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

February 27, 2014

Mr. Kevin K. Davison
Site Vice President
Northern States Power Company - Minnesota
Prairie Island Nuclear Generating Plant
1717 Wakonade Drive East
Welch, MN 55089-9642

SUBJECT: PRAIRIE ISLAND NUCLEAR GENERATING PLANT UNITS 1 AND 2 – INTERIM STAFF EVALUATION RELATING TO OVERALL INTEGRATED PLAN IN RESPONSE TO ORDER EA-12-049 (MITIGATION STRATEGIES) (TAC NOS. MF0834 AND MF0835)

Dear Mr. Davison:

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 26, 2013 (ADAMS Accession No. ML13060A379), Northern States Power Company, a Minnesota corporation (NSPM or the licensee), doing business as Xcel Energy, submitted its Overall Integrated Plan for Prairie Island Nuclear Generating Plant Units 1 and 2 in response to Order EA-12-049. By letter dated August 26, 2013 (ADAMS Accession No. ML13239A094), NSPM submitted a six-month update to the Overall Integrated Plan.

Based on a review of NSPM's plan, including the six-month update dated August 26, 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 Prairie Island Nuclear Generating Plant Units 1 and 2. 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.

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

If you have any questions, please contact James Polickoski, Mitigating Strategies Project Manager, at 301-415-5430 or at james.polickoski@nrc.gov.

Sincerely,

Victor Cusumano (for Jeremy Bowen)

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

Docket Nos. 50-282 and 50-306

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

cc w/encl: Distribution via Listserv

UNITED STATES
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INTERIM STAFF EVALUATION AND AUDIT REPORT BY THE OFFICE OF NUCLEAR REACTOR REGULATION RELATING TO ORDER EA-12-049 MODIFYING LICENSES WITH REGARD TO REQUIREMENTS FOR MITIGATION STRATEGIES FOR BEYOND-DESIGN-BASIS EXTERNAL EVENTS

NORTHERN STATES POWER COMPANY – A MINNESOTA CORPORATION

PRAIRIE ISLAND NUCLEAR GENERATING PLANT UNITS 1 AND 2

DOCKET NOS. 50-282 AND 50-306

1.0 INTRODUCTION

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 26, 2013 [Reference 2], Northern States Power Company, a Minnesota corporation (the licensee or NSPM), doing business as Xcel Energy, provided the Overall Integrated Plan (hereafter referred to as the Integrated Plan) for compliance with Order EA-12-049 for Prairie Island Nuclear Generating Plant Units 1 and 2 (Prairie Island or PINGP). The Integrated Plan describes the guidance and strategies under development for implementation by NSPM 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 26, 2013 [Reference 3], the licensee submitted the first six-month status report since the submittal of the Integrated Plan, describing the progress made in implementing the requirements of the order.

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 if 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 a BDBEE. 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,[1] requires that operating power reactor licensees and construction permit holders use a three-phase approach for mitigating BDBEEs. The initial

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[1] Attachment 3 provides requirements for combined License holders.

phase requires the use of installed equipment and resources to maintain or restore core cooling, containment and SFP cooling capabilities. 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 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 BDBEEs 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 used by the staff in its review, leading to the issuance of this interim staff evaluation (ISE) 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. 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 Mega-Tech Services, LLC (MTS) for technical support in the evaluation of the Integrated Plan for Prairie Island, submitted by NSPM's letter dated February 26, 2013, as supplemented. NRC and MTS staff have reviewed the submitted information and held clarifying discussions with NSPM in evaluating the licensee's plans for addressing BDBEEs and its progress towards implementing those plans.

A simplified description of the Prairie Island 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 turbine-driven auxiliary feedwater pump (TDAFWP) to supply water to the steam generators (SGs) from the condensate storage tank (CST), if available, or cooling water (CL) system and release steam from the SG power operated relief valves or SG safety valves. In order to address reactivity concerns and control reactor coolant system (RCS) inventory loss, the licensee will be installing low-leakage reactor coolant pump (RCP) seals. Additionally, the licensee will commence a cooldown of the RCS within two hours of an ELAP allowing the safety injection accumulators to inject borated water. Within 33 hours, a 480 Vac portable FLEX diesel generator (DG) will be aligned to power an installed charging pump to provide borated make-up water to the RCS from the refueling water storage tank. The licensee's longer term core cooling strategy includes utilizing the portable, diesel-driven FLEX SG makeup pump for direct SG injection supported by the diesel-driven cooling water pump (CL system) providing SG makeup pump suction from the ultimate heat sink (UHS). The licensee's longer term RCS inventory control strategy includes utilizing the portable, electric FLEX RCS makeup pump to add borated make-up water from either the refueling water storage tank or boric acid storage tanks (if available) powered by the FLEX portable DG. Portable FLEX 480 Vac DGs will power the safeguard battery chargers and allow energizing critical loads such as required motor-operated valves, direct current components, and desired ac instrumentation. Additional equipment and supplies, such as portable 4.16kV DGs, additional pumps, water filtration capability, mobile boration units, and additional fuel for portable equipment, will be delivered from one of two Regional Response Centers (RRCs) established by the nuclear power industry to provide supplemental accident mitigation equipment.

With regard to containment, the licensee concluded by analysis that initially, containment will not be challenged for at least seven days after the ELAP. Should long term containment cooling be required, the licensee will utilize RRC provided DGs to repower a containment fan coil unit cooled by the CL system.

In the postulated ELAP event, the SFP will initially heat up due to the unavailability of the normal cooling system. To provide makeup and cooling water flow to the SFP, the licensee will utilize the SFP spray strategy pursuant to 10 CFR 50.54(hh)(2) and/or RRC provided DGs to repower installed SFP cooling and component cooling system pumps. The licensee intends to open the roll-up doors from the common areas of the auxiliary building to establish ventilation in the SFP area.

By letter dated February 26, 2014 [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, in general, 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 the NRC considers 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 for NRC to determine that the issue is on a path to resolution. The intent behind designating an issue as an open item is to document significant 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, in general, it accurately reflects the state of completeness of the licensee's Integrated Plan. The open and confirmatory items identified in the TER are listed in the tables below, with some NRC item characterization changes and minor NRC edits made for clarity from the TER version. Further details for each open and confirmatory item are provided in the corresponding sections of the TER, identified by the item number.

As clarification of differences between the ISE open and confirmatory item list below and the enclosed TER:

(1) TER open item 3.2.1.6.A was removed and consolidated with confirmatory item 3.2.1.A.

(2) TER confirmatory item 3.2.1.6.B was removed as duplicative of the request for information pursuant to 10 CFR 50.54(f) regarding recommendation 9.3, staffing assessment, of the Near-Term Task Force review of insights from the Fukushima Dai-

ichi accident (ADAMS Accession No. ML12053A340).

(3) Confirmatory items 3.2.4.7.A, 3.2.4.8.C, and 3.2.4.10.A were removed and consolidated with similar subject confirmatory items 3.2.1.9.A, 3.2.4.8.A, and 3.2.4.10.B.

4.1 OPEN ITEMS

Item Number	Description	Notes
None		

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.2.A	Confirm the final storage locations for FLEX equipment and the deployment routes during extreme external events are acceptable to include further detail regarding seismic protection of connection points and the access to those points through seismically robust structures.	
3.1.1.4.A	Confirm the SAFER group plan routes for deployment of off-site resources are acceptable.	
3.2.1.A	Confirm applicability of the WCAP-17601-P analysis to PINGP to include differences between the reference case and plant specific parameter values.	
3.2.1.1.A	Confirm that use of the NOTRUMP code for the ELAP analysis is limited to the flow conditions before reflux condensation initiates. This includes specifying an acceptable definition for the onset of reflux condensation cooling.	
3.2.1.2.A	RCP Seal Leakage. Confirm that since PINGP will install FlowServe N-9000 seals with Abeyance seal option, the licensee addresses the acceptability of the use of non-Westinghouse seals, and provides the acceptable justification for the RCP seal leakage rates for use in the ELAP analysis, to include whether the FlowServe white paper justifies the use of the FlowServe N-9000 seals and bounds the 21 gpm/seal leakage rate assumed in the analysis.	
3.2.1.3.A	Decay Heat - Confirm the applicability and adequacy of the ANS 5.1-1979 + 2 sigma model analysis relative to Prairie Island, and if a different decay heat model is used, address the acceptability of the model.	
3.2.1.6.A	Verify differences between the plant parameter values used in this reference case contained in Table 5.2.2-1 of WCAP-17601-P and the PINGP plant specific parameters.	
3.2.1.8.A	Core Sub-Criticality – Confirm the licensee adopts the generic	

	resolution for boron mixing under natural circulation conditions potentially involving two-phase flow, in accordance with the Pressurized-Water Reactor Owners Group position paper, dated August 15, 2013 (ADAMS Accession No. ML13235A135 (non-public for proprietary reasons)), and subject to the conditions provided in the NRC endorsement letter dated January 8, 2014 (ADAMS Accession No. ML13276A183), or the approach as detailed in Xcel Energy correspondence IC OC-PX-2012-021 is acceptable.	
3.2.1.9.A	Confirm that the time required before a makeup water source is required for RCS inventory control can be extended following installation FlowServe N-9000 RCP seals with the Abeyance seal option such that the portable pump would not be necessary until Phase 3. In addition, determination of method or connection point for the RCS portable pump is needed.	
3.2.2.A	Confirm the licensee's SFP spray capability from its existing B.5.b strategy is reasonably protected.	
3.2.4.4.A	Confirm emergency lighting will be available during dc load shedding or that the licensee provides adequate lighting for the mitigating strategies.	
3.2.4.4.B	Confirm upgrades to the site's communications systems have been completed.	
3.2.4.8.A	Confirm the licensee provides appropriate electric isolation and connections.	
3.2.4.8.B	Confirm the licensee's sizing calculations for the 480VAC and the 4KV DGs are acceptable.	
3.2.4.9.A	Portable Equipment Fuel – Confirm the total fuel consumption need calculations when FLEX equipment designs are finalized and the methods for onsite fuel transport are acceptable.	
3.2.4.10.B	Confirm the adequacy of the licensee's FLEX strategy station battery run-time calculation, battery depletion calculation, the supporting vendor discharge test data, FLEX strategy battery load profile, and other inputs/initial conditions.	
3.3.2.A	Confirm the licensee addresses considerations 1 and 2 of NEI 12-06, Section 11.8 regarding maintaining a historical record and documented engineering basis.	
3.4.A	Off-Site Resources – Confirm the licensee's arrangement for off-site resources addresses the guidance of Guidelines 2 through 10 in NEI 12-06, Section 12.2.	

Based on this review of NSPM's plan, including the six-month update dated August 26, 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 Prairie Island. 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 this ISE and Audit Report.

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 BDBEE. 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 BDBEEs to power reactors do not pose an undue risk to public health and safety.

The NRC's objective in preparing this ISE 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. 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 BDBEE that impacts the availability of ac power and the UHS. 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 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12054A736)

2. Letter from NSPM to NRC, "Prairie Island Nuclear Generating Plant's 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 26, 2013 (ADAMS Accession No. ML13060A379)

3. Letter from NSPM to NRC, "Prairie Island's 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 26, 2013 (ADAMS Accession No. ML13239A094)

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

14. NEI 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. NEI industry comments to draft JDL-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. NEI document NEI 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, Mega-Tech Services, LLC, to Eric Bowman, NRC, submitting "Fifth Batch SE Final Revision 1 – 1 Site (Prairie Island)" providing revision 1 of the final version of the fifth batch of Safety Evaluation (SEs) (one site) for the Technical Evaluation Reports (TERs) Related to Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, EA 12-049," dated February 26, 2014 (ADAMS Accession No. ML14057A709)

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Date: February 27, 2014

Enclosure 2

Technical Evaluation Report

ML14041A204

MEGA-TECH SERVICES LLC

Mega-Tech Services, LLC

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

Revision 1

February 26, 2014

Xcel Energy
Prairie Island Nuclear Generating Plant, Units 1 & 2
Docket Nos. 50-282 and 50-306

Prepared for:

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

Contract NRC-HQ-13-C-03-0039
Task Order No. NRC-HQ-13-T-03-0001
Job Code: J4672
TAC Nos. MF0834 and MF0835

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1.0 BACKGROUND

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

As directed by the Commission's staff 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 the Overall Integrated Plan (hereafter, the Integrated Plan) describing their course of action for mitigation strategies that are to conform with the guidance of NEI 12-06, or provide an acceptable alternative to demonstrate compliance with the requirements of Order EA-12-049.

2.0 EVALUATION PROCESS

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

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

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

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

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

Confirmatory Item – an item that is considered conceptually acceptable, but for which resolution may be incomplete. These items are expected to be acceptable, but are expected to require some minimal follow up review or audit prior to the licensee's compliance with Order EA-12-049.

Open Item – an item for which the licensee has not presented a sufficient basis to determine that the issue is on a path to resolution. The intent behind designating an issue as an Open Item is to document items that need resolution during the review process, rather than being verified after the compliance date through the inspection process.

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

3.0 TECHNICAL EVALUATION

By letter dated February 26, 2013, (ADAMS Accession No. ML13060A379), as supplemented by the first six month status report in letter dated August 23, 2013 (ADAMS Accession No. ML13239A094), Northern States Power Company, a Minnesota corporation (NSPM), doing business as Xcel Energy, (hereinafter referred to as the licensee) provided the Integrated Plan for Compliance with Order EA-12-049 for Prairie Island Nuclear Generating Plant, Units 1 & 2 (PINGP). The Integrated Plan describes the strategies and guidance under development for implementation by Xcel for the maintenance or restoration of core cooling, containment, and SFP cooling capabilities following a BDBEE, including modifications necessary to support this implementation, pursuant to Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049. That letter described the process used by the NRC staff in its review, leading to the issuance of an interim staff evaluation and audit report. The purpose of the staff's audit is to determine the extent to which the licensees are proceeding on a path towards successful implementation of the actions needed to achieve full compliance with the Order.

3.1 EVALUATION OF EXTERNAL HAZARDS

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

3.1.1 Seismic Events

NEI 12-06, Section 5.2 states:

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

On page 1 of the Integrated Plan, the licensee stated that seismic hazards are applicable to PINGP, and that the design basis earthquake (DBE) is based upon a maximum horizontal ground acceleration of 0.12 g and the associated response spectra are given in Plate 4.6, Appendix E of the PINGP Updated Safety Analysis Report (USAR), and the vertical ground acceleration is equal to two-thirds of the horizontal ground acceleration. Structures classified as Class 1 at the PINGP are designed for the licensing basis DBE. The reviewer consulted the PINGP USAR, Appendix E, Part 4, "Engineering Seismology," and Plate 4.6 in order to ascertain that the DBE referred to in the Integrated Plan corresponds to the Safe Shutdown Earthquake (SSE) that is used in NEI 12-06. The PINGP USAR, Appendix E, Part 4 does not use the term DBE, but describes two design earthquakes, one an earthquake of .06 g for which critical structures should be conservatively designed and one a maximum credible earthquake of .12 g to provide for safe shutdown of the reactors. The reviewer concludes that the 0.12 g earthquake described in the Integrated Plan corresponds to the SSE as it is used in NEI 12-06.

On page 5 of the Integrated Plan, the licensee stated that the seismic re-evaluation pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 was not completed and therefore not assumed in the Integrated Plan.

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

3.1.1.1 Protection of FLEX Equipment - Seismic Hazard

NEI 12-06, Section 5.3.1 states:

1. FLEX equipment 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 1 of the Integrated Plan, the licensee stated that it plans to construct two separate storage locations to meet the guidance of NEI 12-06, and that the equipment will be stored in structures that are designed to ASCE 7-10 or an evaluated equivalent so that at least one of the storage locations can be expected to withstand the seismic event. The licensee also stated that the final storage locations will be provided in subsequent 6-month status reports. Additionally, large portable FLEX equipment will be secured for a seismic event and located so that it is not damaged by other items in a seismic event

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 and storage of FLEX equipment considering the seismic hazard, if these requirements are implemented as described.

3.1.1.2 Deployment of FLEX Equipment - Seismic Hazard

NEI 12-06, Section 5.3.2 states:

> 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 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 [mitigation] strategy relies on a water source that is not seismically robust, e.g., a downstream dam, the deployment of 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 deployment.

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

On pages 1 and 2 of the Integrated Plan, the licensee stated that as described in PINGP USAR, Appendix E, liquefaction is not expected at the site during the postulated DBE. The licensee further stated that deployment pathways for FLEX equipment from the proposed storage location(s) will include the potential for debris due to non-seismically designed structures. Debris removal equipment onsite will be capable of clearing pathways for deployment.

On page 22 of the Integrated Plan the licensee stated that the auxiliary feedwater (AFW) pump room is in a Class 1 area of the turbine building (TB). Thus connections inside the AFW pump rooms are protected. Multiple pathways exist for hose and cable routing to connection points. Debris removal equipment will be available to clear debris as necessary to facilitate access. The licensee further stated that the diesel driven cooling water pump (DDCLP) rooms are in a Class 1 area of the plant screenhouse. Thus connection points for the portable diesel generators at motor control centers (MCCs) 1AB1 and 1AB2 are protected. In order to access the connection points from the FLEX diesel generator (DG), the cabling will be routed through part of the screen house that is not designed for Class 1 loads. Debris removal equipment will be available to clear debris in the screen house to facilitate access. The staff noted that these electrical connection points will be provided to enable providing primary and alternate portable power supply to the DDCLP fuel oil transfer pumps.

On pages 24 and 33 of the Integrated Plan, the licensee stated that the FLEX DG connection points will be located inside the 4.16 kV bus room in the TB for Unit 1, and the D5/D6 building for Unit 2. Both of these rooms are Class 1 areas and provide adequate protection for connection. Multiple access pathways exist for hose and cable routing to connection points. Debris removal equipment will be available to clear debris as necessary to facilitate access.

On page 29 of the Integrated Plan, the licensee stated that connection points for the FLEX makeup water pump suction and discharge for both the primary and alternate makeup paths will be installed on both units. On page 30 of the Integrated Plan, the licensee stated that these connection points will be made inside the auxiliary building (AB) which is a Class 1 structure. Thus the connection points inside the AB will be protected. The licensee stated that multiple access pathways exist for hose and cable routing to connection points, and that debris removal equipment will be available to clear debris as necessary to facilitate access.

During the audit process the licensee was requested to discuss power requirements to move equipment. The licensee stated that as part of the FLEX equipment building procurement specifications, they will require that the ability to open the doors does not rely on site power. Vehicles used for moving the FLEX equipment will be located inside the FLEX storage building. The license stated that they have not identified any access routes into the plant through doors that require electric power.

Regarding downstream dams, the license stated that lock and dam #3 on the Mississippi River is located downstream of the PINGP site and is assumed to fail in a seismic event which will potentially impact access the UHS. The staff noted that the failure of lock and dam #3 in a seismic event is part of the licensee's current licensing basis and is discussed in USAR Section 10.4.1.2.2. However, the licensee explained that the cooling water system includes an emergency intake line to supply the cooling water system in the event of dam failure and plant procedures require limiting flow to the capacity of the emergency intake line, which is determined by Calculation ENG-ME-254. Additionally, Calculation ENG-ME-219 shows that the available net positive suction head (NPSH) exceeds cooling water pump requirements.

On page 56 of the Integrated Plan, the licensee identified vehicles, trailers and front end loader as the means for towing pumps and generators and transporting hoses, strainers, cables, and miscellaneous equipment to staging areas. During the audit, the licensee indicated that the vehicles used to deploy the FLEX equipment will be located inside the FLEX storage structure.

The licensee stated in its Integrated Plan that the final storage locations for the FLEX buildings will be provided in subsequent 6-month status reports. In addition, the staff noted that until the final storage locations are selected the deployment routes cannot be established. Identification of the final storage locations and the associated deployment routes is identified as Confirmatory Item 3.1.1.2.A in Section 4.2.

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

3.1.1.3 Procedural Interfaces - Seismic Hazard

NEI 12-06, Section 5.3.3 states:

> There are four procedural interface considerations that should be addressed.
>
> 1. Seismic studies have shown that even seismically qualified electrical equipment can be affected by BDB seismic events. In order to address these considerations, each plant should compile a reference source for the plant operators that provides approaches to obtaining necessary instrument readings to support the implementation of the coping strategy

(see Section 3.2.1.10). This reference source should include control room and non-control room readouts and should also provide guidance on how and where to measure key instrument readings at containment penetrations, where applicable, using a portable instrument (e.g., a Fluke meter). Such a resource could be provided as an attachment to the plant procedures/guidance. Guidance should include critical actions to perform until alternate indications can be connected and on how to control critical equipment without associated control power.

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

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

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

On page 13 of the Integrated Plan, the licensee stated that strategies will be driven by qualified programs and procedures, including administrative controls to ensure that FLEX portable equipment remains available and deployment will be possible in all modes.

On page 47 of the Integrated Plan, the licensee stated that the capability will exist to take field readings of important plant parameters using non-electrical gauges/indicators or with installed transmitters through the use of hand held meters, and a reference source of field reading locations and instructions will be compiled. Some of the field reading locations may be at the containment penetrations.

The licensee was requested to address considerations 2, 3 and 4 regarding the procedural interfaces considerations for seismic hazards associated with 1) large internal flooding sources that are not seismically robust and do not require ac power, 2) the use of ac power to mitigate ground water in critical locations, and 3) deployment of equipment for those plants that could be impacted by failure of a not seismically robust downstream dam.

During the audit process, the licensee stated that PINGP large non-robust internal water sources consist of the condenser hotwell, the reactor makeup water tanks, lube oil reservoir, the heater drain tank and backwash storage and receiving tanks all located in the TB with a total volume of approximately 136,000 gallons for each unit, which would all drain into the condenser pit. Additionally the volume of each unit's condenser pit is 730,000 gallons; therefore the rupture of any of these tanks will not affect the credited mitigation strategies. The licensee also stated that PINGP does not use dewatering system to mitigate ground water intrusion therefore backup power is not required to mitigate groundwater. Information regarding the failure of a downstream dam is provided in TER Section 3.1.1.2 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 for seismic hazards, 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 15 of the Integrated Plan, the licensee stated the industry will establish two (2) Regional Response Centers (RRC) to support utilities during beyond design basis events. NSPM has signed a participation contract with the Strategic Alliance for FLEX Emergency Response (SAFER). Equipment will be moved from an RRC to a local assembly area, established by the SAFER team and the utility. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request.

During the audit process the licensee stated that an Xcel facility has been identified approximately 26 miles from the site that can be used as the RRC staging area (the Newport Service Center in Newport, MN.) However the SAFER group has not yet visited the site to review and plan routes for deployment of off-site resources. The licensee stated that they will provide these plans at a later date but prior to the February 2015 6-month update. This has been identified as Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.2 Flooding

NEI 12-06, Section 6.2 states:

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

NEI 12-06, Section 6.2.1 states in part:

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

On pages 4 and 5 of the Integrated Plan, the licensee stated that:

> External flooding events are applicable to the PINGP. As described in PINGP USAR Section 2.4, the current design bases flood for the PINGP is a flood on the Mississippi River. The flood is a relatively slow developing event; developing over several days with actions based on three-day forecasts of river water level. Finished site grade is at elevation 695 ft. Maximum predicted flood water level is 703.6 ft. with wave run-up to elevation 706.7 feet. Site grade would be flooded for approximately 13 days. Based on flood analysis information in PINGP USAR Appendix F, access to the site could be flooded for up to approximately 20 days.

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 flooding hazards, if these requirements are implemented as described.

3.1.2.1 Protection of FLEX Equipment - Flooding Hazard

NEI 12-06, Section 6.2.3.1 states:

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

2. Storage areas that are potentially impacted by a rapid rise of water should be avoided.

On page 2 of the Integrated Plan the licensee stated that:

> NSPM plans to construct two separate storage locations to meet the guidance of NEI 12-06. The equipment will be stored in structures that are designed to the ASCE 7-10, or an evaluated equivalent. The buildings will not be designed to withstand an external flood because the flood hazard has ample warning time to allow deployment of FLEX equipment. The planned new storage buildings will be located at elevations that prevent a flood from impacting access to FLEX equipment during the early stages of the flood.

However, the staff noted that the final locations and deployment routes have not been identified. The Integrated Plan indicates that identification of final storage locations for the FLEX equipment will be provided in the subsequent six month status reports. In addition, the staff noted that until the final storage locations are selected the deployment routes cannot be established. Identification of the final storage locations and deployment routes has been combined with Confirmatory Item 3.1.1.2.A in Section 4.2.

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

3.1.2.2 Deployment of FLEX Equipment - Flooding Hazard

NEI 12-06, Section 6.2.3.2 states:

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

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

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

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

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

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

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

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

On pages 2, of the Integrated Plan, the licensee stated that:

> There will be sufficient time for pre-staging of the Phase 2 FLEX equipment within the flood-protected areas of the building or above the flood level before the design basis flood level is reached. Phase 3 equipment from the Regional Response Center can be requested prior to the flooding of the main access road and set up on site in advance of the probable maximum flood. Plant procedures require shut down in preparation for flooding. Current procedures require the plant to shut down when the river level is predicted to exceed elevation 692 feet. Backup power supplies and pumps will be pre-staged as part of the plant procedures for construction of flood protection features. ... Portable pumps will be moved as necessary to ensure that they are protected from the flood but also have access to a water supply.

Regarding consideration 1 the licensee stated on page 2 of the Integrated Plan that there will be sufficient time for pre-staging of the Phase 2 FLEX equipment within the flood-protected areas of the buildings or above the flood level before the design basis flood level is reached. Phase 3 equipment from the Regional Response Center can be requested prior to the flooding of the main access road and set up on site in advance of the probable maximum flood. Plant procedures require shut down in preparation for flooding. Current procedures require the plant to shut down when the river level is predicted to exceed elevation 692 feet.

On page 56 of the Integrated Plan, the licensee identified vehicles, trailers and front end loader as the means for towing pumps and generators and transporting hoses, strainers, cables, and miscellaneous equipment to staging areas. During the audit, the licensee indicated that the vehicles used to deploy the FLEX equipment will be located inside the FLEX storage structure.

On page 22 of the Integrated Plan, the licensee stated that the connection points for SG makeup located in the AFW pump rooms are protected, (located in the Class 1 area of the turbine building) and that there are multiple access pathways for hose and cable routing to the connection points.

On page 30 of the Integrated Plan, the licensee stated that the connection points for RCS makeup are located in the Class 1 AB and are protected

During the audit, the licensee was requested to provide a discussion regarding considerations 2, 3, 4, 7, and 8 of NEI Section 6.2.3.2. In response, the licensee provided the following information regarding these considerations: Since the current design basis flood (DBF) indicates that the site could be flooded for approximately 13 days, the DBF mitigation strategy is to install flood panels at various doorways to prevent water intrusion. Plant procedures include steps to evaluate and restock supplies and provide a means to transport personnel and additional supplies to the site during flood conditions. This includes action to top off fuel tanks and setting up sump pumps for water removal which will be set up before the event. The DDCLPs are located in the screenhouse in an area protected from floods. These pumps provide access to the UHS, thus access to the UHS is protected during a flood. The licensee also stated that flood panels will be installed at various doorways to prevent water intrusion and sump pumps will be set up prior to the flood to support water extraction.

Consideration 6, hurricane storm surge, is not applicable to Prairie Island as the site is not located on a coastal area.

The staff noted that the final locations and deployment routes have not been identified. The Integrated Plan indicates that identification of final storage locations for the FLEX equipment will be provided in the subsequent six month status reports. In addition, the staff noted that until the final storage locations are selected the deployment routes cannot be established. Identification of the final storage locations and deployment routes has been combined with Confirmatory Item 3.1.1.2.A in Section 4.2.

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

3.1.2.3 Procedural Interfaces - Flooding Hazard

NEI 12-06, Section 6.2.3.3 states:

> The following procedural interface considerations should be addressed.

1. Many sites have external flooding procedures. The actions necessary to support the deployment considerations identified above should be incorporated into those procedures.

2. Additional guidance may be required to address the deployment of FLEX for flooded conditions (i.e., connection points may be different for flooded vs. non-flooded conditions).

3. FLEX guidance should describe the deployment of temporary flood barriers and extraction pumps necessary to support FLEX deployment.

On page 2 of the Integrated plan the licensee stated that there will be sufficient time for pre-staging of the Phase 2 FLEX equipment within the flood-protected areas of the building or above the flood level before the design basis flood level is reached. Phase 3 equipment from the RRC can be requested prior to the flooding of the main access road and set up on site in advance of the probable maximum flood

On page 6 of the Integrated plan the licensee stated that though specific strategies are being developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions. These preplanned strategies developed to protect the public health and safety will be incorporated into the unit emergency operating procedures in accordance with established EOP change processes, and their impact to the design basis capabilities of the unit evaluated under 10 CFR 50.59.

The licensee stated that actions to address core cooling during Phase 1 are currently provided within PINGP's EOP ECA 0.0, *Loss of All Safeguards AC Power.* ECA 0.0 will be updated, as necessary, to reflect the results from the ELAP related analyses. FSGs will be developed to support the ELAP event. These procedures will be developed in conjunction with the PWR Owners Group (PWROG).

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

3.1.2.4 Considerations in Using Offsite Resources - Flooding Hazard

NEI 12-06, Section 6.2.3.4 states:

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

During the audit process the licensee stated that an Xcel facility has been identified approximately 26 miles from the site that can be used as the RRC staging area (the Newport Service Center in Newport, MN.) However the SAFER group has not yet visited the site to review and plan routes for deployment of off-site resources. The licensee stated that they will provide these plans at a later date but prior to the February 2015 6-month update. This has been combined with Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.3 High Winds

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

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

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

On page 3 of the Integrated Plan the licensee stated that:

> The PINGP is located at 92° 37" 9' west longitude and 44° 37" 3' north latitude. As described in NEI 12-06, Section 7.2.1, tornadoes with the capacity to do significant damage are generally considered to be those with winds above 130 mph. Figure 7-2 in NEI 12-06 provides recommended design wind speeds for probability level of 10^{-6} per year of 191 mph based on the plant location. A tornado event has very little warning to enable anticipatory plant response. The design bases wind speed for the PINGP is 100 mph. Design bases tornado loadings are a pressure drop to 3 psi in 3 seconds, peripheral wind velocity of 300 mph with a forward progression of 60 mph. Tornado missiles design parameters are provided in PINGP USAR Table 12.2-9 and Table 12.2-43.

Although not specifically addressed in the Integrated Plan, PINGP screens out for hurricane winds because the site is located north and west of the 130 mph contour of NEI 12-06, Figure 7-1, which is in the direction of reducing peak-gust wind speeds. Therefore, evaluation of the licensee's protection, deployment, procedural interfaces, and offsite resources for high winds will only consider the hazards of a tornado.

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

3.1.3.1 Protection of FLEX Equipment - High Winds Hazard

NEI 12-06, Section 7.3.1 states:

> These considerations apply to the protection of FLEX equipment from high wind hazards:
>
> 1. For plants exposed to high wind hazards, FLEX equipment should be stored in one of the following configurations:
>
>   a. In a structure that meets the plant's design basis for high wind hazards (e.g., existing safety-related structure).
>
>   b. In storage locations designed to or evaluated equivalent to ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures* given the limiting tornado wind speeds from Regulatory Guide 1.76 or design basis hurricane wind speeds for the site.
>
>   - Given the FLEX basis limiting tornado or hurricane wind speeds, building loads would be computed in accordance with requirements of ASCE 7-10. Acceptance criteria would be based on building serviceability requirements not strict compliance with stress or capacity limits. This would allow for some minor plastic deformation, yet assure that the building would remain functional.
>
>   - Tornado missiles and hurricane missiles will be accounted for in that the FLEX equipment will be stored in diverse locations to provide reasonable assurance that N sets of FLEX equipment will remain deployable following the high wind event. This will consider locations adjacent to existing robust structures or in lower sections of buildings that minimizes the probability that missiles will damage all mitigation equipment required from a single event by protection from adjacent buildings and limiting pathways for missiles to damage equipment.
>
>   - The axis of separation should consider the predominant path of tornados in the geographical location. In general, tornadoes travel from the West or West Southwesterly direction, diverse locations should be aligned in the North-South arrangement, where possible. Additionally, in selecting diverse FLEX storage locations, consideration should be given to the location of the diesel generators and switchyard such that the path of a single tornado would not impact all locations.
>
>   - Stored mitigation equipment exposed to the wind should be adequately tied down. Loose equipment should be in protective boxes that are adequately tied down to foundations or slabs to prevent

protected equipment from being damaged or becoming airborne. (During a tornado, high winds may blow away metal siding and metal deck roof, subjecting the equipment to high wind forces.)

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

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

On page 3 of the Integrated Plan, the licensee stated that:

> NSPM plans to construct two separate storage locations to meet the guidance of NEI 12-06. The equipment will be stored in structures that are designed to the ASCE 7-10, or an evaluated equivalent. Large portable FLEX equipment will be secured for a high wind event and located so that it is not damaged by other items in a high wind event. The location of the structures will be selected considering the predominant tornado travel paths from the West or West Southwesterly direction, thus FLEX equipment will be stored in diverse locations in a North-South arrangement with sufficient separation distance such that "N sets" of equipment are protected and deployable after a tornado.

The staff noted that the final locations and deployment routes have not been identified. The Integrated Plan indicates that identification of final storage locations for the FLEX equipment will be provided in the subsequent six month status reports. In addition, the staff noted that until the final storage locations are selected the deployment routes cannot be established. Identification of the final storage locations and deployment routes has been combined with Confirmatory Item 3.1.1.2.A in Section 4.2

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

3.1.3.2 Deployment of FLEX Equipment - High Winds Hazard

NEI 12-06, Section 7.3.2 states:

> There are a number of considerations which apply to the deployment of FLEX equipment for high wind hazards:
>
> 1. For hurricane plants, the plant may not be at power prior to the simultaneous ELAP and LUHS condition. In fact, the plant may have been shut down and the plant configuration could be established to optimize FLEX deployment.

For example, the portable pumps could be connected, tested, and readied for use prior to the arrival of the hurricane. Further, protective actions can be taken to reduce the potential for wind impacts. These factors can be credited in considering how the baseline capability is deployed.

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

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

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

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

On page 3 of the Integrated Plan, the licensee stated that:

> Following a high wind event, deployment of FLEX equipment could be impaired by large debris. Debris removal equipment will be provided to ensure a clear path for deployment of FLEX equipment is available. The debris removal equipment will be protected to ensure it is available after a tornado.

As noted above in TER Section 3.1.3, the site is screened out for hurricane; therefore, considerations 1, 2 and 5 regarding hurricanes do not apply to PINGP.

On page 56 of the Integrated Plan, the licensee identified vehicles, trailers and front end loader as the means for towing pumps and generators and transporting hoses, strainers, cables, and miscellaneous equipment to staging areas. During the audit, the licensee indicated that the vehicles used to deploy the FLEX equipment will be located inside the FLEX storage structure. Based on the information above, the licensee addressed considerations 3 and 4 related to debris removal and its ability to deploy FLEX equipment with vehicles protected from the extreme external events.

The staff noted that the final locations and deployment routes have not been identified. The Integrated Plan indicates that identification of final storage locations for the FLEX equipment will be provided in the subsequent six month status reports. In addition, the staff noted that until the final storage locations are selected the deployment routes cannot be established. Identification of the final storage locations and deployment routes has been combined with Confirmatory Item 3.1.1.2.A in Section 4.2

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

3.1.3.3 Procedural Interfaces - High Winds Hazard

NEI 12-06, Section 7.3.3, states:

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

On page 6 of the Integrated Plan, the licensee stated that:

> Though specific strategies are being developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions. These preplanned strategies developed to protect the public health and safety will be incorporated into the unit emergency operating procedures in accordance with established EOP change processes, and their impact to the design basis capabilities of the unit evaluated under 10 CFR 50.59(p).

On page 13 of the Integrated Plan, the licensee stated that:

> Strategies will be driven by qualified programs and procedures, including administrative controls to ensure that FLEX portable equipment remains available and deployment will be possible in all modes. Specifically, outage arrangements will not prevent FLEX portable equipment deployment.

On page 18, and 26 of the Integrated Plan, the licensee stated that:

> Actions to address core cooling during Phase 1 are currently addressed within PINGP's EOP ECA 0.0, *Loss of All Safeguards AC Power.* ECA 0.0 will be updated, as necessary, to reflect the results from the ELAP related analyses. NSPM FSGs will be developed to support the ELAP event. These procedures will be developed in conjunction with the PWR Owners Group (PWROG).

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

3.1.3.4 Considerations in Using Offsite Resources - High Winds Hazard

NEI 12-06, Section 7.3.4 states:

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

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

During the audit process the licensee stated that an Xcel facility has been identified approximately 26 miles from the site that can be used as the RRC staging area (the Newport Service Center in Newport, MN.) However the SAFER group has not yet visited the site to review and plan routes for deployment of off-site resources. The licensee stated that they will provide these plans at a later date but prior to the February 2015 6-month update. This has been combined with Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.4 Snow, Ice and Extreme Cold

As discussed in part in NEI 12-06, Section 8.2.1:

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

On pages 3 and 4 of the Integrated Plan, the licensee stated that:

> Snow, Ice and Extreme Cold hazards are applicable to the PINGP, consistent with NEI 12-06 Section 8.2. The design basis for the PINGP is snow load of 50 lbs. per sq-ft of horizontal projected area for structures and components exposed to snow. The PINGP USAR is not specific with regards to values for design for ice or cold; however, the extreme cold temperature recorded in the Twin Cities is -34°F based on temperature data available from the University of Minnesota.

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

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

NEI 12-06, Section 8.3.1 states:

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

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

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

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

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

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

On page 4 of the Integrated Plan, the licensee stated that:

> NSPM plans to construct two separate storage locations to meet the guidance of NEI 12-06. The equipment will be stored in structures that are designed to the ASCE 7-10, or an evaluated equivalent, consistent with NEI 12-06 Section 8.3. Buildings will be provided with adequate heating to maintain a temperature that will ensure equipment is likely to function when called upon, and will also be designed to withstand required snow and ice loads.

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

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

NEI 12-06, Section 8.3.2 states:

> There are a number of considerations that apply to the deployment of FLEX equipment for snow, ice, and extreme cold hazards:
>
> 1. The FLEX equipment should be procured to function in the extreme conditions applicable to the site. Normal safety-related design limits for outside conditions may be used, but consideration should also be made for any manual operations required by plant personnel in such conditions.
>
> 2. For sites exposed to extreme snowfall and ice storms, provisions should be made for snow/ice removal, as needed to obtain and transport equipment from storage to its location for deployment.

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

On page 4 of the Integrated Plan, the licensee stated that:

> Personal protection gear will be available for use by plant personnel during deployment for extreme cold protection. Snow removal is a normal activity at the plant site because of the climate. Reasonable access to FLEX equipment will be maintained throughout a snow event. Ice management will be performed as required such that large FLEX equipment can be moved by vehicles. Debris removal equipment will be able to move through expected snow accumulations and can also be used to move portable equipment.

On page 14 of the Integrated Plan, the licensee stated that regarding consideration 1, FLEX equipment will be procured as commercial equipment unless credited for other functions; then the quality attributes of the other functions apply.

During the audit process the licensee was requested to provide a discussion regarding the possible formation of ice in the UHS and how it would be managed. In response the licensee stated that as shown on USAR Figure 10.4.3B, the top of the trash grating over the intake crib for the cooling water system emergency intake line is at elevation 664 ft. Normal water elevation at the site is approximately 674.5 ft. per USAR Section 2. This water level is controlled by lock and dam #3 thus the top of the intake crib is approximately 10 feet below normal river water elevation. The licensee concluded that the submergence of the intake crib provides assurance that it will not be affected by surface ice. Additionally the licensee stated that the flow rate in the branch channel where the intake crib is located is relatively low such that surface ice forms during the winter. However as described in the Army Corps of Engineers Cold Regions Technical Digest 91-1 the presence of surface ice precludes the formation of frazil ice that could impact the UHS

The staff noted that the final locations and deployment routes have not been identified. The Integrated Plan indicates that identification of final storage locations for the FLEX equipment will be provided in the subsequent six month status reports. In addition, the staff noted that until the final storage locations are selected the deployment routes cannot be established. Identification of the final storage locations and deployment routes has been combined with Confirmatory Item 3.1.1.2.A in Section 4.2.

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

3.1.4.3 Procedural Interfaces - Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.3 states:

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

The effects of snow and ice on access and movement of FLEX equipment is included in Section 3.1.4.2 of this TER.

On page 13 of the Integrated Plan, the licensee stated that:

> Strategies will be driven by qualified programs and procedures, including administrative controls to ensure that FLEX portable equipment remains available and deployment will be possible in all modes. Specifically, outage arrangements will not prevent FLEX portable equipment deployment.

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

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

NEI 12-06, Section 8.3.4, states that:

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

During the audit process the licensee stated that an Xcel facility has been identified approximately 26 miles from the site that can be used as the RRC staging area (the Newport Service Center in Newport, MN.) However the SAFER group has not yet visited the site to review and plan routes for deployment of off-site resources. The licensee stated that they will provide these plans at a later date but prior to the February 2015 6-month update. This has been combined with Confirmatory Item 3.1.1.4.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to use of off-site resources considering snow, ice and extreme cold conditions, 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 4 of the Integrated Plan, the licensee stated that:

> Consistent with NEI 12-06 Section 9.2, all sites will address high temperatures. The PINGP USAR is not specific with regards to values for design for heat; however, the extreme hot temperature recorded in the Twin Cities is 108°F based on temperature data available from the University of Minnesota.

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

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

On page 4 of the Integrated Plan, the licensee stated that:

> NSPM plans to construct two separate storage locations to meet the guidance of NEI 12-06. The equipment will be stored in structures that are designed to the ASCE 7-10, or an evaluated equivalent. Buildings will be provided with adequate ventilation to maintain reasonable storage temperatures.

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

3.1.5.2 Deployment of FLEX Equipment - High Temperature Hazard

NEI 12-06, Section 9.3.2 states:

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

On page 5 of the Integrated Plan, the licensee stated that:

> High temperature is not expected to impact the deployment of FLEX equipment. All FLEX equipment will be procured to be suitable for use in peak temperatures for the region.

On page 14 of the Integrated Plan, the licensee stated that regarding consideration 1, FLEX equipment will be procured as commercial equipment unless credited for other functions; then the quality attributes of the other functions apply.

During the audit, the licensee was requested to address the potential impact of high temperatures on the storage of equipment, e.g., expansion of sheet metal, swollen door seals, etc. In response the licensee stated that they have not selected the design for the FLEX equipment storage structure and that they are currently developing procurement specifications. The licensee also stated that they will specify the maximum temperature as a consideration for building design construction and that they have the tools available on site that can be used to open stuck doors as 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 provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to deployment of FLEX equipment considering high temperature conditions, if these requirements are implemented as described.

3.1.5.3 Procedural Interfaces - High Temperature Hazard

NEI 12-06, Section 9.3.3 states that:

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

On page 5 of the Integrated Plan, the licensee stated that all FLEX equipment will be procured to be suitable for use in peak temperatures for the region.

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

3.2 PHASED APPROACH

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

To meet these EA-12-049 requirements, licensees will establish a baseline coping capability to prevent fuel damage in the reactor core or 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 discussed in NEI 12-06, Section 1.3, plant specific analysis will determine the duration of each phase.

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

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

As described in NEI 12-06, Section 3.2.1.7 and JLD-ISG-2012-01, Section 2.1, strategies that have a time constraint to be successful should be identified and a basis provided that the time can be reasonably met. NEI 12-06, Section 3 provides the performance attributes, general criteria, and baseline assumptions to be used in developing the technical basis for the time constraints. Since the event is a BDB 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) prevention of recriticality as discussed in Appendix D, Table D-1.

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 performed 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).

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

The licensee provided the following information in response to the above request:

The following analysis in WCAP-17601-P is applied to PINGP: The base coping time scenario analysis is contained in Section 5.2.1 of the WCAP. Other important considerations related to WCAP-17601 are as follows:

1) Section 5.6 addresses accumulator injection of RCS boration. NPSM performed site specific analysis to quantify accumulator injection. The volume of water injected from the accumulators is a function of the extent of the RCS depressurization. The stopping point for the RCS cooldown is determined using the PWROG Core Cooling Position Paper. The calculation is available on the ePortal as Calculation 178599.51.2001.

2) Section 5.7 addresses RCS response with little or no RCS leakage. This section of the WCAP was not applicable during initial development of the Integrated Plan. NPSM is in the process of installing new low leakage RCP seals. When detailed information is available from FlowServe for the replacement seals, NPSM will evaluate the applicability of Section 5.7. This is covered in Section 3.2.1.2 of this TER.

3) Section 5.8 addresses maintaining subcriticality and recommends that a site specific analysis should be performed. NPSM performed site specific analysis of boric acid injection from the accumulators to demonstrate that this would maintain the core subcritical. The calculation is available on the ePortal as calculation 178599.51.2002.

As part of developing the Integrated Plan, the licensee also developed a supporting document, Number 178599.50.2200-02. Section 3.0 of this supporting document evaluates the applicability of the WCAP-17601-P analysis to PINGP and is available on the ePortal. Review of this analysis has been identified as Confirmatory Item 3.2.1.A in Section 4.2.

On page 20 of the Integrated Plan, the licensee stated that the discharge from the portable diesel-driven steam generator feedwater pump will be split to provide flow into a connection into the AFW lines downstream of each motor driven AFW pumps (MDAFWPs), and that this will provide flow to the SGs in both Units. In addition, the AFW system includes the capability to cross-connect the piping downstream of each MDAFWP. The licensee also stated that this cross-connection would provide the capability to feed the SGs for one or both of the Units from either of the two FLEX connection points. The licensee was requested to discuss any time constraints and necessary actions to operate the associated valves for this cross connection, and to describe the locations and accessibility of these valves to operate this cross-connection.

During the audit process the licensee provided the following information regarding AFW flow to the SGs:

- The DDCLPs and TDAFW pumps will be available therefore there are no associated time constraints to open the cross-tie valves, as there is no reason to believe that the DDCLPs and TDAFW pumps will not continue to operate. The valves are located in the AFW pump rooms and the valves are physically located higher up in the room. Both of the valves are configured with chains to allow operation form the floor level without requiring a ladder. There are two pathways to the AFW pump rooms, one each from the TB.

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 RCS cooling and heat removal, and inventory control strategies, if these requirements are implemented as described.

3.2.1.1. Computer Code Used for the 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 did not perform a plant-specific analysis to determine RCS response to the ELAP, however it did perform an analysis using RETRAN computer code, but only to predict the time needed to restore AFW following loss of off-site power. The licensee has used a comparison to WCAP-17601-P, Table 4.1.1-1, to provide a basis for PINGP's response to the ELAP. The licensee stated that, consistent with the Core Cooling Position Paper, comparison of the PINGP to WCAP-17601-P Section 5.4.2.1 shows that the PINGP core thermal power is less than that assumed in the WCAP and the total steam relief capability is greater than that assumed in the WCAP. Therefore, WCAP-17601-P can be applied to PINGP.

Although the licensee referenced WCAP-17601-P, the licensee did not clearly identify the code(s) and thermal-hydraulic analysis relied upon to support the Integrated Plan. It appears likely that the generic Westinghouse calculations with the NOTRUMP code informed the development of the Integrated Plan for PINGP. Although NOTRUMP has been reviewed and approved for performing small-break loss of coolant accident (LOCA) analysis for pressurized water reactors, the NRC staff had not previously examined its technical adequacy for simulating an ELAP event. In particular, the ELAP scenario is differentiated from typical design-basis small-break LOCA scenarios in several key respects, including the absence of normal emergency core cooling system (ECCS) injection and the substantially reduced leakage rate, which places significantly greater emphasis on the accurate prediction of primary-to-secondary heat transfer, natural circulation, and two-phase flow within the RCS. As a result of these differences, concern arose associated with the use of the NOTRUMP code for ELAP analysis for modeling of two-phase flow within the RCS and heat transfer across the SG tubes as single-phase natural circulation transitions to two-phase flow and the reflux condensation cooling mode. Although the above discussion focuses on the NOTRUMP code, regardless of the specific thermal-hydraulic code and analysis on which the PINGP's Integrated Plan is based, analogous concerns regarding the adequacy of code predictions of the time to reflux condensation cooling would remain applicable. This concern resulted in the following Confirmatory Item:

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

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

3.2.1.2 RCP Seal Leakage Rates

NEI 12-06, Section 1.3 states:

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

During the audit process the licensee was requested to provide additional information regarding RCP seal performance. The licensee responded by stating that new FlowServe seals have been installed in Unit 2 in the Fall of 2013, and new FlowServe seals will be installed in Unit 1 during the refueling outage in the Fall of 2014. These seals have a much lower leak rate than what was assumed (21 gpm per RCP) in the original Integrated Plan.

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

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

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

- A position paper dated August 16, 2013, entitled "Westinghouse Response to NRC Generic Request for Additional Information (RAI) on Reactor Coolant Pump (RCP) Seal Leakage in Support of the Pressurized Water Reactor Owners Group (PWROG)" (ADAMS Accession No. ML13235A151 (Non-Publicly Available)).

After reviewing these submittals, the NRC staff identified the following Confirmatory Item applicable to PINGP:

(1) Since PINGP will install FlowServe N-9000 seals (non-Westinghouse RCP seals) in the existing Westinghouse RCPs, the acceptability of the use of the non-Westinghouse

> RCP seals in the Westinghouse RCPs should be addressed, and the RCP seal leakages rates for use in the plant specific ELAP analysis should be provided with acceptable justification. This is identified as Confirmatory Item 3.2.1.2.A in Section 4.2 below.

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

3.2.1.3 Decay Heat

NEI Section 3.2.1.2 states in part:

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

The licensee was requested to address the applicability of assumption 4 from WCAP Section 4.2.1 Input Assumptions - Common to All Plant Types on page 4-13 of WCAP-17601, which states that "Decay heat is per ANS 5.1-1979 + 2 sigma, or equivalent", and to provide a discussion regarding the following key parameters used to determine the decay heat: (1) initial power level, (2) fuel enrichment, (3) fuel burnup, (4) effective full power operating days per fuel cycle, (5) number of fuel cycles, if hybrid fuels are used in the core, and (6) fuel characteristics are based on the beginning of the cycle, middle of the cycle, or end of the cycle. If a different decay heat model is used, the licensee was also requested to address the specific model and the acceptability of the model. This has been identified as Confirmatory Item 3.2.1.3.A in Section 4.2.

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

3.2.1.4 Initial Values for Key Plant Parameters and Assumptions

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

The licensee has not completed a plant specific analysis and notes that the technical basis for strategies, assumptions, acceptance criteria and time constraint are described in WCAP-17601-P. Issues regarding the plant specific analysis are discussed in

Sections 3.2.1 and 3.2.1.1 of the TER. The licensee stated that there were no differences or gaps between the WCAP reference case generic analysis and plant parameters.

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

3.2.1.5 Instrumentation and Controls

NEI 12-06, Section 3.2.1.10 provides the following guidance with regards to instrumentation and controls:

Actions specified in plant procedures/guidance for loss of ac power are predicated on use of instrumentation and controls powered by station batteries. In order to extend battery life, a minimum set of parameters necessary to support strategy implementation should be defined. 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 for PWR's

- SG Level
- SG Pressure
- RCS Pressure
- RCS Temperature
- Containment Pressure
- SFP Level

On pages 18, 21, and 23 of the Integrated Plan for Phase 1, 2, and 3, the licensee provided the following regarding instrumentation credited for ELAP analysis and to support strategy implementation:

RCS Hot Leg Temperature
RCS Cold Leg Temperature
RCS Wide Range Pressure
Steam Generator Levels
Core Exit Thermocouples
Pressurizer Level
RVLIS
AFW Pump Flow
SG Pressure
CST Level
Neutron Flux/Startup Rate

The licensee was requested to provide the following information: 1) a justification that the instrumentation listed and the associated indications are reliable and adequate to provide the desired functions on demand during the ELAP with the containment harsh conditions at high moisture, temperature and pressure levels, 2) a discussion of the containment analysis which addresses the adequacy of the analysis including the computer code/method and assumptions, and also, a discussion of the analysis used to determine the strategies and time requirements for actions beyond 7 days to reduce containment pressure and temperature, which addresses the adequacy of the analysis, 3) include a discussion of the analysis that is used to determine the containment temperature, pressure, and moisture profiles during the ELAP event, and address the adequacy of the computer codes/methods, and assumptions used in the analysis.

During the audit the licensee provided the following information regarding the containment analysis:

- The containment analysis for the ELAP scenario was performed using the CONTEMPT-LT/028 computer code. This is the same code and model that is used for the PINGP design basis containment response to a loss of coolant accident (LOCA). The analysis is summarized in OC-PX-2013-02 which is available on the ePortal. The model includes conservatisms that maximize the containment pressure and temperature response Initial conditions (pressure and temperature) inside containment assumed in the analysis is based on Technical Specification and current analysis limitations. The mass and energy input to the analysis is based on RCS leakage rates from WCAP-17601. The licensee is in the process of replacing RCP seals with FlowServe N-9000 seal with the Abeyance seal option. With the replacement seals, the seal leakage will be lower and containment results would also be lower.

- The analysis predicts a containment pressure of 41.7 psia and temperature of 233.7 degrees F after seven days. Containment design pressure and temperature are 60.7 psia and 268 degrees F. As shown in USAR Appendix K, Table K-28, peak pressure and temperature conditions for the design basis LOCA analysis are 43.5 psig and 265.1 degrees F. Instrumentation that is credited as part of the mitigation strategy is qualified for the post-LOCA conditions.

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

3.2.1.6 Sequence of Events

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

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

> Each site should establish the minimum coping capabilities consistent with unit-specific evaluation of the potential impacts and responses to an ELAP and LUHS. In general, this coping can be thought of as occurring in three phases:
>
> - Phase 1: Cope relying on installed plant equipment.
>
> - Phase 2: Transition from installed plant equipment to on-site FLEX equipment.

- Phase 3: Obtain additional capability and redundancy from off-site equipment until power, water, and coolant injection systems are restored or commissioned.

On pages 8 thru 12 the Integrated Plan the licensee provided a sequence of events (SOE) and the technical basis for each event. The basis for several of the time constraints in the SOE is contained in Table 5.2.2-1 of WCAP-17601-P. The discussion leading up to this table states that this reference case is based on a plant with a core power of 3723 MWt. The licensee did not specify any differences between the plant parameter values used in this reference case and PINGP's plant specific parameters. This has been identified as Open Item 3.2.1.6.A in Section 4.1 below.

The staff noted in the Integrated Plan that the licensee has not completed its Phase 2 Staffing Assessment. In addition, it is noted that the completion of this staffing assessment, including walkthroughs and licensee validation that defined actions from the FLEX strategies can be completed within the time constraints is necessary. This is identified as Confirmatory Item 3.2.1.6.B in Section 4.2 below

During the audit the licensee was requested to provide a discussion of the motive force for SG power-operated relief valve (PORV) operations by responding to the follow items:

(a) Specify the size of the SG PORV backup nitrogen supply source and the required time for its use as motive force to operate the SG PORV for mitigating an ELAP event.

(b) Discuss the analysis determining the size of the subject nitrogen supply to show that the nitrogen sources are available and adequate, lasting for the required time.

(c) Discuss the electrical power supply that is required for operators to throttle steam flow through the SG PORVs within the required time and show that the power is available and adequate for the intended use before the operator takes actions to manually operate the SG PORVs.

(d) Discuss the operator actions that are required to operate SG PORVs manually and show that the required actions can be completed within the required time.

During the audit, the licensee provided the following response to these questions regarding SG PORV operation:

- SG PORVS are normally operated from the control room (CR). The SG PORVs require an air supply from the instrument air system. The instrument air system would not be available in an ELAP scenario, thus, operation of the valves will be performed locally using the valve handwheel. Operating the valves locally using the handwheel is per established plant procedures for a SBO event.

- The SG PORVs are located in the AB which is a Class 1 structure. The steam and feedwater lines are also routed through the AB. With both units shutdown with the ELAP, the major heat source would be removed and the AB would not reach excessive temperatures.

- In addition the AB provides protection from cold outside air temperatures during and excessive cold event. The operators responsible for operating the SG PORVs would be in communication with the CR using sound powered communications to maintain RCS and SG conditions. Local SG pressure gauges are also available to the operators in the AB for monitoring SG pressure.

The licensee was requested to address the following items during the audit process:

a. Excessive moisture in the steam supply can disrupt turbine operation. Typically steam traps remove this excessive moisture. However, the condensate return lines from these traps can be isolated or crimped during an ELAP event. The licensee was requested to provide a discussion on how the steam traps will continue to operate during an ELAP event if the condensate header is isolated or can become isolated during an ELAP, and if the condensate discharges to a local sump, address long term area temperature and humidity along with the removal of the condensate before local room flooding can occur.

b. The TDAFW pump has mini flow recirc line that provides relief from dead heading the pump. This recirc may not be protected from external events associated with an ELAP event. The licensee was requested to assess operation of the mini flow recirc line and describe any actions required if the line become crimped, or severed resulting in loss of inventory.

During the audit process the licensee provided the following information regarding the above concerns:

- The steam traps are provided to remove condensate in the lines when the TDAFW pump is not operating. There are no valves that would be closed that would isolate the drain system for the TDAFW pump steam supply. The condensate drain lines are routed from the steam line for the TDAWF pump to the condenser. This pipe routing is within the AFW pump room and the lower elevations of the TB. These lines would be well shielded and thus, would be reasonably protected from damage during an external event. Thus, there is reasonable assurance that the drain path would be available. In addition, based on saturated steam conditions when the pump is operating and pump operational history, NSPM believes that the pump can operate if the traps are not available.

- In addition to providing a minimum flow path, the recirculation line also provides cooling for the associated lube oil cooler. Normally the recirculation line is routed back to the CST. During the ELAP scenario, the operator would locally control AFW flow to the SGs and also monitor pump parameters in the AFW pump room. Blockage of the recirculation line would be indicated by rising oil temperatures. If temperatures were increasing, the operator can open a local valve to provide a flow path to a drain.

The licensee was requested to clarify whether the SG PORV or upstream associated piping is a safety system, protected from external events such as tornados. In response the licensee stated that the SG PORV and upstream piping is safety related and designed for external events such as an earthquake, and is also located within the AB, which is a Class 1 structure protected from tornadoes. Thus, the staff determined that in accordance with the guidance in NEI 12-06, these components are robust with respect to design basis external events and are assumed to be fully available for an ELAP/LUHS.

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 and Open Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to the SOE 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 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 licensee informed the NRC staff of their plans to abide by this generic resolution. The NRC staff will evaluate the licensee's resulting program through the audit and inspection processes.

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

3.2.1.8 Core Sub-Criticality

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

> All plants provide means to provide borated RCS makeup.

The licensee was requested to discuss the results of the plant specific boration analysis and show that the core will remain sub-critical throughout the ELAP event for the limiting condition with respect to shutdown margin. Note that the limiting conditions with respect to shutdown margin may be different than for the core cooling analysis (e.g., no seal leakage versus the maximum postulated value).

During the audit process the licensee stated that the PINGP design includes the following sources of borated water:

- Two SI Accumulators per unit. Technical Specification 3.5.1 defines accumulator volume and boric acid requirements. Each accumulator maintains between 1250 and 1290 cubic feet of borated water. Minimum boron concentration in each accumulator is 2300 ppm
- One Refueling Water Storage Tank (RWST). Technical Specification 3.5.4 defines RWST volume and boric acid requirements. The RWST contains a

minimum of 265,000 gallons of borated water with a concentration between 2600 and 3500 ppm.

- There are other sources of higher concentrated borated water such as the Boric Acid Storage Tanks, but the other sources are not credited as part of the ELAP mitigation strategies.

The ELAP analysis assumes uniform boron mixing. Injection of boric acid from the SI Accumulators occurs during the RCS cooldown and depressurization. Attachment 1A in the OIP shows that the cooldown to approximately 430F (SG pressure of 350 psig) is completed in the 4 to 5 hour timeframe; although cooldown is not a specific time constraint. Calculations, documented in the Xcel Energy correspondence IC OC-PX-2012-021, were performed to determine the time requirements for boric acid injection to maintain sub-criticality. This document is uploaded to the ePortal. These calculations were performed for Beginning-of-Cycle (BOC), Middle-of-Cycle (MOC) and End-of-Cycle (EOC) conditions at RCS temperatures of 350 and 420F. Lower RCS temperature is conservative relative to the 430F. The limiting condition is EOC, where boric acid needs to be injected between 36 and 40 hours to maintain subcriticality. This provides more than enough time for mixing to occur. An additional calculation, 178599.51.2001, was performed to determine the volume of water injected from the SI Accumulators during the cooldown taking no credit for RCS leakage. This calculation confirmed the boric acid injected by the SI Accumulators was sufficient to maintain subcriticality indefinitely. This calculation is uploaded to the ePortal.

With the relatively early injection from the Accumulators there is assurance that there would be adequate natural circulation flow to promote mixing. In addition, there are more than 30 hours between the time of the boric acid injection from the Accumulators and the time period when criticality could occur if the boric acid were not injected. This provides ample time for mixing to occur.

NPSM recognizes that Westinghouse is developing a WCAP to evaluate boron mixing. NPSM will review the WCAP, when it is available, for any additional changes that should be considered for the strategies.

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

The Pressurized Water Reactor Owners Group (PWROG) submitted a position paper, dated August 15, 2013 (withheld from public disclosure due to proprietary content), which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlined applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available. In an endorsement letter dated January 8, 2014 (ADAMS Accession No. ML13276A183), the NRC staff concluded that the August 15, 2013, position paper constitutes an acceptable approach for addressing boric acid mixing under natural circulation during an ELAP event, provided that the following additional conditions are satisfied:

(1) The required timing for providing borated makeup to the primary system should consider conditions with no reactor coolant system leakage and with the highest applicable leakage rate for the reactor coolant pump seals and unidentified reactor coolant system leakage.

(2) For the condition associated with the highest applicable reactor coolant system leakage rate, two approaches have been identified, either of which is acceptable to the staff:

   a. Adequate borated makeup should be provided such that the loop flow rate in two-phase natural circulation does not decrease below the loop flow rate corresponding to single-phase natural circulation.

   b. If loop flow during two-phase natural circulation has decreased below the single-phase natural circulation flow rate, then the mixing of any borated primary makeup added to the reactor coolant system is not to be credited until one hour after the flow in all loops has been restored to a flow rate that is greater than or equal to the single-phase natural circulation flow rate.

(3) In all cases, credit for increases in the reactor coolant system boron concentration should be delayed to account for the mixing of the borated primary makeup with the reactor coolant system inventory. Provided that the flow in all loops is greater than or equal to the corresponding single-phase natural circulation flow rate, the staff considers a mixing delay period of one hour following the addition of the targeted quantity of boric acid to the reactor coolant system to be appropriate.

The additional conditions specified in the NRC's endorsement letter were not known to the licensee at the point in the audit considered for this TER, nor had the licensee informed the staff of its intent to abide by the white paper. However, the licensee's boron mixing discussion above does address some of the considerations of the NRC staff regarding the review and endorsement of the PWROG position paper. Therefore, further clarification is needed from the licensee on its commitment to abide by the generic approach discussed above with the additional conditions specified in the NRC's endorsement letter, and further staff review of the calculations documented in the Xcel Energy correspondence IC OC-PX-2012-021 is required for the staff to determine if the boron mixing discussion above is an acceptable approach. This is identified as Confirmatory Item 3.2.1.8.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 Open Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to core sub-criticality if these requirements are implemented as described.

3.2.1.9 Use of Portable Pumps

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

> Regardless of installed coping capability, all plants will include the ability to use portable pumps to provide RPV/RCS/SG makeup as a means to provide diverse capability beyond installed equipment. The use of portable pumps to provide RCS/SG makeup requires a transition and interaction with installed systems. For example, transitioning .... 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 page 20 of the Integrated Plan, the licensee stated that following plant cooldown to approximately 350 psig SG pressure, continued heat removal would be accomplished using the TDAFW pump. The licensee also stated that as a backup to the TDAFW pump, portable feedwater capability will be installed. The discharge from the portable pump will be split to provide flow into a connection into the AFW lines downstream of each MDAFWP. This will provide flow to the SGs in both Units. In addition, the AFW System includes the capability to cross-connect the piping downstream of each MDAWFP. This cross-connection would provide the capability to feed the SGs for one or both of the Units from either of the two FLEX connection points.

The licensee provided a portable pump to be used to supply water to the SGs via a connection into the AFW lines downstream of each MDAFWP, and specified in the table on page 56 of 67 of the Integrated Plan that the pump has a 400 gpm (flow rate) and discharge pressure sufficient to provide required flow against SG backpressure of 350 psig. The licensee was requested to provide a discussion or analysis regarding deployment timing and under what circumstances this portable pump would be needed. The licensee was also requested to clarify the timing for the installation and use of the portable pump to supply the SGs under the WCAP Table 5.2.2-11 which specifies a cooldown to 300 psia or 285 psig which is different that the PING pressure of 350 psig.

In response, the licensee provided the following information:

- The value of 300 psia in WCAP Table 5.2.2-1 is the value from the Westinghouse Emergency Response Guidelines (ERGs) as noted in Section 5.6.1 in WCAP-17601. Each plant should determine their site specific values to preclude nitrogen injection into the RCS from the SI Accumulators. NPSM determined the 350psig value using the methodology in the PWROG Core Cooling Position Paper. The determination is documented in Calculation 178559.51.2001, and serves as the basis for the 350 psig backpressure in the SGs used for sizing the portable SG makeup pump.

- The flow rate of 400 gpm described in the Integrated Plan is sized to provide 200 gpm to each Unit which is representative of required AFW flow shortly after shutdown. After 34 hours, the required flow rate would be less than 60 gpm per Unit, thus the pump sizing is conservative.

- As Identified in Attachment 1A of the Integrated Plan, the action to install the portable SG makeup pump is not considered an ELAP time constraint. The source of water to the DDCLPs is considered infinite and is expected to be available beyond 24 hours. The 24 hour time period for providing the portable SG makeup pump is considered to be a reasonable time frame for installing the portable secondary water supply given that there are other higher priorities. It is expected that installing the portable diesel generators for repowering the MCCs to restore the battery chargers and the DDCLP fuel oil transfer pumps will be a higher priority as these have defined time constraints. Although 24 hours was identified in the Integrated Plan, it is planned that site procedures will direct installation of the portable SG injection as soon as resources permit and well before 24 hours.

The licensee originally stated that they planned to operate a DG inside the AB but did not discuss a plan to provide a pathway for diesel exhaust. The licensee was requested to provide a discussion of the vent path for diesel exhaust from the AB if a diesel is operated in this enclosed space. In response, the licensee stated that intent of this strategy was to provide a portable electric pump for RCS makeup in the AB, and the power would be supplied by a portable DG located outside the AB. The licensee has revised their strategies to now re-power an installed charging pump using a portable DG located outside the AB. In addition, the licensee stated that subsequent to submittal of the Integrated Plan, it was decided that the existing RCP seals will be replaced with the FlowServe N-9000 with the Abeyance seal option. With the new RCP seals the licensee anticipates that the time required before a makeup water source is required can be extended such that the portable pump would not be necessary until phase 3, which still needs to be confirmed based on the final seal design information from FlowServe. As part of the strategies, the RRC will provide a portable RCS makeup pump and the licensee will either provide the connection points for the portable pump or provide a procedure with the necessary equipment to install the portable pump, when needed. Thus, the reviewer noted that the licensee needs confirmation of the leakage rates in order to demonstrate that the time required before a makeup water source is required for RCS inventory control can be extended such that the portable pump would not be necessary until phase 3. In addition, the licensee needs to determine the method or connection point for the RCS portable pump. This is identified as Confirmatory Item 3.2.1.9.A in Section 4.2.

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

3.2.2 Spent Fuel Pool Cooling Strategies

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

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

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

On page 12 of the Integrated Plan the licensee stated that per Action Item 9 in the SOE they would pre-stage equipment on SFP floor at 33 hours, and to avoid concerns related to habitability during installation, the strategy will be to install the makeup hose prior to pool boiling. During the initial part of Phase 2, SFP cooling is provided by allowing the pool liquid to heat-up and then boil. For the ELAP scenario, the time to boiling is expected to be greater than 33 hours.

On page 45 of the Integrated Plan the licensee stated that Phase 3 equipment for PINGP includes installation of two 4.16 kV FLEX DGs provided from the RRC. Alternate connection points for each unit will be provided to the opposite train inside the 4.16 kV bus rooms in the TB (Unit 1) and the D5/D6 Building (Unit 2). The RRC 4.16 kV generators will provide the option to repower a SFP cooling or CC Pumps and associated support equipment to restore normal SFP cooling or makeup.

The licensee is in the process of identifying SFP cooling strategies and noted that, when the SFP reaches a particular level, actions will be taken to provide makeup to the SFP. This level will be higher than the Level 2 defined in NSPM's response to NRC Order EA-12-051. The licensee was requested to provide an update to the SFP cooling strategies.

The licensee provided the following information regarding updated SFP cooling strategies:

- Mitigation strategies for SFP cooling are described in document 178559.50.2200-02 for ELAP strategies
- SFP cooling is provided by allowing the pool liquid to heat-up and then boil. USAR Section 10.2.2.3 and associated calculations indicate that under maximum heat load conditions, the time to boiling is 8 hours and the time to boil off to elevation 727 ft. (above the top of the fuel assemblies) is another 56 hours, with a boil off rate of less than 66 gpm.
- The licensee also described a Normal case for SFP heat load as 1362 normally discharged fuel assemblies with a resultant time to boiling of 34 hours.

- As described in the Integrated Plan, the licensee will provide that capability to install the SFP makeup equipment before boiling starts. This strategy is described in the existing B.5.b strategy in EDMG-2 Attachment A. The procedure requires drawing water from the intake bay of from the pump safeguards bay via the emergency intake line and is capable of being implemented with 2 hours. A backup strategy that does not require access to the SFP area will be provided through a connection to the SFP skimmer system using a portable pump.
- The capacity of the makeup system will exceed 66 gpm. The B.5.b strategy provides the capability to inject 500 gpm. The strategy will continue until the Phase 3 strategy can be implemented.

The licensee was requested to specify any measures to be taken or identify any strategies to vent steam and condensate from the SFP in the event boiling occurs. In response the licensee stated that the SFP enclosure, a Class 1 structure is located within the common area of the AB. The strategy is to open the roll-up doors from the common areas of the AB to the outside to vent any steam the leaks form the SFP enclosure.

During the audit process, the staff noted that the licensee's existing B.5.b strategy and procedures includes a means to provide SFP spray monitor nozzles that are capable of providing a minimum of 200 gallons per minute (gpm) per unit (250 gpm to account for overspray). Thus, the staff noted licensee's capability to provide SFP spray is consistent with the guidance provided in Table D-3 of NEI 12-06. Licensee acknowledgement that the spray capability noted above is correct and conforms to NEI 12-06 Table D-3 has been identified as Confirmatory Item 3.2.2.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 SFP cooling, if these requirements are implemented as described.

3.2.3 Containment Functions Strategies

NEI 12-06, Table 3-2 and Appendix D provide some examples of acceptable approaches for demonstrating the baseline capability of the containment strategies to effectively maintain containment functions during all phases of an ELAP. For example, containment pressure control/heat removal utilizing containment spray.

On pages 34 and 36 of the Integrated Plan, the licensee stated that containment pressure and temperature analyses were performed using mass and energy release rates associated with RCP seal package leak rate from WCAP-17601-P with an additional 1 gpm leak rate assumed from the RCS and that the analyses results show that containment pressure and temperature remain below the limits beyond seven days, therefore, no actions are needed regarding containment pressure and temperature during Phase 1 or 2.

On page 38 of the Integrated Plan, the licensee stated Phase 3 equipment for PINGP includes installation of two 4.16 kV generators provided from the RRC. Alternate connection points for each unit will be provided to the opposite train inside the 4.16 kV bus rooms in the TB (Unit 1) and the D5/D6 building (Unit 2). The RRC 4.16 kV generators will be used to repower at least one containment fan coil unit (CFCU). Cooling water to the operating CFCU(s) will be provided using a DDCLP or a repowered motor driven cooling water pump (121 MDCLP). With one fan coil unit running inside of each containment, containment pressure and temperature can be controlled. Each of the 4.16 kV RRC FLEX DGs will be capable of carrying approximately 2000 kW load which will be sufficient to carry all of the loads on a 4.16 kV safeguard bus necessary to support the Phase 3 FLEX strategies for providing containment heat removal for one unit. This load will be confirmed once the design process is complete. If necessary, any changes will be reported in the six month status report. Loads previously shed will be reestablished to provide breaker control functions.

The licensee performed a containment integrity analysis using the CONTEMPT-LT/028 computer code, and noted that no actions were required to maintain containment in Phase 1 or 2. The licensee specified that for Phase 3 "Cooling water to the operating CFCU(s) will be provided using a DDCLP or a repowered motor driven cooling water pump (121 MDCLP)." The licensee was requested to provide a discussion of the results of the analysis details, and supporting information regarding the CONTEMPT computer code analysis that determined the above times for the need for containment cooling.

The licensee provided the following information regarding the containment ELAP analysis:

- During the audit process the licensee stated that the containment analysis for the ELAP scenario was performed using the CONTEMPT-LT/028 computer code. This is the same code and model that is used for the PINGP design basis containment response to a LOCA. The analysis is summarized in OC-PX-2013-02 which is available on the ePortal.

- This analysis is considered to be conservative as there will still be CL flow through the CFCUs with at least one DDCLP operating. The dampers in the containment ventilation system fail open, thus even without forced air flow there will be some heat removal due to natural circulation that is not credited in the calculation. The model includes conservatisms that maximize the containment pressure and temperature response. Initial conditions (pressure and temperature) inside containment assumed in the analysis is based on Technical Specification and current analysis limitations. The mass and energy input to the analysis is based on RCS leakage rates from WCAP-17601. The licensee is in the process of replacing RCP seals with Flow serve N-9000 seal with the abeyance seal option. With the replacement seals, the seal leakage will be lower and containment results would also be lower.

- The analysis predicts a containment pressure of 41.7 psia and temperature of 233.7 degrees F after seven days. The containment design pressure and temperature are 60.7 psia and 268 degrees F, respectively. As shown in USAR Appendix K, Table K-28, peak pressure and temperature conditions for the design basis LOCA analysis are 43.5 psig and 265.1 degrees F. Instrumentation that is credited as part of the mitigation strategy is qualified for the post-LOCA conditions.

On page 38 of the Integrated Plan, the licensee stated that the Phase 3 strategy to maintain containment is to repower at least one CFCU, and that cooling water to the operating CFCUs will be provided using a diesel driven cooling water pump or a repowered motor driven cooling water pump. The NRC has identified a potential issue with steam generation within the cooling water circuit of a containment fan cooler due to high containment temperatures in ELAP conditions. As addressed in NRC GL 96-06, steam generation is adverse as it can lead to water hammer events on re-initiating cooling water system flow. The licensee was requested to discuss this consideration related to steam generation within the water circuit.

In response, the licensee stated the following regarding the CFCUs:

- As part of the strategies, the DDCLPs are running to provide cooling water flow to the suction of the AFW pumps. When the DDCLPs are operating there is also flow through the CFCUs. Thus, steam formation in the CFCUs would not be a concern when the DDCLPs are operating. If only one DDCLP is operating and a suction path was only available through the Emergency Intake Line, the flow through two of the CFCUs per unit would be isolated to reduce the system flow demand. The isolation is accomplished by closing a valve in the outlet from each CFCU. The supply line to the CFCUs is still open and the operating DDCLP would maintain the pressure above the saturation pressure for the containment temperature.

On pages 34, 36, and 38 of the Integrated Plan for Phases 1 - 3, the licensee listed the essential instrumentation for the ELAP mitigating strategies but did not include instrumentation for measuring the temperature of the containment atmosphere. During the audit, the licensee was requested to provide the basis for concluding that monitoring the temperature of the containment atmosphere is not required.

In response, the licensee stated the following regarding monitoring the temperature of the containment atmosphere:

- Since the predicted containment temperature after seven days is well below design temperature and the analysis is considered to be very conservative, monitoring of containment temperature is not considered to be 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 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 was requested to provide information regarding cooling functions provided by such systems as auxiliary building cooling water, service water, or component cooling water cooling when ac power is lost during the ELAP for Phase 1 and 2. For example, the potential need for cooling water for the TDAFW pump and the DDCLP bearings was not discussed.

In response, licensee stated that the following installed pumps are credited in the ELAP mitigation strategies; The TDAFW, DDCLP and the charging pumps. These pumps do not rely on other systems for support functions. Flow tapped from the discharge piping of the TDAFW pump provides associated bearing cooling and cooling for the lube oil heat exchanger. Flow tapped from the discharge of the DDCLP provides the associated jacket water cooling, bearing cooling and gear oil cooling. The charging pump does not rely on other systems for any cooling or lubrication.

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 portable equipment functionality can be maintained. Nonetheless, the only portable equipment used for coping strategies identified in the Integrated Plan that would require some form of cooling are portable diesel powered pumps and generators. These self-contained commercially available units would not be expected to require an external cooling system nor would they require AC power or normal access to the UHS.

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

3.2.4.2 Ventilation – Equipment Cooling

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

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

> provided to the affected cabinet or area, and/or designate alternate means for monitoring system functions.
>
> For the limited cooling requirements of a cabinet containing power supplies for instrumentation, simply opening the back doors is effective. For larger cooling loads, such as HPCI, RCIC, and AFW pump rooms, portable engine-driven blowers may be considered during the transient to augment the natural circulation provided by opening doors. The necessary rate of air supply to these rooms may be estimated on the basis of rapidly turning over the room's air volume.
>
> Temperatures in the HPCI pump room and/or steam tunnel for a BWR may reach levels which isolate HPCI or RCIC steam lines. Supplemental air flow or the capability to override the isolation feature may be necessary at some plants. The procedures/guidance should identify the corrective action required, if necessary.
>
> Actuation setpoints for fire protection systems are typically at 165-180°F. It is expected that temperature rises due to loss of ventilation/cooling during an ELAP/LUHS will not be sufficiently high to initiate actuation of fire protection systems. If lower fire protection system setpoints are used or temperatures are expected to exceed these temperatures during an ELAP/LUHS, procedures/guidance should identify actions to avoid such inadvertent actuations or the plant should ensure that actuation does not impact long term operation of the equipment.

On page 8 of the Integrated Plan, the licensee stated that environmental conditions within the station compartments were evaluated using the GOTHIC and HEATSINK computer models.

On pages 47 and 48 of the Integrated Plan, the licensee stated that for Phase 1:

> A loss of Control Room cooling is addressed in current plant procedures; which include actions to open panel doors in the Control Room, reduce heat loads and provide natural circulation air flow or a temporary fan. Calculations performed to evaluate temperature transients in the Control Room include a case for reduced heat load and natural circulation provided by opening the doors between the Control Room and Turbine Building. The results show that the doors would need to be opened at about 11.7 hours to maintain the Control Room temperature less than the acceptance criteria of 120°F. After the doors are open, the Control Room temperature stabilizes at approximately 106°F. Thus, the analysis indicates that no actions are needed during Phase 1 to provide Control Room cooling. However, it may be desirable to take actions, (i.e., open doors) sooner based on human comfort considerations. These considerations will be factored into the procedures.
>
> A calculation of the loss of AFW Pump room cooling shows that, without cooling, the temperature in the rooms does not increase above temperatures that will adversely impact equipment in the room. Because the calculation assumes operation of equipment such as air compressors and motor driven AFW pumps that will not be operating, the inputs to this calculation are conservative relative to the ELAP scenario. In the ELAP scenario, the heat rejection rates to the room

are based on the TDAFW Pumps operating. Based on the lower heat rejection rates, the temperatures in the room would be lower in an ELAP than predicted in current calculation. In addition to equipment capability, operator actions are required in the AFW Pump rooms for an ELAP. To be conservative, doors will be opened, as necessary, between the AFW Pump Rooms and the Turbine Building in order to maintain room temperatures acceptable for personnel.

Cooling for the Battery Rooms is provided by opening doors per PINGP EOP ECA 0.0, *Loss of All Safeguards AC Power*. Calculations performed to evaluate temperature transients in the Battery Rooms demonstrate that opening the doors between the Battery Rooms and the Turbine Building at approximately 18 hours maintains the temperature in the Battery Rooms less than the limiting value of 120°F. Thus, no actions are required during Phase 1 to provide battery room cooling.

For an ELAP scenario, DDCLP Room temperature response with the ventilation system not functioning has been determined through testing. The testing demonstrated that with outside ambient air temperature of approximately 85°F, the room temperature did not exceed 100°F. The maximum acceptable temperature in the DDCLP Room is 135°F. Thus, there is reasonable assurance that, even with elevated outside air temperatures, the temperature in the pump rooms will not reach unacceptable levels during Phase 1.

On page 50 of the Integrated Plan the licensee stated that for Phase 2:

In addition, portable fans will be available and can be installed to further reduce room temperatures.

Additional formal analysis will be performed to determine the timing and scope of the supplemental cooling or hydrogen ventilation required, and the results of this analysis will be provided in a six-month status report.

As described above in the discussion related to the fuel oil transfer pumps, a portable FLEX diesel generator will be installed to repower 480VAC Motor Control Centers (MCC) IABI or IAB2 in the Plant Screenhouse. In addition to repowering the fuel oil transfer pumps, this will also restore the HV AC system for the DDCLP Rooms.

Regarding the TDAFW pump room, the battery rooms, and the diesel driven cooling water pump room, the licensee will use a strategy of opening doors to adjacent compartments to maintain acceptable temperatures for equipment operation. The licensee was requested to provide; 1) a summary of the analysis and/or technical evaluation performed to demonstrate the adequacy of the ventilation provided in the TDAFW pump room to support equipment operation throughout all phases of an ELAP; and 2) a discussion on the adequacy of the ventilation provided in the battery room to protect the batteries from the effects of extreme high and low temperatures.

During the audit process the licensee provided the following information regarding the TDAFW pump room, the DDCL rooms and the battery rooms:

- An analysis was previously performed to estimate AFW room temperature conditions with no forced cooling, which compared the analysis equipment heat rejection rate verses the ELAP equipment heat rejection rate. The analysis predicts that at 39 hours the room temperature is approximately 132 degrees F; which is determined to be acceptable for equipment operation. This is documented in Calculation ENG-ME-021. Thus with lower heat rejection rates assumed during the ELAP the temperature profile for the ELAP would be much lower. Therefore, no actions such as opening doors are required in the ELAP scenario to maintain room temperature below operating limits. There are operator actions in the TDAFW pump room during the event, and habitability will be maintained by opening doors, monitoring operators and limiting stay times, if necessary. Opening doors is a step in current operating procedures that is not performed as part of the step sequence and not based on room temperature monitoring.

- Regarding the battery rooms, the maximum allowable temperature in the battery rooms is 120 degrees F. Battery room heatup calculation shows that 120 degrees F is reached in about 18 hours. Opening doors reduces the battery room temperature to approximately 100 degrees F and is documented in Calculation EVAL-XCELP-11-01. Opening doors is performed per existing plant procedures. The calculation does not credit the reduction in heat load in the rooms due to the battery load shedding, thus the calculation is conservative. Operator actions in the battery rooms to perform load shedding activities are performed within the first 60 minutes and the predicted battery room temperature at 60 minutes is less than 100 degrees F. Opening doors is a step in current procedures that is not performed as part of the step sequence and based on room temperature monitoring.

- Regarding the DDCLP rooms the maximum allowable temperature is 135 degrees F. Similar to an ELAP scenario, data has been collected for DDCLP room temperature response with no ventilation. The data demonstrated that with outside ambient air temperature of approximately 85 degrees F, the room temperature did not exceed 100 degrees F. Thus there is reasonable assurance that even with elevated outside air temperatures, the temperature in the pump rooms will not reach unacceptable levels during phase 1, during Phase 2, a portable generator is used to repower the MCCs in the screen house at 8 hours. In addition repowering the fuel oil transfer pump to refill the DDCLP fuel oil tank, repowering the MCC from the portable generator also repowers the forced ventilation fans from the DDCLP rooms.

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 ventilation for 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 provide a discussion of the effects on the core cooling strategies of loss of power to heat tracing. During the audit process the licensee stated that the CSTs would initially be used for Phase 1 coping, and since the tanks are located outside, heat trace is provided for outside piping. Additionally during the initial response the already heated water would be flowing through lines and should not be subject to freezing. If the CSTs are not available the CL and AFW systems are used to provide makeup flow to the SG's, and are located inside of buildings and are not exposed to the severe cold conditions.

The licensee was requested to discuss whether the potential for an extreme cold event to result in boric acid precipitation or the freezing of water in equipment that would be subject to abnormally low temperatures (e.g., installed piping, instrument lines, and tanks; FLEX piping and hoses, FLEX equipment used to prepare additional borated coolant) has been analyzed and verified as being unable reduce or interrupt the flow of coolant necessary to mitigate an ELAP. The licensee was also requested to account for the potential for loss of normal heating, and heat tracing due to the ELAP event.

During the audit process the licensee provided the following information regarding boric acid heat tracing:

- The lines that would contain boric acid for RCS makeup are located in the AB. The AB is a thick walled concrete structure that contains systems that would continue to give off heat after the unit trip; for example, steam and feedwater lines. Thus, the AB would not be expected to rapidly cooldown.

- The piping systems used for RCS makeup would contain a relatively low concentration of boric acid, less than the maximum concentration of 3500 ppm in the RWST. The solubility temperature for 3500 ppm boric acid is low, i.e., near freezing. Systems that contain higher concentration boric acid, such as the BASTs, are not relied on as part of the strategies.

- Therefore, heat tracing is not considered 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 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.

On page 48 of the Integrated Plan, the licensee stated that lighting is required for operator actions and access in the plant to implement actions associated with the procedures. Emergency lighting will not be available due to being stripped from the batteries in order to extend battery capability. Available lighting will be the battery-backed Appendix R light units and portable lighting that personnel can use such as head lamps and flashlights.

On pages 50 and 51 of the Integrated Plan, the licensee stated that with the use of a portable generator to the dc system, described above, the emergency lighting system will be restored.

On page 48 of the Integrated Plan, the licensee stated that battery powered Appendix R lighting would not be available until a portable diesel generator was connected to re-power the dc system. Action Item 14 of the SOE on page 59 of the Integrated Plan specifies that at 16 hours, "Provide power to Motor Control Centers 1AC1, 1AC2, 2AC1, and 2AC2 to Maintain DC." The licensee was requested to discuss how power will be maintained for portable lighting until 16 hours into the event when diesel generators will repower noted busses.

During the audit process the licensee stated that the PINGP design includes emergency incandescent lighting that is initially powered from the batteries, and that to extend battery life the strategy described in the Integrated Plan is to shed the emergency lighting load. The PINGP design also includes Appendix R lighting units installed throughout the plant, which are sized for a minimum of 8 hours. Additionally the licensee stated that using the strategy described in the Integrated Plan, the Appendix R lights along with handheld lights would be used, and that after the Appendix R lights exhausted the operators will use hand held lights. Re-powering the battery room MCCs will re-energize the emergency lighting system. The licensee is evaluating a revised strategy for dc load shedding that will maintain additional emergency lighting. This is identified as Confirmatory Item 3.2.4.4.A in Section 4.2.

The NRC staff has reviewed the licensee communications assessment (ADAMS Accession No. ML12306A198 and ML13053A200) in response to the March 12, 2012, 50.54(f) request for information letter, and as documented in the staff analysis (ADAMS Accession No. ML13156A213) has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by the licensee will conform to the guidance of NEI 12-06 Section 3.2.2 (8) regarding communications capabilities during an ELAP. Confirmation will be required that upgrades to the site's communications systems have been completed. This has been identified as Confirmatory Item 3.2.4.4.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 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 licensee was requested to provide a discussion regarding any measures needed to compensate for loss of ac power to security systems. During the audit process, the licensee stated that access to vital areas will require operators to use keys, and that an operator typically carries the keys which are also available in the CR.

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

If temperatures within the CR approach a steady-state condition of 110 degrees F, the environmental conditions within the CR would remain at the uppermost habitability temperature limit defined in NUMARC 87-00 for efficient human performance. NUMARC 87-00 provides the technical basis for this habitability standard as MIL-STD-1472C, which concludes that 110 degrees F is tolerable for light work for a 4 hour period while dressed in conventional clothing with a relative humidity of ~30%. During the audit the licensee stated that the acceptance criteria in the calculation for CR heatup (EVAL XCELPI 12-02) is 120 degrees F, with the limitations identified as the equipment in the CR. The licensee was requested to provide a discussion and supporting information details regarding MCR heatup analyses and provide a reference for these calculations or analyses and justify why 120 degrees F is an appropriate upper limit for MCR habitability.

During the audit process the licensee provided the following information regarding the CR:

- With a loss of forced cooling the temperature in the CR will increase. A CR heatup calculation with no forced cooing demonstrated that CR temperature will increase to 120 degrees F in approximately 11.7 hours. Operators will initiate actions per procedure C37.9 AOP1 including actions to reduce heat loads and open doors. The calculation demonstrated that opening the doors between the CR and the TB at 11.7 hours initially reduces the temperature to 106 degrees F, after which the temperature slowly increases with time. The acceptance criteria in the calculation is 120 degrees F with the limitations identified as the equipment in the CR.

- The actions to open the doors in the existing procedure are based on CR temperature of 85 degrees F, or well before the 120 degrees F value is achieved. Thus the action would be expected to be performed much earlier than the time frame in the Integrated Plan. In addition, actions will be taken to support operator habitability such as ensuring water is available, and monitoring personnel conditions. During Phase 2, if necessary, additional actions would be taken to install portable fans to further enhance CR cooling. Portable fans are stored so they are protected from external hazards, therefore there is reasonable assurance for acceptable CR habitability during the ELAP event.

With no ventilation for the battery rooms, hydrogen gas building could become an issue. The licensee did not provide a discussion on the hydrogen gas exhaust path, nor a discussion of the accumulation of hydrogen with respect to national standards and codes which limit hydrogen concentration to less than 2% (IEEE Standard 484 as endorsed by Regulatory Guide 1.128, "Installation Design and Installation of Vented Lead-Acid Storage Batteries for Nuclear Power Plants") and less than 1% (National Fire Code) when the batteries are being recharged during Phase 2 and 3. The licensee was requested to provide a discussion of battery room ventilation to prevent hydrogen accumulation while recharging the batteries in phase 2 or 3 which includes a description of the exhaust path if it is different from the design basis.

During the audit, the licensee provided the following information regarding the battery room hydrogen issue;

- During Phase 2 a portable generator will repower the battery chargers and hydrogen would be released during battery charging. Calculation ENG-EE-024 indicates that under the worst case conditions, without ventilation, the battery room hydrogen level could reach the 4% flammability limit in 24 hours of charging. The calculation determined the minimum flow (13.56 cfm) necessary to maintain hydrogen concentration below hazardous levels.

When the battery chargers are repowered the associated battery room exhaust fans will also be repowered, but only one fan is needed at 170 cfm capability. If fans are not repowered, natural circulation flow created by opening doors per procedure ECA 0.0 would be sufficient to maintain hydrogen concentration within acceptable values. Opening the battery room doors results in a ventilation path to the TB, which provides a large volume for mixing and dilution.

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 habitability considering high 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.

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 pages 17-18 of the Integrated Plan, the licensee stated that:

The CSTs will be the preferred water supply for the TDAFWP, if available following an ELAP event Minimum water volume in the CSTs is specified in plant Technical Specifications. ..... However, NSPM will not rely on the CSTs as the primary makeup water source in an ELAP event, as the CSTs are not protected from all external hazards.

> The CL System, which is a safety related system, would provide the credited source of water to the TDAFW Pumps. In an ELAP event, the CL system will be supplied from two Diesel Driven Cooling Water Pumps (DDCLPs). Each DDCLP has its own dedicated diesel engine and does not rely on AC power. The suction supply to the DDCLP pulls from a safeguards bay inside the Plant Screenhouse that can be supplied from the normal intake or from a dedicated emergency cooling water intake line. As described in PINGP USAR Section 10.4.1.2.2, the Emergency Cooling Water Intake provides water to maintain safe shutdown for both units after a Design Basis Earthquake. This intake is a 36 inch pipe buried approximately 40 feet below the Circulating Water Intake Canal water level in non-liquefiable soil, connecting the screenwell to a submerged intake crib in a branch channel of the Mississippi River. This Emergency Cooling Water Intake is a Class I structure as is the Approach canal which supplies the intake crib from the main channel of the Mississippi River. The intake crib is designed to exclude trash, and means are provided for back flushing. Back flushing is performed on a monthly basis to ensure that the line remains unobstructed. Furthermore, as described in PINGP USAR Section 10.4.1.2.2, lateral movements of liquefied soil layers are not expected in the intake area, nor is it expected that a covering of the intake itself, because the intake crib is located in a 575 foot wide intake canal which has been sized by applying the 25 to 1 slough angle. If the 36 inch pipe is the only source of water available to the DDCLPs, operator actions are necessary to reduce the system flow demand to within the capacity of the line. Operators would initiate actions to reduce CL system flow demand based on low bay water level. As described in PINGP USAR Section 10.4.1.2.2, there are four hours available to perform these actions. With the assumed loss of the CSTs, the TDAFW Pumps would automatically trip on low suction pressure, protecting the pump from damage due to a loss of suction water supply. Aligning the CL system to the suction of the TDAFW Pumps requires local manual operation of one Motor Operated Valve (MOV) per pump and then locally restarting the TDAFW Pump. These actions are provided within current plant procedures. Analyses demonstrate that there is at least 72 minutes available to restore AFW flow to the Steam Generators.

On page 28 of the Integrated Plan, the licensee stated that:

> During Phase 2 coping, the RCS will be maintained at approximately 350 psig to preclude nitrogen injection from the SI Accumulators into the RCS and to ensure that the reactor is maintained subcritical. During Phase 2, the capability to supply makeup water will be provided. Redundant RCS makeup capabilities will be provided as follows.
>
> A portable FLEX makeup water pump will be staged in the Auxiliary Building. A connection to each unit's Chemical Volume Control System (CVCS) will be provided from the portable electric pump. This connection is shown on Figure 4 in Attachment 3. A portable FLEX diesel generator will be provided with cabling to power the electric FLEX makeup water pump. The FLEX makeup water pump will be sized to accommodate the makeup requirements for both units. WCAP-17601-P, Section 3.1.1, indicates that the makeup requirement for a single unit is 20 gpm at 1500 psig.

An alternate RCS connection point will be provided in each unit's CVCS. The alternate connection points, once identified in the design process, will be provided in a six month status report. Similar to the primary means, a portable FLEX makeup water pump will be staged in the Auxiliary Building. A portable FLEX diesel generator will be provided with cabling to power the electric FLEX makeup water pump.

Primary and Alternate makeup capabilities will be provided using this combination of FLEX equipment.

The water supply to the makeup pumps will be of sufficient quantity to meet chemistry requirements (e.g., boric acid concentration). Provided that the RCS is maintained at, or above, approximately 350 psig, the water volume injected from the SI Accumulators provides sufficient boron to maintain the reactor subcritical. The boron concentration in the water source to the makeup pumps will be greater than the boron concentration in the RCS to avoid the potential for dilution. At PINGP, there are two Class 1 designed sources of borated water that can be used for Phase 2. These sources are the following:

- Reactor Water Storage Tank (RWST) - The boron concentration in the RWST is maintained between 2600 and 3500 ppm per Technical Specification 3.5.4. There are two storage tanks with 265,000 gallons per tank.

- Boric Acid Storage Tank - The boric acid storage tanks are typically maintained at 12 weight percent. This source may not be available due to loss of tank heating and piping heat trace. There are three boric acid storage tanks with a 5,000 gallon capacity per tank.

The licensee stated that the three CST with a total volume of 450,000 gallons would be the first source of water for the TDAFW pumps followed by water from the Mississippi river via the CL system DDCLPs. The licensee also stated that, however, NSPM will not rely on the CSTs as the primary makeup water source in an ELAP event, as the CSTs are not protected from all external hazards. Additionally the licensee noted that calculations and analysis were performed to assure that time was available to manually align the DDCLPs to the TDAFW pumps prior to SG dryout. However no supporting information regarding the calculation and analysis performed to ensure the timing of shifting of TDAFW pumps suction to the DDCLPs. Also, the licensee plans on shifting to a portable pump to supply the SGs at 24 hours into the event. The SOE timeline noted that, "Plant equipment meets coping requirements through Phase 2, and that 24 hours conservatively bounds loss of natural circulation cooling at 33 hours."

The licensee was requested to discuss why the DDCLPs would not be available at 24 hours, hence requiring the use of the portable pump, and also to specify why loss of natural circulation has any bearing on which method water is supplied to the SG's. Additionally specify the water supply for the portable pump, and provide the reference documents and calculations that were developed that address the above assumptions.

The licensee provided the following information regarding the above question:

- Westinghouse performed an analysis (see Calculation NSP-07-033) using RETRAN to model plant conditions during an ELAP. The analysis determined that 74 minutes are available for operators to take action to align the AFW pumps to take suction from the alternate water source. The Integrated Plan used 72 minutes based on the original SGs which were installed in Unit 2 at the time. The 74 minutes time frame is based on the replacement SGs now installed on both Units.

- Both the DDCLPs and the TDAFW pumps are expected to be available beyond 24 hours, the portable pumps are provided as a backup, and will take suction from the intake bay. The action to install the portable makeup pump is not a time constraint since the source of water to the DDCLPs is essentially unlimited and is expected to be available beyond 24 hours. The 24 hour time frame for providing the portable SG makeup pump is considered to be a reasonable time frame for installing the portable secondary water supply pumps given that there are other higher priorities, for example the portable diesel generators. Although 24 hours is specified in the Integrated Plan the portable SG injection pump will be installed as soon as resources permit and well before 24 hours.

The licensee was requested to provide a summary of non-safety-related installed equipment (e.g., piping and piping components, valves, water sources, exhaust piping, etc.) that is used in the mitigation strategies, which includes a discussion of whether the equipment is qualified to survive all ELAP events.

During the audit process the licensee provided the following information regarding use of non-safety equipment credited in the mitigating strategies:

The following non-safety related installed equipment is used in the mitigation strategies:

- The charging pumps active function to provide flow is non-safety related. The passive pressure boundary function of the system is safety related. The charging pumps have been evaluated and determined to be capable of withstanding a seismic event, and the charging pumps, piping, electrical power supply including cables are located in the AB which is a Class I structure and provides protection for all ELAP events.

- The non-safety related CSTs will be used if they are available as the water source for the TDAFW Pumps, and in the event that the CSTs are not available, the supply to the TDAFW pump will be from the cooling water (CL) system, which is a safety related supply.

The reviewer noted that USAR Section 10.4.1.2 indicates that the Cooling Water System uses two horizontal motor-driven pumps with the vertical motor-driven pump for normal operation with two vertical diesel-driven pumps provided for emergency operation. In addition, the reviewer noted that consistent with Order EA-12-049 and NEI 12-06, the licensee's FLEX strategy does not credit the motor-driven pumps, which provide the normal access to the UHS. The reviewer noted that the licensee's FLEX strategy relies on the safety-related diesel-driven CL pumps, which are located in the Class 1 portion of the Plant Screen house, to provide the suction source for the TDAFW pumps. The diesel-driven pumps automatically start on a drop in the associated discharge header pressure and take a suction on an emergency cooling water intake consisting of a Class I 36-inch pipe buried approximately 40 feet below the Circulating Water Intake Canal water level in nonliquefiable soil, connecting the screenwell to a submerged intake crib in a branch channel of the Mississippi River. The reviewer concludes that this portion of the cooling water system constitutes a separate, emergency access to the UHS and that reliance on it as a water source is consistent with NEI 12-06, Section 3.2.1.3, initial condition (4), which specifies that normal access to the UHS is lost. The reviewer further notes that the adequacy of protection afforded the diesel-driven CL pumps and the emergency cooling water intake will be subject to further re-evaluation pursuant to Section 402 of Public Law 112-074, "Consolidated Appropriations Act," which requires that the NRC to require licensees to reevaluate the seismic, tsunami, flooding, and other external hazards at their sites against current applicable Commission requirements and guidance for such licenses as expeditiously as possible, and thereafter when appropriate.

Based on the licensee's response, the staff determined that although the components described above are non-safety related, the licensee's FLEX strategies relies on components located within a structure that is protected from the external hazards or the reliance on a non-safety related water source is only preferential and that a safety related water source is available after a BDBEE.

The licensee stated that the suction supply to the DDCLP pulls from a safeguards bay inside the screenhouse that can be supplied from the normal intake or from a dedicated emergency cooling water intake line. The licensee further stated that the intake crib is designed to exclude trash, and means are provided for back flushing. The licensee was requested to discuss whether this intake crib and its ability to be the water suction source will be impacted by any of the extreme external hazards, for example, surface ice accumulation, or debris from tornados and floods.

During the audit process the licensee provided the following information regarding use of the emergency intake line:

- As shown on USAR Figure 10.4-3B, the top of the trash grating over the intake crib for the CL System emergency intake line is at elevation 664 ft. After entering through the intake crib, water passes through the traveling screens before entering the pump suction and strainers after leaving the pump discharge. Normal water elevation at the site is approximately 674.5 ft. as described in USAR Section 2. This water level is controlled by the USACE at Lock & Dam #3.

- Thus, the top of the intake crib is approximately 10 feet below normal river water evaluation. Therefore, it is not expected that the intake would be affected by surface ice or debris in the water from tornados or floods. During a seismic event, the minimum final established water level at the intake crib is 666.5 ft. by an assumed failure of downstream Lock & Dam #3. This provides a minimum of 2.5 ft. submergence. The river bottom in the vicinity of the intake crib is dredged to ensure a clear path for water to the crib.

- The intake crib is located in a branch channel of the Mississippi River, referred to as Sturgeon Lake. The flow rate in the branch channel is relatively low, such that surface ice forms during the winter. This would especially be true during an extreme cold event. As described in USACE Cold Regions Technical Digest 91-1, the presence of surface ice precludes the formation of frazil ice that could impact the UHS.

Based on the licensee's response, the reviewer noted that the licensee has considered its credited water source being impacted by any of the results of extreme external hazards, such as surface ice accumulation, or debris from tornados and floods. Thus, the licensee has provided assurance of equipment reliability that draws suction from the safeguards bay inside the Plant Screenhouse.

Water for RCS makeup is supplied from the SI accumulators and the Class 1 RWST's. The licensee will depend on water injected from the SI accumulators during the cooldown that starts at two hours into the event. The licensee is following the generic WCAP reference case noted in Table 5.2.2-1 of the WCAP. The fourth item from the bottom of the tables states that 47.2 hours, "Accumulators empty (note approx. 21,800 lbm/accumulator remains due to conservative aspect of EOP setpoint) - Must be vented prior to this time."

The licensee was requested to provide the strategy for venting the accumulators and the basis for the timing in the SOE timeline, and to provide a discussion of how RCS pressure would be maintained on natural circulation cooling such that nitrogen from the accumulators will not enter the RCS. The licensee was also requested to discuss what instrumentation and valve operations would be required for this operation, and discuss any power requirements. Since the licensee plans on installing the portable RCS makeup pump at 33 hours which is the time natural circulation ends per the WCAP reference case, the licensee was also requested to clarify the timing of the use of the portable RCS makeup pump, and to specify how this pump would be connected to the water sources (RWST and BAST).

During the audit process the licensee provided the following information regarding the accumulators and RCS makeup:

- As described in the Integrated Plan, early in the ELAP event the RCS is cooled down and depressurized to a SG pressure of 350 psig. The minimum SG pressure of 350 psig is determined following the methodology in the PWROG Core Cooling Position Paper to preclude nitrogen injection into the RCS from the SI accumulators. Consistent with the Core Cooling Position Paper the minimum SG pressure is a plant specific value. The RCS cooldown and depressurization would be performed following procedure ECA 0.0. Consistent with ECA 0.0, the operators would maintain the RCS conditions monitoring RCS Cold Leg Temperature and SG Pressure.

- These conditions will be maintained until phase 3. During Phase 3, 4KV generators will be provided by RRC. The 4KV generators will be used to repower a safety related 4KV bus on each Unit, which will then be used to repower Motor Operated Valves to isolate the accumulators or an Instrument Air compressor that will be used to vent the Accumulators. Either action will preclude nitrogen injection from the Accumulators into the RCS.

- The strategy described in the Integrated Plan was to install a portable electric driven pump to provide RCS makeup. The power supply to the portable electric pump will be provided by a portable generator located outside the building with cabling routed from the generator to the pump motor. The strategy in the Integrated Plan included providing a discharge tap into the Chemical and Volume Control System (CVCS) and a suction source from the RWST.

- Subsequent to submittal of the Integrated Plan, NSPM is replacing the RCP seals with the FlowServe N-9000 with the Abeyance seal option. With the new RCP seals NSPM anticipates that the time required before a makeup water source is required can be extended such that the portable pump would not be necessary until phase 3. This still needs to be confirmed as NSPM receives the final seal design information from FlowServe. As part of the strategies, the RRC will provide a portable RCS makeup pump.

NSPM will either provide the connection points for the portable pump or provide a procedure with the necessary equipment to install the portable pump, when needed. For example, the strategy to install the RCS makeup pump could be implemented by removing a valve bonnet and installing the pump connection. Review of final RCS makeup strategies for all Phases has been combined with Confirmatory Item 3.2.1.9.A in Section 4.2.

- As a backup to the low-leakage RCP seals, the licensee will provide portable generators to repower the charging pumps during phase 2. The charging pumps are qualified to function during the postulated external events. The charging pumps draw suction from the RWST and discharge directly to the RCS. Thus, no new suction or discharge connections are required to use the charging pumps. There are three charging pumps; two are powered from one MCC and the other from the opposite train MCC.

The licensee was requested to provide a discussion of the FLEX pump suction/water source for this FLEX pump and describe the quality of water and any need for filtering to prevent damage to the FLEX pump. The licensee was also requested to provide a discussion of the use of potentially impure water in the SGs for core cooling and heat removal and under what conditions operators would choose this option.

During the audit process the licensee provided the following information regarding potentially impure water sources:

- As described in USAR Section 11.9.2.2, the CL system supply to the AFW pumps is the design bases safety related water supply to the pumps. This water source passes through intake screens upstream of the pump and strainers downstream of the pump, and as such a certain amount of water filtering occurs.
- The preferred water source is the CSTs, which will be used if they are available. The CSTs have been evaluated to provide assurance the tanks would be available following a seismic event. There are three CSTs, two located on the west side of the plant and one located on the east side of the plant. The CST locations provide reasonable assurance that at least one tank could be available following a tornado. The three CSTs are interconnected such that operator action would be necessary to isolate a ruptured tank.
- The licensee will evaluate including additional actions to the existing plant response procedure for responding to a tornado, in order to credit the CSTs following a tornado/missile event.
- Consistent with existing plant procedures, other sources will also be considered, but the other possible sources rely on ac power and most likely would not be available in an ELAP event. During phase 3, the RRC will provide water treatment capability. The purpose of the water treatment is to provide clean water to the SGs. Thus, the time frame that the raw water would be provided to the SGs is relatively short.
- The portable pumps will be designed for the Mississippi River water, however this design has not yet been finalized.

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

3.2.4.8 Electrical Power Sources/Isolations and Interactions

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

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

The licensee 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 provided the following information regarding electrical isolation:

- The use of portable generators will be procedurally controlled. During phase 2, the portable generators will be installed to power the MCCs. The procedures for installation/operation of the portable generator will address considerations such as:
    a) Ensuring the normal source(s) to the MCC is(are) isolated to provide isolation from the other Class 1E equipment.
    b) The sequence of the loads that are placed on the MCC to ensure that the loading is consistent with the sizing calculation for the portable generator.
- NSPM has not developed the design for the connections to the MCC. The above procedures will be developed as part of the modification that installs the MCC connections and are not yet available.

The procedure for installation and operations of the portable generators is being developed to address above considerations. This is identified as Confirmatory item 3.2.4.8.A in Section 4.2.

The licensee was requested to provide a summary of the sizing calculation for the FLEX generators to show that they can supply the loads assumed in phases 2 and 3.

During the audit process the licensee provided the following information regarding FLEX generator load sizing:

- One portable generator is sized for the combined loads of two battery room MCCs and one screenhouse MCC.
- To meet N+1 a second portable generator will be available to provide power to MCCs 1AB2, screenhouse Train B, MCC1AC2, battery room Unit 1 Train B, and MCC2AC2, battery room Unit 2 Train B.
- The loads that are repowered on the MCCs are identified in the calculation. The calculation determines the minimum on-site 480 V portable diesel generator (PDG) sizes to cope with the ELAP due to a beyond-design-basis external event. This is a simplified calculation for sizing on-site 480V PDGs as each manufacturer's diesel engine, governor, and fuel supply is different, and, therefore, will vary on the capability to cope with the transient frequency dips and voltage drop during motor starting. It is anticipated that the selected diesel generator manufacturer will confirm the capability of their machine to meet the loading requirements, frequency variation, and motor starting voltage drop. Additional margin has been added to the loads being powered from the

on-site 480V PDGs to account for cable loss voltage drop and frequency variation which have an effect on the sizing for transient conditions only. The sizing calculation is currently being reviewed by NSPM and will be uploaded on the ePortal when it is complete.

- The sizing calculations for the 480VAC PDGs that re-power the charging pumps and the 4KV generators are not completed. The licensee plans to summarize the results in the August 2014 6-month status report. This is identified as Confirmatory Item 3.2.4.8.B in Section 4.2.

The licensee was requested to provide single line diagrams showing the proposed connections of Phase 2 and 3 electrical equipment on the e-Portal, and also to show protection information (breaker, relay etc.) and rating of the equipment on the diagrams.

During the audit process the licensee provided the following information regarding electrical diagrams:

- In support of installing 480VAC portable generators during phase 2, connections will be provided at the four Battery Room MCCs, two Screenhouse MCCs, and four MCCs in the Auxiliary Building for repowering the installed Charging Pumps.
- In support of installing 4KV portable generators, supplied by the RRC, during phase 3, connections will be provided at the safety related 4KV switchgear.
- NSPM has not developed the design for the electrical connections. Single line diagrams for Phase 2 and 3 electrical equipment showing protection information and equipment rating will be provided at a later date when the design details are further developed. Based on the current schedule for developing modification packages, NSPM anticipates being able to upload this information in the ePortal prior to the August 2014 six month status report. This is identified as Confirmatory Item 3.2.4.8.C in Section 4.2.

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

3.2.4.9 Portable Equipment Fuel

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

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

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

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

On page 10 of the Integrated Plan, the licensee stated that:

The fuel oil supply to each DDCLP is from its associated Fuel Oil Day Tank (FODT). The FODT contains sufficient fuel oil to support approximately 8 hours of DDCLP operation. In order to ensure continued availability of the CL supply to the TDAFW Pumps (or the portable pump), a portable FLEX diesel generator will be installed to repower 480VAC Motor Control Centers (MCC) 1AB1 or 1AB2 in the Plant Screenhouse. The primary means to repower a Fuel Oil Transfer Pump will be to repower MCC IAB2 from a portable FLEX diesel generator. Repowering the Fuel Oil Transfer Pump allows refilling the associated FODT from the associated Fuel Oil Storage Tank (FOST). The alternate means to repower a Fuel Oil Transfer Pump will be to repower MCC 1AB1 from a portable FLEX diesel generator to allow refilling the associated FODT from the FOST. Restoration of power to MCCs 1AB1 or 1AB2 will also restore the HV AC system for the DDCLPs. NSPM will perform a walkthrough demonstration of the ability to complete these actions within the time constraint.

On page 20 of the Integrated Plan, the licensee stated that:

Water supply to the TDAFW Pump will be supplied from either the CST (if available) or the CL System using a DDCLP. Availability of the CL supply from a DDCLP is discussed in the previous section on Phase 1. During Phase 1, the fuel oil supply to the DDCLPs will be supplied from the associated Fuel Oil Day Tank (FODT). The FODT contains sufficient fuel oil to support approximately 8 hours of DDCLP operation. In order to ensure continued availability of the CL supply to the TDAFW Pumps, a portable FLEX diesel generator will be installed to repower 480VAC Motor Control Centers (MCC) 1AB1 or 1AB2 in the Plant Screenhouse, Repowering MCCs 1AB1 or 1AB2 will repower the Fuel Oil Transfer Pumps to allow refilling the FODTs from the associated fuel oil storage tanks (FOST). The FOST has sufficient fuel oil to supply the DDCLP for greater than 72 hours.

On page 50 of the Integrated Plan, the licensee stated that:

Two portable 480VAC generators (primary and alternate connections) will be installed to provide power to the DC system and to recharge the batteries and power the fuel oil transfer pumps to supply DDCLP operation. The primary connection will be to MCCs IAC2 and 2AC2 to repower the associated Battery Chargers, Instrument Inverters and MCC 1AB2 for the associated Fuel Oil Transfer Pump. The alternate connection point will be to MCCs 1AC1 and 2AC1 to repower the associated Battery Chargers, Instrument Inverters, and MCC 1AB1 for the associated Fuel Oil Transfer Pump.

On page 51 of the Integrated Plan, the licensee stated that:

Portable equipment used in Phase 2 will be equipped with fuel storage tanks sufficient for at least 24 hours of operation without refueling to minimize actions required to keep equipment running. Portable fuel containers can be used to refuel equipment, and the fuel stored in day tanks for the Emergency Diesel Generators will be available.

......

Electrical connections to MCCs 1AB1 and 1AB2 will be provided to enable providing primary and alternate portable power supply to the DDCLP fuel oil transfer pumps.

The licensee was requested to provide information regarding fuel supply locations and capacities and strategies for fuel delivery to the portable FLEX equipment and specify that the fuel is stored in structures with designs which are robust with respect to seismic events, floods and high winds and associated missiles, and will remain available during these events. The licensee was also requested to describe plans for supplying fuel oil to FLEX equipment (i.e., fuel oil storage tank volume, supply pathway, etc.), to discuss the quantity of fuel that is expected to be initially available on site for fueling the FLEX portable pumps and generators and the amount and frequency of refueling requirements for each portable pump and generator deployed, and also, explain how fuel quality will be assured if stored for extended periods of time.

During the audit process the licensee provided the following information regarding fuel oil supplies:

- During phase 2, the current strategy is to refuel portable equipment by draining fuel oil from the DDCLP fuel oil day tanks. The fuel oil day tanks for the DDCLPs are located within the screenhouse, which is a Class I structure and protects the day tanks from external events. The fuel oil day tanks for the Unit 1 and Unit 2 Emergency Diesel Generators (EDGs) are also stored within Class 1 structures. The fuel oil storage tanks and fuel oil transfer pumps for the DDCLPs and the Emergency Diesel Generators are also protected from external events. The fuel oil storage tanks are located below grade and are designed for external events.
- During phase 2, the fuel oil storage tank transfer pumps for the DDCLPs are repowered by the portable diesel generators. Specifics related to volumes, supply pathways, etc. are being developed. During Phase 3, portable 4KV diesel generators will be provided by the RRC. With the 4KV diesel generators, additional loads such as the EDG fuel oil transfer pumps will be repowered, greatly increasing the available fuel oil inventory. The RRC will also provide the means to transfer and store the fuel oil after it is withdrawn from the storage tanks.

- The quality of the fuel in the safety related day tanks and storage tank is assured based on existing plant programs and procedures.

As noted in the licensee's response the specifics of related to the fuel oil volumes, supply pathways, etc. are being developed. Thus, the licensee has not demonstrated that the fuel necessary to operate the FLEX equipment has been assessed to ensure sufficient quantities are available in accordance with NEI 12-06, Section 3.2.2, guideline (13). The licensee did not provide fuel consumption rate for each FLEX piece of equipment to calculate total fuel usage and thus demonstrate that sufficient fuel with margin exists on site until off-site resources arrive. In addition, the licensee did not discuss the method of transporting the fuel oil from its on-site storage tanks to the portable equipment. This is identified as Confirmatory Item 3.2.4.9.A in Section 4.2.

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

3.2.4.10 Load Reduction to Conserve DC Power

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

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

On page 11 of the Integrated Plan, the licensee stated that:

> <u>5. DC Load Management (60 and 90 minutes - Attachment 1A, Items 4 and 6)</u>.
>
> ... Load shedding will be performed in order to extend battery operational times. The strategy for the load shedding will be to reduce the load on the batteries through use of relatively simple actions (opening DC Panel Breakers). ... Preliminary estimates indicate that battery life can be extended up to at least 16 hours with this load shedding scheme. The battery depletion calculation is currently being finalized to account for these changes. If the results are different than reported herein, this will be reported in a six month status report, as required by Order EA-12-049. Prior to the batteries being depleted, portable 480V AC generators will be installed to provide power to the DC system and to recharge the batteries.

The battery depletion calculation is currently being finalized to account for these changes. If the results are different than reported herein, this will be reported in a six month status report, as required by Order EA-12-049." Review of the results of these final calculations has been identified as Confirmatory Item 3.2.4.10.A in Section 4.2.

The licensee was requested to provide; 1) The direct current (dc) load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and SFP cooling and 2) 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, 3) explain which functions are lost as a result of shedding each load and discuss any impact on defense in depth and redundancy, and

4) 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 provided the following information regarding battery issues:

- The FLEX strategy station battery run-time was calculated in accordance with the IEEE-485 methodology using manufacturer discharge test data applicable to the licensee's FLEX strategy as outlined in the NEI white paper on Extended Battery Duty Cycles. The calculation is not yet completed and will be provided on the ePortal prior to the August 2014 6-month status report. The detailed licensee calculations, supporting vendor discharge test data, FLEX strategy battery load profile, and other inputs/initial conditions required by IEEE-485 will also be provided on the e-Portal. This is identified as Confirmatory Item 3.2.4.10.B in Section 4.2.

- Specific responses to the above questions are as follows:
    1) As part of developing the OIP, NSPM also developed a supporting document, Document Number 178599.50.2200-02; which describes the bases for the load shedding scheme. Document 178599.50.2200-02 is available on the ePortal. The load shedding is implemented per existing plant procedures. The dc load profile that is consistent with the load shedding is described as part of the calculation that will be provided on the ePortal prior to the August 2014 six month status report.

    2) The detailed discussion of the loads shed including the required operator actions are described in the supporting document 178599.50.2200-02. The load shedding strategies were developed to maximize the load shed benefit with the minimal amount of operator actions. For each train of batteries, the operator sheds loads from two dc panels. The load shedding is implemented per existing procedure ECA 0.0.

    3) The minimum dc bus voltage is used as the acceptance criteria in the calculation and is based on providing sufficient voltage to the Instrument Inverters in order to maintain the required instrumentation available during the ELAP.

The licensee was requested to confirm that load shed activities will not interfere with required valve positioning or operator action capability that may be credited in establishing ELAP response strategies, including specifically those actions related to isolating RCS leakage paths. In response, the licensee provided the following information:

- The load shedding scheme was developed by first reviewing the load on the dc panels. PINGP does not have dc motor operated valves. The air operated valves and dampers that use dc solenoid valves also require an air supply.
- For valves and dampers that do not have accumulators, maintaining dc is not required as there would be no motive force to operate the valve. For valves that have accumulators, the need to maintain dc was evaluated as part of the load shedding scheme.

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 Nos. ML13241A186 (position paper) and ML13241A188 (NRC endorsement letter)).

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

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

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

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

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory 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 guidance provided in INPO AP 913, Equipment Reliability Process, to verify proper function. The maintenance program should ensure that the FLEX equipment reliability is being achieved. Standard industry templates (e.g., EPRI) and associated bases will be developed to define specific maintenance and testing including the following:

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

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

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

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

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

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

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

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

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

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

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

> NSPM will implement an administrative program in accordance with NEI 12-06, Section 11. FLEX strategies and their basis will be maintained in an overall program document, which will contain the basis for the ongoing maintenance and testing chosen for the FLEX equipment. This will include standard industry preventative maintenance (PM) with scope and frequency established considering EPRI guidelines and manufacturer recommendations. FLEX equipment will be procured as commercial equipment unless credited for other functions; then the quality attributes of the other functions apply.

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 maintenance and testing if these requirements are implemented as described.

3.3.2 Configuration Control

NEI 12-06, Section 11.8 states:

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

2. Existing plant configuration control procedures will be modified to ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies.

3. Changes to FLEX strategies may be made without prior NRC approval provided:

    a) The revised FLEX strategy meets the requirements of this guideline.

    b) An engineering basis is documented that ensures that the change in FLEX strategy continues to ensure the key safety functions (core and SFP cooling, containment integrity) are met.

On page 15 of the Integrated Plan, the licensee stated that 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.

The licensee did not address consideration 1 of NEI 12-06, Section 11.8 regarding maintaining a historical record of previous strategies and the basis for changes, or consideration 2 regarding providing a documented engineering basis that ensures that any change in FLEX strategy continues to ensure the key safety functions (core and SFP cooling, containment integrity) are met. This has been identified as Confirmatory Item 3.3.2.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 and Open Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to configuration control if these requirements are implemented as described.

3.3.3 Training

NEI 12-06, Section 11.6, Training, states:

1. Programs and controls should be established to assure personnel proficiency in the mitigation of beyond-design-basis events is developed and maintained.

These programs and controls should be implemented in accordance with an accepted training process.

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

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

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

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

On page 15 of the Integrated Plan, the licensee stated that training for FLEX strategies will be established in accordance with NEI 12-06, Section 11.6. The Systematic Approach to Training (SAT) will be followed.

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 <u>OFF SITE RESOURCES</u>

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

1) A capability to obtain equipment and commodities to sustain and backup the site's coping strategies.
2) Off-site equipment procurement, maintenance, testing, calibration, storage, and control.
3) A provision to inspect and audit the contractual agreements to reasonably assure the capabilities to deploy the FLEX strategies including unannounced random inspections by the Nuclear Regulatory Commission.
4) Provisions to ensure that no single external event will preclude the capability to supply the needed resources to the plant site.
5) Provisions to ensure that the off-site capability can be maintained for the life of the plant.

6) Provisions to revise the required supplied equipment due to changes in the FLEX strategies or plant equipment or equipment obsolescence.
7) The appropriate standard mechanical and electrical connections need to be specified.
8) Provisions to ensure that the periodic maintenance, periodic maintenance schedule, testing, and calibration of off-site equipment are comparable/consistent with that of similar on-site FLEX equipment.
9) Provisions to ensure that equipment determined to be unavailable/non-operational during maintenance or testing is either restored to operational status or replaced with appropriate alternative equipment within 90 days.
10) Provision to ensure that reasonable supplies of spare parts for the off-site equipment are readily available if needed. The intent of this provision is to reduce the likelihood of extended equipment maintenance (requiring in excess of 90 days for returning the equipment to operational status).

The license'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, insufficient information was provided regarding the remaining items (2 through 10 above). This has been identified as Confirmatory Item 3.4.A in Section 4.2.

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

4.0 OPEN AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number	Description	Notes
3.2.1.6.A	Verify differences between the plant parameter values used in this reference case contained in Table 5.2.2-1 of WCAP-17601-P and the PINGP plant specific parameters.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.2.A	Confirm the final storage locations for FLEX equipment and the deployment routes during extreme external events are adequate to include further detail regarding seismic protection of connection points and the access to those points through seismically robust structures.	
3.1.1.4.A	Confirm the SAFER group plan routes for deployment of off-site resources are adequate.	
3.2.1.A	Confirm applicability of the WCAP-17601 analysis to PINGP to include review of supporting document number 178599.50.2200-02.	

Item Number	Description	Notes
3.2.1.1.A	Confirm that use of the NOTRUMP code for the ELAP analysis is limited to the flow conditions before reflux condensation initiates. This includes specifying an acceptable definition for the onset of reflux condensation cooling.	
3.2.1.2.A	RCP Seal Leakage. Confirm that since PINGP will install FlowServe N-9000 seals, the licensee addresses the acceptability of the use of non-Westinghouse seals, and provides the acceptable justification for the RCP seal leakage rates for use in the ELAP analysis, to include whether the FlowServe white paper justifies the use of the FlowServe N-9000 seals and bounds the 21 gpm/seal leakage rate assumed in the analysis.	
3.2.1.3.A	Decay Heat - Confirm the applicability and adequacy of the ANS 5.1-1979 + 2 sigma model analysis relative to Prairie Island, and if a different decay heat model is used, address the acceptability of the model.	
3.2.1.6.B	Confirm completion and adequacy of the licensee's Phase 2 staffing assessment.	
3.2.1.8.A	Core Sub-Criticality – Confirm that calculations in the licensee's Xcel Energy correspondence IC OC-PX-2012-021 align with the generic resolution for boron mixing under natural circulation conditions potentially involving two-phase flow, in accordance with the Pressurized-Water Reactor Owners Group position paper, dated August 15, 2013 (ADAMS Accession No. ML13235A135 (non-public for proprietary reasons)), and subject to the conditions provided in the NRC endorsement letter dated January 8, 2014 (ADAMS Accession No. ML13276A183).	
3.2.1.9.A	Confirm that the time required before a makeup water source is required for RCS inventory control can be extended such that the portable pump would not be necessary until Phase 3. In addition, determination of method or connection point for the RCS portable pump is needed.	
3.2.2.A	Confirm the licensee's SFP spray capability from its existing B.5.b strategy conforms to NEI 12-06 Table D-3, and that B.5.b strategy provided equipment is protected.	
3.2.4.4.A	Confirm the licensee's revised strategy for dc load shedding will maintain additional emergency lighting.	
3.2.4.4.B	Confirm upgrades to the site's communications systems have been completed.	
3.2.4.7.A	In regards to the PINGP FLEX mitigating strategy change to install FlowServe N-9000 RCP seals with Abeyance seal option, confirm the revision to the RCS makeup strategies are complete and adequate for all Phases.	
3.2.4.8.A	Confirm the design of the portable generator connections to the MCC are complete and adequate to include electric isolation and load sequencing.	
3.2.4.8.B	Confirm the licensee's sizing calculations for the 480VAC and the 4KV diesel generators are adequate.	
3.2.4.8.C	Confirm the adequacy of design for the FLEX electrical connections to include single line diagrams for Phase 2 and 3	

Item Number	Description	Notes
	electrical equipment.	
3.2.4.9.A	Portable Equipment Fuel – Confirm the total fuel consumption need calculations when FLEX equipment designs are finalized and the methods for onsite fuel transport are adequate.	
3.2.4.10.A	Confirm that the results of the battery depletion calculation are adequate.	
3.2.4.10.B	Confirm the adequacy of the licensee's FLEX strategy station battery run-time calculation, the supporting vendor discharge test data, FLEX strategy battery load profile, and other inputs/initial conditions.	
3.3.2.A	Confirm the licensee addresses considerations 1 and 2 of NEI 12-06, Section 11.8 regarding maintaining a historical record and a documented engineering basis.	
3.4.A	Off-Site Resources – Confirm the licensee's arrangement for off-site resources addresses the guidance of Guidelines 2 through 10 in NEI 12-06, Section 12.2.	

If you have any questions, please contact James Polickoski, Mitigating Strategies Project Manager, at 301-415-5430 or at james.polickoski@nrc.gov.

Sincerely,

/RA by Victor Cusumano for/

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

Docket Nos. 50-282 and 50-306

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

cc w/encl: Distribution via Listserv

DISTRIBUTION
PUBLIC
MSD R/F
RidsNrrDorlLpl3-1 Resource
RidsNrrPMPrairieIsland Resource
RidsNrrLASLent Resource
RidsAcrsAcnw_MailCTR Resource
RidsRgn3MailCenter Resource
JPolickoski, NRR/MSD
JBowen, NRR/MSD

ADAMS Accession Nos. Pkg ML14030A529, Letter/ISE ML14030A540, TER ML14041A204 *via email / via phone

OFFICE	NRR/MSD/MSPB/PM	NRR/MSD/MSPB /LA	NRR/MSD/SA*	NRR/MSD/MSPB/BC*
NAME	JPolickoski	SLent	EBowman	JBowen
DATE	02/26/14	02/26/14	02/26/14	02/26/14
OFFICE	NRR/MSD/MESB/BC*	NRR/MSD/MRSB/BC*	NRR/MSD/D*	NRR/MSD/MSPB/BC
NAME	SBailey	SWhaley	JDavis (SWhaley for)	JBowen (VCusumano for)
DATE	02/26/14	02/26/14	02/26/14	02/27/14

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