Mega-Tech Services, LLC

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

Revision 1

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NextEra Energy Point Beach, LLC
Point Beach Nuclear Plant, Units 1 & 2
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1.0 BACKGROUND

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

As directed by the Commission's staff requirements 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, 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. 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 was provided to all licensees in a letter dated August 28, 2013 from Jack R. Davis, Director, Mitigating Strategies Directorate (ADAMS Accession No. ML13234A503).

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

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

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

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

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

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

3.0 TECHNICAL EVALUATION

By letter dated February 22, 2013, (ADAMS Accession No. ML13053A401), and as supplemented by the first six-month status report in letter dated August 28, 2013 (ADAMS Accession No. ML13241A203), NextEra Energy Point Beach, LLC, (the licensee) provided Point Beach Nuclear Plant's (PBNP) Integrated Plan for Compliance with Order EA-12-049. The Integrated Plan describes the strategies and guidance under development for implementation by the licensee for the maintenance or restoration of core cooling, containment, and SFP cooling capabilities following a BDBEE, including modifications necessary to support this implementation, pursuant to Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049. That letter described the process used by the NRC staff in its review, leading to the issuance of an interim staff evaluation and audit report. The purpose of the staff's audit is to determine the extent to which the licensees are proceeding on a path towards successful implementation of the actions

needed to achieve full compliance with the Order.

3.1 EVALUATION OF EXTERNAL HAZARDS

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

3.1.1 Seismic Events

NEI 12-06, Section 5.2 states:

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

The licensee's Integrated Plan identified the Safe Shutdown Earthquake (SSE) to be 0.12 g horizontal ground motion with a simultaneous vertical acceleration of 2/3 of the magnitude of the horizontal component as identified in the PBNP Final Safety Analysis Report (FSAR). The licensee also confirmed on page 1 of their Integrated Plan that the site screens in for an assessment for the seismic hazard. The licensee also stated on page 2 that the seismic re-evaluation pursuant to the Code of Federal Regulations (CFR), 10 CFR 50.54(f) letter of March 12, 2012 had not been completed and therefore was not assumed in the Integrated Plan. 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 bases 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 seismic screening if these requirements are implemented as described.

3.1.1.1 Protection of FLEX Equipment – Seismic Hazard

NEI 12-06, Section 5.3.1 states:

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

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

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

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

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

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

On page 11 of the Integrated Plan regarding how strategies will be deployed in all modes, the licensee stated:

> Some FLEX equipment will be stored within Class I seismic and missile protected structures near the location where it will be required. The equipment will be adequately secured to prevent any seismic interaction.

The Integrated Plan does not discuss securing of equipment in other storage locations. During the audit, the licensee stated that the stored FLEX portable equipment will be secured as appropriate, evaluated and protected from seismic interactions to ensure they are not damaged from unsecured and/or non-seismic components.

In various sections of the Integrated Plan, the licensee stated that storage of portable equipment will be within existing Class I structures, within existing structures qualified in accordance with the robust seismic requirements contained in NEI 12-06 or new structures designed and constructed in accordance with the robust requirements contained in NEI 12-06. The necessary upgrade of existing structures or construction of new storage facilities will be completed by October, 2014.

On page 61 of the Integrated Plan, the licensee stated:

> The storage of FLEX equipment will be in existing Class 1 structures or in a new structure designed and constructed in accordance with the requirements of NEI 12-06. The Steam Generator Storage Building (SGSB) is a concrete structure located just north of PBNP and directly outside of the security fence. The SGSB will be analyzed for seismic and tornado loading to qualify it for FLEX purposes. There is high confidence that most of the SGSB (except the southern half of the west wall) can be qualified, without modification, for the seismic and tornado loads required to satisfy the FLEX requirements. The west wall of the SGSB will

require additional evaluation and modification to ensure that it satisfies the FLEX requirements and is appropriately robust and functional after a BDB event. The SGSB will provide adequate space and protection to be used as the primary storage location for essential FLEX equipment.

The final design of a new structure or modification of existing structure(s) will require additional development by the licensee. This has been identified as Confirmatory Item 3.1.1.1.A in Section 4.2.

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

3.1.1.2 Deployment of FLEX Equipment - Seismic Hazard

NEI 12-06, Section 5.3.2 states:

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

The licensee addresses the potential for soil liquefaction on page 10 of the Integrated Plan by referring to studies performed in support of the PBNP Individual Plant Examination of External Events (IPEEE) reported by letter dated June 30, 1995, ADAMS Accession No. ML080100398, and studies performed in support of the PBNP Independent Spent Fuel Storage Installation (ISFSI) and discussing the application of these studies to the transport routes for portable equipment.

On page 24 of the Integrated Plan, the licensee stated the portable diesel driven pump (PDDP) will be positioned in the area near the pump house and suction hoses will be routed to draw water from the pump house forebay or pump bay. Alternative suction paths include the ability to draw water directly from Lake Michigan using a floating strainer. Hose(s) from the PDDP will be routed through the 8' Elevation of the Turbine Building (TB) and Primary Auxiliary Building (PAB) to an adapter on the (auxiliary feedwater) AFW piping which would allow water to be injected to any of the Unit 1 or Unit 2 (steam generators) SGs once the SG pressure reduces below the shutoff head of the pump. This deployment is intended only as a backup means for supplying water to the SGs.

Page 24 also states the connection points to AFW are located within a Class I structure in the PAB, and the connection point to service water (SW) is located within a Class I structure in the Pump House.

On pages 44 and 45 of the Integrated Plan, the licensee stated that if necessary, the capability exists to connect a PDDP to supply water to the containment spray system via an adapter which replaces the cover of a spray pump discharge check valve. Hose(s) from the PDDP will be routed through the 8' Elevation of the TB and PAB to this connection point.

On pages 63 and 67 of the Integrated Plan, the licensee stated all connections for the FLEX equipment for safety functions support will be designed to withstand and be protected from the applicable hazards. The licensee provided detailed discussions of the connection points to be installed for portable ac power supplies, fuel oil and portable (direct current) dc power supplies. The licensee's plan for routing hoses and cables specifies access through the TB. The licensee was requested during the audit to identify if at least one connection point for the FLEX equipment will only require access through seismically robust structures. The licensee response was that the TB is not a seismic Class I structure, but was analyzed during original design and found capable of withstanding SSE loads. The licensee did not address if other sections of routes will only require access through seismically robust structures or alternative calculations/evaluations that show they are capable of withstanding SSE loads. This has been identified as Confirmatory Item 3.1.1.2.A. in Section 4.2.

PBNP relies on Lake Michigan as a water source and there are no downstream dams that have a perceptible effect on the water level of the lake.

During the audit, the licensee was requested to address if power is required to move or deploy the equipment (e.g., to open the door from a storage location). The licensee response was that power is not required to move or deploy equipment. Present buildings have and future installations will have doors and gates with manual systems for their opening.

On page 10 of the Integrated Plan, the licensee stated vehicles necessary to transport FLEX equipment to the deployment areas will be stored in the same structure.

The licensee's plan for protection of the means to move the equipment (consideration 5 above) provides reasonable assurance that guidance and strategies developed pursuant to the plan will conform to the guidance of NEI 12-06, Section 5.3.2.

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

3.1.1.3 Procedural Interfaces – Seismic Hazard

NEI 12-06, Section 5.3.3 states:

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

On page 61 of the Integrated Plan, the licensee stated:

> <u>Field Instrument Readings</u>
>
> Where practical, the capability will exist to take field readings of important plant parameters using non-electrical gauges/indicators or with the installed transmitters through the use of hand held meters (e.g. FLUKE 705, FLUKE 114). A reference source of field reading locations and instructions will be compiled. Some of the field reading locations may be at the containment penetrations. The

handheld meters will be available in the general location of the field readings (i.e., PAB and Control Building).

The Integrated Plan did not include a discussion of guidance for critical actions to perform until alternate indications can be connected or on how to control critical equipment without associated control power. This has been identified as Confirmatory Item 3.1.1.3.A. in Section 4.2.

The Integrated Plan did not contain any information in regards to seismic hazards associated with large internal flooding sources that are not seismically robust and do not require ac power; or whether the use of ac power to mitigate ground water in critical locations would be required. During the audit, the licensee identified that the major contributors to internal flooding are the Circulating Water (CW), Fire Water (FW), SW (non-seismic portions) and Condensate systems and large non-seismic /non-missile protected tanks. The FLEX strategies include isolation of the non-seismic portions of SW and FW. The large tanks that provide a threat are the Condensate Storage Tanks (CSTs), Reactor Makeup Water (RMW) Tank, Monitor Tank (MT), and the upper non-missile protected portion of the Refueling Water Storage Tank (RWST). The CST is being seismically upgraded and a portion of it missile protected. The CST is located in the turbine hall and water would be collected in the condenser pit or drain from the truck access to the outside yard area. Water from an MT failure drains to the minus 19 (feet) ft. of the PAB, which does not require access for implementing the Integrated Plan strategies. Failure of the RMW or RWST would result in flooding of the 6 ft. elevation of the façade. Access to this area is required during Phase 2 to connect the suction of portable diesel pumps to the RWST. If access to the RWST is restricted by the flooding a secondary connection point located within the PAB would be used. Diesel-driven and electric sump pumps are included as miscellaneous portable equipment and would be available to address ground water or water from an internal source if required.

PBNP relies on Lake Michigan as a water source and there are no downstream dams that have a perceptible effect on the water level of the lake.

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 considerations for the seismic hazard if these requirements are implemented as described.

3.1.1.4 Considerations in Using Offsite Resources – Seismic Hazard

NEI 12-06, Section 5.3.4 states:

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

On page 13 of the Integrated Plan, the licensee stated that they will participate in the process to establish the Regional Resource Centers (RRCs) as required for additional Phase 3 equipment. Equipment will be moved from an RRC to a local Assembly Area, established by the Strategic Alliance for FLEX Emergency Response (SAFER) team and the utility. 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.

In various sections of the Integrated Plan, the licensee stated equipment from the RRC will initially be transported to an offsite receiving area. The Green Bay airport was identified as a potential receiving area. The licensee stated an accessible route to the site will be identified based on the extent of damage. The licensee identified the site staging area as one of the designated parking lots located to the South and North of the plant and equipment will be deployed from the staging area through the Protected Area vehicle trap under the control of Station Security. The equipment may be deployed through either the South or North Security fence gate.

The licensee's plans for the use of offsite resources provided insufficient information regarding finalization of the identification of the receiving area and a description of the methods to be used to deliver the equipment from the receiving area to the site. Confirmation of the location of the receiving area and description of the methods to be used to deliver from the receiving area to the site staging area has been identified as Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.2 Flooding.

NEI 12-06, Section 6.2 states:

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

NEI 12-06, Section 6.2.1 states in part:

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

On page 2 of the Integrated Plan, the licensee stated that flood re-evaluations pursuant to the 10 CFR 50.54(f) letter, dated March 12, 2012, are not completed and therefore not assumed in

the Integrated Plan. As the re-evaluations are completed, appropriate issues will be entered into the CAP and addressed on a schedule commensurate with other licensing bases changes.

On page 2 of the Integrated Plan, the licensee stated that there are no rivers or large streams at or near PBNP. The most plausible flooding hazard at PBNP is the probability of a simultaneous melting of a large amount of snow in the spring combined with sustained heavy rains. Assuming conservatively that the maximum wave height occurs simultaneously with the maximum Lake Michigan level, the run-up would be to the elevation +8.42 ft. on a vertical structure. PBNP has procedures in place to address Lake Michigan induced flooding. During the audit, the licensee identified that both events are predictable and would be of short duration.

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

3.1.2.1 Protection of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.1 states:

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

On page 23 of the Integrated Plan, the licensee stated that storage of portable equipment will be in structures located above the design flood level or within existing Class I structures in areas protected from external flooding. The necessary upgrade of existing structures or construction of new storage facilities will be completed by October, 2014.

The same statement is provided on pages 36, 43, 51, and 62 respectively. This conforms to considerations 1 and 2, above; however, the final design and location of a new structure will require additional development by the licensee. This has been combined with Confirmatory Item 3.1.1.1.A in Section 4.2.

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

3.1.2.2 Deployment of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.2 states:

> There are a number of considerations which apply to the deployment of FLEX equipment for external flood hazards:
>
> 1. For external floods with warning time, the plant may not be at power. In fact, the plant may have been shut down for a considerable time and the plant configuration could be established to optimize 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 [reactor coolant system] RCS, isolating accumulators, isolating RCP seal leak off, obtaining dewatering pumps, creating temporary flood barriers, etc. These factors can be credited in considering how the baseline capability is deployed.
>
> 2. The ability to move equipment and restock supplies may be hampered during a flood, especially a flood with long persistence. Accommodations along these lines may be necessary to support successful long-term FLEX deployment.
>
> 3. Depending on plant layout, the ultimate heat sink may be one of the first functions affected by a flooding condition. Consequently, the deployment of the FLEX equipment should address the effects of [loss of ultimate heat sink] LUHS, as well as [extended loss of ac power] 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 64 of the Integrated Plan, the licensee states that the connection point for the credited fuel oil supply is inside the DG building which is a structure located well above the maximum projected flood level. On page 98 of the Integrated Plan, there is a sketch that depicts the diesel fuel tank adjacent to the DG building. During the audit, the licensee stated that the diesel fuel tanks are in an area well above the maximum flood level.

On pages 63 and 67 of the Integrated Plan, the licensee states that primary and secondary connection points for portable ac power supplies and dc power are protected from flooding.

In various sections of the Integrated Plan, the licensee identifies the location of connection points for pump suction and discharge. The licensee does not specify if these connection points are protected from flooding. This has been identified as Confirmatory Item 3.1.2.2.A in Section 4.2.

During the audit, the licensee was requested to address how they conform to the guidance of NEI 12-06, Section 6.2.3.2 consideration 8. The licensee responded that per procedure Lake Michigan level is tracked and barriers are placed at a predetermined lake level and prior to any event. Deployment would not be an issue as this would be done prior to an assumed event. The storage area of the equipment and the route for deployment are in areas that would not be impacted by high water level.

Page 10 of the Integrated Plan identifies that transport vehicles will be stored in the same structures as the FLEX equipment.

During the audit, the licensee was requested to address non-tropical or extra tropical cyclonic storms which can include high winds often accompanied with precipitation changing from rain to ice and snow along with decreasing air temperatures. The licensee responded that deployment and operation of equipment will be directed by FLEX procedures. The procedures will include directions to safely deploy equipment under various weather conditions. Site equipment will be available to clear areas of ice and snow and to safely move equipment and personnel.

The licensee also stated that the outdoor FLEX equipment will be rated to operate in all types of weather. Precautions will be taken to leave hoses drained if not in use or to provide constant flow through the lines to prevent freezing. Provisions will also be available to provide supplemental heat to thaw equipment if it becomes necessary (e.g. tenting, portable heaters).

Furthermore, there are multiple deployment areas for FLEX equipment. If water or freezing spray is encountered alternate areas could be used. The buildup of ice and snow at the plant site is routinely controlled with site equipment and personnel. Personnel and equipment could be pre-staged to respond to a forecasted event.

The licensee clarified that Lake Michigan water levels decline from summer to winter. The range of seasonal water level fluctuations on the Great Lakes averages 12' from winter lows to summer highs. The likelihood of a high water event in the winter is minimized.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to deployment of FLEX equipment during 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 2 of the Integrated Plan, the licensee stated PBNP has procedures in place to address Lake Michigan induced flooding.

As identified in Section 3.1.2.2 above, the Integrated Plan does not address if connection points for the pumps are protected from the flooding hazard. This was previously identified as Confirmatory Item 3.1.2.2.A in Section 4.2.

The Integrated Plan does not address procedures to implement the use of barriers. During the audit, the licensee identified that placement of sandbags and jersey barriers for flood protection is controlled by PC 80 Part 7, "Lake Water Determination."

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

3.1.2.4 Considerations in Using Offsite Resources – Flooding Hazard

NEI 12-06, Section 6.2.3.4 states:

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

On page 13 of the Integrated Plan, the licensee stated that they will participate in the process to establish the RRCs as required for additional Phase 3 equipment. Equipment will be moved from an RRC to a local Assembly Area, established by the SAFER team and the utility. 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.

In various sections of the Integrated Plan, the licensee stated equipment from the RRC will initially be transported to an offsite receiving area. The Green Bay airport was identified as a potential receiving area. The licensee stated an accessible route to the site will be identified based on the extent of damage. The licensee identified the site staging area as one of the designated parking lots located to the South and North of the plant and equipment will be deployed from the staging area through the Protected Area vehicle trap under the control of Station Security. The equipment may be deployed through either the South or North Security fence gate.

The licensee's plans for the use of offsite resources provided insufficient information regarding finalization of the identification of the receiving area and a description of the methods to be used to deliver the equipment from the receiving area to the site. Confirmation of the location of the receiving area and description of the methods to be used to deliver to the site staging area 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 considerations in using off-site resources during a flooding hazard if these requirements are implemented as described.

3.1.3 High Winds

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

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

wind speeds in excess of 130 mph exceeds 10^{-6} per year, the site should address hazards due to extreme high winds associated with hurricanes.

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

On page 2 of the Integrated Plan, the licensee stated regional history with tornadoes does exist for PBNP. PBNP location falls in Region 1 of Figure 7.2 of NEI 12-06. This would correspond to a location with a one in a million probability of tornado wind speeds approaching 200 mph. The PBNP design basis for Class I safety related structures is a tornado with winds of 300 mph plus a forward velocity of 60 mph and corresponding missiles.

The reviewer noted that the Integrated Plan does not discuss a comparison of the site location with NEI 12-06, Figure 7-1. By reference to the PBNP FSAR, Section 2.1, the reviewer noted that the site is located at 44° 17.0’ N and 87° 32.5’ W. This location is north and west of the contour line for 120 mph peak-gust wind with an annual exceedance probability of 10^{-6}, which is in the direction of diminishing wind speeds, and therefore the licensee does not need to address hazards due to extreme high winds associated with hurricanes.

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

3.1.3.1 Protection of FLEX Equipment - High Winds Hazard

NEI 12-06, Section 7.3.1 states:

> These considerations apply to the protection of FLEX equipment from high wind hazards:
>
> 1. For plants exposed to high wind hazards, FLEX equipment should be stored in one of the following configurations:
>
>   a. In a structure that meets the plant’s design basis for high wind hazards (e.g., existing safety-related structure).
>
>   b. In storage locations designed to or evaluated equivalent to ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures* given the limiting tornado wind speeds from Regulatory Guide 1.76 or design basis hurricane wind speeds for the site.
>
>   - Given the FLEX basis limiting tornado or hurricane wind speeds, building loads would be computed in accordance with requirements of ASCE 7-10. Acceptance criteria would be based on building serviceability requirements not strict compliance with stress or capacity limits. This would allow for some minor plastic deformation, yet assure that the building would remain functional.

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

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

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

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

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

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

On page 23 of the Integrated Plan, the licensee stated that storage of portable equipment will be within existing Class I structures designed to withstand severe winds and tornado missiles or within existing structures qualified in accordance with the robust requirements contained in NEI 12-06. If new structures are required they will be designed and constructed in accordance with the robust and diversity requirements contained in NEI 12-06. The necessary upgrade of existing structures or construction of new storage facilities will be completed by October, 2014.

The same statement is provided on pages 36, 44, 51 and 62 for RCS inventory control, maintain containment, SFP cooling, and safety function support, respectively.

The final design and location of a new structure or modification of existing structure(s) will require additional development by the licensee. This has been identified as Confirmatory Item 3.1.1.1.A in Section 4.2.

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

Because PBNP is not subject to high wind hazards associated with hurricanes, considerations 1, 2, and 5 are not applicable.

On page 10 of the Integrated Plan, the licensee stated the preferred deployment route is through an open, non-forested area. However, this route does have an overhead ac service line along a portion of the path. If the line is down across the path, it will be verified as dead and removed using debris removal equipment. Also non-seismic/non-tornado qualified warehouses and buildings exist alongside the deployment route. Debris along the route will be removed using designated FLEX debris removal equipment.

The Integrated Plan does not list debris removal equipment in the Phase 2 equipment listing on pages 69 through 71. Debris clearing equipment is only listed in the Phase 3 response equipment/commodities listing on page 73. The use of debris removal equipment is identified, however, during the Phase 2 response at 1.5 hours after the event starts. During the audit, the licensee identified that an assessment of needed debris removal equipment will be completed in the first quarter of 2014. This has been identified as Confirmatory Item 3.1.3.2.A in Section 4.2.

On page 10 of the Integrated Plan, the licensee stated vehicles necessary to transport FLEX equipment to the deployment areas will be stored in the same structure. This conforms to the guidance of NEI 12-06, Section 7.3.2, consideration 4.

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

3.1.3.3 Procedural Interfaces - High Winds Hazard

NEI 12-06, Section 7.3.3, states:

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

On page 11 of the Integrated Plan, the licensee identified that deployment strategy will be included within an administrative program that will include requirements to keep routes and staging areas clear or invoke contingency actions.

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 interface for in a high wind hazard if these requirements are implemented as described.

3.1.3.4 Considerations in Using Offsite Resources – High Winds Hazard

NEI 12-06, Section 7.3.4 states:

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

On page 13 of the Integrated Plan, the licensee stated that they will participate in the process to establish the RRCs as required for additional Phase 3 equipment. Equipment will be moved

from an RRC to a local Assembly Area, established by the SAFER team and the utility. 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.

In various sections of the Integrated Plan, the licensee stated equipment from the RRC will initially be transported to an offsite receiving area. The Green Bay airport was identified as a potential receiving area. The licensee stated an accessible route to the site will be identified based on the extent of damage. The licensee identified the site staging area as one of the designated parking lots located to the South and North of the plant and equipment will be deployed from the staging area through the Protected Area vehicle trap under the control of Station Security. The equipment may be deployed through either the South or North Security fence gate.

The licensee's plans for the use of offsite resources provided insufficient information regarding finalization of the identification of the receiving area and a description of the methods to be used to deliver the equipment from the receiving area to the site. Confirmation of the location of the receiving area and description of the methods to be used to deliver to the site staging area 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 considerations in using off-site resources following a high wind hazard, if these requirements are implemented as described.

3.1.4 Snow, Ice and Extreme Cold

As discussed in NEI 12-06, Section 8.2.1:

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

On page 2 and 3 of the Integrated Plan, the licensee stated that regional experience with snow, ice and low temperatures does exist for PBNP. From Figure 8.2 of NEI 12-06, the PBNP location falls under Region 5, corresponding to the highest region for ice severity. The hazard would include frost, ice cover, frazil ice, snow and extreme low temperature. It does not include an avalanche for PBNP. An outside air temperature of -25.0°F has been used in the PBNP 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, 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 N+1 equipment may be stored in an evaluated storage location capable of withstanding historical extreme weather conditions such that the equipment is deployable.
>
> 2. Storage of FLEX equipment should account for the fact that the equipment will need to function in a timely manner. The equipment should be maintained at a temperature within a range to ensure its likely function when called upon. For example, by storage in a heated enclosure or by direct heating (e.g., jacket water, battery, engine block heater, etc.).

In various sections of the Integrated Plan, the licensee stated storage of portable equipment will be within existing structures designed to withstand snow and ice conditions and provided with heating to maintain equipment functional. The necessary upgrade of existing structures or construction of new storage facilities will be completed by October, 2014.

The final design of a new structure or modification of existing structure(s) will require additional development by the licensee. This has been previously identified as Confirmatory Item 3.1.1.1.A.

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

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

NEI 12-06, Section 8.3.2 states:

> There are a number of considerations that apply to the deployment of FLEX equipment for snow, ice, and extreme cold hazards:
>
> 1. The FLEX equipment should be procured to function in the extreme conditions applicable to the site. Normal safety-related design limits for

outside conditions may be used, but consideration should also be made for any manual operations required by plant personnel in such conditions.

2. For sites exposed to extreme snowfall and ice storms, provisions should be made for snow/ice removal, as needed to obtain and transport FLEX equipment from storage to its location for deployment.

3. For some sites, the ultimate heat sink and flow path may be affected by extreme low temperatures due to ice blockage or formation of frazil ice. Consequently, the evaluation should address the effects of such a loss of UHS on the deployment of FLEX equipment. For example, if UHS water is to be used as a makeup source, some additional measures may need to be taken to assure that the FLEX equipment can utilize the water.

During the audit, the licensee identified that the FLEX equipment is specified to operate at the temperature extremes of -28°F to 110°F.

On page 60 of the Integrated Plan, the licensee stated:

> The installed electrical freeze protection heat tracing and building heating system are not seismically qualified and much of the distribution network and freeze protection circuitry is not protected from tornado missiles. However, the installed freeze protection equipment and building heating system is presumed to be available in the case of an extreme low temperature event (i.e., not coincident with a seismic or tornado event). In this circumstance PDGs connected to 1B-03 and 2B-04 [revised to 2B-03 in the 6 month update] would be used to power those portions of the Freeze Protection System that would be necessary to maintain the functionality of the installed equipment credited for a FLEX strategy that is not located within a heated building.
>
> In the case of a seismic or tornado missile event occurring during normal winter conditions, the installed Freeze Protection electrical distribution system may not survive. The capability will exist to locally connect PDGs to the Freeze Protection heating elements within a time frame that will prevent the FLEX credited equipment from becoming non-functional or a means (portable heaters, torches, etc.) will be provided to restore the equipment function in time to support the FLEX strategy.
>
> Insulation blankets, portable torpedo heaters and temporary enclosures will be used as necessary to maintain the functionality of various pieces of portable equipment (PDGs, PDDP, etc.) while not in use after deployment. PDDPs deployment in extremely cold temperatures will include a recirculation flow path to maintain sufficient flow through the deployed hoses to keep them from freezing. Alternatively the pumps and hoses will be drained.

The licensee's plan for implementation of the strategies to deploy portable equipment in the context of snow, ice and extreme cold did not provide reasonable assurance that the plan conforms to the guidance of NEI 12-06, Section 8.3.2, consideration 2 because there is insufficient information to conclude that equipment is available for the removal of snow and ice as needed to obtain and transport equipment from storage to its location for deployment. This is identified as Confirmatory Item 3.1.4.2.A in Section 4.2.

On pages 15 and 16 of the Integrated Plan, the licensee stated:

> Upon completion of the TDAFW suction swap over from the CST to the SW system, the [diesel driven fire pump] DDFP will take suction from the pump bay and discharge to the SW system. The discharge of the DDFP will supply SW to the suction of the TDAFW pump to feed the SGs. The DDFP will start automatically on a loss of ac and can also be started from the control room. The DDFP will take suction from the SW Pump Bay in the Circulating Water Pump House (CWPH). The CWPH is a robust structure that meets seismic and missile protection criteria. The pump house forebay design provides four connection paths to Lake Michigan, two intake pipes and two discharge flumes. Any one of the paths is capable of supplying a quantity of water well in excess of the amount required for decay heat removal. Normal water supply from Lake Michigan, the Ultimate Heat Sink (UHS), is via an intake crib located approximately ¼ mile out in the lake. If the normal supply to the UHS is lost, flow will be established through the discharge flumes to the pump bay (NRC Safety Evaluation Report (SER) for PBNP Units 1 and 2 dated July 15, 1970). Sufficient water is available within the pump bay to supply the DDFP while manual actions are taken to establish the alternate connection to the UHS. Per PBNP Calculation 2003-0063, 440,826 gallons are available in the forebay/pump bays. Per WCAP-17601-P, this would provide greater than 24 hours of decay heat makeup for both of the PBNP two loop plants. The DDFP is supplied from a 250 gallon diesel oil day tank with an operating time of 13 hours based on usable volume.
>
> Lake Michigan is the source of cooling water to the PBNP. When the water in the CSTs is depleted, suction for the AFW pumps automatically shifts to the SW system to provide makeup water from the lake for an indefinite time period. The [current licensing basis] CLB for PBNP credits Lake Michigan water for long term cooling.

During the audit, the licensee was requested to address extreme cold weather conditions with significant surface icing on sources of make-up water for FLEX pumps or under frazil ice conditions. The licensee's response stated that during extreme cold temperatures heated water is returned to the area under the floor of the pump house and the fore bay, which is the primary suction source for make-up water, via the ice melt system from an operating unit. The licensee clarified that an installed standpipe and portable standpipe are available such that pump suction will be below the surface and explained that areas of water suction are not prone to frazil ice development. The licensee's Integrated Plan and response adequately addresses the concern associated with flow paths being affected by extreme low temperatures due to ice blockage or formation of frazil ice.

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

3.1.4.3 Procedural Interfaces – Snow, Ice, and Extreme Cold Hazard

NEI 12-06, Section 8.3.3, states:

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

On page 11 of the Integrated Plan, the licensee stated that deployment strategy will be included within an administrative program and address all MODES of operation. The administrative program will include requirements to keep routes and staging areas clear or invoke contingency actions.

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

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

NEI 12-06, Section 8.3.4, states:

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

On page 13 of the Integrated Plan, the licensee stated that they will participate in the process to establish the RRCs as required for additional Phase 3 equipment. Equipment will be moved from an RRC to a local Assembly Area, established by the SAFER team and the utility. 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.

In various sections of the Integrated Plan, the licensee stated equipment from the RRC will initially be transported to an offsite receiving area. The Green Bay airport was identified as a potential receiving area. The licensee stated an accessible route to the site will be identified based on the extent of damage. The licensee identified the site staging area as one of the designated parking lots located to the South and North of the plant and equipment will be deployed from the staging area through the Protected Area vehicle trap under the control of Station Security. The equipment may be deployed through either the South or North Security fence gate.

The licensee's plans for the use of offsite resources provided insufficient information regarding finalization of the identification of the receiving area and a description of the methods to be used to deliver the equipment from the receiving area to the site. Confirmation of the location of the receiving area and description of the methods to be used to deliver to the site staging area 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 considerations in using off-site resources snow, ice and extreme cold hazard if these requirements are implemented as described.

3.1.5 High Temperatures.

NEI 12-06, Section 9.2 states:

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

On page 3 of the Integrated Plan, the licensee stated that regional experience with high temperatures does exist for PBNP. DBD-29 "Auxiliary Building and Control Building [‘heating ventilation and air conditioning] HVAC" specifies a summer temperature of 95°F. FSAR Figure 2.6-1 "Climate of Point Beach Site Region," shows a max temperature of greater than 100°F. The current 50 year high is 105°F per (American Society of Heating, Refrigerating and Air Conditioning Engineers) ASHRAE 1% data (1% of the hours, 7 hours, in one month of 50 years exceed that value) with an average temperature swing of approximately 17°F in the hottest months. Based on the previous information, PBNP will use 105.5°F for extreme environmental conditions. However, portable FLEX equipment will be designed for a maximum temperature of 110°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, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to screening for high temperature hazard if these requirements are implemented as described.

3.1.5.1 Protection of FLEX Equipment - High Temperature Hazard

NEI 12-06, Section 9.3.1, states:

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

In various sections of the Integrated Plan, the licensee stated that storage of portable equipment will be within existing structures designed to withstand local high temperature conditions. Based on maximum temperature conditions expected and the equipment that will be stored no specific heat removal provisions are considered necessary to maintain equipment functional. The necessary upgrade of existing structures or construction of new storage facilities will be completed by October, 2014.

During the audit, the licensee stated that the storage structure is poured concrete that has a significant thermal inertia. The building has HVAC and is being designed to maintain temperatures between 50°F and 80°F.

The final design of a new structure or modification of existing structure(s) will require additional development by the licensee. This has been previously identified as Confirmatory Item 3.1.1.1.A.

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

guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of FLEX equipment for the high temperature hazard if these requirements are implemented as described.

3.1.5.2 Deployment of FLEX Equipment - High Temperature Hazard

NEI 12-06, Section 9.3.2 states:

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

On page 3 of the Integrated Plan, the 50 year high is 105.5°F per ASHRA 1% data (1% of the hours, 7 hours, in one month of 50 years exceed that value). The design temperature of the FLEX equipment is 110.0°F. As noted in 3.1.5.1 above, the normal temperature of the storage building is between 50°F and 80°F. During the audit, the licensee identified that the FLEX equipment is specified to operate at the temperature extremes of -28°F to 110°F.

The final design of a new structure or modification of existing structure(s) will require additional development by the licensee. This has been previously identified as Confirmatory Item 3.1.1.1.A.

Page 71 of the Integrated Plan identifies 2 Ford F-350 tow vehicles for portable equipment movement, and fuel tanker movement.

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

3.1.5.3 Procedural Interfaces – High Temperature Hazard

NEI 12-06, Section 9.3.3 states:

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

During the audit, the licensee identified that the FLEX equipment is specified to operate at the temperature extremes of -28°F to 110°F. This bounds the site extreme temperatures.

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

3.2 PHASED APPROACH

Attachment (2) to Order EA-12-049 describes the three-phase approach required for mitigating BDBEEs in order to maintain or restore core cooling, containment and spent fuel pool 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 spent fuel pool and to maintain containment capabilities in the context of a BDBEE that results in the loss of all ac power, with the exception of buses supplied by safety-related batteries through inverters, and loss of normal access to the UHS.

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

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

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

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

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

During the audit, the licensee was requested to provide its position on each of the recommendations discussed in Section 3.1 of WCAP-17601-P for developing the FLEX mitigation strategies. The licensee was requested to list the recommendations that are applicable to the plant, including rationale for the applicability, including how the applicable

recommendations are considered in the ELAP coping analysis, and the plan to implement the recommendations. The licensee was further requested to provide the rationale for each of the recommendations that are determined to be not applicable to the plant.

The licensee responded as follows:

> Objective #1 of WCAP-17601-P section 3-1 recommends performing a cooldown of the RCS when time and resources permit. Point Beach plans on installing the Westinghouse SHIELD Passive Thermal Shutdown Seal SDS provided the 10 CFR part 21 issue can be adequately resolved. The Point Beach strategy delays RCS cooldown for about 12 hours. Delay of the cooldown is also addressed in WCAP-17601-P section 5.7.1 for the three reference cases with low RCP seal leakage, no RCS cooldown was assumed, but recognized that there may be other reasons for performing RCS cooldown when time and resources permit.
>
> Delaying the RCS cooldown allows time for:
>
> > Establishing the ability to isolate the accumulators.
> >
> > Decay heat to lower to a level which can be removed by one SG ADV at reduced SG pressure.
> >
> > Deployment of the Portable Diesel Driven Charging Pump (PDDCP) and the establishment of RCS makeup/boric acid injection.
> >
> > Damage assessment.
> >
> > Increasing available margin for time constrained activities.
>
> Objective #2 of WCAP-17601-P section 3.1 recommends developing coping times beyond the Reference case. Point Beach still plans on install the Westinghouse SHIELD Passive Thermal Shutdown Seal SDS provided the 10CFR part 21 issue can be resolved.
>
> Objective #3: of WCAP-17601-P section 3.1 recommends developing a high level list of instrumentation for the RCS in order to confirm/maintain adequate core cooling. Point Beach will have indication of the parameters listed in section 3.4.
>
> Objective #4 of WCAP-17601-P section 3.1 recommends a set of plant specific curves be developed for maintaining a subcritical condition. Point Beach is developing plant specific curves for the operators to use to determine the amount of borated water needed for maintaining adequate shutdown margin during a cooldown (Pending Action 29).
>
> Objective #5 of WCAP-17601-P section 3.1 recommends providing a means of adding inventory and borating the RCS. The Integrated Plan stated that the performance criteria of the portable diesel driven charging pump would be 15 gpm@2500 psig. This is being reassessed in consideration of the desire to maintain the physical size and weight of the equipment within manageable limits. Any change to this strategy will be described in the next six month update. To maintain 1% [shutdown margin] SDM during a cooldown to 350°F, approximately

6600 gallons of RWST water must be added to the RCS. A 24 hour cooldown interval can be accommodated with less than 5 gpm flow from the RWST to the RCS. Adding the RCS makeup requirements to account for RCP low leakage seals (1 gpm per pump) and assumed RCS leakage (1 gpm) results in approximately an 8 gpm flow requirement. The nominal capacity of the portable diesel driven changing pump is expected to be in the range of 10-15 gpm. If necessary the cooldown rate can also be adjusted to match the makeup capabilities.

Objective #6 of WCAP-17601-P section 3.1 recommends Qualifying RCS response with [safe shut-down] SDS/low leakage seals. The use of the SDS or Low-leakage seal reduces the complexity of the transient and eases operator burden.

Objective #7 of WCAP-17601-P section 3.1 recommends prioritizing of pre-staging a flex strategy for alternative feedwater addition when time and resources permit. Point Beach will pre-stage a Godwin Pump Model 3316, nominally rated at 325 gpm at 400 psi for an alternative feedwater source. In addition the opposite units TDAFW pump can be aligned to provide feedwater.

Objective #8 of WCAP-17601-P section 3.1 recommends a portable feedwater system capable of delivering 300 gpm at 300 psig. A Godwin Pump Model 3316, nominally rated at 325 gpm at 400 psi, will be used to supply water to both units SGs. The decay heat load nine hours after reactor trip can be handled with approximately 80 gpm SG feed flow to each unit.

Objective #9 of WCAP-17601-P section 3.1 recommends prioritizing staging of portable equipment to isolate/vent the accumulator. The Point Beach Integrated Plan stated the 480 Volt safeguards busses would be energized by portable diesel generators at nine hours into the event; this would allow isolation of the [safety injection] SI accumulators. The timeline for isolating the accumulators is at 13 hours into the event. The RCS cooldown will be initiated at 12 hours into the event.

Objective #10 of WCAP-17601-P section 3.1 recommends prioritizing staging of portable equipment to isolate/vent the accumulators. The Point Beach Integrated Plan stated the 480 Volt safeguards busses would be energized by portable diesel generators at nine hours into the event; this would allow isolation of the SI accumulators. The timeline for isolating the accumulators is 13 hours into the event. The accumulators could be isolated when the 480 volt safeguards busses are energized. The RCS cooldown will be initiated at 12 hours.

During the audit, the licensee was requested to identify the non-safety related installed systems or equipment that are credited in establishing ELAP mitigation strategies and to discuss the intended mitigation functions and provide information to show that the identified systems or equipment are available and reliable to provide the intended mitigation functions on demand during an ELAP event.

The licensee responded that the following equipment and systems or portions thereof are not safety related; Diesel fire pump; Fire water system; Condensate storage tanks; SFP makeup line; Charging connection; Accumulator fill valve air supply; RHR connection; Ultimate Heat Sink

connection to forebay/pump bay. The licensee discussed the use of these structures, systems and components (SSCs) as follows:

Diesel fire pump/Fire water system:
The Fire water system ties into the safety related service water header inside the pump house which is a robust structure. The SW Pipe is routed underground from the pump house to the Class 1 control building and then through the control building to the suction of the TDAFW pump. The cross connection between FW and SW will be designed and installed to meet seismic requirements. Remote manual valves will be installed to allow isolation of the non-seismic portion of the FW system and establish the cross connection to SW. The DDFP including the engine and control cabinet, portions of the fire water system, the fuel oil tank (T-30) and the fuel oil piping are all being upgraded to meet seismic requirements for a BDBEE per EC 259770. The pump, diesel engine, control cabinet and fuel oil tank are all being replaced. The TDAFW pump and the DDFP do not require any ac power to start or to operate. The DDFP has its own set of starting batteries that will be charged by an engine driven alternator. A dedicated set of batteries will also be installed to allow remote manual operation of the valves that must change position to isolate the DDFP from non-seismic portions of the fire water system and cross connect it to service water. The DDFP is periodically tested to demonstrate reliability.

Condensate storage tanks:
A modification will be performed on both CSTs to provide seismic qualification and tornado missiles protection to a tank level of 6 ft. which will provide a volume of 14,100 gallons of available water per tank. The 14,100 gallons value is the minimum allowed [Technical Specification] value which is logged and monitored.

SFP makeup line:
The connection points and flow path are being seismically reviewed and qualified as part of the Engineering Change package. The location is within the Primary Auxiliary Building which is a Class 1 structure. There are no active components that require periodic testing to demonstrate reliability. Manual valves that must be opened will be periodically checked to demonstrate reliability.

Charging connection;
The connection points and flow path are being seismically reviewed and qualified as part of the Engineering Change package. The location is within the Primary Auxiliary Building which is a Class 1 structure. There are no active components that require periodic testing to demonstrate reliability. Manual valves that must be opened will be periodically cycled to demonstrate reliability.

Accumulator fill valve air supply;
The backup compressed gas supply is being seismically designed and qualified as part of the Engineering Change package. The location is within the Containment which is a Class 1 structure. Reliability of the valves is demonstrated by normal operation which requires periodic operation and maintenance. Depending on the final design, a pressure drop test is being considered.

RHR connection;

The connection points and flow path are being seismically reviewed and qualified as part of the Engineering Change package. The location is within the Primary Auxiliary Building which is a Class 1 Structure. There are no active components that require periodic testing to demonstrate reliability. Manual valves that must be opened will be periodically cycled to demonstrate reliability.

Ultimate Heat Sink connection to forebay/pump bay:
Normal intake to the Pump house is through two 14 ft. diameter pipes that take suction from an intake crib located about ¼ mile off shore in Lake Michigan. The intake pipes and crib are below the surface of the lake and thus would not be subjected to high winds or missiles. The intake crib and piping are not seismically designed but are robust steel and rock structures. The intake pipes are corrugated, galvanized, structural plate pipes buried to a minimum depth of 3 ft. below lakebed. The intake structure consists of two annular rings of 12 in. structural steel H piles. The annulus is filled with individually place limestone blocks having two approximately parallel surfaces and weighing between 3 and 12 tons. The structure is located in a water depth of approximately 22 ft., has an outside diameter of 110 ft., an inside diameter of 60 ft. and a top elevation of approximately -11 ft. Water enters the intake primarily throughout the 60 ft. opening above the intake cones but can also enter through the stone annulus. The 60 ft opening is covered with a trash rack having approximately 7 in by 18 in openings. The intake valve is within the pump house structure which is seismically designed. The valve is not safety related or seismically qualified but the massive steel structure is considered inherently robust. Both intake pipes would have to be 100% blocked to prevent makeup flow to the diesel fire pump which is only about 0.25-0.5% of normal flow to the pump bay. If this occurred flow from the discharge flume to the forebay intake which is common to both units using either the unit 1 or unit 2 ice melt valves would be established. The valve if closed would only have to be partially opened. One valve is typically partially open for several months during the winter period. The ice melt valves are similar to the intake valves and also located within the pump house structure. The valves would have to be manually opened. The valve operators for these valves are located within the pump house concrete structure. An operator would have to traverse a short distance outside to get to the pump house and another short distance to get to the valve gallery where the valve operators are located. Immediate operator action is not required because as stated in the Integrated Plan there is enough water contained within the forebay and pump bays to provide greater than 24 hours of decay heat makeup for both Point Beach units. This provides sufficient time to obtain additional resources and establish access. Instruction for monitoring pimp bay level and establishing makeup will be contained in a FLEX Support Guideline (FSG). Finally a portable diesel driven pump could be used to pump water from the lake into the pump house forebay. The flume are constructed of heavy steel pylons driven into the lakebed and are considered inherently robust. The discharge valves are similar to the intake valves and also located within the pump house structure. Reliability of the valves is demonstrated by normal operation which requires periodic operation and maintenance.

During the audit, the licensee was requested to discuss the possibility of falling debris from non-seismic or tornado qualified overhead structures or components located near the CSTs to damage the CSTs below the 6-foot level. The licensee responded as follows:

The turbine building has been evaluated to withstand a seismic event. The structure and overhead crane has also been analyzed to withstand a seismic event with the crane at loaded capacity and does not fail. When not in use the Overhead crane is parked at the north or south end of the turbine hall, not directly above the CSTs. The turbine building interior office to the north and west of the CST on the turbine operating floor has been evaluated to withstand a seismic event. North of the CSTs there is the battery room that is seismic. South of the CSTs is an open area (truck access bay) to the floor below so there is no equipment in the immediate area that would present a risk to the CSTs. The CSTs are mounted on top of a seismic Class 1 structure.

Tornado:
The CST upgrade is accounting for the tornado wind loads for tank anchorage loading. The FSAR states tornado missiles are defined in Bechtel Topical Report B-TOP-3. The report only accounts and defines horizontal missiles. The turbine building structure is analyzed for 360 mph wind with 1/3 of the siding remaining. The NRC endorsed NEI-12-06 Figure 7-2 places PBNP in an area with tornado winds of 182 mph. Having a tornado with wind speeds in excess of 183 mph is considered improbable (10^{-6} probability level). The energy in any object is a squared function of the velocity. Any missiles produced would not have anywhere near the forces or energy to produce damage that were designed for.

Based on the design of the turbine building and structures near the CSTs falling or wind generated debris would be light weight in nature, mainly metal siding and ventilation ducting, and would not pose a threat to the CSTs. The CSTs are enclosed tanks so light weight debris would be deflected by the roof of the tanks and a substantial amount of debris is not expected to enter the tank. The CSTs will be protected to an elevation greater than 25 ft. above the surrounding grade so the plank missile is the only concern. A missile strike above the protected elevation could penetrate the tank. Debris from the missile strike is expected to be only from the missile itself. A puncture of the metal tank may occur but the deformed sections would remain attached. If debris does enter the tank it would likely sink or float. The AFW suction comes off the side of the tank not the bottom material that sinks would not pose a threat. Switch over to the alternate supply to the TDAFW pump is done before vortexing occurs which would prevent floating material from being drawn into the pump suction.

During the audit, the licensee was requested identify how the PDDP will tie into the TDAFW pump, including the specific location of the connection. The licensee responded that the PDDP ties into the safety-related SW system in the Pumphouse using an adapter with a hose fitting that replaces the top cover of one of the 6 SW pump discharge valves.

During the audit, the licensee was requested to justify the use of probability, separation and diversity to conclude that the TDAFW pump exhaust stacks will not both be damaged by tornado missiles even though they are not fully protected against tornado damage.

The licensee responded that to improve the robustness and diversity of the current plant design, PBNP is modifying its Steam Driven Auxiliary Feedwater steam supply and exhaust systems. Steam supply from any one of the four main steam lines, which are separated by large substantial structures will ensure Feed Water supply to both units. PBNP believes that the

modifications proposed satisfy the robustness prescribed by NEI-12-06. The licensee further stated that:

> The steam exhaust stacks for the two turbine driven AFW pumps are fabricated from 8” diameter butt-welded seamless ASTM A-53B schedule 40 carbon steel pipes. They are unprotected by substantial Class 1 structures from the 66’ plant elevation (~45’ above the surrounding grade) to their terminus at the ~117’ plant elevation. The stacks are run vertically, and are 48.5 feet apart. They are supported by X and Y guides at the 64’, 89” and 107’ plant elevations. The guides are anchored to either the Class 1 structure (64’) or the steel building superstructure. From the above information, the target area per stack is the exposed height (51 ft) multiplied by the diameter (0.72 ft,), or 37 ft^2. The docketed risk assessment of missile hazards submitted in response to GL88-20 Supplement 4 and previously accepted by the NRC, considered targets of this type to be small targets. The assigned probability of a missile strike for these type targets ranged from a high of 2.4E-9 to a low of 1.5E-11 missile strikes per square foot of target area per tornado point strike frequency (Table 5.1.4-3 of Report REP-0699-C).
>
> Conservatively using the high end assessment of missile strike frequency, the risk of a single stack being struck by a missile in a single tornado point strike event is; $2.4 \times 10^{-9}/ft^2$-event x 37 ft^2 = 8.9×10^{-8}/tornado event. The risk of both stacks being struck in the same event is the square of this value, or 7.9×10^{-15}/tornado event (Table 5.1.4-1 of Report REP-0699-C). The same assessment of missile hazard risks determined a tornado point strike frequency of 5.38×10^{-4}/yr for any size tornado (wind speeds ranging from 74 mph to 349 mph). Therefore, the likelihood for a single stack being struck by a missile is; 8.9×10^{-8}/tornado event x 5.38×10^{-4} events/yr. = 4.88×10^{-11}/yr. Similarly, the likelihood of both stacks each being struck by a missile in a single event is 7.9×10^{-15}/event x 5.38×10^{-4}/yr. = $4.25\ 10^{-19}$/yr.
>
> By cross connecting the two exhaust lines within the Class 1, missile hardened structure, the likelihood of simultaneous missile strikes that might defeat the function of the turbine driven AFW pumps is reduced by 7 orders of magnitude. These results conservatively presume that any missile strike, occasioned by and tornado (even those with wind speeds too low to credibly generate missiles capable of damaging the steel pipe stacks) will cause consequential failure of the AFW pump turbines. They do not consider the relatively high elevation of the targets, their relatively low population of massive missiles at such elevation, the relatively robust construction and supporting, etc. Even accounting for several orders of magnitude of uncertainty and inaccuracies in the above formulations, the use of a cross connect provides ample assurance of ability to perform the design functions for the postulated beyond design basis event.
>
> The alternatives to crediting a protected cross tie are to either harden the stacks, or to foreshorten them so that a missile strike above the existing Class 1 structure would be inconsequential. Hardening the stacks would require massive steel and/or concrete barriers to be erected atop the Class 1 structure and to be seismically supported by it. It is apparent that such a massive and tall cantilevered structure would overload the Class 1 structure, particularly during a seismic event. Foreshortening the stacks to the point where they emerge from

> the Class 1 structure is physically feasible by installing a missile hardened "t" with a rupture disk at the point that each stack emerges from the Class 1 structure. The complexity, time to implement, and economic impact of this modification would be comparable to installation of the cross tie. However this approach comes with increased complications and risks of rupture disk failure. Failure to rupture (or to vent adequately) during a valid loss of the upper stack can be can be conjectured to occur due to obstruction by debris. Conversely (and more likely), premature activation during much more frequent operation of the TDAFW pumps would introduce large volumes of moist, low quality steam into the Primary Auxiliary Building where the heat and humidity would be expected to negatively affect the numerous safety related components that are not environmentally qualified for such conditions. Based on the relative risks, and the large reduction in risk afforded by installing a hardened cross-connect line between the stacks has been judged to be the most beneficial approach to protecting the health and safety of the public.

The licensee further quoted text regarding tornado missile protection that was added to Section 1.3.1 of the PBNP FSAR in 2012. This text states that:

> The design basis for tornado missile protection of systems and components is that it is possible to shut the plant down and keep it in hot shutdown during and after the passage of a tornado. The equipment needed for this event remains operable if:
>
> a) Critical items are housed in structures capable of withstanding tornado winds, depressurization, and missiles;
> OR
> b) the separation provided between redundant systems or components is such that reasonable assurance exists that a single missile cannot render both systems or components inoperable; and large structures, such as facade, auxiliary building superstructure, turbine buildings, etc., are so designed that they will not collapse and fall on redundant components or systems.

The licensee uses a probabilistic approach to reach a conclusion that one steam exhaust stack for the TDAFW pumps will survive an ELAP event. It appears that the licensee's reliance on probability to conclude that one steam exhaust stack for the TDAFW pumps is protected from missiles generated from high winds is in accordance with its current licensing basis.

During the audit, the licensee was requested to justify the use of probability, separation and diversity to conclude that the ADVs will not both be damaged by tornado missiles even though they are not fully protected against tornado damage.

The licensee responded that:

> The atmospheric steam dump valves present a smaller cross sectional target area than do each of the TDAFW pump exhaust stacks. Therefore, using the conservative approach detailed above, the probability of each being struck by missiles and incapacitated during the same wind event is correspondingly lower. Furthermore, these two valves are situated approximately 90 degrees apart around the circumference of the massive containment buildings, making it even less likely for them to both be struck during the same event. These valves are

fail-closed valves designed to operate at the design pressure of the main stream system. Accordingly, they are robust and not likely to fail open if subjected to a missile strike. The air operator (and the attached manual handwheels to locate operate the valve) might be damaged by a postulated missile strike however, rendering the valve unavailable to dump steam. In that event, the four redundant main steam safety valves mounted on each of the two redundant main steam headers would maintain decay heat removal pending repairs to the affected atmospheric dump valve(s). In extremis, the manual lifting levers of the main steam safety valves could be used to dump steam.

On page 14 of the Integrated Plan, the licensee stated that the ADVs are not fully protected during an ELAP event. The Integrated Plan does not address whether the potential for damage to an ADV or upstream associated piping could result in an ELAP scenario involving an uncontrolled cooldown of the RCS. During the audit, the licensee was requested to address the following items:

(a) Clarify whether consequential damage to an ADV or upstream associated piping directly resulting from the ELAP initiating event (e.g., tornado, earthquake) could result in an uncontrolled cooldown of the RCS and provide a basis.

(b) Clarify whether postulated damage would be limited to a single ADV and/or associated piping, or whether failures could be postulated resulting in an uncontrolled cooldown affecting both steam generators and provide a basis.

(c) If ELAP scenarios involving the uncontrolled cooldown of one or more steam generators may be postulated, describe key operator actions that would be taken to mitigate these events.

(d) If ELAP scenarios involving the uncontrolled cooldown of one or more steam generators may be postulated, provide analysis demonstrating that the intended mitigating actions would lead to satisfaction of the requirements of Order EA-12-049 for these cases.

(e) As applicable, if the operator actions to mitigate an ELAP event involving an uncontrolled cooldown results in an asymmetric cooldown of the RCS, address the consequences of the asymmetric cooldown on the mixing of boric acid that is added to the RCS to ensure subcriticality.

The licensee responded as follows:

(a) The main steam line and connections are seismically supported and the heavy wall steam piping is considered resistant to puncture from the plank missile. The elevation of the main steam lines and SG ADVs is well above the height of a vehicle strike. The ADVs are fail-closed valves designed to operate at the design pressure of the main steam system. The ADVs are designed for full main steam pressure (1100 psig), and the robust pressure boundary is not vulnerable to damage from postulated missiles. The valve topworks (i.e., air operator and associated handwheel), while seismically qualified, are less resilient to postulated missiles and could credibly be damaged. If damaged the struck valve may be incapable of being opened remotely or locally. In that event, the four redundant main steam safety valves mounted on each of the two redundant

main steam headers would maintain decay heat removal pending repairs to the affected atmospheric dump valve(s). These valves are fail-closed and valves seat with steam pressure. To open the main plug of an ADV requires lifting of an internal pilot valve. Shearing or loss of the valve operator stem would result in the inability to open the valve, even if the closure springs are unloaded, and this would preclude an uncontrolled cool down.

(b) The atmospheric steam dump valves present a small cross sectional target area for a missile strike and are located above the elevation of an assumed vehicle impact. Furthermore, these two valves are situated approximately 90 degrees apart around the circumference of the massive containment buildings, making it even less likely for them to both be struck during the same event [by the same missile].

(c) Although considered highly unlikely, failing a single ADV fully open would result in a steam release rate of about 5% (333,200 [pound mass] lbm/hr) at 1085 psig which is much less severe than a main steam line break. Since this exceeds the decay heat generation immediately after a trip from full power, it would result in an initial cooldown of the RCS. The cooldown would be arrested when either; steam pressure decreased to the point that the steam release rate matches reactor decay heart rate, or feed to the affected steam generator was isolated and permitted to boil dry. Operators would take action to stabilize the plant at this point by controlling steam release using the operable ADV or by limiting feed flow.

If both ADVs are damaged and fail open the cooldown would be somewhat worse but still well within the bounds of the main steam line break and less than a single main steam safety valve. The results would be similar to the single valve failure except that feed flow would be the only method of stabilizing the plant.

(d) Because the ADVs are not fully protected from tornado missiles the potential for loss of functionality of one ADV was considered in the development of the Integrated Plan. In the event that both ADVs are rendered non-functional the plant would remain in a hot shutdown condition until the ADVs are repaired or an alternate steam release path can be established. Point Beach could remain in hot shutdown for several days (greater than a week). With the planned installation of low leakage shutdown RCP seals RCS, inventory is not a concern for several days and makeup from Lake Michigan to the SGs is considered as an inexhaustible supply.

(e) The primary strategy would be to use both SG ADVs to remove decay heat and cooldown the plant. In the event that one ADV is damaged a single ADV would be used to remove decay heat and cooldown the plant in a manner similar to that analyzed for a station blackout event consistent with the current design and licensing basis response to station blackout. This analysis addressed the concern for a stagnant loop flow condition and in calculated a maximum allowable cooldown rate which will ensure flow stagnation will not occur. The purpose of preventing loop stagnation is to support boron mixing and RCP seal cooling. Additional analysis is being considered to determine if adequate boron mixing can be demonstrated during a single loop cooldown. This analysis would also verify single phase flow conditions that meet the NRC definition of single

phase/two phase/reflux cooling consistent with the endorsed CENTS white paper related to percent voids and boron mixing. Point Beach is exploring the performance of this analysis through Westinghouse using the NOTRUMP code. This analysis is also expected to demonstrate the acceptability of the Point Beach RCS and cooldown strategy.

An alternative considered was to erect a hardened missile barrier on the main steam platforms to protect the ADVs. These platforms are seismic Class 1 structures mounted high on the side of the containment buildings where the seismic response spectrum is particularly severe, and where the addition of mass would be difficult physically, and would have an adverse impact on the seismic capability of the main steam platforms and the containment itself. In light of these considerations, it has been determined that protecting the ADVs is neither necessary, nor would it result in a net reduction in risk to the health and safety of the public.

In accordance with the current licensing basis for PBNP, the reviewer considered the licensee's approach acceptable for demonstrating compliance with Order EA-12-049, but noted that the adequacy of protection against tornado missile hazards afforded the ADVs and the TDAFWP steam exhaust stacks will be subject to further re-evaluation pursuant to Section 402 of Public Law 112-074, "Consolidated Appropriations Act," which requires the NRC to require licensees to reevaluate the seismic, tsunami, flooding, and other external hazards at their sites against current applicable Commission requirements and guidance for such licenses as expeditiously as possible, and thereafter when appropriate.

The licensee stated that analysis is being considered to address the potential for damage to one of the ADVs that would prevent its opening, thus rendering a controlled symmetric cooldown of the reactor coolant system impossible. The reviewer considers this analysis appropriate and consistent with NEI 12-06, Section 3.2.1.4, boundary condition (4), which allows for inclusion of consequential failures resulting from the hazard that initiates the ELAP event. Completion of analysis addressing the potential for damage to an ADV that would prevent its opening and demonstration of acceptable results, or otherwise demonstrating the acceptability of an asymmetric cooldown under ELAP conditions, is designated Confirmatory Item 3.2.1.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 the Confirmatory Item above, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to RCS cooling and heat removal, and RCS inventory control strategies if these requirements are implemented as described..

3.2.1.1. Computer Code Used for ELAP Analysis.

NEI 12-06, Section 1.3 states:

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

The licensee's Integrated Plan stated that the mitigating strategy for PBNP would be based on thermal-hydraulic analysis performed with the [Modular Accident Analysis Program] MAAP code or a comparable code. During the audit, discussion with the licensee identified that it had used or was planning to use the Generation of Thermal-Hydraulic Information for Containments (GOTHIC) code for the thermal-hydraulic analysis of the RCS in natural circulation during an ELAP. As implied by its full name, the GOTHIC code was written and has been approved for certain containment analysis applications. Therefore, based upon this information, the NRC staff generated additional audit questions requesting that the licensee consider whether generic calculations with NOTRUMP in WCAP-17601-P could be referenced by PBNP to demonstrate the success of its mitigating strategy as an alternative to the use of the GOTHIC containment analysis code for analyzing RCS thermal-hydraulics.

The licensee stated during the audit that it had intended to have a vendor perform containment and RCS analysis using the GOTHIC containment analysis code. However, following discussion with the NRC staff during the audit, the licensee recognized that the NRC staff has not accepted the GOTHIC containment analysis code for RCS thermal-hydraulic analysis and lacked confidence in the code's existing capabilities for such an application under ELAP conditions. As such, the licensee stated that additional analysis is being considered to demonstrate the acceptability of the RCS inventory and core cooling strategy for PBNP. The licensee stated that the analysis will also determine if adequate boron mixing can be demonstrated during a single-loop cooldown. The licensee further stated that this analysis would also verify single-phase flow conditions that meet the NRC definition of single-phase natural circulation, two-phase natural circulation, and reflux cooling, consistent with the endorsed CENTS white paper, ADAMS Accession No. ML13297A150, related to percent voids and boron mixing. While the use of the definitions proposed in the CENTS white paper may constitute a rough working criterion, the cited definitions from the CENTS white paper have not been endorsed by the NRC staff for the analysis of Combustion Engineering plants using the CENTS thermal-hydraulic code; nor have they been validated as applicable to simulations performed for Westinghouse plants with the NOTRUMP code.

Reliance on the NOTRUMP code (or other thermal-hydraulic code) for the ELAP analysis of Westinghouse plants is limited to the flow conditions before reflux condensation initiates. This includes specifying an acceptable definition for reflux condensation cooling. The licensee should confirm the applicability of this approach for PBNP. This has been identified as Confirmatory Item 3.2.1.1.A in Section 4.2 below.

During the audit the licensee was requested to specify which analysis performed in WCAP-17601-P, if any, is being referenced for PBNP. Additionally, as applicable, the licensee was requested to justify the use of that analysis by identifying and evaluating the important parameters and assumptions demonstrating that they are representative of PBNP and appropriate for simulating the ELAP transient.

The licensee responded that PBNP identified where strategies deviated from WCAP-17601-P on pages 81 through 84 of the Integrated Plan. The licensee contracted a third party review of the Integrated Plan with respect to WCAP-17601-P to verify all the appropriate deviations were identified and determine if additional analysis was required.

From this third party review, the following analyses were recommended;

1. RCS Integrated Plan Case with Cooldown Starting at 12 Hours and low leakage RCP seals.

2. Containment Response to Integrated Plan Case with Cooldown Starting at 12 hours and low leakage RCP seals.

3. Containment Response to Mode 5 with SGs unavailable.

The licensee has a contract in place to perform these calculations. The analyses are being performed using the GOTHIC code.

The licensee further stated during the audit that:

> The Point Beach strategy is to use both loops to cooldown the plant provided both steam generators are available, however because the SG atmospheric dump valves are not fully missile protected, asymmetric cooldown using only one loop is being addressed. A cooldown will be done using only one loop which is consistent with the current design and licensing basis response to station blackout. This analysis addresses the concern for a stagnant loop flow condition and calculated a maximum allowable cooldown rate which will ensure flow stagnation will not occur. The purpose of preventing loop stagnation is to support boron mixing and RCP seal cooling. Point Beach is a two loop plant which requires a single loop (asymmetric) cooldown for several design basis accidents.

In light of the deviations between PBNP conditions and those in the analysis in WCAP-17601-P, the licensee is considering performing plant-specific analysis for the ELAP event. Should the licensee decide to perform its own plant-specific analysis, a detailed parameter comparison between PBNP and the generic reference case in WCAP-17601-P would not be necessary. However, since the licensee has not yet (1) performed an adequate plant-specific analysis of the ELAP event, nor (2) justified an adequate generic analysis as applicable to PBNP, the Integrated Plan does not provide reasonable assurance that the plan will conform to NEI 12-06, Section 1.3. Such analysis would need to be performed with an acceptable code, address the assumptions common to the other ELAP analysis as specified in WCAP-17601-P, and be applicable to PBNP. The licensee stated that it is exploring the possibility of performing an analysis using the NOTRUMP code but did not commit to the use of a specific thermal-hydraulic code and evaluation model during the audit. Therefore, completion of analysis of the RCS under ELAP conditions with an appropriate thermal-hydraulic code and evaluation model has been identified as Open Item 3.2.1.1.B in Section 4.1.

The licensee's approach described above, as currently understood, has raised a concern which must be addressed before confirmation can be provided that the approach is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, with respect to the computer code used for the ELAP analysis. This concern has been identified as an Open Item in Section 4.1. An additional Confirmatory Item associated with this section has been identified in Section 4.2.

3.2.1.2 RCP Seal Leakage Rates

NEI 12-06, Section 1.3 states:

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

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

The licensee provided an SOE in its Integrated Plan, which included the time constraints and the technical basis for its site. The existing Integrated Plan assumes that SHIELD low-leakage seals will be installed on both RCPs at each reactor at Point Beach. The existing Integrated Plan assumes that this configuration will result in a seal leakage rate of 1 gpm per pump at normal operating pressure and temperature. The issue of RCP seal leakage rates under ELAP conditions was identified as a generic concern during the staff's audit review and was addressed by the industry in the following submittals:

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

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

After reviewing these submittals, the NRC staff placed certain limitations for Westinghouse designed plants. Those limitations and their applicability are discussed below in light of design-specific information pertaining to the reactors at PBNP:

(1) Some Westinghouse plants have installed or will install the SHIELD shutdown seals, or other types of low leakage seals, and have credited or will credit a low seal leakage rate (e.g., 1 gpm/seal) in the ELAP analyses for the RCS response. For those plants, information should be provided to address the impacts of the Westinghouse 10 CFR Part 21 report, "Notification of the Potential Existence of Defects Pursuant to 10 CFR Part 21," dated July 26, 2013 (ADAMS No. ML13211A168) on the use of the low seal leakage rate in the ELAP analysis.

During the audit, the licensee stated that it still plans on installing the Westinghouse SHIELD Passive Thermal Shutdown Seal SDS provided the 10 CFR Part 21 issues can be adequately

resolved. At this time, the proposed changes to the SDS are not expected to affect the leak limiting characteristics of the seal. Testing will be performed by Westinghouse to qualify the design. Completion of this testing and demonstration of its applicability to the RCP design at PBNP has been identified as Open Item 3.2.1.2.A in section 4.1.

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

During the audit, the licensee stated that other seal suppliers are being evaluated for a replacement for the Westinghouse seal in the event the Westinghouse seal cannot be qualified. No other alternatives are actively being pursued at this time. This has been identified as Confirmatory Item 3.2.1.2.B in Section 4.2.

During the audit, the NRC requested that the licensee discuss how the pressure-dependent seal leakage rates during the ELAP are calculated. If the analysis uses the equivalent size of the break area based on the initial total RCP leakage rate and a specific flow model to calculate the pressure-dependent RCP seal leakage rates during the ELAP, the licensee was requested to discuss and justify the flow rate model used. If the break size remains unchanged, the licensee was requested to address the adequacy of the unchanged break size throughout the ELAP event in conditions with various pressure, temperature (considering that the seal material may fail due to an increased stress induced by cooldown) and flow conditions that may involve two-phase flow, which is different from the single-phase flow modeled for the RCP seal tests that are used to determine the initial total RCP seal leakage rate assumed in the ELAP analysis.

The licensee responded that the pressure-dependent seal leakage rates in the GOTHIC containment analysis assume a constant geometry and an initial flow rate of 1 gpm per RCP plus 1 gpm for other RCS leakage. The licensee stated that preliminary comparisons with the plot of leakage flow in Figure 5.7.1.5 of WCAP-17601-P show that the GOTHIC model is at least as conservative as the Westinghouse results up to the time of RCS saturation at approximately 24 hours. Although the licensee's response addressed the mass and energy in leakage terms for the containment analysis, it does not address how seal leakage will be modeled in the RCS analysis. Specifically, during the audit, the staff had requested information in reference to the RCS analysis concerning the modeling of the leak area, the flow model used for computing leakage flow, the modeling of two-phase leakage, and consideration of increased leak areas due to stresses on the seal from the RCS cooldown. The staff noted in the previous section of this report that the RCS analysis has not yet been performed, nor have the thermal-hydraulic code and evaluation model been selected. This has been identified as Open Item 3.2.1.2.C in Section 4.1.

The licensee was requested to address the applicability of Information Notice (IN) 2005-14 to the ELAP analysis. The licensee responded that IN 2005-14 is not considered applicable to the PBNP ELAP strategies because PBNP plans to install the Westinghouse SHIELD Passive Thermal Shutdown Seal SDS as part of the PBNP Integrated Plan strategy to address RCS inventory and core cooling.

The NRC staff understood the licensee's plan to install SHIELD seals at PBNP, but noted that the licensee did not address whether the restoration of cooling to these seals would be

attempted and could lead to thermal shock of the seal materials. This has been identified as Confirmatory Item 3.2.1.2.D in Section 4.2.

On page 82 of the Integrated Plan, the licensee stated:

> RCS T_{hot} temperature will be procedurally maintained below 550°F in cases of asymmetric cooling to protect the seal O-Rings.

During the audit, the licensee was requested to address Section 4.4.1.1 of WCAP-17601-P which states that "… In some plant designs, such as those with 1200 to 1300 psia SG design pressures and no accumulator backing of the main steam system PORV actuators, the cold legs could experience temperatures as high as 580°F before cooldown commences". It further states that "this is beyond the qualification temperature (550°F) of the O-rings but it is judged that the O-rings will remain intact for at least several hours at this temperature and normal operating pressure."

The licensee responded that the lowest SG safety valve setpoint at Point Beach is 1085 psig which corresponds to a temperature of 556°F. Although this temperature is greater than 550°F, an open item is not necessary because Point Beach plans to install the Westinghouse SHIELD Passive Thermal Shutdown Seal SDS as part of the Point Beach Integrated Plan strategy to address RCS inventory and core cooling. WCAP-17100-P, Supplement 1 addresses the use of the SDS for Model 93 RCP's seals directly to the pump shaft above the number 1 seal and thus does not rely on any O-ring elastomer seals to limit seal leakage once the SDS has activated. Therefore, the NRC staff considers the temperature qualification limit for the SHIELD seal to be adequately captured under Open Item 3.2.1.2.A.

During the audit, the licensee was requested to confirm that the primary ELAP strategy is to perform a symmetric cooldown using all RCS loops. The licensee responded that the PBNP strategy is to use both loops to cool down the plant provided both SGs are available. If for some reason only one SG is available for cooldown, the cooldown will be done using only one loop, which the licensee considers to be consistent with the current design and licensing basis response to station blackout. The licensee stated that previous analysis addressed the concern for a stagnant loop flow condition and calculated a maximum allowable cooldown rate which will ensure flow stagnation will not occur. However, the analyses referenced by the licensee during the audit with regard to (1) demonstrating that an asymmetric cooldown being part of the current station blackout analysis and (2) demonstrating that flow conditions in an idle loop will not stagnate or otherwise result in adverse consequences under ELAP conditions were not made available for review. The licensee also noted that further analysis was being considered to address asymmetric cooling under ELAP conditions, but did not discuss specifics during the audit.

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

3.2.1.3 Decay Heat

NEI Section 3.2.1.2 states in part:

The initial plant conditions are assumed to be the following:

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

Westinghouse completed generic analyses for Westinghouse plants as documented in WCAP-17601-P. Assumption 4 on page 4-13 of WCAP-17601-P states that decay heat is per ANS 5.1-1979 + 2 sigma, or equivalent.

The Integrated Plan does not address the applicability of assumption 4 to PBNP. The licensee was requested to provide additional information to address the adequacy of the use of the decay heat model in terms of the plant-specific values of the following key parameters: (1) initial power level, (2) fuel enrichment, (3) fuel burnup, (4) effective full power operating days per fuel cycle, (5) number of fuel cycles, if hybrid fuels are used in the core, and (6) fuel characteristics (addressing whether they are based on the beginning of the cycle, middle of the cycle, or end of the cycle).

The license responded that assumption 4 on page 4-13 of WCAP-17601-P states that the decay heat model is based on ANS 5-1-1979+2 sigma. The licensee stated that this decay heat model is applicable to PBNP and is currently used in the PBNP design-basis analysis. The licensee thus considered the model adequate for use in ELAP applications for PBNP. The licensee further considered the fuel and core characteristics of PBNP to be adequately handled by the ANS 5.1-1979 model for obtaining decay heat loads. The following are PBNP specific values of the stated parameters:

Power level 1800 megawatt thermal (MWT)
Fuel enrichment ≤5w/o U-235 (typical range is 4.0 to 4.95 w/o U-235)
Fuel burnup ≤60,000 MWD/MTU (assembly maximum)
Effective Full Power days (EFPD) ~500 to 530 average (18 month cycles)
PBNP does not use hybrid fuel and the fuel characteristics throughout the cycle are typical of fuel used in the nuclear industry for PWR plants.

Although the licensee's thermal hydraulic analysis has not been completed, nor have the code and evaluation model been selected, the licensee has identified its plans to use a decay heat model that is consistent with that of WCAP-17601-P.

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 decay heat if these requirements are implemented as described.

3.2.1.4 Initial Values for Key Plant Parameters and Assumptions

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

On page 4 of the Integrated Plan, the licensee stated considerations and assumptions for the Extended Loss of Alternating Current Power (ELAP) at PBNP are consistent with Section 3.2.1, "General Criteria and Baseline Assumptions" 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, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to initial values for key plant parameters and assumptions if these requirements are implemented as described.

3.2.1.5 Monitoring Instrumentation and Controls

NEI 12-06, Section 3.2.1.10 states in part:

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

The Licensee indicated in the Integrated Plan that as they continue to evaluate the FLEX strategy, they 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 (NEI 12-06 Rev. 0, Section 3.2.1.10).

On page 18 of the Integrated Plan regarding maintaining core cooling & heat removal for Phase 1, the licensee listed the following key reactor parameters for maintaining core cooling and heat removal:

A and B Loop RCS Hot Leg Temperature
Core Exit Thermocouples
A and B Loop RCS Cold Leg Temperature
Wide Range RCS Pressure
A and B SG Wide Range Level
SI Accumulator Pressure
Pressurizer Level
Reactor Vessel Level Steam Generator AFW Flow
A and B SG Pressure
CST Level
DC Bus Voltage
Neutron Flux

On page 23 of the Integrated Plan, the licensee stated credited portable equipment will be instrumented to provide operators the required information to verify that it is functioning properly and meeting the requirements of the strategy being implemented.

On page 26 of the Integrated Plan, the licensee stated:

> Where practical, the capability will exist to take field readings of important plant parameters using non-electrical gauges/indicators or with the installed transmitters through the use of hand held meters (e.g. FLUKE 705, FLUKE 114). A reference source of field reading locations and instructions will be compiled. Some of the field reading locations may be at the containment penetrations. The handheld meters will be available in the general location of the field readings (i.e., PAB and Control Building).

The licensee's plans in regards to instrumentation and controls as described above, includes those parameters listed in NEI 12-06, Section 3.2.1.10. The licensee was requested to identify the following:

a. What instruments will be used?

b. Are the instruments powered by ac, dc, or non-powered?

c. Is readout location in the Main Control Room (MCR) or non-local readout?

During the audit, the licensee responded by providing the list of credited instrumentation powered from the normal instrument channels which will remain available. The list included instrumentation that addressed all of the identified parameters except for dc bus voltage subsequent to dc load shedding which could be measured with a portable voltmeter. In addition to this list, battery voltmeters and SFP level indication will be used. All of the Phase 1 powered instrumentation is either directly powered from dc, or is powered from dc through an inverter. Non-powered pressure gauges will be available for connection and use near the ADVs to monitor SG pressure locally.

All of the listed instrumentation and the battery voltmeters indicate in the MCR. The SFP level will be indicated in the central Primary Auxiliary Building (PAB), 26 foot elevation at an appropriate and accessible location allowed by NRC Order EA-12-051.

During the audit, the licensee was requested to provide justification that the instrumentation to measure the listed parameters and the associated setpoints credited in the ELAP analysis for automatic actuations and indications required for the operator to take appropriate actions are reliable and accurate in the containment harsh conditions with high moisture levels, temperature and pressure during the ELAP event. The licensee responded that of the listed instrumentation, the only ones with components inside containment are the following: A and B RCS Hot Leg Temperature; Core Exit Thermal couples; A and B Loop Cold Leg Temperature; Wide Range RCS Pressure, A and B SG Wide Range Level; SI Accumulator Pressurizer; Pressurizer Level; Reactor Vessel Level; Neutron Flux. Of this list, all are environmentally qualified (EQ) for post-accident conditions except for Neutron Flux. Channels 1N and 2N-40 are EQ, but will be de-energized between 1 and 2 hours of the event as part of the dc load shedding when the 1DY-02 and 2DY-02 inverters (Blue Channel) are shutdown. The remaining source range NI channels are not EQ. If necessary, the capability exists to provide power to the 1&2 NI channels by

restoring the alternate shutdown inverter (s) (currently de-energized as part of dc load shedding) and aligning the NI channels with an existing power supply transfer switch. The GOTHIC analysis to determine the containment conditions expected during an ELAP event with low leakage RCP seals has not yet been completed (Pending Action 5). This has been identified as Open Item 3.2.1.5.A in Section 4.1.

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

3.2.1.6 Sequence of Events

NEI 12-06 discusses an event timeline and time constraints in several sections of the document, for example Section 1.3, Section 3.2.1.7 principles (4) and (6), Section 3.2.2 Guideline (1), and Section 12.1.

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

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

In order to support the objective of an indefinite coping capability, each plant will be expected to establish capabilities consistent with Table 3-2 (PWRs) of NEI 12-06. Additional explanation of these functions and capabilities are provided in NEI 12-06 Appendix D, "Approach to PWR Functions."

The Integrated Plan stated on page 15 that it takes approximately 58 minutes for the SGs to dry out following loss of AFW. During the audit, the licensee was requested to discuss the calculation method and assumptions that were used (or which will be used) to determine the time for SG dry out and provide justification that the computational method is adequate. The licensee was further requested to clarify whether the basis for the time to steam generator dryout is a plant-specific or generic calculation. If a generic calculation was performed, the licensee was requested to demonstrate the applicability to PBNP.

The licensee responded as follows:

> The original value (3670 seconds) was taken from the generic analysis in WCAP-17601-P, Table 5.4.1.1-1 Generic AFW Flow Interruption Results for Case 2A interruption at time 0.

A combination of generic and site specific values were used to derive the site specific dry out time. WCAP-17601-P was utilized and PBNP site specific scaling factors were applied for SG secondary inventory and reactor thermal power. The conservatively estimated actual time to boil dry is ~53 minutes.

Generic values were based on:

WCAP-17601-P SG Boil Dry Time Model; Based on 412 Rx; 4 loop; 3723 MWT; 91,200 LBM [pounds mass]/SG on secondary side; 3670 seconds to SG boil dry; 930.75 MWT power per SG (3723/4).

PBNP specific factors:

2 Loop; 1800 MWT; 76,994 LBM/SG on secondary side 10% tube plugging this is conservative because as tube plugging % goes down SG mass goes up and as power goes down SG mass goes up (Ref CN-CPS-08-20, Table 4.6-4); 900 MWT per SG (1800 MWT/2SG's).

Time to SG dry out evaluation:

Decay heat rates are the same per MWT produced. SG mass ratio PBNP is 0.844 of model (76,994 LBM PBNP/91,200 LBM Generic). This mass ratio will reduce the time to boil the SG dry because the SG mass is lower in the PBNP SG than in the model.

MWT per SG ratio PBNP is 1.034 of model (930.75 MWT per SG Generic/900 MWT per SG PBNP. This power ratio will increase the SG boil dry time because the SG has less decay heat due to the lower power.

PBNP Time to boil dry.
53 minutes=3204 sec=3670x0.844 SG LBM ratio x 1.034 SG MWT ratio.

The Point Beach strategy was designed to prevent an interruption of feed to the SG. The time to SG dry out evaluation was done to determine the available time to establish feed flow using the diesel driven fire water pump. The current time estimate for aligning valves to establish flow from the DDFP to the suction of the TDAFW pump is approximately 30 minutes from the time the operators are instructed to make the alignment (Pending Action 15 will validate the time requirements). The primary strategy provides additional margin for establishing flow from the DDFP to the suction of the TDAFW pump, the CSTs are being upgraded to provide a protected volume of water of 14,100 gallons of water which will provide approximately 1.9 hours of decay heat removal. Using the same scaling and information from the WCAP table SG dry out does not occur for approximately 3.7 hours following feed flow interruption at 2 hours post event. The times taken from the WCAP are only being used for information and an indication that margin exists; the values are not used in any analysis.

The NRC staff considered the licensee's calculation above to be sufficient to determine an approximate time for the SGs at Point Beach to boil dry if auxiliary feedwater could not be provided immediately post-trip. Due to the difference in the SG safety / relief valve lift setpoints

and hence the difference in latent heat of vaporization between PBNP and the WCAP-17601-P analysis case, the staff expected the licensee's calculation to be conservative. However, the staff did not consider it necessary to confirm the conservatism of the approximate calculation to a precise degree in light of the specified evaluation criteria for the ELAP event, which do not require consideration of an additional single failure (e.g., TDAFW pump failure to start). However, one issue was noted, in that, on page 6 of the Integrated Plan, the CST volume of water of 14,100 gallons is stated to be adequate for 1 hour and 20 minutes of decay heat. This in not consistent with the approximately 1.9 hours stated above. This has been identified as Confirmatory Item 3.2.1.6.A in Section 4.2.

The SOE is discussed in the Integrated Plan on pages 5 through 10 and in Attachment 1A on pages 75 through 80. At an elapsed time of 12 hours, action 26 calls for commencing RCS cool down to desired temperature and pressure and action 27 calls for commencing boric acid / inventory additions to the RCS. There is no technical basis for these items and they are not identified as time constraints. During the audit, the licensee was requested to provide justification for why no time constraint is needed to provide reasonable assurance to conclude conformance to NEI 12-06 section 3.2.1.7, consideration (6).

The licensee responded that, with the installation of the Westinghouse SHIELD Passive Thermal Shutdown Seal SDS, RCS leakage will be minor and inventory makeup will not be required for days or until a cooldown is initiated. WCAP-17601-P [page 5-2] states that, contingent upon the installation of SDS/Low-Leakage seals, coping times for RCS inventory and core cooling in excess of a week without makeup are achievable. WCAP-17100-P, Supplement 1, address the use of the SDS for Model 93 RCPs (i.e., the pump design installed at PBNP) and again makes the statement that, since the SDS allows negligible RCS inventory loss through the RCP seals, RCS makeup is no longer essential to achieve a stable steady state with the reactor core being cooled.

The licensee stated it has performed an SDM calculation and determined that if the plant is kept hot (greater than 500°F); greater than 1% SDM exists for a xenon free condition. Even at 425°F, SDM remains greater than 1% for greater than 24 hours; thus there are no time constraints. The licensee made a similar argument in regard to taking manual control of the steam generator atmospheric dump valves.

The licensee also stated that:

> A shutdown margin calculation has been performed to determine the required boron addition to maintain a SDM of 1% for various times after shutdown and various RCS temperatures. It also evaluated the Xenon free condition. The results of this calculation will be incorporated into appropriate FSGs to assure adequate SDM is established before the temperature or time after shutdown is exceeded.

The statement that there are no time constraints is not accurate. However, inclusion of the shutdown calculation into the FSGs makes the issue moot since cool-down and boration will be initiated at the same time.

On page 79 of the Integrated Plan, Action Item 28 is to isolate the SI Accumulators at 13 hours into the event. During the audit, the licensee was requested to clarify the power supply used to isolate the accumulator discharge motor operated valves (MOVs) to prevent nitrogen injection into the RCS. Also the licensee was requested to clarify whether the potential for heat transfer

from containment to the accumulator volume was considered in determining the pressure at which the accumulator should be isolated, per the methodology in Attachment 1 of the PWROG Core Cooling Interim Position Paper, dated November 9, 2012, ADAMS Accession No. ML130420011 (not publicly available).

The licensee responded that the accumulator discharge valves will be powered from a portable 480V Phase 2 diesel generator. The primary connection for the Phase 2 portable diesel generator is the 480V safeguards bus 1B-03. The 1B-03 (2B-03) bus will be cross connected to the 1B-04 (2B-04) bus. This then provides the ability to power the motor control centers 1/2B-32 and 1/2B-42). That provides power to the accumulator isolation valves. A secondary connection has also been identified at the motor control centers to power each accumulator's isolation MOV individually.

The licensee also stated considering the potential for heat transfer from the containment to the accumulator volume and the impact on the pressure at which the accumulator should be isolated is not applicable to the PBNP strategy. The PBNP strategy is to isolate the accumulators before initiating a cooldown which eliminates the concern of nitrogen injection.

The licensee response that the PBNP strategy is to isolate the accumulators before initiating cooldown is not reflected in the Integrated Plan. The SOE states on page 79 of the Integrated Plan that RCS cooldown is initiated at 12 hours post event and the accumulators are isolated at 13 hours post event. The SOE states a constraint that accumulator isolation must occur prior to a SG pressure of 200 psig. Confirmation that the methodology in Attachment 1 of the PWROG Core Cooling Interim Position Paper was properly utilized to determine the 200 psig constraint has been identified as Confirmatory Item 3.2.1.6.B in Section 4.2.

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

3.2.1.7 Cold Shutdown and Refueling

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

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

The generic concern related to shutdown and refueling requirements is applicable to PBNP. This generic concern has been resolved generically through the NRC endorsement of NEI position paper entitled "Shutdown/Refueling Modes" (ADAMS Accession No. ML13273A514); and has been endorsed by the NRC in a letter dated September 30, 2013 (ADAMS Accession No. ML13267A382).

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

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

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

3.2.1.8 Core Sub-Criticality

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

> All plants provide means to provide borated RCS makeup.

NEI 12-06 Table D-1 states that for RCS inventory control/long term subcriticality that:

> Extended coping without RCS makeup is not possible without minimal RCS leakage. Plants must evaluate use of low leak RCP seals and/or providing a high pressure RCS makeup pump.

On page 29 of the Integrated Plan in the section regarding maintaining RCS inventory control, the licensee stated:

> The Reactor Coolant Pump (RCP) seals will be upgraded with low leakage RCP seals qualified for the service conditions for 7 days. Since the low leakage seals will allow negligible RCS inventory losses through the RCP seals, RCS makeup is no longer required to achieve a stable steady state in Phase 1 with the reactor core being cooled. Cooldown of the RCS will commence approximately 12 hours after the BDBEE. Delaying the RCS cooldown allows time for:
>
> - Deployment of the Phase 2 low capacity, high pressure PDDCP and the establishment of RCS makeup/boric acid injection. A preliminary evaluation indicates that there would be sufficient volume available during a cooldown to inject water from the RWST and maintain the core sub-critical during cooldown without establishing letdown or venting the RCS to containment. Pending Action 29 will verify this initial evaluation.

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

The PWROG submitted a position paper, dated August 15, 2013 (withheld from public disclosure due to proprietary content), which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlined applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available. During the audit, the licensee informed the NRC staff of its intent to abide by the generic approach discussed above except for assumption 1 under certain conditions.

1. The Point Beach strategy is to use both loops to cooldown the plant provided both steam generators are available. If for some reason only one SG is available for cooldown the cooldown will be done using only one loop which is consistent with the current design and licensing basis response to station blackout. This analysis addressed the concern for a stagnant loop flow condition and calculated a maximum allowable cooldown rate which will ensure flow stagnation will not occur. The purpose of preventing loop stagnation is to support boron mixing and RCP seal cooling. Point Beach is a two loop plant which requires a single loop (asymmetric) cooldown for several design basis accidents. Additional analysis is being considered to determine if adequate boron mixing can be demonstrated during a single loop cooldown. This analysis would also verify single phase flow conditions that meet the NRC definition of single phase/two phase/ reflux cooling consistent with the endorsed CENTS white paper related to percent voids and boron mixing. Point Beach is exploring the performance of this analysis through Westinghouse using the NOTRUMP code. This analysis is also expected to demonstrate the acceptability of the Point Beach RCS and cooldown strategy.

2. A portable diesel driven charging pump will be used to inject boric acid into the RCS during cooldown to maintain Shutdown Margin. Connection locators have been identified for both the normal charging path and the aux charging path. This will allow injection into either or both RCS cold legs.

3. The Point Beach strategy and timeline would complete boron injection to achieve cold shutdown within 100 hours after shutdown.

4. The shutdown margin and boron injection requirements are based on the limiting condition of zero RCS leakage and uniform mixing throughout the entire RCS volume.

5. The SDM calculation did consider both the xenon transient (time after shutdown) and plant cooldown. The 1 hour requirement prior to the need time will be incorporated into the applicable FSG. A shutdown Margin calculation has been performed to determine the required boron addition to maintain a SDM of 1% for various times after shutdown and various RCS temperatures. It also evaluated the xenon free condition. The results of this calculation will be incorporated into appropriate FSGs to assure adequate SDM is established before the temperature or time after shutdown is exceeded. The daily time required for adequate mixing will also be addressed.

The NRC staff concluded that the August 15, 2013, position paper was not adequately justified and has not endorsed this position paper. As such, resolution of this concern associated with boric acid mixing for PBNP has been identified as Open Item 3.2.1.8.A in Section 4.1. Resolution of this open item includes making modifications to existing SDM calculations if currently assumed boric acid mixing times cannot be justified and providing SDM calculations for NRC staff audit.

During the audit, the licensee was requested to clarify the statement on page 20 of the Integrated Plan that the RCS would be cooled down to an average RCS temperature (Tavg) of

350°F, which is stated to correspond to an SG pressure of approximately 150 psia. The staff expected that the SG pressure corresponding to an RCS Tavg of 350°F would be approximately 135 psia. The licensee was requested to clarify whether operators would use the RCS Tavg or steam generator pressure to determine the cooldown termination point, and state the range within which value operators would be required to control this parameter per the applicable procedural guidance. The licensee was further requested to clarify the basis for cooling the RCS down to approximately 350°F rather than maintaining steam generator pressure at 300 psia as in the generic cases analyzed in WCAP-17601. Additional cooldown requires additional shutdown margin and, as noted in the submittal, addressing the need for extended operation of the TDAFW pump at low steam generator pressures and core decay heat loads. Finally, the licensee was requested to confirm that the intended cooldown strategy ensures adequate shutdown margin and TDAFW performance.

The licensee responded that

> The values for steam generator pressure and RCS Tavg were taken from Calculation CN-NO-08-5, "Point Beach Units 1 and 2 Appendix R and Main Steam Line Break (MSLB) Cooldown Evaluations to RHR Cut-In Conditions for the 1800 MWt Uprating Revision 0." This calculation was done to demonstrate that PBNP could perform a natural circulation cooldown on a single loop and establish RHR cut in conditions within 44 hours. At 42 hours the calculation lists Tcold as 334.50°F, Thot as 365.42°F, Tavg as 349.96°F and SG pressure as 151 psia. The desired cooldown termination point is a temperature and pressure that would allow establishment of normal decay heat removal via the RHR system (less than 350°F) when the system becomes available. The actual termination point will depend on equipment available and previous operating conditions. The unit will be stabilized at a temperature that provides adequate steam pressure and flow to the TDAFW pump to maintain SG level.
>
> Maintaining SG pressure above 300 psia in the WCAP is to prevent nitrogen injection from the accumulators. The Point Beach strategy is to isolate the accumulators before initiating a cooldown which eliminates the concern of nitrogen injection. A shutdown margin calculation has been performed to determine boron injection requirements versus time after shutdown and temperature. The requirements for boron injection to maintain a 1% shutdown margin will be included in an FSG. A motive force calculation is being done to determine the capability of the TDAFW pump. This analysis assumes 4 hours have elapsed from reactor trip until the time a natural circulation cooldown is initiated using a single loop. A 25°F/hour cooldown rate is assumed for hours 5 to 11.5 and then the unit is held at a Tavg of approximately 380°F for 30 hours. A 30 hour hold with Thot controlled between 390°F and 400°F is required by Point Beach procedure AOP-10B. A 25°F/hour cooldown rate is assumed for hours 42-44 to establish RHR cut in conditions of Thot less than 350°F.

The licensee's response states that a motive force calculation is being performed to ensure that the TDAFW pump will be capable of performing its function at the depressurization terminus identified in the licensee's Integrated Plan. The completion of this calculation and demonstration of adequate TDAFW capability is identified as Confirmatory Item 3.2.1.8.B 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 Open and Confirmatory Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to core sub-criticality if these requirements are implemented as described.

3.2.1.9 Use of Portable Pumps

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

> Regardless of installed coping capability, all plants will include the ability to use portable pumps to provide RPV/RCS/SG makeup as a means to provide diverse capability beyond installed equipment. The use of portable pumps to provide RPV/RCS/SG makeup requires a transition and interaction with installed systems. For example, transitioning from [reactor core isolation cooling] 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 19 and 20 of the Integrated Plan, the licensee stated:

> Per guidance of NEI 12-06, Phase 2 also requires a baseline capability for reactor core cooling to connect an onsite, portable pump (SG FLEX pump) for injection into the SGs in the event that a TDAFW pump fails or when sufficient steam pressure is no longer available to drive the turbine. This capability will be implemented by depressurizing the SGs to allow makeup with the PDDP. To achieve the baseline capability of providing a portable pump for the Phase 2 strategy of core cooling, deployment of the PDDP will be completed so that it is available for operation to coincide with RCS cooldown and SG depressurization.
>
> To meet the recommendation of WCAP-17601-P, the portable pump designated for SG injection, or SG FLEX pump, must be rated for a minimum flow rate of 300

> gpm at a discharge pressure (of 300 psig) equal to the SG pressure in addition to any line losses associated with its connecting equipment. This requirement is for a 4-loop plant. For PBNP the decay heat removal requirement is approximately 60 gpm per unit, thus, 300 gpm would be adequate for both units. At an RCS temperature of 350°F (Taverage) the SG pressure is approximately 150 psia. PBNP will verify that the TDAFW pump is capable of supplying the required decay heat removal flow rate at the reduced SG pressure (Pending Action 14). At this SG pressure the existing B.5.b pump should be adequate (Pending Action 32). Additional B.5.b pumps have been purchased for FLEX deployment. The PDDP will be positioned in the area near the pump house and suction hoses will be routed to draw water from the pump house forebay or pump bay. Alternative suction paths include the ability to draw water directly from Lake Michigan using a floating strainer. Hose(s) from the PDDP will be routed through the 8' Elevation of the Turbine Building and PAB to existing AFW connection points for injection directly into the SGs.

The Integrated Plan does not describe the capacity, qualification, protection, and deployment of the B.5.b pumps. This has been identified as Confirmatory Item 3.2.1.9.A in Section 4.2.

On page 33 of the Integrated Plan discussing the strategy for maintaining RCS Inventory Control in Phase 2, the licensee stated:

> Reactor Coolant System makeup and boron addition is accomplished via a PDDCP drawing water from the RWST or BAST and discharging to the RCS loop A or B via the normal or alternate charging lines. The PDDCP will be a low capacity, high pressure pump capable of delivering 15 gpm at approximately 2,500 psig. A separate PDDCP will be provided for each unit.
>
> The RWST has been seismically qualified however the tank is not located within a Class I structure that would protect it from tornado wind loading and missiles. A condition evaluation was performed to demonstrate that the lower portion of the RWST was protected from wind loading and missiles by surrounding structures. The conclusion was that the RWST remains functional following a tornado and tornado missile event with a contained volume of approximately 160,000 gallons. This volume is over eight times the makeup volume required to cooldown the plant to 70°F which was estimated to be 19,000 gallons. The RWST is the primary source of boric acid.
>
> The BASTs are located within a Class I structure and thus protected from wind and missile hazards. The BASTs were originally designed and installed as seismic Class I but were administratively downgraded to Class II when their safety related function was changed, however they are still considered as seismically robust. The boric acid concentration is maintained between 3.5 and 4.0 Wt% boric acid and the required volume per unit is 7,470 gallons and a minimum temperature of 70°F. The BASTs are considered backup source of boric acid if available.

On pages 50 of the Integrated Plan discussing the strategy for maintaining SFP cooling in Phase 2, the licensee stated water is added to the SFP with a PDDP and hoses using either direct addition or spray.

During the audit, the licensee was requested to clarify whether a single FLEX pump will be used to provide cooling flow to multiple destinations (e.g., the reactor core, steam generators, and the spent fuel pool). If so, the licensee was requested to confirm that the FLEX pump can supply adequate flow and clarify whether the pumped flow will be split and simultaneously supplied to all destinations or whether the flow will be alternated between them. If simultaneous flow will be used, the licensee was requested to clarify how the flow splits will be measured and controlled (i.e., whether control exists for the total flow on a common line or on lines to individual destinations) to ensure that adequate flow (i.e., sufficient but not excessive) reaches each destination.

The licensee responded that

> Each unit will have a designated pump to provide RCS inventory/boron control. The flow from these pumps will not be split. A third pump with a capacity of at least 300 gpm will be available to supply both units steam generators and the Spent Fuel Pool. The Spent Fuel Pool will not require makeup during the first 10 hours of the event. The 300 gpm is sufficient flow to remove decay heat from both units and provide makeup flow to the SFP simultaneously. Flow to each steam generator and the Spent Fuel Pool can be individually controlled. Each steam generator and the Spent Fuel Pool will have level indication available to ensure adequate flow is provided to each destination.
>
> A forth pump with a capacity of approximately 1000 gpm will be available to provide flow to both units containment. This pump may also be used in lieu of the 300 gpm capacity pump discussed above to provide makeup water to the SFP. The flow to each containment and the SFP can be individually controlled. Containment pressure and temperature indication will be available to ensure adequate spray flow is being provided.

During the audit, the licensee was requested to specify the elapsed time and time constraint for the operator to deploy and start each of the portable pumps discussed above. The licensee was further requested to justify that deployment of the listed portable pumps can be completed within the associated time constraint as deployment will require portable pump installation, which should be started prior to the time constraint with enough margin to ensure strategy success.

The licensee responded that:

> The plans to use a single HL130M diesel driven pump as described in the Integrated Plan are in the process of being revised to use two pumps with different capacity ratings. A Godwin Model HL130M, nominally rated at 1,000 gpm at 160 psi will be used to supply water to both units containment spray system and can also be used in lieu of the 300 gpm capacity pump discussed above to provide makeup water to the SFP. The flow to each containment and the SFP can be individually controlled. Containment pressure and temperature indication will be available to ensure adequate spray flow is being provided. While the containment analysis based on the low leakage RCP seal has not yet been completed, an existing Appendix R analysis projects the containment will not be challenged for at least 72 hours, with no active heat removal systems available. The analysis with the low leakage RCP seals is expected to extend that time further. Deployment of the high volume pump has not been identified

as a time constraint for the Point Beach strategies. A Godwin Model 3316, nominally rated at 325 gpm at 400 psi, will be used to supply water to both units SGs and can also be used to provide water for SFP Makeup. The change to the mitigation strategies will be described in the next six month update.

Flow from the Godwin Model 3316 pump to the SGs will not be required until such time that the SG pressure has decreased to a value that would no longer support operation of the installed TDAFW pump. Therefore there is no time constraint for deployment of this pump for this function. This pump may also be used to provide makeup water to the SFP. As indicated in the SOE timeline, makeup flow to the SFP would not be required until the SFP has boiled down to a level 2'8" above the fuel, approximately 72 hours into the event. Pump deployment is estimated to take 9 hours. This provides a significant amount of margin to the time the pump is needed for this function.

The reviewer noted that in Section 3.2.1.6 of this document, WCAP-17601-P identifies on page 5-2 that the TDAFW can cope for over a week on available decay heat. Although availability of the TDAFW would eventually become a time constraint due to reduced decay heat, the Integrated Plan identifies the Godwin Model 3316 pump as available in 9 hours which provides significant margin. The licensee identified Pending Action 14 which specifies site specific evaluation to address the TDAFW pump extended operation at low SG pressures and low decay heat loads.

PDDCP – This pump provides for RCS boron addition and water makeup to compensate for shrink during the RCS cooldown. The cooldown will not commence until after this portable pump has been deployed. The actual time required for deployment of the diesel driven charging pump will be addressed under Pending Action 15 but it is estimated to take 9 hours based on preliminary walk downs. The Integrated Plan stated that the performance criteria of the portable diesel driven charging pump would be 15 gpm at 2500 psig. This is being reassessed in consideration of the desire to maintain the physical size and weight of the equipment within manageable limits. Any change to this strategy will be described in the next six month update.

Finalizing the performance criteria for the portable diesel driven charging pump and implementing any necessary changes to the mitigation strategy has been identified as Confirmatory Item 3.2.1.9.B in Section 4.2 below.

On page 15 of the Integrated Plan, the licensee identified Pending Action 15 which states:

If the non-safety related batteries are required to be credited as part of the battery load management strategy, they will be evaluated and upgraded as necessary to make them seismically robust and tornado missile protected.

On page 59 of the Integrated Plan in the Section on safety functions support, the licensee stated:

At full capacity, the PDDP uses 13.5 GPH [of fuel oil]. The PDDP has a fuel tank which will provide a minimum of 12 hours of operation at full capacity. The PDG connected to 1B-03 and 2B-04 [2B-03 per 6 month update], and the other small diesel powered equipment (e.g., 5.5 kW PDGs and diesel driven charging

> pumps) will also require periodic refueling. The refueling frequency of this equipment will be based on fuel oil consumption (Pending Action 13).
>
> Technical Specification requirements ensure greater than 64,000 gallons of fuel oil is maintained on site in SR seismic Class I underground tanks. This fuel would be available to supply permanently installed and/or portable diesel powered equipment credited for a FLEX mitigation strategy. The capability will exist to refuel required permanently installed and portable FLEX equipment within 12 hours following an event. This will be accomplished with the use of an approximately 500 gallon fuel tank trailer capable of being towed by a Ford F-350 or equivalent truck. The trailer/truck combination will have the capability to draw fuel oil from on-site fuel oil tanks.

During the audit, the licensee was requested to discuss how the required capacity (i.e., flow rate and corresponding pump head) of each of the listed pumps is determined. The requested information should include a discussion and justification of methods and assumptions used for determining the required pump capacity. The licensee responded that the determination of the portable pump capacity/rating will take into consideration the pressure drop of the permanently installed and temporary (e.g., hoses, etc.) components in the flow path; head loss due to elevation change; back pressure; and available suction pressure or required lift.

During the audit, the licensee was requested to provide information to show that the required capacity of each of the above portable pumps is sufficient for use in maintaining core cooling and sub-criticality during an ELAP event. The licensee responded that

> The decay heat load 9 hours after reactor trip can be handled with approximately 80 gpm SG feed flow to each unit. SFP makeup will be approximately 50 gpm after the SFP starts to boil. The total required flow is approximately 210 gpm. The Godwin Model 3316 pump is nominally rated at 325 gpm at 400 psi. To maintain 1% SDM during a cool down to 350°F, approximately 6600 gallons of RWST water must be added to the RCS. A 24 hour cool down interval can be accommodated with less than 5 gpm. If necessary the cool down rate can also be adjusted to match the makeup capabilities.

On pages 102 and 103 of the Integrated Plan, are sketches of layout of connections for RCS makeup. Page 69 identifies portable diesel driven charging pumps with a capacity of 15 gpm at 2500 psig, but does not identify hoses and fittings that are indicated on the sketches. Information on the hoses, fittings, etc., will be necessary in order to finalize the sizing of the pumps as identified in Confirmatory Item 3.2.1.9.B above.

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 use of portable pumps if these requirements are implemented as described.

3.2.2 Spent Fuel Pool Cooling Strategies

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

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

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

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

On page 48 of the Integrated Plan during the Phase 1, the licensee stated in part:

> The SFP temperature is allowed to increase to the boiling point. Water will be added (Phase 2) well before fuel becomes uncovered. The PAB is vented by opening the PAB truck access doors and the 66' Elevation personnel doors as necessary based on PAB conditions.
>
> Assuming a loss of SFP cooling with the worst case design heat load (including a full core offload) the time-to-boil is approximately 10 hours. PBNP tracks the SFP heat load on a real time basis. Based on current SFP heat loading, and assuming a full core offload with an initial SFP temperature of 100°F, the projected time for the SFP to reach 200°F is 11 hours. After reaching the boiling point, it would take an additional 71 hours for the SFP to boil down to 6 inches above the fuel.
>
> As noted in the NextEra Energy Point Beach, LLC Overall Integrated Plan in Response to March 12, 2012 Commission Order to Modify Licenses with Regard to Reliable Spent Fuel Instrumentation, action will be initiated prior to the spent fuel pool lowering to a level of 2 feet 11 inches above the fuel. This level corresponds to the height of the east-west wall opening that separates the northern and southern areas of the pool. The level was chosen to ensure the SFP continues to function as a single pool for level monitoring reliability. After reaching the boiling point, the estimated time to a level of 2 feet 11 inches above the fuel would be an additional 64 hours.

In the description of strategies, the licensee stated:

> ECA-0.0, "Loss of All AC Power" and SEP-3.0, "Loss of All AC Power to a Shutdown Unit," will remain the entry point and controlling procedures for ELAP Events with a LUHS. ECA-0.0 contains a step to periodically check the status of the SFP cooling by checking level greater than 62' 8" and SFP temperature less than 120°F. If either condition is not met AOP-8F, "Loss of Spent Fuel Pool Cooling," will be entered. AOP-8F will prompt for review of ROD 1.4, "Spent Fuel Pool Heatup Data Unit 1" and ROD 1.4 "Spent Fuel Pool Heatup Data Unit 2" to determine projected time to reach 200°F and the projected time to boil the water level down to 6" above the stored fuel. FLEX Support Guidelines will be developed and will be entered as directed by ECA-0.0, SEP-3.0 and if appropriate, other procedures. Emergency Operating Procedures, Shutdown Emergency Procedures, Emergency Contingency Actions, Abnormal Operating Procedures, and if appropriate other procedures will be updated as required to support the FSGs.

On page 78 of the Integrated Plan timeline (Attachment 1A), the licensee stated the following action at elapsed time 9 hours:

> Complete deployment of PDDP and Route 5 inch hose for SFP makeup at P-9.

The following time constraint was identified:

> Time Constraint to have completed prior to SFP level reaching 2 feet 8 inches above the fuel. It is desired to have completed prior to SFP reaching 200°F.

The PBNP FSAR Section 9.9 indicates a SFP system design temperature of 200°F. It is not clear if the SFP liner has been designed for the thermal stresses resulting from the higher temperatures related to boiling. During the audit, the licensee responded that the 200°F design temperature referenced from the FSAR refers to the SFP cooling and purification systems, not the SFP liner. An existing SFP structural evaluation assuming SFP boiling conditions demonstrated that thermal loads are acceptable; however this evaluation did not specifically address the SFP liner. Any slight buckling of the SFP liner that might occur at boiling conditions is not expected to result in any leakage that is not well within the makeup capacity that will be available from the FLEX portable pump. SFP liner leakage will be to the leak collection system which drains through 1 inch valves. These isolation valves are located in an area that will remain accessible when the SFP is boiling and can be closed if necessary.

On page 50 of the Integrated Plan in regards to maintaining SFP cooling during Phase 2, the licensee stated:

> Water is added to the SFP with a PDDP and hoses using either direct addition or spray. The PDDP will draw raw water from the pump house forebay, pump bay, or directly from Lake Michigan. A connection point on the suction of the P-9, Hold Up Tank (HUT) Recirculation Pump will allow the addition of approximately 250 gpm of raw water from the PDDP to the SFP without accessing the refueling deck. A makeup water supply of 50 gpm is adequate to maintain SFP level. Spent fuel pool criticality analysis allows the use of non-borated water.
>
> If necessary based on PAB conditions, the PAB truck access doors and PAB personnel doors will be opened to vent steam from the PAB. PAB condensation

removal will be addressed with a portable sump placed on the -19' Elevation of the PAB.

An analysis will be performed to demonstrate the adequacy of the PAB environment for equipment and personnel access (Pending Action 6).

This has been identified as Confirmatory Item 3.2.2.A in Section 4.2.

An alternate method to SFP cooling is described on page 52 of the Integrated Plan where the licensee stated:

> A 5" discharge hose is routed from the PDDP to the SFP truck bay area where a Gated Wye connection is installed from the Gated Wye; two 2 1/2" hoses are run up to each end of the SFP and tied off for direct discharge into the SFP or to spray nozzles (see Attachment 3, Figure 15). This will allow for a total flow rate of at least 500 gpm to the SFP.

While NEI 12-06, Table D-3 provides that the spray capability is not required for sites that have SFPs that cannot be drained, the reviewer noted that this provision is inapplicable to PBNP. Sites with SFPs that cannot be drained were identified in the course of the evaluations and assessments pursuant to Order EA-02-026, "Issuance of Order for Interim Safeguards and Security Compensatory Measures," Section B.5.b, resulting in the imposition of the Mitigating Strategies License Conditions and made generically applicable as 10 CFR 50.54(hh)(2). Sites with SFPs that cannot be drained can be identified by the absence of a license condition requiring the development of strategies that include operations to mitigate fuel damage considering SFP mitigation measures. These requirements were imposed on PBNP Unit 1 as license condition 4.L.2.g and on PBNP Unit 2 as license condition 4.K.2.g.

The timeline (Attachment 1A) does not address the time constraint for the alternate approach identified above. The timeline does identify that at 75 hours elapsed time the SFP level reaches 2 feet 8 inches (not listed as a time constraint). The analysis that will be performed to demonstrate the adequacy of the PAB environment for equipment and personnel access (Pending Action 6) needs to address the alternate approach since refueling floor access when the SFP level is 2 feet 8 inches above the fuel is questionable.

During the audit, the licensee stated the mitigating strategy for SFP cooling is addressed with the PDDP hose connection to the flange on the suction of P-9 as reflected on the timeline at 9 hours [boiling is at ~ 10 hours]. The P-9 connection point area will remain habitable if boiling is occurring in the SFP. While the P-9 hose connection is not required prior to SFP boiling, completion prior to that time is prudent in case problems arise with hose deployment such that the alternate approach of adding water directly to the SFP is required.

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

3.2.3 Containment Functions Strategies

NEI 12-06, Table 3-2 and Appendix D provide some examples of acceptable approaches for

demonstrating the baseline capability of the containment strategies to effectively maintain containment functions during all phases of an ELAP. One of these acceptable approaches is by analysis.

On page 41 of the Integrated Plan regarding maintaining containment, Phase 1, the licensee stated:

> PBNP will install low leakage RCP seals which will prevent significant leakage from the RCS seals into containment. During Phase 1 containment pressure is monitored, but there is no significant mass release to containment expected and the containment safety function is not challenged.
>
> An existing Appendix R scenario analysis projects the containment to reach approximately 28 psig and 205°F after 72 hours with no active containment heat removal systems available. This calculation assumed an RCP seal leakage of 21 gpm per pump and an RCS leak of 10 gpm for a total RCS leak rate of 52 gpm. The installation of the low leakage RCP seals is expected to result in a much lower containment pressure and temperature. The low leakage RCP seal leakage is assumed to be 1gprn per pump and an RCS Technical Specification allowed leak rate of 1 gpm (typical RCS leakage is approximately 0.1 gpm) is assumed for a total RCS leak rate of 3 gpm. A new containment analysis will be performed based on the use of low leakage RCP seals and the FLEX mitigation strategy (Pending Action 5).
>
> In MODES 5 and 6, the plant Technical Specifications do not require containment operability other than the specific closure requirements of Technical Specification Limited Condition for Operation 3.9.3, "Containment Penetrations." While the containment may not initially be isolated in MODE 5 or 6, plant procedures require containment closure capability prior to bulk boiling when the RCS is not intact. Containment closure can be accomplished following a loss of power event. The consideration of the RCS being intact includes the ability to remove decay heat via natural circulation (i.e., SG available).

The containment design temperature is 286°F and containment design pressure is 60 psig. Based on a review of the above information for Phase 1, there are no Phase 1 actions required.

On page 44 of the Integrated Plan regarding maintaining containment, Phase 2, the licensee stated:

> If necessary, the capability exists to connect a PDDP to supply water to the containment spray system via an adapter which replaces the cover of a spray pump discharge check valve (see Attachment 3, Figure 14). Hose(s) from the PDDP will be routed through the 8' Elevation of the Turbine Building and PAB to this connection point.
>
> The PDDP will be positioned in the area near the pump house and suction hoses will be placed to draw water from the pump house fore bay or pump bay. Alternative suction paths include the ability to draw water directly from Lake Michigan using a floating strainer (see Attachment 3, Figures 8a, 8b, and 14).
>
> No modifications are required since connection points already exist.

With regard to the protection of connection points, the licensee stated:

> The connection points at the spray pump discharge check valves are located within the PAB, which is a seismic Class I, SR structure and provides protection from tornado missiles. All of the related installed piping that will provide the intended flow path is SR seismic Class I and is located within the PAB until it enters containment.

The licensee identified that a new containment analysis will be performed based on the use of low leakage RCP seals and the FLEX mitigation strategy (Pending Action 5). This has been previously identified as Open Item 3.2.1.5.A in Section 4.1.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and, subject to the successful closure of issues related to the Open Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to 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) provides 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 auxiliary building cooling water, service water, or component cooling water may normally be used in order for equipment to perform their function. It may be necessary to provide an alternate means for support systems that require ac power or normal access to the UHS, or provide a technical justification for continued functionality without the support system.

The SOE identifies that at elapsed time 0 hours, the turbine driven auxiliary feed water pump starts automatically and feeds the steam generators. The PBNP FSAR states that:

> The turbine and pump are normally cooled by service water with an alternate source of cooling water from the firewater system.

The service water is lost at the start of the event and the diesel driven firewater pump (DDFP) starts automatically. At elapsed time 1.3 hours there is establishment of service water flow to the turbine driven auxiliary feedwater pump suction via the diesel driven fire pump. Insufficient information is presented in the Integrated Plan to have reasonable assurance that it conforms to NEI 12-06, Section 3.2.2, Guideline (3) because the following issues are not addressed that influence the availability of the alternate source of cooling water:

a. Actions required to establish firewater cooling water to the turbine and pump

are not identified in the text or timeline.

b. Identifications if actions are independent of ac power.

c. Time required to establish the cooling flow from the firewater system.

d. Identification if the firewater piping from the DDFP to the AFW turbine and pump is seismically robust and protected from missiles.

e. Impact on cooling water flow when the DDFP switches over to supply service water via remote manual operator actions.

During the audit, the licensee stated that the TDAFW turbine and pump are being replaced under a non-Fukushima modification in the 2014 refueling outages and the new design will not require an external cooling water source. Cooling will be provided by process flow and does not require manual action, ac power or other system support.

The DDFP including the engine and control cabinet, portions of the fire water system, the fuel oil tank (T-30) and the fuel oil piping are all being upgraded to meet seismic requirements for a BDBEE per EC 259770. The pump, diesel engine, control cabinet and fuel oil tank are all being replaced. The TDAFW pump and the DDFP do not require any ac power to start or to operate. The DDFP will start on a loss of ac and can be remotely started from the control room. The DDFP has its own set of starting batteries that will be charged by an engine driven alternator. A dedicated set of batteries will also be installed to allow remote manual operation of the valves that must change position to isolate the DDFP from non-seismic portions of the fire water system and cross connect it to service water. The non-seismic portions of the SW can be isolated. The licensee clarification adequately addresses the listed concerns.

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

3.2.4.2 Ventilation – Equipment Cooling

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

> *Plant procedures/guidance should consider loss of ventilation effects on specific energized equipment necessary for shutdown (e.g., those containing internal electrical power supplies or other local heat sources that may be energized or present in an ELAP).*
>
> ELAP procedures/guidance should identify specific actions to be taken to ensure that equipment failure does not occur as a result of a loss of forced ventilation/cooling. Actions should be tied to either the ELAP/LUHS or upon reaching certain temperatures in the plant. Plant areas requiring additional air flow are likely to be locations containing shutdown instrumentation and power supplies, turbine-driven decay heat removal equipment, and in the vicinity of the inverters. These areas include: steam driven AFW pump room… the control room, and logic cabinets. Air flow may be accomplished by opening doors to rooms and electronic and relay cabinets, and/or providing supplemental air flow.

> Air temperatures may be monitored during an ELAP/LUHS event through operator observation, portable instrumentation, or the use of locally mounted thermometers inside cabinets and in plant areas where cooling may be needed. Alternatively, procedures/guidance may direct the operator to take action to provide for alternate airflow 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 … and AFW pump rooms, portable engine-driven blowers may be considered during the transient to augment the natural circulation provided by opening doors. The necessary rate of air supply to these rooms may be estimated on the basis of rapidly turning over the room's air volume.
>
> Actuation setpoints for fire protection systems are typically at 165 - 180°F. It is expected that temperature rises due to loss of ventilation/cooling during an ELAP/LUHS will not be sufficiently high to initiate actuation of fire protection systems. If lower fire protection system setpoints are used or temperatures are expected to exceed these temperatures during an ELAP/LUHS, procedures/guidance should identify actions to avoid such inadvertent actuations or the plant should ensure that actuation does not impact long term operation of the equipment.

On page 57 of the Integrated Plan Phase 1, the licensee stated:

> Room temperatures in areas containing equipment required to mitigate a SBO event do not increase to values impacting operability following a loss of ventilation for at least one hour. Reasonable assurance of equipment operability is based on calculated maximum room temperature less than or equal to 120°F. Calculation 2005-0054 verifies the times which control building rooms reach 120°F. The worst case room is the cable spreading room which will require an action to increase area cooling prior to 76 minutes.
> Specific actions per AOP-30 "Temporary Ventilation for Vital Areas" will be developed to account for the loss of all ac. Additional analysis will be performed to determine what additional time may be gained by opening cabinets and area doors (Pending Action 31).

On page 60 of the Integrated Plan regarding safety function support, Phase 2, the licensee stated:

> Temperatures in vital areas will continue to be monitored. Temporary ventilation may be set up per AOP 30 "Temporary Ventilation for Vital Areas".

The licensee's plan for ventilation cooling as it relates to equipment protection did not provide reasonable assurance that the plan conforms to the guidance of NEI 12-06, Section 3.2.2, Guideline (10), because no specific information on ventilation cooling was provided in the plan, but rather specific actions per AOP-30 "Temporary Ventilation for

Vital Areas" will be developed to account for the loss of all ac, and additional analysis will be performed to determine what additional time may be gained by opening cabinets and area doors (Pending Action 31).

During the audit, the licensee was requested to provide a discussion on the following:

> (a) Impact of elevated temperatures, as a result of loss of ventilation and/or cooling, on electrical equipment being credited as part of the ELAP strategies (e.g., electrical equipment in the turbine driven emergency feedwater pump room).
> (b) Whether the initial temperature condition assumed the worst-case outside temperature with the plant operating at full power.
> (c) Qualification level for temperature and pressure for electrical components that are located in the pump rooms that are necessary to ensure successful operation of required pumps for the duration that the pumps are assumed to perform its mitigating strategies function.

The licensee responded that an analysis of vital area heatup times under specific FLEX conditions has not been performed. A recent analysis for the cable spreading room assuming 97°F outdoor temperature resulted in a time of 9 hours to reach 120°F, or 13.7 hours if the doors to the turbine building are opened within 4 hours from the loss of normal ventilation. This analysis does not account for dc load shedding and does not include an ELAP. Therefore it is considered to be very conservative with regard to the conditions that would exist in an ELAP event. An analysis of the TDAFW room assuming 66°F outdoor temperature resulted in a time of 12.5 hours to reach 120°F and in a time greater than 24 hours if the doors to the turbine building are opened within 8 hours.

The temperatures in the vital areas will be monitored and compensatory actions (opening doors, installing temporary ventilation, etc.) will be taken as necessary to limit the temperature rise. Some area doors will be pre-emptively opened within 2 hours as part of the dc load shedding actions. Even though not specific to FLEX conditions, existing heatup evaluations provide reasonable evidence to support the expectation that sufficient time will be available to deploy any required temporary ventilation.

The licensee input does not address heatup under worst case conditions and a commitment to maintain temperatures below 120°F or qualify electrical components for more severe temperatures. This has been identified as Confirmatory Item 3.2.4.2.A in Section 4.2.

The Integrated Plan provides insufficient details of the ventilation provided in the battery room to support a conclusion that there is reasonable assurance that the effects of elevated or lowered temperatures in the battery room, especially if the ELAP is due to a high or low temperature hazard, have been considered. During the audit, 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 elevated or lowered temperatures.

The licensee responded that the installed battery room ventilation systems maintains the room temperature within the necessary temperature range prior to the ELAP, the thermal inertia of the battery room structure and battery is expected to maintain the room temperature within the range required for the battery to function. Portable heaters and fans will be available for deployment if necessary to address low temperatures. Elevated temperatures affect the batteries long term life, not short term performance.

The licensee did not address the need for hydrogen gas ventilation in the battery rooms. During the audit, the licensee stated required ventilation times following restoration of battery chargers have been established for each of the SR batteries credited for FLEX and will be incorporated into the appropriate FSG. The ventilation times represent the time for the battery room hydrogen concentration to reach 2% and are dependent on room temperature. The most limiting battery room ventilation time is 7.5 hours at 120°F. Prior to reaching the listed ventilation time, battery room ventilation will be provided by opening doors and using temporary fans as necessary if the installed vent systems are not available. The temporary ventilation exhaust path for D-05, D-06, and D-305 batteries will be to the turbine building, which is the same as the installed system. The temporary ventilation exhaust path for the D-105 and D-106 batteries will be to the PAB. The normal exhaust path for the installed system for these rooms is to the turbine building. While the normal ventilation systems for the turbine building and PAB will not be in operation during an ELAP, both of these areas are very large volumes and the envelopes are not air tight. Therefore significant hydrogen accumulation is not expected to occur.

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

3.2.4.3 Heat Tracing

NEI 12-06, Section 3.2.2, Guideline (12) 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.

On page 60 of the Integrated Plan for safety functions support, the licensee stated:

> The installed electrical freeze protection heat tracing and building heating system are not seismically qualified and much of the distribution network and freeze protection circuitry is not protected from tornado missiles. However, the installed freeze protection equipment and building heating system is presumed to be available in the case of an extreme low temperature event (i.e., not coincident with a seismic or tornado event). In this circumstance PDGs connected to 1B-03 and 2B-04 [2B-03 in 6 month update] would be used to power those portions of the Freeze Protection System that would be necessary to maintain the

functionality of the installed equipment credited for a FLEX strategy that is not located within a heated building.

In the case of a seismic or tornado missile event occurring during normal winter conditions, the installed Freeze Protection electrical distribution system may not survive. The capability will exist to locally connect PDGs to the Freeze Protection heating elements within a time frame that will prevent the FLEX credited equipment from becoming non-functional or a means (portable heaters, torches, etc.) will be provided to restore the equipment function in time to support the FLEX strategy.

Insulation blankets, portable torpedo heaters and temporary enclosures will be used as necessary to maintain the functionality of various pieces of portable equipment (PDGs, PDDP, etc.) while not in use after deployment. PDDPs deployment in extremely cold temperatures will include a recirculation flow path to maintain sufficient flow through the deployed hoses to keep them from freezing. Alternatively the pumps and hoses will be drained.

During the audit, the licensee was requested to perform the following actions:

a. Confirm that all systems and equipment (FLEX and installed equipment) credited as part of the primary strategy to mitigate an ELAP (e.g., RWST, BAST, condensate tanks, associated piping, etc.) will be protected by heat tracing and freeze protection circuitry that would be repowered during an extreme cold weather event as discussed on page 60. Clarify the timing at which this circuitry would be restored relative to the time at which it must be placed into service.

b. Confirm that the plan for restoration of heat tracing and freeze protection following a seismic- or tornado-induced ELAP would be sufficient to prevent boron precipitation and freezing in all systems and equipment (FLEX and installed equipment) credited as part of the primary strategy to mitigate an ELAP under normal cold weather conditions. Clarify the timing at which the actions would be taken to protect the systems and equipment relative to the time at which the protective actions must be taken.

c. Following depletion of the borated coolant stored in the RWST and BASTs, identify how coolant would be supplied to the RCS and spent fuel pool in the long-term and clarify how precipitation of boric acid and freezing would be prevented.

The licensee responded as follows.

a. Not all of the equipment credited as part of the primary strategy to mitigate an ELAP is protected by heat tracing and freeze protection. The ability to repower the available heat tracing and freeze protection within a time frame to prevent freezing has not been analyzed. The majority of the installed credited equipment is located inside of heated buildings which will be maintained within their normally expected temperature range prior to the ELAP. The thermal inertia provided by the structures and equipment is expected to provide sufficient time to install temporary heaters if necessary during the ELAP. FLEX portable equipment supplies will include torches and portable heaters which can be used to thaw those few FLEX connection

points which are not located in a normally heater building (e.g., RWST drain valves) should they freeze prior to use. On line risk management includes extreme weather conditions and contingency plans will be developed if required.

b. Because the installed electrical freeze protection heat tracing is not seismically qualified and is not protected from tornado missiles there is no assurance that these systems will be available following a seismic or tornado induced ELAP. While an option of energizing surviving portions of the freeze protection system may exist, the likely means of providing freeze protection will be via the use of portable heaters, insulation blankets, etc. A tornado induced ELAP is not likely to occur during cold (i.e., freezing) weather conditions. With the exception of the RWST drain connection, the piping used for the primary RCS makeup strategy is all located inside the PAB, which is normally heated. The maximum boron concentration in the pipes used for the primary connection point strategy is approximately 3200 ppm, which must be maintained greater than 32°F. A GOTHIC analysis shows that it takes greater than 12 hours for the lowest temperature in the general areas of the PAB below the 46' EL. To drop below 32°F assuming an outdoor air temperature of -15°F (Ref 2). This is considered to be sufficient time to deploy portable heaters if necessary. These areas will be monitored for temperature as part of the FLEX implementing guidance

c. Makeup to the spent fuel pool (SFP) will match the decay heat boil off rate and maintain SFP level. The source of water is Lake Michigan which is considered as an inexhaustible source. By matching the boil off rate the boron concentration in the SFP will not be affected thus precipitation of boric acid and freezing is not a concern. As noted in the Point Beach OIP criticality is also not a concern since the SFP criticality analysis allows the use of non-borated water.

d. Depletion of the RWST and BAST is only a concern for the Mode 5 and 6 conditions that require makeup to RHR and the RCS to account for decay heat boil off. For the other conditions the RWST has more than enough borated water to maintain KRCS inventory and shutdown margin during cooldown. Once the RWST and BAST are depleted for the shutdown unit the excess borated water in the other units RWST can be used and/or recirculation from containment can be established. Recirculation from containment can be established by opening the sump B valves and RHR pump drain valves. The sump B valves can be manually opened from outside of containment using a hydraulic hand pump per existing design. This allows water to drain from the containment sump to the PAB-19 foot sump. The portable diesel pump that was used for taking suction from the RWST and pumping into RHR and the RCS can then be rerouted to take suction from the -19 foot sump. As discussed in the Point Beach Integrated Plan the portable diesel pumps will have enough flow capability to periodically increase flow to greater than the decay heat boil off rate to flush concentrated boric acid from the vessel and prevent precipitation of boric acid and freezing.

e. The BAST or the RWST are the supplies to the secondary connection point. A GOTHIC analysis with an outside air temperature of -15°F shows that it

takes 12 hours for the room temperature to drop below 70°F. The BAST is insulated and typically maintained at greater than 80°F so it would take in excess of 12 hours to drop below 70°F. This provides adequate time to deploy a portable heater if the BAST is being used and room temperatures continue to drop.

The NRC staff considered the licensee's approach regarding heat tracing to be reasonable; however, during the audit the licensee did not demonstrate that a sufficient number of heaters will be provided to serve all necessary vulnerable equipment or demonstrate that they will be deployable in a manner that will support completion of all actions in the Integrated Plan. As necessary, this topic may be reviewed in further audits or inspections of the mitigating strategy for Point Beach following the licensee's development of procedures for FLEX implementation.

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

3.2.4.4 Accessibility – Lighting and Communications

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

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

Lighting
On page 56 of the Integrated Plan in the section on safety functions support, Phase 1, the licensee stated:

> Existing battery-operated emergency lighting units designed to provide adequate illumination for an 8-hour lighting duration are provided at local control panels and along the normal access routes traveled by operators to establish the Appendix R hot standby condition. In the exterior areas, emergency lighting is not provided for the access and egress routes. Appendix R emergency lighting is not seismically qualified. Many, but not all of the units are protected from tornado missiles. While not formally credited as FLEX equipment, surviving Appendix R emergency lighting may be available in some of the designated safe shutdown areas until the batteries are depleted.
>
> In addition to the fixed emergency lights, 8-hour, battery powered portable lights are provided in the Control Room for operator use when performing manual operator actions. These lights are designed for mounting on hard hats allowing

hands free use. The helmet-mounted lights are provided for use in exterior areas and as a supplement to the fixed emergency lighting for traversing areas of low lighting and to compensate for out-of-service fixed emergency lights. Additional hand-held, battery powered, portable lights are provided in various plant locations for emergency use.

> The need for additional lighting will be evaluated as FSGs are developed (Pending Action 9).

On page 59 of the Integrated Plan in the section on safety functions support, Phase 2, the licensee stated:

> Appendix R emergency lighting is not seismically qualified. Many, but not all of the units are protected from tornado missiles. While not formally credited as FLEX equipment, surviving Appendix R emergency lighting may be available in some of the designated safe shutdown areas, until the batteries are depleted (approximately 8 hours). Portable lighting powered by PDGs will be available for installation in those areas of the plant requiring occupation for significant periods of time. Emergency lanterns will be used as necessary in other plant areas.

Communications
The NRC staff has reviewed the licensee communications assessment (ML12305A538) and (ML13053A400) in response to the March 12, 2012 50.54(f) request for information letter for PBNP and, as documented in the staff analysis (ML13135A271) has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by the licensee will conform to the guidance of NEI 12-06 Section 3.2.2 (8) regarding communications capabilities during an ELAP. This has been identified as Confirmatory Item 3.2.4.4.A in Section 4.2 below.

During the audit, the licensee was requested to clarify the means of communication between the control room and local equipment operators for the steam generator makeup pumps (i.e., TDAFW or FLEX pumps) and atmospheric dump valves to affect a symmetric cooldown of the RCS. The licensee was further requested to clarify whether environmental factors such as elevated temperatures or ambient noise of exiting steam have been considered in the evaluation to determine that the necessary coordination is feasible. The licensee responded that radio communication will be used between the control room and local equipment operators for the steam generator makeup pumps and atmospheric dump valves. Elevated temperatures will be addressed by the use of heat stress counter measures and rotation of personnel to the extent feasible. Normal surveillance testing of the TDAFW pump and atmospheric dump valves have demonstrated that radio communication is acceptable with the elevated noise from the exiting steam. Lower noise areas are located near the TDAFW pump and atmospheric dump valves and could be used if necessary. The clarification provided by the licensee is adequate.

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

3.2.4.5 Protected and Internal Locked Area Access

NEI 12-06, Section 3.2.2, Guideline (9) 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.

Page 10 of Integrated Plan regarding how strategies will be deployed in all modes, the licensee stated for Phase 2 equipment:

> The gate and vehicle barrier in the route will be manually opened by security in accordance with existing instructions for B.5.b deployment.

In various sections of the Integrated Plan regarding portable equipment Phase 3 for maintaining core cooling and heat removal, the licensee stated:

> Equipment from the RRC will initially be transported to an offsite receiving area like the Green Bay airport and an accessible route to the site will be identified based on the extent of damage. It is assumed that two diesel generators, of approximately 2 MW each, and two UHS pumps will arrive at the site staging area (one of the designated parking lots located to the South and North of the plant) from the RRC between 72 and 96 hours into the event. The equipment will be deployed from the staging area through the Protected Area vehicle trap under the control of Station Security. The equipment may be deployed through either the South or North Security fence gate.
>
> These generators will be connected to the B train 4.16 KV Emergency Bus (see Attachment 3, Figure 9). The UHS pumps will be staged near the pump house and connected to the SW system.

The Integrated Plan does not identify if the security system may be adversely affected by the loss of the preferred or Class 1E power supplies in an ELAP. If the security system is affected, identification is needed of what manual actions specified in ELAP response procedures/guidance may require additional actions to obtain access. This has been identified as Confirmatory Item 3.2.4.5.A in Section 4.2.

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

3.2.4.6 Personnel Habitability – Elevated Temperature

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

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

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

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

Section 9.2 of NEI 12-06 states:

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

An alternate method of SFP cooling is described on page 52 of the Integrated Plan where the licensee stated in part:

A 5" discharge hose is routed from the PDDP to the SFP truck bay area where a Gated Wye connection is installed from the Gated Wye; two 2 1/2" hoses are run up to each end of the SFP and tied off for direct discharge into the SFP or to spray nozzles. This will allow for a total flow rate of at least 500 gpm to the SFP.

The timeline (Attachment 1A) does not address the time restraint for the alternate approach identified above. The analysis that will be performed to demonstrate the adequacy of the PAB environment for equipment and personnel access (Pending Action 6) needs to address the alternate approach since refueling floor access when the SFP level is 2 feet 8 inches above the fuel is questionable. Access at the “desirably before 200 °F” temperature is also questionable. This has been previously identified as Confirmatory Item 3.2.2.A in Section 4.2.

On page 57 of the Integrated Plan regarding safety function support, Phase 1 the licensee stated:

Room temperatures in areas containing equipment required to mitigate a SBO event do not increase to values impacting operability following a loss of ventilation for at least one hour. Reasonable assurance of equipment operability is based on calculated maximum room temperature less than or equal to 120°F. Calculation 2005-0054 verifies the times which control building rooms reach 120°F. The worst case room is the cable spreading room which will require an action to increase area cooling prior to 76 minutes.

Specific actions per AOP-30 "Temporary Ventilation for Vital Areas" will be developed to account for the loss of all ac. Additional analysis will be performed

to determine what additional time may be gained by opening cabinets and area doors (Pending Action 3 1).

On page 60 of the Integrated Plan regarding safety function support, Phase 2, the licensee stated:

> Temperatures in vital areas will continue to be monitored. Temporary ventilation may be set up per AOP 30 "Temporary Ventilation for Vital Areas".

The environmental conditions of 120°F would exceed the habitability limits defined in NUMARC 87-00 for efficient human performance. NUMARC 87-00 provides the technical basis for this habitability standard as MIL-STD-1472C, which concludes that 110°F is tolerable for light work for a 4 hour period while dressed in conventional clothing with a relative humidity of ~30%.

The licensee's plan on personnel habitability/accessibility in an elevated temperature environment did not provide reasonable assurance that the plan conforms to the guidance of NEI 12-06, Section 3.2.2, Guideline (11), because no specific information on maintaining habitability conditions in the control room or other critical areas where operators may have to go for strategy deployment and operation was provided in the plan, but rather specific actions per AOP-30 "Temporary Ventilation for Vital Areas" will be developed to account for the loss of all ac, and additional analysis will be performed to determine what additional time may be gained by opening cabinets and area doors . This has been identified as Confirmatory Item 3.2.4.6.A in Section 4.2.

The licensee's plan on personnel habitability/accessibility in an elevated temperature environment did not provide reasonable assurance that the plan conforms to the guidance of NEI 12-06, Section 3.2.2, Paragraph (11), because there is insufficient information to determine that operator protective measures (e.g. short stay time cycles, use of ice vests/packs, supplies of bottled water, etc.) will be employed in all Phases of an ELAP to ensure operators will be capable of FLEX strategy execution under adverse temperature conditions. Examples of areas of concern are the control room, TDFW pump room, cable spreading room, SFP area, and charging pump room.

During the audit, the licensee stated long term habitability will be assured by monitoring conditions in the required work areas. Heat stress countermeasures, cold weather counter measures and rotation of personnel to the extent feasible will be employed to ensure operators will be capable of FLEX strategy execution. At PBNP, the impact to habitability would be impacted from elevated temperatures and extreme cold air temperatures. Point Beach FSGs will provide guidance to evaluate work area conditions and take actions as necessary. This has been identified as Confirmatory Item 3.2.4.6.B in Section 4.2 below.

The Integrated Plan did not identify procedures/guidance that addressed the use of appropriate human performance aids (e.g., component marking, connection schematics, installation sketches, photographs, etc.). During the audit, the licensee stated installation sketches will be included in Point Beach FSGs when appropriate. Installation sketches will include identification of connection points and the suggested layout of hoses, cables and portable equipment. The Phase 2 staffing study will evaluate the FLEX strategies and determine if additional equipment marking is required to ensure successful completion of the FLEX strategies. This has been identified as Confirmatory Item 3.2.4.6.C 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 Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to personnel habitability – elevated temperature if these requirements are implemented as described.

3.2.4.7 Water Sources.

NEI 12-06, Section 3.2.2, Paragraph (5) provides that:

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

Maintain core cooling
On page 6 of the Integrated Plan, the licensee stated:

> The PBNP Condensate Storage Tanks (CSTs) will be modified to qualify them as seismic and tornado missile protected up to the 6 foot level (see Attachment 3, Figure 4), (Pending Action 18). This will provide the initial qualified source of water for the TDAFW pumps. The CST at 6 feet provides 14,100 gallons of available water per tank. The TDAFW pump flow rate is assumed to be the Design Basis Accident (DBA) flow rate of 230 gallons per minute (gpm) for 20 minutes. This brings the CST level down to the 4 foot level. A CST level of 4 feet provides enough volume for one hour of decay heat removal from a reactor trip without a cool down.

> The DDFP will be modified to upgrade its seismic qualifications and provide a cross connect to the SW system, (Pending Action 19). The DDFP takes suction from the SW pump bays in the Circulating Water Pump House. The Circulating Water Pump House is a robust structure and can take water from Lake Michigan through the discharge flumes in the event the normal intake piping is damaged. The DDFP starts automatically on a loss of ac and will switch over to supply SW via remote manual operator actions. An evaluation will be performed to determine whether SW system return and non-seismic/missile protected portions of the SW system will need to be isolated to ensure adequate flow to the suction of the TDAFW pump (Pending Action 2). Based on the results of the evaluation required operator actions will be time validated (Pending Action 3).

On pages 15 and 16 of the Integrated Plan, the licensee stated:

> Upon completion of the TDAFW suction swap over from the CST to the SW system, the DDFP will take suction from the pump bay and discharge to the SW system. The discharge of the DDFP will supply SW to the suction of the TDAFW pump to feed the SGs. The DDFP will start automatically on a loss of ac and can also be started from the control room. The DDFP will take suction from the SW Pump Bay in the Circulating Water Pump House (CWPH). The CWPH is a robust structure that meets seismic and missile protection criteria. The pump house forebay design provides four connection paths to Lake Michigan, two intake pipes and two discharge flumes. Any one of the paths is capable of supplying a quantity of water well in excess of the amount required for decay heat removal. Normal water supply from Lake Michigan, the Ultimate Heat Sink (UHS), is via an intake crib located approximately ¼ mile out in the lake. If the normal supply to the UHS is lost, flow will be established through the discharge flumes to the pump bay (NRC Safety Evaluation Report (SER) for PBNP Units 1 and 2 dated July 15, 1970). Sufficient water is available within the pump bay to supply the DDFP while manual actions are taken to establish the alternate connection to the UHS. Per PBNP Calculation 2003-0063, 440,826 gallons are available in the forebay/pump bays. Per WCAP-17601-P, this would provide greater than 24 hours of decay heat makeup for both of the PBNP two loop plants. The DDFP is supplied from a 250 gallon diesel oil day tank with an operating time of 13 hours based on usable volume.
>
> Lake Michigan is the source of cooling water to the PBNP. When the water in the CSTs is depleted, suction for the AFW pumps automatically shifts to the SW system to provide makeup water from the lake for an indefinite time period. The CLB for PBNP credits Lake Michigan water for long term cooling.

During the audit, the licensee was requested to clarify how the alternate connections to the UHS will be accomplished during an ELAP given the potential for limiting weather conditions (e.g., extreme cold, high winds). The licensee responded that to establish flow from the discharge flume to the forebay intake which is common to both units, either the unit 1 or unit 2 ice melt valve would have to be partially opened. The valves would have to be manually opened. The valve operators for these valves are located within the pumphouse concrete structure. An operator would have to traverse a short distance outside to get to the pumphouse and another short distance to get to the valve gallery where the valve operators are located. This action would only be required in the event that both of the 14 foot intake pipes are 100% blocked. Immediate operator action is not required because as stated in the Point Beach Integrated Plan

there is enough water contained within the forebay and pump bays to provide greater than 24 hours of decay heat makeup for both Point Beach units. This provides sufficient time to obtain additional resources and establish access. Instructions for monitoring pump bay level and establishing makeup will be contained in an FSG. The licensee response adequately addressed the requested clarification.

Maintain containment
On pages 44 and 45 of the Integrated Plan regarding maintaining containment in Phase 2, the licensee stated:

> If necessary, the capability exists to connect a PDDP to supply water to the containment spray system via an adapter which replaces the cover of a spray pump discharge check valve (see Attachment 3, Figure 14). Hose(s) from the PDDP will be routed through the 8' Elevation of the Turbine Building and PAB to this connection point.
>
> The PDDP will be positioned in the area near the pump house and suction hoses will be placed to draw water from the pump house fore bay or pump bay. Alternative suction paths include the ability to draw water directly from Lake Michigan using a floating strainer.

On page 45 of the Integrated Plan regarding protection of connection points, the licensee stated:

> The connection points at the spray pump discharge check valves are located within the PAB, which is a seismic Class I, SR structure and provides protection from tornado missiles. All of the related installed piping that will provide the intended flow path is SR seismic Class I and is located within the PAB until it enters containment.

SFP cooling
On page 50 of the Integrated Plan regarding Phase 2 maintaining spent fuel pool cooling, the licensee stated:

> Water is added to the SFP with a PDDP and hoses using either direct addition or spray. The PDDP will draw raw water from the pump house forebay, pump bay, or directly from Lake Michigan. A connection point on the suction of the P-9, Hold Up Tank (HUT) Recirculation Pump will allow the addition of approximately 250 gpm of raw water from the PDDP to the SFP without accessing the refueling deck (see Attachment 3, Figures 8a, 8b, and 15). A makeup water supply of 50 gpm is adequate to maintain SFP level. Spent fuel pool criticality analysis allows the use of non-borated water,

On page 52 of the Integrated Plan regarding an alternate approach for Phase 2 maintaining spent fuel pool cooling, the licensee stated:

> Water is added to the SFP with a PDDP and hoses using either direct addition or spray based on plant conditions.
>
> The PDDP will be positioned in the area near the pump house and suction hoses will be placed to draw water from the pump house fore bay or pump bay.

Alternative suction paths include the ability to draw water directly from Lake Michigan using a floating strainer.

A 5" discharge hose is routed from the PDDP to the SFP truck bay area where a Gated Wye connection is installed from the Gated Wye; two 2 1/2" hoses are run up to each end of the SFP and tied off for direct discharge into the SFP or to spray nozzles. This will allow for a total flow rate of at least 500 gpm to the SFP.

During the audit, the licensee was requested to discuss how the floating strainer will be deployed i.e., boat availability or where a boat could be launched. The licensee was also requested to discuss how, if a floating strainer is intended for all weather use, will it be deployed during late fall, winter, or early spring storms. The licensee responded that guidance for deployment of the floating strainer will be provided in the Point Beach FLEX Support Guidelines. Use of the floating strainer will be determined based on conditions at the time of the event. If the floating strainer is used, the strainer will be deployed by hand without the aid of a boat. Appropriate safety precautions will be contained in Point Beach FLEX Support Guidelines for the portable strainer deployment.

During the audit, the licensee was requested to clarify whether each unit has a DDFP, or whether a single pump serves the entire site. The licensee was also requested to identify the flow rate that the DDFP would supply to the auxiliary feedwater pump(s) and confirm that this flow rate would be sufficient for decay heat removal via the steam generators at the time at which it begins supplying suction to the auxiliary feedwater pumps; and identify whether a single diesel driven fire pump has sufficient capacity to support the cross-connected turbine-driven auxiliary feedwater pump configuration discussed on page 19 of the Integrated Plan.

The licensee responded that a single DDFP serves the entire site. The DDFP has a design flow rate of 2,000 gpm at approximately 290 ft. of head. At the time of alignment for FLEX strategy the decay heat removal via the secondary side of the SGs for each reactor requires less than 200 gpm or a total of 400 gpm for the site. The single DDFP has an adequate capacity to supply the 400 gpm to the TDAFW pump(s) suction. The flow path head losses (elevation and piping) from the pump bay to the TDAFW pump(s) suction are a small portion of the available DDFP head. Per the FLEX strategy non-seismic portions of the Fire Protection (FP) will be isolated for FLEX flow path protection. A FP cross tie valve to the seismic SW will be opened to supply the suction to the TDAFW). Non-FLEX essential portions of the SW system will be isolated to protect the flow path to the TDAFW. The DDFP has a pressure control regulating valve that will protect the DDFP from minimum flow operation.

During the audit, the licensee was requested to address changes to the design of the AFW system to improve system redundancy by incorporating cross connects for steam supply, exhaust, and discharge piping. The licensee was also requested to clarify whether the cross-connect modifications or any other planned modifications to support the implementation of mitigating strategies will require a license amendment. The licensee responded that changes to the AFW system are being reviewed in accordance with their modification and 50.59 process. No unanalyzed failures impacting the current design basis of the AFW system and its capability for mitigating design basis accidents and transients have been identified to date. A license amendment is not expected to be required. This applies to all of the currently identified modification required to implement the Point Beach FLEX strategies.

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

assurance that the requirements of Order EA-12-049 will be met with respect to water sources if these requirements are implemented as described.

3.2.4.8 Electrical Power Sources/Isolations and Interactions.

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

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

On pages 63 and 64 of the Integrated Plan in regards to safety function support during the Phase 2, the licensee stated:

> The 480VAC PDG will be positioned east of the turbine building. Cable routes will be through either of the turbine building truck access area doors, up through the non-vital 4.16 kV switchgear area, and into the CSR. An alternate PDG location will be west of the turbine building near the boiler room. The cable route from this location will be through the boiler room, B-08/B-09 switchgear area, turbine building, and then into the CSR.
>
> If the primary connection points are not available, the capability will exist to make connections local to the required equipment. These connections will require some disassembly of existing equipment. The secondary connection points will be designated (Pending Action 11).

On page 67 of the Integrated Plan during the Phase 3, the licensee stated:

> The primary connection points for the 4.16 kV PDG(s) will be at 1A-06 and 2A-06. The PDG(s) will be positioned near the DG building. Cable routes will be through the west DG building vestibule to the Unit 1 and Unit 2 4.16 kV switchgear rooms. An alternate cable route path would be through the G-03 and G-04 Emergency Diesel Generator (EDG) rooms via the north and south doors of the DG building (See Attachment 3, Figure 9).
>
> If the primary connection points are not available, local connections will be required. These connections will require some disassembly of existing equipment. These connection points would require the use of power supplies and transformers provided by the RRCs.

During the audit, the licensee was requested to describe how electrical isolation will be maintained such that (a) Class 1E equipment is protected from faults in portable/FLEX equipment and (b) multiple sources do not attempt to power electrical buses. The licensee responded that currently no portable FLEX equipment loads are planned to be connected to the Class 1E distribution equipment. Should any be required, appropriate current interrupting devices (i.e., circuit breakers and /or fuses) will be used to provide fault protection. Administrative controls (e.g., racking out breakers, going to pull-out on control switches, removing control power, etc.) will be used to prevent multiple power sources from powering electrical buses unless the ability to synchronize and parallel the power sources is provided. The licensee response is adequate.

During the audit, the licensing 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. The licensee provided the following information:

> Phase 2 minimum credited loads:
> D-107 or D-108 or D-109 Battery Charger 76 kW/107 kVA
> D-07 or D-08 or D-09 Battery Charger 58kW/77kVA
> Accumulator isolation Valve (one valve at a time) 5.2 kW/50 kVA
> Total 139 kW/234 kVA
>
> Phase 2 480 VAC DGs have not yet been purchased. It is anticipated that equipment with a minimum standby rating of 300 kW/375 kVA will be purchased to provide margin for supplying additional equipment if that is later determined to be necessary or desirable (e.g., additional battery chargers, heat tracing, etc.).

The need to confirm that appropriately sized FLEX DGs are procured has been identified as Confirmatory Item 3.2.4.8.A in Section 4.2.

Phase 3 loads:
Specific FLEX Phase 3 loads have not been tabulated other than those which will continue over from Phase 2. The safe shutdown loads of both units can be supplied with a single installed EDG rated at 2848 kW for Phase 3, the RRC is expected to provide 4 generator sets rated at approximately 1MW each. This is more than enough capacity to power any of the expected loads.

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

3.2.4.9 Portable Equipment Fuel.

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

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

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

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

On page 56 of the Integrated Plan for Phase 1, the licensee stated:

> The only equipment requiring fuel during Phase 1 will be the upgraded P-35B, DDFP. The upgraded P-35B fuel requirement is approximately 11.4 gallons per hour. The P-35B engine is gravity fed from T-30, Diesel Fire Pump Fuel Tank which has a capacity of 250 gallons and will be administratively controlled to

ensure the availability of a quantity of fuel oil sufficient to supply P-35B for at least 13 hours. T-30 and all related piping are located within the Pump House which is a safety related, seismic Class I structure capable of handling tornado design wind and missile loads. T-30 and the related piping are not seismically qualified and will be evaluated and/or upgraded for the applicable seismic loading (Pending Action 8). The tank is protected from the expected Pump House flood level.

On page 59 of the Integrated Plan for Phase 2, the licensee stated:

> At full capacity, the PDDP uses 13.5 GPH. The PDDP has a fuel tank which will provide a minimum of 12 hours of operation at full capacity. The PDG connected to 1B-03 and 2B-04 [2B-03 in 6 month update], and the other small diesel powered equipment (e.g., 5.5 kW PDGs and diesel driven charging pumps) will also require periodic refueling. The refueling frequency of this equipment will be based on fuel oil consumption (Pending Action 13).
>
> Technical Specification requirements ensure greater than 64,000 gallons of fuel oil is maintained on site in SR seismic Class I underground tanks. This fuel would be available to supply permanently installed and/or portable diesel powered equipment credited for a FLEX mitigation strategy. The capability will exist to refuel required permanently installed and portable FLEX equipment within 12 hours following an event. This will be accomplished with the use of an approximately 500 gallon fuel tank trailer capable of being towed by a Ford F-350 or equivalent truck. The trailer/truck combination will have the capability to draw fuel oil from on-site fuel oil tanks.

On page 64 of the Integrated Plan for Phase 2, the licensee stated:

> The existing underground SR fuel oil tanks seismic are Class I and protected from tornado missiles. The connection point for the credited fuel oil supply is inside the DG building which is a SR seismic Class I structure located well above the maximum projected flood level.

On page 68 of the Integrated Plan regarding safety function support in Phase 3, the licensee stated:

> Onsite fuel oil stores and/or equipment will be replenished from offsite suppliers. Local suppliers within 35 miles of PBNP have substantial bulk storage capacity and the capability to provide emergency delivery at any time.

On page 111 of the Integrated Plan, the licensee stated:

> Pending Action (13)
> An overall diesel refueling plan will be developed based on final FLEX diesel driven component fuel consumption requirements that specifies refueling frequency and time requirements. Time Constraint based on Fuel Oil Consumption of DDFP will be validated.

During the audit, the licensee was requested to describe plans for supplying fuel oil to FLEX equipment (i.e., fuel oil storage tank volume, supply pathway, etc.). Describe how oil will be

supplied from the underground tanks. Also, explain how fuel quality will be assured if stored for extended periods of time.

The licensee responded that fuel oil is stored onsite in 2 safety related 35,000 gallon underground tanks with a Technical Specification limit of greater than 86.2% (32,100 gallons) each. Fuel from the tanks can be transferred to the Fuel Oil Transfer trailer and delivered to the portable FLEX equipment. Transport routes for the Fuel Oil trailer will be the same routes used for FLEX equipment deployment (as indicated in Point Beach Integrated Plan figure 11). The tanks are adjacent to the deployment routes in figure 11.

Fuel Oil quality in the tanks is assured by quarterly sampling in accordance with TS 5.5.12 and TRM 4.12. The Fuel Oil Transfer trailer will not normally be filled with fuel oil when in storage. The trailer will be filled from the underground tanks during Phase 2 of the FLEX strategies. The quality of the fuel oil in the tanks of the portable FLEX equipment will assured through a combination of the use of fuel oil preservatives and periodic replacement.

On page 9 of the Integrated Plan, the licensee states that the trailer/truck combination will have the capability to draw fuel from the on-site fuel oil tanks.

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

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

On page 7, 8, and 9 of the Integrated Plan, the licensee stated:

> The safety-related (SR) 125V system consists of four main distribution buses: D-

01, D-02, D-03, and D-04. The D-01 (train A) and D-02 (train B) main Direct Current (dc) distribution buses supply power for control, emergency lighting, and the red and blue 120 Voltage Alternating Current (VAC) Vital Instrument bus (Y) inverters. The D-03 (train A) and D-04 (train B) main dc distribution buses supply power for control and the white and yellow 120 VAC Vital Instrument (Y) buses. In addition, there exists a swing safety-related battery D-305 which is connected to swing dc distribution bus D-301. This swing battery is capable of being aligned to any one of the four main distribution buses to take the place of the normal SR battery. There are also two non-safety related (non-SR) 125V distribution buses (112D-201), and batteries installed (Attachment 3, Figure 7). These buses and ancillary equipment are dedicated to a specific unit, and supply power to non-safety related loads. A connection is provided from swing bus D-301 to both non-SR buses and batteries. All five of the SR batteries are located within SR seismic Class I, tornado missile protected structures. If the non-safety related batteries are required to be credited as part of the battery load management strategy, they will be evaluated and upgraded as necessary to make them seismically robust and tornado missile protected (Pending Action 35).

A battery load management strategy will be developed to provide power to credited installed equipment (e.g., DC Motor Operated Valves (MOV), Solenoid Operated Valves (SOV), etc.), and at least one channel of credited instrumentation during Phase 1 (Pending action 1). The strategy will include initial load stripping to extend battery life. The dc load stripping will be initiated at 1 hour into the event and will be completed within the next hour. As the connected batteries become depleted, the batteries with remaining capacity will be switched in to replace them. Based on initial evaluation, the battery load management strategy is expected to provide greater than 18 hours of dc power before battery charger restoration will be required. A formal evaluation will be performed to verify available dc power time as part of Pending Action 1.

Energize 480 Volt Safeguards Buses

The Time Constraint for re-powering the 480V Safeguards Buses is associated with re-powering the battery chargers. The battery load management strategy to be developed will provide power to credited installed equipment (e.g., DC MOVs, SOVs, etc.) and at least one channel of credited instrumentation during Phase 1 (Pending Action 1).

Energize the Required Station Battery Chargers and Align to the Batteries

The Time Constraint for energizing the battery chargers is based on a preliminary evaluation that indicates the battery load management strategy will provide greater than 18 hours of dc power before battery charger restoration will be required. Based on this, a goal of 10 hours to re-power the battery chargers has been established. A formal evaluation will be performed to verify available dc power time (Pending Action 1).

On page 78 of the Integrated Plan regarding time restraints (Attachment 1A), the license identified in action item (20) to energize the 480 Volt safeguards buses.

For the various safety-related batteries at PBNP, the licensee stated that battery durations have

been preliminarily evaluated to last at least 18 hours. Deployment of 480 VDC DGs is at 3 hours. Six hours later the 480 VDC DGs will be in service. Thus, within 9 hours the FLEX DGs can be in service to supply power to both divisions of Class 1E emergency 480VAC.

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.

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

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

The licensee informed the NRC of their plan to abide by this generic resolution, and their plans to address potential plant-specific issues associated with implementing this resolution that were identified during the audit. The NRC staff has determined the licensee's submittal is acceptable, per JLD ISG-2012-01 and provides reasonable assurance that the requirements of Order EA-12-049 will be met if these requirements are implemented as described in the licensee's Integrated Plan.

During the audit, the licensee was requested to provide the dc load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling. The licensee provided the requested information on their Portal.

During the audit, 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 the required operator actions needed to be performed and the time to complete each action. In addition, the licensee was requested to explain which functions are lost as a result of shedding each load and discuss any impact on defense in depth and redundancy.

The licensee responded by providing a list of dc distribution panels with resulting circuit breaker position following dc load shedding. The list includes a description of the affected circuits and the location of the distribution panel. In addition to the positioning of these circuit breakers, dc load shedding actions also include:

1. Shutdown of the IDY-02, 2DY-02, and DY-OB “Blue” instrument inverters located in the cable spreading room.

2. Shutdown of the spare DY-OA “Red” instrument inverter located in the cable spreading room.

3. Shutdown of the 1DY-04 and DY-OD instrument inverters located in the PAB.

4. Shutdown of the 2DY-03 and DY-OC instrument inverters located in the PAB.

5. Opening the 120 VAC instrument power supply circuit breakers 1Y-103-14, 1Y-104-14, 2Y-103-14, 2Y-103-14, and 2Y-104-14 which are located in the computer room. These breakers supply power to the RMS.

6. Opening Breaker D72-04-06 which is located in the PAB electrical equipment room. This breaker supplies power to EDG G-03 distribution panel D-28.

Based on a preliminary field walk down performed by a licensed RO and licensed SRO, the estimated time to complete the entire load shedding actions is less than 45 min if performed by one person. It is expected that available personnel will allow some of these actions to be performed in parallel, which will reduce the time required.

Following load shedding, power will remain available to operate all of the installed plant equipment credited in the FLEX mitigation strategies. Two instrument channels will remain in service on each unit; Red and White channels for U1, and the Red and Yellow channels for U2. At least one channel of plant instrumentation necessary to monitor the FLEX strategies will remain available.

The dc load shedding will not remove power from equipment that may be required to function during the implementation of the mitigation strategies and that do not fail to the required position upon loss of dc power. There are no RCS leakage paths that require dc power for isolation. Any required valve repositioning from the control room will occur before the applicable indication is removed by dc load shedding actions.

The load shedding actions described above have been used as the basis for the preliminary battery evaluations and may be subject to change as the evaluations and implementing documents are finalized.

During the audit, the licensee was requested to identify the minimum voltage that must be maintained and the basis for the minimum voltage on each battery/dc bus during each Phase under all MODES of operation. The licensee responded that preliminary evaluations have been performed using ETAP Battery Discharge and Control System Diagrams (CSD) modules. The CSD module was utilized to establish the minimum voltage requirements for each credited equipment to ensure the equipment remains above the equipment’s minimum voltage ratings. The ETAP CSD module performs individual voltage drop analysis for each circuit (e.g. schematic). The Battery Discharge module is used to determine the voltages at the battery

terminal, dc buses and at loads during the loading scenarios based on the load duty cycle on each respective battery. The voltage drop in the circuit is applied to the minimum operating voltage of the credited equipment to determine the required minimum bus/battery voltage. The preliminary evaluations have been performed for battery D-05 which is considered bounding for battery D-06, and battery D-105 which is considered bounding for battery D-106. Final evaluations, planned for completion in 2014 will be performed on each of the four battery distribution systems using a similar basis for determining minimum dc bus voltage. This has been identified as Confirmatory Item 3.2.4.10.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 load reduction to conserve dc power if these requirements are implemented as described.

3.3 PROGRAMMATIC CONTROLS

3.3.1 Equipment Maintenance and Testing.

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

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

NEI 12-06, Section 11.5 states:

> 1. FLEX mitigation equipment should be initially tested or other reasonable means used to verify performance conforms to the limiting FLEX requirements. Validation of source manufacturer quality is not required.
>
> 2. Portable equipment that directly performs a FLEX mitigation strategy for the core, containment, or SFP should be subject to maintenance and testing guidance provided in INPO [Institute of Nuclear Power Operations] 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., Electrical Power Research Institute

(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 12 of the Integrated Plan discussing programmatic controls, the licensee stated:

Existing plant maintenance programs will be used to identify and document maintenance and testing requirements. Preventative Maintenance (PM) work orders will be established and testing procedures will be developed in accordance with the PM program. Testing and PM frequencies will be established based on type of equipment and considerations made within Electric Power Research Institute (EPRI) guidelines. The control and scheduling of the PMs will be administered under the existing site work control processes. PBNP will assess the addition of program description into the FSAR, and Technical Requirements Manual.

On page 113 of the Integrated Plan in the listing of pending actions, the licensee stated, in part:

PBNP will implement a FLEX program stipulating the required administrative controls to be implemented. The program will include:

a. FLEX equipment procurement requirements,

b. Plant configuration control procedures to assure plant physical changes will not adversely impact the approved FLEX strategies,

c. Complete Maintenance and Operations Procedures related to FLEX Equipment Storage, Maintenance, and Testing, and

d. Deployment strategy administrative requirements that address all MODES of operation and requirements to keep routes and staging areas clear or invoke contingency actions.

The Integrated Plan identifies pending action (36) on page 12 to implement a FLEX program stipulating the required administrative controls from NEI 12-06, Section 11 to be implemented. This pending action is further described on page 113 and includes complete maintenance and operations related to FLEX equipment storage, maintenance and testing.

On page 69 of the Integrated Plan identifying PWR portable equipment, the Licensee stated:

Note: The amount of FLEX equipment will meet the N+1 criteria of NEI 12-06.

During the audit, the licensee was requested to identify the number of each type of portable equipment instead of just an X to indicate where it is used. The licensee responded that the exact numbers of each type of equipment not yet determined. Purchase specifications are still being developed and reviewed for some of the portable equipment. The exact capacity of the new equipment will determine if it is capable of supplying one or two units. That will determine if we need two or three of a particular item. This will be in accordance with the N+1 criteria of NEI 12-06.

The large components determined to date include:

Godwin Model HL130M 2 High capacity pumps (containment, SFP)
Godwin Model 3316 (New) 2 (Makeup for SG, SFP)
Diesel Generator (480V)* 2 - 250 to 500KW
Portable Diesel Charging Pump* 3 High pressure for RCS injection

Tow Vehicle* 2 F-350 or F-650 truck
Fuel Oil Trailer* 1@500 gallons diesel
*Manufacturer/Model TBD

Confirmation of the exact capacity of new FLEX equipment is required to enable determination if two or three of a particular item is required to meet the N+1 criteria of NEI 12-06 has been identified as Confirmatory Item 3.3.1.A in Section 4.2.

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

This Generic Concern involves clarification of how licensees would maintain FLEX equipment such that it would be readily available for use. The technical report provided sufficient basis to resolve this concern by describing a database that licensees could use to develop preventative maintenance programs for FLEX equipment. The database describes maintenance tasks and maintenance intervals that have been evaluated as sufficient to provide for the readiness of the FLEX equipment. The NRC staff has determined that the technical report provides an acceptable approach for maintaining FLEX equipment in a ready-to-use status. The NRC staff has evaluated PBNP application of the guidance in its development of the technical evaluation report documenting review of the licensee's Integrated Plan.

During the NRC audit, PBNP informed the NRC of their plans to abide by this generic resolution or note any deviations and the basis.

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

> Exiting 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.

On page 113 of the Integrated Plan in the listing of pending actions, the licensee stated, in part:

> PBNP will implement a FLEX program stipulating the required administrative controls to be implemented. The program will include:
>
> b. Plant configuration control procedures to assure plant physical changes will not adversely impact the approved FLEX strategies,

On page 4 of the Integrated Plan discussing key site assumptions, the licensee stated, in part:

> These pre-planned strategies will be incorporated into the unit emergency operating procedures in accordance with established EOP change processes, and their impact to the design basis capabilities of the unit evaluated under 10 CFR 50.59.

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

3.3.3 Training.

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 pages 12 and 13 of the Integrated Plan in regards to training, the licensee stated:

> A Systematic Approach to Training (SAT) will be used to evaluate training requirements for station personnel based upon changes to plant equipment, implementation of FLEX portable equipment, and new or revised procedures that result from implementation of the FLEX strategies (Pending Action 17). Training modules for personnel that will be responsible for implementing the FLEX strategies, and Emergency Response Organization (ERO) personnel will be developed to ensure personnel proficiency in the mitigation of beyond-design-basis external events. The training will be implemented and maintained in accordance with existing PBNP training programs. The details, objectives, frequency, and success measures will follow the plant's SAT process. FLEX training will ensure that personnel assigned to direct the execution of mitigation strategies for BDBEEs will achieve the requisite familiarity with the associated tasks, considering available job aids, instructions, and mitigating strategy Time Constraints.
>
> Training will be completed prior to final implementation of the requirements of this Order on Unit 1 in October of 2014 (Pending Action 17).

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

3.4 OFFSITE RESOURCES

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

1) A capability to obtain equipment and commodities to sustain and backup the site's coping strategies.
2) Off-site equipment procurement, maintenance, testing, calibration, storage, and control.
3) A provision to inspect and audit the contractual agreements to reasonably assure the capabilities to deploy the FLEX strategies including unannounced random inspections by the Nuclear Regulatory Commission.

4) Provisions to ensure that no single external event will preclude the capability to supply the needed resources to the plant site.
5) Provisions to ensure that the off-site capability can be maintained for the life of the plant.
6) Provisions to revise the required supplied equipment due to changes in the FLEX strategies or plant equipment or equipment obsolescence.
7) The appropriate standard mechanical and electrical connections need to be specified.
8) Provisions to ensure that the periodic maintenance, periodic maintenance schedule, testing, and calibration of off-site equipment are comparable/consistent with that of similar on-site FLEX equipment.
9) Provisions to ensure that equipment determined to be unavailable/non-operational during maintenance or testing is either restored to operational status or replaced with appropriate alternative equipment within 90 days.
10) Provision to ensure that reasonable supplies of spare parts for the off-site equipment are readily available if needed. The intent of this provision is to reduce the likelihood of extended equipment maintenance (requiring in excess of 90 days for returning the equipment to operational status).

On page 13 of the Integrated Plan regarding the Regional Response Center plan, the licensee stated:

> The industry will establish 2 RRCs to support utilities during BDBEEs. Each RRC will hold 5 sets of equipment, 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 a local Assembly Area, established by the SAFER team and PBNP. Communications will be established between PBNP and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of the PBNP's playbook, will be delivered to the site within 24 hours from the initial request.
> A contract has been issued to the administrator of SAFER for PBNP participation.

Review of the licensee's use of off-site resources, as described above, provides reasonable assurance that the proposed arrangement will conform to the guidance found 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 (Guideline 1). However, the plan failed to provide any information as to how conformance with NEI 12-06, Section 12.2 Guidelines 2 through 10 will be met. 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 offsite resources if these requirements are implemented as described.

4.0 OPEN AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number/ Status	Description	Notes
3.2.1.1.B	An acceptable analysis has not been referenced for the RCS inventory and core cooling strategy. More significantly, the licensee has yet not finalized what code and evaluation model will be used for the analysis.	Significant
3.2.1.2.A	Qualification testing should be completed demonstrating a maximum seal leakage rate no greater than 1 gpm/ pump for the SHIELD low-leakage seal design under ELAP conditions. This qualification and the resulting leakage rate should be shown applicable to the RCP design at PBNP.	
3.2.1.2.C	The licensee needs to perform the RCS analysis and demonstrate the acceptability of the analytical modeling for the pressure dependence of RCP seal leakage.	
3.2.1.5.A	The GOTHIC analysis to determine the containment conditions expected during an ELAP event with low leakage RCP seals has not yet been completed (Pending Action 5).	
3.2.1.8.A	During the audit process, the licensee informed the NRC staff of its intent to abide by the generic approach regarding boric acid mixing discussed in Section 3.2.1.8 of this report; however, the NRC staff concluded that the August 15, 2013, position paper was not adequately justified and has not yet endorsed this position paper. As such, resolution of this concern for the plant is identified as an open item.	

4.2 CONFIRMATORY ITEMS

Item Number/ Status	Description	Notes
3.1.1.1.A	Protection of FLEX Equipment – Seismic Hazard - Flooding Hazard - High Winds Hazard - Snow, Ice and Extreme Cold Hazard - High Temperature Hazard - Confirmation of the final design and location of new structures or modification of existing structures for the protection of FLEX equipment.	
3.1.1.2.A	The licensee did not address if sections of routes	

	to implement FLEX strategies will only require access through seismically robust structures or alternative calculations/evaluations that show they are capable of withstanding SSE loads.	
3.1.1.3.A	The Integrated Plan did not include a discussion of guidance for critical actions to perform until alternate indications can be connected or on how to control critical equipment without associated control power. Confirmation that guidance developed is necessary to show conformance to NEI 12-06, Section 5.3.3, consideration 1.	
3.1.1.4.A	Confirm location of the receiving area for off-site resources and identification of the methods to be used to deliver from the receiving area to the site staging area.	
3.1.2.2.A	Confirm that connection points are protected from flooding.	
3.1.3.2.A	During the audit, the licensee identified that an assessment of needed debris removal equipment will be completed in the first quarter of 2014.	
3.1.4.2.A	The Integrated Plan does not identify any equipment for the removal of snow and ice as needed to obtain and transport equipment from storage to its location for deployment.	
3.2.1.A	In light of the potential for consequential damage to ADVs, the licensee should complete the analysis of the ELAP scenario with an asymmetric cooldown and demonstrate acceptable results and/or otherwise demonstrate the acceptability of using a single-loop cooldown strategy for ELAP mitigation.	
3.2.1.1.A	Reliance on the NOTRUMP code (or other thermal-hydraulic code) for the ELAP analysis of Westinghouse plants is limited to the flow conditions before reflux condensation initiates. This includes specifying an acceptable definition for reflux condensation cooling. The licensee should confirm the applicability of this approach for PBNP.	
3.2.1.2.B	RCP seals - If the seals are changed to the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals, the acceptability of the use of the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals should be addressed, and the RCP seal leakages rates for use in the ELAP analysis should be provided with acceptable justification.	
3.2.1.2.D	The licensee needs to address whether the restoration of cooling to the SHIELD seals would be attempted and, if so, demonstrate that thermal	

	shock from restoration of seal cooling would not occur or would not adversely affect the RCP SHIELD seals planned for installation at Point Beach.	
3.2.1.6.A	Confirm resolution of Integrated Plan statement that a CST volume is adequate to support decay heat removal for 1 hour 20 minutes and an audit response that states it is adequate for approximately 1.9 hours.	
3.2.1.6.B	Confirm that the methodology in Attachment 1 of the PWROG Core Cooling Interim Position Paper was properly utilized to determine the 200 psig constraint for accumulator isolation.	
3.2.1.8.B	Completion of the motive force calculation for the TDAFW pump and demonstration that it will be capable of performing its function at the depressurization terminus identified in the integrated plan.	
3.2.1.9.A	The Integrated Plan indicates use of additional B.5.b pumps as FLEX pumps; however it does not describe their capacity, qualification, protection, and deployment.	
3.2.1.9.B	Verify that the pumps selected for the revision of the mitigation strategy are capable of providing the necessary flow including consideration of hoses, fittings, elevation, etc.	
3.2.2.A	The licensee needs to complete analysis to demonstrate the adequacy of the PAB environment for equipment and personnel access with the SFP boiling.	
3.2.4.2.A	The Integrated Plan does not address heatup under worst case conditions and a commitment to maintain temperatures below the 110 design temperature specified on page 3 of the Integrated Plan or qualify electrical components for more severe temperatures.	
3.2.4.4.A	Generic confirmatory item related to communications capabilities during an ELAP.	
3.2.4.5.A	The Integrated Plan does not identify if personnel access may be adversely affected by the loss of the preferred or Class 1E power supplies in an ELAP. If access is affected, the licensee should identify any additional actions necessary to ensure operator access to areas where manual actions are specified in ELAP response procedures/guidance.	
3.2.4.6.A	The licensee's procedure on temporary ventilation for vital areas requires additional development to address habitability conditions.	
3.2.4.6.B	Provide guidance to evaluate work area	

	conditions and take actions as necessary to address elevated temperatures and extreme cold air temperatures for inclusion in FSGs.	
3.2.4.6.C	Confirm development of installation sketches that include identification of connection points and the suggested layout of hoses, cables and portable equipment when needed. Identify if additional equipment marking is required to ensure successful completion of the FLEX strategies.	
3.2.4.8.A	It is anticipated that equipment with a minimum standby rating of 300 kW/375 kVA will be purchased to provide margin for supplying additional equipment if that is later determined to be necessary or desirable (e.g., additional battery chargers, heat tracing, etc.). Need to confirm that appropriately sized FLEX DGs are procured.	
3.2.4.10.A	Review is necessary for final load shedding evaluations that will be performed on each of the four battery distribution systems using ETAP Battery Discharge and Control System Diagrams for determining minimum dc bus voltage.	
3.3.1.A	The licensee has not determined the exact capacity of new FLEX equipment and thus does not know if it is capable of supplying one or two units. This information is required to determine if two or three of a particular item are required to meet the N+1 criteria of NEI 12-06.	
3.4.A	Offsite Resources - Confirm 12-06 Section 12.2 Guidelines 2 through 10 are covered in the SAFER playbook when finalized.	