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

January 14, 2014

First Energy Nuclear Operating Company
Perry Nuclear Power Plant, Unit 1
Docket No. 50-440

Prepared for:

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

Contract NRC-HQ-13-C-03-0039
Task Order No. NRC-HQ-13-T-03-0001
Job Code: J4672
TAC No. MF0962

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Technical Evaluation Report

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

1.0 BACKGROUND

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

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

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

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

Guidance and strategies required by the Order would be available if a loss of power, motive force and normal access to the ultimate heat sink needed to prevent fuel damage in the reactor and SFP affected all units at a site simultaneously. The Order requires a three-phase approach for mitigating BDBEEs. The initial phase requires the use of installed equipment and resources

to maintain or restore key safety functions including core cooling, containment, and SFP cooling. The transition phase requires providing sufficient portable onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from offsite. The final phase requires obtaining sufficient offsite resources to sustain those functions indefinitely.

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

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

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

2.0 EVALUATION PROCESS

In accordance with the provisions of Contract NRC-HQ-13-C-03-0039, Task Order No. NRC-HQ-13-T-03-0001, Mega-Tech Services, LLC (MTS) performed an evaluation of each licensee's Integrated Plan. As part of the evaluation, MTS, in parallel with the NRC staff, reviewed the original Integrated Plan and the first 6-month status update, and conducted an audit of the licensee documents. The staff and MTS also reviewed the licensee's answers to the NRC staff's and MTS's questions as part of the audit process. The objective of the evaluation was to assess whether the proposed mitigation strategies conformed to the guidance in NEI 12-06, as endorsed by the positions stated in JLD-ISG-2012-01, or an acceptable alternative had been proposed that would satisfy the requirements of Order EA-12-049. The audit plan that describes the audit process was provided to all licensees in a letter dated August 29, 2013 from Jack R. Davis, Director, Mitigating Strategies Directorate (ADAMS Accession No. ML13234A503).

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

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

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

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

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

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

3.0 TECHNICAL EVALUATION

By letter dated February 27, 2013, (ADAMS Accession No. ML13064A243), and as supplemented by the first six-month status report in a letter dated August 26, 2013 (ADAMS Accession No. ML13238A260), First Energy Nuclear Operating Company (FENOC or the licensee) provided Perry Nuclear Power Plant's (PNPP) Unit 1 Integrated Plan for Compliance with Order EA-12-049. The Integrated Plan describes the strategies and guidance under development for implementation by FENOC 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 Hazard

NEI 12-06, Section 5.2 states:

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

On page 2 of the Integrated Plan, the licensee referenced the UFSAR Section 2.5, which provides the seismic criteria for PNPP. The seismic criterion includes two design basis earthquake spectra: Operating Basis Earthquake (OBE) and the Safe Shutdown Earthquake (SSE). The Integrated Plan states that the maximum horizontal acceleration for the SSE is 0.15g and 0.075 for the OBE and that the maximum vertical response spectrum for the SSE is 0.15g and 0.075g for the OBE.

On page 7 of the Integrated Plan, the licensee states that the seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 are not complete. As the re-evaluations are completed, appropriate issues will be entered into the corrective action program (CAP) and addressed on a schedule commensurate with other licensing changes.

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

3.1.1.1 Protection of FLEX Equipment – Seismic Hazard

NEI 12-06, Section 5.3.1 states:

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

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

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

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

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

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

On pages 20, 31, and 38 of the Integrated Plan the licensee states that PNPP plans to store the FLEX Pumps and hoses in an existing robust building meeting the requirements for storage of FLEX equipment. The diesel pumps (trucks and towable) will likely be stored in the Unit 2 Auxiliary Building (AB). This is an existing building designed to site seismic criteria. FLEX equipment will be secured as appropriate during an SSE and will be protected from seismic interactions from other components. No components will be stacked or at a raised elevation to cause interference with the deployment of any FLEX equipment.

On page 45 of the Integrated Plan the licensee states that a FLEX storage building will be constructed to be seismically robust per the requirements of ASCE 7-10. Equipment inside the building will be secured in such a way that it will not be damaged by a seismic event.

During the audit process, the licensee was requested to provide a discussion of the equipment location and how the equipment will be secured to protect it from being damaged by a seismic event. In response, the licensee stated that the current PNPP FLEX storage strategy will include the use of three separate storage locations. Two existing plant Unit 2 Seismic Category 1 structures will serve as FLEX storage locations, in addition to the new FLEX Storage Building constructed to ASCE 7-10 requirements.

The licensee stated that the Unit 2 portions of the Emergency Diesel Generator (EDG) Building will be used to house one FLEX Phase 2 Pump, and both of the FLEX Phase 2 Generators ("N" and "N+1" equipment). In addition, the second FLEX pump will be stored in the Unit 2 AB. The new FLEX storage building will house other "N+1" equipment.

On page 19 of the Integrated Plan, the licensee lists several modifications necessary to support Phase 2 core cooling including the installation of hydrants and piping. On Page 20 of the Integrated Plan, the licensee describes the plan protecting the Phase 2 equipment, but does not discuss the design or protection of the hydrants or piping.

During the audit, the licensee was requested to provide information describing the design and protection of the hydrants and piping and whether they are provided reasonable protection from seismic events. In response, the licensee stated the new buried pipe run originating at the barge slip and terminating within the Emergency Service Water Pump House (ESWPH) will be seismically installed and buried sufficiently below grade to provide the required protection. The hydrants at the barge slip will be protected via robust and qualified structures that will provide both debris and environmental protection.

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 storage for seismic hazards, if these requirements are implemented as described.

3.1.1.2 Deployment of FLEX Equipment – Seismic Hazard

NEI 12-06, Section 5.3.2 states:

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

On pages 21 and 46 of the Integrated Plan, the licensee states that site evaluations have determined that no soil liquefaction will occur during a seismic event.

On page 10 of the Integrated Plan, the licensee states that deployment and routing paths are shown in Attachment 3 of the Integrated Plan. However, the licensee did not state whether all the deployment paths have been evaluated for routing through seismic structures with seismic connection points, the need for ac power to deploy FLEX equipment, or if the means to move equipment will be protected.

During the audit, the licensee was asked to provide a discussion on how the PNPP intends to conform to the guidance in NEI 12-06, Section 5.3.2, Considerations 2 through 5. In its response, the licensee stated, that with the exception of the barge slip, FLEX primary coping strategy actions are performed inside seismically qualified structures, which includes the connection points for cooling water located in the ESWPH.

The licensee stated that Consideration 3 is not applicable to PNPP because the site is located on Lake Erie and has no downstream dams.

The licensee stated that the doors for the FLEX storage location will not require power supplies to open and that the ability to manually open storage location doors will be included in the design and/or modification of any FLEX storage location. In addition, the licensee stated that procurement of heavy duty trucks will be considered to assist in the movement of FLEX equipment, as necessary, and will be stored in either Unit 2 seismic structures or the new FLEX storage building.

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

3.1.1.3 Procedural Interfaces – Seismic Hazard

NEI 12-06, Section 5.3.3 states:

> There are four procedural interface considerations should be addressed.
>
> 1. Seismic studies have shown that even seismically qualified electrical equipment can be affected by 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 (see Section 3.2.1.10). This reference source should include control room and non-control room readouts and should also provide guidance on how and where to measure key instrument readings at containment penetrations, where applicable, using a portable instrument (e.g., a Fluke meter). Such a resource could be provided as an attachment to the plant procedures/guidance. Guidance should include critical actions to perform until alternate indications can be connected and on how to control critical equipment without associated control power.
>
> 2. Consideration should be given to the impacts from large internal flooding sources that are not seismically robust and do not require ac power (e.g.,

gravity drainage from lake or cooling basins for non-safety-related cooling water systems).

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

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

On pages 16, 19, 35, 38, and 40 of the Integrated Plan, the licensee specified that they will develop procedures to read instrumentation locally, where applicable, using a portable instrument. However the Integrated Plan did not include consideration of critical actions to perform until alternate/local indications can be connected, or whether the PNPP has guidance in place that includes instructions on how to control critical equipment without indications.

During the audit, the licensee was asked to address conformance with NEI 12-06, Section 5.3.3, Consideration 1. In response, the licensee stated that as part of the PNPP mitigation strategy, a specific FLEX Support Guideline (FSG) will be written to provide operator direction on obtaining readings of critical plant parameters. This FSG will include the compilation reference document identified in Consideration 1. Provisions will be provided to allow plant parameters to be obtained locally utilizing portable instrumentation, or restored via operator action utilizing power supplied by the FLEX Phase 2 generators.

The Integrated Plan did not address procedural interface considerations for seismic hazards associated with large internal flooding sources that are not seismically robust and do not require ac power. During the audit, the licensee was asked to provide a discussion of any large internal flooding sources that are not seismically robust and do not require ac power. In response, the licensee stated that one flooding source is the Circulating Water System and that failure of this system internal to plant structures will result in flooding of the turbine power complex (TPC), Turbine Building (TB), and heater bay (HB). The licensee stated that there are no FLEX related operator actions within these plant locations. Plant design provides for flooding of the TPC, TB, and HB during a circulating water system failure without flooding of the AB or other safety related structures. In addition, the licensee stated that no equipment required for the FLEX coping strategy is located in these plant areas.

The licensee stated that another potential source of flooding is from the Radwaste Storage Tanks, which are located internal to the plant in the lowest elevation of the Radwaste Building. However, the licensee states that the piping configuration which connects plant floor drains and equipment sumps within the Radiologically Restricted Area (RRA) to the receiving tanks is physically routed in such a way that gravity backflow will not result in flooding of plant areas which support FLEX actions.

The Integrated Plan does not discuss whether a strategy to remove ground water will be required. During the audit, the licensee was asked to provide a discussion on the PNPP ground water mitigation strategy. In response, the licensee stated that the Plant Underdrain System consists of an active subsystem with several automatic and manually-activated pumps to discharge groundwater away from plant structures in order to maintain groundwater below an elevation of 568 ft.-6 in. The licensee stated that in the event of a total failure of all of these pumps, the gravity discharge portion of this system will maintain groundwater elevation below a static groundwater elevation of 590 ft. and that this elevation maintains the hydrostatic

pressures on plant structures within acceptable limits. However, PNPP is planning to evaluate providing ac power to the Plant Underdrain pumps for additional margin.

The licensee's response did not provide enough detail describing how the gravity discharge portion of this system will maintain groundwater elevation below 590 ft. with no pumping power when the flood level around the plant may be at 620 ft. A discussion is needed describing how the gravity drain from elevation 590 ft. will function in flood waters at 620 ft. This is identified as Confirmatory Item 3.1.1.3.A in Section 4.1.

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

3.1.1.4 Considerations in Using Offsite Resources – Seismic Hazard

NEI 12-06, Section 5.3.4 states:

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

On page 13 of the Integrated Plan, the licensee states that the industry will establish two (2) Regional Response Centers (RRCs) to support utilities during a BDBEE. Equipment will be moved from an RRC to the near site staging area, established by the Strategic Alliance for FLEX Emergency Response (SAFER) team and the utility. The Integrated Plan does not discuss any primary or secondary staging areas and deployment paths, the effects of seismic events on the deployment strategies for receiving offsite resources, or any applicable contingency plans. During the audit, the licensee stated that evaluation of site access routes will be addressed during the development of the PNPP SAFER Response Plan (playbook). Site actions from the playbook require assessment of the access routes to the site to allow delivery of required equipment. In addition, the licensee stated that provisions for access to the site via air routes are being developed to allow delivery of equipment and supplies from the RRC. The final development of these plans is identified as Confirmatory Item 3.1.1.4.A. in Section 4.2.

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

3.1.2 Flooding Hazard

NEI 12-06, Section 6.2 states:

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

NEI 12-06, Section 6.2.1 states in part:

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

On page 3 of the Integrated Plan, the licensee states that the flood assessment for the PNPP site, provided in the updated safety analysis report (USAR), considered four prospective sources of flooding: Lake Erie, intense local precipitation, and flooding by two small, nameless streams which border the site to the east and south. The licensee states that flooding from Lake Erie is extremely improbable because the maximum monthly mean lake elevation is approximately 45 feet below plant grade elevations of 617 to 620 ft. The licensee states that the Probable Maximum Flood (PMF) reaches an elevation of 620 ft.-5 in. and that the site building floor elevations are at an elevation of 620 ft.-6 in. The licensee states that localized flooding from the streams during a PMF will not affect plant buildings or equipment. However, the licensee states that localized ponding may occur but that the resulting increase in surface elevation of water flowing over the surrounding roads and railroads (acting as weirs) would not exceed one inch. The licensee states that because safety-related equipment is protected from the PMF and that floor elevations of safety-related structures are above the PMF, PNPP is considered a "dry" site and is not susceptible to external flooding.

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.

On page 3 of the Integrated Plan, the licensee states that final grade elevations for the plant were 617 ft. to 620 ft. However the licensee states that the PMF elevation is 620 ft.-5 in. Because the PMF elevation is above 617 ft., some places at PNPP may be susceptible to flooding. However, because the site building floor elevations are at 620 ft.- 6 in., the licensee screened PNPP as a dry site. As a result, the licensee did not discuss how flooding between 617 ft. and the PMF elevation would affect the deployment of FLEX equipment and associated FLEX coping strategies.

During the audit, the licensee was asked to identify any site elevations below the PMF and how flooding at these elevation would impact storage and deployment of FLEX equipment. In response, the licensee stated that a stream would flood the area of plant access road above, and in the vicinity of a stream culvert. The flooding of the stream is confined to the owner controlled area (OCA) and does not affect areas of the protected area (PA). The licensee stated that the flooding of the stream will reach an elevation of approximately 620 ft. in the PA and that this may affect FLEX deployment actions in the PA. The licensee stated that the Plant Power Block buildings and existing building used for FLEX storage have a ground floor elevation of 620 ft.-6 in. and that the new storage building design will take the flooding re-analysis results into consideration.

During the audit, the licensee was asked to provide information describing the location of the new FLEX storage building. In response, the licensee stated that the new FLEX storage building will be constructed to provide additional and diverse storage locations for FLEX equipment in addition to the storage capacity provided in the Unit 2 structures. The licensee stated that the design details for the FLEX Storage Building have not yet been finalized but that the building will be designed and constructed to the requirements of ASCE 7-10, and will comply with the specifications of NEI 12-06.

On page 17 of the Integrated Plan, the licensee states that diesel-driven pumps will be staged at the barge landing area near Lake Erie. However, the licensee did not discuss the elevation of the barge landing or other staging areas in the Integrated Plan. During the audit, the licensee was requested to provide the elevations of all FLEX equipment that will be deployed or staged across the site. In response, the licensee stated that the flooding re-analysis will need to be reviewed to determine the potential impacts. The location of FLEX equipment that will be deployed or staged needs to be finalized. This is identified as Confirmatory Item 3.1.2.1.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 protection of FLEX equipment during a flooding hazard if these requirements are implemented as described.

3.1.2.2 Deployment of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.2 states:

> There are a number of considerations which apply to the deployment of FLEX equipment for external flood hazards:
>
> 1. For external floods with warning time, the plant may not be at power. In fact, the plant may have been shut down for a considerable time and the plant configuration could be established to optimize FLEX deployment. For example, the portable pump could be connected, tested, and readied for use prior to the arrival of the critical flood level. Further, protective actions can be taken to reduce the potential for flooding impacts, including cooldown, borating the RCS, isolating accumulators, isolating RCP seal leak off, obtaining dewatering pumps, creating temporary flood barriers, etc. These factors can be credited in considering how the baseline capability is deployed.
>
> 2. The ability to move equipment and restock supplies may be hampered during a flood, especially a flood with long persistence. Accommodations along these lines may be necessary to support successful long-term FLEX deployment.
>
> 3. Depending on plant layout, the [ultimate heat sink] 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.

On page 3 of the Integrated Plan, the licensee states that because the final site grade at PNPP is one inch above the PMF elevation, PNPP is considered a dry site. As a result, the licensee does not address NEI 12-06, Section 6.2.3.2, Considerations 1-9. Given the low margin available between the maximum plant grade and the PMF elevation, the licensee was asked to provide a discussion addressing NEI 12-06, Section 6.2.3.2, Considerations 1-9. In response, the licensee stated that a flooding re-analysis is currently in progress and once the re-analysis is complete, site modifications will be performed, as required, to resolve flooding hazards.

On page 21 of the Integrated Plan, the licensee states that flooding of deployment paths and resulting debris is not expected. However, the licensee states that the FLEX equipment includes a front-end loader that can be used to clear the route if necessary.

On page 44 of the Integrated Plan, the licensee states that portable diesel powered air compressors will be deployed to re-establish the air capability to control components at the plant. The licensee states that the primary connection to the A train instrument air (IA) is in the Fuel Handling Building (FHB) and that the secondary connection to the IA system is an existing fitting on the B train at the 620 ft. elevation of the AB with a pipe run to the A train.

During the audit the licensee was asked to discuss why the location of the secondary connection to the IA system at the 620 ft. elevation of the AB is not susceptible to flooding. In response, the licensee described the location and elevation of the existing pipe run and the new pipe run between A and B trains. In addition, the licensee stated that the new pipe run would be protected from flooding.

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 for 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.

On page 3 of the Integrated Plan, the licensee states that because the final site grade at PNPP is 1 in, above the PMF elevation, PNPP is considered a dry site. As a result, the licensee does not address NEI 12-06, Section 6.2.3.3, Considerations 1-3. Given the low margin available between the maximum plant grade and the PMF elevation, the licensee was asked to provide a discussion addressing NEI 12-06, Section 6.2.3.2, Considerations 1-3. In response, the licensee stated that a flooding re-analysis is currently in progress and once the re-analysis is complete, modifications to site procedures will be performed, as required, to resolve flooding hazards.

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

On page 3 of the Integrated Plan, the licensee states that they are developing procedures and strategies for delivery of offsite FLEX equipment during Phase 3 that consider regional impacts from flooding. During the audit, the licensee was asked to provide an assessment of the flooding potential for low level roadways around PNPP site, the Lake Erie area and the staging area for the offsite FLEX equipment. In response, the licensee stated that an evaluation of site access routes would be addressed during the development of the PNPP playbook. The licensee stated that site actions from the playbook require assessment of the access routes to the site to allow delivery of required equipment. In addition, the licensee stated that provisions for access to the site via air routes are being developed to allow delivery of equipment and supplies from the RRC. This has been included with Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.3 High Winds Hazard

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

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

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

On page 3 of the Integrated Plan, the licensee states that Figures 7-1 and 7-2 from NEI 12-06 were used for to assess high wind hazards for PNPP. In addition, the licensee states that Figure 7-1 of NEI 12-06 indicates that the high wind speed from a hurricane at PNPP does not exceed 130 mph. The licensee also states that Figure 7-2 of NEI 12-06 indicates a maximum wind speed of 188 mph for Region I plants including PNPP. The licensee states that high wind hazards are applicable to the PNPP site.

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

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

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

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

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

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

  - Consistent with configuration b., the axis of separation should consider the predominant path of tornados in the geographical location.
  - Consistent with configuration b., stored mitigation equipment should be adequately tied down.

On pages 20, 31, 38, and 46 of the Integrated Plan, the licensee states that protection of associated FLEX equipment from hazards associated with severe storms with high winds will be provided by the Unit 2 EDG Building and the Unit 2 AB which are designed as Seismic Category 1, and the new FLEX storage facility will be constructed to the requirements of ASCE 7-10.

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

3.1.3.2 Deployment of FLEX Equipment – High Wind Hazard

NEI 12-06, Section 7.3.2 states:

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

As discussed in Section 3.1.3 of this evaluation, PNPP screens out for high wind hazards due to hurricanes. As a result, Considerations 1, 2, and 5 of NEI 12-06, Section 7.3.2 are not applicable.

In the Integrated Plan, the licensee does not discuss a plan for debris removal following a tornado or other high wind event. During the audit, the licensee was asked to provide additional information about expected debris following a tornado or other high wind event, and to discuss the plan for debris removal at PNPP. In response, the licensee stated that PNPP has several travel paths that can be used to deploy the FLEX portable equipment. The licensee stated that debris from tornados should consist mostly of large tree limbs and building materials such as roofing and siding (a major failure of the buildings on site is not expected). The licensee plans to purchase additional diverse equipment (e.g., front end loader, bobcat, and heavy duty trucks) to assist in debris removal along with any identified portable equipment such as saws). In

addition, the licensee stated that the major equipment to be moved are the FLEX portable pumps and that the pumps will be staged in multiple locations so that a single blocked travel path will not prevent deployment.

In the Integrated Plan, the licensee does not discuss the protection for equipment used to transport FLEX equipment. During the audit, the licensee was asked to provide information regarding the protection of equipment used to transport FLEX equipment. In response, the licensee stated that the FLEX pumps (fire trucks) are self-powered and will be housed within seismic Category 1 structures and that the generators will be "staged in place" within seismic Category 1 structures. In addition, the licensee stated that procurement of heavy duty trucks is being reviewed to support various event mitigation activities. If purchased, the licensee states that the trucks will be stored in either seismic category 1 or ASCE 7-10 structures.

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 in a high wind hazard if these requirements are implemented.

3.1.3.3 Procedural Interfaces – High Wind Hazard

NEI 12-06, Section 7.3.3 states:

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

On page 11 of the Integrated Plan, the licensee states that PNPP participates in the BWROG and will implement the FSGs in a timeline to support the implementation of FLEX by Spring 2015. The BWROG is generating guidelines to assist utilities with the development of site-specific procedures to cope with an ELAP in compliance with the requirements of the strategies described for PNPP, which are consistent with the Alternate Means of Heat Removal strategies developed for the BWR 6 Mark 3 plants. The BWROG report (GE Hitachi Report NEDC-33771P/NEDO-33771, Revision 1, "GEH Evaluation of FLEX Implementation Guidelines," ADAMS Accession No. ML130370742, hereinafter NEDC-33771P) will be updated to reflect these and incorporate these strategies at the next revision.

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

3.1.3.4 Considerations in Using Offsite Resources – High Wind Hazard

NEI 12-06, Section 7.3.4 states:

> Extreme storms with high winds can have regional impacts that could have a significant impact on the transportation of off-site resources.
>
> 1. Sites should review site access routes to determine the best means to obtain

resources from off-site following a hurricane.

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

As discussed in Section 3.1.3 of this evaluation, high wind speed from a hurricane at PNPP is not expected to exceed 130 mph. As a result, Consideration 1 of NEI 12-06, Section 7.3.4 is not applicable.

On page 13 of the Integrated Plan, the licensee states that equipment will be moved from an RRC to the near site staging area, established by the SAFER team and the utility. The licensee does not discuss any primary or secondary staging areas and deployment paths, the effects of tornados or high wind events on the deployment strategies for receiving offsite resources, or any applicable contingency plans.

During the audit, the licensee was asked to provide a discussion of the utilization of off-site resources in the context of the high winds hazard. In response, the licensee stated that evaluation of site access routes would be addressed during the development of the PNPP playbook. The licensee stated that site actions from the playbook require assessment of the access routes to the site to allow delivery of required equipment. In addition, the licensee stated that provisions for access to the site via air routes are being developed to allow delivery of equipment and supplies from the RRC. This has been included with Confirmatory Item 3.1.1.4.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 use of off-site resources during high wind hazards if these requirements are implemented as described.

3.1.4 Snow, Ice and Extreme Cold Hazard

As discussed in part 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 4 of the Integrated Plan, the licensee stated that PNPP is above the 35th parallel and therefore must provide the capability to address extreme snowfall with snow removal equipment. The licensee stated that, according to Figure 8-1 of NEI 12-06, PNPP is located in the area where a 3-day snowfall of up to 36 inches should be anticipated. The licensee further states that PNPP is a Level 3 region as defined by NEI 12-06, Figure 8-2 and therefore the PNPP FLEX strategies must consider the impact of ice storms.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and provides reasonable

assurance that the requirements of Order EA-12-049 will be met with respect to screening for snow, ice, and extreme cold hazards if these requirements are implemented as described.

3.1.4.1 Protection 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.).

On pages 20, 31, 38, and 46 of the Integrated Plan, the licensee states that all FLEX equipment will be stored in locations that provide general protection from snow, ice, and extreme cold temperatures and FLEX equipment will be maintained at a temperature within a range to ensure its likely function when called upon. Heating of the FLEX storage facilities will ensure that the equipment is maintained at a temperature of at least 55 degrees F.

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

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

NEI 12-06, Section 8.3.2 states:

> There are a number of considerations that apply to the deployment of FLEX equipment for snow, ice, and extreme cold hazards:

1. The FLEX equipment should be procured to function in the extreme conditions applicable to the site. Normal safety-related design limits for outside conditions may be used, but consideration should also be made for any manual operations required by plant personnel in such conditions.

2. For sites exposed to extreme snowfall and ice storms, provisions should be made for snow/ice removal, as needed to obtain and transport 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 3 of the Integrated Plan, the licensee stated that in extreme low temperatures it is possible that the cooling lake will develop frazil ice on its surface; however, the intake structures to the UHS are approximately 2,600 feet offshore and well below the surface of the water.

During the audit process, the licensee indicated that the PNPP mitigation strategy does not rely on access to the UHS (Lake Erie) through the normal plant intake structure. As part of normal plant design, if the intake structure would for some reason become unavailable e.g., blockage, collapse, the plant has the ability to align the discharge structure as a suction supply. The heated water is then returned to the environment by way of the swale. (The reviewer noted that this flow path is described in the PNPP UFSAR, Section 9.2.1.2.) The PNPP Integrated Plan discussion on the normal plant intake and discharge structures was included for reference purposes only. Initial conceptual design of the FLEX intake structures was matched to the depth and off-shore distance of the normal plant intake structures to demonstrate acceptability in terms of ice blockage concerns. The licensee indicated that the PNPP FLEX strategy will not use the existing plant intake and discharge structures.

The licensee was requested to discuss the evaluation of deployment paths regarding snow, ice and extreme cold hazards. During the audit process, the licensee indicated that with respect to Consideration 1, procurement specifications for FLEX equipment will include specifications for operation in extreme cold conditions. In accordance with NEI 12-06, normal safety-related temperature limits will be applied. PNPP will have debris removal equipment available which will also be capable of snow/ice removal. The heavy duty trucks under review for procurement, if procured for debris removal and equipment transport, will also have snow removal equipment installed (e.g., snow plows). The licensee stated that Bobcats® are also capable of removing snow/ice in more physically restrictive areas and that a Bobcat® has already been purchased and is currently on site, but did not identify the model or type. Additionally, the site will evaluate the need to have a readily available supply of liquid deicing agent 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 deployment of FLEX equipment – snow, ice, and extreme cold hazard if these requirements are implemented as described.

3.1.4.3 Procedural Interfaces – Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.3 states:

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

During the audit process, with respect to the procedural aspects of the plan for deploying equipment for snow, ice and extreme cold, PNPP will incorporate appropriate information and/or direction into plant procedures (likely FSGs). It is anticipated that this procedural guidance will include information on the relevant potential deployment hazards. Information will be contained in these procedures as to which pieces of equipment may be used for mitigation of a specific hazard and the storage location of that equipment for efficient assignment of personnel.

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

During the audit process, the licensee indicated that Phase 3 equipment will be provided by the RRC. Evaluation of site access routes will be addressed during the development of the PNPP playbook. Site actions from the playbook require assessment of the access routes to the site to allow delivery of required equipment. Provisions for access to the site via air routes are being developed to allow delivery of equipment and supplies from the RRC. This has been combined with Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.5 High temperatures Hazard

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

On page 4 of the Integrated Plan regarding the determination of applicable extreme external hazards, the licensee stated that for selection of FLEX equipment at Perry site, the site will consider the site maximum expected temperatures in their specification, storage, and deployment requirements, including ensuring adequate ventilation or supplementary cooling, if 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 screening for the high temperature hazard if these requirements are implemented as described.

3.1.5.1 Protection of FLEX Equipment – High temperature Hazard

NEI 12-06, Section 9.3.1 states:

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

On pages 20, 31, 39, and 46 of the Integrated Plan regarding the strategies for maintaining core cooling, containment, spent fuel pool cooling, and safety function support, respectively, the licensee indicated that protection of associated FLEX equipment from hazards from high temperatures would include adequate ventilation to ensure that high temperatures do not affect the functionality of FLEX equipment. The licensee indicated that they will provide a building with adequate ventilation to ensure that temperatures do not affect functionality of FLEX equipment, although no plan was provided to demonstrate how this will be accomplished. During the audit, the licensee indicated that the design activities related to FLEX equipment storage are not yet complete. The licensee states that they are planning for the storage location(s) to have HVAC systems which may include installed turbine-style ventilation fans and/or air conditioning units.

The licensee defined adequate ventilation as providing a means to control temperature within a specified range to ensure proper equipment operation when called upon. The licensee noted that equipment will be procured using specifications which will include maximum operating temperature values. Given this design input, the equipment will function regardless of ventilation system, however the ventilation equipment will provide additional assurance of equipment operation when called upon.

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

3.1.5.2 Deployment of FLEX Equipment – High temperature Hazard

NEI 12-06, Section 9.3.2 states:

> The FLEX equipment should be procured to function, including the need to move the equipment, in the extreme conditions applicable to the site. The potential impact of high temperatures on the storage of equipment should also be considered, e.g., expansion of sheet metal, swollen door seals, etc. Normal

> safety-related design limits for outside conditions may be used, but consideration should also be made for any manual operations required by plant personnel in such conditions.

During the audit process, the licensee indicated that, as appropriate, extreme high temperatures will be incorporated into equipment specifications used for the procurement of equipment used for deployment and mitigation activities. This will ensure that equipment is able to function in such conditions. This may include equipment with oversized radiators and/or separate fluid coolers (oil/transmission fluid coolers). Equipment, which is currently owned by the station, is commercial and heavy duty equipment (bobcat, fire trucks) and generally serves in such conditions as specified in NEI 12-06, Section 9.3.2. Equipment storage facilities will be designed, constructed and repurposed with the ability to mitigate extreme high temperature conditions.

The licensee also indicated, with respect to plant personnel performing actions under these environmental conditions, the debris removal and deployment equipment (heavy duty trucks, bobcat) are provided with climate control features. The site will evaluate the need for additional high-temperature personal protective equipment such as ice vests, which are used for maintenance purposes in heat stress environments. The site will also maintain a readily available supply of water for personnel hydration purposes.

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

3.1.5.3 Procedural Interfaces – High Temperature Hazard

NEI 12-06, Section 9.3.3 states:

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

During the audit process, the licensee indicated that, as appropriate, extreme high temperatures will be incorporated into equipment specifications used for the procurement of equipment used for deployment and mitigation activities. This will ensure that equipment is able to function in such conditions. This may include equipment with oversized radiators and/or separate fluid coolers (oil/transmission fluid coolers). Equipment, which is currently owned by the station, is commercial and heavy duty equipment (bobcat, fire trucks) and generally serves in such conditions as specified in NEI 12-06, Section 9.3.2. Equipment storage facilities will be designed, constructed and repurposed with the ability to mitigate extreme high temperature conditions.

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

3.2 PHASED APPROACH

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

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

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

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

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

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

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

3.2.1.1 Computer Code Used for ELAP Analysis

NEI 12-06, Section 1.3 states in part:

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

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 Modular Accident Analysis Program (MAAP) Version 4 computer code. MAAP4 was written to simulate the response of both current and advanced light water reactors to Loss of Coolant Accident (LOCA) and non-LOCA transients for probabilistic risk analyses as well as severe accident sequences. The code has been used to evaluate a wide range of severe accident phenomena, such as hydrogen generation and combustion, steam formation, and containment heating and pressurization.

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

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

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

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

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

substantially affect the ELAP analysis performed for that licensee's plant. Although some suggested key phenomena are identified below, other parameters considered important in the simulation of the ELAP event by the vendor / licensee should also be included.

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

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

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

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

3.2.1.2 Recirculation Pump Seal Leakage Models

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

On page 6 of the Integrated Plan, the licensee states that the following sources of expected BWR reactor coolant inventory loss would be included in the reactor transient evaluation

- Normal system leakage,
- Losses from letdown unless automatically isolated or until isolation is procedurally directed,
- Losses due to BWR recirculation pump seal leakage, and
- BWR inventory loss due to operation of steam-driven systems, SRV cycling, and RPV depressurization.

There were no other discussions in the integrated plan of how the seal leakage was determined or even if it was considered in the reactor transient analyses associated with PNPP time line evaluation. The licensee was requested to provide the amount of seal leakage that was used in the PNPP transient analyses and how the seal leakage was determined and for the technical basis for the assumptions made regarding the leakage rate through the recirculation pump seals and other sources.

During the audit process, the licensee described that:

- A qualitative comparison was used to determine the potential Reactor Recirculation pump seal leakage. Compared to the inventory losses resulting from RCIC system steam consumption and SRV cycling, the potential leakage from recirculation pumps was deemed insignificant.

- Calculations prepared in support of the PNPP submittal determined the required Phase 1 flow rate needed to stabilize boil-off, using Suppression Pool water, is approximately 300 gpm. System leakage with the vessel pressurized was estimated to be 66 gpm. This results in a total Phase 1 injection capability of 366 gpm.

- This value is well within the RCIC System injection capacity of 700 gpm.

- Further information regarding the specific assumptions and calculations for quantification of inventory losses are captured in proprietary analysis performed by the vendor used for Integrated Plan preparation.

The licensee was requested to provide the analyses for review. This has been identified as Confirmatory Item 3.2.1.2.A in Section 4.2.

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

3.2.1.3 Sequence of Events (SOE)

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

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

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

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

On page 8 of the Integrated Plan, the licensee describes the SOE and any associated time constraints are identified for PNPP Modes 1 through 4 strategies for FLEX Phases 1 through Phase 3. These actions are bounding when compared to Mode 5 as they require the most personnel, actions, and time constraints. The times identified to initiate each action in this section and in Attachment 1A of the Integrated Plan are based on resource loading to allow completion of all actions prior to their individual time constraints. The time and resources required to complete these tasks have been developed using plant staff walkthroughs and table top evaluations. The action times stated are intended to be the elapsed time after the loss of power due to the external event. Time sensitive completion times are included.

The plant staff walkthroughs and table top evaluations were not documented with an established basis that justifies final numbers and results. The licensee was requested to provide documentation that discusses the plant staff walkthroughs and table top evaluations with an established bases that justifies final action times and results used in the PNPP Integrated Plan.

During the audit process, the licensee described that the intent of the Integrated Plan is to state that walk downs were performed with plant personnel for feasibility of the strategy and for timing considerations of SOEs. Procedures will be developed for operation of FLEX equipment per site procedural requirements. As part of the procedure generation/approval process, physical walkthroughs will be performed to ensure the actions can be implemented in the required timeframes. Additionally, plant operators will be trained to the new procedures and strategies prior to the “go-live” date for FLEX (end of Perry’s 15th Refueling Outage). This will include simulator activities.

On page 26 of the Integrated Plan, the licensee states, in part, that:

> The containment design temperature of 185 °F for the suppression pool will likely be exceeded within 5 hours regardless of actions that can be taken. This limit normally comprises part of the consideration in maintaining containment integrity; however, industry consensus is that this limit should not be inviolable at the conditions and limited time period contemplated for FLEX. Industry initiatives are underway to confirm this position.

During the audit, the licensee was requested to provide a description of the industry initiatives and a timeline when the information will be available for NRC staff review. During the audit process, the licensee stated that:

> The suppression pool temperature limit is based upon the Heat Capacity Temperature Limit as defined in Owner's Group guidance EPG/SAG. This limit would require Emergency Depressurization of the RPV when the limit is exceeded per EPG/SAG Rev 2 guidance. This would result in a loss of High Pressure Injection from steam driven equipment. Changes approved to the EPG/SAG in Revision 3 have addressed the loss of injection due to exceeding limits by modification of the requirements for Emergency Depressurization. These changes allow a partial depressurization of the RPV to allow Steam Driven Equipment to be preserved, and limit the challenges to the RPV and Containment. EPG/SAG Rev 3 guidance is being incorporated into the Perry Emergency Operating Procedures (EOPs) and is scheduled to be effective by mid-year 2014. This will address the issue of exceeding the Heat Capacity

Temperature Limit resulting in the loss of RCIC injection.

The licensee stated that BWROG EPG/SAG, Revision 3, would allow the temperature limit of the suppression pool to be exceeded. Provide the technical justification which demonstrates why exceeding this temperature limit is acceptable and discuss its applicability to PNPP. This is identified as Confirmatory Item 3.2.1.3.A in Section 4.2.

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

3.2.1.4 Systems and Components for Consequence Mitigation

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

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

and,

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

NEI 12-06, Section 3.2.1.12 states:

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

On page 11 of the Integrated Plan, the licensee indicated that equipment associated with these strategies will be procured as commercial equipment with design, storage, maintenance, testing, and configuration control in accordance with NEI 12-06 Revision 0, Section 11. In addition, the licensee states that programs and controls will be established to assure personnel proficiency in the mitigation of beyond-design-basis events are developed and maintained in accordance with NEI 12-06 Rev.0, Section 11.6.

The licensee was requested to provide a summary of non-safety-related installed equipment that is used in the mitigation strategies. In addition, the licensee was also asked to include a discussion of whether the equipment is qualified to survive all ELAP events.

During the audit process, the licensee described that non-safety-related equipment utilized within the base coping strategy includes portions of the Alternate Decay Heat Removal (ADHR)

and SP Clean-Up (SPCU) Systems. The pumps in these systems are used for the "bleed" portion of the "Feed and Bleed" containment cooling method. The portions of these systems which are utilized within the base coping strategy include piping, isolation/boundary valves and pumps. The applicable components will be analyzed to demonstrate the ability to survive the postulated BDBEE. Other non-safety related equipment is being modified; however this equipment only represents additional (i.e. secondary), non-credited portions of the strategy. They are essentially enhancement-type items and are not required to survive the event per the specifications of NEI 12-06. With the exception of the portions of the ADHR and SPCU Systems identified above, the credited strategy for event mitigation utilizes safety-related SSCs.

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

3.2.1.5 Monitoring Instrumentation and Controls

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

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

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

On page 19 of the Integrated Plan, the Key Reactor Parameters for Phase 2 were identified by the licensee as list instrumentation credited for this coping evaluation phase.

- RPV Level
- RPV Pressure
- RPV Temperature
- RCIC Flow Rate
- Containment Pressure

On page 17 of the Integrated Plan, the licensee indicated that the coping strategy for Phase 2 consists of maintaining RCIC operation with an alternate cool water supply or injection with a low pressure source, and removing heat from the suppression pool using a feed and bleed alternate heat removal strategy. Suppression pool level would be an important parameter to

monitor to ensure the pool level does not go below the suction of the pump during a feed and bleed operation. Also, measurement for the temperature of the pool would be necessary to determine when feed and bleed operations should begin. It would appear that suppression pool Level and Temperatures would be important Key Parameters for heat removal for Phase 2, although they were not identified by the licensee as a Reactor Key Parameter identified on page 19 of the Integrated Plan. The licensee was requested to provide an explanation and technical basis why the suppression pool temperature and level are not Key Reactor Parameters for Heat Removal in Phase 2.

During the audit process, the licensee described that the Unit 1 suppression pool temperature and level would be important parameters for observation during the event. These two parameters will be monitored consistent with the approach specified for other key reactor parameters. This instrumentation is dc-powered and would be available for the entire event duration. Procedural guidance will be provided for observation of critical plant parameters for which observation methods differ from normal means. Such instruction will be captured in a new FLEX Support Guideline (FSG). Note that for Feed and Bleed activities; the impact on Unit 1 suppression pool level can be controlled through the monitoring and adjustment of flow rates into and out of the Unit 1 suppression pool. As suppression pool parameters are monitored, flow rate changes may be made to adjust suppression pool level and rate of temperature change.

On page 14 of the Integrated Plan, the licensee stated that:

> The normal water source for the RCIC pump is the condensate storage tank (CST). However, the CST is not considered “robust” as defined in NEI 12-06 for protection from seismic and tornado events. Therefore, the Suppression Pool is credited as the source for the RCIC pump. Suction will be aligned to the alternate suction from the Suppression Pool if the CST is unavailable per existing operations procedure(s).

In the audit process, the licensee was requested to provide information with a discussion that supports the instrumentation to switch RCIC suction from CST to Suppression Pool will remain operational, the switchover function will be accomplished in a timely manner, and that RCIC injection to RPV will remain uninterrupted in the event that the ELAP completely destroys the CST. In addition, the licensee was requested to discuss whether the switchover function during ELAP would be carried out manually or automatically; and if manually, then whether it is carried out from the main control room, or from the remote control panel, or from any other secured and accessible location and should further address whether the switchover function is fail-safe, and the function logic, software, hardware, related piping, valves, SSCs, and CST water level instrumentation to support the switchover function, either manually or automatically, are of safety grade and are qualified for all potential ELAP events including seismic, tornado/high winds, flooding and missiles. If this were not the case, the licensee was requested to justify how switchover of RCIC suction from CST to Suppression Pool would be assured in an ELAP if the CST is not available.

During the audit process, the licensee described that the RCIC system is designed with dual suction; one source being the Unit 1 suppression pool and the second being the Condensate Storage Tank (CST). The suction source is controlled by two interlocked [direct current] DC valves that are controlled from the Unit 1 Control Room. These suction valves automatically align the suction source based upon low CST level or high suppression pool water level signals.

In addition, the Perry CST is not seismic qualified and not fully missile protected and therefore is not credited in the Perry FLEX Submittal. The Unit 1 Suppression Pool is the credited RCIC water source. However, the CST is enclosed by a retention dike that is seismically qualified and missile proof. This retention dike houses the level transmitters for the CST to ensure they are availed for design bases events. RCIC Suction line transfer control (instrumentation/valve control) is safety related and is powered from Divisional DC power and remains available during the conditions postulated in NEI 12-06.

The licensee also described that the RCIC suction is normally aligned [to] the CST during standby conditions. In the event of a CST tank failure, the water volume of the tank is not lost and remains available for use by RCIC System for all cases except where a portion of the tank covers the RCIC/HPCS pump CST suction line tap (located at the bottom of the CST). In the event of RCIC being aligned to the CST and the suction piping from the CST becoming blocked, thereby preventing the CST water from reaching the RCIC pump, the system would trip on low suction pressure once the RCIC turbine has started.

The licensee stated that procedural guidance is provided for operation of the RCIC system under emergency conditions through Alarm Response Instructions (ARIs), Off-Normal Instruction support procedures (ONI-SPIs) and Emergency Operating Procedures support procedures (EOP-SPIs). This guidance provides sufficient detail and guidance to operate RCIC with the exception of the case where the CST fails and covers the RCIC/HPCS suction line. For cases where the CST fails and covers the RCIC/HPCS suction line the current Alarm Response Instruction guidance would only direct the operator to verify a suction source is available without any details as to how to accomplish this task. This guidance is not adequate for use in the FLEX event (due to the time needed to work through multiple procedures). Changes to the applicable EOP-SPIs will be provided as part of the Perry FLEX Project. These changes will add guidance for a low suction pressure trip, directing action to align RCIC suction to the Suppression Pool, if the cause of the trip is a CST Failure. ONI-SPI guidance establishes RCIC suction from the Suppression Pool during system startup and does not require revision to address CST failure. FLEX guidance (FSGs) will be generated and will contain guidance for management of the RCIC Suction source to ensure that all RCIC procedures are consistent to support RCIC operation.

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

3.2.1.6 Motive Power, Valve Controls and Motive Air System

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

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

and,

> Table 12-1 provides a sample list of the equipment expected to be provided to

each site from off-site within 24 hours. The actual list will be specified by each site as part of the site-specific analysis.

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

On page 9 of the Integrated Plan the licensee described that at 16 hours, the diesel powered compressor needs to be started. Calculations have determined that instrument air receiver tanks can support operation of the SRV valves for up to 24 hours. This calculation is based on design leakage and air use for over 200 actuations. The coping analysis estimates less than 200 actuations in 24 hours.

In the Integrated Plan, the licensee referred to calculations for determining the operation of SRVs for up to 24 hours and for SFP heat up and boil off. These calculations did not have a reference identified nor were the assumptions and initial conditions for the calculations stated. The licensee was requested to provide the calculations that support the above evaluations for determining the operation of SRVs for up to 24 hours and for SFP heat up and boil off.

During the audit process, the licensee stated that Westinghouse (WEC) prepared the requested documents in support of the Perry submittal. These documents are currently classified as proprietary by WEC. FENOC is currently working with WEC to release these documents from proprietary status. Once the release is obtained, FENOC will upload the document to the ePortal. This is combined with Confirmatory Item 3.2.1.2.A in Section 4.2.

On page 28 of the Integrated Plan, the licensee described that the current condition of the Unit 2 suppression pool will require upgrade to serve as a watertight temporary repository for Unit 1 suppression pool water. Requirements for Unit 2 water retention and ventilation barrier tightness include closing the 6 open connections below the water line and providing ventilation barriers to those ventilation paths opening into the Unit 1 side to maintain personnel access.

It appears that many PNPP Unit 2 pipes, instruments, valves and connections will be used as part of the Integrated Plan FLEX coping strategies. It is unclear how many of these valves, instruments and pipes that will require upgrades and/or refurbishment to satisfy specifications of NEI 12-06. It is also unclear how the licensee intends to qualify the Unit 2 valves and associated instruments to ensure they are consistent with NEI 12-06 for active use. The licensee was requested to provide a detailed description of the process by which these Unit 2 pipes, instruments and valves that will be used for FLEX coping activities will be returned to operable status, maintained, and tested in the future to ensure that they will be able to perform their function in an ELAP scenario.

During the audit process, the licensee described that PNPP was originally designed and constructed with a number of systems that contained Unit 1 to Unit 2 interfaces and/or common systems that were intended to support operation of both units simultaneously. As part of the cancelation efforts of Unit 2, these systems were modified (either physically of procedurally) to preserve the operation of Unit 1. In some cases, equipment designated as Unit 2 equipment was retained and currently serves in a Unit 1 support capacity. In these cases, the Unit 2 equipment has been maintained in accordance with the requirements of Unit 2 operation (an example would be Unit 2 divisional batteries).

The licensee also described that with one exception, the PNPP mitigation strategy does not rely on any Unit 2 pipes, instruments, valves or connections that were intended for Unit 2-only

service. The PNPP FLEX strategy uses system components and interfaces which currently actively support Unit 1 operation. These components/systems are maintained and tested accordingly and will continue to be maintained and tested. The noted exception is the restoration of Unit 2 Suppression Pool Clean-up piping. As part of the modification process, this piping will be inspected and refurbished as required. New components will be added as required to complete the new interface. Normal testing and maintenance activities will be conducted in accordance with standard site practices to ensure the functionality of these components when called upon.

In addition, the licensee described that the Unit 2 Suppression Pool, the structure has been inspected as part of development of the PNPP Integrated Plan. As part of modification development/implementation, the Unit 2 Suppression Pool will again be inspected and cleaned. Open penetrations will be closed to ensure the integrity of the structure to serve in the new FLEX capacity to act as a storage volume. Unit 2 Suppression Pool instrumentation is not required for implementation of the Perry FLEX Strategies. Sufficient volume is available to accommodate the expected water transfer from Unit 1 Suppression Pool to the Unit 2 Suppression Pool without concerns of over flow of the available volume.

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

3.2.1.7 Cold Shutdown and Refueling

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

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

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

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

PNPP has not informed the NRC of their plan to abide by this generic resolution and their plans to address potential plant specific issues associated with implementing this resolution that have been identified during the audit process. This has been identified as Open Item 3.2.1.7.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 the issue related to the Open Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to the analysis of an ELAP during Cold Shutdown or Refueling, if these requirements are implemented as described.

3.2.1.8 Use of Portable Pumps

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

> 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 18 of the Integrated Plan the licensee describes that core cooling can be maintained after the RPV has been depressurized to less than approximately 50 psig with continued core boiling. This RPV pressure can be achieved from deliberate pressure reduction by using the controlled opening of a SRV (within the 100 degrees F/hr cooldown rate), or by rapid depressurization using a full division ADS initiation. The FLEX diesel pumps are rated to supply 1500 gpm each at 150 psig. Analyses have demonstrated the ability to provide required flow to the RPV at 50 psig. In this strategy, SRV's would be opened to maintain a low pressure condition. SRVs are controlled using dc power from the control room (CR).

Since the analyses was not available for review during the Integrated Plan review, insufficient technical information was presented in the plan to confirm the ability of the portable FLEX pumps to deliver the required flow through the system of flex hoses, couplings, valves, elevation changes, etc. for either the primary or the alternate strategy. The licensee was requested to provide the analyses and/or the calculation on the ePortal that demonstrates proper water flow.

During the audit process, the licensee described that the analyses requested is Westinghouse Report TR-FSE-13-9, “Perry FLEX Integrated Plan," dated February 2013, Revision 2 and that, the document has been uploaded to the ePortal.

On page 15 of the Integrated Plan, the licensee states that the primary and secondary strategies for Mode 4 are the same as those for Modes 1-3 as discussed for core cooling. However, the licensee only discusses a primary strategy for core cooling using RCIC and the SRVs. The licensee was requested to provide information describing the secondary strategies for Phase 1 core cooling.

During audit process, the licensee described that in an ELAP event, system is the only credited injection method. This is in accordance with the guidance of NEI 12-06. Failure of the RCIC system is not required to be assumed by NEI 12-06; however to bound cases where RCIC system is unavailable, or does fail, an alternate (secondary) method for RPV level control was evaluated. If the RCIC System were to fail, an alternate method for vessel injection could be provided via a “Fast Fire Water" method if the Diesel Fire Pump is available. Alternatively, the FLEX Phase 2 pumps (Fire Trucks) could be used in lieu of the Diesel Fire Pump. Either method would require emergency depressurization of the reactor vessel.

The licensee also described that the RPV level is controlled during the event by the Emergency Operating Procedures (EOPs). The EOPs provide guidance for alignment of injection systems to maintain RPV level above the point where adequate core cooling is lost. Change to the EOPs are scheduled to be completed prior to Perry’s 15th Refueling Outage will include use of the FLEX equipment for control of RPV water level. Since any "Fast Fire Water" injection method would require operator action and involve the use of more than only installed plant equipment, this method is not credited as a Phase 1 strategy.

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 equipment if these requirements are implemented as described.

3.2.2 Spent Fuel Pool Cooling Strategies

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

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

NEI 12-06, Section 3.2.1.2 describes the initial plant conditions for the at-power mode of operation; Section 3.2.1.3 describes the initial conditions; and Section 3.2.1.6 describes SFP conditions.

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

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

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

On page 37 of the integrated plan, the licensee indicated that in Phase 2, the spent fuel pool will heat to the boiling point and the level in the pool will continue to reduce. The licensee states that calculations have been performed to determine the time to heat up the SFP and boil down to 10 ft. above the fuel using the maximum heat load associated with a full core offload. After reducing the pool inventory due to seismically induced sloshing, the time to reach 10 feet above the fuel was over 29 hours.

The licensee described that in Phase 2; actions will be taken to align make-up to the SFP using lake water supplied through the ESW pipes to a new spray header over the spent fuel pool. Make-up will be established such that cooling will be maintained throughout the event. Per the SOE, makeup to the SFP is schedule to start six hours into the event.

Additionally, the licensee described that diesel driven pumps will be staged near Lake Erie. Hoses will connect the pumps to hydrants supplied by the lake and to discharge into a hydrant connected by a buried pipe to the ESWPH. In the ESWPH, hoses will be connected between the pipe outlet and installed Storz® connectors on the ESW A or alternately the ESW B pump discharge pipes to allow the lake water to flow to the AB. Within the AB, a new pipe with supply valves will be constructed to direct flow from the ESW system to spray the SFP.

During the audit process, the licensee stated that the new SFP Spray System will be operated during emergency situations via a new FSG. New and revised plant procedure development is currently in progress. The guidance of NEI 12-06, Section 11.4 will continue to be used to support development of new FSGs.

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

3.2.3 Containment Function Strategies

NEI 12-06, Table 3-1 and Appendix C provide a description of the safety functions and performance attributes for BWR containments which are to be maintained during an ELAP as

defined by Order EA-12-049. The safety function applicable to a BWR with a Mark III containment listed in Table 3-1 is Containment Pressure Control/Heat Removal, and the method cited for accomplishing this safety function is Containment Venting or Alternative Containment Heat Removal. The performance attributes listed in Table C-2 also denote the containment's function is to provide a reliable means to assure containment heat removal. JLD-ISG-2012-01, Section 5.1 is aligned with this position stating, in part, that the goal of this strategy is to relieve pressure from the containment.

Furthermore, Tables 3-1 and C-2 both include a Containment Integrity safety function for BWRs with Mark III containments. Specifically, the guidance of NEI 12-06 directs licensees with Mark III containments to re-power the permanently installed containment hydrogen igniters as a part of their strategy.

The licensee states on pages 26-34 of their Integrated Plan that containment limits will not be challenged in Phase 1. However, as stated by the licensee, the current design temperature limit of the suppression pool (SP), which is 185° F, will be exceeded at approximately 5 hours regardless of what actions are taken. During the audit process, the licensee stated that exceeding this limit would be allowed by incorporation of Revision 3 of the BWROG's Emergency Procedure Guideline/Severe Accident Guideline document. The NRC staff has yet to review the technical justification for this new allowance and its applicability to PNPP. This is combined with Confirmatory Item 3.2.1.3.A in Section 4.2.

Furthermore, the NRC staff requested the licensee to provide their plant-specific containment response calculation, commensurate with the level of detail contained in NEDC-33771P. During the audit process, the licensee stated that they were working with Westinghouse Electric Company to resolve a proprietary withholding on the plant-specific calculation which was performed for PNPP, and that it could be made available to the staff once this issue was resolved. This is identified as Confirmatory Item 3.2.3.A in Section 4.2.

The Phase 2 strategy is to control the containment pressure and temperature first by using a FLEX generator to repower valves which will allow cool water from the upper containment pool to flow into the Unit 1 suppression pool and later in Phase 2 by performing a feed-and-bleed of the hot water from the Unit 1 suppression pool to the Unit 2 suppression pool. The water will be moved from the Unit 1 suppression pool to the Unit 2 suppression pool by the Suppression Pool Clean Up (SPCU) pump which will be repowered by a portable 480 vac FLEX generator. The water which is removed from the Unit 1 suppression pool will be made up using water from Lake Erie pumped by FLEX pumps through the Low Pressure Core Spray (LPCS) or High Pressure Core Spray (HPCS) system piping. When supplementary equipment arrives from the RRC (Phase 3), feed-and-bleed operations will be suspended and replaced by the shutdown cooling function of the repowered RHR system. When the licensee repowers the 480 vac vital bus with the FLEX generators mentioned above, they will also be restoring power to the hydrogen igniters as directed by the guidance of NEI 12-06.

The Unit 2 piping of the SPCU system has been abandoned in place, so justification of its ability to perform its function during an ELAP event is necessary. In the audit process, the licensee stated that the piping would be inspected and refurbished as required, and that new components would be added as required to complete the interface to support the strategies. The licensee also stated that normal testing and maintenance activities will be conducted in accordance with standard site practices to ensure the functionality of these components when called upon.

The SPCU pump and piping are not safety grade, seismic category 1 components. The licensee has committed to performing evaluations and possible modifications to designate these items as “robust” such that they may be credited in the mitigation strategies. The successful completion of these evaluations and possible modifications which demonstrate that the SPCU pump and piping are seismically “robust” is identified as Confirmatory Item 3.2.3.B in Section 4.2.

On page 30 of the Integrated Plan, under Key Containment Parameters, the licensee indicated that the list of containment instrumentation credited or recovered for this coping evaluation is

- U1 SP Level
- U1 SP Temperature
- SPCU flow rate
- ADHR flow rate
- Containment Pressure

Since Unit 2 SP is a key part of this coping strategy that requires drainage from Unit 1 SP, the Unit 2 SP level would be a key parameter, although it is not presented as a Containment Parameter. The licensee was requested to explain why Unit 2 SP level is not considered a Key Containment Parameter.

During the audit process, the licensee indicated that Unit 2 suppression pool is normally maintained in a dry condition. Unit 2 was not completed and instrumentation for the Unit 2 suppression pool was not installed. The available volume of the Unit 2 SP is sufficient to receive the expected water transferred from the Unit 1 suppression pool without challenges to exceeding the available storage capacity. There is approximately 3.5 million gallons of capacity within the Unit 2 suppression pool /drywell available to receive “bleed” water resulting from the PNPP strategy. The expected volume of fluid transfer is on the order of one million gallons. There is therefore approximately 300% margin between transferred and storage volumes. Given this, Unit 2 level is not expected to be considered a key parameter. The actual volume of water transferred can be controlled by observing the transfer flow rate and time of transfer to estimate the volume transferred. FSG guidance will be provided to terminate the Bleed of Unit 1 suppression pool prior to exceeding the capacity of the Unit 2 suppression pool.

The licensee also indicated that once water is transferred to the Unit 2 suppression pool it remains stored until such time as recovery actions are put into place to remove the water. This is not part of the FLEX strategy.

The key containment parameters listed for Phase 1 of the Integrated Plan include Drywell Pressure and Drywell Temperature; however, these two key containment parameters are markedly absent from the Phase 2 and Phase 3 lists on pages 30 and 34, respectively. The licensee was requested to clarify whether Drywell Pressure and Drywell Temperature will continue to be monitored throughout Phases 2 and 3 of an ELAP event and if these parameters will not be monitored beyond Phase 1, provide a technical justification for the deactivation of the instruments.

During the audit process, the licensee indicated that key parameters were identified by each sub section of the integrated Plan to address the indications needed for implementation of that section of the response. Key parameters continue to apply throughout the Integrated Plan, even if the parameter is not explicitly identified in a specific subsection of the response. Key

parameters identified in the strategies will be monitored throughout the event and actions to maintain these indications available will be taken, such as restoring power to battery chargers. As part of the PNPP mitigation strategy, a specific FSG will be written to provide operator direction on obtaining readings of critical plant parameters. Provisions will be provided to allow plant parameters to be obtained locally utilizing portable instrumentation, or restored via operator action utilizing power supplied by the FLEX Phase 2 generators. These activities will be captured within the FSG.

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

3.2.4 Support Functions

3.2.4.1 Equipment Cooling – Cooling Water

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

> *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 AB cooling water, service water, or component cooling water may normally be used in order for equipment to perform their function. It may be necessary to provide an alternate means for support systems that require ac power or normal access to the UHS, or provide a technical justification for continued functionality without the support system.

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

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

3.2.4.2 Ventilation – Equipment Cooling

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

> *Plant procedures/guidance should consider loss of ventilation effects on specific energized equipment necessary for shutdown (e.g., those containing internal electrical power supplies or other local heat sources that may be energized or present in an ELAP.*

ELAP procedures/guidance should identify specific actions to be taken to ensure that equipment failure does not occur as a result of a loss of forced ventilation/cooling. Actions should be tied to either the ELAP/LUHS or upon reaching certain temperatures in the plant. Plant areas requiring additional air flow are likely to be locations containing shutdown instrumentation and power supplies, turbine-driven decay heat removal equipment, and in the vicinity of the inverters. These areas include: steam driven [auxiliary feedwater] AFW pump room, HPCI and RCIC pump rooms, the control room, and logic cabinets. Air flow may be accomplished by opening doors to rooms and electronic and relay cabinets, and/or providing supplemental air flow.

Air temperatures may be monitored during an ELAP/LUHS event through operator observation, portable instrumentation, or the use of locally mounted thermometers inside cabinets and in plant areas where cooling may be needed. Alternatively, procedures/guidance may direct the operator to take action to provide for alternate air flow in the event normal cooling is lost. Upon loss of these systems, or indication of temperatures outside the maximum normal range of values, the procedures/guidance should direct supplemental air flow be provided to the affected cabinet or area, and/or designate alternate means for monitoring system functions.

For the limited cooling requirements of a cabinet containing power supplies for instrumentation, simply opening the back doors is effective. For larger cooling loads, such as HPCI, and RCIC pump rooms, portable engine-driven blowers may be considered during the transient to augment the natural circulation provided by opening doors. The necessary rate of air supply to these rooms may be estimated on the basis of rapidly turning over the room's air volume.

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

Actuation setpoints for fire protection systems are typically at 165-180 degrees 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 41 and 42 of the Integrated Plan, under BWR installed Equipment Phase 1, the licensee indicated that the temperature in the RCIC rooms, the HPCI valve room, and other vital plant areas are not expected to be above limits defined in USAR Chapter 3 within the first 24 hours.

On page 43 of the Integrated Plan, under Safety function support for BWR Portable Equipment for Phase 2, the licensee indicated that with the loss of power following a FLEX event a portable generator will have to be connected to important buses in order to provide power to essential

instruments, portable fans for ventilation, vital pumps, and valves. It is estimated that a 750 kW generator will be able to provide the required power.

It was noted that none of these descriptions are consistent with the guidelines for ventilation in NEI 12-06, Section 3.2.2. There are no calculations provided for room heat up for extended ELAP. The portable fans identified on page 43 of the Integrated Plan do not have any requirements for deployment or staging. The licensee was requested to provide information concerning ventilation needs and room heat up calculations that show that effective room cooling of the proposed ventilation equipment is available.

During the audit process, the licensee indicated that procedural changes/actions for the preservation of vital equipment in the RCIC pump room, CR and instrumentation cabinets are provided in existing PNPP SBO procedures.

With respect to the RCIC pump room, the licensee stated the room is passively ventilated during loss of HVAC conditions, and does not rely on the dedicated room cooler or forced ventilation. The RCIC pump room is located at the lowest elevation of the AB and current plant environmental series drawings show that a loss of HVAC event results in a maximum temperature of 141 degrees F for a duration of 100 hours. If required, operator action to open the door to the RCIC pump room would establish a passive draft cooling effect. The licensee concluded it is not expected that this design limit would be exceeded under these conditions.

Also in the audit process, with respect to the CR, the licensee stated the primary heat source during an ELAP would be the instrumentation and controls panels/displays that remain available running off of dc power. The licensee stated that the CR doors could be quickly propped open by plant personnel. Given that the CR is continuously manned, this is not considered to be a resource intensive action. Additionally, per NEI 12-06, instrumentation cabinets can be sufficiently cooled simply by opening panel doors. The licensee concluded these passive strategies are expected to be sufficient for Phase 1 coping.

The licensee noted that for Phase 2, FLEX generators will be brought into service. They stated the generators will be procured with sufficient capacity to support operation of portable ventilation fans for use in plant vital areas. No specific timeframe is established for the deployment of these fans. In accordance with 3.2.2 consideration (10), the licensee indicated that operator observation with specific instruments will determine if supplemental cooling is needed. If needed, procedural direction will establish the ventilation mechanism.

It is not clear that (1) the assumed temperatures of the various critical rooms, e.g., RCIC Room and, CR, are adequately evaluated for the potentially high temperature that may occur in these areas or that (2) time critical actions are not required to be taken to maintain equipment functionality or personnel habitability limits. The licensee was requested to provide analyses to establish the temperature versus time curves to ensure equipment qualification requirements are met and the habitability requirements are met in those areas. This has been identified as Confirmatory Item 3.2.4.2.A in Section 4.2.

The licensee was requested to provide information on the adequacy of the ventilation provided in the battery room to protect the batteries from the effects of extreme high and low temperatures. During the audit process, the licensee indicated that the battery rooms are located internal to safety related plant structures and are therefore not subjected to extreme low temperatures. Operation of the dc distribution system with a loss of ventilation provides a challenge to heat removal from battery operation therefore low temperatures are not a concern

during a FLEX event. The safety-related M23/M24 plant system provides ventilation to the battery rooms to remove hydrogen and provide cooling. As part of the FLEX strategy Phase 2 electrical loads include the battery room exhaust fans and Phase 2 generators will supply the necessary power to support operation of battery room ventilation.

The licensee was requested to provide a discussion of battery room ventilation to prevent hydrogen accumulation while recharging the batteries in phase 2 or 3, and include a description of the exhaust path if it is different from the normal vent path. During the audit process, the licensee indicated that the loads supported by the FLEX Phase 2 generators will include the normal installed divisional battery room ventilation fans. The use of the battery room ventilation systems will alleviate potential hydrogen accumulation during the recharging of batteries. Safety-related electrical distribution buses will be powered via the Phase 2 generators. Selective electrical alignments will be performed by plant personnel through procedural direction and Shift Manager Guidance. The normal design basis ventilation path will be utilized. However, the licensee provided insufficient information on monitoring temperatures and hydrogen concentration levels in the battery rooms to ensure temperature and hydrogen concentration are within acceptable levels. This is identified as Confirmatory Item 3.2.4.2.B in Section 4.2.

The licensee was requested to provide a detailed summary of the analysis and/or technical evaluation performed to demonstrate the adequacy of the ventilation provided in the RCIC pump rooms to support equipment operation throughout all phases of an ELAP.

During the audit process, the licensee indicated that the RCIC room was designed to operate without forced ventilation. Above the RCIC room is an open area which permits communication from the lower elevation to an upper elevation which contains equipment which is not required for FLEX coping. The equipment located on the next elevation is Reactor Water Clean-Up System equipment. Under a postulated ELAP event, a passive flow path would be established by thermal air currents from the RCIC pump room to the next elevation; opening of the RCIC Pump Room door would enhance the passive air flow mechanism. The ELAP scenario is essentially an extended duration Total Loss of AC Power event (TLAC). There were no additional evaluations done to support the current plant design for TLAC operation of the system in regards to room heat up. Contingency plans to supply portable fans were postulated. As needed, power will be supplied to portable ventilation fans via Phase 2 generator(s). This results in a forced ventilation process in which cool air is taken from the Emergency Core Cooling Systems (ECCS) pump rooms hallway, passes through the RCIC pump room and exhausts the heated air through the next elevation.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-0, and subject to the successful closure of issues related to the Confirmatory Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to ventilation equipment cooling if these requirements are implemented as described.

3.2.4.3 Heat Tracing

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

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

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

The licensee was requested to provide information that addresses heat tracing and the potential freezing of piping or instrument lines.

During the audit process, the licensee indicated that the piping associated with the PNPP FLEX strategy, which is maintained water-solid only, includes systems which are in operation during normal plant activities, or maintained filled and vented in standby configurations. This piping is primarily located internal to safety-related plant structures. The one exception to this is the yard portion of the Emergency Service Water (ESW) System between the ESWPH and other plant structures. This piping is buried to a sufficient depth as to preclude the need for freeze protection, i.e., below the frost line. New piping which is to be installed as part of the FLEX modifications is likewise installed within existing plant structures. The only exception to this is the piping originating at the barge slip and running up to the ESWPH. This piping however will be maintained dry under all normal plant conditions buried to a sufficient depth as to preclude the need for freeze protection. The FLEX intake design, which will be used to obtain cooling water for the FLEX strategy, has not yet been finalized. If appropriate, freeze protection mechanism(s) will be provided as part of the final design.

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

3.2.4.4 Accessibility – Lighting and Communication

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

> *Plant procedures/guidance should identify the portable lighting (e.g., flashlights or headlamps) and communications systems necessary for ingress and egress to plant areas required for deployment of FLEX strategies.*
>
> Areas requiring access for instrumentation monitoring or equipment operation may require portable lighting as necessary to perform essential functions.

The licensee's Integrated Plan did not provide adequate information regarding the development of guidance and strategies for portable lighting. The licensee was requested to provide information regarding development of guidance and strategies with regard to the provision of portable lighting.

During the audit process, the licensee indicated that plant procedures/guidance should identity the portable lighting (e. g., flashlights or headlamps) 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 Plant modifications are being evaluated to ensure that there is adequate lighting to safely implement the FLEX strategies. The licensee also indicated that currently a combination of battery backed lighting and restoration of ac power is being evaluated. Flashlights are standard equipment for plant operators. Each operator is expected to have and use a flashlight as needed when in the plant. Normal Appendix R Emergency lighting is available to provide lighting in critical areas during the first part of the event. Critical parameter instrument monitoring will be performed in the Control Room and does not require access to the plant to perform. The PNPP design has critical instruments accessible in back panels of the Main Control Room. Emergency lighting and flashlights are available for use to complete this task.

The NRC staff has reviewed the licensee communications assessment (ML12306A131 and ML13053A366) in response to the March 12, 2012 50.54(f) request for information letter for PNPP and, as documented in the staff analysis (ML13170A334 and ML13170A355) has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by the licensee will conform to the guidance of NEI 12-06 Section 3.2.2, Guideline (8) regarding communications capabilities during an ELAP. Verification of required upgrades 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, if these requirements are implemented as described.

3.2.4.5 Protected and Internal Locked Area Access

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

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

The licensee's Integrated Plan provided no information regarding the development of guidance and strategies with regard to the access to the Protected Area and internal locked areas. Because no information is provided, there is no reasonable assurance that the guidance and strategies developed are consistent with the guidance of NEI 12-06 Section 3.2.2 consideration (9). The licensee was requested to provide information in the PNPP's Integrated Plan that is consistent with NEI 12-06 Section 3.2.2 Guideline (9) with regard to the accessing the Protected Area and internal locked areas.

During the audit process, the licensee indicated that security personnel are included in the minimum site staffing requirements. Consistent with the guidance of NEI 12-06, a security

event is not postulated to occur concurrent with the FLEX event. The minimum staffing security personnel are therefore available to provide support in the opening/unlocking of doors. Under the same justification, security personnel are available to assist in the deployment of FLEX equipment into and out of the Protected Area.

The licensee also indicated that site emergency procedures will be revised, as required, to ensure that security personnel are dispatched in support of event mitigation.

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

3.2.4.6 Personal Habitability – Elevated Temperature

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

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

Section 9.2 of NEI 12-06 states:

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

On pages 41 and 43 of the Integrated Plan, the licensee indicated that instrument function and control room habitability are supported by establishing appropriate control room ventilation. There is no discussion in the PNPP Integrated Plan regarding procedures or protective clothing to protect operators or any discussion on the extent of potential operator stay times in adverse condition locations. The licensee was requested to provide information in the Integrated Plan with regard to procedures or protective clothing to protect operators and discussions on the extent of potential operator stay times in adverse condition locations.

During the audit process, the licensee indicated that the standard PPE will be available for use during the event such as hardhats, gloves and Safety Glasses. Water will also be available to the operators during the event. Adequate clothing for cold weather is available for use in the

Fire Brigade Station (each operator has own bunker gear). The only areas that require extended operator actions are the control room, Diesel Generator building, and barge slip areas. Procedures for control of the control room and Diesel Generator building high temperatures will be provided; low temperature is not expected to be a concern due to the nature of the building (safety-related structures constructed out of concrete, representing a large heat capacity) and heat loading of operating equipment. The barge Slip area is an outside area. The Fire Truck and Fire Engine are heated and normal dress requirements should be sufficient to support low temperature concerns. Additionally, site expectations require plant personnel to carry a copy of the Personal Generation Safety Manual which contains guidance regarding high and low temperatures.

Additional analysis is required to confirm that personnel habitability will be maintained in the various locations where personnel will be required to perform operations. This has been combined with Confirmatory Item 3.2.4.2.A in Section 4.2.

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

3.2.4.7 Water Sources.

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

> *Plant procedures/guidance should ensure that a flow path is promptly established for makeup flow to the 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 or raw water 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 sources of water that the licensee has identified in the Integrated Plan as being available are the CST (potentially unavailable after a BDBEE), the SP and Lake Erie. A discussion of the quality of this water (e.g., suspended solids) and a justification that its use will not result in blockage at the fuel assembly inlets to an extent that would inhibit adequate flow to the core is needed. Alternately, if blockage at the fuel assembly inlets cannot be precluded, an alternate means for assuring adequate core cooling is needed.

During the audit process, the licensee indicated that the suppression pool is a credited source of RPV makeup for all events postulated in the USAR. Water quality is maintained within specified limits per the requirements of the USAR. The water is drawn for the SP through a suction strainer that removes suspended solids. Lake water will be drawn from the barge slip area through dry hydrants. These hydrants will contain a suction strainer to prevent large debris from being drawn into the portable pumps. As part of the dry hydrant design, a third (spare) hydrant is being provided to ensure that flushing operations can be performed, as necessary. Additional filtering of the lake water is accomplished by the ESW Pump Discharge Strainers before the water is delivered to the plant for use. Lake water injected into the RPV is via either the RCIC head spray piping, high pressure core spray (HPCS) sparger, or the low pressure core spray (LPCS) sparger. All three of these flow paths deliver water to the area above the fuel and water will enter the fuel from the top of the fuel assembly. The licensee indicated that a proprietary report was prepared by WEC in support of the PNPP Integrated Plan. This report provides information on the quality of water identified for cooling purposes. The report is identified as proprietary information; however it concludes that 3.0 cubic feet of water precipitate could be introduced over a 72 hour period. The WEC report should be reviewed to ensure that an adequate review of debris and particulates from water sources has been performed. The WEC report was not available for review. This has been identified as Confirmatory Item 3.2.4.7.A in Section 4.2.

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

3.2.4.8 Electrical Power Sources/Isolations and Interactions

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

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

The licensee was requested to provide the basis for the minimum dc bus voltage that is required to ensure proper operation of all required electrical equipment. During the audit process, the licensee indicated that the basis for the minimum bus voltage for Division 1 and Division 2 battery systems is based upon the coil voltage required to operate the 4160 VAC breakers (diesel generator output breakers) on the divisional busses and operation of ADS SRV solenoids. However, the licensee did not provide any reference to the existing analysis or calculation as the basis of the minimum bus voltage. This has been identified as Confirmatory Item 3.2.4.8.A in Section 4.2.

The licensee was requested to provide a summary of the sizing calculation for the FLEX generators to show that they can supply the loads assumed in phases 2 and 3. During the audit process, the licensee indicated that the following list comprises the base coping strategy electrical loads which will be supplied by the primary Phase 2 FLEX generator (“N" unit) with redundant supply from the secondary generator ("N+1“ unit).

ADHR pump 325 hp soft start (240 kW)
SPCU pump 100 hp (75 kW)
Battery Charger (50 kW)
Hydrogen Igniter (15 kW)
Battery Exhaust Fan (7.5 kW)
Fuel Oil transfer Pump (12 kW)
Various Motor Valves, 5 hp each (10 kW)
DC Valves Varies (small loads < 1 kW each)
Radio Repeaters (3 kW)
Temporary Lights (10 kW)
Temporary Fans (20 kW)

In the audit response, the licensee stated a total load of 429 kW. This value does not appear to match the total sum of all the loads above. The licensee is requested to explain how a total load of 429 kW was estimated. This is identified as Confirmatory Item 3.2.4.8.C in Section 4.2.

The licensee also indicated that the Phase 2 FLEX generators will be procured with capacity in excess of this total loading. Current site plans for the PNPP FLEX modification for plant electrical systems provides updates to the electrical distribution system which will allow loading of the FLEX generators to approximately 750 kW. This provides for more than sufficient capacity to satisfy minimum required loads, and allows for potential additional loads to be supplied at the discretion of the Control Room operators and at the guidance of FSG procedures. Additional Phase 3 loading is essentially limited to the power requirements for one RHR pump/motor. This power requirement is satisfied by Phase 3 RRC generator(s). Information has been provided to the RRC, and will be included in the PNPP Playbook to ensure adequate generator capacity is received for plant recovery during Phase 3.

The licensee was also requested to provide electrical single line diagrams showing the proposed connections of Phase 2 and 3 electrical equipment to permanent plant equipment. During the audit process, the licensee indicated that a working electrical diagram will be provided via the ePortal, however the diagram is to be considered to be a working document, and has been prepared as pan of conceptual modification development. It is not to be interpreted as a final design configuration document. The review finds that the applicable changes to the electrical drawing(s) posted on ePortal did not appear to be legible for the mitigation strategies area. The licensee is requested to provide or post a legible copy of electrical drawings on ePortal. This is identified as Confirmatory Item 3.2.4.8.B in Section 4.2.

The licensee was requested to describe how electrical isolation will be maintained such that (a) Class 1E equipment is protected from faults in portable/FLEX equipment and (b) multiple sources do not attempt to power electrical buses.

During the audit process, the licensee indicated that FLEX equipment will be physically disconnected from plant equipment during periods of normal operation or isolated by open manual breakers. Following the onset of a FLEX event, cables (which are expected to be

staged locally to the generators) will be connected to corresponding power receptacles ("docking stations"). Prior to energy being able to reach permanently installed plant equipment several operator actions will be required (closing of breakers). No automatic function is provided to start, sync or load the Phase 2 generators. Procedural guidance (FSGs) will direct the necessary operator actions to connect, start, sync and load the Phase 2 generators. The procedurally controlled breaker alignment will prohibit plant equipment from being energized by multiple power sources.

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

3.2.4.9 Portable Equipment Fuel

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

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

NEI 12-06, Section 3.2.1.3, 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 41 of the Integrated Plan, the licensee indicated that task timing estimates are provided for the diesel fuel oil makeup strategy. These strategies describe the means to provide fuel from the on-site diesel fuel storage tanks to all the FLEX equipment which requires diesel fuel. These fueling strategies will be implemented before on-board FLEX fuel supplies are depleted. The principal fuel oil consumption is for the two FLEX pumps at the barge landing at an estimated 60 gph total. The licensee estimated the initial fuel load of each FLEX pump to be 300 gallons or ten hours of full load operation. The fuel oil for refueling the FLEX pumps can be supplied from the Unit 1 day tank. The total Unit 1 diesel day tank capacity is about 1550 gallons. With the 480V bus reenergized, the underground tanks can refill the day tanks and provide a pressurized hose connection to the FLEX generator. The FLEX generator will have a full 24 hours for diesel fuel on each skid at 75% loading and therefore will not require refueling until Phase 3. To transport the fuel oil, a truck with one 100 gallon tank will be stored, with a full tank, in the FLEX storage facility in the Unit 2 AB. The diesel-driven air compressor will have substantial on-board fuel storage and its small size, 10 cfm, will not require prompt refueling. The portable light stands will be available for use and have approximately a 60 hour operational fuel supply on-board. Portable 25 gallon hand dollies are available to refuel the portable light stands and/or the diesel-driven air compressor.

On Page 48 of the Integrated Plan the licensee indicated that the RRC generator will need a larger fuel supply than can be reasonably supplied from the existing day tanks or underground tanks. Large fuel trucks will be delivered from the RRC to provide indefinite coping for the fuel supply and to allow transfer for minor needs such as the air compressor and the portable lighting stands.

The staff also asked the licensee to explain how fuel quality will be assured if stored for extended periods of time. During the audit process, the licensee indicated that existing on-site safety-related fuel oil supplies include three physically separated underground tanks, one for each division, containing 90,000 gallons each, and one containing 39,375 gallons. Additionally, three qualified day tanks are located in the EDG rooms (one tank per room, approximately 550 gallons per tank). The total on-site volume within safety-related tanks therefore exceeds 220,000 gallons of diesel fuel. The licensee noted that additional non-credited fuel volumes may also be available via the diesel fire pump and auxiliary boiler supplies; however these volumes are not included in the above specified supply. Day tank volumes can be manually drained into transport tanks for use in FLEX equipment. Portable pumps may also be used to transfer fuel from the underground tanks for use in FLEX equipment. Additionally, the Phase 2 generators have been sized to supply power to permanently installed fuel oil transfer pumps to replenish day tank volumes. If needed, the fuel may be directly obtained from the underground supplies through existing tank access points.

The licensee indicated that the fuel supplies referenced above are normally monitored and tested for chemical quality and contaminants. Periodic testing of these diesel generators via monthly surveillance runs consume a quantity of fuel that is later replenished with "fresh" fuel. These activities ensure the quality of the fuel for use during a FLEX event when required. Fuel stored in portable equipment is expected to be maintained per site preventive maintenance strategies tasks, may be tested on a specified frequency, if deemed required. These activities will be determined/established as part of overall FLEX program implementation.

The licensee also noted that much of the site FLEX equipment has not yet been purchased and therefore specific vendor requirements or industry templates have not yet been determined. With respect to refueling of deployed equipment, PNPP is currently evaluating the feasibility of either procuring a fuel trailer (trailer mounted tank with on-board pump mechanism), or mounting a fuel tank within the bed of a heavy-duty truck, with appropriate pumping mechanisms. This has been identified as Confirmatory Item 3.2.4.9.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, 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 pages 41 of Integrated Plan, the licensee indicated maintaining indications and control requires maintenance of battery power, which is extended by cross tying Unit 1 and Unit 2 batteries and performing a load shed on the dc busses. Although the licensee has a procedure that provides guidance on cross tying Unit 1 batteries to Unit 2, it is not clear how the Unit 2 batteries are maintained and if there is adequate protection. The licensee was requested to explain how the Unit 2 batteries have been maintained and to what standard the Unit 2 batteries are protected.

During the audit process, the licensee indicated that Unit 2 Divisional and BOP Batteries are maintained in an operable status to support Unit 1 operation. The Unit 2 batteries are tested and maintained to the same requirements of the Unit 1 Batteries.

The licensee was requested to provide the battery dc load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling. During the audit process, the licensee stated that direct current load profiles are only of concern during Phase 1 mitigation. Following deployment of the FLEX generators, battery chargers are repowered to replenish dc power sources, however, the licensee did not provide dc load profile as requested. This has been identified as Confirmatory Item 3.2.4.10.A in Section 4.2.

On page 41 of the Integrated Plan, the licensee indicated that the SBO procedure directs that the battery bank on Unit 2 is cross tied to Unit I and load shedding is performed such that all non-essential circuit breaker loads are opened within three hours of the event. The maximum mission time for the battery bank is then greater than 24 hours per station calculations. In conjunction with cross tying to the Unit 2 Division 1 batteries and load shedding the dc busses provide greater than 24 hours of power to essential instrumentation and RCIC control. Therefore, on-site portable equipment must be deployed, staged, and able to power to essential instrumentation within 24 hours of the event.

The licensee was requested to provide a detailed discussion on the loads that will be shed from the dc bus, the equipment location, or location where the required action needs to be taken, and specify the required operator actions needed to be performed and the time to complete each action. Additionally the licensee was requested to explain which functions are lost as a result of shedding each load and discuss any impact on defense in depth and redundancy.

During the audit process, the licensee indicated that dc load shedding is accomplished by an existing plant Off-Normal Instruction #ONI-SPI D-2, Nonessential dc Loads. Current dc load shedding removes power from non-emergency core cooling system (ECCS) loads and non-vital ECCS loads supplied from the divisional dc busses. All ECCS systems remain available for use during the time dc load shedding is being performed. Load shedding actions are required within 3 hours of a total loss of ac power to extend battery life. Load shedding removes power to the following loads:

- Reactor Recirc Breakers
- Non Critical RHR Logic and Annunciators
- Redundant Reactivity Control Panels
- RPS RPS INST AND AUX RELAY PANEL dc power
- Diesel Generator dc power
- ATWS UPS

Direct current load shedding was developed to support the PNPP TLAC evaluation. There have been no changes to this process to support the FLEX requirements. Changes to the load shedding procedure for additional loads will be evaluated to the specifications of NEI 12-06. The final load shedding procedure is required for review when completed. This has been identified as Confirmatory Item 3.2.4.10.B in Section 4.2.

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

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

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

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

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

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

guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to the load reduction to conserve dc power, if these requirements are implemented as described.

3.3 PROGRAMMATIC CONTROLS

3.3.1 Equipment Maintenance and Testing.

NEI 12-06, Section 3.2.2, Guideline (15) states in part:

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

NEI 12-06, Section 11.5 states:

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

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

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

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

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

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

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

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

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

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

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

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

On page 11 of the Integrated Plan the licensee stated that the FLEX mitigation equipment will be initially tested (or other reasonable means used) to verify performance conforms to the limiting FLEX requirements. It is expected that the testing will include the equipment and the assembled sub-system to meet the planned FLEX performance. Additionally, the licensee will implement the maintenance and testing template upon issuance by the Electric Power Research Institute (EPRI). The template will be developed to meet the FLEX guidelines established in Section 11.5 of NEI 12-06. The unavailability of equipment and applicable connections that directly performs a FLEX mitigation strategy will be managed using plant equipment control guidelines developed in accordance with NEI 12-06 Rev. 0 Section 11.5.

The NRC staff reviewed the Integrated Plan for PNPP 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.

During the audit process, FENOC indicated to the NRC that they expect to utilize the EPRI templates for PNPP.

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

3.3.2 Configuration Control

NEI 12-06, Section 11.8 provides that:

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

On page 11 of the Integrated Plan, the licensee indicated that equipment associated with these strategies will be procured as commercial equipment with design, storage, maintenance, testing, and configuration control in accordance with NEI 12-06 Section 11, and that they are participants in the BWROG and will implement the FSGs in a timeline to support the implementation of FLEX by Spring 2015.

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

3.3.3 Training

NEI 12-06, Section 11.6 provides that:

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

2. 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 13 of the Integrated Plan, in the section describing the training plan, the licensee indicated that Training plans will be developed for plant groups such as the Emergency Response Organization (ERO), Fire, Security, EP, Operations, Engineering and Maintenance. The training plan development will be done in accordance with PNPP procedures using the Systematic Approach to Training, and will be implemented to ensure that the required PNPP staff is trained prior to implementation of FLEX. The training program will comply with the specifications outlined in Section 11.6 of NEI 12-06.

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

3.4 <u>OFFSITE RESOURCES</u>

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

1) A capability to obtain equipment and commodities to sustain and backup the site's coping strategies.
2) Off-site equipment procurement, maintenance, testing, calibration, storage, and control.
3) A provision to inspect and audit the contractual agreements to reasonably assure the capabilities to deploy the FLEX strategies including unannounced random inspections by the Nuclear Regulatory Commission.
4) Provisions to ensure that no single external event will preclude the capability to supply the needed resources to the plant site.
5) Provisions to ensure that the off-site capability can be maintained for the life of the plant.
6) Provisions to revise the required supplied equipment due to changes in the FLEX strategies or plant equipment or equipment obsolescence.
7) The appropriate standard mechanical and electrical connections need to be specified.
8) Provisions to ensure that the periodic maintenance, periodic maintenance schedule, testing, and calibration of off-site equipment are comparable/consistent with that of similar on-site FLEX equipment.
9) Provisions to ensure that equipment determined to be unavailable/non-operational during maintenance or testing is either restored to operational status or replaced with appropriate alternative equipment within 90 days.
10) Provision to ensure that reasonable supplies of spare parts for the off-site equipment are readily available if needed. The intent of this provision is to reduce the likelihood of extended equipment maintenance (requiring in excess of 90 days for returning the equipment to operational status).

On page 13 of the Integrated Plan, in the section describing the RRC plan, the licensee indicated that the industry will establish two (2) RRC to support utilities during BDBEE. Each RRC will hold five (5) sets of equipment, four (4) 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 the near site staging area, established by the SAFER team and the utility. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request. The licensee has signed a contract with SAFER to meet the specifications of NEI 12-06, Section 12.

The licensee's plans for the use of off-site resources conform to the minimum capabilities specified in NEI 12-06 Section 12.2, with regard to the capability to obtain equipment and commodities to sustain and backup the site's coping strategies (item 1 above). However, the licensee did not address considerations 2 through 10 of NEI 12-06, Section 12.2. 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 use of off-site resources, if these requirements are implemented as described.

4.0 OPEN ITEMS AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number	Description	Notes
3.2.1.7.A	The Shutdown/Refueling Modes 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. PNPP has not informed the NRC of their plan to abide by this generic resolution and their plans to address potential plant specific issues associated with implementing this resolution that have been identified during the audit process.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.3.A	PNPP is planning to evaluate providing ac power to the Plant Underdrain pumps for groundwater control for additional margin; however the gravity discharge system passively performs the necessary functions of controlling groundwater level. It was not clear how the gravity discharge portion of this system will maintain groundwater elevation below 590 ft. with no pumping power when the flood level around the plant may be at 620 ft. A discussion is needed of how the gravity drain from elevation 590 ft. will function in flood waters at 620 ft.	
3.1.1.4.A	With regard to offsite resources, the licensee will develop a plan that will address the logistics for equipment transportation, area set up, and other needs for ensuring the equipment and commodities to sustain the site's coping strategies.	
3.1.2.1.A	During the audit, the licensee was requested to provide the elevations of all FLEX equipment that will be deployed or staged across the site. In response, the licensee stated that the flooding re-analysis will need to be reviewed to determine the potential impacts. The location of FLEX equipment that will be deployed or staged needs to be finalized.	
3.2.1.1.A	From the June 2013 NEI position paper on MAAP4, benchmarks must be identified and discussed which demonstrate that MAAP4 is an appropriate code for the simulation of an ELAP event at your facility.	
3.2.1.1.B	During the MAAP4 analysis, the collapsed level must remain above Top of Active Fuel (TAF) and the cool down rate must be within technical specification limits.	
3.2.1.1.C	MAAP4 must be used in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper.	

3.2.1.1.D	In using MAAP4, the licensee must identify and justify the subset of key modeling parameters cited from Tables 4-1 through 4-6 of the "MAAP4 Application Guidance, Desktop Reference for Using MAAP4 Software, Revision 2" (Electric Power Research Institute Report 1020236). This should include response at a plant-specific level regarding specific modeling options and parameter choices for key models that would be expected to substantially affect the ELAP analysis performed for that licensee's plant. Although some suggested key phenomena are identified below, other parameters considered important in the simulation of the ELAP event by the vendor / licensee should also be included as follows: Nodalization, General two-phase flow modeling, Modeling of heat transfer and losses, Choked flow, Vent line pressure losses, and Decay heat.	
3.2.1.1.E	The specific MAAP4 analysis case that was used to validate the timing of mitigating strategies in the Integrated Plan must be identified and should be available on the ePortal for NRC staff to view. Alternately, a comparable level of information may be included in the supplemental response. In either case, the analysis should include a plot of the collapsed vessel level to confirm that TAF is not reached (the elevation of the TAF should be provided) and a plot of the temperature cool down to confirm that the cool down is within technical specification limits.	
3.2.1.2.A	Calculations prepared in support of the licensee's Integrated Plan determined the required Phase 1 flow rate needed to stabilize boil-off, using Suppression Pool water, is approximately 300 gpm. System leakage with the vessel pressurized was estimated to be 66 gpm. This results in a total Phase injection capability of 366 gpm. The licensee noted that this value is well within the RCIC System injection capacity of 700 gpm and that further information regarding the specific assumptions and calculations for quantification of inventory losses are captured in proprietary analysis used for Integrated Plan preparation. The licensee was requested to provide the analyses for review.	
3.2.1.3.A	The licensee stated that BWROG EPG/SAG, Revision 3, would allow the temperature limit of the suppression pool to be exceeded. Provide the technical justification which demonstrates why exceeding this temperature limit is acceptable and discuss its applicability to PNPP.	
3.2.3.A	Provide the plant-specific containment response calculation, commensurate with the level of detail contained in NEDC-33771P for NRC staff review.	
3.2.3.B	Provide results from the successful completion of the evaluations and possible modifications which demonstrate that the SPCU pump and piping are seismically "robust".	
3.2.4.2.A	It is not clear that (1) the assumed temperatures of the various critical rooms, e.g., RCIC Room and, CR, are adequately evaluated for the potentially high temperature that may occur in these areas or that (2) time critical actions are not required to be taken to maintain equipment functionality or personnel habitability	

	limits. The licensee was requested to provide analyses to establish the temperature versus time curves to ensure equipment qualification requirements are met and the habitability requirements are met in those areas.	
3.2.4.2.B	The licensee provided insufficient information on monitoring temperatures and hydrogen concentration levels in the battery rooms to ensure temperature and hydrogen concentration level are within acceptable level.	
3.2.4.4.A	The NRC staff has reviewed the licensee communications assessment (ML12306A131 and ML13053A366) in response to the March 12, 2012 50.54(f) request for information letter for PNPP and, as documented in the staff analysis (ML13170A334 and ML13170A355) 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. Verification of required upgrades is identified as a confirmatory item.	
3.2.4.7.A	The licensee indicated that a proprietary report was prepared by WEC in support of the PNPP Integrated Plan. This report provides information on the quality of water identified for cooling purposes. The report is identified as proprietary information; however it concludes that 3.0 cubic feet of water precipitate could be introduced over a 72 hour period. The WEC report should be reviewed to ensure that an adequate review of debris and particulates from water sources has been performed. The WEC report was not available for review. This has been identified as Confirmatory	
3.2.4.8.A	The licensee was requested to provide the basis for the minimum dc bus voltage that is required to ensure proper operation of all required electrical equipment. During the audit process, the licensee indicated that the basis for the minimum bus voltage for Division 1 and Division 2 battery systems is based upon the coil voltage required to operate the 4160 VAC breakers (diesel generator output breakers) on the divisional busses and operation of ADS SRV solenoids. However, the licensee did not provide any reference to the existing analysis or calculation as the basis of the minimum bus voltage.	
3.2.4.8.B	The review finds that the applicable changes to the electrical drawing(s) posted on ePortal did not appear to be legible for the mitigation strategies area. The licensee is requested to provide or post a legible copy of electrical drawings on ePortal.	
3.2.4.8.C	During the audit, the licensee indicated a total load of 429 kW which does not appear to match the total sum of all the loads provided during the audit. The licensee is requested to explain how a total load of 429 kW was estimated.	
3.2.4.9.A	The licensee also noted that much of the site FLEX equipment has not yet been purchased and therefore specific vendor requirements or industry templates have not yet been determined. With respect to refueling of deployed equipment, PNPP is	

	currently evaluating the feasibility of either procuring a fuel trailer (trailer mounted tank with on-board pump mechanism), or mounting a fuel tank within the bed of a heavy-duty truck, with appropriate pumping mechanisms.	
3.2.4.10.A	The licensee was requested to provide the battery dc load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling. During the audit process, the licensee stated that direct current load profiles are only of concern during Phase 1 mitigation. Following deployment of the FLEX generators, battery chargers are repowered to replenish dc power sources, however, the licensee did not provide dc load profile as requested.	
3.2.4.10.B	Direct current load shedding was developed to support the PNPP TLAC evaluation. There have been no changes to this process to support the FLEX requirements. Changes to the load shedding procedure for additional loads will be evaluated to the specifications of NEI 12-06. The final load shedding procedure is required for review when completed.	
3.4.A	The licensee's plans for the use of off-site resources conform to the minimum capabilities specified in NEI 12-06 Section 12.2, with regard to the capability to obtain equipment and commodities to sustain and backup the site's coping strategies (item 1 above). However, the licensee did not address considerations 2 through 10 of NEI 12-06, Section 12.2.	