UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 16, 2013

Mr. John Dent, Jr.
Site Vice President
Pilgrim Nuclear Power Station
600 Rocky Hill Road
Plymouth, MA 02360-5508

SUBJECT: PILGRIM NUCLEAR POWER STATION - INTERIM STAFF EVALUATION RELATING TO OVERALL INTEGRATED PLAN IN RESPONSE TO ORDER EA-12-049 (MITIGATION STRATEGIES) (TAC NO. MF0777)

Dear Mr. Dent:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12054A736). By letter dated February 28, 2013 (ADAMS Accession No. ML13063A063), Entergy Nuclear Generation Company (Entergy, the licensee) submitted its Overall Integrated Plan for Pilgrim Nuclear Power Station in response to Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13247A411), Entergy submitted a six-month update to the Overall Integrated Plan.

Based on a review of Entergy's plan, including the six-month update dated August 28, 2013, and information obtained through the mitigation strategies audit process,[1] the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that the plan, when properly implemented, will meet the requirements of Order EA-12-049 at Pilgrim Nuclear Power Station. This conclusion is based on the assumption that the licensee will implement the plan as described, including the satisfactory resolution of the open and confirmatory items detailed in the enclosed Interim Staff Evaluation and Audit Report.

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[1] A description of the mitigation strategies audit process may be found at ADAMS Accession No. ML13234A503.

If you have any questions, please contact John Boska at 301-415-2901.

Sincerely,

Jeremy S. Bowen, Chief
Mitigating Strategies Projects Branch
Mitigating Strategies Directorate
Office of Nuclear Reactor Regulation

Docket No. 50-293

Enclosures:
1. Interim Staff Evaluation
2. Technical Evaluation Report

cc w/encl: Distribution via Listserv

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INTERIM STAFF EVALUATION AND AUDIT REPORT BY THE OFFICE OF

NUCLEAR REACTOR REGULATION

RELATED TO ORDER EA-12-049 MODIFYING LICENSES

WITH REGARD TO REQUIREMENTS FOR

MITIGATION STRATEGIES FOR BEYOND-DESIGN-BASIS EXTERNAL EVENTS

ENTERGY NUCLEAR GENERATION COMPANY

PILGRIM NUCLEAR POWER STATION

DOCKET NO. 50-293

The earthquake and tsunami at the Fukushima Dai-ichi nuclear power plant in March 2011, highlighted the possibility that extreme natural phenomena could challenge the prevention, mitigation and emergency preparedness defense-in-depth layers. At Fukushima, limitations in time and unpredictable conditions associated with the accident significantly challenged attempts by the responders to preclude core damage and containment failure. During the events in Fukushima, the challenges faced by the operators were beyond any faced previously at a commercial nuclear reactor. The Nuclear Regulatory Commission (NRC) determined that additional requirements needed to be imposed to mitigate beyond-design-basis external events (BDBEE). Accordingly, by letter dated March 12, 2012, the NRC issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" [Reference 1]. The order directed licensees to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities in the event of a BDBEE.

By letter dated February 28, 2013 [Reference 2], Entergy Nuclear Generation Company (Entergy, the licensee) submitted its Overall Integrated Plan (hereafter referred to as the Integrated Plan) for Pilgrim Nuclear Power Station (Pilgrim) in response to Order EA-12-049. The Integrated Plan describes the guidance and strategies under development for implementation by Entergy 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. As further required by the order, by letter dated August 28, 2013 [Reference 3], Entergy submitted a six-month update to the Overall Integrated Plan.

2.0 REGULATORY EVALUATION

Following the events at the Fukushima Dai-ichi nuclear power plant on March 11, 2011, the 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 and methodical review of the NRC's regulations and processes, and with determining whether the agency should make 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 [Reference 4]. These recommendations were enhanced by the NRC staff following interactions with stakeholders. Documentation of the NRC 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 [Reference 5] and SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," dated October 3, 2011 [Reference 6].

As directed by the Commission's Staff Requirement Memorandum (SRM) for SECY-11-0093 [Reference 7], 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 NRC staff's prioritization of the recommendations based upon the potential safety enhancements.

After receiving the Commission's direction in SRM-SECY-11-0124 [Reference 8] and SRM-SECY-11-0137 [Reference 9], the NRC staff conducted public meetings to discuss enhanced mitigation strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities following beyond-design-basis external events. At these meetings, the industry described its proposal for a Diverse and Flexible Mitigation Capability (FLEX), as documented in the Nuclear Energy Institute's (NEI's) letter dated December 16, 2011 [Reference 10]. 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 than 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," [Reference 11] to the Commission, including the proposed order to implement the enhanced mitigation strategies. As directed by SRM-SECY-12-0025 [Reference 12], the NRC staff issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" [Reference 1].

Order EA-12-049, Attachment 2,[2] requires that operating power reactor licensees and construction permit holders use a three-phase approach for mitigating beyond-design-basis external events. The initial phase requires the use of installed equipment and resources to maintain or restore core cooling, containment and SFP cooling capabilities. The transition

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[2] Attachment 3 provides requirements for Combined License holders.

phase requires providing sufficient, portable, onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from off site. The final phase requires obtaining sufficient offsite resources to sustain those functions indefinitely. Specific operational requirements of the order are listed below:

1) Licensees or construction permit (CP) holders shall develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and SFP cooling capabilities following a beyond-design-basis external event.

2) These strategies must be capable of mitigating a simultaneous loss of all alternating current (ac) power and loss of normal access to the ultimate heat sink and have adequate capacity to address challenges to core cooling, containment, and SFP cooling capabilities at all units on a site subject to the order.

3) Licensees or CP holders must provide reasonable protection for the associated equipment from external events. Such protection must demonstrate that there is adequate capacity to address challenges to core cooling, containment, and SFP cooling capabilities at all units on a site subject to the order.

4) Licensees or CP holders must be capable of implementing the strategies in all modes.

5) Full compliance shall include procedures, guidance, training, and acquisition, staging, or installing of equipment needed for the strategies.

On May 4, 2012, NEI submitted document 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision B [Reference 13] to provide specifications for an industry developed methodology for the development, implementation, and maintenance of guidance and strategies in response to the Mitigating Strategies order. On May 13, 2012, NEI submitted NEI 12-06, Revision B1 [Reference 14]. The guidance and strategies described in NEI 12-06 expand on those that industry developed and implemented to address the limited set of BDBEE that involve the loss of a large area of the plant due to explosions and fire required pursuant to paragraph (hh)(2) in Section 50.54, "Conditions of licenses" of Title 10 of the *Code of Federal Regulations*.

On May 31, 2012, the NRC staff issued a draft version of the interim staff guidance (ISG) document 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," [Reference 15] and published a notice of its availability for public comment in the *Federal Register* (77 FR 33779), with the comment period running through July 7, 2012. JLD-ISG-2012-01 proposed endorsing NEI 12-06, Revision B1, as providing an acceptable method of meeting the requirements of Order EA-12-049. The NRC staff received seven comments during this time. The NRC staff documented its analysis of these comments in "NRC Response to Public Comments, JLD-ISG-2012-01 (Docket ID NRC-2012-0068)" [Reference 16].

On July 3, 2012, NEI submitted comments on JLD-ISG-2012-01, including Revision C to NEI 12-06 [Reference 17], incorporating many of the exceptions and clarifications included in the draft version of the ISG. Following a public meeting held July 26, 2012, to discuss the remaining exceptions and clarifications, on August 21, 2012, NEI submitted Revision 0 to NEI 12-06 [Reference 18].

On August 29, 2012, the NRC staff issued the final version of 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" [Reference 19], endorsing NEI 12-06, Revision 0, as an acceptable means of meeting the requirements of Order EA-12-049, and published a notice of its availability in the *Federal Register* (77 FR 55230).

The NRC staff determined that the overall integrated plans submitted by licensees in response to Order EA-12-049, Section IV.C.1.a should follow the guidance in NEI 12-06, Section 13, which states that:

> The Overall Integrated Plan should include a complete description of the FLEX strategies, including important operational characteristics. The level of detail generally considered adequate is consistent to the level of detail contained in the Licensee's Final Safety Analysis Report (FSAR). The plan should provide the following information:
>
> 1. Extent to which this guidance, NEI 12-06, is being followed including a description of any alternatives to the guidance, and provide a milestone schedule of planned actions.
>
> 2. Description of the strategies and guidance to be developed to meet the requirements contained in Attachment 2 or Attachment 3 of the order.
>
> 3. Description of major installed and portable FLEX components used in the strategies, the applicable reasonable protection for the FLEX portable equipment, and the applicable maintenance requirements for the portable equipment.
>
> 4. Description of the steps for the development of the necessary procedures, guidance, and training for the strategies; FLEX equipment acquisition, staging or installation, including necessary modifications.
>
> 5. Conceptual sketches, as necessary to indicate equipment which is installed or equipment hookups necessary for the strategies. (As-built piping and instrumentation diagrams (P&ID) will be available upon completion of plant modifications.)
>
> 6. Description of how the portable FLEX equipment will be available to be deployed in all modes.

By letter dated August 28, 2013 [Reference 20], 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 to be used by the staff in its reviews, leading to the issuance of this interim staff evaluation and audit report for each site. The purpose of the staff's audits is to determine the extent to which licensees are proceeding on a path towards successful implementation of the actions needed to achieve full compliance with the order. Additional NRC staff review and inspection may be necessary following full implementation of those actions to verify licensees' compliance with the order.

3.0 TECHNICAL EVALUATION

The NRC staff contracted with MegaTech Services, LLC (MTS) for technical support in the evaluation of the Integrated Plan for Pilgrim, submitted by Entergy's letter dated February 28, 2013, as supplemented. NRC and MTS staff have reviewed the submitted information and held clarifying discussions with Entergy in evaluating the licensee's plans for addressing beyond-design-basis external events and its progress towards implementing those plans.

A simplified description of the Pilgrim Integrated Plan to mitigate the postulated extended loss of ac power (ELAP) event is that the licensee will initially remove the core decay heat by using the Reactor Core Isolation Cooling (RCIC) system. The steam-driven RCIC pump will initially supply water to the reactor from the condensate storage tank, or the suppression pool, depending on availability. Steam from the reactor will then be vented through the safety relief valves to the suppression pool in the torus to gradually cool down the reactor pressure vessel (RPV). RPV depressurization will be stopped at a pressure of about 120 pounds per square inch gauge (psig) to ensure sufficient steam pressure for continued RCIC operation. Once FLEX pumps are deployed, with suction aligned to Cape Cod Bay, the RCIC turbine will be shut down and the FLEX pumps will be used to inject seawater into the RPV. Water will fill the RPV and flow out the SRVs to the suppression pool. Before the suppression pool temperature exceeds 281 degrees Fahrenheit, the suppression pool (torus) will be vented to atmosphere using the hardened vents to release heat and stop the temperature increase. In the long term, the licensee will fill a tank with fresh water from wells at the site, and then inject fresh water into the RPV and establish a stable water level with heat removal by boiling. The licensee's analysis shows that the suppression pool will not overfill during this event.

FLEX generators will be used to reenergize the installed battery chargers to keep the necessary direct current (dc) buses energized, which will then keep the 120 volt ac instrument buses energized. The licensee's long term plan is that the FLEX equipment available at the plant site can maintain plant safety functions without the need for additional equipment. The licensee stated that they will utilize the industry Regional Response Centers (RRC) for additional and/or backup supplies of phase 3 equipment, as needed, and to replenish consumable items.

In the postulated extended loss of ac power event, the SFP will initially heat up due to the unavailability of the normal cooling system. A FLEX pump will be aligned and used to add water to the SFP to maintain level as the pool boils. This will maintain a sufficient amount of water above the top of the fuel assemblies for cooling and shielding purposes.

Pilgrim plans to use containment (suppression pool) venting to maintain containment pressure and temperature within acceptable values, as necessary.

By letter dated December 9, 2013 [Reference 21], MTS documented the interim results of the Integrated Plan review in the attached technical evaluation report (TER). The NRC staff has reviewed this TER for consistency with NRC policy and technical accuracy and finds that it accurately reflects the state of completeness of the Integrated Plan. The NRC staff therefore adopts the findings of the TER with respect to individual aspects of the requirements of Order EA-12-049.

4.0 OPEN AND CONFIRMATORY ITEMS

This section contains a summary of the open and confirmatory items identified as part of the technical evaluation. The NRC and MTS have assigned each review item to one of the following categories:

> 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.

As discussed in Section 3.0, above, the NRC staff has reviewed MTS' TER for consistency with NRC policy and technical accuracy and finds that it accurately reflects the state of completeness of the licensee's Integrated Plan. The NRC staff therefore adopts the open and confirmatory items identified in the TER and listed in the tables below. Minor editorial changes were made by the NRC staff to some confirmatory items. These summary tables provide a brief description of the issue of concern. Further details for each open and confirmatory item are provided in the corresponding sections of the TER, identified by the item number.

4.1 OPEN ITEMS

Item Number	Description	Notes
3.2.1.4.A	On pages 16, 23, and 63 of the Integrated Plan regarding Portable Equipment to Maintain Core Cooling, the licensee describes the use of portable pumps to provide RPV injection. No technical basis or a supporting analysis was provided for the diesel-driven FLEX pump capabilities considering the pressure within the RPV and the loss of pressure along with details regarding the FLEX pump supply line routes, length of hoses runs, connecting fittings, and elevation changes to show that the pump is capable of injecting water into the RPV with a sufficient rate to maintain and recover core inventory for both the primary and alternate flow paths.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.1.A	The Integrated Plan does not specify procedures and programs will provide for securing large portable equipment to protect them during a seismic event or to ensure unsecured and/or non-seismic components do not damage the equipment as is specified in NEI 12-06, Section 5.3.1, considerations 2 and 3.	
3.1.1.2.A	The licensee identified that access to at least one connection point for the equipment will requires access through routes that are not FSAR Seismic Class I, however they have been evaluated and the potential for large scale debris field that would prevent access to the equipment needed to be repowered is not present. Their evaluation should be validated during the site audit.	
3.1.1.3.A	The licensee was requested to provide additional information concerning coping strategies for the failure of seismically qualified electrical equipment that can be affected by beyond-design-basis seismic events as discussed in NEI 12-06, Section 5.3.3 consideration 1.	
3.1.3.1.A	The storage of the FLEX equipment is in sea vans. The licensee is in the process of performing a calculation to demonstrate conformance with NEI 12-06, Section 7.3.1.b, bullet 4 related to adequate tie down of the sea vans. Evaluation of the completed calculation must be completed to determine if it demonstrates conformance to guidance in NEI 12-06, Section 7.3.1.b, bullet 4.	
3.1.3.2.A	During the audit process, the licensee identified that there are existing plant procedures that address hurricanes. The procedures need to be evaluated for conformance to NEI 12-06, considerations 1, 2, and 5.	
3.2.1.1.A	From the June 2013 position paper, benchmarks must be identified and discussed which demonstrate that the Modular Accident Analysis Program (MAAP) 4 is an appropriate code for the simulation of an ELAP event at your facility.	
3.2.1.1.B	The collapsed level must remain above Top of Active Fuel (TAF) and the cool down rate must be within technical specification limits.	
3.2.1.1.C	MAAP4 must be used in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper.	

3.2.1.1.D	In using MAAP4, the licensee must identify and justify the subset of key modeling parameters cited from Tables 4-1 through 4-6 of the "MAAP4 Application Guidance, Desktop Reference for Using MAAP4 Software, Revision 2" (Electric Power Research Institute Report 1020236). This should include response at a plant-specific level regarding specific modeling options and parameter choices for key models that would be expected to substantially affect the ELAP analysis performed for that licensee's plant.	
3.2.1.1.E	The specific MAAP4 analysis case that was used to validate the timing of mitigating strategies in the integrated plan must be identified and should be available on the ePortal for NRC staff to view. Alternately, a comparable level of information may be included in the supplemental response. In either case, the analysis should include a plot of the collapsed vessel level to confirm that TAF is not reached (the elevation of the TAF should be provided) and a plot of the temperature cool down to confirm that the cool down is within tech spec limits.	
3.2.1.2.A	The following is requested: 1. Justification for the assumptions made regarding primary system leakage from the recirculation pump seals and other sources. 2. Assumed pressure-dependence of the leakage rate. 3. Clarification on whether the leakage was determined or assumed to be single-phase liquid, two-phase mixture, or steam at the donor cell and discuss how mixing of the leakage flow with the drywell atmosphere is modeled.	
3.2.1.5.A	The integrated plan does not identify non-powered local instrumentation other than Containment pressure and RPV level and pressure. The integrated plan identifies that phase 2 equipment will have installed local instrumentation needed to operate the equipment. The licensee needs to identify the instrumentation that will be used to monitor portable FLEX electrical power equipment.	
3.2.4.2.A	The licensee was requested to provide the maximum calculated MCR temperature and a detailed summary of the analysis used to determine the temperature and the procedure for control of MCR temperature. The licensee response was that existing procedure 2.4.149 addresses "Loss of MCR H&V". The procedure is symptom driven, containing temperature limits to perform actions, and it is not time driven. Pilgrim will provide the referenced "GOTHIC"	

	evaluation. Evaluation of the "GOTHIC" analysis is needed to evaluate the MCR temperature.	
3.2.4.4.A	The licensee needs to provide complete details of portable lighting.	
3.2.4.4.B	The licensee provided its communications assessment in letters dated October 31, 2012 and February 21, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML12321A051 and ML13058A032) in response to the NRC letter dated March 12, 2012, 50.54(f) request for information letter. The NRC staff provided its evaluation on May 21, 2013 (ADAMS Accession No. ML13127A179). The NRC staff has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. This has been identified for confirmation that upgrades to the site's communications systems have been completed.	
3.2.4.5.A	The Integrated Plan does not identify procedures/guidance with regard to the access to the Protected Area and internal locked areas. During the audit process, the licensee identified existing security doors that provide egress capability and have key access in the event of a power loss. Operations and Security are currently researching options, the intention is to include it in the Emergency procedures addressing BDBEE perimeters, the site declaration of 50.54(x), and recognizing resource needs, including Security, and compensatory measures based on the event.	
3.2.4.8.A	During the audit process, the licensee was requested to provide electrical Single Line Diagrams showing the proposed connections of Phase 2 and 3 electrical equipment to permanent plant equipment. The licensee responded that Engineering Change markup of the One-Line Diagrams E13 and E14Sh1 (EC45555 & EC45556), will be posted to the ePortal. The NRC staff will complete the review after they are posted.	
3.2.4.8.B	During the audit process, the licensee identified Engineering Changes are being developed to support the FLEX project which requires electrical studies to be performed. This includes the electrical diesel loading and load flow studies. The addition of the transfer switches and additional cable lengths are being incorporated into the Pilgrim design calculations (load flow, short circuit and coordination.) The FLEX diesel generator sizes need to be verified after the loading calculations are finalized.	

3.2.4.10.A	Attachment 1A of the Integrated Plan notes that at one hour, the ELAP decision is made and deep dc load shedding begins at one hour (item 3), and at 2 hours the dc load shed is complete (item 4). 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. During the audit process, the licensee responded that the dc load flow profiles are being developed as part of a new electrical battery FLEX extended operation load flow and battery sizing study PS258.	
3.2.4.10.B	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). During the audit process, the licensee responded by identifying that a tentative list of loads proposed to isolate, isolation time and panel locations are available and provided in the ePortal. The licensee will finalize the load-shed list after a review by Operations.	
3.4.A	The licensee's plans for the use of off-site resources did not address considerations 2 through 10 of NEI 12-06, Section 12.2.	

Based on a review of Entergy's plan, including the six-month update dated August 28, 2013, and information obtained through the mitigation strategies audit process, the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that the plan, when properly implemented, will meet the requirements of Order EA-12-049 at Pilgrim. This conclusion is based on the assumption that the licensee will implement the plan as described, including the satisfactory resolution of the open and confirmatory items.

5.0 SUMMARY

As required by Order EA-12-049, the licensee is developing, and will implement and maintain, guidance and strategies to restore or maintain core cooling, containment, and SFP cooling capabilities in the event of a beyond-design-basis external event. These new requirements provide a greater mitigation capability consistent with the overall defense-in-depth philosophy, and, therefore, greater assurance that the challenges posed by beyond-design-basis external events to power reactors do not pose an undue risk to public health and safety.

The NRC's objective in preparing this interim staff evaluation and audit report is to provide a finding to the licensee on whether or not their integrated plan, if implemented as described, provides a reasonable path for compliance with the order. For areas where the NRC staff has insufficient information to make this finding (identified above in Section 4.0), the staff will review these areas as they become available or address them as part of the inspection process. The staff notes that the licensee has the ability to modify their plans as stated in NEI 12-06, Section 11.8. However, additional NRC review and/or inspection may be necessary to verify compliance.

The NRC staff has reviewed the licensee's plans for additional defense-in-depth measures. With the exception of the items noted in Section 4.0 above, the staff finds that the proposed measures, properly implemented, will meet the intent of Order EA-12-049, thereby enhancing the licensee's capability to mitigate the consequences of a beyond-design-basis external event that impacts the availability of ac power and the ultimate heat sink. Full compliance with the order will enable the NRC to continue to have reasonable assurance of adequate protection of public health and safety. The staff will issue a safety evaluation confirming compliance with the order and may conduct inspections to verify proper implementation of the licensee's proposed measures.

6.0 REFERENCES

1. Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," March 12, 2012 (ADAMS Accession No. ML12054A736)

2. Letter from Entergy to NRC, "Overall Integrated Plan in Response to March 12, 2012, Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," dated February 28, 2013 (ADAMS Accession No. ML13063A063)

3. Letter from Entergy to NRC, "First Six Month Status Report In Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," dated August 28, 2013 (ADAMS Accession No. ML13247A411)

4. SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," July 12, 2011 (ADAMS Accession No. ML11186A950)

5. SECY-11-0124, "Recommended Actions to be Taken without Delay from the Near-Term Task Force Report," September 9, 2011 (ADAMS Accession No. ML11245A158)

6. SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," October 3, 2011 (ADAMS Accession No. ML11272A111)

7. SRM-SECY-11-0093, "Staff Requirements – SECY-11-0093 – Near-Term Report and Recommendations for Agency Actions following the Events in Japan," August 19, 2011 (ADAMS Accession No. ML112310021)

8. SRM-SECY-11-0124, "Staff Requirements – SECY-11-0124 – Recommended Actions to be Take without Delay from the Near-Term Task Force Report," October 18, 2011 (ADAMS Accession No. ML112911571)

9. SRM-SECY-11-0137, "Staff Requirements – SECY-11-0137- Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," December 15, 2011 (ADAMS Accession No. ML113490055)

10. Letter from Adrian Heymer (NEI) to David L. Skeen (NRC), "An Integrated, Safety-Focused Approach to Expediting Implementation of Fukushima Dai-ichi Lessons Learned," December 16, 2011 (ADAMS Accession No. ML11353A008)

11. 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," February 17, 2012 (ADAMS Accession No. ML12039A103)

12. SRM-SECY-12-0025, "Staff Requirements – 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," March 9, 2012 (ADAMS Accession No. ML120690347)

13. Nuclear Energy Institute (NEI) document 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision B, May 4, 2012 (ADAMS Accession No. ML12144A419)

14. Nuclear Energy Institute document NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision B1, May 13, 2012 (ADAMS Accession No. ML12143A232)

15. Draft 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," May 31, 2012 (ADAMS Accession No. ML12146A014)

16. NRC Response to Public Comments, JLD-ISG-2012-01 (Docket ID NRC-2012-0068), August 29, 2012 (ADAMS Accession No. ML12229A253)

17. Nuclear Energy Institute comments to draft JLD-ISG-2012-01 and document 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision C, July 3, 2012 (ADAMS Accession No. ML121910390)

18. Nuclear Energy Institute document 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 0, August 21, 2012 (ADAMS Accession No. ML12242A378)

19. Final 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," August 29, 2012 (ADAMS Accession No. ML12229A174)

20. Letter from Jack R. Davis (NRC) to All Operating Reactor Licensees and Holders of Construction Permits, "Nuclear Regulatory Commission Audits of Licensee Responses to Mitigation Strategies Order EA-12-049," August 28, 2013 (ADAMS Accession No. ML13234A503)

21. Letter from John Bowen, MegaTech Services, LLC, to Eric Bowman, NRC, submitting "Technical Evaluation Reports Related to Order Modifying Licenses with Regard to

Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, EA 12-049," dated December 9, 2013 (ADAMS Accession No. ML13346A616)

22. Order EA-13-109, "Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," June 6, 2013 (ADAMS Accession No. ML13143A321)

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Enclosure 2

Technical Evaluation Report

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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Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
Docket No. 50-293

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Technical Evaluation Report

Pilgrim Nuclear Power Station
Order EA-12-049 Evaluation

1.0 BACKGROUND

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

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

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

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

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

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

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

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

2.0 EVALUATION PROCESS

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

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

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

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

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

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

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

3.0 TECHNICAL EVALUATION

By letter dated February 28, 2013, (ADAMS Accession No. ML13063A063, and as supplemented by the first six-month status report in letter dated August 28, 2013 (ADAMS Accession No. ML13247A411, Entergy Nuclear Operations, Inc. (the licensee or Entergy) provided the Integrated Plan for Compliance with Order EA-12-049 for Pilgrim Nuclear Power Station (PNPS). The Integrated Plan describes the strategies and guidance under development for implementation by the licensee for the maintenance or restoration of core cooling, containment, and SFP cooling capabilities following a BDBEE, including modifications necessary to support this implementation, pursuant to Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049. That letter described the process used by the NRC staff in its review, leading to the issuance of an interim staff evaluation and audit report. The purpose of the staff's audit is to determine the extent to which the licensees are proceeding on a path towards successful implementation of the actions needed to achieve full compliance with the Order.

3.1 EVALUATION OF EXTERNAL HAZARDS

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

3.1.1 Seismic Events.

NEI 12-06, Section 5.2 states:

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

The licensee's Integrated Plan identified the Safe Shutdown Earthquake (SSE) to be 0.15g horizontal ground motion as identified in the PNPS Final Safety Analysis Report (FSAR). The Integrated Plan also identified that it is highly unlikely that liquefaction of the foundation material would occur under the postulated earthquake conditions at PNPS according to FSAR Section 2.5.3.2. The licensee also confirmed on page 1 of their Integrated Plan that the site screens in for an assessment for the seismic hazard except for liquefaction. The licensee also stated on page 2 that the seismic re-evaluation pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 had not been completed and therefore was not assumed in their Integrated Plan.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to 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 29 of the Integrated Plan the licensee stated the PNPS FLEX Equipment Storage Strategy will be configured to meet the requirements identified in NEI 12-06, Section 11, and is based on the use of seismically rugged, diverse, spatially separated locations. Also, PNPS procedures and programs are being developed to address storage structure requirements.

The licensee's plans were reviewed for the storage and protection of portable equipment with regard to seismic hazard. Although the licensee has indicated Pilgrim procedures and programs are being developed to address storage structure requirements, insufficient information has been provided to ascertain that these procedures and programs will provide for securing large portable equipment to protect them during a seismic event or to ensure unsecured and/or non-seismic components do not damage the equipment as is specified in NEI 12-06, Section 5.3.1, considerations 2 and 3. While NEI 12-06, Section 11 does provide guidance on the selection of storage locations, it does not address these considerations. This has been identified as Confirmatory Item 3.1.1.1.A in Section 4.2.

The licensee stated on page 36 that Phase 1 (i.e., the use of permanently installed plant equipment/features) of containment integrity is maintained throughout the duration of the event; no non-permanently installed equipment is required to maintain containment integrity. Therefore, there is no defined end time for the Phase I coping period for maintaining containment integrity. An alternative strategy for containment during Phase 1 is not provided, because containment integrity is maintained by the plant's design features.

On page 38 of the Integrated Plan regarding the strategies for maintaining containment, the licensee stated the Hardened Containment Vent System (HCVS) will meet the design requirements as specified for reasonable protection per NEI 12-06. During the audit process, the licensee identified that the FLEX portable generators will repower the batteries and that the HCVS utilizes the 125 VDC for operation of the HCVS from the main control room. Also, HCVS will be capable of stand-alone 24 VDC battery operation, with additional Gel-Cell batteries available from FLEX storage (the batteries will be added to the list of Phase 2 equipment in a future 6 month status update). The HCVS will also be capable of local manual pneumatic operation with permanently installed high pressure nitrogen cylinders and valve manifolds with sufficient capacity for the ELAP event without reliance on 125 VDC power for HCVS operation.

On page 46 of the Integrated Plan, the licensee stated that FLEX equipment will be provided with a Storage Strategy based on the use of seismically rugged, diverse, spatially separated locations to meet the requirements 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 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 protection of FLEX equipment during a 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.

Consideration 1 is not applicable because the site is not subject to liquefaction as discussed in Section 3.1.1, above.

The Integrated Plan does not identify that at least one connection point for the equipment will only require access through seismically robust structures. This is to include both the connection point and any areas that plant operators will have to access to deploy or control the capability. During the audit process, the licensee identified that the strategies provide multiple routes to repower the necessary station equipment. The routes are not FSAR Seismic Class I, however they have been evaluated and the potential for a large scale debris field that would prevent access to the equipment needed to be repowered is not present. This has been identified as Confirmatory Item 3.1.1.2.A. in Section 4.2.

Consideration 3 is not applicable because the water source does not rely on dams (Cape Cod Bay).

On page 82 the licensee identified that PNPS will be storing FLEX equipment in Sea Vans. The licensee does not require power to move or deploy equipment (sea vans have manually opened doors). This adequately addresses consideration 4.

On page 58 of the Integrated Plan, the licensee identified two pickup trucks (¾ Ton) with trailer towing attachments and bed-mounted 100 gallon fuel storage tank with transfer pump. The licensee's Integrated Plan did not provide a discussion of the protection to be afforded the trucks from any hazard. During the audit process, the licensee identified that the trucks are redundant to each other and are routinely in use (one in the protected area and one inside the owner controlled area but outside the protected area). The trucks are parked in designated areas, separated and not close to trees and buildings. The trucks are inherently seismic robust. Plant procedure 2.1.37, "Coastal Storms" will be modified to provide for sheltering the trucks.

Based on review of the above, consideration 5 is adequately addressed.

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 a seismic hazard if these requirements are implemented as described.

3.1.1.3 Procedural Interfaces – Seismic Hazard

NEI 12-06, Section 5.3.3 states:

> There are four procedural interface considerations that should be addressed.
>
> 1. Seismic studies have shown that even seismically qualified electrical equipment can be affected by BDB seismic events. In order to address these considerations, each plant should compile a reference source for the plant operators that provides approaches to obtaining necessary instrument readings to support the implementation of the coping strategy (see Section 3.2.1.10). This reference source should include control room and non-control room readouts and should also provide guidance on how and where to measure key instrument readings at containment penetrations, where applicable, using a portable instrument (e.g., a Fluke meter). Such a resource could be provided as an attachment to the plant procedures/guidance. Guidance should include critical actions to perform until alternate indications can be connected and on how to control critical equipment without associated control power.

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

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

4. Additional guidance may be required to address the deployment of FLEX for those plants that could be impacted by failure of a not seismically robust downstream dam. [not applicable, no dams on Cape Cod Bay]

The licensee's plans for the development of the mitigating strategies were reviewed, but there was insufficient information in the plans to conclude that there is reasonable assurance that they address determination of necessary instrument readings to support the implementation of the mitigating strategies in the event that seismically qualified electrical equipment is affected by beyond-design-basis seismic events. Instruments were reviewed from pages 19, 20, 21, 27, and 28 (maintain core cooling). The same instruments are identified in maintain containment. The instrumentation that will be installed per NRC order EA-12-051 is identified for the SFP cooling safety evaluation. Evaluation of the SFP instrumentation will be conducted as part of the NRC order EA-12-051. The only non - powered local instrumentation is Containment pressure and RPV Level and RPV Local Pressure. Torus water temperature is available via 120VAC powered local instrument in phase 2. Page 27 notes that Phase 2 FLEX equipment will have installed local instrumentation needed to operate the equipment.

The licensee does not identify the use of portable instruments and controls to obtain necessary instrument readings as described in NEI 12-06, Section 5.3.3, consideration 1. The need for a discussion of the licensee's approach to this consideration has been identified as Confirmatory Item 3.1.1.3.A. in Section 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 procedural interfaces during a seismic hazard if these requirements are implemented as described.

3.1.1.4 Considerations in Using Offsite Resources – Seismic Hazard

NEI 12-06, Section 5.3.4 states:

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

On page 14 of the Integrated Plan, the licensee stated equipment will be moved from a Regional Response Center (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.

Review of the licensee's plan for the use of offsite resources, did not provide reasonable assurance that the plan will comply with NEI 12-06, Section 5.3.4, due to the absence of a description of the local arrival staging area and method of transportation methods to be used to deliver the equipment to the site. During the audit process, the licensee clarified that the only equipment that is planned to be provided from the RRC is the mobile demineralizer that is required for the Phase 2 to Phase 3 transition at 72 hours post event. The equipment is within the air-lift capability of the RRC. Also, the RRC may also be used to replenish commodities including additional fuel and food after 72 hours.

The 72 hour period is sufficient to clean up on-site debris, and air lift capability is an adequate means of delivery. This adequately addresses the guidance of NEI 12-06, Section 5.3.4.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to use of offsite resources 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 pages 1 and 2 of the Integrated Plan regarding the determination of applicable extreme external hazards, the licensee stated that:

> External Flood Hazard Assessment:
> The PNPS Site general elevation of 23 ft above mean sea level (msl) places it in the category of "dry sites" according to NEI 12-06, Section 6.2.1, based on the following design basis flood level from FSAR Section 2.4.4.2, "Tide Levels":

Extreme Storm Tide = + 13.5 ft msl

Extreme Low Tide = -10.1 ft msl

The datum relationship at the site is that msl is 4.8 ft above mean low water (mlw) level. It has been calculated that the 100 year storm could produce a still water level of +15.8 ft mlw. This is a combination of storm surge combined with astronomical high tide. The hydrometeorological section of the U.S. Weather Bureau has established a standard northeaster for New England. Using this storm, the peak storm surge, having a return frequency of 1,000 years, is 6.6 ft.

The concurrence of peak storm surge with an astronomical high tide of (+)11.7 ft mlw would give an extreme storm tide level of(+)18.3 ft mlw, such that +18.3 ft mlw = +13.5 ft msl, with a probability of occurrence of once every 4,000 yr. Additionally the climatological precipitation quantities in eastern Massachusetts show that the region does not have a wet or a dry season. Monthly averages vary from about 3 in to 4 ½ inches at Plymouth. The maximum 24 hour rainfall is 6.88 inches from FSAR table 2.3-16. All Class I structures are designed for flood protection in the event of a maximum probable flood. Therefore, because PNPS is built above the design basis flood level and is considered a "dry" site by the NEI 12-06, Section 6.2.1 guidance, PNPS is not required to evaluate flood-induced challenges.

The licensee was requested to address the licensee Flooding Walkdown Report (ADAMS Accession No. ML12333A321) dated November 27, 2012 that identified a transient PMP event (lasting 1 hour or less) that could produce flood levels water depths up to 1.5 feet in height against the south side of the power block buildings. During the audit process, the licensee identified the PNPS flooding walkdown study determined that installed passive design features such as doors, conduit seals, and roof designs are acceptable and capable of performing their design basis function such that this beyond current licensing basis (CLB) event is not a threat.

Review of the licensee's Integrated Plan with respect to screening for extreme external flooding shows that the licensee has screened out the flooding hazard (pages 1 and 2), which conforms to the guidance found in NEI 12-06. The licensee also stated on page 4 that the flooding re-evaluation pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 had not been completed and therefore was not assumed in their Integrated Plan.

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

3.1.2.1 Protection of FLEX Equipment – Flooding Hazard

The licensee screened as a "dry site" and therefore does not need to address storage of FLEX equipment for protection in the context of a flooding hazard.

3.1.2.2 Deployment of FLEX Equipment – Flooding Hazard

The licensee screened as a "dry site" and therefore does not need to address deployment of FLEX equipment in context of a flooding hazard.

3.1.2.3 Procedural Interfaces – Flooding Hazard

The licensee screened as a "dry site" and therefore does not need to address procedural interfaces in the context of flooding hazard.

3.1.2.4 Considerations in Using Offsite Resources – Flooding Hazard

The licensee screened as a "dry site" and therefore does not need to address using offsite resources in the context of a flooding hazard.

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 the PNPS design basis does not meet the NEI 12-06 definition of "sites with the potential to experience severe winds from hurricanes based on winds exceeding 130 mph." The applicable wind hazards are bounded by the tornado event. The maximum 5 Minute sustained wind speed is 87 mph due to the Hurricane of 1938 from FSAR Table 2.3-18.

NEI 12-06 Figure 7-1 indicates hurricane wind speeds of approximately 160 to 170 mph at the Pilgrim site. The licensee was requested to address why hurricanes were not addressed in the Integrated Plan. During the audit process, the licensee clarified that they did not screen out hurricanes. The licensee stated they did not address hurricanes in this section of the Integrated Plan because existing procedures address them (i.e., Procedure 2.1.37, "Coastal Storm-Preparations and Actions", and 2.1.42, "Operating During Severe Weather"). The FLEX Strategy Evaluations, particularly of the FLEX storage sites, will address hurricane wind hazards. Although the discussion of the high wind hazard on page 2 of the Integrated Plan is not clear on the subject, the screening for hurricanes is consistent with the guidance of NEI 12-06.

On page 2 of the Integrated Plan regarding determination of applicable extreme external hazards, the licensee identified for the tornado, per the FSAR, the velocity of the components are applied as a 300 mph horizontal wind applied over the full height structure. The pressure differential is applied as a 3 psi positive (bursting) pressure occurring in 3 seconds. The screening for tornados is consistent with the guidance 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 the characterization and screening for a 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.

In the section of its Integrated Plan regarding the strategies for maintaining core cooling (page 30), the licensee stated that protection of associated portable equipment from high wind hazards would be provided as follows:

> The storage provided for FLEX equipment will be configured to meet the requirements identified in NEI 12-06 section 11.
>
> The PNPS FLEX Equipment Storage Strategy is based on the use of seismically rugged, diverse, spatially separated locations. There will be two primary FLEX Equipment Storage Locations at opposite ends of the PNPS Site outside of the Protected Area.
>
> Each FLEX Equipment Storage Location will have the required "N" quantity of items with the exception of the 100 kVA Diesel Generators that will have one at each location and one normally pre-staged in the Turbine Building. This provides a total "N+1" quantity on the site.
>
> This storage strategy provides a total "2N" quantity of the FLEX Equipment that is required during the initial 24 hour time period and "N+1" quantity for all equipment.
>
> The "2N" equipment is split between two locations each of which provides protection from Seismic, Flooding, Hurricane, and Extreme Temperature.
>
> For Extreme Wind & Tornado, with associated Missile Hazards, the strategy is based on "N" equipment remaining deployable based on the diverse storage locations and the localized effect of these events.

On page 46 of the Integrated Plan, the licensee identified the piping used to provide makeup flow to the SFP from the RHR System is contained within the Reactor Building and Auxiliary Bay and is protected from storms and high winds. FLEX equipment will be provided with a Storage Strategy based on the use of seismically rugged, diverse, spatially separated locations to meet the requirements of NEI 12-06.

On page 52 of the Integrated Plan, the licensee identified that FLEX equipment will be stored at diverse locations that are robust for weather-related events, except for direct-strike tornado hazards. The site's FLEX Storage configuration is such that a minimum "N" quantity of FLEX equipment will be available after any of the applicable BDBEEs.

During the audit process, the licensee was requested to provide justification for taking exception to protection for tornado hazards. The licensee responded that they do not take exception to protection for tornado hazards; rather they credit two spatially separate storage areas as discussed in NEI 12-06, Section 7.3.1.1.b. The areas are approximately 2400 feet apart, orientated North to South. Should one storage area be lost, the surviving storage area has adequate equipment to implement the FLEX strategy. The response is consistent with the guidance in NEI 12-06.

The marked-up photograph of the site is shown on page 76 of the Integrated Plan. The FLEX storage areas are aligned to the North and South which meets the guidance of NEI 12-06, Section 7.3.1.

The Integrated Plan does not discuss the anchoring of the equipment storage facilities e.g., sea vans. The licensee was requested to provide additional details to demonstrate conformance to NEI 12-06, Section 7.3.1.b bullet 4 and/or 7.3.1.c bullet 2. The licensee responded that a calculation is in progress to demonstrate conformance with 12-06, Section 7.3.1.b, bullet 4. The pumps, compressors, shelving within the sea vans are being tied down to address NEI 12-06, Section 7.3.c bullet 2, and seismic excitation. This has been identified as Confirmatory Item 3.1.3.1.A. in Section 4.2.

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

During the audit process, the licensee identified that there are existing plant procedures that address hurricanes. The procedures need to be evaluated for conformance to NEI 12-06, considerations 1, 2, and 5. This has been identified as Confirmatory Item 3.1.3.2.A.

On page 80 of the Integrated Plan, the use of an on-site debris removal wheel loader (listed in BWR Portable Equipment Phase 2 on page 57) is identified for use during all hazard events. The licensee was requested to provide a discussion of the protection to be afforded the on-site debris removal wheel loader from any hazard. The licensee responded that in response to predicted weather driven events, the debris removal vehicle would be secured in the turbine building pursuant to existing procedures. Per the UFSAR, the wind load for the turbine building is based on 100 mph wind which bounds the CLB 87 mph hurricane.

On page 14 of the Integrated Plan, the licensee stated that communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request.

On page 61 of the Integrated Plan (Phase 3), the licensee listed heavy duty debris clearing equipment.

On pages 62 and 63 of the Integrated Plan, the licensee lists various items of portable equipment being utilized before the arrival of Phase 3 debris clearing equipment such as at least two FLEX DGs at 8 hours and FLEX pumps staged approximately 6 – 9 hours.

The licensee's plans for deployment of portable equipment in the event of a high wind event were reviewed to determine whether debris clearing equipment will be available on site to support actions credited in the Events Timeline occurring before the 24 hour equipment arrival. The single debris removal equipment identified may not be able to move debris to enable transport of equipment within the 6- 9 hour time restriction for the pumps and generator. The licensee was requested to provide additional justification. During the audit process the licensee identified that redundant equipment is available for debris removal. The equipment includes a 10K forklift and the Grove Crane which is controlled for weather events by existing procedures such that no less than two pieces of mobile equipment capable of debris removal would be available.

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 if these requirements are implemented as described.

3.1.3.3 Procedural Interfaces – High Wind Hazard

NEI 12-06, Section 7.3.3, states:

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

The Integrated Plan stated (page 26, 36, 45, and 51) that PNPS will utilize the industry developed guidance from the Owners Groups, Electric Power Research Institute (EPRI) and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.

Hurricane procedures are not addressed in the licensee's Integrated Plan. During the audit process, the licensee stated they did not address hurricanes because existing procedures address them (i.e., Procedure 2.1.37, "Coastal Storm-Preparations and Actions", and 2.1.42, "Operating During Severe Weather"). This has previously been identified as Confirmatory Item 3.1.3.2.A.

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

3.1.3.4 Considerations in Using Offsite Resources – High Wind Hazard

NEI 12-06, Section 7.3.4 states:

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

On page 14 of the Integrated Plan, the licensee stated equipment will be moved from an RRC to a local Assembly Area established by the SAFER team and the utility.

On page 33 and 34 of the Integrated Plan describing Phase 3, the licensee stated replenishment of consumable items, including fuel, protective gear, food, potable water, and disposable batteries will be required. Skid-Mounted Demineralizer resin tanks may be replaced with larger capacity water treatment trailers or complete mobile water treatment systems.

Backup or alternate pumping and ac generator equipment transported to the site will be either immediately staged at the point of use location or temporarily stored at an appropriate lay down area until moved to the point of use area.

Review of the licensee's plan for the use of offsite resources, did not provide reasonable assurance that the plan will comply with NEI 12-06, Section 7.3.4, due to the absence of a description of the local arrival staging area and method of transportation methods to be used to deliver the equipment to the site. During the audit process, the licensee clarified that the only equipment that is planned to be provided from the RRC is the mobile demineralizer that is required for the Phase 2 to Phase 3 transition at 72 hours post event. The equipment is within the air-lift capability of the RRC. Also, the RRC may also be used to replenish commodities including additional fuel and food after 72 hours.

The 72 hour period is sufficient to clean up on-site debris, and air lift capability is an adequate means of delivery. This adequately addresses the guidance of NEI 12-06, Section 7.3.4.

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

3.1.4 Snow, Ice and Extreme Cold

As discussed in NEI 12-06, Section 8.2.1:

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

On page 2 of the Integrated Plan, the licensee stated the guidelines provided in NEI 12-06 (Section 8.2.1) determine that an assessment of extreme cold conditions must be performed for sites above the 35th parallel. PNPS is located above the 35th parallel; therefore, the effects of snow, ice, and extreme cold will be considered for the storage and deployment of FLEX equipment.

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

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

NEI 12-06, Section 8.3.1 states:

> These considerations apply to the protection of FLEX equipment from snow, ice, and extreme cold hazards:

1. For sites subject to significant snowfall and ice storms, portable FLEX equipment should be stored in one of the two configurations.

   a. In a structure that meets the plant's design basis for the snow, ice and cold conditions (e.g., existing safety-related structure).

   b. In a structure designed to or evaluated equivalent to ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures* for the snow, ice, and cold conditions from the site's design basis.

   c. Provided the N sets of equipment are located as described in a. or b. above, the N+1 equipment may be stored in an evaluated storage location capable of withstanding historical extreme weather conditions such that the equipment is deployable.

2. Storage of FLEX equipment should account for the fact that the equipment will need to function in a timely manner. The equipment should be maintained at a temperature within a range to ensure its likely function when called upon. For example, by storage in a heated enclosure or by direct heating (e.g., jacket water, battery, engine block heater, etc.).

On page 30 of the Integrated Plan, the licensee stated stored equipment will be provided with a heated enclosure and/or diesel engine block (internal) heaters as needed to ensure equipment operability or prevent degradation under all temperature conditions. Also, the storage provided for FLEX equipment will be configured to meet the requirements identified in NEI 12-06 Section 11.

On page 82, the licensee identified that PNPS will be storing FLEX equipment in Sea Vans that are supplied with ac power for equipment heaters and lighting, one Sea Van is environmentally controlled, and the others ventilated.

On page 46 of the Integrated Plan, the licensee stated the piping used to provide makeup flow to the SFP from the RHR System is contained within the Reactor Building and Auxiliary Bay and is protected from snow, ice, and extreme cold.

On page 52 of the Integrated Plan, the licensee stated that FLEX equipment will be stored at diverse locations that are robust for weather-related and extreme temperature events, and include heating and environmental controls, where needed.

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

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

NEI 12-06, Section 8.3.2 states:

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

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

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

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

On page 12 of the Integrated Plan, the licensee stated that deployment routes to be utilized to transport FLEX equipment are via the normal site roadways and access points as shown in Figure 8 & 9 of Attachment 3. The paths will be accessible during all modes of operation and comply with NEI 12-06, Section 5.3.2. This strategy will be included within an administrative program in order to keep pathways clear.

During the audit process, the licensee identified the two FLEX storage areas on the edges of existing paved parking lots. Winter weather events are predictable. The site has snow plows mounted and road sanders pre-staged prior to snow/ice events. Since the FLEX storage areas are contiguous to existing employee parking areas, plowing and sanding are routine activities. Also, the PNPS site has contracts with local providers to augment on-site capabilities.

The licensee also identified that the existing haul path along the intake canal revetment to the "Barge Berth" for connection to the UHS will be paralleled with a graded roadway 50 feet further inland, protected by the revetment, and behind a 3 foot high security barrier. This provides assurance the UHS flow path would be available. It is expected that in the context of a snow, ice, and extreme cold event, the conventional water sources of condensate, fire water, and public water supply are expected to be available and would be preferentially used.

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

3.1.4.3 Procedural Interfaces – Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.3, states:

> The only procedural enhancements that would be expected to apply involve addressing the effects of snow and ice on transport the FLEX equipment. This

includes both access to the transport path, e.g., snow removal, and appropriately equipped vehicles for moving the equipment.

As noted in Section 3.1.4.2 above, there is ready access to the transportation path that is kept clear of snow and ice via trucks with mounted snow plows and road sanders pre-staged prior to snow/ice events.

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

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

NEI 12-06, Section 8.3.4, states:

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

Site access and access to staging areas for receipt of offsite materials and equipment can be by air and once on site, access is ensured by site trucks with mounted snow plows and road sanders.

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

3.1.5 High Temperatures

NEI 12-06, Section 9 states:

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

On page 3 of the Integrated Plan, the licensee stated all sites will address high temperatures in accordance with NEI 12-06, Section 9.2. The design bases temperature for HVAC System design ambient temperature is 88°F, and this represents a standard 1% exceedance value with a short-term peak design temperature of 102°F as described in FSAR Table 10.9-2. The 1% value would be expected to be exceeded for a total of 30 hours during the summer months (June to September) based on the ASHRAE design standards. The PNPS site historical highest recorded temperature is also noted to be 102°F from FSAR Table 2.3-15.

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

3.1.5.1 Protection of FLEX Equipment – High Temperature Hazard

NEI 12-06, Section 9.3.1, states:

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

On page 3 of the Integrated Plan, the licensee stated the FLEX equipment will be procured to function in high temperatures and consideration will be given to the impacts of these high temperatures on equipment storage and deployment; however, extreme high temperatures are not expected to impact the utilization of off-site resources or the ability of personnel to implement the required FLEX strategies. Stored equipment will be provided with environmental air conditioning or ventilation as needed to ensure equipment operability or prevent degradation under all temperature conditions.

On page 46 of the Integrated Plan, the licensee stated the piping used to provide makeup flow to the SFP from the RHR System is contained within the Reactor Building and Auxiliary Bay and is protected from high temperatures. Also, FLEX equipment will be stored at diverse locations that are robust for weather-related and extreme temperature events, and include ventilation and environmental controls, where needed.

The licensee stated on page 53 that FLEX equipment will be stored at diverse locations that are robust for weather-related and extreme temperature events, and include ventilation and environmental controls, where needed.

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 protection of FLEX equipment from high temperatures 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.

As identified on page 3 of the Integrated Plan, the FLEX equipment is procured to function in high temperatures. The FLEX equipment is stored in sea vans that can be opened manually. Maximum site design temperature is less than 110°F which would not impact personnel.

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

Same licensee information as identified in 3.1.5.1 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 provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedural interfaces related to high temperatures if these requirements are implemented as described.

3.2 PHASED APPROACH

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

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

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

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

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

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

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

3.2.1.1. Computer Code Used for ELAP Analysis.

NEI 12-06, Section 1.3 states:

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

The licensee has provided a Sequence of Events (SOE) in their Integrated Plan, which included the time constraints and the technical basis for the site. That SOE is based on an analysis using the industry-developed MAAP Version 4 computer code. MAAP4 was written to simulate the response of both current and advanced light water reactors to loss of coolant accident (LOCA) and non-LOCA transients for probabilistic risk analyses as well as severe accident sequences. The code has been used to evaluate a wide range of severe accident phenomena, such as hydrogen generation and combustion, steam formation, and containment heating and pressurization.

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

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

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

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

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

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

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

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

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

3.2.1.2. Recirculation Pump Seal Leakage Models.

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

The licensee did not Identify or provide justification for the assumptions made regarding primary system leakage from the recirculation pump seals and other sources that addresses the following items:

a. The assumed leakage rate and its predicted pressure dependence relative to test data.
b. Clarification of whether the leakage was determined or assumed to be single-phase liquid, two-phase mixture, or steam at the donor cell.
c. Comparison of design-specific seal leakage testing conditions to code-predicted thermal hydraulic conditions (temperature, void fraction) during an ELAP and justification if predicted conditions are not bounded by testing.
d. Discussion of how mixing of the leakage flow with the drywell atmosphere is modeled.

Recirculation pump seal leakage is not addressed in the Integrated Plan. The licensee was requested to provide additional details for recirculation pump seal leakage including justification for the assumptions made regarding primary system leakage from the recirculation pump seals and other sources. Also requested were additional details on the assumed pressure-dependence of the leakage rate. Clarification is needed on whether the leakage was determined or assumed to be single-phase liquid, two-phase mixture, or steam at the donor cell and discuss how mixing of the leakage flow with the drywell atmosphere is modeled. The licensee responded by stating recirculation pump seal leakage is addressed in the PNPS FLEX Strategy using what are believed to be reasonable assumptions for this parameter. During the Phase 1 response, with RCIC or HPCI maintaining the RPV water level, any seal leakage is readily accommodated by the injection pump flow capacity (while maintaining RPV level) and there is no immediate concern or need to have knowledge of the leakage flow. The RPV depressurization is commenced at approximately 6 hours after shutdown and performed over the next 3 to 4 hours. During this initial 10 hour period, after sufficient heatup of the Recirculation System piping and pumps, the saturated water seal leakage would partially flash to steam sufficiently for the discharge to transition to the containment saturation temperature and pressure conditions. It is a basic observation from containment analyses that the drywell and wetwell will be converging upon a saturated temperature and pressure condition by the 10 hour point, at which time the wetwell temperature has reached 250°F at 15 PSIG. The large quantity of thermal energy added to the wetwell during this time (970 MBtu) is such that the conditions will not be significantly different with recirculation pump seal leakage and the drywell will remain below the containment design temperature of 281°F at 35 PSIG.

After RPV depressurization, the FLEX low pressure injection pumps are capable of maintaining core cooling with an accounting for recirculation pump seal leakage. During the sub cooling phase of the PNPS FLEX Strategy, from 10 to 72 hours after shutdown, the FLEX injection pumps are providing flow at two-times the RPV boil-off rate with flow out the SRV discharge, and with some through recirculation pump seal leakage, both of which provide cooling to the RPV and discharge to the wetwell. When the FLEX Strategy is changed to a balanced RPV feed & bleed at 72 hours after shutdown, with the water source from the FLEX groundwater wells, the makeup requirements are based on the following assumptions:

The FLEX groundwater well shall have a production capability that is based on the reactor makeup water requirements at 72(+) hours after reactor shutdown, with an accounting for recirculation pump seal leakage, plus the spent fuel pool makeup water requirement, as follows:

Reactor Makeup for Boil-Off @ 75 PSIG at 72(+) Hrs. after Shutdown	= 52 GPM
Reactor Recirculation Pumps P-201A/B Seal Leakage at 75 PSIG	= 16 GPM
Spent Fuel Pool Makeup for Boil-Off at 30 Days after RFO Shutdown	= 12 GPM

Total Makeup Water Required	= 80 GPM

Page 33 of the Integrated Plan identified a modification to install Groundwater Supply Wells that shall be capable of providing a Total "N" Flow Rate of 80 GPM with a total quantity of "N+ 1" Wells, each rated for 60 GPM at 300 ft total head from a 6-inch well casing. The Wells shall include readily accessible protected Well-Heads that are robust with respect to seismic events, floods, and high winds, and associated missiles. It is not clear what a Total "N" Flow Rate of 80 GPM means, however there will be at least 2 wells rated at 60 GPM at 300 ft total head which provides margin over the calculated need of 80 GPM.

The licensee did not explicitly address the request. The following is requested:

1. Justification for the assumptions made regarding primary system leakage from the recirculation pump seals and other sources.
2. Assumed pressure-dependence of the leakage rate.
3. Clarification on whether the leakage was determined or assumed to be single-phase liquid, two-phase mixture, or steam at the donor cell and discuss how mixing of the leakage flow with the drywell atmosphere is modeled.

This has been identified as Confirmatory Item 3.2.1.2.A. in Section 4.2.

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

3.2.1.3 Sequence of Events

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

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

> Each site should establish the minimum coping capabilities consistent with unit-specific evaluation of the potential impacts and responses to an ELAP and

LUHS. In general, this coping can be thought of as occurring in three phases:

- Phase 1: Cope relying on installed plant equipment.
- Phase 2: Transition from installed plant equipment to on-site FLEX equipment.
- Phase 3: Obtain additional capability and redundancy from off-site equipment until power, water, and coolant injection systems are restored or commissioned.

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

In response to the need to identify expected time constraints, the licensee's Integrated Plan for Pilgrim includes a discussion of time constraints on pages 7 through 10 and a Sequence of Events Timeline, Attachment 1A, on pages 62 through 65.

The following sequence of events of the ELAP was provided by the licensee in the description of the strategy to maintain core cooling, maintain containment and in attachment 1A to the integrated plan. The event starts with the plant at 100% power when the initiating event of an instantaneous loss of all ac power is assumed. Upon the event initiation, with only dc power available, the main method of RPV level control is RCIC and High Pressure Coolant Injection System (HPCI). The pumps can take suction from the demineralized water in the condensate storage tank or from the suppression pool. Following any reactor shutdown, steam generation continues due to heat produced by the radioactive decay of fission products. The RCIC and HPCI system turbine pump units start automatically upon a receipt of a reactor vessel low-low water level signal. Because the Condensate Storage Tank (CST) is not seismically qualified, it is considered unavailable for the BDBEE. RCIC suction will be manually switched to the Suppression Pool. The HPCI system suction will automatically switch to the Suppression Pool (Torus) on a low CST level and HPCI will be secured when the Low-Low Water Trip clears. The ELAP analysis for Pilgrim assumes that the RCIC system will be placed into service and HPCI will be secured within two minutes.

On pages 15 and 16 the licensee identified that at six (6) hours after the reactor shutdown, the Torus will be at 170°F and a controlled reactor depressurization is commenced based on EOP-11 HCTL curve. The RPV will be depressurized by manually cycling the SRVs in conjunction with continued RCIC operation to reduce reactor pressure to 120 psig over a three hour period, at which time the Torus will heat up to 235°F. The SRVs are powered off of the 125 VDC batteries and the existing High Pressure Backup SRV Nitrogen Cylinder Supply to SRVs RV-203-3B and C will be modified to provide a set of pressure regulators for a continuous source of backup nitrogen at any time that the Drywell Essential Instrument Air Nitrogen Makeup System pressure drops below 90 psig.

In subsequent discussions with the licensee during the audit process, information was requested regarding manual RCIC CST to suppression pool switchover function will be accomplished in a timely manner so that RCIC injection to RPV will commence without delay and remain uninterrupted. The discussion was to include whether the software and hardware, related piping, valves, systems, structures, and components (SSCs) to support the switchover function are of safety grade and are qualified for all potential ELAP events including seismic, tornado/high winds and flooding. The licensee identified the RCIC system will be initiated manually from operator recognition of the reactor isolation, or automatically as a result of reactor low-low water level. With the loss of the CSTs, the dc powered annunciators will alert operators to the condition, or the turbine will trip from low pump suction pressure. The operator's response is to swap suction from the CSTs to the torus using dc powered valves. The dc control switches and annunciators are in the MCR and the swap over would be performed from the MCR. Should the dc power not be available, the valves can be manually operated. They are physically located in the RCIC quadrant of the reactor building, and in the Class 1 auxiliary building. The buildings are seismically rugged, capable of withstanding design wind loadings, and Pilgrim is a dry site. There are multiple routes available to access the valve locations.

During the audit process, the licensee was requested to discuss additional information to justify RCIC will continue to operate with a suppression pool suction greater than 200°F. The licensee stated that if primary containment is depressurized (vented), then the loss of available NPSH becomes the limiting factor for RCIC injection. This is consistent with the PNPS FLEX Strategy, in which RCIC is operated until the RPV depressurization is complete at 10 hours after shutdown. The depressurization begins at a suppression pool temperature of 170°F at 6 hours after shutdown and the final 50°F temperature rise is due to the added heat from RPV depressurization and decay heat over the subsequent 4 hour period. No containment venting is performed during RCIC operation, which ensures adequate NPSH at all temperatures. The period of time that the RCIC System is operating above 200°F is approximately 2 hours, which, based on the available evidence, is within the known robust capabilities of the system.

In the section of its Integrated Plan regarding Technical Basis Support Information (page 10), the licensee stated that on behalf of the Boiling Water Reactor Owners Group (BWROG), GE-Hitachi (GEH) developed a document (NEDC-33771P, Revision 1) to supplement the guidance in NEI 12-06 by providing additional BWR-specific information regarding the individual plant response to the ELAP and loss of UHS events. As part of this document, a generic BWR 3/Mark I containment NSSS evaluation was performed. The BWR 3/Mark I containment analysis is applicable to the PNPS (a BWR 3 Mark I plant) coping strategy because it supplements the guidance in NEI 12-06 by providing BWR-specific information regarding plant response for core cooling and containment integrity. The guidance was utilized as appropriate to develop coping strategies and for prediction of the plant's response.

NEDC-33771P states on Page 46, "Therefore, the analyses results presented herein are not deemed to be bounding. Plant-specific justification or detailed analysis is required." The licensee was requested to provide a detailed discussion of the extent to which the Integrated Plan and the time constraints in it depend on NEDC-33771P, and to the extent that the NEDC report was relied upon. During the audit process, the licensee identified that the GEH NEDC-33771P Report is not the directly applicable basis for the PNPS FLEX Strategy. GEH NEDC-33771P is considered to be a supporting document that is useful for evaluating the trends and behavior of the drywell and wetwell parameters and the relative effectiveness of venting. The GEH evaluation shows that the drywell and wetwell temperatures converge onto the saturation temperature and pressure condition for containment at approximately 10 hours after shutdown. Aside from this general behavior of drywell and wetwell parameters, the GEH report was not relied upon and the PNPS-specific analyses were performed as stand-alone calculations that are not based on any particular applicability of the GEH document. The only plant parameter that refers to the data and analyses from the GEH document is the drywell temperature profile during the initial 10 hours as that is not separately evaluated in the PNPS FLEX Calculations.

NEDC-33771P analyzed the case of a 1998 MW_t BWR 3 Mark I plant with RCIC taking suction from the CST. Temperature and pressure go up slower with suction from the CST than from the Suppression Pool due to the cooler water. The 6 hour time to reach 170°F in the Integrated Plan is significantly greater than that identified in the NEDC-33771P analysis. The Suppression Pool temperature is substantially higher than 235°F at 9 hours into the event in the NEDC-33771P analysis. The NEDC-33771P analysis indicates a containment pressure significantly greater than the containment design pressure at 16 hours. The licensee was requested to address the disparity. The licensee responded that the GEH report is a parametric study that is not directly applicable to any one plant's FLEX Strategy in terms of the absolute values versus time. Appendix B of the GEH Report is for RCIC operation from the suppression pool and also shows a heatup at higher temperatures than the PNPS calculation and MAAP Analysis. A principal difference is the higher bounding decay heat values used in the GEH Report, which are approximately 20% higher than the most recent PNPS-specific decay heat data provided by GEH to PNPS in 2011, which is up to date in every respect for decay heat calculations. The GEH Report is useful for evaluating the trends and behavior of the drywell and wetwell and the relative effectiveness of venting. The PNPS-specific MAAP Analysis provided results that are considerably more favorable than the PNPS base case analysis used for the FLEX Strategy, as is typical for an integrated computer model analysis versus a simplified heat balance calculation. The recent GEH Report NEDC-33823P provided a GEH MAAP-SHEX Benchmark Study for the BWROG, which concluded that "This study showed that MAAP results, for containment parameters in these plants, are in reasonable agreement with SHEX when using similar inputs and assumptions".

On page 55 of the Integrated Plan, the licensee identified two (2) 120/240 VAC 1-PH 12 kW generators, and four (4) 120/240 VAC 1-PH 6 kW generators to be deployed in Phase 2 for instrumentation. The licensee was requested to identify in the sequence of events timelines when these will be deployed. During the audit process, the licensee stated these small 12 kW & 6kW generators are not required for the FLEX Strategy equipment. Station equipment needing to be repowered, which includes the 125 & 250 VDC System Battery Chargers (and Battery Room Exhaust Blowers) and the 120 VAC distribution panels powering instrumentation, will use the larger 150 kW generators. Pilgrim is reviewing the use of 15 kW Generators that have been added to the FLEX Strategy for repowering two of the 120 VAC distribution panels. This is being evaluated to minimize the effort needed to repower these two panels. The small 12 kW & 6kW generators will be available for portable lighting, ventilation fans, and later in the event, may be used to repower the 120 VAC Panels The deployment of the connection of the pre-staged 150kW generator would be accomplished in 4 hours. If the pre-staged unit was not available one of the remote on-site FLEX generators would be deployed and connected within 8 hours. The 15kW generators can be deployed and connected within 8 hours. The Pilgrim sequence of events timeline will be revised to indicate the use of the 15kW generators.

On page 16 of the Integrated Plan, the licensee stated that the RPV will be depressurized by manually cycling the SRVs in conjunction with continued RCIC operation to reduce reactor pressure to 120 psig over a three hour period, at which time the Torus will heat up to 235°F. The SRVs are powered off of the 125 VDC batteries and the existing High Pressure Backup SRV Nitrogen Cylinder Supply to SRVs RV-203-3B and C will be modified to provide a set of pressure regulators for a continuous source of backup nitrogen at any time that the Drywell Essential Instrument Air Nitrogen Makeup System pressure drops below 90 psig.

Depending on primary containment environmental conditions during the event, SRV actuation may require a higher than nominal dc voltage to actuate the SRVs. The SRV pilot solenoid coil electrical resistance will increase due to a higher containment temperature with a longer duration event than an existing SBO coping time. Therefore, to achieve the necessary coil current, a higher voltage is needed to overcome the increase in the coil's resistance. The licensee should evaluate their SRVs' qualification against the predicted containment response with FLEX implementation to ensure there will be sufficient dc bus voltage during the ELAP event. Determination of site-specific timing requirements is needed for resources and potential higher voltage dc power to reliably actuate SRVs. During the audit process, the licensee identified that the design temperature for the Target Rock 125 VDC SRV solenoid valve is 350°F. The drywell temperature does not exceed this value in the PNPS FLEX Strategy. The resistance of the SRV coil will increase as temperatures rise; however, in the EQ testing qualification, the SRV coils were cycled multiple times over 32 days at 350°F; whereas in BDBEE the air space temperature is less than 250°F at 4 days. Because Pilgrim's SRVs are rated for 350°F, the existing dc bus voltage is sufficient for the SRV solenoids following a BDBEE; a review of EQ testing in the ADS files shows a higher and longer temperature profile in a LOCA event than the BDBEE.

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

3.2.1.4 Systems and Components for Consequence Mitigation

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

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

And,

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

NEI 12-06, Section 3.2.1.12 states:

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

On page 4 of the Integrated Plan, the licensee stated that all components will be procured commercially and tested or evaluated, as appropriate, for seismic, environmental, and radiological conditions.

The sizing of the FLEX DGs is addressed in Section 3.2.4.8 of this evaluation. Two 150 KW DGs will be provided and the worst case loading on a DG is approximately 110 KW.

On page 23 of the Integrated Plan, the licensee stated the initial strategy for cooling is to inject water into the RPV at twice the boil-off rate to preclude concentrating minerals from seawater in the RPV and to preclude any significant fouling of heat transfer surfaces. The initial boil-off rate is not identified; however the initial rate is provided by 2 FLEX pumps in tandem providing 400 GPM and that is reduced to 180 gpm at 10 hours and steadily reduced at a prescribed rate after that. On page 78 of the Integrated Plan, the licensee identified 5 (2 in each FLEX storage area plus 1 B.5.b unit on site) 400 GPM diesel pumps with a capacity of 400 GPM at 350 ft TH.

No technical basis or a supporting analysis was provided for the diesel-driven FLEX pump capabilities considering the pressure within the RPV and the loss of pressure along with details regarding the FLEX pump supply line routes, length of hoses runs, connecting fittings, elevation changes to show that the pump is capable of injecting water into the RPV with a sufficient rate to maintain and recover core inventory for both the primary and alternate flow paths. This has been identified as Open Item 3.2.1.4.A in Section 4.1.

The FLEX diesel pumps can also provide water to the SFP although the initial means of providing make-up to the SFP is via a prestaged Submersible Air-Powered Diaphragm Pump with a bottom suction and capacity up to 120 GPM taking suction from the Separator Storage Pool that has a usable volume of 30,000 gallons. This provides adequate makeup for approximately 74 hours. One of the FLEX diesel pumps can be used to supply water prior to the 74 hours.

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 systems and components for consequence mitigation if these requirements are implemented as described.

3.2.1.5 Monitoring Instrumentation and Controls

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

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

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

DC and 120VAC powered instruments are listed on pages 19, 20, 21, 27 and 28 (maintain core cooling). The same instruments are identified on page 37 (maintain containment). The instrumentation that will be installed per NRC order EA-12-051 is identified for the SFP cooling safety evaluation. Evaluation of the SFP instrumentation will be conducted as part of the NRC order EA-12-051. The only non-powered instruments are the local RPV Level (NR), RPV Pressure, and Containment Pressure.

The following dc powered instrumentation was listed by the licensee: Reactor Water Level, Reactor Pressure, Drywell Pressure, RCIC Suction Pressure and HPCI Suction Pressure. Battery powered instrumentation is not identified for Suppression Pool Level, Suppression Pool Temperature, and Suppression Pool Pressure. The licensee was requested to provide justification as to why battery powered instrumentation is not available for Suppression Pool Level, Suppression Pool Temperature, and Suppression Pool Pressure. During the audit process, the licensee identified that during Phase 1, there is sufficient instrumentation powered from the station dc systems to complete the Phase 1 operation of the RCIC System, including HPCI & RCIC suction pressure indication, which is located on main control room panels. The containment parameters listed are on the main control room Post Accident Monitoring (PAM) Panels and their associated instruments for Shutdown Wide Range Reactor Water Level, Torus Bottom Pressure, Wide Range Containment Pressure, Low Range Containment Pressure, Torus Water Level, and Drywell & Torus High Radiation, and are powered from 120 VAC Safeguards Controls Panels. Main Control Room Panel Torus Water Local & Bulk Temperature Indicators and Drywell & Torus Atmosphere Temperatures are also powered from 120 VAC Safeguard Controls Panels. These 120 VAC instruments will be repowered from the FLEX 150 kW Generators at 4 hours which is 2 hours before instrumentation is needed to initiate RPV depressurization (initiates at 170 degree F torus temperature - approximately 6 hours after shutdown).

The integrated plan does not identify non-powered local instrumentation other than Containment pressure and RPV level and pressure. The integrated plan identifies that Phase 2 equipment will have installed local instrumentation needed to operate the equipment. The licensee needs to identify the instrumentation that will be used to monitor portable FLEX electrical power equipment. This has been identified as Confirmatory Item 3.2.1.5.A. in Section 4.2.

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

3.2.1.6 Motive Power, Valve Controls and Motive Air System

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

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

And,

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

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

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

On page 12 of the Integrated Plan, the licensee stated the RPV will be depressurized by manually cycling the SRVs in conjunction with continued RCIC operation to reduce reactor pressure to 120 psig over a three hour period, at which time the Torus will heat up to 235°F. The SRVs are powered off of the 125 VDC batteries and the existing High Pressure Backup SRV Nitrogen Cylinder Supply to SRVs RV-203-3B and C will be modified to provide a set of pressure regulators for a continuous source of backup nitrogen at any time that the Drywell Essential Instrument Air Nitrogen Makeup System pressure drops below 90 psig.

On page 35 of the Integrated Plan, the licensee stated the reliable operation of HCVS can be met because the HCVS is fully qualified and powered by the 125 VDC systems and will be provided with an independent pneumatic system supplied from nitrogen bottles to operate the HCVS valves. Critical instruments associated with containment and the HCVS are dc powered and can be read locally and in the MCR. The HCVS system is addressed as part of order EA-13-109. The motive power for the HCVS will be evaluated in the EA-13-109 Safety Evaluation.

The Integrated Plan provides no guidance on how to control critical equipment without control power. [An example would be controlling the RCIC pump without control power]. This is combined with previously identified Confirmatory Item 3.1.1.3.A. in Section 4.2.

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

3.2.1.7 Cold Shutdown and Refueling

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

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

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

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

The licensee informed the NRC of their plan 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 or Refueling if these requirements are implemented as described.

3.2.1.8 Use of Portable Pumps

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

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

NEI 12-06 Section 11.2 states in part:

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

On pages 16 and 63 of the Integrated Plan, the licensee identified that at 9 hours after shutdown, the core cooling strategy transitions from RCIC to diesel powered FLEX Low Pressure Injection Pumps from the UHS through a duplex strainer cart to the isolated CST common suction line to either the HPCI or RCIC pump flow path, by injecting through the idle pump and into the normal pump discharge path to the RPV Feedwater lines. An alternate FLEX injection point is to the RHR System via the readily accessible Firewater to Service Water Cross-Tie to RHR, which provides a path to inject into the RPV, Drywell Spray, or Torus via the RHR System. Both FLEX injection points will be similarly outfitted with 5" Storz hose connections, as will all other FLEX connectors to the pumps, strainers, water tanks, and demineralizer tanks.

No technical basis or a supporting analysis was provided for the diesel-driven FLEX pump capabilities considering the pressure within the RPV and the loss of pressure along with details regarding the FLEX pump supply line routes, length of hoses runs, connecting fittings, elevation changes to show that the pump is capable of injecting water into the RPV with a sufficient rate to maintain and recover core inventory for both the primary and alternate flow paths. This has been combined with Open Item 3.2.1.4.A in Section 4.1.

On pages 43 and 44, the licensee addressed the SFP makeup via use of a pre-staged Submersible Air-Powered Diaphragm Pump with suction from demineralized water in the lower volume of the Dryer & Separator Storage Pool (capacity 34,000 gallons). This provides a 42 hour supply of makeup water at a boil-off rate of 12 GPM.

An alternate strategy of SFP makeup is with the FLEX Pump as a source of makeup water. The pump can be connected to the RHR System via the Fire Water to RHR / SSW System Cross-Tie via 10-HO-511 in accordance with PNPS 5.3.26 that installs an 8" Victaulic to 2-1/2" fire hose adaptor to the lower flange of the Fire Water to RHR crosstie pipe connection at the Aux Bay EL 23 ft location. The makeup source of water will be from the UHS and will satisfy the requirements of the primary strategy for makeup water at a boil-off rate of 12 GPM.

For the case with a full core offload, the boil-off rate is 51 GPM.

Either strategy of SFP makeup has significant margin, therefore no additional calculations are necessary.

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

3.2.2 Spent Fuel Pool Cooling Strategies

NEI 12-06, Table 3-1 and Appendix C summarize one acceptable approach for the SFP cooling strategies for BWRs. This approach uses a portable injection source to provide 1) makeup via hoses on the refuel deck/floor capable of exceeding the boil-off rate for the design basis heat load; 2) makeup via connection to SFP cooling piping or other alternate location capable of exceeding the boil-off rate for the design basis heat load; and alternatively 3) spray via portable monitor nozzles from the refueling deck/floor capable of providing a minimum of 200 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 a time constraint to be successful should be identified and a basis provided that the time can be reasonably met. NEI 12-06, Section 3 provides the performance attributes, general criteria, and baseline assumptions to be used in developing the technical basis for the time constraints. Since the event is a beyond-design-basis event, the analysis used to provide the technical basis for time constraints for the mitigation strategies may use nominal initial values (without uncertainties) for plant parameters, and best-estimate physics data. All equipment used for consequence mitigation may assume to operate at nominal setpoints and capacities. NEI 12-06, Section 3.2.1.2 describes the initial plant conditions for the at-power mode of operation;

Section 3.2.1.3 describes the initial conditions; and Section 3.2.1.6 describes SFP conditions.

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

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

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

On pages 43 and 44 of the Integrated Plan, the licensee addressed the case where the Reactor full core has been off-loaded to the Spent Fuel Pool, and the SFP Gate has been installed to allow complete or partial draining of the Reactor Basin, such as might be done for some type of major vessel internals repair activity. At the earliest time this plant condition can be accomplished (150 hours), the time-to-boil is 7.3 hours based on a starting temperature of 125°F and the boil-off rate is 51 GPM.

> Per Calculation M907, Rev O, "Refueling Outage Decay Heat Removal System", the earliest time that this plant configuration could be accomplished is assumed to be at least 150 Hrs. after Reactor shutdown. The SFP conditions at this point in time are then:
>
> Time-to-Boil at 150 Hrs. = 7.3 Hrs. (based on 125°F starting temp)
>
> Boil-Off Rate at 150 Hrs. = 51 GPM

The reference was reviewed in the licensee's Portal and these values were verified.

On pages 43 and 44 of the Integrated Plan, the following strategies were presented:

> <u>Refueling Mode Core Offload in Progress</u>
>
> The addition of up to 350,000 gallons required to complete the filling of the Reactor Basin and Dryer & Separator Pool, or an equal volume added to the Torus, will allow at least 72 Hours to either restore active cooling, or to begin providing makeup only at the total rate for the Reactor Full Core and Spent Fuel Pool that will be 68 GPM at 72 Hours after Reactor shutdown. For the alternative plant shutdown conditions during which the Reactor normal or full core fuel discharge is in the process of transfer or has been completely off-loaded to the Spent Fuel Pool, the same FLEX equipment will be used to provide makeup water to the Reactor and/or Spent Fuel Pool at a rate equal to the maximum 51 GPM Boil-Off Rate at 150 Hours. after shutdown to maintain a nominally full water level.
>
> <u>Primary Strategy Method 1</u>
>
> The initial source of SFP makeup water will be provided by storage of demineralized

water in the lower volume of the Dryer & Separator Storage Pool (below EL 97 ft). The capacity of this lower volume is 34,000 gallons. Transfer of water from the Dryer & Separator Storage Pool to the SFP will be via a hose connected to a Submersible Air-Powered Diaphragm Pump with a bottom suction and capacity up to 120 GPM. A Diesel Air Compressor (DAC) and hose will be pre-staged for use on the Reactor Building Refuel Floor to provide SFP makeup water transfer from the Dryer & Separator Storage Pool to the SFP. A usable volume of 30,000 GPM will provide a 42 Hr. supply of makeup water at a boil-off rate of 12 GPM. The total heatup Time to boiling and available makeup water supply is then 74 hours.

Primary Strategy Method 2

There will be an existing capability to supply makeup water to the SFP without accessing the refueling floor. This connection will be via the RHR to Fuel Pool Cooling System (RHR/FPC) Intertie from RHR System 6-inch valve 1001-104 to 19-HO- 166 that connects to the Fuel Pool Cooling System 8-inch Return Header directly to the SFP as described in the Design Basis Report MDBR1 1. If the FLEX Pump will be the source of makeup water, it will be connected to the RHR System via the Fire Water to RHR / SSW System Cross-Tie via 10-HO-511 in accordance with PNPS 5.3.26 that installs an 8"Victaulic to 2-1/2" fire hose adaptor to the lower flange of the Fire Water to RHR crosstie pipe connection at the Aux Bay EL 23 ft location. The makeup source of water will be from the UHS and will satisfy the requirements of the primary strategy for makeup water at a boil-off rate of 12 GPM.

Primary Strategy Method 3

The case that requires spray cooling for the SFP greater than the makeup rate will utilize existing equipment that is intended to support the Mitigating Strategies Requirements from previous NRC Order EA-02-026, Section B.5.b, and 10 CFR 50.54(hh)(2). The regulatory guidance contained in NRC Order EA-02-026, Section B.5.b, as noted in JLD-ISG-2012-01 continues to provide an acceptable means of meeting the requirement to develop, implement and maintain the necessary guidance and strategies for that subset of beyond-design-basis external events.

The Integrated Plan does not specify if the storage and deployment of the 10 CFR 50.54(hh)(2) equipment meets the requirements and guidance of NEI 12-06, Section 11.3 (8). The licensee was requested to address storage of 10 CFR 50.54(hh)(2) equipment. During the audit process, the licensee identified that at PNPS, no 50.54(hh)(2) equipment, other than the SFP spray monitor nozzles, is credited in the FLEX Strategy. That is, the existing B.5.b equipment and strategy are not changed or affected by the FLEX Strategy. If the event includes the need for spray cooling of the SFP, either the B.5.b or FLEX pumps can provide the pump flow required using the SFP spray monitor nozzles originally provided for the 50.54(hh)(2) scenario. Only the B.5.b pump is situated to respond within the timeline required for the 50.54(hh)(2) events.

On page 9 of the Integrated Plan regarding time constraints, the licensee stated

Establish natural free convection ventilation to exhaust the humid atmosphere from the EL 117 ft SFP/Refuel Floor Area with an outside air inlet at a lower elevation though the Reactor Building Truck Lock at EL 23 ft (table item 13). This action will be required to be performed prior to the onset of SFP boiling (as water temperature approaches 200 °F).

Procedural guidance will be provided for Operations to open the Reactor Bldg. Hatch while also opening a ground level ventilation inlet.

On page 9 of the Integrated Plan, the licensee identified action Item 13 that at 32 hour, establish natural free convection ventilation to exhaust the humid atmosphere from the EL 117 ft SFP/Refuel Floor Area with an outside air inlet at a lower elevation though the Reactor Building Truck Lock at EL 23 ft. This action is required to be performed prior to the onset of SFP boiling (as water temperature approaches 200°F). Procedural guidance will be provided for Operations to open the Reactor Bldg. Hatch while also opening a ground level ventilation inlet.

The time constraints are not consistent. The pool is boiling at 32 hours and the time constraint identified for ventilation is as water approaches 200°F (no time identified). The licensee was requested to provide clarification. During the audit process, the licensee identified that the procedural guidance will ensure that the reactor building ventilation is established prior to 32 hours, which is the earliest possible time that spent fuel pool (SFP) boiling can begin or later if SFP temperature is known and remains less that 200°F, which is likely to be reached significantly later than 32 hours under most actual conditions. There is at least 4 hours heatup time available between 200 and 212°F to perform this action. As listed in the Attachment 1A Sequence of Events Timeline, "This action is required to be performed prior to the SFP boiling."

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 spent fuel pool cooling strategies if these requirements are implemented as described.

3.2.3 Containment Functions Strategies

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

On page 35 of the Integrated Plan, the licensee stated the PNPS FLEX Strategy is based on performing Torus Venting for Containment heat removal when the Drywell or Torus approaches the Design Temperature of 281°F, which corresponds to a Saturation Pressure of 35 psig which is well below the Primary Containment Pressure Limit (PCPL) of 60 psig as given in EOP-11, Figure 4. The containment design pressure is 56 psig, as noted in FSAR table 5.2-1 which is at a Low-Low Torus Water Level and corresponds to 60 psig Torus Bottom Pressure. Containment pressure limits are not expected to be reached during the event as indicated by FLEX Strategy Thermal-Hydraulic Analysis, because the HCVS is opened prior to exceeding any containment pressure limits. Thus, containment integrity is not challenged and remains functional throughout the event. Monitoring of Containment Drywell & Torus Pressure and Torus Water Level & Temperature will be available via normal plant instrumentation.

Although NEI 12-06, Table 3-1 indicates heat removal as one of the Safety Functions, the Integrated Plan appears to correlate containment integrity solely with ensuring containment pressure limits are not exceeded. This is evident by the fact that the essential containment instruments listed on pages 27 and 28 of the Integrated Plan does not include a means for measuring drywell temperature. In general, excessive temperatures could result in a loss of containment integrity due to the failure of containment penetration seals or other portions of the containment boundary. Furthermore, excessive temperatures may need to be monitored to ensure the qualification range of necessary measurement instruments located in the drywell is not exceeded. The licensee was requested to provide the basis for concluding that monitoring drywell temperature is not required for purposes such as validating the qualification range of measurement instruments located in the drywell or establishing the survivability of penetration seals or other equipment. During the audit process, the licensee stated that as shown in GEH NEDC-33771P, the drywell and wetwell temperatures converge onto the saturation temperature and pressure condition for containment at approximately 10 hours after shutdown, and this is a key consideration in FLEX Strategy planning. Thus, by monitoring the drywell pressure, assuming saturated conditions, the temperature could also be determined if necessary. This is consistent with NEI 12-06, Table C-2. The information provided in response to the calculated peak drywell temperature request in the following paragraph was also considered in resolving the temperature monitoring issue.

During the audit process, the licensee was requested to identify if the calculated peak temperature of the drywell was bounded by the temperature used for EQ evaluations for instrumentation/controls and the penetration seals. The licensee responded that the peak Drywell and Wetwell (Torus) temperature for the FLEX Strategy occurs at 16 Hours after shutdown and is equal to the Primary Containment Design Temperature of 281°F, which is the initiation condition for Containment Venting that stops the temperature rise and begins a gradual drop in temperature to 250°F at 72 Hours. The peak Drywell temperature for EQ evaluations is 334°F and the temperature profile remains above 250°F for 24 Hours. The licensee response adequately addressed the request.

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 containment functions strategies if these requirements are implemented as described.

3.2.4 Support Functions

3.2.4.1 Equipment Cooling – Cooling Water

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

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

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

Review of the licensee's approach as described above confirms that the Integrated Plan is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-1201-01, and provides reasonable assurance that the requirements of Order EA-12-049 are met with respect to support functions.

3.2.4.2 Ventilation – Equipment Cooling

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

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

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

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

MCR

On page 49 of the Integrated Plan, the licensee stated that GOTHIC analysis of the main control room (MCR) over a period of 72 hours following an ELAP shows that by opening Door 145 "Main Control Room to Stairway 8" within 30 minutes, the MCR temperature will be kept under 110°F, the limit for human performance as specified in NUMARC-87-00. The GOTHIC analysis uses the conservative assumptions of a 102°F outside temperature and loss of offsite power heat loads for the MCR. Per NUMARC-87-00, the equipment in the MCR should be functional up to 120°F.

The licensee was requested to provide the maximum calculated MCR temperature and a detailed summary of the analysis used to determine the temperature and the procedure for control of MCR temperature. The licensee response was that existing procedure 2.4.149 addresses "Loss of MCR H&V". The procedure is symptom driven, containing temperature limits to perform actions, and it is not time driven. Pilgrim will provide the referenced GOTHIC evaluation. This has been identified as Confirmatory Item 3.2.4.2.A. in Section 4.2.

RCIC

On page 49 of the Integrated Plan, the licensee stated that RCIC room area temperatures of 160°F to 170°F or RCIC valve station temperatures of 190°F to 200°F will isolate both the inboard and outboard steam isolation valves. The PNPS Probabilistic Safety Assessment contains evaluations of the RCIC room heatup for station blackout conditions. One evaluation was performed using GOTHIC (Appendix M2) and another evaluation was performed by General Electric as part of a Station Blackout study (Appendix F7). The GOTHIC results indicate temperatures of 124.5°F for the RCIC Pump Quadrant, 137.7°F for the RCIC Pump Quadrant Mezzanine, and 121.8°F for the RCIC Valve Station at 10 hours. The GE evaluation indicates temperatures of 112°F for a realistic 10 lbm/hr steam leakage rate and 137.5°F for an extreme 70 lbm/hr leakage rate at 10 hours. Based on this, cooling for the RCIC room is not required.

HPCI

Page 15 of the Integrated Plan indicates that HPCI is secured within 2 minutes of the event. Based on this, cooling for the HPCI room is not required.

Battery Room

On page 51 of the Integrated Plan the licensee stated the equipment and procedures to establish ventilation of the 125V & 250V Battery Rooms using portable fans to exhaust from the top of the room volumes to outside air using existing ventilation ducts will be provided to prevent

H2 gas accumulation resulting from battery charging.

On page 81 of the Integrated Plan, the licensee stated two 12" Duct Intrinsically Safe Portable Ventilation Fans are to be deployed, one in each DC Power System Battery Room, to provide forced exhaust ventilation to prevent the accumulation of Hydrogen gas that evolves from lead-acid battery charging. The fans are 120 VAC 1-PH ac Motor driven and can be powered from the 120 VAC outlets on the 480 VAC 3-PH 100 kVA DG that is charging the batteries or from any one of the small 120/240 VAC 1-PH 6 kW or 12 kW DGs.

The licensee was questioned on why they did not address the staging and use of the ventilation fans in the Attachment 1A SOE. During the audit process, the licensee identified that Attachment 1A; Sequence of Events Timeline should have been more specific and included staging of ventilation equipment in the discussion of FLEX EDG deployment. The licensee stated that the fans, intrinsically safe ductwork, and electrical supply cables will be stored in or in close proximity to the battery rooms. The procedure used to charge the batteries using the FLEX EDGs will include the steps to stage and activate the fans used to vent the battery rooms using the FLEX fans. The FLEX fans will vent the battery rooms at the normal system flow rates. The same FLEX EDG will be used to power the fans and the battery charger, ensuring that the gas generation and dispersal are driven by the same power source. The licensee adequately addressed this question.

The licensee has not provided analysis on the hydrogen gas ventilation. Analysis requires discussion on the accumulation of hydrogen with respect to national standards and codes which limit hydrogen concentration to less than 1% (according to the National Fire Code and Regulatory Guide 1.128, "Installation Design and Installation of Vented Lead-Acid Storage Batteries for Nuclear Power Plants," which endorses IEEE Standard 484, with exceptions) when the batteries are being recharged during Phase 2 and 3 has not been provided. The licensee was requested to address hydrogen gas ventilation. During the audit process, the licensee identified that the same FLEX generator repowering the battery chargers is used to power a pre-staged, intrinsically safe FLEX fan of the same rating as the normal H&V system. The normal H&V flow is adequate to prevent the buildup of H2 in all modes of battery operation, therefore the use of FLEX fan, and the existing flow path out of the room and out of the building was considered to be reasonable and conservative. The licensee adequately addressed this request.

On page 81 of the Integrated Plan, the licensee stated one FLEX Portable 480 VAC 3-PH 100 kVA Diesel Generator (DG) will normally be prestaged in the Turbine Building Truck Lock, which is adjacent to the ac Switchgear and DC System Battery Rooms. This DG is thereby capable of early deployment (within 4 Hours) during any Station Black-Out (SBO) and is capable of maintaining both 125 VDC Battery Divisions, and the 250 VDC Battery, charged and operating indefinitely. The licensee was requested to provide additional detail on the need or means to ventilate the DG exhaust to facilitate personnel access. During the audit process, the licensee identified that there are three FLEX 150KW EDGs. One is stored in the north FLEX storage area. One is stored in the south FLEX storage area. The third is stored inside of the turbine building truck lock. If called upon to operate, it would be rolled outside of the truck lock, with only the electrical leads being run under the truck lock door. The licensee adequately addressed this request.

During the audit process, the licensee was requested to address the effects of heightened/lowered temperatures (i.e., temperatures above/below temperatures assumed in the sizing calculation for each battery) on each battery's capability to perform its function for the duration of the ELAP event. The licensee responded that the station batteries are located in a separate room inside the protected switchgears rooms. During the initial stages (time 0 to 2 hours) of the battery support period (when the potential loads are the largest) the room temperature should be still within its normal design range. Later in the event (time > 2 hours) the room temperatures may increase or decrease, with the loss of the normal ventilation. At this point battery loads will have decreased because of the lack of ac loads and isolation of non-essential dc loads. The adverse impact of low temperature on the battery capacity will be less of an impact than if it occurred earlier in the event when battery loads are higher. In addition, there will be some self-heating provided by the battery system during the discharge because of loads internal and external resistance. The effect of elevated temperature on the battery is to decrease service life over an extended period. At time 4 hours or 8 hours, the battery charger will be repowered, thereby providing additional battery support. The licensee response adequately addressed the requested evaluation.

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

3.2.4.3 Heat Tracing.

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

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

The licensee was requested to address heat tracing since the Integrated Plan does not identify any procedures/guidance that addresses the effects of loss of power on heat tracing. The licensee responded that the PNPS FLEX Strategy does not have dependency on heat tracing for any required equipment after the initiation of the event. The FLEX equipment is protected from low temperatures and freezing during normal plant operation using electric heaters. Such heaters are provided for all diesel engine block heaters and for the primary mobile 21,000 gallon demineralized water storage tank, as described in the PNPS submittal. The licensee adequately addressed this request.

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

3.2.4.4 Accessibility – Lighting and Communications.

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

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

In its Integrated Plan, the licensee does not identify procedures/guidance that addresses the identification of 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. Updated information provided by the licensee during the audit process identified that they are developing plans to fully address lighting. The licensee stated that the first phase of portable lighting includes delivery to the site and storage of 3 Scenestar LED 110V push up tripod light intrinsically safe, 19000 lumens ; 110 V cord reels and gang box, and three 6 KW generators. In addition, an assessment of installed emergency lighting demonstrates that adequate lighting is available for access to the torus vent controls. The licensee needs to provide details of portable lighting. This has been identified as Confirmatory Item 3.2.4.4.A. in Section 4.2.

The licensee provided its communications assessment in letters dated October 31, 2012 and February 21, 2013 (ML12321A051 and ML13058A032) in response to the NRC letter dated March 12, 2012, 50.54(f) request for information letter. The NRC staff provided its evaluation on May 21, 2013 (ML13127A179). The NRC staff determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by the licensee will conform to the guidance of NEI 12-06 Section 3.2.2 (8) regarding communications capabilities during an ELAP. This has been identified as Confirmatory Item 3.2.4.4.B. in Section 4.2 below for confirmation that upgrades to the site's communications systems have been completed.

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

3.2.4.5 Protected and Internal Locked Area Access

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

> *Plant procedures/guidance should consider the effects of ac power loss on area access, as well as the need to gain entry to the Protected Area and internal*

locked areas where remote equipment operation is necessary.

At some plants, the security system may be adversely affected by the loss of the preferred or Class 1E power supplies in an ELAP. In such cases, manual actions specified in ELAP response procedures/guidance may require additional actions to obtain access.

The Integrated Plan does not identify procedures/guidance with regard to the access to the Protected Area and internal locked areas. During the audit process, the licensee identified that Operations and Security are currently researching options, the intention is to include in the EP procedures addressing BDBEE perimeters, the site declaration of 50.54x, and recognizing resource needs, including Security, and compensatory measures based on the event. Existing security doors provide egress capability and have key access in the event of a power loss. 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.

MCR
NEI 12-06, Section 3.2.1.9 requires that areas requiring personnel access should be evaluated to ensure that conditions will support the actions required by the plant-specific strategy for responding to the event.

On page 49 of the Integrated Plan, the licensee stated GOTHIC analysis of the main control room (MCR) over a period of 72 hours following an ELAP shows that by opening Door 145 "Main Control Room to Stairway 8" within 30 minutes, the MCR temperature will be kept under 110°F, the limit for human performance as specified in NUMARC-87-00. The GOTHIC analysis uses the conservative assumptions of a 102°F outside temperature and loss of offsite power heat loads for the MCR. No other actions or modifications are required for MCR Accessibility.

The Sequence of Events Timeline (Attachment 1A) does not identify the actions needed to maintain MCR habitability. The licensee was requested to address why the required action is not on the Timeline. During the audit process, the licensee identified that the opening of the control room doors upon loss of air conditioning is a subsequent operator action directed by Procedure 2.4.149. The procedure is invoked upon loss of air conditioning for greater than 10 minutes. The procedure includes blocking open specific doors to provide cooling flow. The doors are part of the control room boundary, and 30 minutes is a reasonable estimate for operators to recognize the situation, and take the prescribed action.

The licensee was requested to provide the maximum calculated MCR temperature and a detailed summary of the analysis used to determine the temperature and the procedure for control of MCR temperature. The licensee response was that existing procedure 2.4.149 addresses "Loss of MCR H&V". The procedure is symptom driven, containing temperature limits to perform actions, and it is not time driven. Pilgrim will provide the referenced GOTHIC evaluation. This has been combined with Confirmatory Item 3.2.4.2.A. in Section 4.2.

RCIC

On page 49 of the Integrated Plan, the licensee stated it is not anticipated that the RCIC room will require occupation by personnel during the event. The only case where personnel would be required to enter the RCIC room will be during Phase 1 if remote operation fails. The PNPS Probabilistic Safety Assessment contains evaluations of the RCIC room heatup for station blackout conditions. One evaluation was performed using GOTHIC (Appendix M2) and another evaluation was performed by General Electric as part of a Station Blackout study (Appendix F7). The GOTHIC results indicate temperatures of 124.5°F for the RCIC Pump Quadrant, 137.7°F for the RCIC Pump Quadrant Mezzanine, and 121.8°F for the RCIC Valve Station at 10 hours. The GE evaluation indicates temperatures of 112°F for a realistic 10 lbm/hr steam leakage rate and 137.5°F for an extreme 70 lbm/hr leakage rate at 10 hours. The RCIC isolation valves will not close in the first 10 hours, but if personnel access is required, mitigating actions such as using portable fans, water sprays, self-contained breathing equipment, and reduced stay times will be used. The licensee's Industrial safety procedures currently address activities with a potential for heat stress to prevent adverse impacts on personnel.

The Sequence of Events Timeline (Attachment 1A page 63) identifies transition from RCIC to portable FLEX pumps at 9 hours, therefore the 10 hours listed above is bounding.

HPCI

Page 15 of the Integrated Plan indicates that HPCI is secured within 2 minutes of the event. Based on this, equipment cooling for the HPCI room is not applicable.

On page 62 of the Integrated Plan, the licensee stated breakers will be appropriately identified (labeled) to show which are required to be opened.

On page 13 of the Integrated Plan, the licensee stated the equipment for ELAP will have unique identification numbers.

SFP Access

On page 44 of the Integrated Plan, the licensee identified under Primary Strategy Method 2 the existing capability to supply makeup water to the Spent Fuel Pool without accessing the refueling floor.

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

3.2.4.7 Water Sources.

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

> *Plant procedures/guidance should ensure that a flow path is promptly established for makeup flow to the steam generator/nuclear boiler and identify backup water sources in order of intended use. Additionally, plant procedures/guidance should specify clear criteria for transferring to the next preferred source of water.*
>
> Under certain beyond-design-basis conditions, the integrity of some water sources may be challenged. Coping with an ELAP/LUHS may require water supplies for multiple days. Guidance should address alternate water sources and water delivery systems to support the extended coping duration. Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles are assumed to be available in an ELAP/LUHS at their nominal capacities. Water in robust UHS piping may also be available for use but would need to be evaluated to ensure adequate NPSH can be demonstrated and, for example, that the water does not gravity drain back to the UHS. Alternate water delivery systems can be considered available on a case-by-case basis. In general, all CSTs should be used first if available. If the normal source of makeup water (e.g., CST) fails or becomes exhausted as a result of the hazard, then robust demineralized, 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.

On page 15 of the Integrated Plan, the licensee identified that because the CST is not seismically qualified, it is considered unavailable for the BDBEE, and the RCIC suction will be manually switched to the Suppression Pool (Torus). The HPCI system suction will automatically switch to the Torus on a low CST level and HPCI will then be secured when the Low-Low Water

Level Trip (-46.3 inches) clears. This is assumed to happen within the first two (2) minutes of the event. The RCIC system will continue to operate after the reactor level returns to the normal band. During the first 6 hours after shutdown, the reactor remains isolated and pressurized with RCIC providing the core cooling, drawing water from the Torus.

On page 16 of the Integrated Plan, the licensee identified that at 9 hours after shutdown the reactor remains isolated and pressurized with RCIC providing core cooling, drawing water from the Suppression Pool (Torus). At this time the core cooling strategy will transition from RCIC to diesel powered FLEX Low Pressure Injection Pumps, which will be staged and connected from the UHS to the CST suction line for injection via either the HPCI or RCIC Pump flow path, by injecting through the idle pump and into the normal pump discharge path to the RPV Feedwater lines. An alternate FLEX injection point is to the RHR System via the readily accessible Firewater to Service Water Cross-Tie to RHR, which provides a path to inject into the RPV, Drywell Spray, or Torus via the RHR System. Both FLEX injection points will be similarly outfitted with 5" Storz hose connections, as will all other FLEX connectors to the pumps, strainers, water tanks, and demineralizer tanks.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the water sources (see Open Item 3.2.1.4.A) 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.

A review was conducted of the integrated plan but there was no discussion regarding electrical isolation and interaction considerations. The licensee provided only the following information regarding connection of portable generators to plant systems.

On page 24 of the Integrated Plan, the licensee stated that to recharge the 125 & 250 VDC batteries ac power transfer switches will be installed to disconnect the chargers from their 480 VAC electrical buses and provide a cable connector on the 480 VAC line side of each individual 125 & 250 VDC Station Battery Charger (Normal & Backup) to provide power directly to the battery chargers using a FLEX mobile 480 VAC 3-PH 100 kVA capacity ac power generator.

During the audit process, the licensee was requested to provide electrical Single Line Diagrams showing the proposed connections of Phase 2 and 3 electrical equipment to permanent plant equipment. The licensee responded that Engineering Change markup of the One-Line Diagrams E13 and E14Sh1 (EC45555 & EC45556), will be posted to ePortal. This has been identified as Confirmatory Item 3.2.4.8.A. in Section 4.2.

During the audit process, the licensee was requested to describe how electrical isolation will be maintained such that (a) Class 1E equipment is protected from faults in portable/FLEX equipment and (b) multiple sources do not attempt to power electrical buses. During the audit process, the licensee responded that FLEX cables to repower the battery chargers and panels will not be connected during normal power or refueling operations. A Safety Class 1E/seismic manual "break-before-make" transfer switch will be installed in the battery charger 480V supply (5 switches), and 120VAC panel supply (4 switches) circuits. The transfer switch will be normally closed in the "normal" supply position and the alternate supply (FLEX diesel generator source) contacts will be open.

The alternate supply will be connected through a non-safety class plug which is wired to the transfer switch alternate supply terminations. The open transfer switch contacts will provide the safety to non-safety isolation. Position of transfer switches will be controlled by station procedures. The licensee response adequately addressed the requested information.

On page 63 of the Integrated Plan describing SOE timeline (Attachment 1A), the licensee stated (Item 6 at 4 hours) that pre-staged FLEX 100 kVA 480 VAC 3-PH Diesel Generator in Turbine Bldg. are deployed and available to repower any one of the 125 or 250 VDC Battery Chargers. Later (Item 8 at 8 hours) there are at least two FLEX 100 kVA 480 VAC 3-PH DGs deployed to repower the 125 & 250 VDC Battery Chargers to maintain the station dc Power Systems operating indefinitely,

During the audit process, the licensee was requested to provide (1) Summary of sizing of FLEX diesel generators, and (2) Clarification, if the first FLEX DG staged in the Turbine Building Truck Lock becomes unavailable due to the Event and the other two FLEX DGs are dedicated to repowering both 125V dc batteries chargers simultaneously for next 8 hours, how will the 250 VDC battery be charged after first 8 hours of Phase 1. The licensee responded that the large FLEX generators size has been increased from 100kVA to 150kW (3 will be available) to repower battery chargers, 120VAC panel & battery room vents. One diesel generator can support two 125V battery chargers or a 125V and 250V battery charger, required battery room ventilation fans, and 120VAC panels. Battery chargers are assumed to be operating within the operating limits, supporting connected loads and recharging the associated batteries.

Engineering Changes are being developed to support the FLEX project which requires electrical studies to be performed. This includes the electrical diesel loading and load flow studies. The addition of the transfer switches and additional cable lengths are being incorporated into the Pilgrim design calculations (load flow, short circuit and coordination.) The worst case loading would be a 125V and a 250V battery charger being supplied a single generator with a load of ≈ 110kW. (Preliminary loading shows 31.4kW & 72.3kW battery chargers; battery room vent fans 1.5kW and 120VAC panels' ≈ 5.5kW). The FLEX diesel generator sizes need to verified after the loading calculations are finalized. This has been identified as Confirmatory Item 3.2.4.8.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 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.

The location and elevation of the EDG Fuel Storage Tanks are not specified in the Integrated Plan. Access by the FLEX Truck is not described. During the audit process, the licensee identified that the site has nominally 48,000 gallons in two EDG underground storage tanks, 36,000 gallons in two SBO underground storage tanks, and 1,000 gallons in two EDG above ground day tanks. The total fuel available in the six spatially diverse, Class 1 structures is > 85, 000 gallons. The underground storage tanks are equipped with waterproof fill heads, and their integrity is routinely verified in accordance with existing PMs. The EDG and SBO tanks are below grade (23ft el), but located to the North, and to the South of the site, separated by the turbine and reactor buildings. A wind driven event affecting both sites would seem unlikely, while the maximum precipitation event could only affect access to the SBO area, and that would be for a period of less than one hour, and not affecting fuel availability thereafter. The day tanks are above grade, but within the Class 1 EDG building. The FLEX EDGs are maintained with filled onboard fuel tanks of 12 hours capacity. The fuel is stabilized, and the diesels are run in accordance with Pilgrim PMs for standby diesels. The fuel management prior to, and in response to the event will be subject to a future procedure, providing the administrative controls for consideration of the FLEX truck routing and fuel sources.

Early in the event, fuel management will commence using the FLEX truck mounted 100 gallon tank with integral pumps, and hand wheeled 28 gallon caddies with pumps to transfer fuel from the above sources to the operating diesels.

As identified above in Section 3.1.2, PNPS is considered a dry site. The FLEX DGs are not used until four hours into the event and the FLEX pumps are not used until 9 hours into the event. The licensee has provided adequate information to address an adequate supply and means to deliver fuel oil.

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

3.2.4.10 Load Reduction to Conserve DC Power.

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

> *Plant procedures/guidance should identify loads that need to be stripped from the plant dc buses (both Class 1E and non-Class 1E) for the purpose of conserving dc power.*
>
> DC power is needed in an ELAP for such loads as shutdown system instrumentation, control systems, and dc backed AOVs and MOVs. Emergency

lighting may also be powered by safety-related batteries. However, for many plants, this lighting may have been supplemented by Appendix R and security lights, thereby allowing the emergency lighting load to be eliminated. ELAP procedures/guidance should direct operators to conserve dc power during the event by stripping nonessential loads as soon as practical. Early load stripping can significantly extend the availability of the unit's Class 1E batteries. In certain circumstances, AFW/HPCI /RCIC operation may be extended by throttling flow to a constant rate, rather than by stroking valves in open-shut cycles.

Given the beyond-design-basis nature of these conditions, it is acceptable to strip loads down to the minimum equipment necessary and one set of instrument channels for required indications. Credit for load-shedding actions should consider the other concurrent actions that may be required in such a condition.

On page 7 of the Integrated Plan, the licensee stated that it is anticipated that the decision to deploy the FLEX DGs will be made during the response phase; however battery durations are calculated to last at least 8 hours without credit for load shed during the initial Phase 1 response.

Attachment 1A notes that at one hour, the ELAP decision is made and deep dc load shedding begins at one hour (item 3), and at 2 hours the dc load shed is complete (item 4). The licensee was requested to provide the direct current (dc) load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling. During the audit process, the licensee responded that the dc load flow profiles are being developed as part of a new electrical battery FLEX extended operation load flow and battery sizing study PS258. This is in development; however, the existing design of the dc system is 8 hours. This has been identified as Confirmatory Item 3.2.4.10.A. in Section 4.2.

During the audit process, the licensee was requested to identify if the backup dc seal oil pump which maintains sufficient seal oil pressure to prevent the escape of hydrogen from the main generator casing is shed. The licensee responded that the present design will not isolate (load shed) the 250V dc generator emergency seal oil pump to limit H2 leakage and allow for controlled H2 venting. The licensee response adequately addressed the concern of shedding the dc seal oil pump.

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. During the audit process, the licensee responded by identifying that a list of loads proposed to isolate, isolation time and panel locations are available and provided in the licensee's ePortal. (Note: this list is being reviewed by Operations at this time.) Due to the capacity of the batteries and the fact that there is a significant number of non-safety loads which can be isolated without impacting defense in depth or redundancy, a deep load shed is not anticipated to be required to extend battery capability to 10 hours to support RCIC/HPCI without the need for repowering the battery chargers. The licensee noted that repowering of the battery chargers will occur between 4 and 8 hours depending on diesel generator availability. The licensee needs to finalize the load-shed list after the Operators' review. This has identified as Confirmatory Item 3.2.4.10.B. in Section 4.2.

The licensee was requested to provide the basis for the minimum dc bus voltage that is required to ensure proper operation of all required electrical equipment. During the audit process, the licensee identified that the minimum component voltage requirements have been identified in the station design basis dc studies PS-233B, C and D. These values will remain the bases (acceptance criteria) for determining the capability of the batteries to support extended operation. (Studies PS233B, C and D have been entered into ePortal). The licensee response adequately addressed the requested information.

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

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

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

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

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

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

3.3 PROGRAMMATIC CONTROLS

3.3.1 Equipment Maintenance and Testing.

NEI 12-06, Section 3.2.2, 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[1] guidance provided in INPO AP 913, Equipment Reliability Process, to verify proper function. The maintenance program should ensure that the FLEX equipment reliability is being achieved. Standard industry templates (e.g., EPRI) and associated bases will be developed to define specific maintenance and testing including the following:

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

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

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

[1] Testing includes surveillances, inspections, etc.

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 13 of the Integrated Plan, the licensee stated:

> A program owner will be assigned with responsibility for configuration control, maintenance and testing.
>
> PNPS will utilize the standard EPRI industry PM process to establish maintenance and testing requirements for all FLEX components. The administrative program will include maintenance guidance, testing procedures and frequencies established based on type of equipment and considerations made within the EPRI guidelines.
>
> PNPS will follow the current programmatic control structure for existing processes such as design and procedure configuration.

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

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

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

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

3.3.2 Configuration Control.

NEI 12-06, Section 11.8 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 13 of the Integrated Plan, the licensee stated that:

> PNPS will implement an administrative program for implementation and maintenance of the PNPS FLEX strategies in accordance with NEI 12-06 guidance.
>
> A program owner will be assigned with responsibility for configuration control, maintenance, and testing.
>
> The equipment for ELAP will have unique identification numbers.
>
> Installed structures, systems and components pursuant to 10CFR50.63 (a) will continue to meet the augmented quality guidelines of Regulatory Guide 1.155, "Station Blackout."

PNPS will follow the current programmatic control structure for existing processes such as design and procedure configuration.

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

3.3.3 Training.

NEI 12-06, Section 11.6 provides that:

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

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

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

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

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

On page 8 of the Integrated Plan discussing time constraints, the licensee committed to provide programs and training to support operation of the FLEX DGs and the deployment and operation of the FLEX pumps

On page 13 the Integrated Plan, the licensee stated new training of general station and

[2] The Systematic Approach to Training (SAT) is recommended.
[3] Emergency response leaders are those utility emergency roles, as defined by the Emergency Plan, for managing emergency response to design basis and beyond-design-basis plant emergencies.

Emergency Planning (EP) staff will be performed, prior to design implementation. Simulation and licensed operator training will not be impacted. These programs and controls will be implemented in accordance with the Systematic Approach to Training.

The Milestone Schedule (Attachment 2) on page 66 of the Integrated Plan commits to develop the training plan with an original target date of Mar. 2014.

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 States:

Each site will establish a means to ensure the necessary resources will be available from off-site. Considerations that should be included in establishing this capability include:

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 65 of the Integrated Plan, the Sequence of Events in item 22, the licensee described transition from Phase 2 to Phase 3 at 72 hours post event.

A determination cannot be made from the information in the Integrated Plan as to when the Regional Response Center assistance would be requested (not on the timeline) and what administrative procedure or program would trigger that request. During the audit process, the licensee identified that FLEX Strategy requests to the RRC will be directed by FLEX Procedures.

On pages 14 of the Integrated Plan regarding the Regional Response Center Plan, the licensee addressed offsite resources as follows:

PNPS will utilize the industry RRC for additional and/or backup supplies of Phase 3 equipment, as needed, and to replenish consumable items. PNPS has contractual agreements in place with the SAFER. The two industry RRCs will be established to support utilities during BDBEE. Communications will be established between the affected nuclear site and the SAFER team and required equipment mobilized as needed. 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.

Review of the licensee's use of off-site resources, as described in the plan, 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, insufficient information has been included to provide reasonable assurance that guidance will be established to conform to the remaining items of NEI 12-06, Section 12.2 (Guidelines 2 through 10) since Guidelines 2 through 10 were not addressed in the Integrated Plan. During the audit process, the licensee stated that NEI 12-06, Section 12.2, Guidelines 2 through 10 pertain to the operation of the RRC by SAFER, of which Entergy is a member. Addressing Guidelines 2 through 10 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	Description	Notes
3.2.1.4.A	On pages 16, 23, and 63 of the Integrated Plan regarding Portable Equipment to Maintain Core Cooling, the licensee describes the use of portable pumps to provide RPV injection. No technical basis or a supporting analysis was provided for the diesel-driven FLEX pump capabilities considering the pressure within the RPV and the loss of pressure along with details regarding the FLEX pump supply line routes, length of hoses runs, connecting fittings, and elevation changes to show that the pump is capable of injecting water into the RPV with a sufficient rate to maintain and recover core inventory for both the primary and alternate flow paths.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.1.A	The Integrated Plan does not specify procedures and programs will provide for securing large portable equipment to protect them during a seismic event or to ensure unsecured and/or non-seismic components do not damage the equipment as is specified in NEI 12-06, Section 5.3.1, considerations 2 and 3.	
3.1.1.2.A	The licensee identified that access to at least one connection point for the equipment will requires access through routes that are not FSAR Seismic Class I, however they have been evaluated and the potential for large scale debris field that would prevent access to the equipment needed to be repowered is not present. Their evaluation should be validated during the site audit.	
3.1.1.3.A	The licensee was requested to provide additional information concerning coping strategies for the failure of seismically qualified electrical equipment that can be affected by beyond-design-basis seismic events as discussed in NEI 12-06, Section 5.3.3 consideration 1.	
3.1.3.1.A	The storage of the FLEX equipment is in sea vans. The licensee is in the process of performing a calculation to demonstrate conformance with NEI 12-06, Section 7.3.1.b, bullet 4 related to adequate tie down of the sea vans. Evaluation of the completed calculation must be completed to determine if it demonstrates conformance to guidance in NEI 12-06, Section 7.3.1.b, bullet 4.	

3.1.3.2.A	During the audit process, the licensee identified that there are existing plant procedures that address hurricanes. The procedures need to be evaluated for conformance to NEI 12-06, considerations 1, 2, and 5.	
3.2.1.1.A	From the June 2013 position paper, benchmarks must be identified and discussed which demonstrate that MAAP4 is an appropriate code for the simulation of an ELAP event at your facility.	
3.2.1.1.B	The collapsed level must remain above Top of Active Fuel (TAF) and the cool down rate must be within technical specification limits.	
3.2.1.1.C	MAAP4 must be used in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper.	
3.2.1.1.D	In using MAAP4, the licensee must identify and justify the subset of key modeling parameters cited from Tables 4-1 through 4-6 of the "MAAP4 Application Guidance, Desktop Reference for Using MAAP4 Software, Revision 2" (Electric Power Research Institute Report 1020236). This should include response at a plant-specific level regarding specific modeling options and parameter choices for key models that would be expected to substantially affect the ELAP analysis performed for that licensee's plant.	
3.2.1.1.E	The specific MAAP4 analysis case that was used to validate the timing of mitigating strategies in the integrated plan must be identified and should be available on the ePortal for NRC staff to view. Alternately, a comparable level of information may be included in the supplemental response. In either case, the analysis should include a plot of the collapsed vessel level to confirm that TAF is not reached (the elevation of the TAF should be provided) and a plot of the temperature cool down to confirm that the cool down is within tech spec limits.	
3.2.1.2.A	The following is requested: 1. Justification for the assumptions made regarding primary system leakage from the recirculation pump seals and other sources. 2. Assumed pressure-dependence of the leakage	

	rate. 3. Clarification on whether the leakage was determined or assumed to be single-phase liquid, two-phase mixture, or steam at the donor cell and discuss how mixing of the leakage flow with the drywell atmosphere is modeled.	
3.2.1.5.A	The integrated plan does not identify non-powered local instrumentation other than Containment pressure and RPV level and pressure. The integrated plan identifies that phase 2 equipment will have installed local instrumentation needed to operate the equipment. The licensee needs to identify the instrumentation that will be used to monitor portable FLEX electrical power equipment.	
3.2.4.2.A	The licensee was requested to provide the maximum calculated MCR temperature and a detailed summary of the analysis used to determine the temperature and the procedure for control of MCR temperature. The licensee response was that existing procedure 2.4.149 addresses "Loss of MCR H&V". The procedure is symptom driven, containing temperature limits to perform actions, and it is not time driven. Pilgrim will provide the referenced "GOTHIC" evaluation. Evaluation of the “GOTHIC” analysis is needed to evaluate the MCR temperature.	
3.2.4.4.A	The licensee needs to provide complete details of portable lighting.	
3.2.4.4.B	The licensee provided its communications assessment in letters dated October 31, 2012 and February 21, 2013 (ML12321A051 and ML13058A032) in response to the NRC letter dated March 12, 2012, 50.54(f) request for information letter. The NRC staff provided its evaluation on May 21, 2013 (ML13127A179). The NRC staff has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. This has been identified for confirmation that upgrades to the site's communications systems have been completed.	
3.2.4.5.A	The Integrated Plan does not identify procedures/guidance with regard to the access to the Protected Area and internal locked areas. During the audit process, the licensee identified existing security doors provide egress capability and have key access in the event of a power loss. Operations and Security are currently researching options, the intention is to include in the EP procedures addressing BDBEE perimeters, the site declaration of 50.54X, and recognizing resource needs, including Security, and compensatory measures based on the event.	

3.2.4.8.A	During the audit process, the licensee was requested to provide electrical Single Line Diagrams showing the proposed connections of Phase 2 and 3 electrical equipment to permanent plant equipment. The licensee responded that Engineering Change markup of the One-Line Diagrams E13 and E14Sh1 (EC45555 & EC45556), will be posted to ePortal.	
3.2.4.8.B	During the audit process, the licensee identified Engineering Changes are being developed to support the FLEX project which requires electrical studies to be performed. This includes the electrical diesel loading and load flow studies. The addition of the transfer switches and additional cable lengths are being incorporated into the Pilgrim design calculations (load flow, short circuit and coordination.) The FLEX diesel generator sizes need to be verified after the loading calculations are finalized.	
3.2.4.10.A	Attachment 1A of the Integrated Plan notes that at one hour, the ELAP decision is made and deep dc load shedding begins at one hour (item 3), and at 2 hours the dc load shed is complete (item 4). The licensee was requested to provide the direct current (dc) load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling. During the audit process, the licensee responded that the dc load flow profiles are being developed as part of a new electrical battery FLEX extended operation load flow and battery sizing study PS258.	
3.2.4.10.B	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). During the audit process, the licensee responded by identifying that a list of loads proposed to isolate, isolation time and panel locations are available and provided in the ePortal. (Note: this list is being reviewed by Operations at this time.) The licensee needs to finalize the load-shed list after the Operations' review.	
3.4.A	The licensee's plans for the use of off-site resources conform to the minimum capabilities specified in NEI 12-06 Section 12.2, with regard to the capability to obtain equipment and commodities to sustain and backup the site's coping strategies (item 1 above). However, the licensee did not address considerations 2 through 10 of NEI 12-06, Section 12.2.	

If you have any questions, please contact John Boska at 301-415-2901.

Sincerely,

/RA/

Jeremy S. Bowen, Chief
Mitigating Strategies Projects Branch
Mitigating Strategies Directorate
Office of Nuclear Reactor Regulation

Docket No. 50-293

Enclosures:
1. Interim Staff Evaluation
2. Technical Evaluation Report

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DATE	12/16/13	12/16/13	12/16/13	12/16/13
OFFICE	NRR/MSD/MESB/BC*	NRR/MSD/MRSB/BC*	NRR/MSD/D	NRR/MSD/MSPB/BC
NAME	SBailey	SWhaley	JDavis (SWhaley for)	JBowen
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