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

November 25, 2013

Ms. Karen D. Fili
Site Vice President
Northern States Power Company – Minnesota
Monticello Nuclear Generating Plant
2807 West County Road 75
Monticello, MN 55362-9637

SUBJECT: MONTICELLO NUCLEAR GENERATING PLANT - INTERIM STAFF EVALUATION RELATING TO OVERALL INTEGRATED PLAN IN RESPONSE TO ORDER EA-12-049 (MITIGATION STRATEGIES)(TAC NO. MF0923)

Dear Ms. Fili:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12054A736). By letter dated February 28, 2013 (ADAMS Accession No. ML13066A066), Northern States Power Company, a Minnesota corporation (NSPM, the licensee) submitted its Overall Integrated Plan for Monticello Nuclear Generating Plant in response to Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13241A200), 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 28, 2013, and information obtained through the mitigation strategies audit process,[1] the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that the plan, when properly implemented, will meet the requirements of Order EA-12-049 at Monticello Nuclear Generating Plant. 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,

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

Docket No. 50-263

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

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

NORTHERN STATES POWER COMPANY, A MINNESOTA CORPORATION

MONTICELLO NUCLEAR GENERATING PLANT

DOCKET NO. 50-263

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. 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 beyond-design-basis external event (BDBEE).

By letter dated February 28, 2013 [Reference 2], Northern States Power Company, a Minnesota corporation (the licensee or NSPM) provided the Overall Integrated Plan for compliance with Order EA-12-049 for Monticello Nuclear Generating Plant (Monticello) (hereafter referred to as the Integrated Plan). 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 28, 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[2], requires that operating power reactor licensees and construction permit holders use a three-phase approach for mitigating beyond-design-basis

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

external events. The initial phase requires the use of installed equipment and resources to maintain or restore core cooling, containment and SFP cooling capabilities. The transition 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 beyond-design-basis external events 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 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 MegaTech Services, LLC (MTS) for technical support in the evaluation of the Integrated Plan for Monticello, submitted by NSPM's letter dated February 28, 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 beyond-design-basis external events and its progress towards implementing those plans.

A simplified description of the Monticello Integrated Plan to mitigate the postulated extended loss of ac power event is that the licensee will initially remove the core decay heat by using both the high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) systems concurrently. The steam-driven HPCI and RCIC pumps will initially supply water to the reactor vessel from the condensate storage tank (CST) or the suppression pool (torus), depending on availability. Steam from the reactor would be vented through the safety relief valves to the torus. Following automatic trip of HPCI and RCIC, RCIC trip signals will be overridden, and RCIC will be used as the primary make-up equipment to maintain reactor level. HPCI equipment will be secured to maintain battery life. A FLEX portable diesel driven pump will be made available to supply water from the discharge canal (or intake structure berm in a flooding event), and a FLEX portable diesel driven generator will be made available to support related direct current (dc) powered equipment. Once RCIC operation is no longer possible, the FLEX portable diesel driven pump will be placed in service providing makeup water to the reactor via the residual heat removal (RHR) low pressure coolant injection (LPCI) lines. The FLEX portable diesel driven generator will be used to power 250 volt dc and 125 volt dc battery chargers and reenergize selected 480 volt load centers. This will allow energizing selected motor control centers so that power is available to critical loads such as required motor-operated valves, dc components through the installed battery chargers, and desired ac instrumentation. In the long-term, additional equipment, such as 4160 volt ac diesel generators and diesel driven pumps, will be delivered from one of two Regional Response Centers established by the nuclear power industry to provide supplemental accident mitigation equipment to power an RHR pump and supply RHR service water cooling water.

Monticello plans to use containment venting via the hardened containment vent system (HCVS) to maintain containment (torus and drywell) pressure and temperature within acceptable values. The exact timing and strategy for venting is still under evaluation by the licensee. The FLEX portable diesel driven generator described above will extend battery life to support the HCVS and associated instrumentation.

In the postulated extended loss of ac power event, the SFP will initially heat up due to the unavailability of the normal cooling system. A portable FLEX pump will be aligned and used to add water to the SFP via installed piping or hoses to maintain level as the pool boils. This will maintain a sufficient amount of water above the top of the fuel assemblies for cooling and shielding purposes. Additional equipment provided by the Regional Response Center will provide backup portable pumps and generators for SFP level instrumentation.

By letter dated November 20, 2013 [Reference 21], MTS documented the interim results of the Integrated Plan review in the attached technical evaluation report (TER). The NRC staff performed minor editing of the 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 EA-12-049, as modified below.

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:

A. Acceptable item – an item that the NRC considers resolved, consistent with the endorsed guidance, or otherwise acceptable to the staff. No further NRC review is required, provided the licensee implements the plan as described. Licensee implementation may be subject to inspection.

B. 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.

C. 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 NRC staff adopts the open and confirmatory items identified in the TER, with several changes. Open Item 3.2.1.3.A was deleted, because it did not represent a technical concern that could call into question the success of the licensee's overall strategy. Open Item 3.2.1.3.B was duplicative of Confirmatory Item 3.2.4.10.A, and was therefore deleted. Finally, Open Item 3.2.1.8.B was moved from an open item to a confirmatory item, because the overall strategy is conceptually acceptable, and the missing information can be provided as confirmatory information once the design details are established. Thus, the summary tables in this interim staff evaluation differ from the corresponding TER tables in these areas, and represent the NRC's assessment of the open and confirmatory items for Monticello. Further details for each open and confirmatory item are provided in the corresponding sections of the TER, identified by the item number.

4.1 OPEN ITEMS

Item Number	Description	Notes
3.1.1.3.A	The licensee's integrated plan did not address the potential impacts from large internal flooding sources that are not seismically robust and do not require ac power, the potential loss of ac power to mitigate ground water in critical locations, or the impact of potential failure of non-seismically robust downstream dams.	
3.1.2.2.A	The licensee's integrated plan did not address flooding deployment issues for restocking supplies during flooding conditions, protection for fuel supplies assuring connection points are protected, the need to provide water extraction pumps, and the need for temporary flood barriers.	
3.1.2.3.A	The licensee did not discuss the need for temporary flood barriers and dewatering pumps during flooding events.	
3.2.1.2.A	The licensee did not Identify or provide justification for the assumptions made regarding primary system leakage from the recirculation pump seals and other sources.	
3.2.3.A	Additional plant-specific Extended Loss of AC Power (ELAP) analysis information commensurate with the level of detail contained in NEDC-33771P, including analysis assumptions and results in their tabulated and plotted formats is needed to conclude that containment functions will be maintained.	
3.2.3.B	The licensee needs to resolve the issue of the potential for the BWROG revised venting strategy to increase (relative to currently accepted venting strategies) the likelihood of detrimental effects on containment response for events in which the venting strategy is invoked. In particular it has not been shown that the potential for negative pressure transients, hydrogen combustion, or loss of containment overpressure (as needed for pump net positive suction head) is not significantly different when implementing Revision 3 of the Emergency Planning Guidelines/Severe Accident Guidelines (EPG/SAG) vs. Revision 2 of the EPG/SAG.	
3.2.4.3.A	The licensee needs to provide a discussion of the effects of loss of power to heat tracing.	
3.2.4.5.A	The licensee needs to provide information regarding local access to the protected areas under ELAP.	
3.2.4.8.A	The licensee did not provide any information regarding loading/sizing calculations of portable diesel generator(s) and strategy for electrical isolation for FLEX electrical generators from installed plant equipment.	
3.2.4.8.B	The licensee needs to provide a description of the instrumentation that will be used to monitor portable/FLEX	

	electrical power equipment including their associated measurement tolerances/accuracy to ensure that the electrical equipment remains protected and that operators are provided with accurate information.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.2.A	The licensee is still developing storage locations and associated deployment pathways for Phase 2 equipment. The availability of the potential need for ac power to deploy equipment could not be evaluated.	
3.1.1.4.A	The licensee's integrated plan did not identify Regional Response Center resources, the off-site staging areas, and delivery methods sufficiently in order to evaluate the means to obtain the resources from off site.	
3.1.5.3.A	The licensee did not provide measures for operating FLEX equipment at possible excessively high temperatures that may exist inside plant structures and buildings.	
3.2.1.1.A	From the June position paper, identify and discuss the benchmarks which are relied upon to demonstrate that MAAP4 is an appropriate code for simulation the of ELAP event.	
3.2.1.1.B	Confirm that the collapsed level remains above Top of Active Fuel (TAF) and that the cool down rate was within the technical specification limits.	
3.2.1.1.C	Confirm that MAAP was used in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June position paper.	
3.2.1.1.D	Identify and justify the subset of key modeling parameters taken from Tables 4-1 through 4-6 of the MAAP4 Applications Guidance (EPRI 1020236). This should include response at a plant-specific level regarding specific modeling options and parameter choices for key models that would be expected to substantially affect the ELAP analysis performed for that licensee's plant. Although some suggested key phenomena are identified below, other parameters considered important in the simulation of the ELAP event by the vendor / licensee should also be included. a. Nodalization b. General two-phase flow modeling c. Modeling of heat transfer and losses d. Choked flow e. Vent line pressure losses f. Decay heat (fission products / actinides / etc.)	
3.2.1.1.E	Identify the specific MAAP analysis case that was used to validate the timing of mitigating strategies in the integrated plan	

	and state that it is available on a web portal for NRC staff to view. Alternately, a comparable level of information may be included in the response to the question. In either case, the analysis should include a plot of the collapsed vessel level to confirm that TAF is not reached (the elevation of the TAF should be provided) and a plot of the temperature cool down to confirm that the cool down is within tech spec limits.	
3.2.1.3.C	The licensee did not provide a completed analysis for repowering batteries using the portable FLEX 480 volt ac diesel generator and the associated time constraint for battery life. Additional analysis is required to confirm timing.	
3.2.1.3.D	The licensee did not provide the basis for SOE Action Item 9 regarding the 8-hour time the portable diesel driven FLEX pumps will be staged. Additional analysis is required to confirm timing.	
3.2.1.3.E	The licensee provided preliminary times for SOE Action Items 10, 11, and 12 regarding ventilation needs for various areas of the plant. Additional analysis is required to confirm timing.	
3.2.1.4.A	The licensee did not provide complete updated information regarding FLEX portable pump flow analyses. This will be provided in the licensee's February 2014 status update report.	
3.2.1.4.B	The licensee needs to provide further technical basis or a supporting analysis for the portable/Flex diesel generator capabilities considering the capacity of the equipment. A summary of the sizing calculation for the FLEX 480 V diesel generators to show that they can supply the loads assumed in phases 2 is also needed.	
3.2.1.6.A	The licensee specified that the 24-hour time constraint for supplying alternate nitrogen is preliminary but provided no technical basis or analysis to support the 24-hour requirement to supply alternate nitrogen. The licensee will provide updated information in a six-month status report in February 2014.	
3.2.1.8.A	The licensee did not provide a discussion regarding the methodology used to assure adequate NPSH for the RCIC pump and justify that it is adequate in light of the potential for limited margins and potentially significant transient phenomena. Additional information will be provided in a six-month update.	
3.2.1.8.B	The integrated plan provides no details regarding; actual connection points, (e.g., system valve numbers and actual location in plant piping) the length of hose runs and associated connecting fittings required to connect the portable pump at the primary and alternate locations, and no details regarding portable pump capabilities to correlate with actual flow and pressure requirements. It is not possible to determine based on the limited information that the strategies for phase 2 core cooling are viable.	

3.2.1.8.C	The licensee will provide additional information regarding final design and implementation plans for use of impure water for core makeup.	
3.2.1.8.D	The licensee provided insufficient information to support a conclusion that the switchover from CST to the torus function will be accomplished in a timely manner so that RCIC injection to RPV will commence without delay and remain uninterrupted. Additional information to be provided in a six-month update.	
3.2.2.A	The licensee will provide additional information regarding providing alternate makeup via RHR spent fuel cooling piping, e.g., the routing of hoses from the FLEX portable pump, location where the portable pump is connected to the RHR system, FLEX pump flow and pressure requirements using this flow path in a six-month update.	
3.2.2.B	The licensee did not provide complete information regarding the FLEX portable pump for the strategy for maintaining SFP level including routing of hoses, available flow rates and flow rates required to the SFP.	
3.2.4.1.A	The licensee did not provide additional formal analysis to determine the timing and scope of the supplemental cooling water, or systems and components need to support ELAP strategies. The results of this analysis will be provided in a six-month status report.	
3.2.4.2.A	The licensee did not perform calculations or supporting analysis regarding the effects of loss of ventilation in the RCIC room (that NEI 12-06 states may be addressed by plant-specific thermal hydraulic calculations) nor other areas of the plant (main control room (MCR) and battery room) when normal ventilation will not be available during the ELAP. This should include formal analysis for supplemental cooling of the RCIC room and battery room using portable fans, opening doors, and the timing and scope of such actions.	
3.2.4.2.B	The licensee needs to provide information to confirm that the habitability limits of the MCR will be maintained in all Phases of an ELAP considering MIL-STD-1472C, which is incorporated by reference in NEI 12-06 via NUMARC 87-00 and specifies that 110°F is tolerable for light work for a 4-hour period while dressed in conventional clothing with a relative humidity of ~30%.	
3.2.4.4.A	The licensee needs to provide a discussion that includes a rationale for eliminating power to 125 volt dc emergency lighting. This action is inconsistent with other sections of the licensee's response regarding emergency lighting.	
3.2.4.4.B	Review of the licensee communications enhancements for confirmation that upgrades to the site's communications systems have been completed if necessary.	
3.2.4.9.A	The licensee did not address actions to maintain the quality of	

	fuel stored in the tanks of the portable equipment for potentially long periods of time when the equipment (diesel driven pumps and generators) will not be operated.	
3.2.4.10.A	The licensee provided various examples of loads to be shed, and loads to remain powered from both divisions of the 125V DC and 250V DC buses, and stated that the station batteries do not require portable supplemental charging before eight (8) hours. The licensee needs to provide a completed load shed analysis.	
3.3.2.A	The licensee needs to provide a description of the configuration control program it will implement that includes a program document that will contain; a historical record of previous strategies and the basis for changes, and a change control process to allow changes to the strategies only if they continue to meet the guidelines of NEI 12-06.	
3.4.A	The licensee needs to provide additional information regarding the minimum capabilities for offsite resources for which each licensee should establish availability as noted in considerations 2 through 10 of NEI 12-06, Section 12.2 lists the following minimum capabilities.	

Based on this review of NSPM's plan, including the six-month update dated August 28, 2013, and information obtained through the mitigation strategies audit process, the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that the plan, when properly implemented, will meet the requirements of Order EA-12-049 at Monticello. 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 Interim Staff Evaluation 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 beyond-design-basis external event. These new requirements provide a greater mitigation capability consistent with the overall defense-in-depth philosophy, and, therefore, greater assurance that the challenges posed by beyond-design-basis external events to power reactors do not pose an undue risk to public health and safety.

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

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

6.0 REFERENCES

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

2. Letter from NSPM to NRC, "Monticello 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 28, 2013 (ADAMS Accession No. ML13066A066)

3. Letter from NSPM to NRC, "Monticello'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 28, 2013 (ADAMS Accession No. ML13241A200)

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

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

15. Draft JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," May 31, 2012 (ADAMS Accession No. ML12146A014)

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

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

19. JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," August 29, 2012 (ADAMS Accession No. ML12229A174)

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

21. Letter from John Bowen, MegaTech Services, LLC, to Eric Bowman, NRC, submitting "First Batch SED Final – 7 Sites" providing final versions of the first batch of Safety Evaluation Drafts (SED) 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 November 20, 2013 (ADAMS Accession No. ML13317B000)

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Date: November 25, 2013

Enclosure 2
Technical Evaluation Report
ML13317A935

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

November 20, 2013

Xcel Energy – Northern States Power Company - Minnesota
Monticello Nuclear Generating Plant
Docket No. 50-263

Prepared for:

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

Contract NRC-HQ-13-C-03-0039
Task Order No. NRC-HQ-13-T-03-0001
Job Code: J4672
TAC No.: MF0923

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

2.0 EVALUATION PROCESS

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

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

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

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

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

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

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

3.0 TECHNICAL EVALUATION

By letter dated February 28, 2013, (ADAMS Accession No. ML13066A066), and as supplemented by the first six-month status report in letter dated August 28, 2013 (ADAMS Accession No. ML13241A200), Xcel Energy – Northern States Power Company - Minnesota (hereinafter referred to as the licensee) provided Monticello Nuclear Generating Plant's (MNGP) Integrated Plan for Compliance with Order EA-12-049. 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 BDBEEs leading to an extended loss of all alternating current (ac) power (ELAP) and loss of normal access to the ultimate heat sink (UHS). These hazards are broadly grouped into the categories discussed below in Sections 3.1.1 through 3.1.5 of this evaluation. Characterization of the applicable hazards for a specific site includes the identification of realistic timelines for the hazard; characterization of the functional threats due to the hazard; development of a strategy for responding to events with warning; and development of a strategy for responding to events without warning.

3.1.1 Seismic Events.

NEI 12-06, Section 5.2 states:

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

The licensee's screening for seismic hazards, as presented in their integrated plan, has screened this external hazard and identified the hazard levels for reasonable protection of the portable equipment. The licensee confirmed on page 1 of the Integrated Plan that seismic hazards are applicable to MNGP and that the design basis safe shutdown earthquake (SSE) is 0.12g; and associated spectra are included in MNGP Updated Safety Analysis Report (USAR). The licensee also states on page 6 that the seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 had not been completed and therefore was not assumed in their Integrated Plan.

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

The licensee plans on storing FLEX equipment in an existing structure required by 10 CFR 50.54(hh) and a new storage building that meets the plant's SSE design basis using the American Society of Civil Engineers (ASCE) 7-10, "Minimum Design Loads for Buildings and Other Structures" standard, as specified by NEI 12-06, Section 5.3.1, Item 1.b. The licensee will also provide for securing large portable equipment to protect them during a seismic event, or to ensure unsecured and/or non-seismic components do not damage the equipment as is also specified in NEI 12-06, Section 5.3.1, considerations 2 and 3.

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

3.1.1.2 Deployment of FLEX Equipment - Seismic Hazard

NEI 12-06, Section 5.3.2 states:

> The baseline capability requirements already address loss of non-seismically robust equipment and tanks as well as loss of all AC. So, these seismic considerations are implicitly addressed.
>
> There are five considerations for the deployment of FLEX equipment following a seismic event:
>
> 1. If the equipment needs to be moved from a storage location to a different point for deployment, the route to be traveled should be reviewed for potential soil liquefaction that could impede movement following a severe seismic event.
>
> 2. At least one connection point for the FLEX equipment will only require access through seismically robust structures. This includes both the connection point

and any areas that plant operators will have to access to deploy or control the capability.

3. If the plant FLEX strategy relies on a water source that is not seismically robust, e.g., a downstream dam, the deployment of FLEX coping capabilities should address how water will be accessed. Most sites with this configuration have an underwater berm that retains a needed volume of water. However, accessing this water may require new or different equipment.

4. If power is required to move or deploy the equipment (e.g., to open the door from a storage location), then power supplies should be provided as part of the FLEX deployment.

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

With respect to the deployment of FLEX equipment during a seismic event, the licensee references MNGP's USAR on page 1 of the integrated plan, which details that the site is not subject to liquefaction (consideration 1) based on the soil properties and design basis earthquake accelerations. Consideration is also given to the deployment pathways of FLEX equipment from the proposed storage locations, including the potential to remove debris from non-seismically designed structures using on-site equipment.

With respect to the licensee's plans for deployment of the portable equipment, and plans for protection and accessibility of the connection points, it was determined that FLEX equipment and hoses would only be routed through seismically robust, Class 1 structures (consideration 2), and that equipment required to move the FLEX equipment will be protected from seismic events (consideration 5). On page 8 of MNGP's submittal, the licensee explained that programs and procedures, including administrative controls, will be employed to ensure that deployment of the FLEX identified for the Mode 1 strategy remains possible in all modes.

However the licensee stated in Integrated Plan that the identification of storage locations, and associated deployment pathways, for Phase 2 equipment are still under development. The integrated Plan did not provide sufficient information regarding whether there is a need for power to move or deploy the equipment (e.g., to open the door from a storage location) as described by NEI 12-06 Section 5.3.2, consideration 4. This was discussed with the licensee during the audit process in order to allow it to be taken into account in the planned storage building(s) and may be verified during on-site audits. This item has been identified as Confirmatory Item 3.1.1.2.A in Section 4.2.

Also, the licensee did not address consideration 3 regarding the possibility of failure of a downstream dam's effect on the supply of water from the Mississippi river. This has been combined with Open Item 3.1.1.3.A in Section 4.1.

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

The licensee's integrated plan did not address measures for determination of necessary instrument readings per NEI 12-06 Section 5.3.3, consideration 1 above, to support the implementation of the mitigating strategies in the event that seismically qualified electrical equipment is affected by beyond-design-basis seismic events. The only instruments identified as being able to be read locally (for example at local panels in the main control room (MCR) or at containment penetrations) using portable instruments are the drywell air temperature instruments. During an audit call on August 28, 2013, the licensee indicated that a reference source for obtaining necessary local instrument readings will be developed as discussed in NEI 12-06.

The licensee's integrated plan did not address procedural interfaces considerations for seismic hazards associated with large internal flooding sources that are not seismically robust and do not require ac power as specified in consideration 2, the use of ac power to mitigate ground water in critical locations as specified in consideration 3, or the existence of non-seismically robust downstream dams as specified in consideration 4. This is identified as Open Item 3.1.1.3.A. in Section 4.1.

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the Integrated Plan is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to seismic event procedural interfaces. This has been identified as an Open Item in section 4.1.

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.

The licensee specified on page 10 of its integrated plan that the industry will establish Regional Response Centers (RRC) to support utilities during beyond design basis events. For MNGP, Equipment will be moved from the RRC in Memphis, TN to a local assembly area. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. Equipment arriving first will be delivered to the local assembly area within 24 hours from the initial request.

However the licensee did not identify the local assembly area or describe the methods to be used to deliver the equipment to the site. This is identified as Confirmatory Item 3.1.1.4.A. in Section 4.2.

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

The licensee's screening for flooding hazards, as presented in their integrated plan, has screened this external hazard and identified the hazard levels for reasonable protection of the portable equipment. The licensee confirmed on page 2 of their submittal that flooding hazards are applicable to MNGP and that the design bases flood for the MNGP is a Probable Maximum Flood (PMF) on the Mississippi River. Maximum predicted flood water level is 939.2 ft. and there are about 12 days available until the peak stage would be reached. The licensee also specified that the peak flood is a result of the worst combination of hydrometeorological, hydrological, and climatic conditions, and that site grade would be flooded for approximately 11 days. The licensee also specified that the flooding re-evaluations requested by the 50.54(f) letter have not been completed.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and 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 specified that it will provide a storage location for the portable equipment required by 10 CFR 50.54(hh) and a new storage location in a building designed to ASCE 7-10, or an evaluated equivalent. The licensee specified that 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 building will be located at an elevation that prevents a flood from impacting access to FLEX equipment during the early stages of the flood, configuration 3 from NEI 12-06 Section 6.2.3.1. The licensee did not provide the actual elevation of the new storage location relative to the maximum flood level, or any discussion regarding how much time was needed to move the equipment before the storage building was flooded, however the licensee noted that it would be in the early stages of the flood.

During the audit process, the licensee indicated that the only pre-staging of equipment at MNGP will occur in a flooding event. At a specified river level (921 feet), site procedures require the plant be shutdown and the FLEX equipment moved to inside the site's levee. This action would stage the FLEX equipment inside a levee before the flood could threaten the FLEX equipment, thereby assuring its availability if flooding levels rise. The licensee further identified that previous time studies have shown that staging of similar pumps and laying out hoses can be accomplished within two hours. Therefore, because the warning time identified for MNGP's PMF is on the order of days, it is reasonable to conclude that equipment would be relocated prior to the flood impacting the storage location.

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

3.1.2.2 Deployment of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.2 states:

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

3. Depending on plant layout, the ultimate heat sink may be one of the first functions affected by a flooding condition. Consequently, the deployment of the FLEX 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 ELAP, plants should consider the need to provide water extraction pumps capable of operating in an ELAP and hoses for rejecting accumulated water for structures required for deployment of FLEX strategies.

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

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

On page 2 and 3 of the integrated plan, regarding consideration 1, the licensee stated that there is sufficient time for pre-staging the Phase 2 FLEX equipment within the flood-protected area before the design basis flood level is reached. The main access road to the site will not be available in the design basis flood. An alternate access road will be constructed as part of the flood preparations. Plant procedures require the plant to shut down when the river level is predicted to exceed elevation 921'. 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 and also have access to a water supply.

As noted above on page 2 of the integrated plan, the licensee states that FLEX equipment would be pre-staged or staged within hours of the initiation of the ELAP. For certain scenarios, such as those involving flooding or high winds, external conditions have the potential to adversely impact staged equipment. The licensee did not provide any station procedures for equipment staging that would address these potential impacts.

The licensee provided updated information as part of the audit process which addresses this issue by stating that the only pre-staging of FLEX equipment at MNGP will occur in a flooding event. When the river level rises to 921', the licensee's procedure require the plant be shutdown and the FLEX equipment moved to inside the site's levee. This action will stage the FLEX equipment inside a levee before the flood could threaten the FLEX equipment, thereby assuring its availability if flooding levels rise. The licensee noted that this strategy could change depending upon building location.

Based on the above response it was concluded that the licensee will pre-stage FLEX equipment prior to any flooding affecting the storage location in accordance with current plant procedures. This will ensure that FLEX equipment will be available in advance of a predicted flood and will be accomplished in a fashion that will not impact the mitigating strategies.

On page 14 of the integrated plan regarding consideration 3, loss of access to the ultimate heat sink, the licensee stated that the Mississippi River is the ultimate makeup water source, and will be available in all scenarios. The FLEX portable pump will be deployed near the discharge canal and take suction directly from the canal. For the flood hazard, the plant will be shutdown. The discharge canal will be flooded therefore the FLEX portable pump will be deployed inside the berm near the intake structure, and take suction directly from the river outside the berm. Using this strategy will ensure that the UHS is available during flooding conditions.

On page 17 of the integrated plan, regarding consideration 9, protection of the means to move equipment, the licensee stated that deployment of portable equipment and hoses will be performed using vehicles and trailers from the storage locations.

The MNGP integrated plan did not address flooding deployment consideration 2, regarding restocking supplies during flooding conditions, consideration 4 regarding protection for fuel supplies from flooding conditions, consideration 5 regarding assuring connection points are protected, consideration 7 regarding the need to provide water extraction pumps, and consideration 8 regarding the need for temporary flood barriers. This has been identified as Open Item 3.1.2.2.A in Section 4.1

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the Integrated Plan is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to flooding deployment. These concerns are identified as an Open Item above and in Section 4.1.

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 pages 15 and 39 of the integrated plan the licensee stated that they will utilize the industry developed guidance from the Boiling Water Reactor Owners Group (BWROG), the Electric Power Research Institute (EPRI) and NEI to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies. Existing procedures will be reviewed with the industry generic FSGs and modified as appropriate. The licensee has committed to provide site specific procedures and guidelines developed by the BWROG, EPRI and NEI to address the guidance of NEI 12-06 Section 6.2.3.3.

However the licensee's plans for the development of procedures and programs regarding the deployment of portable equipment in flooded conditions information is required to address consideration 3 above. The licensee's response notes that the maximum height of flood water is expected to be 939.2 ft. and notes that the site grade will be flooded for 11 days. No information is provided regarding any needed procedures to ensure the availability of and deployment for temporary flood barriers or extraction pumps or dewatering equipment for the condition where the site grade is flooded. This has been identified as Open Item 3.1.2.3.A in Section 4.1.

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

3.1.2.4 Considerations in Using Offsite Resources – Flooding Hazard

NEI 12-06, Section 6.2.3.4 states:

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

The licensee specified on page 10 of its Integrated Plan that NSPM has signed a participation contract as part of the industry establishment of RRCs to support utilities during beyond design basis events. For MNGP, equipment will be moved from the RRC in Memphis, TN to a local assembly area. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. Equipment arriving first will be delivered to the local assembly area within 24 hours from the initial request.

However, the licensee did not identify the local assembly area nor describe the methods to be used to deliver the equipment to the site. 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 during 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 tornado and high wind hazards are applicable to the MNGP and MNGP screens in for the tornado hazard. The design bases wind speed for Class I and II structures at the MNGP is 100 mph, and design bases tornado loadings are a differential pressure of 2 psi, rotational wind with tangential velocity of 300 mph, and a torsional moment from the wind speed on half of the structure. Tornado missiles design parameters are provided in USAR Section 12.2.1.8.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to 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 pages 3 and 4 of the Integrated Plan the licensee stated that the MNGP plan for storage locations includes use of the existing onsite storage location for the portable equipment required by 10 CFR 50.54(hh) and a new storage location in a building designed to ASCE 7-10, or an evaluated equivalent building. 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 new building will be selected considering the predominant tornado travel paths from the West or West Southwesterly direction. The FLEX equipment will be stored in diverse locations in a North-South arrangement with sufficient separation distance such that "N" sets of equipment are reasonably protected and deployable after a tornado.

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

3.1.3.2 Deployment of FLEX Equipment – High Wind Hazard

NEI 12-06, Section 7.3.2 states:

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

On page 4 of the integrated plan the licensee stated that regarding consideration 3 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. On page 44 of the integrated plan in the table describing Phase 2 equipment, the licensee notes that a forklift and front loader will be available for debris removal.

On page 17 of the integrated plan, regarding consideration 4, protection of the means to move equipment, the licensee stated that deployment of portable equipment and hoses will be performed using vehicles and trailers from the storage locations.

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 during high wind or tornado events, if these requirements are implemented as described.

3.1.3.3 Procedural Interfaces – High Wind Hazard

NEI 12-06, Section 7.3.3, states:

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

On page 39 of the integrated plan, the licensee stated that they will utilize the industry developed guidance from the Boiling Water Reactor Owners Groups, EPRI and NEI to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom-based command and control strategies. Existing procedures will be reviewed with the industry generic FSGs and modified as appropriate.

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 procedure interfaces for high wind or tornado events, if these requirements are implemented as described.

3.1.3.4 Considerations in Using Offsite Resources – High Wind Hazard

NEI 12-06, Section 7.3.4 states:

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

The licensee specified on page 10 of its Integrated Plan that the industry will establish RRCs to support utilities during beyond design basis events. For MNGP, equipment will be moved from the RRC in Memphis, TN to a local assembly area. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. Equipment arriving first will be delivered to the local assembly area within 24 hours from the initial request.

However the licensee did not identify the local assembly area nor describe the methods to be used to deliver the equipment to the site. 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 during high wind events, if these requirements are implemented as described.

3.1.4 Snow, Ice and Extreme Cold

As discussed in NEI 12-06, Section 8.2.1:

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

On page 5 of the Integrated Plan the licensee stated that snow, ice and extreme cold hazards are applicable to the MNGP. MNGP is located in the Level 4 region for ice severity and must consider ice storm impacts. The USAR design bases for the MNGP ground snow load of 50 pounds per square foot of horizontal projected area Actual snow load on the structure accounts for roof geometry and features of the surrounding area, and includes various return periods for ice thicknesses due to freezing rain. The USAR identifies an extreme minimum air temperature of -38°F.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to screening for 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 pages 4 and 5 of the integrated plan, the licensee stated that the plan for storage locations includes use of the existing onsite storage location for the portable equipment required by 10 CFR 50.54(hh) and a new storage location in a building designed to ASCE 7-10, or an evaluated equivalent. Buildings will be provided with adequate heating to prevent equipment from freezing, and will also be designed to withstand required snow and ice loads. Backup heating is not required if power is lost because the equipment is expected to be deployed within 12 hours of the initiation of the extended loss of AC power (ELAP).

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

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

NEI 12-06, Section 8.3.2 states:

> There are a number of considerations that apply to the deployment of FLEX equipment for snow, ice, and extreme cold hazards:
>
> 1. The FLEX equipment should be procured to function in the extreme conditions applicable to the site. Normal safety-related design limits for outside conditions may be used, but consideration should also be made for any manual operations required by plant personnel in such conditions.
>
> 2. For sites exposed to extreme snowfall and ice storms, provisions should be made for snow/ice removal, as needed to obtain and transport FLEX equipment from storage to its location for deployment.
>
> 3. For some sites, the ultimate heat sink and flow path may be affected by extreme low temperatures due to ice blockage or formation of frazil ice. Consequently, the evaluation should address the effects of such a loss of UHS on the deployment of FLEX equipment. For example, if UHS water is to be used as a makeup source, some additional measures may need to be taken to assure that the FLEX equipment can utilize the water.

On page 5 of the integrated plan the licensee stated that 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 moderate snow accumulations and can also be used to move portable equipment. The ultimate heat sink will remain available as the discharge canal is maintained open during normal plant operations due to normal warm water discharge. Procedures will ensure that following plant shutdown, deployment of the FLEX pump suction piping will not be prevented by any minor ice development on the surface of the discharge canal.

On page 44 of the integrated plan in the section describing portable equipment, the licensee listed debris clearing equipment, but does not specify whether this equipment would be capable of removing snow or ice. Also on page 45, the licensee listed no equipment capable of removing snow or ice. The licensee response in the August 21st, 2013, audit clarification call resolved this issue. The licensee stated that snow removal was a routine evolution at Monticello and that snow removal equipment was available at the site.

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

3.1.4.3 Procedural Interfaces – Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.3, states:

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

As discussed in Section 3.1.4.2 above, the licensee has supplied additional information during the audit process regarding plans to address needed procedures that deal with the effects of snow and ice on transporting the equipment.

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

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

NEI 12-06, Section 8.3.4, states:

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

The licensee specified on page 10 of its Integrated Plan that the industry will establish RRCs to support utilities during beyond design basis events. For MNGP, equipment will be moved from the RRC in Memphis, TN to a local assembly area. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. Equipment arriving first will be delivered to the local assembly area within 24 hours from the initial request.

However, the licensee did not identify the local assembly area nor describe the methods to be used to deliver the equipment to the site. 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 during extreme cold events, if these requirements are implemented as described in the licensee's Integrated Plan.

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 5 of the integrated plan the licensee stated that consistent with NEI 12-06, Section 9.2, they will address high 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 screening for high temperature hazards, if these requirements are implemented as described.

3.1.5.1 Protection of FLEX Equipment – High Temperature Hazard

NEI 12-06, Section 9.3.1, states:

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

On page 5 of the integrated plan, the licensee stated the MNGP plan for storage locations includes use of the existing onsite storage location for the portable equipment required by 10 CFR 50.54(hh) and a new storage location in a building designed to ASCE 7-10, or an evaluated equivalent. Buildings will be provided with adequate ventilation to maintain reasonable storage temperatures. Backup ventilation cooling is not required if power is lost because the equipment is expected to be deployed within 12 hours of the initiation of the ELAP.

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

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 6 of the integrated plan the licensee stated that high temperature does not impact the deployment of FLEX equipment. 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 deployment of FLEX equipment for high temperature hazards, if these requirements are implemented as described in The licensee's integrated plan

3.1.5.3 Procedural Interfaces – High Temperature Hazard

NEI 12-06, Section 9.3.3 states:

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

On pages 37 and 38 of the integrated plan, the licensee noted that for various rooms; MCR, Battery Rooms, reactor core isolation cooling (RCIC) room, and residual heat removal (RHR) room, a formal analysis that the temperatures will be maintained within equipment functional limitations, or whether supplemental cooling is required, had not been completed and would be provided in six month status updates.

The licensee addressed the effects of high temperatures on the storage of the equipment in Section 3.1.5.1 above but there is no information presented in the Integrated Plan regarding the heat up of a variety of rooms and enclosures and no discussion of the potential effects of high temperature on the portable equipment in the event the equipment would located in the room and enclosures noted above. This has been identified as Confirmatory Item 3.1.5.3.A in Section 4.2.

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

3.2 PHASED APPROACH

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

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

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

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

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

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

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

3.2.1.1. Computer Code Used for ELAP Analysis.

NEI 12-06, Section 1.3 states in part:

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

The licensee provided a Sequence of Events (SOE) on pages 46-49 of their integrated plan, which included the time constraints and the technical basis for the MNGP site. The SOE is based on an analysis using the industry-developed Modular Accident Analysis Program (MAAP) Version 4 computer code. MAAP4 was written to simulate the response of both current and advanced light water reactors to LOCA and non-LOCA transients for probabilistic risk analyses as well as severe accident sequences. The code has been used to evaluate a wide range of severe accident phenomena, such as hydrogen generation and combustion, steam formation, and containment heating and pressurization.

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

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

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

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

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

regarding specific modeling options and parameter choices for key models that would be expected to substantially affect the ELAP analysis performed for that licensee's plant. Although some suggested key phenomena are identified below, other parameters considered important in the simulation of the ELAP event by the vendor / licensee should also be included.

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

(This has been identified as Confirmatory Item 3.2.1.1.D)

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

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

3.2.1.2. Recirculation Pump Seal Leakage Models

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

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

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

A review was conducted of the licensee's integrated plan and it was determined that there is insufficient information provided to determine the adequacy of the determination of recirculation pump seal or other sources of leakage used in the ELAP analysis. This has been identified as Open Item 3.2.1.2.A in Section 4.1.

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the Integrated Plan is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to recirculation pump seal leakage models and other sources of RCS leakage.

3.2.1.3 Sequence of Events

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

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

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

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

In its integrated plan, the licensee provided a sequence of events (SOE) identifying the time constraints and their applicability. Many of the time constraints were listed as preliminary. As noted above in section 3.2.1.1, the computer code analysis used in ELAP analysis, the licensee did not provide information regarding how MAAP was used in establishing an (SOE) time line, nor provide a technical basis for the results of the MAAP analysis.

NEDC 33771P/NEDO-33771, "GEH Evaluation of FLEX Implementation Guidelines," Revision 1 (hereinafter NEDC-33771P, ADAMS Accession No. ML130370742) specifies the beginning of the sequence for SBO for BWR/3/4 with Mark 1 Containment as follows:

> BWRs that have RCIC will respond to an SBO with the initiation of RCIC to inject water into the reactor vessel. High Pressure Coolant Injection (HPCI) may respond if RCIC is not available. RCIC and HPCI utilize reactor steam for motive force, exhausting this steam to the suppression pool. This exhaust steam transfers decay heat from the reactor vessel to the suppression pool. In addition to the RCIC steam supply, the [safety-relief valves] SRVs may open automatically to relieve pressure. Also some SRVs under operator control may

be manually opened to maintain a reactor pressure band while there is sufficient direct current (DC) power and pneumatic supply. For both cases, SRV steam flow will remove additional reactor decay heat.

The RCIC system is proposed as the primary means by which the licensee will remove decay heat during an ELAP event. The RCIC system consists of a steam-driven turbine pump unit and associated valves and piping capable of delivering makeup water to the reactor vessel. The steam supply to the turbine comes from the reactor vessel. The steam exhaust from the turbine dumps to the torus. The pump can take suction from the demineralized water in the condensate storage tank or from the torus. Following any reactor shutdown, steam generation continues due to heat produced by the radioactive decay of fission products. The steam normally flows to the main condenser through the turbine bypass or if the condenser is isolated, through the relief valves to the torus. The RCIC system turbine pump unit either starts automatically upon a receipt of a reactor vessel low-low water level signal or is started by the operator from the Control Room by remote manual controls. To limit the amount of fluid leaving the reactor vessel, the reactor vessel low-low water level signal also actuates the closure of the main steam isolation valves. The RCIC system has a makeup capacity sufficient to prevent the reactor vessel water level from decreasing to the level where the core is uncovered without the use of core standby cooling systems.

The ELAP analysis for MNGP generally assumes that the RCIC system will be placed into service. On page 46 of the integrated plan, the SOE notes Action Item 1, "HPCI placed in pull-to-lock" and the applicability statement states that, HPCI must be placed in pull-to-lock prior to its second automatic initiation such that it does not start. This is to preserve the Division II 250 VDC battery for other Phase 1 functions, including SRV and Hardened Containment Vent System operation. This planned action by the licensee will preclude any concerns regarding HPCI interaction and hence would not generate significant issues such as steam usage and temperature qualification.

The sequence of events of the ELAP was provided by the licensee in the description of the strategy to maintain core cooling and in Attachment 1 to the integrated plan. The event starts with the plant at 100% power when the initiating event of an instantaneous loss of all ac power is assumed. RCIC is manually initiated following the initial trip on high RV water level per the SBO procedure, but a time constraint is not identified. As noted above HPCI is deactivated per SBO procedure prior to its second start by placing it in pull-to-lock.

On page 11 of the integrated plan the licensee stated that after the initial automatic initiation and trip of RCIC and HPCI, RCIC will be used as the primary strategy to provide makeup water to the reactor. RCIC will be manually started and operated to maintain reactor level in the normal range above -47" and below +48". No information or technical basis was provided to determine if; RCIC will be started at a time required by analysis following the initial trip, if any elapsed time constraint exists for this action or if pressure and temperature conditions in the containment predicted in NEDC-33711P have been considered. This has been identified as Open Item 3.2.1.3.A in Section 4.1.

The SOE notes that at approximately one hour, the ELAP decision is made, and at approximately 2 hours the DC loadshed is complete. No analysis or technical basis was provided for the completion of this action. The licensee's integrated plan stated in the SOE that the time shown is preliminary as the supporting loadshed analysis is not complete. This has been identified as Open Item 3.2.1.3.B in Section 4.1.

The SOE notes for Action 5 that following Action 4, the operators will depressurize the Reactor using the SRV's to Approximately 100 psig. The SOE notes in the remarks column for this action that reactor depressurization to approximately 100 psig will enable continued RCIC operation. Reactor depressurization is not time critical. Depressurization is required prior to venting the Torus, and on page 11 of 50 in the section for Maintain Core Cooling Phase 1, the licensee stated that reactor depressurization will be initiated to reduce reactor pressure to approximately 100 psig using SRVs. SRVs will be manually cycled per procedure to control reactor pressure, but it will be maintained high enough such that RCIC can operate.

NEI 12-06 Section 3.2.1.7, principle 6, specifies that strategies that have a time constraint to be successful should be identified and a basis provided that the time can reasonably be met. No technical basis or supporting analysis is provided for (1) why Action Item 5 (depressurization of the RCS to 100 psig) has no time constraint, (2) why depressurization is required prior to venting the Torus, (3) the rate of depressurization that would be implemented, or (4) that the resulting pressure or temperature conditions in the containment have been determined to be acceptable, e.g., for RCIC NPSH.

The licensee provided updated information as part of the EA-12-049 Audit response process which addresses this issue by stating that, the strategy to depressurize was based on depressurizing the reactor to allow future water injection with lower pressure pumps, and reduces the fuel temperatures providing more margin to core damage. The licensee stated that prior to venting, current EOP requires depressurization, and that here was no critical performance time for this action. The depressurization strategy will increase the depressurization pressure of 100 psig to 200 psig following implementation of the next revision of the EOPs. The depressurization is required to reduce the energy within the RPV before reaching plant conditions for which the pressure suppression system may not be able to safely accommodate ADS valves opening. The depressurization rate is procedurally restricted. Concurrent opening of all ADS values is within analyzed plant design limits. Cool down rate will be controlled to less than 100°F/hr unless a higher cool down rate (emergency depressurization) is required/allowed by the EOPs.

The SOE notes that for action item 6, operators will initiate use of the hardened containment vent system at 6 hours and in the remarks column for this action that, the Hardened Containment Vent System (HCVS) must be opened per the EOPs. Opening the vent provides a path for heat removal from the Torus which extends time that the Torus is able to function as a heat sink and makeup water source.

Additionally on page 12 in the integrated plan, the licensee states that the Torus performs as the heat sink for core cooling. The Hardened Containment Vent System (HCVS) line for the Torus will be opened to remove heat from the Torus per the EOPs based on the pressure suppression pressure limit (a range of 17 to 33 psig, depending on Torus level). Based on MAAP analysis, this is expected to be approximately 6 hours after the initiation of the event, and will be confirmed by analysis. If the completed analysis results in a change in strategy, this will be provided in a six-month status report.

The licensee provided no technical basis or supporting analysis is provided to determine if the 6-hour time constraint to vent containment is valid or that pressure and temperature conditions in the containment predicted in NEDC-33711P have been considered. The licensee provided updated information as part of the EA-12-049 Audit response process addresses this issue by stating that the MAAP analysis would be completed and the licensee would provide the requested information in the February 2014 update. Additionally, in the audit process the licensee specified that revision 3 of the EPGs/SAG's will provide an override which will allow containment venting above the high containment pressure scram setpoint. The override will be permitted if there is no core cooling available. The venting strategy during the ELAP will be to open the vent as soon as there is sufficient pressure to remove heat from the Torus (e.g., ~ 15 psig)

The SOE notes that for action item 8 that the batteries are being repowered using portable FLEX 480V AC Diesel Generators and in the remarks column for this action that the time (8 hours) is shown as preliminary as the supporting loadshed analysis is not yet completed.

On page 12 of the integrated plan, the licensee states that load shedding will be performed on the Division I and Division II station batteries to extend the time station batteries can be used to operate equipment and instruments used to provide core cooling. RCIC operates using the Division I station batteries. Instruments, SRVs, and the HCVS will be operated using Division II station batteries. Additional discussion of the load shedding strategy is provided in the section for Safety Functions Support – BWR Installed Equipment Phase 1.

On page 33 and 34 of the integrated plan, the licensee stated that DC power is supplied to RCIC, SRVs, Hardened Containment Vent System (HCVS), critical instrumentation, and emergency lighting. DC power is provided by two divisions of batteries and each division includes 125 VDC and 250 VDC sources. Battery life will be extended through deep load shedding on each battery. A high level, preliminary summary of the major loads to remain and examples of those to be shed are provided below. With this deep load shedding strategy, it is expected that the station batteries can be extended through Phase 1 and do not require portable supplemental charging before eight hours for the most limiting battery. Additional formal analysis will be performed to support this. Action item 8 and the associated time constraint are noted as preliminary and additional formal analysis is required. This has been identified as Confirmatory Item 3.2.1.3.C in Section 4.2.

NEI 12-06 Section 3.2.1.7, principle 6, specifies that strategies that have a time constraint to be successful should be identified and a basis provided that the time can reasonably be met. The SOE notes that for Action Item 9, that the Portable diesel driven FLEX pumps will be staged for use within 8 hours, but that it is not an ELAP Event Time constraint. The remarks section of the SOE notes that the strategy for core cooling relies on a portable diesel driven FLEX pump in Phase 2. Given that this pump is necessary for the strategy for core cooling, the licensee needs to identify the time constraint for staging of these pumps and provide a basis that this time constraint can reasonably be met.

The licensee provided updated information as part of the audit process which addresses this issue by stating that the FLEX portable diesel driven pump will be staged for use within 8 hours as specified in the sequence of events Action Item 9. This time was chosen as the earliest reasonable time for pump staging, as additional staff begins arriving on site at 6 hours, and pump deployment and hose layout have been demonstrated to be accomplished within two hours in previous time studies. It is not identified as a time constraint as the licensee strategy relies on RCIC as long as possible, and does not start the FLEX pump until RCIC failure. Preliminary MAAP analysis indicated RCIC will operate beyond 12 hours, providing sufficient margin for the FLEX pump staging such that it does not need a time constraint. The MAAP analysis is not yet complete. The licensee plans to provide the requested information in the licensee's February 2014 six-month status report for Order EA-12-049, Mitigating Strategies. This has been identified as Confirmatory Item 3.2.1.3.D in Section 4.2.

Action Items 10, 11, and 12 state actions for providing room cooling or ventilation for the RCIC room, MCR, and the Battery room respectively. A preliminary elapsed time to provide cooling or ventilation is noted as 8 hours for all three rooms. It was noted that the 8 hours is not a time constraint for RCIC or the MCR but only for the battery room. The remarks column for this three items noted that supporting formal analysis for all three rooms is not complete and will be provided later.

The licensee specified that the 8 hour time is preliminary and provided no technical basis or analysis for action items 10, 11, and 12. This has been identified as Confirmatory Item 3.2.1.3.E in Section 4.2.

The SOE notes in the remarks column for item 13, at 12 hours, for the SFP emergency heat load, provide makeup to the SFP using portable FLEX pump to at least meet to boil off rate (53 gpm for emergency heat load). No technical basis or analysis was provided for the 12 hour time constraint to supply makeup to the SFP. The licensee provided updated information as part of the EA-12-049 Audit response process which addresses this issue by stating that the emergency heat load case assumes a full core discharge is complete after plant shutdown. In this scenario, there is no fuel in the reactor core, therefore the entire site focus would be on maintaining cooling in the SFP. The 8 hour time constraint for staging the FLEX portable diesel driven pump for injection to the SFP remains the same. The 12 hour time constraint for providing makeup to the pool will be changed to 8 hours to ensure pool makeup could begin prior to the pool boiling.

On page 26 of the integrated plan the licensee stated that the only Phase 1 action is to monitor the SFP level. The emergency heat load assumes a full core discharge is required 30 days following startup from the last refueling discharge. In this scenario, there is no fuel in the core, therefore the entire site focus would be on maintaining cooling in the SFP. Under this condition, the SFP will reach a boiling temperature no earlier than 8.3 hours, and have a maximum evaporation rate of 53 gpm after bulk boiling commences. The SFP has 7,769 gallons per foot of depth. Once boiling begins, SFP level would drop less than two feet in four hours. Four hours is adequate to stage a FLEX portable pump to inject water into the SFP. Therefore, assuming event initiation under these conditions, no actions are required for SFP cooling or makeup during Phase 1. The licensee established the 8 hour time constraint for supplying makeup to the SFP as adequate. The licensee specified that boiling would not occur until at least 8.3 hours with the maximum heat load.

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

3.2.1.4 Systems and Components for Consequence Mitigation

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

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

apply.

And,

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

NEI 12-06, Section 3.2.1.12 states:

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

On page 9 of the integrated plan the licensee specified that FLEX equipment will be procured as commercial grade equipment unless credited for other functions, in which case the quality attributes of the other functions apply.

On page 14 of the integrated plan regarding Portable Equipment to Maintain Core Cooling, the licensee describes the use of portable pumps to provide RPV injection. No technical basis or a supporting analysis was provided for the diesel-driven FLEX pump capabilities considering the pressure within the RPV and the loss of pressure along with details regarding the FLEX pump supply line routes, length of hoses runs, connecting fittings, elevation changes to show that the pump is capable of injecting water into the RPV with a sufficient rate to maintain and recover core inventory for both the primary and alternate flow paths.

The licensee provided updated information as part of the audit process regarding incomplete FLEX portable pump flow analyses. The requested information will be provided in NSPM's February 2014 status update report for Order EA-12-049 Mitigating Strategies. Review of the final flow analyses, has been identified as Confirmatory Item 3.2.1.4.A in Section 4.2.

Further technical basis or a supporting analysis is needed for the portable/Flex diesel generator capabilities considering the capacity of the equipment. A summary of the sizing calculation for the FLEX 480 V diesel generators to show that they can supply the loads assumed in phases 2 is needed. The licensee provided updated information as part of the audit process regarding this issue by stating that the generator sizing calculations have not been performed to date. The licensee plans to provide a summary of the calculation in the licensee's February 2014 six-month status report for Mitigating Strategies Order, EA-12-049. Review of the final diesel generator sizing calculations, has been identified as Confirmatory Item 3.2.1.4.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 systems and components for consequence mitigation, if these requirements are implemented as described.

3.2.1.5 Monitoring Instrumentation and Controls

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

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

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

On pages 13, 15, and 19 of the integrated plan, the licensee listed the installed instrumentation credited for the coping evaluation for maintaining core cooling during ELAP as follows:

For Phase 1:

> Drywell Pressure (PT-7251A,B) Containment integrity, Drywell Air Temperature (TE-4247A/B/C/D/E/F/G/H) Containment integrity Torus Water Temperature (TE-4073A through 4080A - Division I, and TE- 4073B through 4080B - Division II Containment integrity Torus Water Level (LT-7338A,B) Containment integrity
>
> RPV Level – (LT-2-3-85A/B, LT-2-3- 112A/B, LT-2-3-61) Reactor vessel inventory and core heat removal RPV Pressure (PT-6-53A/B) Reactor vessel pressure boundary and pressure control.

For Phase 2, the licensee noted that the instrumentation credited was the same as that for Phase 1, along with re-powered Division 1 instruments and local instrumentation for the FLEX equipment. For Phase 3, local instrumentation (e.g., flow meter, pressure gauge) will be available where required to operate the FLEX equipment obtained from the RRC.

The licensee defined the appropriate instrumentation specified by NEI 12-06 Section 3.2.1.10 to support key actions. On page 27 of 50 in the integrated plan, the licensee noted that new SFP level instrumentation is addressed under EA-12-051.

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 plant instrumentation credited in the ELAP mitigation strategies, if these requirements are implemented as described.

3.2.1.6 Motive Power, Valve Controls and Motive Air System

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

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

And,

> Table 12-1 provides a sample list of the equipment expected to be provided to each site from off- site within 24 hours. The actual list will be specified by each site as part of the site-specific analysis.

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

The primary method of pressure control for the RPV during the ELAP is the SRVs. The SRVs require nitrogen from the Nitrogen Supply system to manually operate them. The Nitrogen Supply system piping to the SRVs is not seismic and therefore is possibly not available during the ELAP event. The alternate for the Nitrogen Supply system is nitrogen bottles that automatically supply backup pressure for SRV operation.

On page 11 of the integrated plan the licensee stated that nitrogen gas requirements for the first 24 hours are expected to be supplied by the installed capacity of the Alternate Nitrogen Supply System, and will be confirmed by analysis, so no changeout of bottles is required during Phase 1.

On page 34 of the integrated plan the licensee stated that the alternate nitrogen system is expected to have the capacity to provide nitrogen to the inboard Main Steam Isolation Valves (MSIV), T-ring seals on the containment purge and vent valves, SRVs, and the HCVS. HCVS usage includes breaking the rupture disc and actuation of air-operated valves. The SRVs and HCVS use the alternate nitrogen gas supply for valve actuation. Additional formal analysis of the nitrogen supply will be performed to assure that it is adequate.

On page 37 of the integrated plan, the licensee stated that, the Alternate Nitrogen Supply System will continue to supply nitrogen gas for SRVs and Hardened Containment Vent System valve actuation. In Phase 2, the nitrogen bottles will be changed out with replacement bottles, if required. The system design allows for replacement of nitrogen bottles without interruption to the nitrogen supply. It is expected that there are sufficient quantities of nitrogen stored on site to supply alternate nitrogen gas system usage for 72 hours. Additional formal analysis of the nitrogen quantities required for Phase 1 and 2 operations will be performed to assure that on site quantities are sufficient for at least 72 hours.

The time estimates noted above are expected values and the licensee specified that additional analysis is required to determine the bases for the 24 hour installed nitrogen capability and the 72 hours for replacement nitrogen bottle capability/availability. Additional technical basis and the supporting details are needed for the actual time that installed nitrogen capability is expected to be available, and the basis for when additional nitrogen is needed and available.

The licensee specified that the 24 hour time constraint is preliminary and provided no technical basis or analysis to support the 24 hour requirement to supply alternate nitrogen. The licensee provided updated information as part of the audit process which addresses this issue by stating that the plant specific analysis is not finalized, but the licensee plans to summarize the results in a 6-monts status report for Mitigating Strategies Order EA-12-048. The target submittal for this analysis is February 2014. This has been identified as Confirmatory Item 3.2.1.6.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 operation of alternate nitrogen system if these requirements are implemented as described.

3.2.1.7 Cold Shutdown and Refueling

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

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

The licensee's Integrated Plan did not discuss providing core cooling if an ELAP occurs during Cold Shutdown or Refueling, Modes 5 and 6.

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

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

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

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

3.2.1.8 Use of Portable Pumps

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

> Regardless of installed coping capability, all plants will include the ability to use portable pumps to provide RPV/RCS/SG makeup as a means to provide diverse capability beyond installed equipment. The use of portable pumps to provide RPV/RCS/SG makeup requires a transition and interaction with installed systems. For example, transitioning from RCIC to a portable FLEX pump as the

source for RPV makeup requires appropriate controls on the depressurization of the RPV and injection rates to avoid extended core uncovery. Similarly, transition to a portable pump for SG makeup may require cooldown and depressurization of the SGs in advance of using the portable pump connections. Guidance should address both the proactive transition from installed equipment to portable and reactive transitions in the event installed equipment degrades or fails. Preparations for reactive use of portable equipment should not distract site resources from establishing the primary coping strategy. In some cases, in order to meet the time-sensitive required actions of the site-specific strategies, the FLEX equipment may need to be stored in its deployed position.

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

NEI 12-06 Section 11.2 states in part:

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

Phase 2 of the plan includes coping strategies using on-site portable equipment and modifications to maintain core cooling. The licensee proposed multiple ways of continuing to cool the reactor core during Phase 2.

On page 14 of the integrated plan the licensee specified that the strategy for Phase 2 Core Cooling will rely on RCIC and the Torus with venting through the HCVS for as long as possible. Once RCIC operation is no longer possible, the reactor will be fully depressurized using SRVs, and core cooling makeup will be provided by a FLEX portable diesel driven pump. DC powered equipment will be supported by a FLEX portable diesel driven generator. Details of this strategy are outlined below.

Additionally, a FLEX portable diesel driven pump will be used during Phase 2 to supply water from the discharge canal that empties to the Mississippi River in all events, except the beyond design basis flooding event. The Mississippi River is the ultimate makeup water source, and will be available in all scenarios. The FLEX portable pump will be deployed near the discharge canal and take suction directly from the canal. It will rely on its suction strainer to prevent large debris from entering the pump. The use of raw water is acceptable because the water level is maintained above the top of the fuel throughout the ELAP so that cooling of the fuel does not rely solely on flow up from the bottom of the fuel assembly.

The FLEX pump will discharge through a hose into a connection point in the Division I RHR Service Water (RHRSW) piping in the Reactor Building, via a seismically qualified cross tie connection between RHR and RHRSW then via RHR Low Pressure Coolant Injection (LPCI) lines. An alternate connection point for the makeup supply for LPCI will be in the Division 1 RHR pump discharge piping.

The licensee specified on Page 14 that when RCIC operation is no longer possible, the reactor will be fully depressurized using the SRVs. The licensee did not provide complete information regarding the criteria that are used to determine whether RCIC operation is possible (e.g., fluid temperature, NPSH) and justify their adequacy, nor an assessment of RCIC pump NPSH margin considering the potential for transient conditions associated with cyclical safety/relief valve discharge (potentially in the vicinity of the RCIC suction line) and containment venting while the suppression pool is saturated or nearly saturated. A discussion is needed regarding the methodology used to assure adequate NPSH for the RCIC pump and justify that it is adequate in light of the potential for limited margins and potentially significant transient phenomena.

Regarding the NPSH issue, the licensee provided updated information as part of the audit process which partially addresses this issue by stating that from an operational point of view, RCIC would be run as long as possible, i.e., it would be run to failure. The licensee would expect RCIC to run until mid-200 degrees Fahrenheit based on GEH analysis and data recorded for Fukushima Unit 2. The licensee will provide a final complete analysis regarding NPSH for the RCIC pump in the licensee's February 2014 six-month status report. Review of the licensee's final analysis regarding the RCIC NPSH issue, has been identified as Confirmatory Item 3.2.1.8.A in Section 4.2

As noted previously in section 3.2.1.5, the Sequence of Events on pages 46 through 49 of the integrated plan, several of the time constraints are noted as preliminary or no technical basis or analysis was provided to support the action items. The licensee also stated that further analysis was required and would be provided at a later date for several action items. The integrated plan provides no details regarding; actual connection points, (e.g., system valve numbers and actual location in plant piping) the length of hose runs and associated connecting fittings required to connect the portable pump at the primary and alternate locations, and no details regarding portable pump capabilities to correlate with actual flow and pressure requirements. It is not possible to determine based on the limited information that the strategies for phase 2 core cooling are viable. This has been identified as Open Item 3.2.1.8.B in Section 4.2.

For the Phase 2 strategy for maintaining adequate core cooling, page 14 of the integrated plan indicates that the use of raw water is acceptable because the water level is maintained above the top of the fuel throughout the ELAP so cooling of the fuel does not rely solely on flow up from the bottom of the fuel assembly. A discussion of the quality of this water (e.g., suspended solids) and a justification that its use will not result in blockage at the fuel assembly inlets to an extent that would inhibit adequate flow to the core is needed. Alternately, if deleterious blockage at the fuel assembly inlets cannot be precluded, an alternate means for assuring adequate core cooling is needed.

The licensee provided updated information as part of the EA-12-049 Audit response process which partially addresses this issue by stating that, the normal water sources are the two Condensate Storage Tanks (non-seismic tanks) and the suppression chamber. The backup water sources are the Discharge Canal, where water is processed through the traveling screens prior to the loss of power, and the Mississippi river, which serves as a backup source of water to the discharge canal. Crediting upflow will be evaluated in the future. Additional filtering of the water drawn from the discharge canal and the Mississippi River will also be evaluated. NSPM plans to submit the conclusion from these evaluations in NSPM's February 2014 six-month status report for Mitigating Strategies Order EA-12-049. Review of the licensee's final design and implementation plans regarding use of impure water for core cooling has been identified as Confirmatory Item 3.2.1.8.C in Section 4.2.

On page 11 of 50, in the integrated plan, in the section describing the BWR Installed Equipment Phase 1, Power Operation, it is stated that RCIC will take suction from the CST if available. If in the event of an ELAP, the CST is significantly damaged, the RCIC suction may have to switch to the suppression pool.

The integrated plan provides insufficient information to support a conclusion that the switchover function will be accomplished in a timely manner so that RCIC injection to RPV will commence without delay and remain uninterrupted. The discussion should include whether manual switch-over function is carried out from the main control room, or from the remote control panel, or from any other secured and accessible location. The discussion should also confirm that software and hardware, related piping, valves, systems, structures, and components (SSCs) to support the switchover function are of safety grade and are qualified for all potential ELAP events including seismic, tornado/high winds and flooding. The discussion should also confirm that the conditions of the loss of the CST will not cause the ingestion of air into the RCIC pump before the switchover is completed. If not, then justify how switchover from CST to Torus will be assured in ELAP conditions if the CST is not available. The lack of this information prevents reaching the conclusion that the strategy will be successful in preventing core damage.

The licensee provided updated information as part of the audit process which partially addresses this issue by stating that RCIC and HPCI are designed to operate on a loss of plant AC power. RCIC is not, by design, safety related, however, RCIC is treated as such and is included in MNGP Quality Assurance Program Boundary (Q-list Safety-related). RCIC and HPCI CST suction valves and downstream piping are seismically analyzed. Level switches that initiate the suction transfers on low CST level are safety related, and are physically located inside the reactor building. RCIC and HPCI suction valves are 250V DC powered with 125V DC control power. Therefore, in an ELAP with significant CST damage, the capability for each system to transfer pump suction from the CSTs to the Torus remains functional. Low level in the CSTs will cause RCIC and HPCI suctions to automatically transfer to the Torus. Additionally, HPCI and RCIC suction transfers can be performed remotely via the control switches or locally via valve motor-operator handwheels. This issue has been identified as Confirmatory Item 3.2.1.8.D 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-2012-0, 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 use of portable equipment if these requirements are implemented as described.

3.2.2 Spent Fuel Pool Cooling Strategies

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

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

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

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

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

On page 26 of the integrated plan, the licensee stated that the only Phase 1 action is to monitor the SFP level. The emergency heat load assumes a full core discharge is required 30 days following startup from the last refueling discharge. Under this condition, the SFP will reach a boiling temperature no earlier than 8.3 hours, and have a maximum evaporation rate of 53 gpm after bulk boiling commences. Once boiling begins, SFP level would drop less than two feet in four hours. Four hours is adequate to stage a FLEX portable pump to inject water into the SFP.

Additionally the normal heat load for the SFP is 5.55 x 106 Btu/hr (USAR Section 10.2.2.3). The time to boil for the SFP after AC power is lost would be no earlier than 36.9 hours, and the evaporation rate would be 11.9 gpm (715 gal/hr), based on scaling the time to boil and evaporation rate of the emergency heat load with the normal heat load. The FLEX portable pump staged for providing water to the reactor to maintain core cooling will be shown to have the capacity to maintain core cooling and maintain SFP level.

As the SFP temperature increases, additional moisture will enter the atmosphere in the reactor building. The roof vent on the SFP floor and the reactor building railroad doors will be able to be opened to allow venting of the area.

The current understanding of the licensee's approach, as described above, confirms that it 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 providing cooling to the SFP during Phase 1 under normal or emergency heat load conditions, if these requirements are implemented as described in the licensee's Integrated Plan.

On page 28 of the integrated plan, the licensee stated that, during Phase 2 for the emergency heat load case, the full core has been moved to the SFP. There is no need to meet core cooling or containment functions. Therefore, the portable diesel-driven FLEX pump staged as described in the Maintain Core Cooling – BWR Portable Equipment Phase 2 section would be relied upon to provide makeup to the SFP to maintain SFP Cooling. The FLEX pump could provide makeup either via RHR SFP cooling piping or via hoses that would be staged directly into the pool.

For Phase 2 for the normal heat load case, the event is assumed to occur with the reactor at 100% rated power, and the Phase 2 actions will be to pre-stage hoses for makeup, and open the roof vent. As noted above, the pool level would drop by less than two feet in no less than 56 hours (36.9 hours to boiling plus 20 hours to drop less than two feet). Therefore, makeup is not necessary for the SFP in Phase 2.

A review of Phase 2 SFP makeup for the emergency heat load case revealed that it did not provide any details regarding providing makeup via RHR spent fuel cooling piping, e.g., the routing of hoses from the FLEX portable pump, location where the portable pump is connected to the RHR system, FLEX pump flow and pressure requirements using this flow path, therefore the viability of this strategy for maximum heat load cannot be determined. The licensee provided updated information as part of the EA-12-049 Audit response process which addresses this issue by stating that an EDMG procedure currently exists for reactor flooding utilizing LPCI (RHR) system. This procedure uses a portable diesel powered pump with suction from the river to discharge into the RHR system piping downstream of the RHR pumps using hoses. From the RHR system piping, flow can be directed into the fuel pool via an existing RHR to Fuel Pool crosstie line. The 8" crosstie line discharges into the 10" fuel pool cooling line leading to the fuel pool spargers. The intent is to create a strategy utilizing the same diesel power pump connected to the RHR injection points, then route the water to the pool using the existing RHR crosstie to emergency fuel cooling discharge line.

The final analysis is not complete but the licensee plans to summarize the results in NSPM's February 2014 six-month status report for Order EA-12-049, Mitigating Strategies. Pending review of the licensee's final design, analyses and implementation plans, this issue is identified as Confirmatory Item 3.2.2.A in Section 4.2.

A review was conducted of the licensee's integrated plan for Phase 2 SFP cooling (normal heat load case) and it was determined that there is insufficient information provided to determine the adequacy SFP cooling strategies. Since information regarding the FLEX portable pump has not been provided, It cannot be determined if the licensee strategy for maintaining SFP level is viable regarding routing of hoses, available flow rates and flow rates required to the SFP under the three conditions noted in NEI 12-06, Table 3-1 and Appendix C. This has been identified as Confirmatory Item 3.2.2.B in Section 4.2.

The source of the information (reference) for the determination of emergency core off load heat load discussed above was also not provided. The licensee provided updated information as part of the audit response process which addresses this issue by stating that, the USAR Section 10.2.2.3 provides the emergency heat load value. This is the same section that has the normal heat load value.

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 SFP cooling strategies, if these requirements are implemented as described.

3.2.3 Containment Functions Strategies

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

On page 12 of the integrated plan, the licensee states that, the Torus performs as the heat sink for core cooling. The HCVS line for the Torus will be opened to remove heat from the Torus per the EOPs based on the pressure suppression pressure limit (a range of 17 to 33 psig, depending on Torus level). Based on MAAP analysis, this is expected to be approximately 6 hours after the initiation of the event, and will be confirmed by analysis. If the completed analysis results in a change in strategy, this will be provided in a six-month status report. In the audit process the licensee specified that revision 3 of the EPGs/SAG's will provide an override which will allow containment venting once the containment pressure rises above the high containment pressure scram setpoint. The override will not be permitted if the Emergency Core Cooling System Pumps have power and are available. The venting strategy during the ELAP will be to open the vent as soon as there is sufficient pressure to remove heat from the Torus (e.g., ~ 15 psig).

It was noted that the licensee did not discuss or reference NEDC-33771P, which was developed by GE-Hitachi on behalf of the Boiling Water Reactor Owners Group (BWROG), as it relates to MNGP. However, the staff needs additional plant-specific ELAP analysis information commensurate with the level of detail contained in NEDC-33771P, including analysis assumptions and results in their tabulated and plotted formats. Without this information, there is insufficient basis to conclude that containment functions will be maintained in all Phases of an ELAP. This has been identified as Open Item 3.2.3.A in Section 4.1.

On page 34 of the integrated plan, the licensee discussed the use of the HCVS line from the torus that will be opened to remove heat from the torus to reduce containment temperature for both Phase 1 and 2 strategies. Also on page 34, the discussion regarding nitrogen supplies, notes that the HCVS usage includes breaking the rupture disc and operation of air operated valves. The licensee did not provide a discussion of valve operations and actions required to break the rupture disc to allow flow from the torus to the vent piping, number of operators required, the need for special equipment, or any access limitations.

The licensee provided updated information as part of the audit process which addresses this issue. The licensee provided a list of actions that will be accomplished to use the HCVS to vent containment. Venting with containment pressure above the rupture disc rupture pressure will be accomplished by opening the containment isolation valves. For venting with containment pressure below the rupture disc rupture pressure, nitrogen will be supplied to the space between the disc and the containment isolation valve to rupture the disc, followed by opening the containment isolation valves. Containment isolation valve controls are located at the ASDS panel in the EFT building. The manual nitrogen valve is located in the turbine building. This is not near the HVCS piping. Per the event scenario, no fuel damage has occurred; therefore no adverse radiological conditions will exist in the turbine building area. Due to the low heat loads in this area during an SBO, loss of ventilation is not expected to affect the local temperature significantly. Should cooling be needed, portable FLEX equipment will be available after the portable diesel generators are set up.

In separate discussions regarding MAAP analysis on page 11 of 50 the licensee noted that, MAAP analysis will be (*emphasis added)* used to confirm that RCIC maintains adequate net positive suction head (NPSH) during the event, taking into account conditions in the Torus. Review of the licensee's final analysis regarding the RCIC NPSH issue, has been identified as Confirmatory Item 3.2.1.8.A in Section 4.2. Additionally, the licensee indicated on page 12 of 50 that regarding venting of containment for temperature control that, based on MAAP analysis, this is expected to be approximately 6 hours after the initiation of the event, and will be (*emphasis added)* confirmed by analysis. This has been identified as Open Item 3.2.3.A in Section 4.1.

The Pressure Suppression Pressure (PSP) Curve that is referenced on pages 12 and 20 of the integrated plan is determined by calculations that assume the suppression pool temperature is at the Heat Capacity Temperature Limit corresponding to the lift pressure of the safety/relief valve with the lowest setpoint. Page 11 of the integrated plan states that the reactor will be depressurized to approximately 100 psig. The licensee did not explain why the existing PSP curve is appropriate to use to determine when to open the containment vent after the reactor has been depressurized to 100 psig. In the audit process the licensee specified that revision 3 of the EPGs/SAG's will provide an override which will allow containment venting once the containment pressure rises above the high containment pressure scram setpoint. The override will not be permitted if the Emergency Core Cooling System Pumps have power and are available. The venting strategy during the ELAP will be to open the vent as soon as there is sufficient pressure to remove heat from the Torus (e.g., approximately 15 psig).

The NRC staff considers the adoption of Revision 3 to the BWROG Emergency Procedure Guidelines (EPG)/Severe Accident Guidelines (SAG) by licensees to be a Generic Concern (and thus an open item for MNGP) because the BWROG has not addressed the potential for the revised venting strategy to increase (relative to currently accepted venting strategies) the likelihood of detrimental effects on containment response for events in which the venting strategy is invoked. In particular it has not been shown that the potential for negative pressure transients, hydrogen combustion, or loss of containment overpressure (as needed for pump NPSH) is not significantly different when implementing Revision 3 of the EPG/SAG vs. Revision 2 of the EPG/SAG. Revision 3 provides for earlier venting than previous revisions. The BWR procedures are structured such that the new venting strategy is not limited to use during the BDBEEs that are the subject of EA-12-049, but could also be implemented during a broad range of events. Acceptance of EPG/SAG Revision 3, including any associated plant-specific evaluations, has been identified as Open Item 3.2.3.B in Section 4.1

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the Integrated Plan is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to maintaining containment functions and containment venting. These concerns are identified as Open Items above and in Section 4.1

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.

On pages 37 and 38 of the integrated plan regarding cooling of the MCR, battery rooms, RHR rooms, and the RCIC room, the licensee specified that, additional formal analysis will be performed to determine the timing and scope of the supplemental cooling, or heating required, and the results of this analysis will be provided in a six-month status report. This has been identified as Confirmatory Item 3.2.4.1.A in Section 4.2.

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

3.2.4.2 Ventilation – Equipment Cooling

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

> *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 38 of the integrated plan, the licensee specified that ventilation for the RCIC Room, Battery Rooms, and Main Control Room will be provided, if required, from portable fans that are powered from the FLEX diesel generator. Plant doors may be opened as necessary to provide additional ventilation and that additional formal analysis will be performed to determine the timing and scope of the supplemental cooling, or heating required, and the results of this analysis will be provided in a six-month status report.

Since the licensee response noted that ventilation needs had not been determined, additional information is required regarding supporting analysis to determine the acceptability of the licensee's plans to provide ventilation to the subject areas when normal ventilation will not be available during the ELAP. This has been identified as Confirmatory Item 3.2.4.2.A in Section 4.2.

On pages 34 and 37 of the integrated plan, the licensee stated that for the Main Control Room, the primary strategy for maintaining the environment of the Main Control Room (MCR) during Phase 1 is to open doors. The MCR temperature is not expected to exceed 110°F within eight hours of the event. In Phase 2, supplemental ventilation will be provided for the operators in the Main Control Room using portable ducting and fans for air circulation as necessary to maintain a temperature below 110°F. Portable fans will be powered by the FLEX portable diesel generator. Additional formal analysis will be performed to determine the timing and scope of the supplemental cooling, or heating required, and the results of this analysis will be provided in a six-month status report.

At a steady-state condition of 110°F, the environmental conditions within the main control room 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°F is tolerable for light work for a 4 hour period while dressed in conventional clothing with a relative humidity of ~30%. It was determined that the licensee has supplied insufficient information to conclude that the habitability limits of the main control room will be maintained in all Phases of an ELAP. This has been identified as Confirmatory Item 3.2.4.2.B in Section 4.2.

On pages 34 and 37 of 50, in the section of its integrated plan, the licensee specified that, the primary strategy for maintaining the environment of the RCIC Room during Phase 1 is to open doors. RCIC room temperatures are not expected to exceed the equipment limitations during Phase 1. The action to open the RCIC Room doors is not currently listed in the Attachment 1A Sequence of Events Timeline table. Additional formal analysis of the RCIC room will be performed to assure that these areas remain accessible and temperatures are within the equipment functional limitations. If changes to the Phase 1 strategy are required as a result of the analysis, they will be provided in a six-month status report. Additionally, to maintain equipment qualification, the RCIC room is provided with supplemental ventilation using portable ducting and fans to lower the room temperature, if required. The RCIC room is open to a large area above. Natural convection will result in cooler air falling to the RCIC room, and warmer air rising to the space above. Portable fans will be powered by the FLEX portable diesel generator. Additional formal analysis will be performed to determine the timing and scope of the supplemental cooling required, and the results of this analysis will be provided in a six-month status report. This has been identified as Confirmatory Item 3.2.4.2.C in Section 4.2.

As specified in NEI 12-06, Section 3.2.1.8, the effects of loss of ventilation may be addressed by plant-specific thermal hydraulic calculations. The licensee has presented no information of the performance of such calculations and therefore it cannot be determined if the licensee's response conforms to the guidance of JLD-ISG-2012-01 and NEI 12-06, Section 3.2.1.7, item 6, and is acceptable for meeting the requirements of Order EA-12-049.. This has been identified as Confirmatory Item 3.2.4.4.D in Section 4.2.

On pages 34 and 37 of the integrated plan, the licensee specified that the primary strategy for maintaining the environment of the Battery Rooms during Phase 1 is to open doors. Battery room temperatures and hydrogen levels are not expected to exceed the equipment limitations during Phase 1. Hydrogen generation is primarily a concern when batteries are charging. Hydrogen generation is negligible when batteries are discharging (i.e., Phase 1); and therefore, hydrogen accumulation to the point of combustibility will not occur during Phase 1. Additional formal analysis of the battery rooms will be performed to assure that these areas remain accessible and temperatures are within the equipment functional limitations. If changes to the Phase 1 strategy are required as a result of the analysis, they will be provided in a six-month status report. In Phase 2 portable fans, if required, will be placed outside the battery room doors to circulate air through the rooms for cooling and to mitigate hydrogen buildup. 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.

The licensee's response noted that the analysis of battery room conditions was not complete, and noted that additional formal analysis to determine the acceptability of the licensee's actions regarding the battery room's accessibility is needed. Also additional discussion on the hydrogen gas exhaust path for each strategy is needed, and a discussion of the accumulation of hydrogen when the batteries are being recharged during Phase 2 and 3.

The licensee provided updated information in the audit process as follows: The primary strategy for ventilation is to re-power the battery room fans. The battery room fans exhaust directly outside the building. The alternate strategy is to prop open doors to the battery rooms and set up portable fans to exhaust into the surrounding rooms. This will provide air flow to dilute and minimize hydrogen concentration buildup. This strategy has been used in past approved industry NRC submittals (e.g., ML021910670 or ML011660010). Due to the similarity of battery rooms, this strategy is appropriate for MNGP.

Review of the licensee's final analysis regarding the timing of the need to re-power the battery room fans to provide battery room ventilation, has been identified as Confirmatory Item 3.2.4.2.E in Section 4.2.

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the Integrated Plan is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to seismic event procedural interfaces. See the five Confirmatory Items noted above in Section 4.2.

3.2.4.3 Heat Tracing.

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

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

In the integrated plan the licensee did not discuss the effects of loss of power to heat tracing and therefore additional information is required to conclude that this consideration from NEI 12-06 has been adequately addressed. This has been identified as Open Item 3.2.4.3.A in Section 4.1.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Open Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to ventilation and equipment cooling, 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 35 of the Integrated Plan, the licensee specified that, lighting is required for operator actions and access in the plant to implement actions associated with the SBO procedure. Emergency lighting is provided by local battery-powered emergency lighting and the lighting is available for at least eight hours.

On page 36 of the Integrated Plan, the licensee specified that, necessary local battery-powered emergency lighting will be modified to use light emitting diode (LED) bulbs to extend the emergency lighting capability to beyond eight hours.

On page 38 of the Integrated Plan, the licensee specified that the Control Room emergency lighting will be available because the 125 V DC system will have power supplied to the battery chargers from the FLEX diesel generator. Portable lights will be available for use in areas that require operator access to perform Phase 2 equipment connections. These lights will either be battery powered, or will be capable of being powered by the FLEX diesel generator.

On page 33 the Integrated Plan the licensee specifies that for the DC load shed analysis, a preliminary study of loads to be shed includes 125 V DC emergency lighting.

The statement on page 33 of the Integrated Plan regarding the preliminary load shed analysis which includes eliminating power to 125V DC emergency lighting is inconsistent with other sections of the licensee's response regarding emergency lighting. Additional information is needed to resolve this apparent discrepancy and provide an analysis for de-energizing 125V DC Division 1 emergency lighting. This has been identified as Confirmatory item 3.2.4.4.A in Section 4.1.

On page 35 of the Integrated Plan, the licensee states that a communications assessment was performed as a result of the information requested for NTTF Recommendation 9.3 in the March 12, 2012 NRC's 10 CFR 50.54(f) letter. This Communications Assessment was provided by the licensee to the NRC in a letter dated October 29, 2012, and supplemented on February 21, 2013.

The NRC staff has reviewed the licensee communications assessment (ML12305A381 and ML13053A196) in response to the March 12, 2012 50.54(f) request for information letter for MNGP and, as documented in the staff analysis (ML13149A324) has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by the licensee will conform to the guidance of NEI 12-06 Section 3.2.2 (8) regarding communications capabilities during an ELAP. This has been identified as Confirmatory Item 3.2.4.4.B. in Section 4.0 below for confirmation that upgrades to the site's communications systems have been completed.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to accessibility considering the availability of 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 provided no information regarding local access to the protected areas under ELAP. This has been identified as Open Item 3.2.4.5.A.

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

3.2.4.6 Personnel Habitability – Elevated Temperature

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

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

> FLEX strategies. The use of appropriate human performance aids (e.g., component marking, connection schematics, installation sketches, photographs, etc.) shall be included in the FLEX guidance implementing the FLEX strategies.

Section 9.2 of NEI 12-06 states,

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

On pages 34 and 37, of the Integrated Plan, the licensee discussed the accessibility of the MCR. For an evaluation, see Section 3.2.4.2. This has been combined with Confirmatory Item 3.2.4.2.A., in Section 4.2, below.

On pages 34 and 37, of the Integrated Plan, the licensee discussed the accessibility of the RCIC Room. For an evaluation, see Section 3.2.4.2. This has been combined with Confirmatory Item 3.2.4.2.B in Section 4.2, below.

On pages 34 and 37, of the Integrated Plan, the licensee discussed the accessibility of the battery rooms. For an evaluation, see Section 3.2.4.2. This has been combined with Confirmatory Item 3.2.4.2.C in Section 4.2.

NEI 12-06 guidance specifies that a baseline capability for Spent Fuel Cooling is to provide a vent pathway for steam and condensate from the SFP. On page 26 of the integrated plan, the licensee's stated that the SFP temperature increases, additional moisture will enter the atmosphere in the reactor building. The roof vent on the SFP floor and the reactor building railroad doors will be able to be opened to allow venting of the area.

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

3.2.4.7 Water Sources.

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

> *Plant procedures/guidance should ensure that a flow path is promptly established for makeup flow to the steam generator/nuclear boiler and identify backup water sources in order of intended use. Additionally, plant procedures/guidance should specify clear criteria for transferring to the next preferred source of water.*
>
> Under certain beyond-design-basis conditions, the integrity of some water sources may be challenged. Coping with an ELAP/LUHS may require water supplies for multiple days. Guidance should address alternate water sources and water delivery systems to support the extended coping duration. Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles are assumed to be available in an ELAP/LUHS at their

nominal capacities. Water in robust UHS piping may also be available for use but would need to be evaluated to ensure adequate NPSH can be demonstrated and, for example, that the water does not gravity drain back to the UHS. Alternate water delivery systems can be considered available on a case-by-case basis. In general, all CSTs should be used first if available. If the normal source of makeup water (e.g., CST) fails or becomes exhausted as a result of the hazard, then robust demineralized, raw, or borated water tanks may be used as appropriate.

Heated torus water can be relied upon if sufficient [net positive suction head] NPSH can be established. Finally, when all other preferred water sources have been depleted, lower water quality sources may be pumped as makeup flow using available equipment (e.g., a diesel driven fire pump or a portable pump drawing from a raw water source). Procedures/guidance should clearly specify the conditions when the operator is expected to resort to increasingly impure water sources.

On page 11 of the Integrated Plan, the licensee specified that the normal suction supply for both RCIC and HPCI are the non-seismically qualified Condensate Storage Tanks (CST) and are the preferred source, if available. If the CSTs are unavailable, which is assumed, suction automatically transfers to the safety-related Suppression Pool (Torus) on a low CST level signal. The Torus will be used as the heat sink for Safety Relief Valve (SRV) discharge, heat sink for RCIC and HPCI exhaust, and makeup water to the reactor. MAAP analysis will be used to confirm that RCIC maintains adequate net positive suction head (NPSH) during the event, taking into account conditions in the Torus. This issue has been combined with Confirmatory Item 3.2.1.8.A in Section 4.2.

Additionally on page 14 of the integrated plan, the licensee noted that a FLEX portable diesel driven pump will be used during Phase 2 to supply water from the discharge canal that empties to the Mississippi River in all events except the beyond design basis flooding event. The Mississippi River is the ultimate makeup water source, and will be available in all scenarios. The FLEX portable pump will be deployed near the discharge canal and take suction directly from the canal, with a strainer installed at the suction to prevent large debris from entering the pump. Water in the canal is less likely to have large debris because the water has already passed through plant equipment. For the flood hazard, the plant will be shutdown. The discharge canal will be flooded therefore the FLEX portable pump will be deployed inside the berm near the intake structure, and take suction directly from the river outside the berm. It will rely on its suction strainer to prevent large debris from entering the pump.

A review was conducted of the licensee's plans regarding availability of makeup water sources and it could not be determined if MNGP plans for water supply will comply with the requirements of NEI 12-06, Section 3.2.2, guideline (5). The licensee's plans do not discuss clear criteria for the changeover from a heated torus water supply to the Mississippi river raw water source as analysis is not complete for NPSH requirements for RCIC pump operations when using the torus as a water supply which would affect the timing of the changeover. This has been combined with Confirmatory Item 3.2.1.8.B in Section 4.2.

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

3.2.4.8 Electrical Power Sources/Isolations and Interactions

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

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

On page 14 of the Integrated Plan, the licensee stated that in Phase 2, a FLEX portable diesel generator is used to provide power to 250 V DC and 125 V DC system battery chargers, to maintain sufficient battery power to maintain the Phase 1 coping strategy. The FLEX portable diesel generator will use a primary connection point to a 480V load center, with an alternate connection point available at the battery chargers. On page 15 of the Integrated Plan, the licensee stated that modifications are planned to add connection points to accomplish the above connections.

The licensee plans on using 480V AC portable diesel generator(s) to power various systems following battery depletion. The licensee did not provide any information regarding loading calculations of portable diesel generator(s) or strategy regarding electrical isolation from installed plant equipment. It was determined that there was insufficient information available to conclude that there is reasonable assurance that the licensee will ensure that portable/FLEX diesel generators are adequately sized and isolated from the Class 1E diesel generators to prevent simultaneously supplying power to the same Class 1E bus. This has been identified as Open Item 3.2.4.8.A., in Section 4.1.

On pages 15, 19, 22, and 24 in the Integrated Plan describing FLEX equipment instrumentation, the licensee stated that for Phase 1 and 2, local Instrumentation (e.g., flow meter, pressure gage) will be available where required to operate FLEX equipment, and for Phase 3 local Instrumentation (e.g., flow meter, pressure gage) will be available where required to operate FLEX equipment, obtained from the RRC.

Additional description of the instrumentation that will be used to monitor portable/FLEX electrical power equipment including their associated measurement tolerances/accuracy to ensure that: 1) the electrical equipment remains protected (from an electrical power standpoint – e.g., power fluctuations) and 2) the operator is provided with accurate information to maintain core cooling, containment, and SFP cooling. This has been identified as Open Item 3.2.4.8.B in Section 4.1.

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the Integrated Plan is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to isolation of electrical power sources and equipment. These questions are identified as Open Items above and in Section 4.1.

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 39 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. At least 3,000 gallons of fuel will be available in the day tanks.

On page 40 of the Integrated Plan, the licensee stated that diesel fuel will be gravity drained, when required, from the Emergency Diesel Generator Day Tanks to fuel canisters, and that the Day Tanks and associated drain lines are located in Class I structures.

On page 43 of the Integrated Plan, the licensee stated the Installed diesel fuel oil transfer pumps will be used to move fuel from the fuel storage tanks to portable tanks and are located inside Class 1 structures.

The licensee will depend on the installed fuel capacity of the portable equipment for the first 24 hours of the event. After that fuel will be provided from systems, e.g., EDG Day Tanks and fuel transfer pumps all located in Class 1 structures. These systems and components will be protected from the effects of seismic events, and high winds and associated missiles. Regarding protection from floods, the licensee has not yet completed flood re-evaluation as noted on page 6 of the integrated Plan. The licensee did not address actions to maintain the quality of fuel stored in the tanks of the portable equipment for potentially long periods of time when the equipment (diesel driven pumps and generators) will not be operated. This has been identified as Confirmatory Item 3.2.4.9.A in Section 4.2.

The licensee provided insufficient information in the Integrated Plan regarding the design of the structures to determine whether they are robust with respect to seismic events, and high winds and associated missiles to ensure that fuel will be stored and delivered by systems (in Class 1 structures) and available in accordance with the requirement of NEI 12-06 Section 3.2.1.3, initial condition (5).

The licensee provided updated information as part of the audit process which addresses this issue. The Phase 2 strategy is to obtain diesel fuel from two 1500 gallon day tanks which normally supply #11 and #12 Emergency Diesel Generators. These tanks are located in a Class 1 Structure. The existing Abnormal Operating Procedure for Plant Flooding, A.6, Acts of Nature, includes a strategy to build a levee that includes protection of this Class 1 Structure from the design basis flood event. The diesel generator day tanks will be within this levee. Procedure A.8-06.03, Refueling Emergency Portable Diesel Powered Equipment, has been created to utilize this diesel fuel source by gravity draining the fuel from the day tanks into containers and then transporting them to the portable diesel generators. No pumps are needed to obtain this diesel fuel. Procedure A.8-06.03 has been approved but not yet issued for distribution.

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 quality, 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.

The licensee has not completed the battery capability analysis, expected time available with AC power, or any load shed analysis to conserve DC power. The licensee noted on page 33 in the Integrated Plan in a preliminary summary, various examples of loads to be shed, and loads to remain powered from both divisions of the 125V DC and 250V DC buses, and stated that, with this deep load shedding strategy, it is expected that the station batteries can be extended through Phase 1 and do not require portable supplemental charging before eight (8) hours for the most limiting battery. Additional formal analysis will be performed to support this. If analysis results require a change in strategy, that change will be communicated in a six-month status report.

In several other sections of the Integrated Plan, the licensee provided strategies where other actions are predicated on this 8-hour assumption, e.g., deployment of 480V portable diesel generators. Based on the lack of information regarding battery availability in Phase 2, and lack of a completed load shed analysis, this has been identified as Confirmatory Item 3.4.2.10.A in Section 4.2.

With regard to time constraints, the licensee noted that for the various 250 and 125 V DC safety-related batteries at MNGP, an eight (8) hour coping time is demonstrated provided that the existing station blackout (SBO) load shed is completed per the current SBO procedure and an extended load shed for 125 V batteries.

The NRC staff reviewed the Integrated Plan for MGNP and determined that the Generic Concern related to battery duty cycles beyond 8 hours is applicable to the plant. The Generic Concern related to extended battery duty cycles, has been resolved generically through the NRC endorsement of Nuclear Energy Institute (NEI) position paper entitled "Battery Life Issue" (ADAMS Accession no ML13241A186 (NRC endorsement letter) and ML13241A188 (white paper)).

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

The Generic Concern related to extended battery duty cycles required clarification of the capability of the existing vented lead-acid station batteries to perform their expected function for durations greater than 8 hours throughout the expected service life. 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 that satisfy NRC Order EA-12-049. The methodology relies on the licensee's battery sizing calculations developed in accordance with the Institute of Electrical and Electronics Engineers Standard 485, "Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations," load shedding schemes, and manufacturer data to demonstrate that the existing vented lead-acid station batteries can perform their intended function for extended duty cycles (i.e., beyond 8 hours). The NRC staff will evaluate a licensee's application of the guidance (calculations and supporting data) in its development of the final Safety Evaluation documenting compliance with NRC Order EA-12-049.

The NRC staff concluded that the position paper provides an acceptable approach for demonstrating that the licensees are capable of implementing mitigation strategies.

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

The licensee did not provide a discussion in the integrated plan regarding the effects of heightened temperatures (i.e., temperatures above those assumed in the sizing calculation for each battery) on each battery's capability to perform its function for the duration of the ELAP event.

The licensee provided updated information as part of the audit response process which addresses this issue. The licensee stated that the battery technical manual for the MNGP 125V DC and 250V DC batteries, notes that operating at higher than normal operating temperature (above 77 degrees Fahrenheit) has the following effects on the batteries; it Increases performance and internal discharge or local action losses, water usage, and maintenance requirements. It lowers cell voltage and shortens life and raises the charging current for a given charge. The licensee specified that for the relative short-duration of this event, the shortened life, increased water usage and maintenance, and increased discharge loss are insignificant. The batteries discharge performance capability change is net positive, with more volts per cell at any discharge level and for any load current. Therefore, the effects of heightened temperatures are not a concern for the batteries' capability to perform their function for the duration of the ELAP event. Based on the above response, this issue is resolved.

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

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 battery load shed analysis, 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 9 of the Integrated Plan the licensee stated that, they will implement an administrative program in accordance with NEI 12-06. 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 Preventative Maintenance (PM) with scope and frequency established considering EPRI guidelines and manufacturer recommendations. FLEX equipment will be procured as commercial grade equipment unless credited for other functions, in which case the quality attributes of the other functions apply.

The licensee did not provide specific information on the maintenance and testing that will be performed, therefore there is insufficient information available to provide reasonable assurance that the licensee's proposed strategy for the maintenance and testing of FLEX electrical equipment at MNGP will ensure the capability and availability of FLEX equipment to assist the maintenance of core cooling, containment, and SFP cooling.

The NRC staff reviewed the Integrated Plan for MNGP 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 endorsement letter from the NRC staff is dated October 7, 2013 (ADAMS Accession No. ML13276A224).

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

The licensee informed the NRC of their plans to abide by this generic resolution and of the licensee's plans to address potential plant specific issues associated with implementing this 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 provides that:

1. The FLEX strategies and basis will be maintained in an overall program document. This program document will also contain a historical record of previous strategies and the basis for changes. The document will also contain the basis for the ongoing maintenance and testing programs chosen for the FLEX equipment.
2. Existing plant configuration control procedures will be modified to ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies.
3. Changes to FLEX strategies may be made without prior NRC approval provided:

a) The revised FLEX strategy meets the requirements of this guideline.
b) An engineering basis is documented that ensures that the change in FLEX strategy continues to ensure the key safety functions (core and SFP cooling, containment integrity) are met.

On page 9 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.

There is insufficient information to conclude that configuration control of equipment and connections will be controlled in conformance with the guidance of NEI 12-06, Section 11.8, Items 1 and 3 regarding a program document that will contain; a historical record of previous strategies and the basis for changes, and a change control process to allow changes to the strategies only if they continue to meet the guidelines of NEI 12-06. 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 Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to configuration control, if these requirements are implemented as described.

3.3.3 Training.

NEI 12-06, Section 11.6 provides that:

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

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

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

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

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

On page 10 of the Integrated Plan, the licensee noted 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 programs, if these requirements are implemented as described.

3.4 OFF SITE RESOURCES

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

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

On page 3 of the Integrated Plan, the licensee stated the Phase 3 equipment from the RRC can be requested prior to flooding of the main access road or can be brought in on the temporary access road and set up on site in advance of the PMF.

The licensee specified on page 10 of its integrated plan that the industry will establish RRCs to support utilities during beyond design basis events. Equipment will be moved from an RRC to a local assemble 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. Equipment arriving first, as established during development of the nuclear site's playbook, will be delivered to the local assemble area within 24 hours from the initial request..

On page 45 of the Integrated Plan the licensee listed two self-priming pumps, one 4160VAC diesel generator, one set of cables for connecting portable generators and, one diesel generator fuel transfer pump and hoses needed from the RRC for Phase 3.

The licensee's plans for the use of off-site resources conform to the minimum capabilities specified in NEI 12-06 Section 12.2, with regard to the capability to obtain equipment and commodities to sustain and backup the site's coping strategies (item 1 above). However, the licensee did not address the remaining items (2 through 10 above) of NEI 12-06, Section 12.2. This has been identified as Confirmatory Item 3.4.A., in Section 4, 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 off-site resources if these requirements are implemented as described.

4.0 OPEN AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number	Description	Notes
3.1.1.3.A	The licensee's integrated plan did not address the potential impacts from large internal flooding sources that are not seismically robust and do not require ac power, the potential loss of ac power to mitigate ground water in critical locations, or the impact of potential failure of non-seismically robust downstream dams.	
3.1.2.2.A	The licensee's integrated plan did not address flooding deployment issues for restocking supplies during flooding conditions, protection for fuel supplies assuring connection points are protected, the need to provide water extraction pumps, and the need for temporary flood barriers.	
3.1.2.3.A	The licensee did not discuss the need for temporary flood barriers and dewatering pumps during flooding events.	
3.2.1.2.A	The licensee did not Identify or provide justification for the assumptions made regarding primary system leakage from the recirculation pump seals and other sources.	
3.2.1.3.A	The licensee did not provide information or technical basis to determine if; RCIC will be started at a time required by analysis following the initial trip, if any elapsed time constraint exists for this action, or if pressure and temperature conditions in the containment predicted in NEDC-33711P have been considered.	
3.2.1.3.B	No analysis or technical basis was provided for the completion of the load shed activity at 2 hours.	
3.2.1.8.B	The integrated plan provides no details regarding; actual connection points, (e.g., system valve numbers and actual location in plant piping) the length of hose runs and associated connecting fittings required to connect the portable pump at the primary and alternate locations, and no details regarding portable pump capabilities to correlate with actual flow and pressure requirements. It is not possible to determine based on the limited information that the strategies for phase 2 core cooling are viable.	
3.2.3.A	Additional plant-specific ELAP analysis information commensurate with the level of detail contained in NEDC-33771P, including analysis assumptions and results in their tabulated and plotted formats is needed to conclude that containment functions will be maintained.	
3.2.3.B A	The licensee needs to resolve the issue of the potential for the BWROG revised venting strategy to increase (relative to currently accepted venting strategies) the likelihood of detrimental effects on containment response for events in which the venting strategy is invoked. In particular it has not been shown that the potential for negative pressure	

	transients, hydrogen combustion, or loss of containment overpressure (as needed for pump NPSH) is not significantly different when implementing Revision 3 of the EPG/SAG vs. Revision 2 of the EPG/SAG.	
3.2.4.3.A	The licensee needs to provide a discussion of the effects of loss of power to heat tracing.	
3.2.4.5.A	The licensee needs to provide information regarding local access to the protected areas under ELAP.	
3.2.4.8.A	The licensee did not provide any information regarding loading/sizing calculations of portable diesel generator(s) and strategy for electrical isolation for FLEX electrical generators from installed plant equipment.	
3.2.4.8.B	The licensee needs to provide a description of the instrumentation that will be used to monitor portable/FLEX electrical power equipment including their associated measurement tolerances/accuracy to ensure that the electrical equipment remains protected and that operators are provided with accurate information.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.2.A	The licensee is still developing storage locations and associated deployment pathways for Phase 2 equipment. The availability of the potential need for ac power to deploy equipment could not be evaluated.	
3.1.1.4.A	The licensee's integrated plan did not identify Regional Response Center resources, the off-site staging areas, and delivery methods sufficiently in order to evaluate the means to obtain the resources from off site	
3.1.5.3.A	The licensee did not provide measures for operating FLEX equipment at possible excessively high temperatures that may exist inside plant structures and buildings.	
3.2.1.1.A	The licensee did not provide the MAAP4 computer code benchmarks which were identified as significant in demonstrating that the MAAP4 computer code could be used to simulate the ELAP.	
3.2.1.1.B	The licensee did not provide a MAAP analysis that demonstrates that water level remains above top of active fuel (TAF), and that complex two-phase flow modeling in the core region is not required and therefore the simplified physical models remain appropriate for simulating the ELAP event.	
3.2.1.1.C	The licensee did not provide a verification of the installation of the MAAP4 computer code, how to perform preliminary testing of a plant specific model, how to prepare input and confirm a successful execution, how to control the input and output files, document the analysis, and review the analysis, and the training and certification of MAAP4 analysts.	

3.2.1.1.D	The licensee did not provide a listing of the important input parameters and physical models selected for MAAP analysis.	
3.2.1.1.E	The licensee did not describe the multiple sensitivity studies to be completed before selecting one specific case to use as their MAAP SOE.	
3.2.1.3.C	The licensee did not provide a completed analysis for Action item 8 and the associated time constraint for battery life. Additional analysis is required to confirm timing.	
3.2.1.3.D	The licensee did not provide the basis for SOE Action Item 9 regarding the 8-hour time the portable diesel driven FLEX pumps will be staged. Additional analysis is required to confirm timing.	
3.2.1.3.E	The licensee provided preliminary times SOE Action Items 10, 11, and 12 regarding ventilation needs for various areas of the plant. Additional analysis is required to confirm timing.	
3.2.1.4.A	The licensee did not provide complete updated information regarding FLEX portable pump flow analyses. This will be provided in the licensee's February 2014 status update report.	
3.2.1.4.B	The licensee needs to provide further technical basis or a supporting analysis for the portable/Flex diesel generator capabilities considering the capacity of the equipment. A summary of the sizing calculation for the FLEX 480 V diesel generators to show that they can supply the loads assumed in phases 2 is also needed.	
3.2.1.6.A	The licensee specified that the 24 hour time constraint for supplying alternate nitrogen is preliminary but provided no technical basis or analysis to support the 24 hour requirement to supply alternate nitrogen. The licensee will provide updated information in a 6-month status report in February 2014.	
3.2.1.8.A	The licensee did not provide a discussion regarding the methodology used to assure adequate NPSH for the RCIC pump and justify that it is adequate in light of the potential for limited margins and potentially significant transient phenomena. Additional information will be provided in a 6-month update	
3.2.1.8.C	The licensee will provide additional information regarding final design and implementation plans for use of impure water for core makeup.	
3.2.1.8.D	The licensee provided insufficient information to support a conclusion that the switchover from CST to the Torus function will be accomplished in a timely manner so that RCIC injection to RPV will commence without delay and remain uninterrupted. Additional information to be provided in a 6-month update.	
3.2.2.A	The licensee will provide additional information regarding	

	providing alternate makeup via RHR spent fuel cooling piping, e.g., the routing of hoses from the FLEX portable pump, location where the portable pump is connected to the RHR system, FLEX pump flow and pressure requirements using this flow path in a 6-month update.	
3.2.2.B	The licensee did not provide complete information regarding the FLEX portable pump for the strategy for maintaining SFP level including routing of hoses, available flow rates and flow rates required to the SFP.	
3.2.4.1.A	The licensee did not provide additional formal analysis to determine the timing and scope of the supplemental cooling, or systems and components need to support ELAP strategies The results of this analysis will be provided in a six-month status report.	
3.2.4.2.A	The licensee needs to provide supporting analysis to validate the acceptability of the licensee's plans to provide ventilation to the areas or the plant (MCR, Battery room and RCIC room) when normal ventilation will not be available during the ELAP.	
3.2.4.2.B	The licensee needs to provide information to confirm that the habitability limits of the main control room will be maintained in all Phases of an ELAP considering MIL-STD-1472C, which specifies that 110°F is tolerable for light work for a 4 hour period while dressed in conventional clothing with a relative humidity of ~30%.	
3.2.4.2.C	The licensee specified that by opening doors, natural convection will result in cooler air falling to the RCIC room, and warmer air rising to the space above. Portable fans will be powered by the FLEX portable diesel generator. The licensee will provide additional formal analysis will be performed to determine the timing and scope of the supplemental cooling required, and the results of this analysis will be provided in a six-month status report. Additionally the action to open the RCIC room doors is not currently listed in the Attachment 1A Sequence of Events Timeline table and it is recommended, for completeness, that it is added accordingly.	
3.2.4.2.D	The licensee did not perform calculations regarding the effects of loss of ventilation in the RCIC room that NEI 12-06 states may be addressed by plant-specific thermal hydraulic calculations.	
3.2.4.2.E	The licensee stated that the primary strategy for ventilation is to re-power the battery room fans. The battery room fans exhaust directly outside the building. The alternate strategy is to prop open doors to the battery rooms and set up portable fans to exhaust into the surrounding rooms. This will provide air flow to dilute and minimize hydrogen concentration buildup. The licensee will provide additional formal analysis will be performed to determine the timing and scope of the supplemental cooling required, and the	

	results of this analysis will be provided in a six-month status report. A review of the licensee's final analysis regarding the timing of the need to re-power the battery room fans to provide battery room ventilation is needed	
3.2.4.4.A	The licensee needs to provide a discussion that includes a rationale for eliminating power to 125V DC emergency lighting which is inconsistent with other sections of the licensee's response regarding emergency lighting.	
3.2.4.4.B	Review of the licensee communications enhancements for confirmation that upgrades to the site's communications systems have been completed.	
3.2.4.9.A	The licensee did not address actions to maintain the quality of fuel stored in the tanks of the portable equipment for potentially long periods of time when the equipment (diesel driven pumps and generators) will not be operated.	
3.2.4.10.A	The licensee provided various examples of loads to be shed, and loads to remain powered from both divisions of the 125V DC and 250V DC buses, and stated that the station batteries do not require portable supplemental charging before eight (8) hours. The licensee needs to provide a completed load shed analysis.	
3.3.2.A	The licensee needs to provide a configuration control program that includes a program document that will contain; a historical record of previous strategies and the basis for changes, and a change control process to allow changes to the strategies only if they continue to meet the guidelines of NEI 12-06.	
3.4.A	The licensee needs to provide additional information regarding the minimum capabilities for offsite resources for which each licensee should establish availability as noted in considerations 2 through 10 of NEI 12-06, Section 12.2 lists the following minimum capabilities.	

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/

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

Docket No. 50-263

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

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