. The licensee stated that the RRCs will hold five sets of equipment, four of which will be able to be fully deployed when requested, with the fifth set will having equipment in a maintenance cycle. Equipment will be moved from an RRC to a local Assemble Area, established by the Strategic Alliance for FLEX Emergency Response (SAFER) team and the utility. Communications will be established between the nuclear site and the SAFER team and required equipment moved to the site as needed. The licensee stated that first arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request. The licensee stated that NPPD has entered into a contract with Pooled Equipment Management Company to obtain, maintain and deliver the equipment specified by NPPD to the designated staging area within 24 hours.

On page 21 of the Integrated Plan, the licensee stated that Phase 3 equipment will be provided by the RRC which is to be located in Memphis, Tennessee, and that equipment transported to the site will be either immediately staged at the point of use location (pumps and generators) of at a staging area yet to be determined.

The licensee's plans for the use of off-site resources conform to the guidance in NEI 12-06 Section 12.2, item 1), with regard to the capability to obtain equipment and commodities to sustain and backup the site's coping strategies. However, CNS's Integrated Plan provides insufficient information to conclude there is reasonable assurance that the licensee's development and implementation of guidance and strategies will conform to the remaining items (2 through 10) of NEI 12-06, Section 12.2 and will comply with the requirements of Order EA-12-049.

During the audit, the licensee was asked to provide a discussion of how CNS will establish availability of offsite resource capabilities (2) through (10) listed in NEI 12-06, Section 12.2. In response the licensee stated that CNS is participating in the industry initiative, SAFER, to maintain and store the equipment and that SAFER has procedures in place to address the items in NEI 12-06, Section 12.2. The licensee also stated that that the SAFER maintenance strategy is to have one extra unit of all equipment so that maintenance, testing and repair can be performed without loss of capability.

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 offsite resources if these requirements are implemented as described.

4.0 OPEN AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number	Description	Notes
	None	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.2.A	The licensee stated that debris removal equipment has not been determined yet and that the final location for the storage buildings impacts what equipment is required. The licensee will need to identify the final storage locations and the required debris removal equipment, including its protection from applicable external events such that it is likely to remain functional and deployable to clear obstructions from the pathway between the FLEX storage location and its deployment location.	
3.1.1.4.A	After the licensee finalizes the location(s) of the staging area(s) for equipment from the RRC, the licensee's plans for transportation from the RRC, staging, and on-site deployment should be reviewed to confirm that they include adequate consideration of the guidance in NEI 12-06, Sections 5.3.4, 6.3.4, 7.3.4, and 8.3.4, or provide an acceptable alternative to that guidance.	
3.1.3.1.A	When FLEX equipment storage building locations are finalized, separation distance and axis of separation should be reviewed to confirm that the building locations are consistent with the recommendations in NEI 12-06, Section 7.3.1.	
3.1.4.2.A	When more fully developed, CNS's procedures or guidance for obtaining makeup water from the Missouri River during an ELAP event should be reviewed to ensure that NEI 12-06, Section 8.3.2, consideration 3 is adequately addressed.	
3.2.1.1.A	From the June 2013 position paper, benchmarks must be identified and discussed which demonstrate that MAAP4 is an appropriate code for the simulation of an ELAP event at the licensee's facility.	
3.2.1.1.B	The collapsed RPV level must remain above Top of Active Fuel (TAF) and the cool down rate must be within technical specification limits.	
3.2.1.1.C	MAAP4 must be used in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper.	
3.2.1.1.D	(1) In using MAAP4, the licensee must identify and justify the subset of key modeling parameters cited from Tables 4-1 through 4-6 of the "MAAP4	

Item Number	Description	Notes
	Application Guidance, Desktop Reference for Using MAAP4 Software, Revision 2" (Electric Power Research Institute Report 1020236). This should include response at a plant-specific level regarding specific modeling options and parameter choices for key models that would be expected to substantially affect the ELAP analysis performed for that licensee's plant. Although some suggested key phenomena are identified below, other parameters considered important in the simulation of the ELAP event by the vendor / licensee should also be included. a. Nodalization b. General two-phase flow modeling c. Modeling of heat transfer and losses d. Choked flow e. Vent line pressure losses f. Decay heat (fission products / actinides / etc.)	
3.2.1.1.E	The specific MAAP4 analysis case that was used to validate the timing of mitigation strategies in the Integrated Plan must be identified and should be available on the ePortal for NRC staff to view. Alternately, a comparable level of information may be included in the supplemental response. In either case, the analysis should include a plot of the collapsed vessel level to confirm that TAF is not reached (the elevation of the TAF should be provided) and a plot of the temperature cool down to confirm that the cool down is within technical specifications limits.	
3.2.1.2.A	The licensee should provide technical justification that during a long-duration ELAP event the RR pump seal leakage value is not expected to exceed the value used in analysis of a 4-hour SBO event.	
3.2.1.3.A	When developed, the licensee's method for transferring water from the hotwells to the ECSTs, including flow path, valves, pumps, and related equipment, should be reviewed to confirm acceptability of the process.	
3.2.1.3.B	When RCIC room heatup evaluation and RCIC room flooding time evaluation are completed, results should be reviewed to confirm acceptability.	
3.2.1.3.C	When it is completed, the licensee's Staffing Assessment should be reviewed to confirm that proposed actions from the FLEX strategies can be completed within the specified time constraints.	
3.2.1.4.A	When calculations are completed to validate or adjust the Phase 2 FLEX equipment performance criteria, including requirements for FLEX pumps, results should be reviewed to confirm adequacy of the specified equipment to support the licensee's mitigation strategies.	

Item Number	Description	Notes
3.2.2.1.A	Verify modifications to reactor building roof hatch provide the ability to maintain adequate SFP area ventilation.	
3.2.3.A	When CNS's containment venting strategy is finalized and related evaluations are completed, the strategy should be reviewed to confirm that it is acceptable both for containment protection and to support proposed RCIC and Phase 2 FLEX pump operation.	
3.2.3.B	With regard to maintaining containment, the implementation of BWROG EPG/SAG, Revision 3, including any associated plant-specific evaluations, must be completed in accordance with the provisions of NRC letter dated January 9, 2014.	
3.2.4.2.A	Verify fan sizing evaluations provide adequate ventilation to maintain equipment cooling in the main control room, in the RCIC room, and in other applicable plant areas.	
3.2.4.6.A	Analyses addressing heat up in areas that might have personnel habitability issues are still in progress and procedures providing more detailed instructions for some mitigation actions are still under development., the licensee's Integrated Plan did not include sufficient information to conclude that it conforms to the guidance in NEI 12-06, Section 3.2.2, Guideline (11) or provides an acceptable alternative to that guidance. When analyses are completed, they should be reviewed to confirm acceptability of the results.	
3.2.4.7.A	The licensee has not finalized design and operational or protection requirements for the new on-site well or the water treatment equipment used for Phase 2 water sources. When the design, including operational and protection requirements, are finalized, they should be reviewed to ensure that these water sources to ensure that these water sources and the associated pumping and delivery system adequately support CNS's proposed ELAP strategies.	
3.2.4.8.A	When procedure that will be used to install, operate and control the FLEX electrical equipment is developed, it should be reviewed to confirm that issues related to electrical interaction and isolation are adequately addressed.	
3.2.4.8.B	When the licensee completes engineering work to determine the sizing of portable FLEX DGs, results should be reviewed to confirm that the specified equipment adequately supports CNS's ELAP mitigation strategy.	
3.2.4.8.C	During the audit, the licensee was asked to provide single-line diagrams showing the proposed connections of Phase 2 and Phase 3 electrical equipment and showing protection information (e.g., breaker, relay, or fuse) and rating for the equipment used. The licensee stated that the requested information has not yet been developed, but that it will be provided when it becomes available.	

Item Number	Description	Notes
3.2.4.10.A	When the minimum dc voltage and dc load profile for the ELAP have been determined, the minimum dc bus voltage and the associated load profile should be reviewed to confirm that results are acceptable for CNS's proposed ELAP mitigation strategy.	