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

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Duke Energy Carolinas, LLC
McGuire Nuclear Station, Units 1 & 2
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Technical Evaluation Report

McGuire Nuclear Station, Units 1 and 2
Order EA-12-049 Evaluation

1.0 BACKGROUND

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

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

After receiving the Commission's direction in SRM-SECY-11-0124 and SRM-SECY-11-0137, the NRC staff conducted public meetings to discuss enhanced mitigation strategies intended to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities following beyond-design-basis external events (BDBEE). 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 Overall Integrated Plan. As part of the evaluation, MTS, in parallel with the NRC staff, reviewed the original Integrated Plan and the first 6-month status update, and conducted an audit of the licensee documents. The staff and MTS also reviewed the licensee's answers to the NRC staff's and MTS's questions as part of the audit process. The objective of the evaluation was to assess whether the proposed mitigation strategies conformed to the guidance in NEI 12-06, as endorsed by the positions stated in JLD-ISG-2012-01, or an acceptable alternative had been proposed that would satisfy the requirements of Order EA-12-049. The audit plan that describes the audit process was provided to all licensees in a letter dated August 29, 2013 from Jack R. Davis, Director, Mitigating Strategies Directorate (ADAMS Accession No. ML13234A503).

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

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

- Spent Fuel Pool Cooling Strategies
- Containment Function Strategies
- Programmatic Controls
    - Equipment Protection, Storage, and Deployment
    - Equipment Quality

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

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

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

3.0 TECHNICAL EVALUATION

By letter dated February 28, 2013, (ADAMS Accession No. ML13063A185), and as supplemented by the first six-month status report in letter dated August 28, 2013 (ADAMS Accession No. ML13254A204), Duke Energy Carolinas, LLC (the licensee or Duke) provided the McGuire Nuclear Station Units 1 & 2 (MNS) Integrated Plan for compliance with Order EA-12-049. The Integrated Plan describes the strategies and guidance under development for implementation by the licensee for the maintenance or restoration of core cooling, containment, and SFP cooling capabilities following a BDBEE, including modifications necessary to support this implementation, pursuant to Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049. That letter described the process used by the NRC staff in its review, leading to the issuance of an interim staff evaluation and audit report. The purpose of the staff's audit is to determine the extent to which the licensees are proceeding on a path towards successful implementation of the actions

needed to achieve full compliance with the Order.

3.1 EVALUATION OF EXTERNAL HAZARDS

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

3.1.1 Seismic Events.

NEI 12-06, Section 5.2 states:

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

In the section of its Integrated Plan regarding the determination of applicable extreme external hazards, page 2, the licensee stated that seismic hazards are applicable to the McGuire site and that the current licensing basis safe shutdown earthquake (SSE) is 0.15g horizontal and 0.10g vertical and the Operating Basis Earthquake (OBE) is 0.08g acting horizontally and 0.0533g acting vertically as documented in the UFSAR Section 3.1. The licensee has appropriately screened in this external hazard and identified the hazard levels for reasonable protection of the FLEX equipment.

On page 3, in the section of its Integrated Plan regarding the determination of applicable extreme external hazards, the licensee stated that the seismic re-evaluation pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 had not been completed and therefore was not assumed in its Integrated Plan.

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

3.1.1.1 Protection of FLEX Equipment - Seismic Hazard

NEI 12-06, Section 5.3.1 states:

> 1. FLEX equipment necessary for the mitigating strategies should be stored in one or more of the 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 ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures*.
> >
> > c. Outside a structure and evaluated for seismic interactions to ensure equipment is not damaged by non-seismically robust components or structures.
>
> 2. Large portable FLEX equipment such as pumps and power supplies should be secured as appropriate to protect them during a seismic event (i.e., SSE level).
>
> 3. Stored equipment and structures should be evaluated and protected from seismic interactions to ensure that unsecured and/or non-seismic components do not damage the equipment.

In several sections of its Integrated Plan the licensee described that portable equipment will be stored in structures to be designed in accordance with ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures.* The structures will consist of three FLEX storage facilities (N+1 where N is the number of units). In some cases, portable equipment will be stored directly in seismic Category I structures to reduce deployment time.

During the audit process the licensee described that large portable FLEX equipment in the three FLEX storage buildings will be strapped to anchor bolts embedded in the floors to prevent seismic interactions with other 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 protection of FLEX equipment considering the seismic hazard, if these requirements are implemented as described.

3.1.1.2 Deployment of FLEX Equipment - Seismic Hazard

NEI 12-06, Section 5.3.2 states:

> The baseline capability requirements already address loss of non-seismically robust equipment and tanks as well as loss of all AC. So, these seismic considerations are implicitly addressed.
>
> There are five considerations for the deployment of FLEX equipment following a seismic event:
>
> 1. If the equipment needs to be moved from a storage location to a different point for deployment, the route to be traveled should be reviewed for potential

soil liquefaction that could impede movement following a severe seismic event.

2. At least one connection point of 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 10 in its Integrated Plan, the licensee described that deployment routes to be utilized to transport FLEX equipment to the deployment areas will be established and included in an administrative program in order to keep pathways clear or actions to clear the pathways to be accessible during all modes of operation.

In the section of its Integrated Plan regarding the determination of applicable extreme external hazards, page 2, the licensee noted that UFSAR Section 2.5.4.8 states that soils beneath the site are not considered susceptible to liquefaction.

During the audit process the licensee described that if the downstream dam (Cowans Ford dam) fails and drains Lake Norman, the standby nuclear service water pond, which is the UHS and is seismically protected, will remain as a water source. Since the TDAFW pump may be taking a suction from the condenser circulating water piping, planned manual actions to open vacuum breaker valves will prevent the draining of that water back to the lake. During Phase 2, the TDAFW pump suction will be locally aligned to the UHS.

Attachment 4A of the licensee’s integrated plan, Engineering Changes, included information pertaining to planned FLEX process connections and other planned, permanent plant modifications which are inherent to deployment of FLEX equipment. In the six month update to the Integrated Plan dated August 28, 2013, the licensee describes that the access pathway via the north end of the Auxiliary Building was chosen for the original submittal as being the most limiting with respect to voltage drop due to FLEX diesel cable lengths. The update describes that the seismic access pathway to Phase 2 equipment will be via one of the turbine buildings. The turbine buildings have been evaluated to be seismically robust with respect to the SSE per the criteria of Electric Power Research Institute (EPRI) NP-6041-SL, Revision 1, “A Methodology for Assessment of Nuclear Power Plant Seismic Margin (Revision 1).”

During the audit process, the licensee stated that power is not required to move or deploy FLEX equipment (e.g., to open the door from a storage location) in that all such mechanisms can be manually operated in the absence of power.

On page 57 of its Integrated Plan, in the chart identifying Pressurized-Water Reactor (PWR) Portable Equipment Phase 2, the licensee lists (9) 9X12 trailers used to store and deploy power equipment, but does not list tow vehicles. During the audit process, the licensee described that MNS will be purchasing equipment with multifunctional capabilities, which will be stored in diverse locations. The equipment will also be available to transport FLEX equipment except for the large FLEX diesel generators. For the generators, MNS will rely on "Dock Tractors" or equivalent for deployment. One is currently available and MNS intends to acquire another for redundancy. This 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 considering the seismic hazard, if these requirements are implemented as described.

3.1.1.3 Procedural Interfaces - Seismic Hazard

NEI 12-06, Section 5.3.3 states:

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

On page 48 of its Integrated Plan, the licensee described that an alternate strategy to utilize handheld instruments will be developed to tap into the instrument loops locally to monitor essential parameters.

On page 7 of its Integrated Plan, the licensee described that sources of water into the ground water sump in the vicinity of the Turbine-Driven Auxiliary Feedwater (TDAFW) pump are isolated early in Phase 2 (8-12 hours) to improve margin to flooding of the auxiliary feedwater pump room. During the audit process, the licensee stated that an evaluation has been completed that confirms time is available to deploy sump pumps as needed in other critical locations. This is identified as Confirmatory Item 3.1.1.3.A in Section 4.2. The piping system tied to large internal flooding sources in the Nuclear Service Water System (RN) is primarily seismically designed and robust. The non-seismic portions of the RN system headers have been evaluated with respect to internal flooding of the Auxiliary Building.

During the audit process the licensee described that if the downstream dam (Cowans Ford dam) fails and drains Lake Norman, the standby nuclear service water pond, which is the UHS and is seismically protected, will remain as a water source. Since the TDAFW pump may be taking a suction from the condenser circulating water piping, planned manual actions to open vacuum breaker valves will prevent the draining of that water back to the lake and protect the available net positive suction head from this water source. The licensee will proceduralize this action.

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

3.1.1.4 Considerations in Using Offsite Resources – Seismic Hazard

NEI 12-06, Section 5.3.4 states:

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

On page 12 of its Integrated Plan the licensee described that it will utilize the nuclear industry established Regional Response Centers (RRCs). Each RRC will hold five sets of equipment, four of which will be able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle. Equipment will be moved from an RRC to a local Assembly Area. Communications will be established between MNS and the Strategic Alliance for Flex Emergency Response (SAFER) team and required equipment moved from the local staging area to the site as needed. First arriving equipment, as established during development of the site's SAFER Response Plan (playbook), will be delivered to the site within 24 hours from the initial request. Development of the MNS playbook as well as identification of the local Assembly Area and routes to the plant site is identified as Confirmatory Item 3.1.1.4.A in Section 4.2.

During the audit process, the licensee provided additional information describing that surrounding off site areas are deemed to have similar characteristics and reasonably are not subject to soil liquefaction that could hinder delivery of offsite resources.

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

3.1.2 Flooding

NEI 12-06, Section 6.2 states:

> The evaluation of external flood-induced challenges has three parts. The first part is determining whether the site is susceptible to external flooding. The second part is the characterization of the applicable external flooding threat. The third part is the application of the flooding characterization to the protection and deployment of FLEX strategies.

NEI 12-06, Section 6.2.1 states:

> Susceptibility to external flooding is based on whether the site is a "dry" site, i.e., the plant is built above the design basis flood level (DBFL). For sites that are not "dry", water intrusion is prevented by barriers and there could be a potential for those barriers to be exceeded or compromised. Such sites would include those that are kept "dry" by permanently installed barriers, e.g., seawall, levees, etc., and those that install temporary barriers or rely on watertight doors to keep the design basis flood from impacting safe shutdown equipment.

On pages 2 and 3 in its Integrated Plan, the licensee described that UFSAR Sections 2.4, 2.4.10, and 3.4 stated that MNS Seismic Category I structures are not susceptible to external flooding from the Probable Maximum Precipitation (PMP) or Probable Maximum Flood (PMF) events. The limiting site flooding event for MNS is the Probable Maximum Precipitation (PMP) event, which is of limited duration and water level. During the audit process, the licensee clarified that MNS is a dry site, meaning that the water level during the PMP event does not exceed the design basis flood level.

On page 3, in the section of its Integrated Plan regarding the determination of applicable extreme external hazards, the licensee stated that the seismic re-evaluation pursuant to the10 CFR 50.54(f) letter of March 12, 2012 had not been completed and therefore was not assumed in its Integrated Plan.

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

3.1.2.1 Protection of FLEX Equipment - Flooding Hazard

NEI 12-06, Section 6.2.3.1 states:

These considerations apply to the protection of FLEX equipment from external flood hazards:

1. The equipment should be stored in one or more of the following configurations:

    a. Stored above the flood elevation from the most recent site flood analysis. The evaluation to determine the elevation for storage should be informed by flood analysis applicable to the site from early site permits, combined license applications, and/or contiguous licensed sites.

    b. Stored in a structure designed to protect the equipment from the flood.

    c. FLEX equipment can be stored below flood level if time is available and plant procedures/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 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.

In several sections of its Integrated Plan, the licensee described that FLEX storage facilities will be located above any potential site flood level, and/or the effects of localized flooding will be evaluated in the FLEX facility design and equipment deployment.

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

3.1.2.2 Deployment of FLEX Equipment - Flooding Hazard

NEI 12-06, Section 6.2.3.2 states:

There are a number of considerations which apply to the deployment of FLEX equipment for external flood hazards:

1. For external floods with warning time, the plant may not be at power. In fact, the plant may have been shut down for a considerable time and the plant configuration could be established to optimize FLEX deployment. For example, the portable pump could be connected, tested, and readied for use prior to the arrival of the critical flood level. Further, protective actions can be taken to reduce the potential for flooding impacts, including cooldown, borating the RCS, 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.

Because MNS is a dry site, considerations 1-9 are not applicable to the flooding hazard.

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

3.1.2.3 Procedural Interfaces - Flooding Hazard

NEI 12-06, Section 6.2.3.3 states:

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

Because MNS is a dry site, these considerations are not applicable.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-1201-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedural interfaces considering the flooding hazard, if these requirements are implemented as described.

3.1.2.4 Considerations in Using Offsite Resources - Flooding Hazard

NEI 12-06, Section 6.2.3.4 states:

> Extreme external floods can have regional impacts that could have a significant impact on the transportation of 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 described above, MNS is a dry site, but the surrounding areas through which offsite resources would be transported could be susceptible to flooding. During the audit process the licensee described that there are multiple access pathways into the plant site, and as such there is reasonable assurance that at least one would be functional after a BDBEE. The location of the RRC deployment site has not yet been established. Development of the MNS playbook as well as identification of the local Assembly Area and routes to the plant site was previously identified as Confirmatory Item 3.1.1.4.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to use of off site resources considering the flooding hazard, 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 second part is the characterization of the applicable high wind threat.

The screening for high wind hazards associated with hurricanes should be accomplished by comparing the site location to NEI 12-06, Figure 7-1 (Figure 3-1 of U.S. NRC, "Technical Basis for Regulatory Guidance on Design Basis Hurricane Wind Speeds for Nuclear Power Plants," NUREG/CR-7005, December, 2009); if the resulting frequency of recurrence of hurricanes with wind speeds in excess of 130 mph exceeds 10^{-6} per year, the site should address hazards due to extreme high winds associated with hurricanes.

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

On page 2 in its Integrated Plan the licensee described that UFSAR Section 2.1.1 states the MNS site is located at latitude 35 degrees - 25 minutes - 59 seconds north and longitude 80 degrees - 56 minutes -55 seconds west. According to NEI 12-06 Figures 7-1 and 7-2, the location of MNS has a hurricane peak-gust wind speed of 150 miles per hour (mph) and a recommended tornado design wind speed of 172 mph.

Based on the potential for winds in excess of 130 mph, the MNS site is susceptible to damage from severe winds from a hurricane or tornado. Therefore, the high wind hazard is applicable for MNS.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-1201-01, 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.

In several sections of its Integrated Plan the licensee described that the Category I structures are designed to withstand design basis winds and tornados. The FLEX storage facilities will be designed in accordance with ASCE 7-10 to withstand the maximum anticipated hurricane and tornado winds as outlined in NEI 12-06. The FLEX buildings will be located in accordance with NEI 12-06 Section 7.3.1 to prevent damage to more than one of the three facilities due to

tornado missiles. Debris removal/remediation equipment and procedures will be provided to support FLEX equipment deployment.

In attachment 4B of its integrated plan, Conceptual Engineering Change Sketches, sheet 11, FLEX Equipment Storage Facility Site Plan, the licensee depicts the locations being considered for three FLEX storage buildings. Building 2 is shown with both a proposed and alternate location. The proposed locations are aligned in a general North-South arrangement no matter which final location of Building 2 is selected. Overlaid on the site plan is the predominant path of tornados in the geographical location, southwest to northeast. The locations of the switchyard and emergency diesel generators are shown in the MNS UFSAR. The diverse locations of the proposed FLEX buildings and existing emergency diesel generators and switchyard are situated such that the path of a single tornado would not impact all locations, depending on the assumed width of the tornado. During the audit process the licensee stated that the buildings will be at least 1200 feet apart based on an assumed tornado width from NOAA's Storm Prediction Center for 1950 – 2011 for which further analysis is not required to justify further diversity for the sites located in region 1 and 2 as shown in Figure 7-2 of NEI 12-06. Site specific data to justify the assumed tornado width of 1200 feet will be required to confirm the final locations of the FLEX storage facilities conform to NEI 12-06 guidance. This is identified as Confirmatory Item 3.1.3.1.A in Section 4.2.

In the six month update to the Integrated Plan, dated August 28, 2013, the licensee described a change in its plans for storage of the high and low pressure make-up pumps for the Reactor Coolant System (RCS). The change was to pre-stage the pumps for each unit in the Auxiliary Building, a Category I seismic structure, near their connection points. In the course of the audit, the licensee provided a revision to this approach, stating that the high and low pressure make-up pumps would instead be diesel-driven and deployed from the FLEX Storage Buildings, with N+1 sets available, rather than pre-staging N sets of them in the Auxiliary Building as described above. The licensee indicated that this approach was chosen due to potential storage space issues for large-footprint pump skids in the Auxiliary Building. The licensee further related that for all of the FLEX equipment deployed from the FLEX Buildings, on the approach of a major storm, current procedures manage plant response, including verification of equipment availability and plant shutdown if necessary.

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 considering the high winds hazard, if these requirements are implemented as described.

3.1.3.2 Deployment of FLEX Equipment - High Wind Hazard

NEI 12-06, Section 7.3.2 states:

> There are a number of considerations which apply to the deployment of FLEX equipment for high wind hazards:
>
> 1. For hurricane plants, the plant may not be at power prior to the simultaneous ELAP and LUHS condition. In fact, the plant may have been shut down and the plant configuration could be established to optimize FLEX deployment. For example, the portable pumps could be connected, tested, and readied for use prior to the arrival of the hurricane. Further, protective actions can be

taken to reduce the potential for wind impacts. These factors can be credited in considering how the baseline capability is deployed.

2. The ultimate heat sink may be one of the first functions affected by a hurricane due to debris and storm surge considerations. Consequently, the evaluation should address the effects of ELAP/LUHS, along with any other equipment that would be damaged by the postulated storm.

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

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

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

On page 10 in its Integrated Plan, the licensee described that deployment routes to be utilized to transport FLEX equipment to the deployment areas will be established and included in an administrative program in order to keep pathways clear or actions to clear the pathways to be accessible during all modes of operation.

On page 57 of its Integrated Plan, in the chart identifying Pressurized Water Reactor (PWR) Portable Equipment Phase 2, the licensee lists (9) 9X12 trailers used to store and deploy power equipment, but does not list tow vehicles. During the audit process the licensee described that MNS will be purchasing equipment with multifunctional capabilities, stored in diverse locations, that will be available to transport FLEX equipment except for the large FLEX diesel generators. For the generators MNS will rely on "Dock Tractors" or equivalent for deployment. One is currently available and MNS intends to acquire another for redundancy. This was previously identified as Confirmatory Item 3.1.1.2.A in Section 4.2.

The integrated plan did not include any information regarding early deployment or pre-staging of equipment prior to the anticipated arrival of a hurricane, as discussed in NEI 12-06, Section 7.3.2 consideration 1, above. During the audit process, the licensee stated that pre-staging in advance of a hurricane or other severe weather is already part of current plant procedures, which will be enhanced to encompass FLEX strategies.

Because MNS is not a coastal site, storm surge considerations are not applicable. For assured water supplies assuming the UHS and other non-robust structures are affected, the licensee will rely on buried condenser circulating water piping headers, which can provide at least two days of cooling water. Phase 2 will then be implemented using either manually realignment of the TDAFWP suction to the UHS by manually opening the ac motor operated nuclear service water (RN) valves or aligning low pressure portable pump(s) to deliver raw water makeup from the UHS to the SGs. The primary SG feed connection is already available (a pre-existing connection installed pursuant to the Section B.5.b mitigating strategy) and can be used in conjunction with the low pressure portable pumps to provide makeup to all four SGs. This connection is located on top of the Auxiliary Building and is protected on the north and south sides from wind and missiles by surrounding structures. A modification will be implemented that will provide alternate SG feed connections in the interior and exterior doghouses that can supply

makeup to all four SGs. These alternate SG feed connections will be fully protected against external events by virtue of being located within the Category I doghouse structures.

On page 26 of its Integrated Plan the licensee described that a high pressure pump will be used for RCS makeup with borated water from the Refueling Water Storage Tank (RWST). For shutdown operations, MNS will employ a low pressure pump for the RCS makeup method. An additional RWST process connection will be installed to provide a borated water suction supply to the RCS makeup pump.

The licensee's plan identified that transportation equipment will be provided to move the large skid/trailer-mounted equipment provided from off-site in Phase 3. However, the plan did not provide sufficient information to provide reasonable assurance that the ability to move equipment and restock supplies that may be hampered during a hurricane is being considered in plans for deployment of FLEX equipment as required by NEI-12-06, Section 7.3.2., consideration 5. During the audit process MNS provided additional information describing that existing plant procedures manage plant response and preparation in advance of a hurricane.

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

The licensee did not provide any information specific to procedural interface considerations as they relate to severe storms with high winds. However, the need for debris removal/remediation equipment and procedures was addressed in several sections of the Integrated Plan.

Additionally, the Integrated Plan contains numerous descriptions of general procedural guidance being developed that are reasonably applicable to mitigation of damage from all analyzed hazards, including development of FLEX Support Guidelines (FSGs) using industry guidance to address the criteria in NEI 12-06, Section 11.4.

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

3.1.3.4 Considerations in Using Offsite Resources - High Wind Hazard

NEI 12-06, Section 7.3.4 states:

Extreme storms with high winds can have regional impacts that could have a significant impact on the transportation of off-site resources.

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

2. Sites impacted by storms with high winds should consider where equipment delivered from off-site could be staged for use on-site.

On page 12 of its Integrated Plan, the licensee described that it will utilize the nuclear industry established RRCs. Each RRC will hold five sets of equipment, four of which will be able to be fully deployed when requested, and the fifth set will have equipment in a maintenance cycle. Equipment will be moved from an RRC to a local Assembly Area. Communications will be established between MNS and the SAFER team and required equipment moved from the local staging area to the site as needed. First arriving equipment, as established during development of the site's playbook, will be delivered to the site within 24 hours from the initial request. Development of the MNS playbook as well as identification of the local Assembly Area and routes to the plant site was previously identified as Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.4 Snow, Ice and Extreme Cold

As discussed in NEI 12-06, Section 8.2.1:

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

On page 3 of its Integrated Plan, the licensee describes that MNS is located above the 35th parallel, and is therefore subject to low-to-significant snowfall accumulation and extreme low temperatures in accordance with NEI 12-06 Figure 8-1. Based on NEI 12-06 Figure 8-2, the MNS site location is also subject to the existence of large amounts of ice, and thus the potential for severe power line damage. Therefore, the extreme cold hazard is applicable for MNS.

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 of the snow, 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 spare (N+1) set of 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.).

In several sections of its Integrated Plan, the licensee described that FLEX storage facilities will be designed to accommodate maximum snow and ice loading. The licensee also indicated that it will evaluate the need to provide freeze protection for critical instrumentation and exposed FLEX connections. During the audit process, the licensee further described that the designs will be 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.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of FLEX equipment considering the snow, ice and extreme cold hazards, 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 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 page 10 in its Integrated Plan, the licensee described that deployment routes to be utilized to transport FLEX equipment to the deployment areas will be established and included in an administrative program in order to keep pathways clear or actions to clear the pathways to be accessible during all modes of operation.

On page 57 of its Integrated Plan, in the chart identifying Pressurized Water Reactor (PWR) Portable Equipment Phase 2, the licensee lists (9) 9X12 trailers used to store and deploy power equipment, but does not list tow vehicles. During the audit process, the licensee described that MNS will be purchasing equipment with multifunctional capabilities, stored in diverse locations, will be available to transport FLEX equipment except for the large FLEX diesel generators. For the generators, MNS will rely on “Dock Tractors” or equivalent for deployment. One is currently available and MNS intends to acquire another for redundancy. This is identified as Confirmatory Item 3.1.1.2.A in Section 4.2.

In several sections of its Integrated Plan, the licensee describes that snow and ice removal/remediation equipment and procedures will be provided to support FLEX equipment deployment. FLEX equipment will be capable of operation under extreme temperatures, and suitably maintained to ensure standby readiness. The licensee will evaluate the need to provide freeze protection for critical instrumentation and exposed FLEX connections at MNS.

On pages 5 and 6 of its Integrated Plan the licensee describes that the MNS nuclear service water intake and discharge headers from the UHS can gravity feed the TDAFW pumps. Additionally, the intake is approximately 40 feet under water. As such, loss of access to the UHS is assumed to result only from the loss of ac power to the motor operated valves that would normally automatically align this flow path. This is consistent with NEI 12-06, 3.2.1.3(4) which states, "Normal access to the ultimate heat sink is lost, but the water inventory in the UHS remains available and robust piping connecting the UHS to plant systems remains intact". Two independent, full safety-related (i.e. robust) flow paths from the UHS to the TDAFW pumps exist and could be locally aligned during an Extended Loss of ac Power (ELAP) event.

During the audit process, the licensee provided information related to manual actions that may be required in the extreme conditions applicable to the site. Because MNS is not subject to conditions requiring extraordinary personnel protection, additional consideration for manual actions is not required.

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

3.1.4.3 Procedural Interfaces - Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.3 states:

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

In several sections of its Integrated Plan the licensee described that snow and ice removal/remediation equipment and procedures will be provided to support FLEX equipment deployment. FLEX equipment will be capable of operation under extreme temperatures, and suitably maintained to ensure standby readiness.

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

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

NEI 12-06, Section 8.3.4, states:

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

On page 12 of its Integrated Plan, the licensee described that it will utilize the nuclear industry established RRCs. Each RRC will hold five sets of equipment, four of which will be able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle. Equipment will be moved from an RRC to a local Assembly Area. Communications will be established between MNS and the SAFER team and required equipment moved from the local staging area to the site as needed. First arriving equipment, as established during development of the site's playbook, will be delivered to the site within 24 hours from the initial request. Development of the MNS playbook as well as identification of the local Assembly Area and routes to the plant site was previously identified as Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.5 High Temperatures

NEI 12-06, Section 9 states:

> All sites will address high temperatures. Virtually every state in the lower 48 contiguous United States has experienced temperatures in excess of 110˚F.

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

On page 3 in its Integrated Plan, the licensee confirms that the extreme high temperature hazard is applicable for MNS.

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 of the high temperature hazard if these requirements are implemented as described.

3.1.5.1 Protection of FLEX Equipment - High Temperature Hazard

NEI 12-06, Section 9.3.1, states:

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

In several sections of its Integrated Plan, the licensee describes that FLEX equipment will be capable of operation under extreme temperatures, and suitably maintained to ensure standby readiness. FLEX storage facilities will be vented to maintain acceptable temperature.

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

On page 10 in its Integrated Plan, the licensee described that deployment routes to be utilized to transport FLEX equipment to the deployment areas will be established and included in an administrative program in order to keep pathways clear or actions to clear the pathways to be accessible during all modes of operation.

On page 57 of its Integrated Plan, in the chart identifying Pressurized Water Reactor (PWR) Portable Equipment Phase 2, the licensee lists (9) 9X12 trailers used to store and deploy power equipment, but does not list tow vehicles. During the audit process the licensee described that MNS will be purchasing equipment with multifunctional capabilities, stored in diverse locations,

will be available to transport FLEX equipment except for the large FLEX diesel generators. For the generators, MNS will rely on “Dock Tractors” or equivalent for deployment. One is currently available and MNS intends to acquire another for redundancy. This was previously identified as Confirmatory Item 3.1.1.2.A in Section 4.2.

Except for venting of storage facilities, no discussion was provided in the integrated plan pertaining to other high temperature storage considerations as specified in NEI 12-06, Section 9.3.2., e.g., expansion of sheet metal, swollen door seals, etc. During the audit process, the licensee provided additional information describing that the storage facilities will be designed for extreme temperature ranges. This is identified as Confirmatory Item 3.1.5.2.A in Section 4.2.

No discussion was provided in the integrated plan that indicated consideration for any manual operations required by plant personnel during deployment of equipment in high temperature conditions. During the audit process the licensee provided information related to manual actions that may be required in the extreme conditions applicable to the site. Because MNS is not subject to conditions requiring extraordinary personnel protection, additional consideration for manual actions is not required.

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

In several sections of its Integrated Plan the licensee described that FLEX equipment will be capable of operation under extreme temperatures, and suitably maintained to ensure standby readiness.

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

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

NEI 12-06, Table 3-2 and Appendix D summarize one acceptable approach for the reactor core cooling strategies. This approach uses the installed auxiliary feedwater (AFW)/emergency feedwater (EFW) system to provide steam generator (SG) makeup sufficient to maintain or restore SG level in order to continue to provide core cooling for the initial phase. This approach relies on depressurization of the SGs for makeup with a portable injection source in order to provide core cooling for the transition and final phases. This approach accomplishes RCS inventory control and maintenance of long term subcriticality through the use of low leakage reactor coolant pump seals and/or borated high pressure RCS makeup with a letdown path. In mode 5 (cold shutdown) and mode 6 (refueling) with SGs not available, this approach relies on an on-site pump for RCS makeup and diverse makeup connections to the RCS for long-term RCS makeup with borated water and residual heat removal from the vented RCS.

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.

During the NRC audit process the licensee stated that the analysis performed in Sections 5.2.1 and 5.2.2 of WCAP-17601 is applicable to their plant. The licensee needs to justify the use of that analysis by identifying and evaluating the important parameters and assumptions demonstrating that they are representative of their plant and appropriate for simulating the ELAP transient. This has been identified as Confirmatory Item 3.2.1.A in Section 4.2.

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

3.2.1.1. Computer Code Used for ELAP Analysis.

NEI 12-06, Section 1.3 states:

> To the extent practical, generic thermal hydraulic analyses will be developed to support plant specific decision-making. Justification for the duration of each

phase will address the on-site availability of equipment, the resources necessary to deploy the equipment consistent with the required timeline, anticipated site conditions following the beyond-design-basis external event, and the ability of the local infrastructure to enable delivery of equipment and resources from offsite.

The licensee has provided a Sequence of Events (SOE) in their Integrated Plan, which included the time constraints and the technical basis for the site. That SOE is based on an analysis using the industry-developed NOTRUMP computer code. NOTRUMP was written to simulate the response of pressurized water reactors to small break LOCA transients for licensing basis safety analysis.

The licensee has decided to use the NOTRUMP computer code for simulating the ELAP event. Although NOTRUMP has been reviewed and approved for performing small break LOCA analysis for PWRs, the NRC staff had not previously examined its technical adequacy for simulating an ELAP event. In particular, the ELAP scenario is differentiated from typical design-basis small-break LOCA scenarios in several key respects, including the absence of normal ECCS injection and the substantially reduced leakage rate, which places significantly greater emphasis on the accurate prediction of primary-to-secondary heat transfer, natural circulation, and two-phase flow within the RCS. As a result of these differences, concern arose associated with the use of the NOTRUMP code for ELAP analysis for modeling of two-phase flow within the RCS and heat transfer across the steam generator tubes as single-phase natural circulation transitions to two-phase flow and the reflux condensation cooling mode. This concern resulted in the following Confirmatory Item:

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

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

3.2.1.2 RCP Seal Leakage Rates

NEI 12-06, Section 1.3 states:

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

During an ELAP event, cooling to the RCPs seal packages will be lost and water at high temperatures may degrade seal materials leading to excess seal leakage from the Reactor Coolant System (RCS). Without ac power available to the emergency core cooling system, inadequate core cooling may result from the leakage out of the seals. The ELAP analysis credits operator actions to align the high pressure RCS makeup sources and replenish the RCS

inventory in order to ensure the core is covered with water, thus precluding inadequate core cooling. The amount of high pressure RCS makeup needed is mainly determined by the seal leakage rate, therefore the seal leakage rate is of primary importance in an ELAP analysis as greater values of the leakage rates will result in a shorter time period for the operator action to align the high pressure RCS makeup water sources.

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

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

- A position paper dated August 16, 2013, entitled "Westinghouse Response to NRC Generic Request for Additional Information (RAI) on Reactor coolant (RCP) Seal Leakage in Support of the Pressurized Water reactor Owners Group (PWROG)" (ADAMS Accession No. ML13190A201 (Non-Publically Available)).

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

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

(2) In some plant designs, such as those with 1200 to 1300 psia SG design pressures and no accumulator backing of the main steam system power-operated relief valve (PORV) actuators, the cold legs could experience temperatures as high as 580 degrees Fahrenheit before cooldown commences. This is beyond the qualification temperature (550 degrees Fahrenheit) of the O-rings used in the RCP seals. For those Westinghouse designs, a discussion of the information (including the applicable analysis and relevant seal leakage testing data) should be provided to justify that (1) the integrity of the associated O-rings will be maintained at the temperature conditions experienced during the ELAP event, and (2) the seal leakage rate of 21 gpm/seal used in the ELAP is adequate and acceptable. (This is Confirmatory Item 3.2.1.2.B)

(3) Some Westinghouse plants have installed or will install the SHIELD shutdown seals, or other types of low leakage seals, and have credited or will credit a low seal leakage rate (e.g., 1 gpm/seal) in the ELAP analyses for the RCS response. For those plants, information should be provided to address the impacts of the Westinghouse 10 CFR Part 21 report, “Notification of the Potential Existence of Defects Pursuant to 10 CFR Part 21,” dated July 26, 2013 (ADAMS No. ML13211A168) on the use of the low seal leakage rate in the ELAP analysis. (This is not applicable to McGuire because they have not proposed to use SHIELD seals.)

(4) If the seals are changed to the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals, the acceptability of the use of the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals should be addressed, and the RCP seal leakages rates for use in the ELAP analysis should be provided with acceptable justification. (This is Confirmatory Item 3.2.1.2.C)

During the audit the licensee provided additional information that they have Westinghouse seals installed, a 21 gpm leakage rate was assumed in the ELAP analysis, and that Westinghouse will be assisting the licensee in providing further information regarding seal leakage. This is Open Item 3.2.1.2.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 Open Item and Confirmatory Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to RCP seal leakage rates if these requirements are implemented as described.

3.2.1.3 Decay Heat

NEI Section 3.2.1.2 states in part:

> The initial plant conditions are assumed to be the following:
>
> (1) Prior to the event the reactor has been operating at 100 percent rated thermal power for at least 100 days or has just been shut down from such a power history as required by plant procedures in advance of the impending event.

In Attachment 1A of its Integrated Plan, the Sequence of Events Timeline, at time 0 of the event, the plant is stated to be at 100% power.

Assumption 4 on page 4-13 of WCAP-17601, states that “Decay heat is per ANS 5.1-1979 + 2 sigma, or equivalent.” During the audit, the licensee stated that the ANS 5.1-1979 + 2 sigma model is used in the ELAP analysis. Values of the following key parameters used to determine the decay heat should be specified and the adequacy of the values evaluated: (1) initial power level, (2) fuel enrichment, (3) fuel burnup, (4) effective full power operating days per fuel cycle, (5) number of fuel cycles, if hybrid fuels are used in the core, and (6) fuel characteristics are based on the beginning of the cycle, middle of the cycle, or end of the cycle. During the audit process, the licensee provided additional information that Westinghouse will be assisting MNS in providing further information regarding decay heat modeling. This issue is identified as Open Item 3.2.1.3.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 Open Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to decay heat modeling if these requirements are implemented as described.

3.2.1.4 Initial Values for Key Plant Parameters and Assumptions

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

In its integrated plan, the licensee does not explicitly state all the assumed initial conditions of the reactor power history or systems configuration. The only information presented in this regard is included in the plan on page 1 of 4 of Attachment 1A, Sequence of Events Timeline, for elapsed time 0, "Plant @ 100% power" is stated in the Remarks/Applicability column and on page 10 of the Integrated Plan stating that Attachment 1B, "NSSS Significant Reference Analysis Deviation Table" is not applicable.

During the audit the licensee identified that the analysis from WCAP 17601 Section 5.2.1 is applicable to McGuire and that Westinghouse would be supplying McGuire with additional information regarding the key plant parameters and assumptions. This issue is identified as Confirmatory Item 3.2.1.4.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 initial values of key plant parameters and assumptions if these requirements are implemented as described.

3.2.1.5 Monitoring Instrumentation and Controls

NEI 12-06, Section 3.2.1.10 states in part:

> The parameters selected must be able to demonstrate the success of the strategies at maintaining the key safety functions as well as indicate imminent or actual core damage to facilitate a decision to manage the response to the event within the Emergency Operating Procedures and FLEX Support Guidelines or within the SAMGs. Typically, these parameters would include the following:
>
> - SG Level
> - SG Pressure
> - RCS Pressure
> - RCS Temperature
> - Containment Pressure
> - SFP Level
>
> The plant-specific evaluation may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance or to

indicate imminent or actual core damage.

On pages 45 and 46 of its Integrated Plan, the licensee listed the instrumentation and components that are required or desired to support the strategy as follows:

SG narrow-range levels
SG steam pressures
Auxiliary Feedwater flow to SGs
TDAFW solenoid operated valves (SOVs)
Wide-range (Gammametrics) neutron source range flux monitoring
Inadequate core cooling monitor (ICCM) including
- RVLIS
- Incore T/Cs
- Wide-range NC system pressure
- Subcooling margin
- NC loop T-HOT

Pressurizer level
Source Range Start-up Rate (SUR) monitor
RWST level
Containment wide-range pressure
Containment sump wide-range level
Containment high-range area radiation monitor
Pressurizer PORV position indication
4160V Essential Auxiliary Power System Switchgear ETA/ETB breaker control and relay power
Battery voltage

On page 39 of its Integrated Plan, the licensee describes that a modification will install two separate wide-range level instruments for SFP level in accordance with NEI 12-02, *Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation,"* Revision 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 monitoring instrumentation and controls, if these requirements are implemented as described.

3.2.1.6 Sequence of Events (SOE) of the ELAP Analysis

NEI 12-06, Section 3.2.1.7, Item 6) states:

> 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 3.2.2 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 the Integrated Plan, the licensee provides the current Sequence of Events timeline as a tabulation of strategies in Attachment 1A. On pages 6 – 10 of its Integrated Plan the licensee provides further detail of the current SOE and lists the strategies from Attachment 1A that have new time constraints to be successful. At the time of submittal of the integrated plan, seventeen items were listed having new time constraints. On page 6 of the Integrated Plan, the licensee describes that the MNS FLEX strategy is evolving. A staffing Phase 2 study will be performed in accordance with NEI 12-01, *Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities,* Revision 0, to verify that all actions can be taken in accordance with the timeline. Time constraints shown in Attachment 1A will be validated to be reasonable as the strategy is finalized.

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

Review of the Integrated Plans for MNS revealed that the Generic Concern related to shutdown and refueling requirements is applicable to the plant. This Generic Concern has been resolved generically through the NRC endorsement of NEI position paper entitled "Shutdown/Refueling Modes" (ADAMS Accession No. ML13273A514); and has been endorsed by the NRC in a letter dated September 30, 2013 (ADAMS Accession No. ML13267A382).

The position paper describes how licensees will, by procedure, maintain equipment available for deployment in shutdown and refueling modes. The NRC staff concluded that the position paper provides an acceptable approach for demonstrating that the licensees are capable of implementing mitigating strategies in all modes of operation.

Pending confirmation that MNS will abide by the generic resolution for shutdown and refueling concerns, this is identified as Confirmatory Item 3.2.1.7.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 cold shutdown and refueling, if these requirements are implemented as described.

3.2.1.8 Core Sub-Criticality

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

> All plants provide means to provide borated RCS makeup.

Section 4.3.2 of WCAP-17601-P indicates that one of the acceptance criteria for the ELAP analysis is to show the core remains subcritical. The control rod shutdown margin, borated water inventory in the RCS and cold leg accumulators, and borated water injection from the RWST through BDB portable RCS injection pump are used in the re-criticality analysis to show that total reactivity remains negative, assuring the core sub-criticality.

On page 24 of its Integrated Plan, the licensee describes that MNS does not have low leakage RCP shutdown seals installed, and does not have the capability for high pressure borated water injection into the RCS for a BDBEE. Further, there is no MNS strategy required to maintain RCS inventory in Phase I, since core uncovery does not occur for 55 hours according to the PWROG generic analysis and 72 hours according to the MNS specific analysis.

On pages 26 and 27 of its Integrated Plan, the licensee described the methodologies that will be used in Phase 2 to maintain RCS inventory control. Due to leakage past the reactor coolant pump seals, the core will eventually uncover if reactor makeup is not established. Additionally, shutdown margin will be reduced as a result of xenon decay and cooldown of the RCS. An analysis will be performed to determine required boration.

In order to compensate for the loss of inventory and ensure the reactor remains subcritical, the PWROG Core Cooling Position Paper provides three options for reactor makeup:

1. High pressure pump (estimated to be greater than or equal to 1600 psig)
2. Low pressure pump (approximately 650 psig)
3. Passive Cold Leg Accumulator (CLA) injection

For normal operations, the licensee described it will employ the first option listed (high pressure diesel-driven pump) for the RCS makeup method since it is simpler than the other approaches and can be implemented earlier in the event. Letdown will be established using the reactor head vent solenoid valves, if required. These valves are powered by vital dc. The portable high pressure pump and associated hose will be staged in a FLEX storage building and moved to the Auxiliary Building to provide makeup to the RCS with borated water from the RWST. The pump pressure and flow rate (greater than 40 gpm at greater than 1600 psig) will be established in accordance with the PWROG Core Cooling Position Paper. Sufficient borated water will be added to maintain the core subcritical, at a xenon free condition, at 350 degrees F. A modification will be implemented to provide permanent process connections for the portable RCS makeup pump suction and discharge. Primary and alternate RCS makeup connections will be provided on the Intermediate Head Safety Injection (NI) discharge headers. The connections will provide diverse makeup paths (separate divisions), as either connection can be aligned to supply the cold legs or hot legs. An additional RWST process connection will be installed to provide a borated water suction supply to the portable RCS makeup pump.

For shutdown operations, the licensee described it will employ the second option listed (low pressure pump) for the RCS makeup method. A second lower pressure, higher flow (~300 gpm at less than 400 psig) pump will be provided to provide borated makeup to the RCS if the event were to occur during a refueling outage. Modifications will be implemented to provide permanent process connections for the portable RCS makeup pump. A primary RCS makeup

connection will be provided on the Residual Heat Removal (ND) discharge header. The Residual Heat Removal connection will provide the ability to make-up to either the RCS cold legs or hot legs. The alternate RCS makeup connections will be provided on the Intermediate Head Safety Injection (NI) discharge headers, as described previously for normal operation. An additional RWST process connection (same as that described for normal operation) will be installed to provide a borated water suction supply to the portable RCS makeup pump.

On page 30 of its Integrated Plan, the licensee describes that additional solid boric acid will be obtained from the RRC to replenish the RWST and maintain shutdown margin.

During the audit process the licensee provided additional information that the ELAP criticality analysis for MNS is still being evaluated and it assumes uniform boron mixing consistent with the PWROG boron mixing white paper, LTR-FSE-13-46, Revision 0. The strategy limitations as documented in the white paper will be met in the shutdown margin calculation and overall FLEX strategy.

The NRC staff reviewed the licensee's Integrated Plan and determined that the Generic Concern associated with the modeling of the timing and uniformity of the mixing of a liquid boric acid solution injected into the reactor coolant system (RCS) under natural circulation conditions potentially involving two-phase flow was applicable to McGuire.

The Pressurized Water Reactor Owners Group submitted a position paper, dated August 15, 2013 (withheld from public disclosure due to proprietary content), which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlined applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available. During the audit, the licensee informed the NRC staff of its intent to abide by the generic approach discussed above. The NRC staff concluded that the August 15, 2013, position paper was not adequately justified and has not endorsed this position paper. As such, resolution of this concern for McGuire is identified as Open Item 3.2.1.8.A in Section 4.1.

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

3.2.1.9 Use of Portable Pumps

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

> Regardless of installed coping capability, all plants will include the ability to use portable pumps to provide RPV/RCS/SG makeup as a means to provide diverse capability beyond installed equipment. The use of portable pumps to provide RPV/RCS/SG makeup requires a transition and interaction with installed systems. For example, transitioning from RCIC to a portable FLEX pump as the source for RPV makeup requires appropriate controls on the depressurization of the RPV and injection rates to avoid extended core uncovery. Similarly, transition to a portable pump for SG makeup may require cooldown and depressurization of the SGs in advance of using the portable pump connections. Guidance should address both the proactive transition from installed equipment

> to portable and reactive transitions in the event installed equipment degrades or fails. Preparations for reactive use of portable equipment should not distract site resources from establishing the primary coping strategy. In some cases, in order to meet the time-sensitive required actions of the site-specific strategies, the FLEX equipment may need to be stored in its deployed position.
>
> The fuel necessary to operate the FLEX equipment needs to be assessed in the plant-specific analysis to ensure sufficient quantities are available as well as to address delivery capabilities.

NEI 12-06 Section 11.2 states in part:

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

On pages 17 and 18 of its Integrated Plan the licensee describes for the case when steam generators are available, in general, the Phase 2 strategy to maintain core cooling involves continued use of the TDAFW pump feedwater control valves (FCVs) to all four steam generators and steam generator PORVs on all four steam generators to provide symmetric cooling to the RCS. Water is provided to the TDAFW pump from one of two sources:

1. Seismic / Other non Tornado/Hurricane ELAP Events

The condensate storage tank (CAST) inventory will eventually be depleted at around 16 hours into the event. Phase 2 will then be implemented using one or more of the following approaches:

* Makeup to the CAST using a low pressure portable pump and the existing "Section B.5.b mitigating strategy" procedure.

* If automatic TDAFW pump suction alignment to the buried condenser circulating water piping headers has not already occurred, manually realign the TDAFW pump suction to the:

* Buried condenser circulating water piping headers which contain at least two days worth of cooling water.
-or-

* UHS by manually opening the ac motor operated nuclear service water (RN) valves

* Align low pressure portable pump(s) to deliver raw water makeup from the UHS to the steam generators. The primary SG feed connection is already available (a pre-existing connection installed pursuant to Section B.5.b mitigating strategy and can be used in conjunction with the low pressure portable pumps to provide makeup to all four SGs. This connection is located on top of the Auxiliary Building and is protected on the north and south sides from wind and missiles by surrounding structures. A modification will be implemented that will provide alternate SG feed connections in the interior and exterior doghouses that can supply makeup to all four SGs. These alternate SG feed connections will be fully protected against external events by virtue of being located within the Category I doghouse structures.

2. Tornado/Hurricane Force Wind ELAP Events:

The CAST is assumed to be unavailable, and Phase 1 coping relies on automatic alignment of the TDAFW suction to the buried condenser circulating water piping headers, which can provide at least two days of cooling water. Phase 2 will then be implemented using one or more of the following approaches:

* Manually realign the TDAFW pump suction to the UHS by manually opening the ac motor operated nuclear service water (RN) valves

*Align low pressure portable pump(s) to deliver raw water makeup from the UHS to the SGs. The primary SG feed connection is already available (a pre-existing connection installed pursuant to the Section B.5.b mitigating strategy) and can be used in conjunction with the low pressure portable pumps to provide makeup to all four SGs. This connection is located on top of the Auxiliary Building and is protected on the north and south sides from wind and missiles by surrounding structures. A modification will be implemented that will provide alternate SG feed connections in the interior and exterior doghouses that can supply makeup to all four SGs. These alternate SG feed connections will be fully protected against external events by virtue of being located within the Category I doghouse structures.

MNS procedures will be written in accordance with PWROG generic FLEX Support Guidelines (FSGs) for each of these options. For use of the low pressure pump option, the SGs will be depressurized below the discharge pressure of the low pressure pump but above a pressure that would result in injection of nitrogen from the cold leg accumulators (~300 psig) into the RCS. The pumps will be specified and procured to provide enough flow (~300 gpm) to remove decay heat.

Additional discussion of use of portable pumps is included in Section 3.2.1.8, above.

On pages 53 and 54 in its Integrated Plan, in the enclosure of PWR Portable Equipment Phase 2, the licensee lists eleven diesel or electric pumps of varying flow rates and pressure capacities covering the described core, containment, and SFP makeup capabilities to satisfy the N+1 site quantity specified in NEI 12-06 for FLEX equipment. (The alternate approach described in section 3.1.3.1 of this TER, if implemented, would alter the number of portable pumps.) Additionally, various size hoses and connectors are listed, although quantities and lengths are not currently specified. On pages 59 and 60 of 61 of its Integrated Plan, in the enclosure of PWR Portable Equipment Phase 3, the licensee notes that additional pumps and other equipment are to be provided from offsite by the RRC to act as spares to existing Phase 2 equipment stored on 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 use of portable pumps, if these requirements are implemented as described.

3.2.2 Spent Fuel Pool Cooling Strategies

NEI 12-06, Table 3-2 and Appendix D summarize one acceptable approach for the SFP cooling strategies. This approach uses a portable injection source to provide 1) makeup via hoses on the refuel deck/floor capable of exceeding the boil-off rate for the design basis heat load; 2)

makeup via connection to SFP cooling piping or other alternate location capable of exceeding the boil-off rate for the design basis heat load; and alternatively 3) spray via portable monitor nozzles from the refueling deck/floor capable of providing a minimum of 200 gallons per minute (gpm) per unit (250 gpm to account for overspray). This approach will also provide a vent pathway for steam and condensate from the SFP.

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

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

On page 39 of its Integrated Plan the licensee described that a modification will install two separate wide-range level instruments in accordance with NRC Order EA-12-051.

During normal plant operation, the SFP will not reach the boiling point after an ELAP/LUHS event for at least 17 hours based on the licensee's analysis. Adequate SFP inventory exists to provide personnel shielding well beyond the time of boiling. Therefore, the licensee concludes no coping strategies are required for Phase 1. However, in non-tornado events where the portion of the RWST above the missile shield cannot be damaged, the RWST can be aligned to the SFP to maintain inventory by gravity feed.

On page 40 of its Integrated Plan, the licensee described the primary and alternate methods for SFP makeup. For the primary method, makeup water will be provided from the UHS to the SFP using a high capacity diesel operated pump. Water will be sprayed into the pool above the operating deck using an existing Section B.5.b mitigating strategy spray nozzle. Once SFP boiling begins, a steam release pathway must be established to minimize potential infiltration of steam into areas of the Auxiliary Building. The steam release pathway will be through the Fuel Building roll-up truck bay door.

For the alternate method, makeup water will be provided from the UHS to the SFP using a high-capacity diesel-operated pump. Water will be directed through a connection to the SFP cooling system located outside the Fuel Building and inside the Auxiliary Building. The connection is being added by a modification. The MNS SFP has been analyzed for various boron dilution events to remain subcritical within established soluble boron concentration limits. Further evaluation will be performed to ensure predicted makeup water dilution rates in the SFPs for the coping strategies described herein are bounded.

On page 43 of its Integrated Plan, the licensee describes that the Phase 3 strategy is a continuation of the Phase 2 strategy. Phase 3 equipment will be used to backup Phase 2

equipment in use to supply SFP makeup. Depending on extent of damage, Phase 3 equipment will be used to repower emergency buses and restore normal SFP cooling.

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

3.2.3 Containment Functions Strategies

NEI 12-06, Table 3-2 and Appendix D provide some examples of acceptable approaches for demonstrating the baseline capability of the containment strategies to effectively maintain containment functions during all phases of an ELAP. For example: containment pressure control/heat removal utilizing containment spray or repowering hydrogen igniters for ice condenser containments. MNS has an ice condenser, pressure suppression containment.

In support of its Integrated Plan, the licensee performed a GOTHIC calculation to demonstrate that no actions would be required to remove heat from the containment for the first 72 hours following an ELAP event. On page 32 of its Integrated Plan, the licensee described that the MNS Reactor Building (the containment) includes a metal containment vessel and annulus region between the metal containment and a reinforced concrete enclosure. The containment vessel design pressure is 15 psig. The MNS containment is initially passively cooled by an ice condenser. The containment analysis was performed based on reactor coolant pump seal leakage that decreased with RCS pressure over time.

On page 34 of its Integrated Plan, the licensee describes primary and alternate strategies to manage containment. Tables 3-2 and D-2 of NEI 12-06 both include a Containment Integrity safety function for PWRs with ice condenser containments. Specifically, the guidance directs licensees with ice condenser containments to re-power the permanently installed containment hydrogen igniters as a part of their strategy. For the MNS primary strategy, one train of hydrogen igniters will be re-powered and restored to service in Phase 2 using portable power. Containment Spray (CS) capability will be restored in accordance with PWROG generic FLEX Support Guidelines, if required. An analysis will be performed to validate that containment spray for temperature/pressure control is not required over the long term. If the long term containment analysis determines that containment temperature and/or pressure will reach unacceptable levels over the long term, connections installed for Section B.5.b containment spray mitigating strategies will be used with the portable diesel driven pumps to supply water from the UHS to the connections located in the Auxiliary building. As discussed in the six month update to the Integrated Plan, dated August 28, 2013, upon further evaluation, the licensee has determined that if the FLEX strategy is needed for containment temperature/pressure mitigation, new connections will be installed and B.5.b connections will not be used. Additional analysis has verified that the annulus portion of the containment does not increase in pressure during the long term, since it passively relieves through the annulus HVAC system (VE) exhaust dampers.

For the alternate strategy, the opposite train of hydrogen igniters can be re-powered and restored to service in Phase 2 using portable power. If the long term containment analysis determines that containment temperature and/or pressure will reach unacceptable levels over the long term, a modification will be performed to add a connection leading to the 'A' containment spray header. A diesel-powered pump will be used to supply water from the UHS to the connection at the pressure and flow rate required to establish a spray field in containment. The completion of the long-term containment analysis and the incorporation of

any actions determined to be necessary based on its results is identified as Confirmatory Item 3.2.3.A in Section 4.2.

On page 37 of its Integrated Plan the licensee describes that the following additional actions will be taken to maintain containment:

1. Fans in containment that circulate air will be restored as required to cool the cubicle areas and to prevent the increase in temperature from having an adverse impact on essential instrumentation.

2. Evaluate other long term strategies for cooling containment such as circulating the air volume in the annulus.

The timing and necessity of taking the above actions is also being evaluated as a part of the long-term containment analysis previously identified as Confirmatory Item 3.2.3.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 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.

In its Integrated Plan, the licensee made no reference regarding the need for, or use of, additional cooling systems necessary to assure that coping strategy equipment functionality can be maintained. Nonetheless, the only portable equipment used for coping strategies identified in the Integrated Plan that would require some form of cooling are portable diesel powered pumps and generators. These self-contained commercially available units would not be expected to require an external cooling system nor would they require AC power or normal access to the UHS.

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

for equipment cooling, if these requirements are implemented as described.

3.2.4.2 Ventilation – Equipment Cooling

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

> *Plant procedures/guidance should consider loss of ventilation effects on specific energized equipment necessary for shutdown (e.g., those containing internal electrical power supplies or other local heat sources that may be energized or present in an ELAP.*
>
> ELAP procedures/guidance should identify specific actions to be taken to ensure that equipment failure does not occur as a result of a loss of forced ventilation/cooling. Actions should be tied to either the ELAP/LUHS or upon reaching certain temperatures in the plant. Plant areas requiring additional air flow are likely to be locations containing shutdown instrumentation and power supplies, turbine-driven decay heat removal equipment, and in the vicinity of the inverters. These areas include: steam driven AFW pump room… the control room, and logic cabinets. Air flow may be accomplished by opening doors to rooms and electronic and relay cabinets, and/or providing supplemental air flow.
>
> Air temperatures may be monitored during an ELAP/LUHS event through operator observation, portable instrumentation, or the use of locally mounted thermometers inside cabinets and in plant areas where cooling may be needed. Alternatively, procedures/guidance may direct the operator to take action to provide for alternate air flow in the event normal cooling is lost. Upon loss of these systems, or indication of temperatures outside the maximum normal range of values, the procedures/guidance should direct supplemental air flow be provided to the affected cabinet or area, and/or designate alternate means for monitoring system functions.
>
> For the limited cooling requirements of a cabinet containing power supplies for instrumentation, simply opening the back doors is effective. For larger cooling loads, such as … AFW pump rooms, portable engine-driven blowers may be considered during the transient to augment the natural circulation provided by opening doors. The necessary rate of air supply to these rooms may be estimated on the basis of rapidly turning over the room's air volume.
>
> Actuation setpoints for fire protection systems are typically at 165-180°F. It is expected that temperature rises due to loss of ventilation/cooling during an ELAP/LUHS will not be sufficiently high to initiate actuation of fire protection systems. If lower fire protection system setpoints are used or temperatures are expected to exceed these temperatures during an ELAP/LUHS, procedures/guidance should identify actions to avoid such inadvertent actuations or the plant should ensure that actuation does not impact long term operation of the equipment.

On page 48 of its Integrated Plan, the licensee described that a Heating, Ventilation, Air-Conditioning (HVAC) analysis will be performed to demonstrate that the ambient room temperatures and hydrogen concentrations (vital battery rooms only) would remain acceptable in critical areas with no additional action.

On page 2 of Attachment 1A of the Integrated Plan, Sequence of Events, item 17 at time 8-24 hours specifies, “Install portable fans and HVAC (powered by portable generators).”

On page 8 in its Integrated Plan for new time constraints identified in the Sequence of Events, item 17 describes that use of portable fans or HVAC units may eventually be required to remove heat or hydrogen (in the case of the vital battery rooms). The response times of 8 to 24 hours are estimated based on existing analyses and engineering judgment. Calculations will be performed to determine room heatup and hydrogen accumulation rates in the vital battery room and heatup rates in the interior doghouses.

On page 4 of Attachment 1A of the Integrated Plan, Sequence of Events, item 28 at time 48 hours refers to cooling critical instrumentation in containment. On page 9 in its Integrated Plan for item 28, the licensee describes that methods will be initiated to circulate and cool air in lower containment subcompartments to prevent any adverse impact on critical instrumentation.

On page 1 of Attachment 1A of the Integrated Plan, Sequence of Events, item 7 at time 2 hours specifies, “Open control room doors.” On page 7 in its Integrated Plan for item 7, the licensee describes that based on analysis the control room doors must be opened at two hours to maintain acceptable control room temperatures.

On page 2 of Attachment 1A of the Integrated Plan, Sequence of Events, item 12 at time 4-15 hours specifies, “Open spent fuel pool roll up doors.” On page 7 in its Integrated Plan for item 12, the licensee describes that the SFP roll-up doors are opened in accordance with NEI 12-06 to vent steam from the SFP building.

During the audit process, the licensee stated that doors to the battery room areas will be opened (Phase 1) to promote air movement prior to Phase 2 FLEX implementation. Fans will be provided for hydrogen mitigation in Phase 2 as necessary (i.e., when the chargers are connected), which will also serve to cool the battery rooms. An evaluation of battery room hydrogen concentration showed that after doors are opened, volatile concentrations would not be reached for many days even after recharging strategies were implemented. Exhaust airflow will be provided during Phase 2 from FLEX equipment to mitigate both hydrogen and temperature in the battery rooms as necessary.

During the audit process, the licensee also provided additional information describing that no equipment cooling concerns existed for any mitigating strategies.

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

3.2.4.3 Heat Tracing

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

> *Plant procedures/guidance should consider loss of heat tracing effects for equipment required to cope with an ELAP. Alternate steps, if needed, should be identified to supplement planned action.*

> Heat tracing is used at some plants to ensure cold weather conditions do not result in freezing important piping and instrumentation systems with small diameter piping. Procedures/guidance should be reviewed to identify if any heat traced systems are relied upon to cope with an ELAP. For example, additional condensate makeup may be supplied from a system exposed to cold weather where heat tracing is needed to ensure control systems are available. If any such systems are identified, additional backup sources of water not dependent on heat tracing should be identified.

In several sections of its Integrated Plan, the licensee describes that MNS will evaluate the need to provide freeze protection for critical instrumentation and exposed FLEX connections.

During the audit process, the licensee provided additional information and stated that no heat tracing is required for successful implementation of the FLEX strategies.

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

Regarding lighting, on page 46 of its Integrated Plan the licensee described that hard hat LED lights have been procured to ensure operators can safely move through the plant during an ELAP and that diverse storage locations will be provided for the hard hat lighting.

Appendix R emergency battery-backed lighting is currently available in many areas where manual actions (eg. connecting hoses, power cables, or operating pumps or compressors) are required. The lighting is nominally rated for 8 hour capacity.

On page 2 of Attachment 1A of the Integrated Plan, Sequence of Events, item 26 at time 24 hours describes that portable lighting (beyond head and hand lamps) would be provided by this time.

On page 9 in its Integrated Plan for new time constraints identified in the Sequence of Events, for item 26, the licensee describes that portable lighting will be put into place around 24 hours as resources become available.

On page 57 of the Integrated Plan, in the table listing PWR Portable Equipment Phase 2, a line item of "(21) lighting strings" is included.

Regarding communications, on page 46 in its Integrated Plan, the licensee describes that enhancements to current communications systems and equipment used during an emergency event are being evaluated pursuant to the 10 CFR 50.54(f) letter of March 12, 2012. The ultra high frequency (UHF) system is relied upon for emergency communication between the control room and the field. The UHF radio communication system was seismically evaluated to assess the system seismic ruggedness. The UHF system cabinet anchorage and antennae mounting were determined to be seismically rugged. The UHF radio system is protected by Category I structures, with the exception of some outdoor antennas. Communication system enhancements are proposed as follows:

* Secure the internal cabinet batteries

* Improve the UHF system ruggedness and reliability in the event of a tornado/wind missile

* Upgrade battery capacity from 4 hours to provide sufficient time for establishing a portable power supply to the system in Phase 2

* Provide additional Technical Support Center (TSC) antennae for portable satellite phones.

As part of the NTTF Recommendation 9.3, the NRC issued a letter on March 12, 2012 requiring NRC licensees to perform a Communications Assessment. This assessment was performed in accordance with NEI 12-01. The results of this assessment identified that prior to any planned improvements the communications systems available to the site personnel for internal communications would be sound-powered phones and radios used in line-of-sight mode. MNS is in the process of upgrading the UHF system as described above.

The licensee provided communications assessment in its letters dated October 31, 2012, and February 22, 2013 (ML12311A028 and ML13058A066) in response to the NRC March 12, 2012 50.54(f) request for information letter. As documented in the staff analysis provided in the letter dated May 13, 2013 (ML13108A167), the NRC staff has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Confirmation will be required that upgrades to the site's communications systems have been completed. This has been identified as Confirmatory Item 3.2.4.4.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 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 Integrated Plan lacked any discussion regarding access to Protected Area and internal locked areas in an ELAP. During the audit process, the licensee provided additional information describing that access to protected areas will not be hindered.

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), states:

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

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

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

NEI 12-06 Section 9.2 states,

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

On page 42 in its Integrated Plan, the licensee describes a modification to add a connection to the SFP cooling system header outside the SFP building to address habitability concerns if operators had to enter the building.

This is the only information provided in the integrated plan that specifically addresses personnel habitability. While a connection to the SFP cooling system header outside the SFP building to ensure habitability for operators will be added, other information pertaining to ventilation and

cooling is presented and discussed above in section 3.2.4.2 of this review pertaining to ventilation and cooling for equipment functionality. That information may also pertain to personnel habitability, but further details and clarification is needed to credit both equipment and personnel concerns.

During the audit process, the licensee provided additional information describing that room heat up response for specific MNS areas has been evaluated as acceptable, except that the containment evaluation has not been completed. As noted previously, the containment evaluation is being tracked as Confirmatory Item 3.2.3.A. Confirmatory Item 3.2.4.6.A in Section 4.2 will track the NRC's review of the room heatup response.

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

3.2.4.7 Water Sources

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

> *Plant procedures/guidance should ensure that a flow path is promptly established for makeup flow to the steam generator/nuclear boiler and identify backup water sources in order of intended use. Additionally, plant procedures/guidance should specify clear criteria for transferring to the next preferred source of water.*
>
> Under certain beyond-design-basis conditions, the integrity of some water sources may be challenged. Coping with an ELAP/LUHS may require water supplies for multiple days. Guidance should address alternate water sources and water delivery systems to support the extended coping duration. Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles are assumed to be available in an ELAP/LUHS at their nominal capacities. Water in robust UHS piping may also be available for use but would need to be evaluated to ensure adequate NPSH can be demonstrated and, for example, that the water does not gravity drain back to the UHS. Alternate water delivery systems can be considered available on a case-by-case basis. In general, all CSTs should be used first if available. If the normal source of makeup water (e.g., CST) fails or becomes exhausted as a result of the hazard, then robust demineralized, raw, or borated water tanks may be used as appropriate.
>
> Heated torus water can be relied upon if sufficient [net positive suction head] NPSH can be established. Finally, when all other preferred water sources have been depleted, lower water quality sources may be pumped as makeup flow using available equipment (e.g., a diesel driven fire pump or a portable pump drawing from a raw water source). Procedures/guidance should clearly specify the conditions when the operator is expected to resort to increasingly impure water sources.

The licensee addressed water sources for coping strategies in its Integrated Plan for Core Cooling & Heat Removal, Maintain RCS Inventory Control, Maintain Containment, and Maintain Spent Fuel Pool Cooling. This aspect of the coping strategies has already been reviewed in sections 3.2.1, 3.2.2, and 3.2.3.

Makeup flow is promptly (immediately) established to the steam generators during the initial phase of the ELAP strategies by existing automatic actions using the TDAFW pumps and an available water supply (the condensate storage tanks if available, otherwise the condenser circulating water piping).

On pages 5 and 6 in its Integrated Plan, the licensee describes that the MNS nuclear service water intake and discharge headers from the UHS can gravity feed to the suction of the TDAFW pumps if normally closed valves are opened. Additionally, the intake is approximately 40 feet under water, thus loss of access to the UHS is assumed to result only from the loss of ac power to the motor operated valves that would normally automatically align this flow path. Two independent, full safety-related flow paths from the UHS to the TDAFW pumps exist and could be locally aligned during an ELAP event.

There was no discussion in the Integrated Plan pertaining to plant procedures specifying that a flow path is promptly established for makeup flow to the steam generators and identifying backup water sources in order of intended use; and that plant procedures/guidance should specify clear criteria for transferring to the next preferred source of water. This has been identified as Confirmatory Item 3.2.4.7.A identified in Section 4.2.

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

3.2.4.8 Electrical Power Sources/Isolations and Interactions

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

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

On page 48 in its Integrated Plan the licensee described that portable power procedures will be developed in accordance with PWROG generic FLEX Support Guidelines. A portable power distribution scheme will be developed consistent with this guidance to energize required equipment using portable diesel generators, transformers, power panels and cables. Equipment required to be re-powered include the vital batteries, the CLA isolation valves, and the hydrogen igniters.

There was no discussion in the Integrated Plan describing that the portable power procedures being developed would include appropriate electrical isolations and interactions. During the audit process, the licensee stated that electrical isolation during FLEX deployment will be administratively controlled (i.e., procedurally): (a) Portable flex electrical distribution system will be regulated and include circuit breakers in the circuits feeding the Class 1E busses; (b) All

breakers except for target load(s) including the plant installed main and alternate feed to the bus will be opened to prevent paralleling sources.

During the audit process, the licensee also stated the FLEX DG sizing evaluation is still being performed; there are several FLEX strategies that have not been fully scoped related to the ongoing containment response evaluations. The FLEX DG sizing has been identified as Confirmatory Item 3.2.4.8.A identified in Section 4.2.

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

3.2.4.9 Portable Equipment Fuel

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

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

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

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

On page 49 in its Integrated Plan the licensee described that fuel oil will be provided from the buried EDG fuel oil tanks, which are robust, using portable fuel oil transfer pumps. The fuel oil will be stored in diesel fuel oil tanker trucks for delivery to portable equipment when required. A fuel oil evaluation will be performed to assess long-term FLEX equipment fuel oil requirements. This is identified as Confirmatory Item 3.2.4.9.A in Section 4.2.

On page 54 of the Integrated Plan in the table listing PWR Portable Equipment Phase 2, a line item of "(2) Fuel oil storage trucks" is included. Regarding fuel oil transfer capability, during the audit process the licensee described that there is a diesel powered fuel transfer/filter trailer currently located at the plant site. This equipment is used by the plant procedures to connect to the Fuel Oil Storage Tank recirculating pump piping to provide additional filtration of the fuel or to transfer the fuel from the storage tank to tanker trucks. This equipment will be stored in a FLEX storage facility and staged as part of the FLEX response to obtain fuel from the underground tanks as needed. This equipment is supplemented by the site fuel oil trucks and a FLEX dedicated fuel oil truck which also have the capability of drafting from the underground tanks and from the fuel supply tanks for plant equipment located at the site garage. Small 12 V dc fuel oil pumps have been purchased and will be staged in the FLEX storage facilities for use in drafting limited quantities of fuel from underground tanks.

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

requirements are implemented as described.

3.2.4.10 Load Reduction to Conserve DC Power

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

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

On page 1 of Attachment 1A of the integrated plan, Sequence of Events, item 8 at time 2 hours directs action to de-energize the vital bus sequencer to prevent automatic cycling of breakers and resulting reduction in vital battery capacity.

On page 1 of Attachment 1A of the Integrated Plan, Sequence of Events, item 10 at time 3 hours directs action to disconnect non-critical loads to preserve vital batteries. On page 7 in the Integrated Plan for new time constraints identified in the Sequence of Events, for item 10 describes that non-critical loads must be disconnected within three hours to preserve the vital batteries.

On page 2 of Attachment 1A of the Integrated Plan, Sequence of Events, item 19 at time 8-24 hours directs action to recharge vital batteries. On page 8 in the Integrated Plan for new time constraints identified in the Sequence of Events, item 19 describes that the vital batteries will conservatively be recharged in 8 to 24 hours. An analysis indicates that vital battery capacity is greater than 24 hours. Future strategies will ensure that battery capability is extended to ensure batteries can be recharged prior to loss of dc power in Phase 2.

On page 45 in its Integrated Plan, the licensee describes that a vital battery load reduction scheme has been developed that includes powering only those components and instrumentation that are essential to supporting the FLEX strategy. Instrumentation will be maintained consistent with PWROG recommendations. Non-critical loads must be disconnected within three hours to preserve vital batteries. This strategy will ensure battery capability is extended to ensure batteries can be recharged in Phase 2, prior to loss of dc power.

On page 48 of its Integrated Plan, the licensee describes that the vital batteries will be recharged within the first 8 to 24 hours.

The coping time analysis is contained in Reference 23 of the integrated plan, "Duke Energy Calculation MCC-1381.05-00-0351, *U1/2, 125VDC Vital I&C Power System (EPL) Battery SBO Coping Time Estimate, (IER L 1 11-4)*." During the audit process, the licensee stated that dc load profile is provided in the site calculation for existing ELAP dc load stripping strategy. This calculation is being revised to take additional 1.25 load factor to account for 80% aging. The site calculation shows that dc power for 2 of 4 channels can be maintained for 24 hours without a charger in place. The NRC staff needs to verify the battery sizing calculation (when revised) which shows that dc power for 2 of 4 channels can be maintained for 24 hours without a charger in place. This has been identified as Confirmatory Item 3.2.4.10.A in Section 4.2.

During the audit process, the licensee also stated that two of the four essential DC channels will be completely stripped. The remaining two channels will be stripped of non-ELAP required instrumentation. Some non-essential loads will be left that are considered prudent and had little impact on times, such as breaker control power required to recover power. A list of remaining critical instrumentation is provided for operator reference in an enclosure to procedure ECA-0.0. All dc loads will be stripped by opening breakers in the Control Room and Battery Room per ECA-0.0. Confirmation that ELAP procedures/guidance will direct operators to conserve dc power during the event by stripping nonessential loads as soon as practical has been identified as Confirmatory Item 3.2.4.10.B identified in Section 4.2.

Review of the Integrated Plans for MNS revealed that the Generic Concern related to battery duty cycles beyond 8 hours is applicable to the plant. The Generic Concern related to extended battery duty cycles, has been resolved generically through the NRC endorsement of NEI position paper entitled "Battery Life Issue" (ADAMS Accession No. ML13241A186 (position paper) and ML13241A188 (NRC endorsement letter)).

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

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

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to load reduction 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, following item (15) states:

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

NEI 12-06, Section 11.5 states:

1. FLEX mitigation equipment should be initially tested or other reasonable means used to verify performance conforms to the limiting FLEX requirements. Validation of source manufacturer quality is not required.
2. Portable equipment that directly performs a FLEX mitigation strategy for the core, containment, or SFP should be subject to maintenance and testing[1] guidance provided in INPO AP 913, Equipment Reliability Process, to verify proper function. The maintenance program should ensure that the FLEX equipment reliability is being achieved. Standard industry templates (e.g., EPRI) and associated bases will be developed to define specific maintenance and testing including the following:
    a. Periodic testing and frequency should be determined based on equipment type and expected use. Testing should be done to verify design requirements and/or basis. The basis should be documented and deviations from vendor recommendations and applicable standards should be justified.

[1] Testing includes surveillances, inspections, etc.

   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 11 in its Integrated Plan the licensee describes that equipment associated with FLEX mitigation strategies will be procured as commercial equipment with design, storage, maintenance, testing, and configuration control in accordance with NEI 12-06 Section 11.1.

On pages 53 – 58 of its Integrated Plan, in the listing of Phase 2 portable equipment, the licensee indicates that maintenance for all equipment (except debris removal and additional equipment such as chain saws) will be performed in accordance with the requirements of NEI 12-06, Section 11.5.

In review sections 3.1.1 through 3.1.5, above, details regarding storage are discussed for each analyzed hazard.

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

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

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

3.3.2 Configuration Control

NEI 12-06, Section 11.8 states:

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

On pages 11 and 12 in its Integrated Plan, the licensee described that equipment associated with FLEX mitigation strategies will be procured as commercial equipment with design, storage, maintenance, testing, and configuration control in accordance with NEI 12-06 Section 11.1. The FLEX strategies and basis will be maintained in overall FLEX basis documents. Existing plant configuration control documents will be modified to ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies in accordance with NEI 12-06 Section 11.8.

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, Training, states:

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

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

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

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

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

On page 12 in its Integrated Plan, the licensee describes that training will be initiated through the Systematic Approach to Training (SAT) process. Training will be developed and provided to all involved plant personnel based on any procedural changes or new procedures developed to address and identify FLEX activities. Applicable training will be completed prior to the implementation of FLEX.

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 pages 12 and 13 in its Integrated Plan the licensee described that the industry will establish two (2) RRCs to support utilities during beyond-design basis events. Each RRC will hold five sets of equipment, four of which will be able to be fully deployed when requested. The fifth set will have equipment in a maintenance cycle. Equipment will be moved from an RRC to a local Assembly Area, established by the SAFER team and the utility. Communications will be established between the affected nuclear site and the SAFER team, and required equipment moved to the site as needed. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request. A contract has been signed between the site and the Pooled Equipment Inventory Company to provide Phase 3 services and equipment.

The licensee’s Integrated Plan addressed the use of off-site resources to obtain equipment and commodities to sustain and backup the site’s coping strategies (Guideline 1). However, the plan did not address implementation Guidelines 2 through 10. This has been identified as Confirmatory Item 3.4.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 off site resources, if these requirements are implemented as described.

4.0 OPEN AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number/ Status	Description	Notes

3.2.1.2.A	RCP Seal leakage rates - During the audit process the licensee provided additional information that Westinghouse will be assisting MNS in providing further information regarding seal leakage. Evaluate any additional analyses.	
3.2.1.3.A.	Decay Heat - Values of the following key parameters used to determine the decay heat should be specified and the adequacy of the values evaluated: (1) initial power level, (2) fuel enrichment, (3) fuel burnup, (4) effective full power operating days per fuel cycle, (5) number of fuel cycles, if hybrid fuels are used in the core, and (6) fuel characteristics are based on the beginning of the cycle, middle of the cycle, or end of the cycle.	
3.2.1.8.A	The PWROG submitted to NRC a position paper, dated August 15, 2013, which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlined applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available. During the audit process, the licensee informed the NRC staff of its intent to abide by the generic approach discussed above; however, the NRC staff concluded that the August 15, 2013, position paper was not adequately justified and that further information is required.	

4.2 CONFIRMATORY ITEMS

Item Number/ Status	Description	Notes
3.1.1.2.A	Deployment of FLEX equipment - On page 57 of its Integrated Plan, in the chart identifying Pressurized Water Reactor (PWR) Portable Equipment Phase 2, the licensee lists (9) 9X12 trailers used to store and deploy power equipment, but does not list tow vehicles. Confirm abilities to move FLEX equipment and the level of protection afforded the means to move.	
3.1.1.3.A	Procedural interfaces, seismic - Confirm evaluation that confirms time is available to deploy ground water sump pumps as needed in critical locations in addition to the vicinity of the TDAFW pump.	
3.1.1.4.A	Off Site Resources, seismic – Confirm development of the MNS playbook as well as identification of the local Assembly Area and routes to the plant.	
3.1.3.1.A	Protection of FLEX equipment, high winds - Site	

	specific data to justify the assumed tornado width of 1200 feet will be required to confirm the final locations of the FLEX storage facilities conform to NEI 12-06 guidance.	
3.1.5.2.A	Deployment of FLEX equipment, high temperatures - Confirm that the storage facilities will be designed for extreme temperature ranges including concerns for expansion of sheet metal, swollen door seals, etc.	
3.2.1.A	RCS Cooling and Heat Removal, and RCS Inventory Control Strategies - Jjustify the use of the analysis from Sections 5.2.1 and 5.2.2 of WCAP-17601 by identifying and evaluating the important parameters and assumptions demonstrating that they are representative of MNS and appropriate for simulating the ELAP transient.	
3.2.1.1.A	Computer Code Used for ELAP Analysis - Reliance on the NOTRUMP code for the ELAP analysis of Westinghouse plants is limited to the flow conditions prior to reflux condensation initiation. This includes specifying an acceptable definition for reflux condensation cooling.	
3.2.1.2.A	RCP seals - For the plants using Westinghouse RCPs and seals that are not the SHIELD shutdown seals, the RCP seal initial maximum leakage rate should be greater than or equal to the upper bound expectation for the seal leakage rate for the ELAP event (21 gpm/seal) discussed in the PWROG white paper addressing the RCP seal leakage for Westinghouse plants.	
3.2.1.2.B	RCP seals - In some plant designs, such as those with 1200 to 1300 psia SG design pressures and no accumulator backing of the main steam system power-operated relief valve (PORV) actuators, the cold legs could experience temperatures as high as 580 degrees F before cooldown commences. This is beyond the qualification temperature (550 degrees F) of the O-rings used in the RCP seals. For those Westinghouse designs, a discussion of the information (including the applicable analysis and relevant seal leakage testing data) should be provided to justify that (1) the integrity of the associated O-rings will be maintained at the temperature conditions experienced during the ELAP event, and (2) the seal leakage rate of 21 gpm/seal used in the ELAP is adequate and acceptable.	
3.2.1.2.C	RCP seals - If the seals are changed to the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals, the acceptability of the use of the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals should be addressed, and	

	the RCP seal leakages rates for use in the ELAP analysis should be provided with acceptable justification.	
3.2.1.4.A	Initial Values for Key Plant Parameters and Assumptions – Confirm results and appropriate actions subsequent to Westinghouse supplying McGuire with additional information regarding the key plant parameters and assumptions.	
3.2.1.7.A	Confirm that MNS will abide by the generic resolution for shutdown and refueling concerns.	
3.2.3.A	Containment Functions Strategies - Confirm completion of the long term containment analysis and appropriate actions.	
3.2.4.4.A	Lighting and Communications - Confirmation will be required that upgrades to the site's communications systems have been completed.	
3.2.4.6.A	Ventilation for Equipment Cooling and Personnel Habitability - Room heat up response for specific MNS areas are completed but need to be evaluated by NRC personnel. Confirm completion of evaluation and appropriate actions.	
3.2.4.7.A	Water Sources - Confirm that plant procedures specify that a flow path is promptly established for makeup flow to the steam generators and identify backup water sources in order of intended use; and that plant procedures/guidance should specify clear criteria for transferring to the next preferred source of water.	
3.2.4.8.A	Electrical Power Sources - Confirm completion of Flex DG sizing calculation and appropriate actions.	
3.2.4.9.A	Portable Equipment Fuel - Confirm completion of evaluation and appropriate actions to assess long-term FLEX equipment fuel oil requirements.	
3.2.4.10.A	The battery sizing calculation needs to be verified when revised to show that dc power for 2 of 4 channels can be maintained for 24 hours without a charger in place.	
3.2.4.10.B	Load Reduction to Conserve DC Power - Confirm that ELAP procedures/guidance will direct operators to conserve dc power during the event by stripping nonessential loads as soon as practical.	
3.4.A	Offsite Resources - Confirm 12-06 Section 12.2 Guidelines 2 through 10 are covered in the SAFER playbook when finalized.	