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

January 31, 2014

Mr. David A. Heacock
President and Chief Nuclear Officer
Dominion Nuclear Connecticut, Inc.
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060

SUBJECT: MILLSTONE POWER STATION, UNITS 2 AND 3 – INTERIM STAFF EVALUATION RELATING TO OVERALL INTEGRATED PLAN IN RESPONSE TO ORDER EA-12-049 (MITIGATION STRATEGIES) (TAC NOS. MF0858 AND MF0859)

Dear Mr. Heacock:

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. ML13064A265), Dominion Nuclear Connecticut, Inc. (Dominion, the licensee) submitted its Overall Integrated Plans for Millstone Power Station, Units 2 and 3, in response to Order EA-12-049. By letter dated April 30, 2013 (ADAMS Accession No. ML13126A206), Dominion submitted an update to the Overall Integrated Plan. By letter dated August 23, 2013 (ADAMS Accession No. ML13242A011), Dominion submitted a six-month update to the Overall Integrated Plan.

Based on a review of Dominion's plans, including the six-month update dated August 23, 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 plans, when properly implemented, will meet the requirements of Order EA-12-049 at Millstone Power Station, Units 2 and 3. 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 Reports.

---

[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 james.polickoski@nrc.gov.

Sincerely,

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

Docket Nos. 50-336 and 50-423

Enclosures:
1. Interim Staff Evaluation for Millstone Unit 2
2. Technical Evaluation Report for Millstone Unit 2
3. Interim Staff Evaluation for Millstone Unit 3
4. Technical Evaluation Report for Millstone Unit 3

cc w/encl: Distribution via Listserv

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

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

DOMINION NUCLEAR CONNECTICUT, INC.

MILLSTONE POWER STATION, UNIT 2

DOCKET NO. 50-336

1.0 INTRODUCTION

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

By letter dated February 28, 2013 [Reference 2], Dominion Nuclear Connecticut, Inc. (Dominion, the licensee) submitted its Overall Integrated Plan (hereafter referred to as the Integrated Plan) for Millstone Power Station, Units 2 and 3 (MPS2 and MPS3), in response to Order EA-12-049. The Integrated Plan describes the guidance and strategies under development for implementation by Dominion 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 April 30, 2013 [Reference 22], Dominion submitted an update to the Overall Integrated Plan. As further required by the order, by letter dated August 23, 2013 [Reference 3], Dominion submitted a six-month update to the Overall 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 whether the agency should make improvements to these programs in light of the events at Fukushima Dai-ichi. As a result of this review, the NTTF developed a comprehensive set of recommendations, documented in SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated July 12, 2011 [Reference 4]. These recommendations were enhanced by the NRC staff following interactions with stakeholders. Documentation of the NRC staff's efforts is contained in SECY-11-0124, "Recommended Actions to be Taken without Delay from the Near-Term Task Force Report," dated September 9, 2011 [Reference 5] and SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," dated October 3, 2011 [Reference 6].

As directed by the Commission's Staff Requirement Memorandum (SRM) for SECY-11-0093 [Reference 7], the NRC staff reviewed the NTTF recommendations within the context of the NRC's existing regulatory framework and considered the various regulatory vehicles available to the NRC to implement the recommendations. SECY-11-0124 and SECY-11-0137 established the NRC staff's prioritization of the recommendations based upon the potential safety enhancements.

After receiving the Commission's direction in SRM-SECY-11-0124 [Reference 8] and SRM-SECY-11-0137 [Reference 9], the NRC staff conducted public meetings to discuss enhanced mitigation strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities following BDBEEs. At these meetings, the industry described its proposal for a Diverse and Flexible Mitigation Capability (FLEX), as documented in the Nuclear Energy Institute's (NEI's) letter, dated December 16, 2011 [Reference 10]. FLEX was proposed as a strategy to fulfill the key safety functions of core cooling, containment integrity, and spent fuel cooling. Stakeholder input influenced the NRC staff to pursue a more performance-based approach to improve the safety of operating power reactors than envisioned in NTTF Recommendation 4.2, SECY-11-0124, and SECY-11-0137.

On February 17, 2012, the NRC staff provided SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," [Reference 11] to the Commission, including the proposed order to implement the enhanced mitigation strategies. As directed by SRM-SECY-12-0025 [Reference 12], the NRC staff issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" [Reference 1].

Order EA-12-049, Attachment 2,[1] requires that operating power reactor licensees and construction permit holders use a three-phase approach for mitigating BDBEE. 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 [UHS] 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

[1] Attachment 3 provides the requirements for Combined License holders

Federal Register (77 FR 33779), with the comment period running through July 7, 2012. JLD-ISG-2012-01 proposed endorsing NEI 12-06, Revision B1, as providing an acceptable method of meeting the requirements of Order EA-12-049. The NRC staff received seven comments during this time. The NRC staff documented its analysis of these comments in "NRC Response to Public Comments, JLD-ISG-2012-01 (Docket ID NRC-2012-0068)" [Reference 16].

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

On August 29, 2012, the NRC staff issued the final version of JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" [Reference 19], endorsing NEI 12-06, Revision 0, as an acceptable means of meeting the requirements of Order EA-12-049, and published a notice of its availability in the *Federal Register* (77 FR 55230).

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

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

piping and instrumentation diagrams (P&ID) will be available upon completion of plant modifications.)

6. Description of how the portable FLEX equipment will be available to be deployed in all modes.

By letter dated August 28, 2013 [Reference 20], the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049. That letter described the process to be used by the staff in its reviews, leading to the issuance of an interim staff evaluation and audit report for each site. The purpose of the staff's audits is to determine the extent to which licensees are proceeding on a path towards successful implementation of the actions needed to achieve full compliance with the order. Additional NRC staff review and inspection may be necessary following full implementation of those actions to verify licensees' compliance with the order.

3.0 TECHNICAL EVALUATION

The NRC staff contracted with MegaTech Services, LLC (MTS) for technical support in the evaluation of the Integrated Plan for MPS2, submitted by Dominion's letter dated February 28, 2013, as supplemented. NRC and MTS staff have reviewed the submitted information and held clarifying discussions with Dominion in evaluating the licensee's plans for addressing BDBEEs and its progress towards implementing those plans.

A simplified description of the MPS2 Integrated Plan to mitigate the postulated extended loss of ac power (ELAP) event is that the licensee will initially remove the core decay heat by adding water to the steam generators (SGs) and releasing steam from the SGs to the atmosphere. The water will initially be added by the unit's turbine-driven auxiliary feedwater (TDAFW) pump, taking suction from the unit's condensate storage tank (CST). The MPS2 FSAR states that the CST is designed to withstand seismic events. It also states that the CST is protected from tornado borne missiles by a partial height concrete wall to a height which will provide adequate water for a safe shutdown (205,800 gallons). The reactor coolant system (RCS) will be cooled down to about 350 degrees Fahrenheit (°F) in the cold legs by releasing steam from the SGs, which will reduce the RCS and SG pressures. When the TDAFW pump can no longer be operated reliably, a FLEX pump will be used to add water to the SGs. Borated water will be added to the RCS using an installed charging pump that will be powered by a FLEX generator. If the installed charging pump cannot be used, the licensee will use a diesel-driven high-pressure FLEX pump, with suction from the unit's refueling water storage tank or from a FLEX boric acid batch tank.

FLEX generators will be used to reenergize the installed battery chargers to keep the necessary direct current (dc) buses energized, which will then keep the 120 volt ac instrument buses energized. The licensee stated that they will utilize the industry Regional Response Centers (RRCs) for supplies of phase 3 equipment, which will supplement the Phase 2 equipment stored onsite.

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

MPS2 has a large dry containment building which contains the RCS. The licensee stated that their initial analysis shows that the containment pressure and temperature will remain within acceptable values for at least the first 7 days. Therefore, actions to reduce containment temperature and pressure will not be required prior to this time and will utilize off-site equipment and resources during Phase 3. The licensee will perform additional analyses on the long-term response of the containment and develop strategies to reduce pressures and temperatures if needed.

By letter dated January 24, 2014 [Reference 21], MTS documented the interim results of the Integrated Plan review in the attached technical evaluation report (TER). The NRC staff has reviewed this TER for consistency with NRC policy and technical accuracy and finds that it accurately reflects the state of completeness of the Integrated Plan. The NRC staff therefore adopts the findings of the TER with respect to individual aspects of the requirements of Order EA-12-049.

The NRC staff notes that the licensee revised the location of the MPS FLEX storage building during the audit process, and that both the original proposed location and the new proposed location are mentioned in the TER. For clarity, the new proposed location is south of the railroad bridge, on the west side of the MPS access road, adjacent to the existing northeast contractor parking lot.

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 certain review items to one of the following categories:

> 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.
>
> 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.

As discussed in Section 3.0, above, the NRC staff has reviewed MTS' TER for consistency with NRC policy and technical accuracy and finds that, in general, it accurately reflects the state of completeness of the licensee's Integrated Plan. The open and confirmatory items identified in the TER are listed in the tables below, with some NRC edits made for clarity from the TER version. Thus, the summary tables presented below, as edited, provide a brief description of the issue of concern and represent the NRC's assessment of the open and confirmatory items for MPS2 under this review. Further details for each open and confirmatory item are provided in the corresponding sections of the TER, identified by the item number. The NRC staff notes that for Open Item 3.2.1.8.A on boric acid mixing, the staff has now endorsed the August 2013, Pressurized-Water Reactor Owners Group (PWROG) position paper, with several clarifications, which the licensee will need to address. The NRC endorsement letter is dated January 8, 2014, and is publicly available (ADAMS Accession No. ML13276A183).

In the table below, the NRC staff made the following change compared to the original summary tables in the TER:

1. Open Item 3.2.1.8.A was revised to show the recent NRC endorsement of the PWROG position paper on boric acid mixing under natural circulation conditions.

2. Confirmatory Item 3.2.1.A was revised to include the information provided by the licensee in its answer to audit question 81.

3. Confirmatory Item 3.2.1.1.A was revised to include the information provided by the licensee in its answer to audit question 11.

4.1 <u>Open Items</u>

Item Number	Description	Notes
3.2.1.8.A	Core Subcriticality and Boron Mixing: The PWROG submitted to NRC a position paper, dated August 15, 2013, which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlined applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available. During the audit process, the licensee informed the NRC staff of its intent to abide by the generic approach discussed above. The licensee should address the clarifications in the NRC endorsement letter dated January 8, 2014.	
3.2.4.1.A	The licensee did not provide sufficient information regarding cooling functions provided by such systems as auxiliary building cooling water, service water, or component cooling water cooling when ac power is lost during the ELAP for Phase 1 and 2. For example, the potential need for cooling water for the TDAFW pump bearings was not discussed. Additional analysis by the licensee is required to determine the acceptability of the licensee's plans to provide supplemental cooling to the subject components when normal cooling will not be available during the ELAP.	

4.2 Confirmatory Items

Item Number	Description	Notes
3.1.1.2.A	Confirm that the preferred travel pathways are determined using the guidance contained in NEI 12-06. The pathways will attempt to avoid areas with trees, power lines, and other potential obstructions and will consider the potential for soil liquefaction. This is scheduled to be completed in June 2014.	
3.1.1.3.A	Confirm that a review is completed to determine impacts from large internal flooding sources that are not seismically robust and do not require ac power.	
3.1.1.4.A	The licensee's plan for implementing the use of off-site resources is not complete. The local assembly areas have not been identified. The licensee is also evaluating the possibility of boat transport for personnel.	
3.1.2.2.A	The licensee has identified open items related to deployment of equipment during flooding conditions resulting from a hurricane; to verify response times listed in the timeline and perform staffing assessment, and to perform an evaluation of all BDB equipment fuel consumption and required re-fill strategies, and to determine preferred travel pathways using the guidance contained in NEI 12-06. The pathways will attempt to avoid areas with trees, power lines, and other potential obstructions.	
3.2.1.A	Confirm that Combustion Engineering Case 21 in WCAP-17601-P, as evaluated in MPS2 document ETE-NAF-2012-0150, Section 6.1, is representative for MPS2 and appropriate for simulating the ELAP transient.	
3.2.1.1.A	Confirm that Westinghouse letter LTR-TDA-13-31, Rev. 0-B, Attachment 1, shows that the CENTS code used in the ELAP analysis for Combustion Engineering (CE) plants is limited to analyzing the flow conditions before reflux boiling initiates. This review should confirm an acceptable definition for the initiation of reflux boiling.	
3.2.1.2.A	The RCP seal initial maximum leakage rate should be greater than or equal to the upper bound expectation for the seal leakage rate for the ELAP event discussed in the PWROG position paper addressing the RCP seal leakage for CE plants (ADAMS Accession No. ML13235A151 (Non-Publicly Available)) or justification should be provided for use of a lower value.	
3.2.1.6.A	Sequence of Event (SOE) action Item 5 indicates that the ELAP is declared at 45 minutes, and Action Item 6 indicates that at 50 minutes (5 minutes after the declaration of the ELAP), the operator controls SG atmospheric dump valves (ADVs) and AFW flow locally as an on-going action for cooldown and decay heat removal. On page 105 of the integrated plan in Attachment 1B NSSS Significant Reference Analysis Deviation Table, the licensee	

Item Number	Description	Notes
	notes in item 6 that cooldown starts at 2 hours at 75 degrees F/hr. to a SG pressure of 135 psia. Clarification is needed to correct this apparent inconsistency.	
3.2.1.6.B	The licensee did not provide a discussion regarding the operator actions required to control SG ADVs and AFW flow and justification is needed to determine that all the required operator actions are reasonably achievable within the required time constraint of 50 minutes during the ELAP conditions, or a discussion regarding the required cooldown completion time that is supportable by analysis.	
3.2.1.6.C	Confirm that response times listed in the SOE timeline are verified and that staffing assessment has been performed.	
3.2.2.A	Following a BDB event, a vent pathway would be required in the event of SFP bulk boiling and can be established by opening the Fuel Building roll-up doors for inlet and outlet air flow. However the licensee's strategy for providing air flow to remove steam generated from pool boiling is not clear. The path for inlet and exhaust air is apparently the same i.e., the fuel building rollup doors. It is not clear from the discussion provided how this will enable a flow path to vent the steam and condensate from the Fuel Building.	
3.2.3.A	During the audit process the licensee stated that the details of the long term containment cooldown and depressurization strategies for MPS2 are still under development. Upon selection of the preferred strategy, detailed GOTHIC analysis will be performed to document and validate the strategy and also to provide operators with timelines and guidelines for actions to ensure the long term integrity of the containment throughout the Phase 3 of the postulated ELAP/LUHS scenario. Confirm that the revised analyses and the selected strategy are acceptable.	
3.2.4.2.A	The ventilation evaluation will be completed later this year and the results will be provided in the February 2014 6-Month update. Confirm that the evaluation and results are acceptable.	
3.2.4.4.A	Confirm the adequacy of existing lighting and the adequacy of portable lighting to perform FLEX strategy actions.	
3.2.4.4.B	Confirm that upgrades to the site's communications systems have been completed.	
3.2.4.6.A	Additional information is needed to confirm habitability of the Main Control Room during the ELAP.	
3.2.4.7.A	Westinghouse is currently performing an analysis to determine the consequences of usage of impure water sources in the steam generators. The results of the analysis are expected to provide the allowed time limits on usage of these sources. The RRC will provide equipment to initiate residual heat removal and water treatment equipment such that heat removal can be ensured for	

Item Number	Description	Notes
	extended durations. Confirm that the analysis results and resultant strategies are acceptable.	
3.2.4.9.A	A secondary source for fuel oil will be the MPS3 Diesel Fuel Oil Storage Tanks. These underground tanks contain a minimum of 32,670 gallons of fuel oil. They are seismic and missile protected. Confirm the ability to transfer this fuel, and complete an evaluation of all BDB equipment fuel consumption and required re-fill strategies, including any gasoline required for small miscellaneous equipment.	
3.2.4.10.A	The licensee has completed an analysis of the battery capability regarding expected time available with ac power. Site specific procedural guidance governing load stripping will be developed. Confirm electrical components performance requirements and electrical loading-related strategy objectives can be met.	
3.4.A	The licensee's plans for the use of off-site resources conform to the minimum capabilities specified in NEI 12-06 Section 12.2, with regard to the capability to obtain equipment and commodities to sustain and backup the site's coping strategies (item 1). Confirm the licensee addresses the remaining items (2 through 10), or provides an appropriate alternative.	

Based on a review of Dominion's plan, including the six-month update dated August 23, 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 for MPS2. 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 BDBEE. These new requirements provide a greater mitigation capability consistent with the overall defense-in-depth philosophy, and, therefore, greater assurance that the challenges posed by beyond-design-basis external events to power reactors do not pose an undue risk to public health and safety.

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

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

6.0 REFERENCES

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

2. Letter from Dominion to NRC, "Overall Integrated Plan In Response to March 12, 2012 Commission Order Modifying Licenses With Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated February 28, 2013 (ADAMS Accession No. ML13064A265)

3. Letter from Dominion to NRC, "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 23, 2013 (ADAMS Accession No. ML13242A011)

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

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

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

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

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

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

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

11. SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," February 17, 2012 (ADAMS Accession No. ML12039A103)

12. SRM-SECY-12-0025, "Staff Requirements – SECY-12-0025 - Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," March 9, 2012 (ADAMS Accession No. ML120690347)

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

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

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

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

17. NEI, Comments from Adrian P. Heymer on Draft Interim Staff Guidance JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,", July 3, 2012 (ADAMS Accession No. ML121910390)

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

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

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

21. Letter from John Bowen, MegaTech Services, LLC, to Eric Bowman, NRC, submitting "Technical Evaluation Reports Related to Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, EA 12-049," dated January 24, 2014 (ADAMS Accession No. ML14024A246)

22. Letter from Dominion to NRC, "Supplement to 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 April 30, 2013 (ADAMS Accession No. ML13126A206)

Principal Contributors: E. Bowman
G. Singh
J. Boska
S. Gardocki
B. Heida
S. Sun
J. Kaizer

Date: January 31, 2014

Enclosure 2

Millstone Power Station, Unit 2

Technical Evaluation Report

Mega-Tech Services, LLC

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

Dominion Nuclear Connecticut, Inc
Millstone Power Station, Unit 2
Docket No. 50-336

REVISION 1

January 24, 2014

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. MF0858

Prepared by:

Mega-Tech Services, LLC
11118 Manor View Drive
Mechanicsville, Virginia 23116

1.0 BACKGROUND

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

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

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

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

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

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

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

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

2.0 EVALUATION PROCESS

In accordance with the provisions of Contract NRC-HQ-13-C-03-0039, Task Order No. NRC-HQ-13-T-03-0001, Mega-Tech Services, LLC (MTS) performed an evaluation of each licensee's Integrated Plan. As part of the evaluation, MTS, in parallel with the NRC staff, reviewed the original Integrated Plan and the first 6-month status update, and conducted an audit of the licensee documents. The staff and MTS also reviewed the licensee's answers to the NRC staff's and MTS's questions as part of the audit process. The objective of the evaluation was to assess whether the proposed mitigation strategies conformed to the guidance in NEI 12-06, as endorsed by the positions stated in JLD-ISG-2012-01, or an acceptable alternative had been proposed that would satisfy the requirements of Order EA-12-049. The audit plan that describes the audit process was provided to all licensees in a letter dated August 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. ML13064A265, as supplemented by a letter dated April 30, 2013, ADAMS Accession No. ML13126A206, and as supplemented by a letter dated August 23, 2013, ADAMS Accession No. ML13242A011, Dominion Nuclear Connecticut, Inc (hereinafter referred to as the licensee or Dominion) provided the Overall Integrated Plan for Compliance with Order EA-12-049 for Millstone Power Station Unit 2 (MPS2). The Integrated Plan describes the strategies and guidance under development for implementation by Dominion for the maintenance or restoration of core cooling, containment, and SFP cooling capabilities following a BDBEE, including modifications necessary to support this implementation, pursuant to Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049. That letter described the process used by the NRC staff in its review, leading to the issuance of an interim staff evaluation and audit report. The purpose of the staff's audit is to determine the extent to which the licensees are proceeding on a path towards successful implementation of the actions needed to achieve full compliance with the Order.

3.1 EVALUATION OF EXTERNAL HAZARDS

Sections 4 through 9 of NEI 12-06 provide the NRC-endorsed methodology for the determination of applicable extreme external hazards in order to identify potential complicating factors for the protection and deployment of equipment needed for mitigation of beyond-design-basis external events leading to a loss of all ac power and loss of normal access to the ultimate heat sink (UHS). These hazards are broadly grouped into the categories discussed below in Sections 2.1.1 through 2.1.5 of this evaluation. Characterization of the applicable hazards for a specific site includes the identification of realistic timelines for the hazard; characterization of the functional threats due to the hazard; development of a strategy for responding to events with warning; and development of a strategy for responding to events without warning.

3.1.1 Seismic Hazard

NEI 12-06, Section 5.2 states:

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

On page 1 of the Integrated Plan, the licensee stated that the MPS2 seismic hazard is considered to be the earthquake magnitude associated with the design basis seismic event. Per Final Safety Analysis Report (FSAR) Section 5.8.1.1, the safe shutdown earthquake (SSE) produces a maximum horizontal ground acceleration of 0.17g and a vertical ground acceleration of 0.11g. Thus, MPS2 screens in for the seismic hazard.

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.

In the August 2013 Integrated Plan update, the licensee stated that a single 10,000 sq-ft. Type 1 building will be constructed for storage of BDB equipment. Per licensee engineering evaluation ETE-CPR-2012-0009 Rev. 1, a Type 1 building is a concrete, tornado missile protected building that meets SSE requirements. The building will be designed to meet the plant's design basis for the SSE, high wind hazards, snow, ice and cold conditions, and be located above the flood elevation from the most recent site flood analysis. The BDB storage building will be sited north of the bridge near the salt-shed.

Additionally, the licensee stated in the Integrated Plan that the BDB pumps, necessary hoses and fittings, debris clearing equipment, and supplemental lighting/communications equipment are protected from seismic events while stored in the BDB storage building or in protected areas of the plant. In ETE-CPR-2012-0009 Rev. 1, the licensee specified that stored equipment and the structures will be evaluated and protected from seismic interactions, and that large portable equipment will be secured inside the storage building to protect them during a seismic event.

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

3.1.1.2 Deployment of FLEX Equipment - Seismic Hazard

NEI 12-06, Section 5.3.2 states:

> There are five considerations for the deployment of FLEX equipment following a seismic event:
>
> 1. If the equipment needs to be moved from a storage location to a different point for deployment, the route to be traveled should be reviewed for potential soil liquefaction that could impede movement following a severe seismic event.
>
> 2. At least one connection point for the 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 [mitigation] 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.

On page 31 of the Integrated Plan, the licensee stated that the condensate storage tank (CST) refill BDB connection will be located within the Turbine Building in an area that is seismic category 1 and protected from high winds and associated missiles. The BDB auxiliary feedwater (AFW) pump suction connection consists of a piping tee fitting installed in the CST supply line to the turbine driven auxiliary feedwater (TDAFW) Pump. The BDB AFW pump suction connection will be located within the Turbine Building (TB) in an area that is seismic category I and protected from high winds and associated missiles.

On page 57 of the Integrated Plan, the licensee stated that for SFP makeup a new BDB pipe connection in the Auxiliary Building (AB) in the SFP skimmer cage will be seismically installed. The piping will be seismically designed and missile protected.

On page 63 of the Integrated Plan, the licensee specified that for the 120 VAC vital bus circuits two 120/240 VAC diesel generators (DGs) per unit will be connected to 120 VAC vital buses through pre-installed BDB cabling, and connections. The portable 120/240 VAC DGs (and connecting power cables) will be deployed from their protected storage location to the area east of the dc switchgear room exterior door. Cables will be run from the portable DGs to seismically-designed, tornado missile protected BDB connection receptacles

In addition to the above strategy, the licensee provided an alternate strategy, which will include the power cables being connected to seismically-designed, tornado missile protected BDB connection receptacles accessible through the TB doorway.

On page 68 of the Integrated Plan, the licensee stated that for the 4KV portable DG the connection will be to an existing load center inside the MPS2 Enclosure Building which is a Class 1 structure protected from wind generated missiles, flooding and extreme temperatures.

On page 93 of the Integrated Plan, the licensee stated that following an Extended Loss of AC Power (ELAP) event, certain barriers (gates and doors) will be opened and remain open. The Security force will initiate an access contingency upon loss of the security diesel and all ac/dc power as part of the security plan. Access to the owner controlled area (OCA), site protected area (PA), and areas within the plant structures will be controlled under this access contingency. Vehicle access to the PA is via the double gated sally-port at the Security building. As part of the Security access contingency, the sally-port gates will be manually controlled to allow delivery of BDB equipment (e.g., generators, pumps) and other vehicles such as debris removal equipment.

On page 108 of the Integrated Plan, the licensee provided an open item that stated that the preferred travel pathways will be determined using the guidance contained in NEI 12-06. The pathways will attempt to avoid areas with trees, power lines, and other potential obstructions and will consider the potential for soil liquefaction. This open item is scheduled to be completed in June 2014. This has been identified as Confirmatory Item 3.1.1.2.A in Section 4.2.

Consideration 3 does not apply to MPS2 as the site is adjacent to Long Island Sound.

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

3.1.1.3 Procedural Interfaces - Seismic Hazard

NEI 12-06, Section 5.3.3 states:

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

On pages 18 and 19 of the Integrated Plan, the licensee stated that FLEX Support Guidelines (FSGs) will be developed in accordance with Pressurized Water Reactors Owners Group (PWROG) guidance. The following procedures; EOP 2530, "Station Blackout," AOP 2560, "Storms, Winds and High Tides," AOP 2562, "Earthquake," and AOP 2578, "Loss of Refuel Pool and Spent Fuel Pool Level," will be revised to the extent necessary to implement FSGs.

Regulatory Screening/Evaluation NEI 96-07, Revision 1, and NEI 97-04, Revision 1, will be used to evaluate the changes to existing procedures as well as to the FSGs to determine the need for prior NRC approval.

On page 29 of the Integrated Plan, the licensee stated that site specific procedural guidance governing the core cooling and heat removal strategies will be developed using industry guidance, and will address the necessary steps to deploy portable pumps and hoses, establish connections, and operate the portable equipment to perform the required function.

The licensee did not provide information in the Integrated Plan regarding considerations 1, 2 or 3. In ETE-CPR-2012-0009 Rev. 1, the licensee stated that regarding consideration 1, MPS2 has the capability to determine local instrument reading per procedure Extreme Damage Mitigation Guideline (EDMG) 2.02 "MP2 B.5.b Event TSC Response", Rev. 8. Additionally the licensee stated that no subsurface groundwater drainage pumping system is installed. Per FSAR Section 5.2.2.1.7 buoyant forces resulting from displacement of ground or flood water by the structure are accounted for in the design of the structure. Regarding consideration 2 the licensee stated that a review will be completed to determine impacts from large internal flooding sources that are not seismically robust and do not require ac power. This has been identified as Confirmatory Item 3.1.1.3.A in Section 4.2.

Consideration 4 does not apply to MPS2 as the site is located adjacent to Long Island Sound.

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 seismic hazards, if these requirements are implemented as described.

3.1.1.4 Considerations in Using Offsite Resources - Seismic Hazard

NEI 12-06, Section 5.3.4 states:

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

On page 22 of the Integrated Plan, the licensee stated that they will participate in the process to support the Regional Response Centers (RRCs) as required for additional Phase 3 equipment. Equipment will be moved from an RRC to a local Assembly Area, established by the Strategic Alliance for FLEX Emergency Response (SAFER) team and the utility. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request. In ETE-CPR-2012-0009 Rev. 1 the licensee stated that in the event of damage to roadways, arrangements have been made with the state of Connecticut for use of helicopters for delivery of RRC equipment to the site.

The licensee's plan for implementing the use of off-site resources is not complete. The local assembly areas have not been identified. The licensee is also evaluating the possibility of boat transport for personnel. This has been identified as Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.2 Flooding

NEI 12-06, Section 6.2 states:

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

NEI 12-06, Section 6.2.1 states:

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

On pages 2 and 3 of the Integrated Plan, the licensee stated that the only sources of flooding that could affect MPS are direct rainfall and storm surge. There are no major rivers or streams in the vicinity of the station, nor are there any watercourses on the site. Since MPS is located on a peninsula projecting into Long Island Sound, it is subjected to tidal flooding from severe storms or hurricanes. The design of MPS2 reflects the decision to provide flood protection up to Elevation 22 feet mean sea level (MSL) minimum for the Containment, Turbine, and Auxiliary Buildings. This is based on the MPS2 Licensing Basis that states for a probable maximum hurricane, the maximum still water level was determined to be +19.17 feet MSL with an associated 2.5 feet of wave runup to an elevation of +21.67 feet MSL. However, Millstone Power Station Unit 3 (MPS3) has a slightly higher Licensing Basis flood level of +19.7 feet MSL still water, with a wave run-up to Elevation 23.8 MSL. Therefore, the more limiting MPS3 flood characteristics are applied to the MPS2 FLEX strategy development.

The areas of the North American continent most susceptible to tsunamis are those bordering the Pacific Ocean and the Gulf of Mexico. MPS is located on the North Atlantic coastline where there is an extremely low probability of tsunamis (MPS3 FSAR Section 2.4.6). Therefore, tsunamis are not considered to be credible natural phenomena which might affect the safety of either unit at the MPS site. Flooding due to ice jams is not a possibility since the site is not on a river. Seiche-related flooding is not addressed in the FSAR.

During the audit process the licensee stated that the MPS2 FSAR does not address seiche-related flooding. However, the MPS3 FSAR does include seiche conditions, but states that the Probable Maximum Hurricane (PMH) surge is the more significant flooding event at the MPS site. Although this statement is made for MPS3, it is applicable to both units at the MPS site. Additionally, preliminary results of the Flooding Hazards Re-evaluation being performed in response to NTTF Recommendation 2.1 regarding flooding have concluded that: potential forcing mechanisms for seiches in the discharge basin are generally weak and not capable of forcing a significant seiche. Potential seiches would be damped by irregularities in the basins. The probable maximum seiche poses no flood risk to SSCs at MPS. Based on the above, the licensee considers the hazard due to a seiche as bounded by the other flooding hazards applicable to MPS2.

In ETE-CPR-2012-0009 Rev. 1 the licensee stated that flooding from a precipitation event would last only as long as the precipitation occurred and that rainfall would drain from the site rapidly. The site would have days of warning before a hurricane and the flooding conditions would also rapidly dissipate.

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 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.

In the August 2013 Integrated Plan update, the licensee stated that a single 10,000 sq-ft. Type 1 building will be constructed at the site for storage of BDB equipment. Per licensee engineering evaluation ETE-CPR-2012-0009 Rev. 1, a Type 1 building is a concrete, tornado missile protected building that meets SSE requirements. The building will be designed to meet the plant's design basis for the SSE, high wind hazards, snow, ice and cold conditions, and be located above the flood elevation from the most recent site flood analysis. The BDB storage building will be sited north of the bridge near the salt shed.

On page 30 of the Integrated Plan, the licensee stated that the BDB pumps, necessary hoses and fittings are protected from flooding events while stored in the BDB storage building or in protected areas of the plant.

On pages 78 and 84 of the Integrated Plan, the licensee stated that supplemental BDB lighting and communications equipment will be protected from flooding events while stored in the BDB storage building or in protected areas of the plant.

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

3.1.2.2 Deployment of FLEX Equipment - Flooding Hazard

NEI 12-06, Section 6.2.3.2 states:

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

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

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

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

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

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

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

On page 9 of the Integrated Plan, the licensee stated that based on plant simulator runs and table-top walkthroughs of planned actions, a two-hour duration is assumed for deployment of equipment from the BDB storage building based on a "sunny day" (i.e. daylight conditions with no adverse weather situations) validation for implementation of 10 CFR 50.54(hh)(2) time sensitive actions. The validation included deploying a portable high capacity pump from its storage location to a location near the Long Island Sound (staging location) and routing hoses to provide flow to the SFP. Validation of estimated response times included in Attachment 1A will be completed once FLEX Support Guidelines (FSGs) have been developed and will include a staffing analysis.

On page 11 of the Integrated Plan, the licensee stated that flooding due to a hurricane could delay deployment of the BDB High Capacity pump (or fire truck) to provide makeup to the CST. Existing procedures direct MPS2 to be shutdown in anticipation of the arrival of the hurricane.

On page 69 of the Integrated Plan, the licensee stated that an evaluation of all BDB equipment fuel consumption and required re-fill strategies will be developed including any gasoline required for small miscellaneous equipment. Site specific procedural guidance governing re-fueling strategies will be developed using industry guidance, and will address the monitoring of fuel supplies and consumption in order to initiate refueling activities prior to equipment shutdown.

On page 98 of the Integrated Plan, the licensee stated that Phase 3 involves the receipt of equipment from offsite sources including the RRC and various commodities such as fuel and supplies. Transportation of these deliveries can be through airlift or via ground transportation. Debris removal for the pathway between the site and the RRC receiving location and from the various plant access routes may be required. The same debris removal equipment used for on-site pathways would be used. Evaluation and development of coordination with the RRC will be performed and documented as described in the Integrated Plan, Section A.9.

In the Integrated Plan, Section B.1, the licensee stated that the TDAFW pump failure due to flooding is an unlikely situation, however, due to potential flood waters outside of MPS2, deployment of the BDB AFW pump from the BDB storage building would not be possible.

During the audit process the licensee stated that regarding consideration 6, MPS2 would potentially be impacted by a storm surge once it rises to and above the plant grade elevation of 14 ft. mean sea level (MSL). Under these conditions, deployment of BDB equipment and refueling of deployed equipment around MPS2 would not be possible. Based on the more recent flood surge analysis (from the MPS3 FSAR) the maximum time at which maximum probable hurricane (MPH) storm surge would exceed the plant grade elevation would be approximately 8 hours. The BDB AFW pump will now be pre-deployed from the BDB storage building to the flood-protected truck bay area of the TB and connections between the pump, the CST supply connection, and primary SG injection connection will be established. The site hurricane preparation procedures will be revised to include this action. The licensee also stated that in the event the backup BDB AFW pump is needed, no time to deploy or install connections would be required. Per the specification for the pump, a 12 hour fuel tank will be provided with the pump and the pump will be stored fueled in the BDB storage building. Twelve hours is more than sufficient time to allow the storm surge to subside and will facilitate refueling from available onsite fuel sources when required. As a clarification, the CST is the water source for either the TDAFW pump or the BDB AFW pump and is a tornado missile protected tank. The final details of this approach will be provided in the February, 2014 Six-Month Status Update.

In the Integrated Plan, the licensee did not specifically address NEI 12-06 Section 6.2.3.2, consideration 5 regarding flood protected connection points, consideration 7 regarding the need for dewatering or extraction pumps, and consideration 8 regarding the need for temporary flood barriers.

During the audit process the licensee stated that considerations 5, 7, and 8 are addressed in Chapter 12 of ETE-CPR-2012-0009. The licensee specified that the BDB strategy is to provide alternate locations for all connections, and that in no cases, are the primary and alternate location both unavailable due to flood conditions. For minor flooding due to storm surge, the licensee stated that they maintain several small self-powered pumps and staged hoses in the TB condenser pit area but are not BDB equipment. The licensee further stated that MPS2 relies on installation of temporary flood barriers for protection in the event of a significant storm surge. In most cases the temporary flood barriers are flood gates installed at doorways with additional stop logs staged at the door locations where needed. Also a temporary barrier (fiberglass can) is installed over a service water pump and motor for flood protection.

The licensee has identified open items related to deployment of equipment during flooding conditions resulting from a hurricane; to verify response times listed in the timeline and perform staffing assessment, to perform an evaluation of all BDB equipment fuel consumption and required re-fill strategies, and to determine preferred travel pathways using the guidance contained in NEI 12-06. The pathways will attempt to avoid areas with trees, power lines, and other potential obstructions. This has been identified as Confirmatory Item 3.1.2.2.A in Section 4.2.

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

3.1.2.3 Procedural Interfaces - Flooding Hazard

NEI 12-06, Section 6.2.3.3 states:

> The following procedural interface considerations should be addressed.
>
> 1. Many sites have external flooding procedures. The actions necessary to support the deployment considerations identified above should be incorporated into those procedures.
> 2. Additional guidance may be required to address the deployment of FLEX for flooded conditions (i.e., connection points may be different for flooded vs. non-flooded conditions).
> 3. FLEX guidance should describe the deployment of temporary flood barriers and extraction pumps necessary to support FLEX deployment.

On pages 18 and 19 of the Integrated Plan, the licensee stated that FSGs will be developed in accordance with PWROG guidance. The following procedures; EOP 2530, "Station Blackout," AOP 2560, "Storms, Winds and High Tides," AOP 2562, "Earthquake," and AOP 2578, "Loss of Refuel Pool and Spent Fuel Pool Level," will be revised to the extent necessary to implement FSGs. Regulatory Screening/Evaluation NEI 96-07, Revision 1, and NEI 97-04, Revision 1, will be used to evaluate the changes to existing procedures as well as to the FSGs to determine the need for prior NRC approval.

On page 29 of the Integrated Plan, the licensee stated that site specific procedural guidance governing the core cooling and heat removal strategies will be developed using industry guidance, and will address the necessary steps to deploy portable pumps and hoses, establish connections, and operate the portable equipment to perform the required function.

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 flood hazards, if these requirements are implemented as described.

3.1.2.4 Considerations in Using Offsite Resources - Flooding Hazard

NEI 12-06, Section 6.2.3.4 states:

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

2. Sites impacted by persistent floods should consider where equipment delivered from off-site could be staged for use on-site.

On page 22 of the Integrated Plan, the licensee stated that they will participate in the process to support the RRCs as required for additional Phase 3 equipment. Equipment will be moved from an RRC to a local Assembly Area, established by the SAFER team and the utility. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request. In ETE-CPR-2012-0009 Rev. 1 the licensee stated that in the event of damage to roadways, arrangements have been made with the state of Connecticut for use of helicopters for delivery of RRC equipment to the site

The licensee's plan for implementing the use of off-site resources is not complete. The local assembly areas have not been identified. The licensee is also evaluating the possibility of boat transport for personnel. This has been combined with Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.3 High Winds

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

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

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

On pages 3 and 4 of the Integrated Plan, the licensee stated that the plant design bases address the storm hazards of hurricanes, high winds and tornadoes. The licensee further stated that MPS is located on the north shore of the Long Island Sound, and it is exposed to tropical storms and hurricanes coming off the Atlantic Ocean, which occasionally affect the region during the summer and fall months. According to a statistical study by Simplon and Lawrence (1971), the 50-mile segment of coastline on which MPS is located, was crossed by five hurricanes during the 1886 to 1970 period. Based on observations from Montauk Point, located about 23 miles southeast of MPS on the eastern tip of Long Island, the maximum reported wind speed in the region was associated with the passage of a hurricane during which sustained winds of 115 mph, with short-term gusts up to 140 mph (Dunn and Miller 1960) were observed. For the period from 1961 through 1990, the "fastest-mile" wind speed recorded at Bridgeport was 74 mph occurring with a south wind in September 1985 (MPS3 FSAR Section 2.3.1.2).

According to MPS3 FSAR Section 2.3.1.2.4, a study of tornado occurrences during the period of 1955 through 1967 (augmented by 1968-1981 storm data reports), the mean tornado frequency in the one-degree (latitude-longitude) square where the MPS site is located is determined to be approximately 0.704 per year (MPS3 FSAR Section 2.3.1.2). MPS2 uses a design basis tornado wind velocity of 360 mph (MPS2 FSAR Section 5.2.2.1.6).

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

3.1.3.1 Protection of FLEX Equipment - High Wind Hazard

NEI 12-06, Section 7.3.1 states:

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

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

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

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

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

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

In the August 2013 Integrated Plan update, the licensee stated that a single 10,000 sq-ft. Type 1 building will be constructed for storage of BDB equipment. Per licensee engineering evaluation ETE-CPR-2012-0009 Rev. 1, a Type 1 building is a concrete, tornado missile protected building that meets SSE requirements. The building will be designed to meet the plant's design basis for the SSE, high wind hazards, snow, ice and cold conditions, and be located above the flood elevation from the most recent site flood analysis. The BDB storage building will be sited north of the bridge near the salt shed.

On pages 30, 78 and 84 of the Integrated Plan, the licensee stated that the BDB pumps, necessary hoses and fittings, supplemental lighting and communications equipment are protected from severe storms with high wind events while stored in the BDB Storage Building or in protected areas of the plant.

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

3.1.3.2 Deployment of FLEX Equipment - High Wind Hazard

NEI 12-06, Section 7.3.2 states:

There are a number of considerations which apply to the deployment of FLEX equipment for high wind hazards:

1. For hurricane plants, the plant may not be at power prior to the simultaneous ELAP and LUHS condition. In fact, the plant may have been shut down and the plant configuration could be established to optimize FLEX deployment. For example, the portable pumps could be connected, tested, and readied for use prior to the arrival of the hurricane. Further, protective actions can be taken to reduce the potential for wind impacts. These factors can be credited in considering how the baseline capability is deployed.

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

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

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

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

On page 11 of the Integrated Plan, the licensee stated that existing procedures direct MPS2 to be shutdown in anticipation of the arrival of a hurricane and that as a result, at the time of the ELAP event, the decay heat in the core would be significantly lower than a shutdown from power operations, therefore extending the time of CST depletion.

On page 72 of the Integrated Plan, the licensee stated that the coping strategy for supplying fuel oil to diesel driven portable equipment, i.e., pumps and generators, is described in Section F2.2 for Phase 2 and is the same for Phase 3. The licensee also stated that an evaluation of all BDB equipment fuel consumption and required re-fill strategies will be developed and will include Phase 3 equipment including any gasoline required for small miscellaneous equipment. The fuel strategy will evaluate the need for additional fuel required from the RRC or other offsite sources.

On page 98 of the Integrated Plan, the licensee stated that Phase 3 involves the receipt of equipment from offsite sources including the RRC and various commodities such as fuel and supplies. Transportation of these deliveries can be through airlift or via ground transportation. Debris removal for the pathway between the site and the RRC receiving location and from the various plant access routes may be required. The same debris removal equipment used for on-site pathways would be used. Evaluation and development of coordination with the RRC will be performed and documented as described in Section A.9 of the Integrated Plan.

On page 96 of the Integrated Plan, the licensee stated that the BDB equipment for removing debris (tractors and front-end loader) will be protected from high wind events while stored in the

BDB Storage Building. One set of miscellaneous debris removal equipment is listed in the Phase 2 equipment table on Page 101 in the Integrated Plan.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to deployment of FLEX equipment considering the high wind hazard, 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 pages 18 and 19 of the Integrated Plan, the licensee stated that FSGs will be developed in accordance with PWROG guidance. The following procedures; EOP 2530, "Station Blackout", AOP 2560, "Storms, Winds and High Tides", AOP 2562, "Earthquake", and AOP 2578, "Loss of Refuel Pool and Spent Fuel Pool Level", will be revised to the extent necessary to implement FSGs. Regulatory Screening/Evaluation NEI 96-07, Revision 1, and NEI 97-04, Revision 1, will be used to evaluate the changes to existing procedures as well as to the FSGs to determine the need for prior NRC approval.

On page 29 of the Integrated Plan, the licensee stated that site specific procedural guidance governing the core cooling and heat removal strategies will be developed using industry guidance, and will address the necessary steps to deploy portable pumps and hoses, establish connections, and operate the portable equipment to perform the required function.

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

3.1.3.4 Considerations in Using Offsite Resources - High Wind Hazard

NEI 12-06, Section 7.3.4 states:

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

On page 22 of the Integrated Plan, the licensee stated that they will participate in the process to support the RRCs as required for additional Phase 3 equipment. Equipment will be moved from an RRC to a local Assembly Area, established by the SAFER team and the utility. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request. In ETE-CPR-2012-0009 Rev. 1 the licensee stated that in the event of damage to roadways, arrangements have been made with the state of Connecticut for use of helicopters for delivery of RRC equipment to the site

The licensee's plan for implementing the use of off-site resources is not complete. The local assembly areas have not been identified. The licensee is also evaluating the possibility of boat transport for personnel. This has been combined with Confirmatory Item 3.1.1.4.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to use of off-site resources considering 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 35^{th} Parallel should provide the capability to address extreme snowfall with snow removal equipment. Finally, all sites except for those within Level 1 and 2 of the maximum ice storm severity map contained in Figure 8-2 should address the impact of ice storms.

On page 4 of the Integrated Plan, the licensee stated that the mean annual snowfall at the present Bridgeport location is 25.3 inches, with totals since 1932 ranging from 8.2 inches in the 1972-1973 seasons, to 71.3 inches in the 1933-1934 seasons. The maximum monthly snowfall, occurring in February 1934, was 47.0 inches. Freezing rain and drizzle are occasionally observed during the months of December through March, and only rarely observed in November and April. An average of 18.5 hours of freezing rain and 8.5 hours of freezing drizzle occur annually in the region. In the 32-year period, 1949-1980, all cases of freezing precipitation were reported as light (less than 0.10 inch per hour), except for one hour of moderate, 0.10 to 0.30 inch per hour precipitation (MPS3 FSAR Section 2.3.1). Minimum daily temperatures during the winter months are usually below freezing, but subzero, degrees F, readings are observed, on the average, less than one day every two years.

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

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

NEI 12-06, Section 8.3.1 states:

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

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

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

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

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

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

In the August 2013 Integrated Plan update, the licensee stated that a single 10,000 sq-ft. Type 1 building will be constructed for storage of BDB equipment. In accordance with licensee engineering evaluation ETE-CPR-2012-0009 Rev. 1, a Type 1 building is a concrete, tornado missile protected building that meets SSE requirements. The building will be designed to meet the plant's design basis for the SSE, high wind hazards, snow, ice and cold conditions, and be located above the flood elevation from the most recent site flood analysis. The BDB storage building will be sited north of the bridge near the salt -shed.

On pages 30, 71, 78 and 84 of the Integrated Plan, the licensee stated that the BDB pumps, necessary hoses and fittings, supplemental lighting and communications equipment are protected from severe storms with high wind events while stored in the BDB Storage Building or in protected areas of the plant.

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

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

NEI 12-06, Section 8.3.2 states:

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

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

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

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

In the Integrated Plan, the licensee did not identify any specific equipment that could be deployed for ice or snow removal. During the audit process, the licensee stated that FLEX equipment will include two John Deere 6125M Cab Tractors and one Caterpillar 924H Front-end Loader. Those three pieces of equipment have buckets that are capable of snow and ice removal. The loader and tractors will be located in the BDB storage building to provide protection from external events.

FLEX Support Guideline, FSG-5, provides direction to clear the haul route for deploying FLEX equipment. The John Deere tractors and Caterpillar front-end loader that will be used to deploy FLEX equipment also would be used to remove snow and ice, ensuring that pathways required for movement of BDB equipment are cleared. Additional procedural guidance for the various uses of the tractors and front-end loader in snow and ice conditions at the plant is not required.

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

3.1.4.3 Procedural Interfaces - Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.3 states:

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

On pages 18 and 19 of the Integrated Plan, the licensee stated that FSGs will be developed in accordance with PWROG guidance. The following procedures; EOP 2530, "Station Blackout", AOP 2560, "Storms, Winds and High Tides", AOP 2562, "Earthquake", and AOP 2578, "Loss of Refuel Pool and Spent Fuel Pool Level", will be revised to the extent necessary to implement FSGs. Regulatory Screening/Evaluation NEI 96-07, Revision 1, and NEI 97-04, Revision 1, will be used to evaluate the changes to existing procedures as well as to the FSGs to determine the need for prior NRC approval.

On page 29 of the Integrated Plan, the licensee stated that site specific procedural guidance governing the core cooling and heat removal strategies will be developed using industry guidance, and will address the necessary steps to deploy portable pumps and hoses, establish connections, and operate the portable equipment to perform the required function.

The licensee did not specifically address the amount, location and storage of snow removal equipment and procedure required for snow and ice conditions at the plant. See Section 3.1.4.2, Deployment of Portable Equipment - Snow, Ice and Extreme Cold Hazard, regarding resolution of this issue.

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

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

NEI 12-06, Section 8.3.4, states:

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

On page 22 of the Integrated Plan, the licensee stated that they will participate in the process to support the RRCs as required for additional Phase 3 equipment. Equipment will be moved from an RRC to a local Assembly Area, established by the SAFER team and the utility. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request. In ETE-CPR-2012-0009 Rev. 1 the licensee stated that in the event of damage to roadways, arrangements have been made with the state of Connecticut for use of helicopters for delivery of RRC equipment to the site.

The licensee's plan for implementing the use of off-site resources is not complete. The local assembly areas have not been identified. The licensee is also evaluating the possibility of boat transport for personnel. This has been combined with Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.5 High Temperatures

NEI 12-06, Section 9 states:

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

degrees F.

> In this case, sites should consider the impacts of these conditions on deployment of the FLEX equipment.

On page 5 of the Integrated Plan, the licensee stated that due to the proximity of Long Island Sound and the Atlantic Ocean, the heat of summer is moderated. Temperatures of 90 degrees F or greater occur an average of seven days per year at Bridgeport, while temperatures of 100 degrees F or greater have occurred only in July and August; with an extreme maximum of 104 degrees F occurring in July 1957 (NOAA 1990) (MPS3 FSAR Section 2.3.1).

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 provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to screening for the high temperature hazard, if these requirements are implemented as described.

3.1.5.1 Protection of FLEX Equipment - High Temperature Hazard

NEI 12-06, Section 9.3.1, states:

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

In the August 2013 Integrated Plan update, the licensee stated that a single 10,000 sq-ft. Type 1 building will be constructed for storage of BDB equipment. In accordance with licensee engineering evaluation ETE-CPR-2012-0009 Rev. 1, a Type 1 building is a concrete, tornado missile protected building that meets SSE requirements. The building will be designed to meet the plant's design basis for the SSE, high wind hazards, snow, ice and cold conditions, and be located above the flood elevation from the most recent site flood analysis. The BDB storage building will be sited north of the bridge near the salt shed.

On page 31 of the Integrated Plan, the licensee stated that the BDB pumps, necessary hoses and fittings, supplemental lighting and communications equipment are protected from high temperatures while stored in the BDB storage building or in protected areas of the plant. The licensee stated in ETE-CPR-2012-0009 that the storage building would be maintained between 50-100 degrees F.

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

3.1.5.2 Deployment of FLEX Equipment - High Temperature Hazard

NEI 12-06, Section 9.3.2 states:

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

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

On page 93 of the Integrated Plan, the licensee stated the FLEX strategies for maintenance and/or support of safety functions involve several elements. One element is the ability to access site areas required to successfully implement the planned FLEX strategy. A potential impairment to required access is inoperable doors and gates. The coping strategy to maintain site accessibility through doors and gates is applicable to all phases of the FLEX coping strategies, but is immediately required as part of Phase 1. For this reason, certain barriers (gates and doors) will be opened and remain open. This violation of normal administrative controls is acknowledged and is acceptable during the implementation of FLEX coping strategies. The licensee stated in ETE-CPR-2012-0009 that the potential impact of high temperatures on the storage building, e.g., expansion of sheet metal, swollen doors and seals, has been considered.

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

3.1.5.3 Procedural Interfaces - High Temperature Hazard

NEI 12-06, Section 9.3.3 states:

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

The licensee has contingency plans that include staging and operating the BDB AFW pump in the TB. This situation (operating inside a confined space) may subject the pump and generator to high temperatures due to lack of ventilation. The licensee stated in ETE-CPR-2012-0009, Rev. 1 that the equipment will be procured to operate at -2 to +120 degrees F applicable to outside ambient temperatures. Other portable equipment will be set up in areas outside of the buildings where the connections will be made. The licensee was requested to clarify the assumptions noted above regarding placement of portable FLEX equipment and the situation where the portable BDB AFW pump is operated inside the TB at potentially higher temperatures than those noted above.

During the audit process the licensee stated that the strategy for having the BDB AFW pump pre-staged at elevation 31' - 6" inside the TB has been revised and is no longer applicable. The current plan for all scenarios except hurricane storm surge flooding is for the BDB AFW pump to be kept in the BDB Storage Building and deployed as needed. In the event of a potential hurricane storm surge, the BDB AFW pump will be pre-deployed into the truck bay area of the TB prior to closure of the TB flood doors. The site hurricane preparation procedures will be revised to include this action.

The licensee stated that high temperature operation will not be a problem for any BDB external event other than hurricane flooding because the pump will be located either outdoors or just inside the TB truck bay with the large rollup door open, as needed. In the case of the pre-deployed BDB AFW pump, provisions to vent the diesel exhaust will be available and it is anticipated that the heat from the diesel operation can be dissipated into the large open TB free volume until such time that the flood doors could be opened. As discussed in ETE-CPR-2012-0009, Section 12.3.3.2, the current hurricane surge hydrograph for Unit 3 (the more recent site hurricane surge evaluation) indicates that the surge would exceed the site roadway outside of the TB, 14 ft. MSL, for approximately 7 hours, worst case. If necessary, doors, windows and roof vent openings in the TB that are above the storm surge levels can be opened to allow for partial heat removal until such time that the TB flood doors can be opened. Under these conditions with available vent pathways, it is not expected that habitability or equipment operational concerns will be a problem for the specific case of the BDB AFW pump operation inside of the TB.

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

3.2 PHASED APPROACH

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

To meet these EA-12-049 requirements, licensees will establish a baseline coping capability to prevent fuel damage in the reactor core or SFP and to maintain containment capabilities in the context of a BDBEE that results in the loss of all ac power, with the exception of buses supplied by safety-related batteries through inverters, and loss of normal access to the UHS.

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

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

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

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

NEI 12-06, Section 3.2.2, Guideline (13) states in part that "Regardless of installed coping capability, all plant will include the ability to use portable pumps to provide RPV/RCS/SG makeup as a means to provide a diverse capability beyond installed equipment".

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

Section 3.2 of WCAP-17601 (ADAMS Accession Nos. ML13042A011 and ML13042A013) discusses the PWROG's recommendations that cover various subjects for consideration in developing FLEX mitigation strategies.

During the NRC audit process the licensee was requested to specify which analysis performed in WCAP-17601 is being applied to their plant. Additionally, justify the use of that analysis by identifying and evaluating the important parameters and assumptions demonstrating that they are representative of their plant and appropriate for simulating the ELAP transient. This has been identified as Confirmatory Item 3.2.1.A in Section 4.2.

Section 3.2 of WCAP-17601 discusses the PWROG's recommendations that cover the following subjects for consideration in developing FLEX mitigation strategies: (1) minimizing RCP seal leakage rates; (2) adequate shutdown margin; (3) time initiating cooldown and depressurization; (4) prevention of the RCS overfill; (5) blind feeding an SG with a portable pump; (6) nitrogen injection from SITs, and (7) asymmetric natural circulation cooldown. The licensee was requested to; discuss their position on each of the recommendations noted above for developing the FLEX mitigation strategies, list the recommendations that are applicable to the plant, provide rationale for the applicability, address how the applicable recommendations are considered in the ELAP coping analysis, discuss the plan to implement the recommendations, and to provide a rationale for each of the recommendations that are determined to be not applicable to the plant.

During the audit process the licensee stated that regarding the seven subjects noted above:

1. The emergency procedure for the response to SBO is being revised to provide the necessary guidance to accomplish the Phase 1 strategy for a rapid cooldown and depressurization consistent with the Integrated Plan and WCAP-17601, as indicated in

Integrated Plan open items No's 5 and 9. As stated in Section 3.2 of WCAP-17601, performing a plant cooldown early in the ELAP and reducing RCS pressure greatly increases the ELAP coping time relative to RCS inventory control by reducing the RCS inventory loss from any leak.

2. Studies have been completed in calculation MISC-11791 on the reactivity effects of early cooldown. The studies show that for a representative recent MPS2 core, no boron addition is required to maintain the core at least 1% shutdown at a 350 degrees F inlet temperature, xenon-free condition. For long-term cooldown to cold shutdown conditions, only small amounts of boration (less than 100 ppm at end-of-cycle core conditions) will be required. Core reload checks are being developed which will confirm that the guidance remains applicable to future fuel reloads.

3. This item is addressed in the response for Item 1.

4. MPS2 will adopt the new PWROG strategy of early cooldown and depressurization of the unit. A target condition of approximately 350 degrees F and 135 psia secondary pressure is anticipated. The studies in WCAP-17601-P show that with the plant in a solid condition, if the SG and RCS temperatures are kept constant, with continued heat removal via the SGs, then maintaining RCS pressure control is not difficult. In addition, the initial cooldown will drain the pressurizer due to RCS inventory volume shrinkage. Once the BDB RCS injection pump is deployed (at approximately 16 hours) and pressurizer level is restored, operators can prevent RCS overfill and control pressure by limiting RCS inventory through injection flow control.

5. The Integrated Plan does not include blind feeding of a SG with a portable pump, therefore this item is not applicable for MPS2.

6. As described in Section B.1 of the Integrated Plan, Phase 1 coping following an ELAP/LUHS will be accomplished using the installed TDAFW pump to feed the SGs, main steam (MS) atmospheric dump valves (ADVs) for SG steam release to control RCS temperature and effect an RCS cooldown, and the CST to provide the AFW water source to the TDAFW pump. The Phase 1 coping strategy provides reactor core cooling and decay heat removal for a minimum of 7.2 hours and is sufficient to stabilize the plant at 120 psig SG pressure, which will result in RCS cold leg temperature of approximately 350 degrees F with pressure greater than safety injection tank (SIT) nitrogen injection pressure. The SITs would either be isolated or vented prior to depressurizing the RCS below the point where nitrogen injection could occur.

7. The MPS2 core cooling and heat removal strategy utilizes a symmetrical natural circulation cooldown of the RCS. The AFW system is aligned for flow to both SGs from the TDAFW pump and the operators will manually control the MS ADVs for steam release from both SGs. This allows for a symmetric natural circulation cooldown of the RCS.

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

3.2.1.1 Computer Code Used for the ELAP Analysis

NEI 12-06, Section 1.3 states:

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

On page 105 of the Integrated Plan the licensee stated that the applicable computer code for Nuclear Steam Supply System (NSSS) analysis is Combustion Engineering Nuclear Transient Simulation (CENTS), and the applicable section of WCAP-17601-P is Section 4.1.2.2.1, and that Section 5.5.2 of WCAP-17601, Case 21 provides results for MPS2 with a cooldown and depressurization of the RCS.

The licensee has provided a Sequence of Events (SOE) in their Integrated Plan, which included the time constraints and the technical basis for the site. That SOE is based on an analysis using the industry-developed CENTS computer code. CENTS was written to simulate the response of pressurized water reactors to non-LOCA transients for licensing basis safety analysis.

The licensee has decided to use the CENTS computer code for simulating the ELAP event. Although the NRC staff does acknowledge that CENTS has been reviewed and approved for performing non-loss of coolant accident (LOCA) event analysis, the NRC staff has not examined its technical adequacy for simulating the ELAP transient. A generic concern associated with the use of CENTS for ELAP analysis arose because NRC staff reviews for previous applications of the CENTS code had imposed a condition limiting the code's heat transfer modeling in natural circulation to the single-phase liquid flow regime. This condition was imposed due to the lack of benchmarking for the two-phase flow models that would be LOCA scenarios. Because the postulated ELAP scenario generally includes leakage from reactor coolant pump seals and other sources, two-phase natural circulation flows may be reached in the reactor coolant system prior to reestablishing primary makeup. Therefore, the NRC staff requested that the industry provide adequate basis for reliance on simulations with the CENTS code as justification for licensees' mitigation strategies.

To address the NRC staff's concern associated with the use of CENTS to simulate two-phase natural circulation flows that may occur during an ELAP for the licensee and other CE-designed PWRs, the PWROG submitted a position paper dated September 24, 2013, entitled "Westinghouse Response to NRC Generic Request for Additional Information (RAI) on CENTS Code in Support of the Pressurized Water Reactor Owners Group (PWROG)" (ADAMS Accession No. ML13297A174 (Non-Publically Available)). This position paper provided a comparison of several small-break LOCA simulations using the CENTS code to the CEFLASH-4AS code that is approved for analysis of design-basis small-break LOCAs. The analyses in the position paper show that the predictions of CENTS were similar or conservative relative to CEFLASH-4AS for key figures of merit for natural circulation conditions, including the predictions of loop flow rates and the timing of the transition to reflux boiling. The NRC staff further observed the fraction of the initial RCS mass remaining at the transition to reflux boiling predicted by the CENTS code for the ELAP simulations in WCAP-17601-P to be (1) in reasonable agreement with confirmatory analysis performed by the staff with the TRACE code and (2) within the range of results observed in scaled thermal-hydraulic tests that involved natural circulation (e.g., Semiscale Mod-2A, ROSA-IV large-scale test facility). After review of this position paper, the NRC staff endorsed a resolution through letter dated October 7, 2013 (ADAMS Accession No. ML13276A555 (Non-Publically Available)). This endorsement contained one limitation on the CENTS computer code's use for simulating the ELAP event. That limitation and its corresponding Confirmatory Item number are provided as follows:

(1) The use of CENTS in the ELAP analysis for CE plants is limited to the flow conditions before reflux boiling initiates. This has been identified as Confirmatory Item 3.2.1.1.A in Section 4.2.

This includes providing a justification for how the initiation of reflux boiling is defined. The requested information should include the CENTS-calculated flow quality at the top of SG U-tube for conditions when two-phase natural circulation ends and reflux boiling initiates. If the calculated flow quality shows an oscillatory pattern in the flow regime of interest, a centered moving average (for one hour) of the flow quality may be used.

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

3.2.1.2 RCP Seal Leakage Rates

NEI 12-06, Section 1.3 states:

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

On page 38 of the integrated Plan, the licensee stated that MPS2 RCPs currently have FlowServe N-9000 RCP seals installed. An analysis of RCS leakage with these seals installed and no RCS makeup indicated that natural circulation flow would end at 32.4 hours.

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

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

- WCAP-17601-P, Revision 1, "Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering and Babcock & Wilcox NSSS Designs" dated January 2013 (ADAMS Accession No. ML13042A011 and ML13042A013 (Non-Publically Available)).
- A position paper dated August 16, 2013, entitled "Westinghouse Response to NRC Generic Request for Additional Information (RAI) on Reactor coolant (RCP) Seal Leakage in Support of the Pressurized Water reactor Owners Group (PWROG)" (ADAMS Accession No. ML13190A201 (Non-Publically Available)).

After review of these submittals, the NRC staff has placed certain limitations for Combustion Engineering Designed Plants (with the exception of Palo Verde Nuclear Generating Station). Those limitations and their corresponding Confirmatory Item number are provided as follows:

(1) The RCP seal initial maximum leakage rate should be greater than or equal to the upper bound expectation for the seal leakage rate for the ELAP event (15 gpm/seal) discussed in the PWROG white paper addressing the RCP seal leakage for CE plants. If the RCP seal leakage rate used in the plant-specific ELAP analysis is less than upper bound expectation for the seal leakage rate discussed in the whitepaper, justification should be provided. This has been identified as Confirmatory Item 3.2.1.2.A in Section 4.2.

The licensee did not address the applicability of the information in Section 4.4.2 of WCAP-17601, Rev 0, which states that "It has been shown that the probability of seal failure greatly increases when there is less than 50 degrees F of subcooling in the cold legs.

During the audit process the licensee stated that Westinghouse letter LTR-SEE-II-13-89 provided a response to this question. Based on the information in this letter the licensee concluded that the current strategy for cooldown will limit total seal leakage.

Also, the licensee did not address the applicability of assumption 2 on page 4-35 of WCAP-17601, which states that "Once RCP seal failure occurs, the leakage flow path characteristics remain constant for the rest of the event," or justify the non-applicability. If applicable, the licensee was requested to address the adequacy of the assumption throughout the ELAP event with consideration of the information in Section 4.4.2 of WCAP-17601, and to address the effects of the assumption on the calculated RCP seal leakage rates during the ELAP event.

During the audit process the licensee stated that Westinghouse letter LTR-TDA-13-31 Attachment 3 provided a response to this question. The conclusion from the letter is that the maximum leak rate of 15 gpm per seal for MPS2 bounds the limiting break sizes for a limiting pressure condition.

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

3.2.1.3 Decay Heat

NEI Section 3.2.1.2 states in part:

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

On page 22 of the integrated Plan, the licensee stated that following the occurrence of an ELAP/LUHS event, the reactor will trip and the plant will initially stabilize at slightly higher than no-load RCS temperature and pressure conditions, with reactor decay heat removal via steam release to the atmosphere through the SG safety valves and/or atmospheric dump valves (MS ADVs). Natural circulation of the RCS will develop to provide core cooling and the steam-driven TDAFW pump will be started to provide flow from the CST to the SGs to make-up for steam release.

On page 27 of the integrated Plan, the licensee stated that the Phase 2 strategy for reactor core cooling and heat removal provides an indefinite supply of water for feeding SGs and a diesel driven backup AFW pump for use in the event that the TDAFW pump becomes unavailable. Initial evaluations indicate that the TDAFW pump will operate long-term until reactor decay heat is reduced to a point where adequate SG steam pressure cannot be provided. In the August 2013 Integrated Plan update, the licensee stated that an engineering evaluation was complete and that operation of the TDAFW pump to supply adequate AFW flow to the SG's at less than 120 psig SG pressure was confirmed. The licensee provide two references that contained the results of this analysis; Calculation 13-024, "Turbine Driven Auxiliary Feedwater (TDAFW) Pump Delivered Flow at Reduced Steam Generator Pressure," and ETE-MP-2013-1034, "MP2 Turbine Driven Aux Feedwater Pump Minimum Continuous Operating Speed."

The licensee did not address the applicability of assumption 4 on page 4-13 of WCAP-17601, which states that "Decay heat is per ANS 5.1-1979 + 2 sigma, or equivalent." The licensee was requested to discuss the following issue related to decay heat. If the ANS 5.1-1979 + 2 sigma model is used in the ELAP analysis, then provide additional information regarding the values of the following key parameters used to determine the decay heat applicable to Millstone: (1) initial power level, (2) fuel enrichment, (3) fuel burnup, (4) effective full power operating days per fuel cycle, (5) number of fuel cycles, if hybrid fuels are used in the core, and (6) fuel characteristics are based on the beginning of the cycle, middle of the cycle, or end of the cycle. The licensee was also requested to provide information to address the adequacy of the values used, and if a different decay heat model is used, then provide a description of the specific model used and a discussion that addresses the adequacy of the model and the analytical results.

During the audit process the licensee stated that Westinghouse Letter LTR-TDA-13-31 Attachment 4 provided a response to issues regarding decay heat. This letter stated that the ELAP analysis for MPS2 in WCAP-17601-P, Rev.1, implemented the ANS 5.1-1979 decay heat curves with two sigma uncertainty. It also stated that the decay heat curve is applicable up to the following limits:

1. Power level of to 4070 MWt (MSP2 at100% power is licensed for 2700 MWt)
2. Fuel enrichments up to and including 5.0 weight percent
3. Fuel burnups up to 73,000 MWD/MTU
4. Up to a 24 month operating cycle with a 90% overall capacity factor

5. Not applicable to hybrid fuel (none at MSP2)
6. Fuel characteristics are based on the entire fuel cycle

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

3.2.1.4 Initial Values for Key Plant Parameters and Assumptions

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

On pages 7 and 8 of the Integrated Plan, the licensee stated that boundary conditions are established to support development of FLEX strategies, as follows:

- The reactor is initially operating at power, unless there are procedural requirements to shut down due to the impending event. The reactor has been operating at 100% power for the past 100 days.
- The reactor is successfully shut down when required (i.e., all rods inserted, no Anticipated Transient Without Scram (ATWS). Steam release to maintain decay heat removal upon shutdown functions normally, and reactor coolant system (RCS) overpressure protection valves respond normally, if required by plant conditions, and reseat.
- The reactor and supporting plant equipment are either operating within normal ranges for pressure, temperature and water level, or available to operate, at the time of the event consistent with the design and licensing basis.

The licensee stated that the following plant initial conditions and assumptions are established for the purpose of defining FLEX strategies:

- 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 available. Permanent plant equipment that is contained in structures with designs that are robust with respect to seismic events, floods, and high winds and associated missiles, are available.
- Normal access to the ultimate heat sink (UHS) is lost, but the water inventory in the UHS remains available and robust piping connecting the UHS to plant systems remains intact. The motive force for UHS flow, i.e., pumps, is assumed to be lost with no prospect for recovery.
- Fuel for BDB equipment stored in structures with designs that are robust with respect to seismic events, floods and high winds and associated missiles, remains available.
- Installed Class 1E electrical distribution systems, including inverters and battery chargers, remain available since they are protected.

- Reactor coolant inventory loss consists of unidentified leakage at the Technical Specifications limit, reactor coolant letdown flow (until isolated), and reactor coolant pump (RCP) seal leak-off at normal maximum rate.
- For the SFP, the heat load is assumed to be the maximum design basis heat load. In addition, inventory loss from sloshing during a seismic event does not preclude access to the pool 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 provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to initial values for key plant parameters and assumptions, if these requirements are implemented as described.

3.2.1.5 Monitoring Instrumentation and Controls

NEI 12-06, Section 3.2.1.10 states in part:

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

On pages 25 to 26 of the Integrated Plan, the licensee stated that the following instrumentation would be available:

- AFW Flowrate: Indication of AFW flowrate to each SG is available in the main control room (MCR) and on the fire shutdown panel (C-10). AFW flowrate indication for all SGs is available throughout the event.
- SG Water Level: SG wide range (WR) and narrow range (NR) water level indication is available for both SGs from the MCR and C-10 throughout the event.
- SG Pressure: SG pressure indication is available for both SGs from the MCR and C-10 throughout the event.
- CST Level: CST water level indication is available from the MCR and locally at the tank throughout the event.
- RCS Temperature: RCS hot-leg and cold-leg temperature indication is available from the MCR and C-10 throughout the event.

- RCS Temperature: Core exit thermocouple indication is available from ICC Cabinet B throughout the event.
- Pressurizer Level: Pressurizer level indication is available from the MCR and C-10. Pressurizer level indication is available throughout the event.
- Reactor Vessel Level Monitoring System (RVLMS): RVLMS indication is available from the MCR and the ICC cabinet. RVLMS is available throughout the event.
- Excore Nuclear Instruments: Indication of nuclear activity is available from the MCR. Indication is available throughout the event.
- RCS Wide Range Pressure: RCS Wide Range Pressure indication is available from the MCR and C-10 throughout the event.
- Containment Pressure - Containment pressure indication is available in the MCR throughout the event.
- Containment Temperature - Containment temperature indication is available in the MCR throughout the event.

(Note: Spent Fuel Pool (SFP) level is addressed in Section E.1.2 of the integrated plan.)

The licensee stated that portable BDB equipment from the RRC will be supplied with local instrumentation needed to operate the equipment. The use of these instruments will be in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.

However, the licensee did not provide justification that the instrumentation listed and the associated indications are reliable and adequate to provide the desired functions on demand during the ELAP with the containment harsh conditions at high moisture, temperature and pressure levels, which should (1) include a discussion of the analysis that is used to determine the containment temperature, pressure, and moisture profiles during the ELAP event, and (2) address the adequacy of the computer codes/methods, and assumptions used in the analysis.

During the audit process the licensee stated that the long term containment pressure and temperature analysis for MPS2 has been documented in calculation MISC-11793. To address instrument qualification, the 7 days post ELAP long term Containment harsh environment profiles generated by GOTHIC were used to evaluate the long term exposure of the credited electrical instruments inside the Containment. The base line evaluation used an Arrhenius methodology, utilizing the plant design basis profile, to demonstrate instrument survivability following ELAP (Dominion Calculation SM-11794). The Phase 3 containment cooldown and depressurization strategy details will be provided in the February 2014 6-month update. The issue of additional analysis for containment response after 7 days is discussed in Section 3.2.3. This has been combined with Confirmatory Item 3.2.3.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 monitoring instrument and controls, if these requirements are implemented as described.

3.2.1.6 Sequence of Events

NEI 12-06, Section 3.2.1.7, Item 6 states:

> Strategies that have a time constraint to be successful should be identified and a basis provided that the time can reasonably be met.

The sequence of events (SOE) timeline is provided in Attachment 1A of the Integrated Plan. The licensee stated that preliminary estimates of response times have been developed based on plant simulator runs and table-top walkthroughs of planned actions. A two-hour duration is assumed for deployment of equipment from the BDB Storage Building, based on a "sunny day" (i.e. daylight conditions with no adverse weather situations) validation for implementation of 10 CFR 50.54(hh)(2) time sensitive actions. The validation included deploying a portable high capacity pump from its storage location to a location near the Long Island Sound (staging location) and routing hoses to provide flow to the SFP. Time to clear debris to allow equipment deployment is assumed to be 2 hours. This time is considered to be reasonable based on the locations of the BDB Storage Building. Debris removal equipment will be stored in the BDB Storage Building.

SOE action Item 5 indicates that the ELAP is declared at 45 minutes, and Action Item 6 indicates that at 50 minutes (5 minutes after the declaration of the ELAP), the operator controls SG ADVs and AFW flow locally as an on-going action for cooldown and decay heat removal. On page 105 of the integrated plan in Attachment 1B NSSS Significant Reference Analysis Deviation Table, the licensee notes in item 6 that cooldown starts at 2 hours at 75 degrees F/hr. to a SG pressure of 135 psia. Clarification is needed to correct this apparent inconsistency. This has been identified as Confirmatory Item 3.2.1.6.A in Section 4.2.

The licensee did not provide a discussion regarding the operator actions required to control SG ADVs and AFW flow and justification is needed to determine that all the required operator actions are reasonably achievable within the required time constraint of 50 minutes during the ELAP conditions, or a discussion regarding the required cooldown completion time that is supportable by adequate analysis. This has been identified as Confirmatory Item 3.2.1.6.B in Section 4.2.

On page 107 of the integrated Plan, the licensee provided an open item to verify response times listed in the SOE timeline and perform staffing assessment. This has been identified as Confirmatory Item 3.2.1.6.C in Section 4.2.

The Integrated Plan SOE Action Item 7, describes the action to strip dc loads. To perform this action, the licensee requires the station operator to perform load stripping in the A and B switchgear rooms. However, this description does not consider whether hazards or debris obstructed the path to reach the switchgear rooms. The licensee was requested to provide a clarification on travel path to reach the switchgear rooms considering that this may require removal of obstructions, and to also provide an estimation of the time that it would take the station operator to reach the switchgear rooms and perform this action.

During the audit response the licensee stated that the travel path from the Control Room to the 'A' and 'B' dc switchgear rooms is through seismic Category 1, tornado-generated missile protected structures such that external hazards or debris are not expected to obstruct the operators access to perform load stripping activities. In addition, there are alternate travel paths that can be utilized to access the 'A' and 'B' switchgear rooms from within plant structures and from outside areas. The operator would be expected to reach the 'A' and 'B' dc switchgear rooms within about 5 minutes of being dispatched to perform load stripping based on the initial table top evaluation. Load stripping can easily be performed within 25 minutes of arrival. The operator times will be formally validated to ensure actions can be performed with adequate margin following completion of FSGs and included in a program for on-going validation.

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 sequence of events, if these requirements are implemented as described.

3.2.1.7 Cold Shutdown and Refueling

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

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

Review of the Integrated Plan for MSP2 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 NRC staff will evaluate the licensee's resulting program through the audit and inspection process.

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

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

3.2.1.8 Core Sub-Criticality

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

> All plants provide means to provide borated RCS makeup.

The licensee addressed maintaining adequate shutdown margin by providing a strategy to inject borated water into the RCS in Phase 2 as noted on pages 41 and 42 of the Integrated Plan. The strategy provided a portable boron mixing tank in the event the RWST (primary source) is damaged. The licensee noted that calculations were completed to show that plant cooldown to 315 degrees F can be accomplished without boron addition and that cooldown to 200 degrees F can be completed with the addition of 2100 gallons of 1720 ppm borated water (RWST concentration), while maintaining adequate shutdown margin with K_{eff} less than 0.99. Cooldown is planned to stop at 350 degrees F to maintain 120 psig in the SG's to provide adequate steam pressure to operate the TDAFW pump.

The licensee's calculations show that no RCS makeup is required in Phase 1 (up to 32.4 hours after ELAP initiation - end of natural circulation) by assuming that the low leakage RCP seals will function adequately to limit RCS leakage and maintain adequate RCS inventory.

During the audit process the licensee specified that calculations have confirmed that no boration is required to maintain subcriticality (K-eff less than 0.99) for temperatures as low as 315 degrees F for all times in core life (Reference Calculation MISC-11791). The controlling EOP for MPS2 will direct a cooldown to approximately 120 psig in the SGs which corresponds to a cold leg temperature of approximately 350 degrees F and remain at this temperature and pressure for several days.

The inventory control strategy will deploy the BDB RCS Injection pump for RCS make-up with borated water by approximately 16 hours into the event. Thus, it is expected that a significant amount of time (many hours) will elapse between the time of initiation of RCS makeup and cooldown below 350 degrees F. Mass addition via the BDB RCS Injection pump will forestall natural circulation flow breakdown and the transition to reflux cooling and restore levels into the pressurizer. Therefore, boron mixing will proceed via turbulent natural circulation flow and would be expected to provide essentially uniform boron concentration in the reactor coolant system well before any boron concentration increases are needed for cooldown to cold shutdown temperatures.

The licensee also stated that calculation, CALC-MISC-11791, uses site-specific core characteristics for a recent MPS2 operating core and did not reference WCAP-17601. Core reactivity vs. time is tracked in a manner similar to WCAP-17601 Figure 5.8.2.2-1. The calculation yields the required boron concentration as a function of time and RCS temperature (or steam pressure) to maintain K-eff less than 0.99. This information is used to develop guidance for reactivity control in FSG-8, "Alternate RCS Boration". Core reload checks are being developed which will confirm that the FSG guidance remains applicable to future fuel reloads. The reactivity control strategy conservatively does not credit passive injection from the Safety Injection Tanks.

Boron mixing is consistent with information provided in the PWROG white paper. As stated boron addition is not required while the unit is stable at approximately 350 degrees F. With RCS injection beginning at 16 hours, RCS inventory will be restored and mixing will occur for greater than 1 hour before unit cooldown below 350 degrees F which is not expected for several days.

The licensee also specified on page 42 of the Integrated Plan, that based on the potential for the formation of reactor head voiding during RCS natural circulation cooling following an ELAP, an evaluation of the need to establish an RCS vent path in order to successfully implement the RCS inventory and reactivity control strategy was performed. In the event that RCS venting becomes necessary or desirable, the remotely-operated reactor head vent valves have been evaluated and determined to provide adequate venting capability to reduce head voiding and allow RCS injection.

During the audit process the licensee stated that dc power to the head vents is not stripped from the battery loads during Phase 1 of an ELAP event, therefore, the reactor head vents can be remotely operated from the Control Room, if needed, to support the addition of borated water to the RCS. Load stripping extends the battery life to more than 29 hours which is beyond the time frame anticipated to begin RCS makeup. In Phase 2, the dc busses will be energized by the BDB 480Vac portable diesel generator supplying the "B" Battery Charger through the 480 Vac Vital bus 22F. In this configuration, the head vent valves will continue to be available to vent steam from the reactor vessel.

Review of the Integrated Plans for MPS2 revealed that the Generic Concern associated with the modeling of the timing and uniformity of the mixing of a liquid boric acid solution injected into the reactor coolant system (RCS) under natural circulation conditions potentially involving two-phase flow is applicable to MPS2.

The PWROG sent NRC a position paper, dated August 15, 2013 (withheld from public disclosure for proprietary reasons), which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlined applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available.

The licensee has informed the NRC of its intent to abide by the generic approach discussed above, including the additional conditions and limitations imposed by the staff; however, the NRC staff concluded that the August 15, 2013, position paper was not adequately justified and has not yet endorsed this position paper, or stated any required additional conditions and limitations. As such, resolution of this concern for MPS2 is identified as Open Item 3.2.1.8.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 approach 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 core sub-criticality. The question is identified as Open Item 3.2.1.8.A above and in Section 4.1.

3.2.1.9 Use of Portable Pumps

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

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

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

NEI 12-06 Section 11.2 states in part:

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

On pages 17 and 18 of the Integrated Plan, the licensee specified that design requirements and supporting analysis will be developed for portable equipment that directly performs a FLEX mitigation strategy for core cooling, RCS inventory, containment function, and SFP cooling. The design requirements and supporting analysis provide the inputs, assumptions, and documented analysis that the mitigation strategy and support equipment will perform as intended. Manufacturer's information is used in establishing the basis for the equipment use. The specified portable equipment capacities ensure that the strategy can be effective over a range of plant and environmental conditions. This design documentation will be auditable, consistent with generally accepted engineering principles and practices, and controlled within the licensee's document management system. The basis for designed flow requirements considers the following factors:

a) Pump design output performance (flow/pressure) characteristics.
b) Line losses due to hose size, coupling size, hose length, and existing piping systems.
c) Head losses due to elevation changes, especially for spray strategies.
d) Back pressure when injecting into closed/pressurized spaces (e.g., RCS, containment, SGs).
e) Capacity, temperature, boron concentration, water quality (suspended solids content, etc.) and availability of the suction sources given the specific external initiating events (DWST)/ (RWST)/fire main/Long Island Sound, etc.) to provide an adequate supply for the BDB pumps (fire engines, portable pumps, fire protection system pumps, etc.).
f) Potential detrimental impact on water supply source or output pressure when using the same source or permanently installed pump(s) for makeup for multiple simultaneous strategies.
g) Availability of sufficient supply of fuel on-site to operate diesel powered pumps and generators for the required period of time.
h) Potential clogging of strainers, pumps, valves or hoses from debris or ice when using rivers, lakes, or ocean as a water supply.
i) Environmental conditions (e.g., extreme high and low temperature range) in which the equipment would be expected to operate.

On page 27 of the Integrated Plan, the licensee specified that the Phase 2 strategy for reactor core cooling and heat removal provides an indefinite supply of water for feeding SGs and a diesel driven backup AFW pump for use in the event that the TDAFW pump becomes unavailable. The diesel driven BDB High Capacity Pump will be transported to a location near the water source. Alternatively, if available, the station fire truck can be utilized in place of the BDB High Capacity Pump. A flexible hose will be routed from the pump suction to the water source where water will be drawn through a strainer sized to limit solid debris size to prevent damage to the TDAFW or the BDB AFW pump. A flexible hose will be routed from the BDB high capacity pump discharge to the CST refill BDB connection via a distribution manifold that also provides water to the SFP as described in Section E.2 and to the RCS as described in Section C.2 of the Integrated Plan. The BDB high capacity pump will be sized to provide 300 gpm AFW water supply, 250 gpm make-up to the SFP, and 45 gpm RCS supply each to both MPS2 and 3 simultaneously.

A backup SG water injection capability will be provided using a portable AFW pump through a primary and alternate connection. The diesel-driven BDB AFW Pump will provide a back-up SG injection method in the event that the TDAFW pump can no longer perform its function. Hydraulic analyses will be performed to confirm that the BDB AFW pump is sized to provide the minimum required SG injection flow rate to support reactor core cooling and decay heat removal.

On page 42 of the Integrated Plan, the licensee specified that discharge from the BDB RCS injection pump will be into a high pressure hose which will be routed to the primary RCS injection connection located in the Turbine Building AFW valve cage. A hose connection will be connected to a 3-inch safety injection line by permanently installed stainless steel piping which will be installed as an extension of the high pressure hose connection.

The alternate RCS injection connection will use the discharge crosstie valve between the "A" charging pump and the "B" and "C" Charging Pumps, 2-CH-338. Hydraulic analysis of the flow-path from the BDB RCS injection pump suction connections to the primary and alternate RCS injection connections will be performed to confirm that applicable performance requirements are met.

On pages 36 and 43 of the Integrated Plan, the licensee specified that the additional pumps will be provided from the RRC to provide backup to the BDB AFW pumps as well as the BDB High Capacity pumps. The installed TDAFW pump has the capability to operate for an extended period of time. Failure of the TDAFW pump can be mitigated by the on-site BDB AFW pump. The RRC pumps provide backup capability should multiple failures occur during extended operation after several days or weeks from the event.

Not all of the RRC pumps required by the Phase 3 strategies are included in the Integrated Plan's Table 2 that lists the portable pumps required during the Phase 3 of ELAP. Only the BDB portable RCS injection pump is listed. During the audit process, the licensee specified that a proposed revision to Table 2, which reflects all equipment being received from the RRC was developed. The table includes generic equipment (received by any site declaring an ELAP event) and non-generic equipment (plant specified equipment identified in the MPS2 SAFER playbook). Not all of the equipment listed in Table 2 is credited in the Phase 3 response strategies, however all of the equipment listed in Table 2 will be shipped to the Millstone site upon declaration of an ELAP event. RRC equipment that has not been credited for Phase 3 response strategies will provide "defense in depth" for other FLEX strategies. The licensee stated that an updated Table 2 will be provided in the February 2014 Six-Month Status Update.

The licensee provided strategies using portable pumps for RCS cooling and maintaining RCS inventory described above. Tables 1 and 2 on pages 100 and 102 of the Integrated Plan list the phases 2 and 3 portable equipment required for the ELAP mitigation. Table 1 lists two BDB high capacity pumps, four BDB AFW pumps, four BDB RCS injection pumps, and four portable boric acid batch tanks that are required during the Phase 2 of ELAP. The required capacities are 1200 gpm, 300 gpm and 40 gpm for each of the BDB high capacity pumps, BDB AFW pumps and BDB RCS injection pump, respectively. However, no required pressures are specified for the corresponding pump flow rate. The required volume of the boric acid batching tank is 1000 gallons. Table 2 of the Integrated Plan lists one BDB RCS injection pump that is required during Phase 3 of ELAP. The required capacities of the respective pumps are 40 gpm with no corresponding required pressure specified.

Regarding the pumps noted in the above paragraph, the licensee did not provide: specifications for the required times for the operator to realign each of the above discussed pumps, confirmation that the required times are consistent with the results of the ELAP analysis, specifications for the required pressures corresponding to the flow rates for each of the above discussed pumps, discussions related to the analyses that are used to determine the required flow rates and corresponding pressures of the portable pumps, and a justification that the capacities of each of the above discussed pumps and the volume of boric acid batching tanks are adequate to maintain core cooling and sub-criticality during phases 2 and 3 of ELAP. The licensee provided an open item regarding the additional analysis required for fluid components performance requirements.

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

1. The BDB high capacity pumps are designed to provide 1200 gpm at 150 psig. The BDB AFW pumps are designed to provide a minimum of 300 gpm at a SG pressure of greater than 300 psig (Reference Calculation MISC-11787). The BDB RCS injection pump sizing criterion for CE plants is based on the PWROG Core Cooling Position Paper (Letter OG-13-26). The recommended formula establishes a pressure criteria of 1737 psia. The selected RCS Injection pump is capable of delivering a minimum flow of 40 gpm at a pressure greater than 2000 psia.
2. The BDB high capacity, BDB AFW, and BDB RCS injection pumps require no external power. These are self-contained diesel powered pumps.
3. Required pump flows and corresponding pressures were qualified in Calculation No. 13-015, "MPS2 & MPS3 FLEX Strategy Hydraulic Calculations", Rev.0.
4. The flow requirement to maintain core cooling is met by the 1200 gpm BDB high capacity pump. The capacity of 1200 gpm, includes 300 gpm for AFW flow for MSP2 and 300 gpm for AFW flow for MPS3 for core cooling. These flow rates are sufficient to remove core heat as determined in Calculation MISC-11787. In addition, the capacity is also adequate to provide 250 gpm make-up for the MPS2 SFP and 250 gpm make-up for the MPS3 SFP. These capacities exceed the boil-off rate for the SFPs per Calculation MISC-11792. The BDB High Capacity pump capacity also includes a 100 gpm flow for miscellaneous makeup water to replenish tanks.

The licensee stated that the RCS inventory control strategy will deploy the BDB RCS injection pump for RCS make-up with borated water by approximately 16 hours. This make-up flow will be in excess of the RCP seal leakage at that time. Mass addition via the BDB RCS injection pump will forestall natural circulation flow breakdown and the transition to reflux cooling, restore levels into the pressurizer, and facilitate turbulent mixing of any added boron. It is anticipated that the RWST will be available for inventory addition. At the RWST minimum TS value of 1720 ppm, approximately 2100 gallons of borated water would provide for adequate boration of the RCS for cooldown from 350 to 200 degrees F. No increase in boron concentration is required prior to cooldown of the RCS to 350 degrees F.

The licensee also stated that charging pumps that are being powered by the portable BDB 480 Vac diesel generator can take suction from either of two approximately 6,500 gallon Boric Acid

Storage Tanks (BASTs) and inject adequate boron into the RCS to achieve the required boron concentration for cold shutdown conditions. Injection of these two tanks (beginning at 16 hours) will provide sufficient inventory makeup for an additional 8-9 hours. Following depletion of the BAST volumes, the charging pumps suction can be aligned to the RWST as a source for significantly more borated water. If the RWST is damaged from a tornado missile and is not available, the boric acid batch tanks will be used to mix additional borated water to a concentration at or above the TS minimum boron concentration of 1720 ppm for RCS injection.

Additionally, the licensee stated that the amount of time needed to mix a tank volume depends on the batch concentration being prepared, tank size, and temperature conditions. Tanks agitators and heaters will be provided as part of the BDB support equipment to facilitate the mixing process. It is expected to take approximately one hour to prepare the 1000 gallon batch of borated water and inject into the RCS. At this rate, the RCS inventory levels can be maintained indefinitely.

Finally the licensee stated that the mixing water for the boric acid batch tanks will either be from the condenser or the city water supply as described in Chapter 2 of ETE-CPR-2012-0009. Although these sources are not fully protected, they would be expected to survive in the unlikely case that the RWST is damaged at its base from a tornado missile. The condenser hotwell is located in the lower parts of the turbine building providing a tortuous path for a missile. The city water storage tank is located several miles from the site, and should not be damaged by the same tornado event damaging the on-site RWST.

During the audit process the licensee stated that the alternate AFW connection is being relocated, therefore removing the bonnet from the feedwater regulating bypass valve is not required. The new connection will utilize the existing SG pump down skid connections (one for each SG) located in the east penetration room, -5 ft. 6 in. elevation in the AB. The connections are not seismically-designed, but are located in a seismic, flood, and missile protected building. The disassembly of the new AFW alternate connection will be performed by augmented staff that will arrive on site approximately 6 hours into the event in accordance with the Integrated Plan SOE timeline. The connections are 4 bolt, 2-inch, 600 lb. blind flanges that will only require manual tools for disassembly of the flange and installation of the hose adapter. No hydraulic or electric tools will be necessary to complete removal of the flange and installation of the hose to the discharge of the BDB AFW pump. Per the SOE timeline, the BDB AFW pump is deployed at 12-24 hours into the event as a back-up to the installed TDAFW pump. At this time, the primary and alternate AFW connections will be evaluated for use and tie-in preparations will be performed. The alternate connection task will be procedurally controlled and will be performed while the BDB AFW pump is staged. This updated AFW alternate connection strategy will be documented in the February 2014 Six-Month Status Update.

Per the SOE Timeline, the BDB AFW pump is deployed at 12-24 hours into the event as a back-up to the installed TDAFW pump. At this time, the primary and alternate AFW connections will be evaluated for use, and tie-in preparations will be performed. The alternate connection task will be procedurally controlled and will be performed while the BDB AFW pump is staged.

Section 3.2.4.9 Portable Equipment Fuel, below addresses the fuel necessary to operate the FLEX equipment. The discussion in Section 3.2.4.9 provides reasonable assurance that sufficient quantities of fuel as well as delivery capabilities are available.

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

3.2.2 Spent Fuel Pool Cooling Strategies

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

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

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

On page 54 of the Integrated Plan, the licensee specified that following the occurrence of an ELAP/LUHS event, normal SFP cooling capability is lost which, in the long term, can result in SFP boiling and loss of adequate SFP level for adequate spent fuel cooling. The licensee stated that conservative analysis has shown that, based on the limiting fuel storage scenario resulting in maximum design heat load, with no operator action, the SFP will reach 212 degrees F in approximately 6 hours and boil off to a level 10 feet above the top of fuel in approximately 30 hours from initiation of the event. Based on the extended time available for action to supplement SFP cooling, the Phase 1 coping strategy is to monitor SFP level, using instrumentation to be installed as required by NRC Order EA-12-051.

No additional modifications are required other than installation of the BDB SFP level monitoring instruments as required by NRC Order EA- 12-051.

On page 55 of the Integrated Plan, the licensee specified that no makeup to the SFP will be required prior to 30 hours, at which time continued pool boiling is calculated to reduce the pool level to within ten feet of the top of stored fuel. For Phase 2, the primary coping strategy for SFP cooling is to utilize the fire truck or BDB High Capacity pump, deployed as described in Section B.2 of the Integrated Plan, to provide makeup water flow to the pool. The water will be drawn from the barge slip and pumped to the pool through a flexible hose connected to the pre-installed, seismically-designed, and missile protected SFP makeup connection located in the

SFP skimmer cage in the AB. The flowpath for SFP make-up is through an existing open ended line which provides flow directly into the pool. Since the BDB SFP makeup connection is protected, and other necessary equipment is deployed from the BDB Storage Building(s), this SFP makeup capability will be available for the external hazards described in Section A.1 of the Integrated Plan.

The alternate capability for SFP makeup utilizes the fire truck or the BDB High Capacity pump to provide flow from the barge slip through portable spray nozzles that will be set-up on the deck near the SFP, or through a flexible hose that will be routed over the edge of the pool. The staging of equipment within the Fuel Building can be accomplished before the SFP area becomes inaccessible since pool boiling is not anticipated until after 6 hours and Fuel Building access is expected to be available for a considerable time after boiling begins.

The BDB High Capacity pump will provide SFP makeup capability of up to 250 gpm, which exceeds the calculated boil-off rate of 75 gpm. Hydraulic analysis of the flow paths from the station discharge canal to the SFP for each of the makeup methods described above will be performed to confirm that applicable performance requirements are met. A separate Phase 3 strategy is not required to maintain SFP cooling. However, the Phase 2 SFP makeup strategies will be maintained using offsite pumps if the onsite portable pumps fail.

Following a BDB event, a vent pathway would be required in the event of SFP bulk boiling and can be established by opening the Fuel Building roll-up doors for inlet and outlet air flow. However the licensee's strategy for providing air flow to remove steam generated from pool boiling is not clear. The path for inlet and exhaust air is apparently the same i.e., the fuel building rollup doors. It is not clear from the discussion provided how this will enable a flow path to vent the steam and condensate from the Fuel Building. This has been identified as Confirmatory Item 3.2.2.A in Section 4.2.

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

3.2.3 Containment Functions Strategies

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

On pages 48 and 49 of the Integrated Plan, the licensee specified that the Phase 1 coping strategy for containment involves verifying containment isolation per EOP- 2530, Station Blackout, and continuing to monitoring containment pressure using installed instrumentation. Evaluations have been performed and conclude that containment temperature and pressure will remain below design limits and key parameter instruments subject to containment environment will remain functional for at least 7 days. Therefore, actions to reduce containment temperature and pressure and ensure continued functionality of the key parameters will not be required prior to this time and will utilize off-site equipment and resources during Phase 3. Procedural guidance for monitoring containment pressure is provided by EOP-2530, Station Blackout. Containment pressure and temperature indication is available in the MCR throughout the event.

On page 50 of the Integrated Plan, the licensee specified that evaluations have been performed and conclude that containment temperature and pressure will remain below design limits and key parameter instruments subject to containment environment will remain functional for at least 7 days. Therefore, actions to reduce containment temperature and pressure and ensure continued functionality of the key parameters will not be required prior to this time and will utilize off-site equipment and resources during Phase 3. There is no separate Phase 2 strategy.

The licensee provided evaluations and calculations that show no strategies are required in Phase 1 or 2 to maintain containment temperature and pressure below design limits and that key parameter instruments subject to the containment environment will remain functional for at least 7 days. The containment response analysis has been performed utilizing the same approved GOTHIC licensing model and methodology that was used for FSAR Chapter 14 containment integrity analysis. The licensee's containment analysis methodology is documented in topical report DOM-NAF-3-0.0-P-A. This topical report describes, in detail, the assumptions to be used and the mathematical formulations employed for containment integrity analysis for all Dominion fleet. The NRC has approved the use of the GOTHIC code and the analysis methodology described in this topical report in a letter dated August 30, 2006. Dominion Nuclear Engineering Calculation MISC-11793, "Evaluation of Long Term Containment Pressure and Temperature Profiles Following Loss of Extended AC Power (ELAP)" provided a summary of the GOTHIC calculation. For MPS2 the calculated values are approximately 14 psig and 199 degrees F after 7 days. The design limits from the FSAR are 54 psig and 289 degrees F.

During the audit process the licensee stated that the details of the long term containment cooldown and depressurization strategies for MPS2 are still under development. Upon selection of the preferred strategy, detailed GOTHIC analysis will be performed to document and validate the strategy and also to provide operators with timelines and guidelines for actions to insure the long term integrity of the containment throughout the Phase 3 of the postulated ELAP/LUHS scenario. The Phase 3 containment cooldown and depressurization strategy will be completed per the schedule given in the August 23, 2013 6-month update and the results will be provided in the February 2014 6-month update. This has been identified as Confirmatory Item 3.2.3.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 Containment Functions Strategies, if these requirements are implemented as described.

3.2.4 Support Functions

3.2.4.1 Equipment Cooling - Cooling Water

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

> Plant procedures/guidance should specify actions necessary to assure that equipment functionality can be maintained (including support systems or alternate method) in an ELAP/LUHS or can perform without ac power or normal access to the UHS.

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

The licensee did not provide sufficient information regarding cooling functions provided by such systems as auxiliary building cooling water, service water, or component cooling water cooling when ac power is lost during the ELAP for Phase 1 and 2. For example, the potential need for cooling water for the TDAFW pump bearings was not discussed. Additional analysis by the licensee is required to determine the acceptability of the licensee's plans to provide supplemental ventilation and cooling to the subject components when normal cooling will not be available during the ELAP. This has been identified as Open Item 3.2.4.1.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 equipment cooling – cooling water, if these requirements are implemented as described.

3.2.4.2 Ventilation – Equipment Cooling

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

> *Plant procedures/guidance should consider loss of ventilation effects on specific energized equipment necessary for shutdown (e.g., those containing internal electrical power supplies or other local heat sources that may be energized or present in an ELAP.*
>
> ELAP procedures/guidance should identify specific actions to be taken to ensure that equipment failure does not occur as a result of a loss of forced ventilation/cooling. Actions should be tied to either the ELAP/LUHS or upon reaching certain temperatures in the plant. Plant areas requiring additional air flow are likely to be locations containing shutdown instrumentation and power supplies, turbine-driven decay heat removal equipment, and in the vicinity of the inverters. These areas include: steam driven AFW pump room, the control room, and logic cabinets. Air flow may be accomplished by opening doors to rooms and electronic and relay cabinets, and/or providing supplemental air flow.
>
> Air temperatures may be monitored during an ELAP/LUHS event through operator observation, portable instrumentation, or the use of locally mounted thermometers inside cabinets and in plant areas where cooling may be needed. Alternatively, procedures/guidance may direct the operator to take action to provide for alternate 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 ... AFW pump rooms, portable engine-driven blowers may be considered during the transient to augment the natural circulation provided by opening doors. The necessary rate of air supply to these rooms may be estimated on the basis of rapidly turning over the room's air volume.
>
> Actuation setpoints for fire protection systems are typically at 165-180 degrees F. It is expected that temperature rises due to loss of ventilation/cooling during an ELAP/LUHS will not be sufficiently high to initiate actuation of fire protection systems. If lower fire protection system setpoints are used or temperatures are expected to exceed these temperatures during an ELAP/LUHS, procedures/guidance should identify actions to avoid such inadvertent actuations or the plant should ensure that actuation does not impact long term operation of the equipment.

On pages 88 through 91 of the Integrated Plan the licensee specified that the FLEX strategies for maintenance and/or support of safety functions involve several elements. One element is to ensure that ventilation, heating, and cooling is adequate to maintain acceptable environmental conditions for equipment operation and personnel habitability. Details of the ventilation strategy are under development and will conform to the guidance given in NEI 12-06. The details of this strategy will be provided at a later date. Any ventilation related procedures, strategies, and/or guidelines needed to support implementation of the Phase 1, 2, and 3 coping strategies will be identified and developed at a later date.

The areas of the plant that would most likely be affected by loss of ventilation and cooling systems are the ones that will be necessary to be occupied (MCR, TDAFW pump room) during the ELAP or will require ventilation for situations like hydrogen generation in the battery rooms.

Since the licensee's plans and strategies to provide cooling and ventilation to areas of the plant affected by loss of ac power during the ELAP are not finished, they will provide strategies for ventilation of areas of the plant affected by ELAP at a later date and noted an open item regarding this issue. The areas of the plant that would most likely be affected by loss of ventilation and cooling systems are the ones that will be necessary to be occupied (MCR, TDAFW pump room) during the ELAP or will require ventilation for situations like hydrogen generation in the battery rooms. The licensee did not provide a discussion of these issues in the update to the integrated plan, or any information on the adequacy of the ventilation provided in the battery room to protect the batteries from the effects of elevated or lowered temperatures, especially if the ELAP is due to high or low temperature hazard.

During the audit process the licensee specified that the areas of the plant that are expected to be affected by the loss of ventilation following ELAP/LUHS scenario at MPS2 have been preliminarily identified to be the MCR, 14 ft. 6 in. elevation of the AB, dc switchgear rooms, east 480V switchgear room, upper 4160 switchgear room, battery rooms, TB and the containment enclosure building east and west penetration areas. The licensee stated that the MPS2 Integrated Plan, Table 1 identifies 2 set of fans, blowers and heaters to be available from the BDB storage building. This number will be revised as necessary based on the results of the final ventilation analysis and finalized strategy.

The licensee was requested to provide information on the adequacy of the ventilation provided in the TDAFW pump room to support equipment operation throughout all phases of an ELAP, and to specify whether the initial temperature condition assumed the worst-case outside temperature with the plant operating at full power.

During the audit process the licensee stated that as documented on page 68 of MPS2 Specification SP-EE-362, Rev. 2, the TDAFW pump room temperature during SBO is bounded by the steady state normal room operating temperature of the pump. The room has a water tight door that is not assumed to be open. Per calculation 97-SBO-02078M2 Rev 1, the heat up analysis for the room does not take credit for ventilation and has been calculated to not exceed 130 degrees F. This temperature is less than the room design temperature of 135 degrees F specified in SP-M2-EE-332. Since this room is not expected to experience a heat load during the ELAP/LUHS scenario that is any greater than the heat load during normal TDAFW pump operation, no compensatory cooling measures are required for this room.

The licensee stated that the ventilation evaluation will be completed later this year and the results will be provided in the February 2014 Six-Month Update. This has been identified as Confirmatory Item 3.2.4.2.A in Section 4.2.

The NRC has also identified issues with hydrogen accumulation in the battery rooms. With no ventilation for the battery rooms, hydrogen gas building could become an issue. As the strategy for providing ventilation to the battery room has not been developed, additional discussion on the hydrogen gas exhaust path is needed, and a discussion of the accumulation of hydrogen with respect to national standards and codes which limit hydrogen concentration to less than 2% (IEEE Standard 484 as endorsed by Regulatory Guide 1.128, "Installation Design and Installation of Vented Lead-Acid Storage Batteries for Nuclear Power Plants") and less than 1% (National Fire Code) when the batteries are being recharged during Phase 2 and 3.

During the audit process the licensee specified that hydrogen gas generation from the charging battery will be dispersed by the normal battery room exhaust flowpath. The battery room exhaust fan is powered from the same electrical bus as the corresponding battery charger. When bus 22F is re-energized to power the 'B' battery charger by the BDB 480Vac DG during implementation of the electrical re-power strategy (described in the August, 2013 6-month update), or by the BDB 4160Vac DG during Phase 3, the associated 'B' battery room exhaust fan will be started and exhaust battery room air through the normal exhaust flowpath to prevent hydrogen accumulation within the battery room.

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

3.2.4.3 Heat Tracing

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

> *Plant procedures/guidance should consider loss of heat tracing effects for equipment required to cope with an ELAP. Alternate steps, if needed, should be identified to supplement planned action.*
>
> Heat tracing is used at some plants to ensure cold weather conditions do not result in freezing important piping and instrumentation systems with small

diameter piping. Procedures/guidance should be reviewed to identify if any heat traced systems are relied upon to cope with an ELAP. For example, additional condensate makeup may be supplied from a system exposed to cold weather where heat tracing is needed to ensure control systems are available. If any such systems are identified, additional backup sources of water not dependent on heat tracing should be identified.

In the Integrated Plan the licensee did not discuss the effects of loss of power to heat tracing. During the audit process the licensee specified that heat tracing is used to maintain highly concentrated soluble boron solutions above the temperature where the soluble boron will precipitate out of solution and to protect piping systems and components from freezing in extreme cold weather conditions. FLEX strategies developed do not depend on highly concentrated soluble boron solutions. FLEX strategies developed will use borated water sources with boron concentrations below 4000 ppm. At these levels boron precipitation is not expected to occur.

FLEX strategies have also been developed to protect piping systems and components from freezing. Commercially available Heat Tape and insulation rolls have been identified and will be procured and maintained in the BDB Storage Building for use on piping systems and components that will be used during an ELAP event where freezing is a concern in extreme cold weather conditions. In addition, major components being procured for FLEX strategies will be provided with cold weather packages and small electrical generators to power the heat tape circuits as well as protect the equipment from damage due to extreme cold weather and help assure equipment reliability.

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

3.2.4.4 Accessibility - Lighting and Communications

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

Plant procedures/guidance should identify the portable lighting (e.g., flashlights or headlamps) and communications systems necessary for ingress and egress to plant areas required for deployment of FLEX strategies.

Areas requiring access for instrumentation monitoring or equipment operation may require portable lighting as necessary to perform essential functions.

Normal communications may be lost or hampered during an ELAP. Consequently, in some cases, portable communication devices may be required to support interaction between personnel in the plant and those providing overall command and control.

On page 75 of the Integrated Plan, the licensee specified MPS2 initially relies on emergency lighting installed for Fire Protection/Appendix R to perform Phase 1 coping strategy activities. However, Appendix R lighting is powered by battery packs at each light and is rated for only 8 hours. This lighting also does not provide 100% coverage of areas involving FLEX strategy activities including ingress and egress from task areas. In these areas and areas poorly lit, portable lighting and head lamps are available for use. Portable lighting is currently staged throughout the site, mainly for use by the Fire Brigade. A lighting study will be performed to validate the adequacy of existing lighting and the adequacy and practicality of using portable lighting to perform FLEX strategy actions. There are no procedures, strategies, or guidelines needed with regard to use or restoration of lighting in Phase 1 of an ELAP/LUHS event. The location of these lights will be identified in the FLEX Guidelines. No modifications are planned to provide lighting to support the implementation of Phase 1 FLEX strategies. Additional portable lighting or necessary modifications may be identified in the lighting study to be performed. This has been identified as Confirmatory Item 3.2.4.4.A in Section 4.2.

For Phase 2, the licensee specified that the use of portable hand held lighting or head lamps will continue to be available for use in dark or poorly lit areas. Secondly, there will be the use of supplemental lights that will be available as stored BDB equipment. This includes additional small portable sources (such as flashlights and head lamps) for personal use, as well as larger portable equipment (such as self-powered light plants). The larger lighting equipment would be typically deployed in outside areas to support deployment of BDB pumps and generators. In some cases, BDB equipment will be equipped with their independent lighting sources.

The NRC staff has reviewed the licensee communications assessment (ML12307A024 and ML13058A038) in response to the March 12, 2012, 50.54(f) request for information letter, and as documented in the staff analysis (ML13189A155) has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by the licensee will conform to the guidance of NEI 12-06 Section 3.2.2 (8) regarding communications capabilities during an ELAP. Confirmation will be required that upgrades to the site's communications systems have been completed. This has been identified as Confirmatory Item 3.2.4.4.B in Section 4.2.

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

On page 94 of the Integrated Plan, the licensee specified that an access contingency in the MPS security plan for loss of power situations ensures the ability of plant personnel and BDB equipment to access areas inside the plant structures as well as access from areas outside the site PA to implement the planned FLEX strategies.

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

3.2.4.6 Personnel Habitability - Elevated Temperatures

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.

NEI 12-06, Section 9.2 states:

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

During the audit process the licensee specified that the areas of the plant that are expected to be affected by the loss of ventilation following ELAP/LUHS scenario at MPS2 have been preliminarily identified to be the MCR, 14 ft. 6 in. elevation of the AB, dc switchgear rooms, east 480V switchgear room, upper 4160 switchgear room, battery rooms, TB and the containment enclosure building east and west penetration areas. It should also be noted that the MPS2 Integrated Plan, Table 1 identifies 2 set of fans, blowers and heaters to be available from the BDB storage building. This number will be revised as necessary based on the results of the final ventilation analysis and finalized strategy.

Licensee completed calculation NAI-1732-001, Rev. 0 demonstrating the area temperatures in the containment enclosure building east and west penetration rooms at elevation 38 ft. 6 in. do not reach temperatures which would inhibit manual operation of the atmospheric dump valves.

The ventilation evaluation will be completed later this year and the results will be provided in the February 2014 Six-Month Update. This has been combined with Confirmatory Item 3.2.4.2.A in Section 4.2.

The NRC has identified the following issues regarding habitability of the MCR during the ELAP. Without ventilation the MCR would most likely heat up. If temperatures approach a steady-state condition of 110 degrees F, the environmental conditions within the MCR would remain at the uppermost habitability temperature limit defined in NUMARC 87-00 for efficient human performance. NUMARC 87-00 provides the technical basis for this habitability standard as MIL-STD-1472C, which concludes that 110 degrees F is tolerable for light work for a 4 hour period while dressed in conventional clothing with a relative humidity of approximately 30%. This has been identified as Confirmatory Item 3.2.4.6.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 Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to personnel habitability with elevated temperatures, if these requirements are implemented as described.

3.2.4.7 Water Sources

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

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

On pages 10 thru 14 of the Integrated Plan, the licensee specified that the procedure for SBO provides direction to start the TDAFW pump and close the RCS isolation valves. At MPS2, the TDAFW pump is aligned to supply water from the CST to both SGs.

On page 24 of the Integrated Plan, the licensee specified that initially, AFW water supply will be provided by the installed CST. The tank has a minimum usable capacity of 142,746 gallons and will provide a suction source to the TDAFW pump for approximately 7.2 hours of RCS decay heat removal assuming a concurrent RCS cooldown to a minimum SG pressure of 120 psig. The 7.2 hours is a time constraint to provide a supplemental AFW source. The credited supplemental source of AFW is water from Long Island Sound.

On page 27 of the Integrated Plan, the licensee specified that an indefinite supply of water for SG injection is available as MPS2 has multiple fresh water supplies which will be deployed to add water to the CST or provide suction directly to the BDB AFW pump. These include the 3,000,000 gallon site pond which can provide core cooling supply for greater than 20 days to each unit. The Long Island Sound will only be used as a last resort.

Evaluations estimate that with no operator action following a loss of SFP cooling, the SFP will reach 212 degrees F in approximately 6 hours and boil off to a level 10 feet above the top of fuel in approximately 30 hours from initiation of the event. To provide makeup to the SFP, a fire hose will be connected to the discharge of the BDB High Capacity pump or fire truck located at the barge slip.

On page 41 of the Integrated Plan, the licensee specified that the primary supply of borated water for injection will be from the RWST. The BDB RCS pump suction supply connection will be located in the RWST valve pit in the RWST pipe chase. A temporary hose will be run from the BDB RCS injection pump suction to this connection. The RWST is stainless steel, safety related, seismically qualified, but is not missile protected. It has a usable volume of 370,000 gal of borated water at a concentration greater than 1720 ppm. The RWST is the preferred borated water source.

In the event the RWST is damaged or should become unavailable, water from a 1000 gallon portable boric acid mixing tank will provide borated water for RCS make-up. This mixing tank would be transported from the on-site BDB Storage Building and positioned near the BDB RCS injection pump. The tank would be filled with water, and powdered boric acid would be added and mixed to the proper boric acid concentration needed to maintain adequate shutdown margin and RCS inventory. Bags of powdered boric acid are easy to deploy to any area of the plant where the batching tanks are required. Water for mixing would be supplied by the BDB High Capacity pump. The water supplies in this instance would be water from either a 3 million gallon site pond or the UHS. Both of these makeup water supplies could potentially contain debris or foreign material. The licensee did not discuss the possible consequences of injecting this water into the RCS or the SG's.

During the audit process the licensee stated that in the unlikely event that a tornado missile strikes the base of the RWST such that the water content is unavailable, another borated water source would be required. The boric acid batch tank is only required if the qualified borated water source, the RWST is not available. The charging pumps that are being powered by the portable BDB 480 Vac diesel generator can take suction from either of two approximately 6,500 gallon Boric Acid Storage Tanks (BASTs) and inject adequate boron into the RCS. Following depletion of the BAST volumes, the batching tank will be deployed, if needed. MPS2 FSGs will provide direction to use available clean water sources for use in the RCS. The clean water sources include the condenser hotwell and the city water supplies as specified in ETE-CPR-2012-0009, Chapter 2. Although these sources are not fully protected, they would be expected to survive from a tornado event which damages the RWST. The condenser is located in the lower parts to the turbine building providing a tortuous path for a missile. The city water storage tank is located several miles from the site and should not be damaged by the same tornado event damaging the on-site RWST.

The usage of the site pond or the UHS (Long Island Sound) for supplying AFW to the SGs will be used only as the lowest priority. Westinghouse is currently performing analysis which will determine the consequences of usage of these water sources in the SGs. The results of the analysis are expected to provide the allowed time limits on usage of these sources. The RRC will provide equipment to initiate RHR and water treatment equipment such that heat removal can be ensured for extended durations. This equipment is expected to be available within the 24-72 hour timeframe. The licensee stated that they will ensure that the strategies being developed will provide adequate margin to ensure core cooling is maintained. Updated strategies for RCS inventory and core cooling utilizing the RRC equipment will be provided in the February 2014 Six-Month Status Update. The final results of the Westinghouse analysis are expected in March 2014 and will be provided in a subsequent Six-Month Update. This has been identified as Confirmatory Item 3.2.4.7.A in Section 4.2.

For Phase 3 in response to an ELAP event, the portable BDB RCS Injection pump will be transported from a BDB storage building and positioned in the PA outside the Turbine building truck bay. A high pressure hose will be routed from the pump discharge to a permanent hose connection, which provides a flow path to the RCS. A second hose will be routed from the pump suction to another permanent hose connection that provides a flow path from the RWST.

The licensee provided supporting information regarding the analyses used to determine: (1) the required time of 1.8 hours to control the AFW flow for SG overfill prevention, and (2) the required CST- Long Island Sound switchover time of no greater than 8.4 hours. The licensee was requested to address the adequacy of the analyses that established the noted times for SG overfill prevention and CST to UHS switchover, including the computer codes/methods and assumptions used, and also discuss and justify the decay heat model used in the analysis.

During the audit process the license stated that calculations of secondary side flow requirements were performed with a mass and energy balance for the SG secondary side using a Microsoft EXCEL® spreadsheet. The spreadsheet model uses finite differences to solve the conservation of mass and energy equations for the SG. The energy addition terms are: enthalpy transport from auxiliary feedwater, decay heat and sensible heat (during the cooldown phase) from the RCS and secondary fluid and the NSSS metal. Energy removal is by saturated steam enthalpy transport through the steam generator ADVs.

The sensible heat term is calculated from a specified RCS cooldown rate. Steam generator pressure is approximated as the saturation pressure corresponding to the cold leg temperature for each time step. A constant primary side deltaT is specified which is consistent with observed/calculated values for natural circulation conditions. Cooldown is terminated at a target steam generator pressure of 120 psig on the secondary side.

The energy balance equation is solved for ADV flow as the independent variable. If the calculated ADV flow is negative, the heat source terms (decay and sensible heat) are less than the heat required to elevate the auxiliary feedwater enthalpy to saturation, and the ADV flow is set to zero. For every time step, the spreadsheet does a check to verify that the calculated ADV flow is within the capacity of the ADV's at the steam pressure for that time step. Initially, the auxiliary feedwater is assumed to be added uniformly to both SG's at the rated flow for the TDAFWP. A mass balance is performed with the added mass from the TDAFWP and the mass removed via the ADV's. The initial mass is set equal to the hot full power value. Once the mass reaches the no-load value, operator action to throttle AFW flow is modeled by setting the AFW mass flow to the calculated ADV flow from the previous time step. At this point a quasi-steady state is reached with a constant steam generator inventory and matched steam and feed flows which remove the decay heat and sensible heat.

The integrated auxiliary feedwater mass flow is compared to the various tank inventories to determine the available duration for the various sources. Thermodynamic properties are calculated with EXCEL macro functions which closely approximate the ASME Steam Tables, 6th addition.

The decay heat for each time step is calculated using rated thermal power and interpolation on a table of normalized decay power vs. time. The table of normalized decay power was calculated using the ANS 5.1-1979 Decay Heat Standard with 2 sigma uncertainty applied. The analysis shows that the minimum usable volume of the CST is adequate to (1) fill the SG secondary to the no-load value; (2) cool the RCS from hot zero power to approximately 350 degrees F (corresponds to a cooldown target pressure of 120 psig) and (3) remove decay heat for the first approximately 8.4 hours of the event.

For the SG overfill case, the calculation proceeds as described above except no throttling of AFW flow is modeled and no cooldown is imposed. The time to reach a secondary steam generator mass corresponding to the secondary side volume times the density of saturated liquid is observed. The time to overfill with no operator action is calculated to be approximately 1.8 hours.

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

3.2.4.8 Electrical Power Sources/Isolations and Interactions

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

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

In the Integrated Plan the licensee did not provide any information regarding how portable generators would be electrically isolated from plant equipment. During the audit process the licensee specified that for permanently connected BDB equipment, such as connection receptacles, conduits, and cables, the BDB electrical equipment is procured and installed to the requirements of safety related equipment or is isolated from the class 1E buses in accordance with the approved design standards per the licensing basis for the unit.

Also, for the portable BDB generators, each generator is to be provided with output electrical protection, e.g., breakers, fuses, relays, that will provide protection for the output cables and the connections to the station buses. Existing load circuit protection will be used for the bus loads. The licensee also stated that the FSG's will ensure that portable generators are not used to energize a station bus until the bus has been isolated from any other potential power sources. Loads to support the FLEX strategies will then be added using the guideline as needed.

Additionally, electrical isolation to prevent simultaneously supplying power to the same bus from different sources will be administratively controlled. The FSGs will be written to ensure the breakers from other potential supply sources are racked out and tagged before power is supplied to the bus by use of BDB portable DGs which are to be backfed through the 'B' heater drain pumps for the 4180 Vac tie-in and the 'B' retired Hydrogen Recombiner for the 480 Vac tie-in.

The Integrated Plan did not provide a summary of the sizing calculation for the FLEX generators to show that they can supply the loads assumed in phases 2 and 3. During the audit process the licensee specified that The Phase 2 strategy for MSP2 is based on using a 480 Vac portable generator and a backup 120 Vac generator. The Phase 3 strategy is based on using a 4 KV portable generator. The generator load requirements for Phase 2 and 3 are summarized in the body of Calculation 2013-ENG-04583E2 Rev. 0 "Millstone Station Unit 2 Beyond Design Basis - FLEX Electrical 4160 VAC System Loading Analysis". A detailed breakdown of the loads is provided in Attachment 1 of the calculation.

Section F1.2 of the Integrated Plan states that the BDB electrical receptacle 53 will be connected to a new breaker on the 120 Vac vital bus panels. However, this new breaker is not identified in Section A.4, Action item 12 (page 11), nor in F1.2.2. It is not clear if this is a breaker that will be installed as part of the FLEX and if it is part of the modifications necessary for Phase 2.

During the audit process the licensee specified that the receptacles identified in F1.2 are to be installed and connected to new breakers within the 120 Vac distribution panels. Regarding F1.2.2, the new breakers were considered part of the receptacle modification. Section A.4 of the Integrated Plan addressed the complete action to provide 120 Vac to the distribution panels. However, the discussion only stated the actions to deploy the portable DGs and connect the DGs to the receptacles. Starting the DGs and closing the breakers to power the panels was an implied action necessary to complete the re-powering of the distribution panels. These additional actions were included in the stated approximate deployment time and do not impact the margin available to the depletion of battery life.

The licensee was requested to: discuss the non-safety related installed systems or equipment that are credited in the ELAP analysis supporting the FLEX mitigation strategies, specify the functions of any such system or equipment credited in the ELAP analysis, or justify that they are available and reliable to provide the desired functions on demand during the ELAP conditions.

During the audit process the licensee clarified that the only non-safety related equipment credited in the ELAP analysis consists of the 4160 Vac non-vital bus 24B, and the refuel load center supply cable.

The licensee stated that the 4160 VAC non-vital bus, 24B is located in the upper switchgear room at the 56 ft. 6 in. level of the TB. This room also contains 4160 VAC vital bus 24D. As indicated in Section 5.5.3 of the MSP2 FSAR, the TB is seismically qualified as well as tornado missile protected. The switchgear in this room is installed to prevent physical interaction during a seismic event. Bus 24B is in a seismic structure, tornado missile protected and above flood levels. Since use of the 4160 Vac non-vital bus is a Phase 3 action, significant time (days) would be available to repair or bypass the bus should it become damaged as a result of a seismic event.

The refuel load center supply cable was installed to allow the refuel load center to be powered from either non-vital 4160 Vac bus 24A, or 24B. As this cable passes through the cable vaults to the upper switchgear room, they are designed to prevent physical interaction with safety related components during a seismic event. Since use of the refuel load center supply cable is a Phase 3 action, significant time (days) would be available to repair or bypass the bus should it become damaged as a result of a seismic event.

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

3.2.4.9 Portable Equipment Fuel

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

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

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

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

On page 69 of the Integrated Plan, the licensee specified that the FLEX strategies for maintenance and/or support of safety functions involve several elements. One element is maintaining fuel to necessary diesel powered generators, pumps, hauling vehicles, and compressors. The general coping strategy for supplying fuel oil to diesel driven portable equipment, i.e., pumps and generators, being utilized during Phases 2 and 3, is to draw fuel oil out of any of the existing diesel fuel oil tanks on the MPS site that are available. The coping strategy for supplying fuel oil to BDB equipment indefinitely is not unit specific. Fuel oil from any storage tank on site will be available to refill BDB equipment being utilized for either MPS2 or MPS3 service.

During the audit process the licensee revised the Integrated Plan information regarding portable equipment fuel sources. Fuel for the BDB portable pumps and generators used for the FLEX strategies during Phase II and Phase III of an ELAP event is provided from the following on-site fuel sources:

Two 12,000 gallon (technical specification minimum) seismically installed, missile protected storage tanks located on the 38 ft. 6 in. elevation in the Unit 2 AB. These two tanks are located well above the maximum postulated flood elevation so they can reasonably be expected to survive following a BDB external event (BDBEE).

As an alternate supply, two below-ground fuel oil (FO) storage tanks, each containing 32,670 gallons (TS Minimum), are located outside the Unit 3 Emergency Diesel Generator facility. These tanks are seismically installed, missile protected, and located above the maximum postulated flood elevation. Therefore, these storage tanks can be reasonably expected to survive following a BDBEE.

As an alternate fuel source, the portable FO tank can be dispatched to the west side of the Unit 3 EDG facility where it can be filled from underground fuel sources using a portable 12Vdc pump. The "Portable Fuel Tank" will be a fuel oil truck with a self-powered pump that will be stored in the BDB storage building.

The proposed BDB equipment storage building would be located south of the railroad bridge, on the west side of the MPS access road, adjacent to the existing northeast contractor parking lot. A figure providing the location of the storage building on the MPS site and the depiction of the main and alternate haul routes was provided as an attachment on the portal. The attachment (MPS2_Q48 Flooding-CLB) also shows the difference in the Unit 2 and 3 site elevations and the flooding associated with the MPS3 CLB hurricane storm surge stillwater level. Additional site haul route details are provided in the attachment labeled MPS2_Q48 BDB Haul Route.

An evaluation of all BDB equipment fuel consumption and required re-fill strategies will be developed including any gasoline required for small miscellaneous equipment. This has been identified as Confirmatory Item 3.2.4.9.A in Section 4.2.

On page 71 of the Integrated Plan, the licensee specified that the BDB fuel carts, pumps, necessary hoses, fittings, and containers will be protected from all hazards events while stored in the BDB storage building or in protected areas of the plant.

In the Integrated Plan the licensee did not address measures to maintain fuel quality. During the audit process the licensee specified that diesel fuel in the above ground FO storage tanks are routinely sampled and tested to assure FO quality is maintained to ASTM standards. This sampling and testing surveillance program also assures the FO quality is maintained for operation of the station Emergency Diesel Generators (EDGs).

To facilitate deployment of the BDB portable pumps and generators the equipment is expected to be stored in a fueled condition. As a part of the Preventative Maintenance (PM) templates being created by Electric Power Research Institute (EPRI), the oil tanks on this FLEX equipment will also be routinely sampled and tested to assure proper FO quality is maintained.

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

3.2.4.10 Load Reduction to Conserve DC Power

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

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

During the audit process the licensee stated that the original documented Class 1E battery life of 19 hours has been superseded by calculation 2013-ENG-04408E2, "MP2 BDB Battery Calculation." This revised calculation documents an extended Class 1E battery life of 29 hours and 9 minutes. The calculation uses the ETAP Battery Discharge Analysis module to determine the performance of the dc system. The battery duty cycle is calculated from load flow calculations, including correction factors for battery temperature and aging, which are applied to the load duty cycles rather than the battery duty cycle or battery capacity. The output records from this module are used to determine the battery terminal voltage and the battery capacity at each time during discharge of the battery.

The extended battery life analysis is based on the following actions:

- Initially, both Train A and Train B batteries are energized; loads consist of both BDB required and non-BDB required loads.
- Starting at 45 minutes from the onset of the ELAP event, the process of isolating Train A and de-energizing loads not required during BDB begins.
- Next, the A and B dc busses are cross-tied.
- Then, at 55 minutes into the event, all Train 'A' dc bus loads are stripped to preserve capacity on the combined batteries.
- On or before 75 minutes, loads not required during BDB conditions are de-energized (stripped) on Train B.
- All other loads on Train B, including Inverters 2 and 4 which supply 120 Vac vital instrumentation, remain energized.
- This configuration remains the same until the batteries are depleted or power is restored directly from a portable BDB diesel generator.

Stripping of dc loads will be performed using FLEX Support Guidelines (FSGs). Detailed lists of all dc bus loads to be stripped are provided in the attached Tables 1 and 2 for Trains A and B, respectively. All breaker manipulations to be performed are located in the East (Train A) and West (Train B) DC Switchgear Rooms, which are adjacent to each other in the 14 ft. 6 in. level of the AB. These rooms are accessible from several paths from the Control Room through areas protected from flooding and tornado missile damage. Operators will cross-tie the dc busses, strip all loads from the 201A dc bus, and strip selected non-BDB loads from the 201B dc bus. The dc load stripping evolution will start 45 minutes after the initiating event and take a total of 30 minutes to complete. The total time from the initiating event to the completion of load stripping is 75 minutes.

Load stripping FSGs will also include the guidance to strip selected 120 Vac vital bus loads to preserve the emergency batteries. All breaker manipulations for stripping 120 Vac loads will be performed on the 120 Vac Vital Panels VA20 and VA40, which are located in the West DC Switchgear Room. Tables providing the 120 Vac vital bus loads that are to be stripped are provided in the attached Tables 3 and 4 for buses VA20 and VA40, respectively. These tables are provided to identify all of the loads being stripped to extend the MPS2 Class 1E battery life.

Load stripping will result in the loss of 2 channels (A and C) out of 4 channels of vital plant instrumentation. This action will leave 2 redundant channels (B and D) available for monitoring plant parameters. The dc loads that are not stripped were carefully selected to ensure all plant safety functions can be monitored during Phase 1 of an ELAP event. Many of the isolated loads are solenoid valves that have no impact on systems important to plant safety.

Upon a loss of power, safety related components are designed to fail to their accident condition. The existing loss of ac power procedural requirement to verify containment isolation will be performed prior to starting FLEX load stripping activities. Also, MPS2 has a separate battery that supplies power to emergency seal oil and lubricating oil pumps for the main turbine. This battery is not included in the load stripping strategy, nor is it required for any safety systems. Per calculation 97-ENG-1776E2, this battery is designed to provide all loads for 2 hours. As time permits, hydrogen will be vented off the main turbine -generator and then these pumps will be secured.

In the August 2013 6-month status update the licensee stated that the primary and alternate strategies for deploying portable DGs have been switched. The primary strategy is to deploy a 480Vac DG from the BDB Storage Building to the location identified in the Integrated Plan Figure 6. The generator will be used to power the "B" battery charger which in turn supplies power to the vital ac instrument panels VA20 and VA40. The 480 Vac DG connection strategy is unchanged. As an alternate re-powering method for instrumentation, the 120/240 Vac portable DGs will be used to power vital ac instrument panels, VA20 and VA40. These DGs will be stored in the BDB Storage Building. The kW rating of the 120/240 Vac DGs, which are now the alternate re-powering strategy, has been increased such that a single DG can be used to re-power the 120 Vac vital bus circuits. A second 120/240 Vac DG of the same rating will be available as a full capacity backup.

During the audit process the licensee was requested to provide the direct current (dc) load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling. In response the licensee stated that Calculation 2013-ENG-04408E2, Rev. 0, "MP2 BDB Battery Calculation," provides the dc load profiles for the MPS2 Class 1E batteries for the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling. The MPS2 batteries will be cross-tied and act as one source; and therefore is modeled as a single battery DB2-201B.

The licensee has completed an analysis of the battery capability regarding expected time available with ac power. Site specific procedural guidance governing load stripping will be developed. The licensee specified that they will perform an analysis to develop electrical components performance requirements and confirm electrical loading-related strategy objectives can be met. This has been identified as Confirmatory Item 3.2.4.10.A in Section 4.2.

Review of the Integrated Plan for MSP2 revealed 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 (position paper) and ML13241A188 (NRC endorsement letter).

The purpose of the Generic Concern and associated endorsement of the position paper was to resolve concerns associated with Order Integrated Plan 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.

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

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

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

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

3.3 PROGRAMMATIC CONTROLS

3.3.1 Equipment Maintenance and Testing

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

> In order to assure reliability and availability of the FLEX equipment required to meet these capabilities, the site should have sufficient equipment to address all functions at all units on-site, plus one additional spare, i.e., an N+1 capability, where "N" is the number of units on-site. Thus, a two-unit site would nominally have at least three portable pumps, three sets of portable ac/dc power supplies, three sets of hoses & cables, etc. It is also acceptable to have a single resource that is sized to support the required functions for multiple units at a site (e.g., a single pump capable of all water supply functions for a dual unit site). In this

case, the N+1 could simply involve a second pump of equivalent capability. In addition, it is also acceptable to have multiple strategies to accomplish a function (e.g., two separate means to repower instrumentation). In this case the equipment associated with each strategy does not require N+1. The existing 50.54(hh)(2) pump and supplies can be counted toward the N+1, provided it meets the functional and storage requirements outlined in this guide. The N+1 capability applies to the portable FLEX equipment described in Tables 3-1 and 3-2 (i.e., that equipment that directly supports maintenance of the key safety functions). Other FLEX support equipment only requires an N capability.

NEI 12-06, Section 11.5 states:

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

2. Portable equipment that directly performs a FLEX mitigation strategy for the core, containment, or SFP should be subject to maintenance and testing guidance provided in INPO 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 19 of the Integrated Plan, the licensee specified that periodic testing and preventative maintenance of BDB equipment will follow guidance provided in Institute of Nuclear Power Operations (INPO) AP-913. Testing and maintenance recommendations will be developed by EPRI, and EPRI guidance documents will be used to develop testing frequencies and maintenance schedules.

The unavailability of equipment and applicable connections that directly performs a FLEX mitigation strategy for core, containment, and SFP will be managed such that risk to mitigating strategy capability is minimized. Maintenance / risk guidance will be developed as follows:

Portable BDB equipment may be unavailable for 90 days provided that the site FLEX capability (N) is available. 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. Work Management procedures will be revised to reflect AOTs (Allowed Outage Times) as outlined above.

On page 107 of the Integrated Plan, the licensee specified that EPRI guidance documents will be used to develop periodic testing and PM procedures for BDB equipment. Procedures will be developed to manage unavailability of equipment such that risk to mitigating strategy capability is minimized.

During the audit process the licensee revised the Integrated Plan information regarding maintenance and testing as follows:

EPRI has completed and has issued "Preventive Maintenance Basis for FLEX Equipment—Project Overview Report" (Report 3002000623). Preventative maintenance (PM) templates for several of the FLEX Portable diesel pumps have also been developed. Additional PM templates are under development for electrical generators and the remaining FLEX equipment. While PM templates have not been finalized some of the typical PM task lists that have been developed are listed below:

- Periodic Static Inspections – Monthly walkdown
- Fluid analysis (Yearly)
- Periodic operational verifications – Quarterly starts
- Periodic functional verifications with performance tests – Annual 1 hour run with pump flow and head verifications

The EPRI PM Templates for FLEX equipment will conform to the guidance of NEI 12-06 providing assurance the FLEX equipment is being properly maintained and tested. EPRI

Templates will be used for most equipment. However, in the event EPRI PM templates are not available, Preventative Maintenance (PM) actions will be developed based on manufacturer provided information/recommendations. Additionally, EPRI PM templates will be adopted for new pieces of FLEX equipment as they are purchased/received on site.

Review of the Integrated Plan for MSP2 revealed that the Generic Concern related to maintenance and testing of FLEX equipment is applicable to the plant. This Generic Concern has been resolved generically through the NRC endorsement of the EPRI technical report on PM 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.

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

3.3.2 Configuration Control

NEI 12-06, Section 11.8 states:

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

On page 20 of the Integrated Plan, the licensee specified that regarding configuration control, the FLEX strategy and its basis will be maintained in an overall program document. The program document will address the key safety functions to: provide reactor core cooling and heat removal, provide RCS inventory and reactivity control, ensure containment integrity, provide SFP cooling, provide indication of key parameters, and provide reactor core cooling in Modes 5 and 6.

In addition to the key safety functions listed above, support functions have been identified that provide support for the implementation of the FLEX strategies. Those support functions include: load stripping, repowering ac and dc busses, providing ventilation lighting, communications, portable fuel and plant access.

The program document will also contain a historical record of previous strategies and their bases. The program document will include the bases for ongoing maintenance and testing activities for the BDB equipment.

Existing design 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. Changes for the FLEX strategies will be reviewed with respect to operations critical documents to ensure no adverse effect.

The licensee stated that future changes to the FLEX strategies may be made without prior NRC approval provided: that the revised FLEX strategies meet the requirements of NEI 12-06 and an engineering basis is documented that ensures that the change in FLEX strategies continues to ensure the key safety functions (core and SFP cooling, containment integrity) are met.

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

3.3.3 Training

NEI 12-06, Section 11.6 states:

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

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

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

4. "ANSI/ANS 3.5, Nuclear Power Plant Simulators for use in Operator Training" certification of simulator fidelity (if used) is considered to be sufficient for the initial stages of the beyond-design-basis external event scenario until the

current capability of the simulator model is exceeded. Full scope simulator models will not be upgraded to accommodate FLEX training or drills.

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

On page 21 of the Integrated Plan, the licensee stated that the Nuclear Training Program will be revised to assure personnel proficiency in the mitigation of BDB events is developed and maintained. These programs and controls will be developed and implemented in accordance with the Systematic Approach to Training (SAT). Initial and periodic training will be provided to site emergency response leaders on BDB emergency response strategies and implementing guidelines. Personnel assigned to direct the execution of mitigation strategies for BDB events will receive necessary training to ensure familiarity with the associated tasks, considering available job aids, instructions, and mitigating strategy time constraints.

The licensee stated that operator training will include use of equipment from the RRC.

The licensee stated that "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 BDB 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.

The licensee stated that where appropriate, integrated FLEX drills will 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 required to connect/operate permanently installed equipment during these drills.

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

3.4 OFFSITE RESOURCES

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

1) A capability to obtain equipment and commodities to sustain and backup the site's coping strategies.

2) Off-site equipment procurement, maintenance, testing, calibration, storage, and control.

3) A provision to inspect and audit the contractual agreements to reasonably assure the capabilities to deploy the FLEX strategies including unannounced random inspections by the Nuclear Regulatory Commission.

4) Provisions to ensure that no single external event will preclude the capability to supply the needed resources to the plant site.
5) Provisions to ensure that the off-site capability can be maintained for the life of the plant.

6) Provisions to revise the required supplied equipment due to changes in the FLEX strategies or plant equipment or equipment obsolescence.

7) The appropriate standard mechanical and electrical connections need to be specified.

8) Provisions to ensure that the periodic maintenance, periodic maintenance schedule, testing, and calibration of off-site equipment are comparable/consistent with that of similar on-site FLEX equipment.

9) Provisions to ensure that equipment determined to be unavailable/non-operational during maintenance or testing is either restored to operational status or replaced with appropriate alternative equipment within 90 days.

10) Provision to ensure that reasonable supplies of spare parts for the off-site equipment are readily available if needed. The intent of this provision is to reduce the likelihood of extended equipment maintenance (requiring in excess of 90 days for returning the equipment to operational status).

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). This has been identified as Confirmatory Item 3.4.A in Section 4.2.

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

4.0 OPEN AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number	Description	Notes
3.2.1.8.A	Core Subcriticality and Boron Mixing: During the audit process, the licensee informed the NRC staff of its intent to abide by the generic approach discussed in Section 3.2.1.8 of this report; however, the NRC staff concluded that the August 15, 2013, position paper was not adequately justified and has not yet endorsed this position paper. As such, resolution of this concern for the plant is identified as an open item.	
3.2.4.1.A	The licensee did not provide sufficient information regarding cooling functions provided by such systems as auxiliary building	

	cooling water, service water, or component cooling water cooling when ac power is_lost during the ELAP for Phase 1 and 2. For example, the potential need for cooling water for the TDAFW pump bearings was not discussed. Additional analysis by the licensee is required to determine the acceptability of the licensee's plans to provide supplemental cooling to the subject components when normal cooling will not be available during the ELAP.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.2.A	On page 108 of the Integrated Plan, the licensee provided an open item that specified that the preferred travel pathways will be determined using the guidance contained in NEI 12-06. The pathways will attempt to avoid areas with trees, power lines, and other potential obstructions and will consider the potential for soil liquefaction. This open item is scheduled to be completed in June 2014.	
3.1.1.3.A	The licensee stated that a review will be completed to determine impacts from large internal flooding sources that are not seismically robust and do not require ac power.	
3.1.1.4.A	The licensee's plan for implementing the use of off-site resources is not complete. The local assembly areas have not been identified. The licensee is also evaluating the possibility of boat transport for personnel.	
3.1.2.2.A	The licensee has identified open items related to deployment of equipment during flooding conditions resulting from a hurricane; to verify response times listed in the timeline and perform staffing assessment, and to perform an evaluation of all BDB equipment fuel consumption and required re-fill strategies, and to determine preferred travel pathways using the guidance contained in NEI 12-06. The pathways will attempt to avoid areas with trees, power lines, and other potential obstructions.	
3.2.1.A	Specify which analysis performed in WCAP-17601 is being applied to your site. Additionally, justify the use of that analysis by identifying and evaluating the important parameters and assumptions demonstrating that they are representative of your site and appropriate for simulating the ELAP transient.	
3.2.1.1.A	A discussion regarding the use of CENTS code in the ELAP analysis for CE plants which shows that the code is limited to analyzing the flow conditions before reflux boiling initiates is needed. This discussion should provide a justification for how the initiation of reflux boiling is defined.	
3.2.1.2.A	The RCP seal initial maximum leakage rate should be greater than or equal to the upper bound expectation for the seal leakage rate for the ELAP event (15 gpm/seal) discussed in the PWROG white paper addressing the RCP seal leakage for CE plants. If the RCP seal leakage rate used in the plant-specific ELAP analysis is less than upper bound expectation for the seal leakage rate discussed in the whitepaper, justification should be provided.	

Item Number	Description	Notes
3.2.1.6.A	SOE action Item 5 indicates that the ELAP is declared at 45 minutes, and Action Item 6 indicates that at 50 minutes (5 minutes after the declaration of the ELAP), the operator controls SG ADVs and AFW flow locally as an on-going action for cooldown and decay heat removal. On page 105 of the integrated plan in Attachment 1B NSSS Significant Reference Analysis Deviation Table, the licensee notes in item 6 that cooldown starts at 2 hours at 75 degrees F/hr. to a SG pressure of 135 psia. Clarification is needed to correct this apparent inconsistency.	
3.2.1.6.B	The licensee did not provide a discussion regarding the operator actions required to control SG ADVs and AFW flow and justification is needed to determine that all the required operator actions are reasonably achievable within the required time constraint of 50 minutes during the ELAP conditions, or a discussion regarding the required cooldown completion time that is supportable by analysis.	
3.2.1.6.C	On page 107 of the integrated Plan, the licensee provided an open item to verify response times listed in the SOE timeline and perform staffing assessment.	
3.2.2.A	Following a BDB event, a vent pathway would be required in the event of SFP bulk boiling and can be established by opening the Fuel Building roll-up doors for inlet and outlet air flow. However the licensee's strategy for providing air flow to remove steam generated from pool boiling is not clear. The path for inlet and exhaust air is apparently the same i.e., the fuel building rollup doors. It is not clear from the discussion provided how this will enable a flow path to vent the steam and condensate from the Fuel Building.	
3.2.3.A	During the audit process the licensee stated that the details of the long term containment cooldown and depressurization strategies for MPS2 are still under development. Upon selection of the preferred strategy, detailed GOTHIC analysis will be performed to document and validate the strategy and also to provide operators with timelines and guidelines for actions to insure the long term integrity of the containment throughout the Phase 3 of the postulated ELAP/LUHS scenario. The Phase 3 containment cooldown and depressurization strategy will be completed per the schedule given in the August 23, 2013 6-month update and the results will be provided in the February 2014 6-month update.	
3.2.4.2.A	The ventilation evaluation will be completed later this year and the results will be provided in the February 2014 Six-Month Update.	
3.2.4.4.A	A lighting study will be performed to validate the adequacy of existing lighting and the adequacy and practicality of using portable lighting to perform FLEX strategy actions. Additional portable lighting or necessary modifications may be identified in the lighting study to be performed.	
3.2.4.4.B	The staff has reviewed the licensee's communications assessment however confirmation will be required that upgrades to the site's communications systems have been completed.	

Item Number	Description	Notes
3.2.4.6.A	Additional information is needed regarding habitability of the MCR during the ELAP. NUMARC 87-00 provides the technical basis for this habitability standard as MIL-STD-1472C, which concludes that 110 degrees F is tolerable for light work for a 4 hour period while dressed in conventional clothing with a relative humidity of approximately 30%.	
3.2.4.7.A	Westinghouse is currently performing analysis which will determine the consequences of usage of impure water sources in the steam generators. The results of the analysis are expected to provide the allowed time limits on usage of these sources. The RRC will provide equipment to initiate RHR and water treatment equipment such that heat removal can be ensured for extended durations. Updated strategies for RCS inventory and core cooling utilizing the RRC equipment will be provided in the February 2014 Six-Month Status Update. The final results of the Westinghouse analysis are expected in March 2014 and will be provided in a subsequent 6-month update.	
3.2.4.9.A	A secondary source for fuel oil will be the MPS3 Diesel Fuel Oil Storage Tanks. These underground tanks contain a minimum of 32,670 gallons of fuel oil. They are seismic and missile protected. However, a pump will be required to transfer this fuel to drums. An evaluation of all BDB equipment fuel consumption and required re-fill strategies will be developed including any gasoline required for small miscellaneous equipment.	
3.2.4.10.A	The licensee has completed an analysis of the battery capability regarding expected time available with ac power. Site specific procedural guidance governing load stripping will be developed. The licensee specified that they will perform an analysis to develop electrical components performance requirements and confirm electrical loading-related strategy objectives can be met.	
3.4.A	The licensee's plans for the use of off-site resources conform to the minimum capabilities specified in NEI 12-06 Section 12.2, with regard to the capability to obtain equipment and commodities to sustain and backup the site's coping strategies (item 1 above), however the licensee should address the remaining items 2 through 10.	

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

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

DOMINION NUCLEAR CONNECTICUT, INC.

MILLSTONE POWER STATION, UNIT 3

DOCKET NO. 50-423

1.0 INTRODUCTION

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

By letter dated February 28, 2013 [Reference 2], Dominion Nuclear Connecticut, Inc. (Dominion, the licensee) submitted its Overall Integrated Plan (hereafter referred to as the Integrated Plan) for Millstone Power Station, Units 2 and 3 (MPS2 and MPS3), in response to Order EA-12-049. The Integrated Plan describes the guidance and strategies under development for implementation by Dominion 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 April 30, 2013 [Reference 22], Dominion submitted an update to the Overall Integrated Plan. As further required by the order, by letter dated August 23, 2013 [Reference 3], Dominion submitted a six-month update to the Overall 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 whether the agency should make improvements to these programs in light of the events at Fukushima Dai-ichi. As a result of this review, the NTTF developed a comprehensive set of recommendations, documented in SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated July 12, 2011 [Reference 4]. These recommendations were enhanced by the NRC staff following interactions with stakeholders. Documentation of the NRC staff's efforts is contained in SECY-11-0124, "Recommended Actions to be Taken without Delay from the Near-Term Task Force Report," dated September 9, 2011 [Reference 5] and SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," dated October 3, 2011 [Reference 6].

As directed by the Commission's Staff Requirement Memorandum (SRM) for SECY-11-0093 [Reference 7], the NRC staff reviewed the NTTF recommendations within the context of the NRC's existing regulatory framework and considered the various regulatory vehicles available to the NRC to implement the recommendations. SECY-11-0124 and SECY-11-0137 established the NRC staff's prioritization of the recommendations based upon the potential safety enhancements.

After receiving the Commission's direction in SRM-SECY-11-0124 [Reference 8] and SRM-SECY-11-0137 [Reference 9], the NRC staff conducted public meetings to discuss enhanced mitigation strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities following BDBEEs. At these meetings, the industry described its proposal for a Diverse and Flexible Mitigation Capability (FLEX), as documented in the Nuclear Energy Institute's (NEI's) letter, dated December 16, 2011 [Reference 10]. FLEX was proposed as a strategy to fulfill the key safety functions of core cooling, containment integrity, and spent fuel cooling. Stakeholder input influenced the NRC staff to pursue a more performance-based approach to improve the safety of operating power reactors than envisioned in NTTF Recommendation 4.2, SECY-11-0124, and SECY-11-0137.

On February 17, 2012, the NRC staff provided SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," [Reference 11] to the Commission, including the proposed order to implement the enhanced mitigation strategies. As directed by SRM-SECY-12-0025 [Reference 12], the NRC staff issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" [Reference 1].

Order EA-12-049, Attachment 2,[1] requires that operating power reactor licensees and construction permit holders use a three-phase approach for mitigating BDBEEs. The initial 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 [UHS] 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

[1] Attachment 3 provides the requirements for Combined License holders

Federal Register (77 FR 33779), with the comment period running through July 7, 2012. JLD-ISG-2012-01 proposed endorsing NEI 12-06, Revision B1, as providing an acceptable method of meeting the requirements of Order EA-12-049. The NRC staff received seven comments during this time. The NRC staff documented its analysis of these comments in "NRC Response to Public Comments, JLD-ISG-2012-01 (Docket ID NRC-2012-0068)" [Reference 16].

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

On August 29, 2012, the NRC staff issued the final version of JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" [Reference 19], endorsing NEI 12-06, Revision 0, as an acceptable means of meeting the requirements of Order EA-12-049, and published a notice of its availability in the *Federal Register* (77 FR 55230).

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

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

6. Description of how the portable FLEX equipment will be available to be deployed in all modes.

By letter dated August 28, 2013 [Reference 20], the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049. That letter described the process to be used by the staff in its reviews, leading to the issuance of an interim staff evaluation and audit report for each site. The purpose of the staff's audits is to determine the extent to which licensees are proceeding on a path towards successful implementation of the actions needed to achieve full compliance with the order. Additional NRC staff review and inspection may be necessary following full implementation of those actions to verify licensees' compliance with the order.

3.0 TECHNICAL EVALUATION

The NRC staff contracted with MegaTech Services, LLC (MTS) for technical support in the evaluation of the Integrated Plan for MPS3, submitted by Dominion's letter dated February 28, 2013, as supplemented. NRC and MTS staff have reviewed the submitted information and held clarifying discussions with Dominion in evaluating the licensee's plans for addressing BDBEEs and its progress towards implementing those plans.

A simplified description of the MPS3 Integrated Plan to mitigate the postulated extended loss of ac power (ELAP) event is that the licensee will initially remove the core decay heat by adding water to the steam generators (SGs) and releasing steam from the SGs to the atmosphere. The water will initially be added by the unit's turbine-driven auxiliary feedwater (TDAFW) pump, taking suction from the unit's demineralized water storage tank (DWST). The MPS3 UFSAR states that the DWST is designed to withstand seismic events and tornado borne missiles. The reactor coolant system (RCS) will be cooled down to about 418 degrees Fahrenheit (°F) in the cold legs by releasing steam from the SGs, which will reduce the RCS and SG pressures and allow some injection of borated water into the RCS cold legs from the safety injection accumulators. When the TDAFW pump can no longer be operated reliably, a FLEX pump will be used to add water to the SGs. Borated water will be added to the RCS using a diesel-driven high-pressure FLEX pump, with suction from the unit's refueling water storage tank (RWST) or a portable boric acid mixing tank.

FLEX generators will be used to reenergize the 120 volt ac instrument buses before the batteries supplying those buses are depleted. The licensee stated that they will utilize the industry Regional Response Centers (RRCs) for supplies of phase 3 equipment, which will supplement the Phase 2 equipment stored onsite.

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

MPS3 has a containment building which contains the RCS. According to the UFSAR, the containment was originally designed as a subatmospheric containment, but is now operated at approximately atmospheric pressure. The licensee stated that evaluations have been performed and concluded that containment temperature and pressure will remain below design limits and key parameter instruments subject to the containment environment will remain functional for at least 7 days. Therefore, actions to reduce containment temperature and pressure and ensure continued functionality of the key parameters will not be required prior to this time; these actions will utilize off-site equipment and resources during Phase 3. The licensee stated that the details of the long term containment cooldown and depressurization strategies are still under development and that the licensee will perform additional analyses on the long-term response of the containment.

By letter dated January 8, 2014 [Reference 21], MTS documented the interim results of the Integrated Plan review in the attached technical evaluation report (TER). The NRC staff has reviewed this TER for consistency with NRC policy and technical accuracy and finds that it accurately reflects the state of completeness of the Integrated Plan. The NRC staff therefore adopts the findings of the TER with respect to individual aspects of the requirements of Order EA-12-049.

4.0 OPEN AND CONFIRMATORY ITEMS

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

> 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.
>
> 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.

As discussed in Section 3.0, above, the NRC staff has reviewed MTS' TER for consistency with NRC policy and technical accuracy and finds that, in general, it accurately reflects the state of completeness of the licensee's Integrated Plan. The open and confirmatory items identified in the TER are listed in the tables below, with some NRC edits made for clarity from the TER version. Thus, the summary tables presented below, as edited, provide a brief description of the issue of concern and represent the NRC's assessment of the open and confirmatory items for MPS3 under this review. Further details for each open and confirmatory item are provided in the corresponding sections of the TER, identified by the item number. The NRC staff notes that for Open Item 3.2.1.8.A on boric acid mixing, the staff has now endorsed the August 2013, Pressurized-Water Reactor Owners Group (PWROG) position paper, with several clarifications, which the licensee will need to address. The NRC endorsement letter is dated January 8, 2014, and is publicly available (ADAMS Accession No. ML13276A183).

In the table below, the NRC staff made the following change compared to the original summary tables in the TER:

1. Open Item 3.2.1.8.A was revised to show the recent NRC endorsement of the PWROG position paper on boric acid mixing under natural circulation conditions.

2. Open Item 3.2.1.2.B was revised to be a Confirmatory Item.

3. Open Item 3.2.1.2.C was revised to be a Confirmatory Item.

4. Confirmatory Item 3.1.2.2.A was deleted as the flooding reevaluation is part of a different NRC initiative (NTTF Recommendation 2.1) and is not scheduled to be completed for MPS3 until after the compliance date of the Mitigation Strategies Order.

5. Confirmatory Item 3.2.3.B was deleted as the licensee has committed to follow the NEI position paper that provides generic resolution of this item, and was endorsed by the NRC by letter dated September 30, 2013 (ADAMS Accession No. ML13267A382).

4.1 Open Items

Item Number	Description	Notes
3.2.1.8.A	Core Sub-Criticality - The PWROG submitted to NRC a position paper, dated August 15, 2013, which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlined applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available. During the audit process, the licensee informed the NRC staff of its intent to abide by the generic approach discussed above. The licensee should address the clarifications in the NRC endorsement letter dated January 8, 2014.	

4.2 Confirmatory Items

Item Number	Description	Notes
3.1.1.2.A	The licensee stated that the haul path from the BDB Storage Building to the MPS3 equipment deployment locations and the building foundation design evaluations are proceeding for Millstone. Confirm that soil liquefaction is not a concern.	
3.1.1.3.A	The licensee stated that the review for internal flooding sources that could result from seismic induced failures and engine-driven or gravity-drain water sources has not been completed. Also MPS3 does not have a permanent safety-related groundwater removal system installed. However, the Engineered Safety Features building does have a sump to control groundwater in-leakage. In ETE-CPR-2012-0008, Section 11.1.3.3, the licensee stated that they also have several small pumps and hoses on site for this purpose. Confirm that the impact of this in-leakage is limited, or can be addressed.	

Item Number	Description	Notes
3.1.1.4.A	The licensee's plan for implementing the use of off-site resources is not complete. The local assembly areas have not been identified. The licensee is also evaluating the possibility of boat transport for personnel.	
3.2.1.A	Confirm that the NOTRUMP analysis provided in Section 5.2.1 of WCAP-17601-P, Revision 1 is applicable to MPS3 and supports the licensee's sequence of events.	
3.2.1.1.A	Confirm that the use of the NOTRUMP code for the ELAP analysis is limited to the flow conditions prior to reflux condensation initiation. This includes specifying an acceptable definition for reflux condensation cooling.	
3.2.1.2.A	If the RCP seal leakage rates used in the plant-specific ELAP analyses are less than the upper bound expectation for the seal leakage rate discussed in the PWROG position paper addressing the RCP seal leakage (ADAMS Accession No. ML13235A151 (Non-Publicly Available)) or justification should be provided for use of a lower value. If the seals are changed to non-Westinghouse seals, the acceptability of the use of non-Westinghouse seals should be addressed, and the RCP seal leakage rates for use in the ELAP analysis should be justified.	
3.2.1.2.B	For Westinghouse Reactor Coolant Pump (RCP) seals, a discussion (including the applicable analysis and relevant seal leakage testing data) should be provided to justify that (1) the integrity of the associated O-rings will be maintained at the temperature conditions experienced during the ELAP event, and (2) the seal leakage rate of 21 gpm/seal used in the ELAP is acceptable.	
3.2.1.2.C	If the seals are changed to the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals, justify the acceptability of the use of the newly designed Generation 3 SHIELD seals or non-Westinghouse seals and the RCP seal leakages rates for use in the ELAP analysis.	
3.2.1.3.A	Confirm that the licensee has addressed the applicability of assumption 4 on page 4-13 of WCAP-17601-P, and confirm that the values used for the requested parameters in the Westinghouse calculations that were performed using the ANS 5.1 1979 +2 sigma decay heat model bound initial condition 3.2.1.2(1) of NEI 12-06, Section 3.2.1.2.	
3.2.1.6.A	The licensee stated that for Action Item 11 the portable boric acid batching tank will be deployed at 12 - 18 hours, if the RWST tank is not available. Confirm that the deployment time of 12 - 18 hours is acceptable.	
3.2.3.A	The strategy for containment cooldown and depressurization will be completed per the schedule given in the August 23, 2013 6-Month Status Update. The detailed validation analysis will be completed later this year and the results will be provided in the	

Item Number	Description	Notes
	February 2014 6-Month Status Update. Confirm that the analysis and the strategy to maintain the containment parameters within acceptable limits is satisfactory.	
3.2.4.2.A	Analyses to evaluate the effects of loss of ventilation in various areas are currently underway. Upon completion of these analyses, detailed strategies and operator action timelines will be developed for the implementation of compensatory measures to maintain the area temperatures below the applicable design limits, if necessary. The results will be provided in the February 2014 6-month update. Confirm that the analyses and the compensatory measures show that room temperatures are acceptable to maintain functionality of the equipment needed to carry out the mitigation strategies.	
3.2.4.2.B	Confirm that the habitability limits of the main control room will be maintained in all Phases of an ELAP.	
3.2.4.4.A	Confirm the adequacy of existing lighting and the adequacy of portable lighting to perform FLEX strategy actions.	
3.2.4.4.B	Confirm that upgrades to the site's communications systems have been completed.	
3.2.4.7.A	Westinghouse is currently performing an analysis to determine the consequences of usage of impure water sources in the steam generators. The results of the analysis are expected to provide the allowed time limits on usage of these sources. The RRC will provide equipment to initiate residual heat removal and water treatment equipment such that heat removal can be ensured for extended durations. Confirm that the analysis results and resultant strategies are acceptable.	
3.4.A	The licensee's plans for the use of off-site resources conform to the minimum capabilities specified in NEI 12-06 Section 12.2, with regard to the capability to obtain equipment and commodities to sustain and backup the site's coping strategies (item 1). Confirm the licensee addresses the remaining items (2 through 10), or provides an appropriate alternative.	

Based on a review of Dominion's plan, including the six-month update dated August 23, 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 for MPS3. 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 BDBEE. These new requirements provide a greater mitigation capability consistent with the overall defense-in-depth philosophy, and, therefore, greater assurance that the challenges posed by BDBEEs to power reactors do not pose an undue risk to public health and safety.

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

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

6.0 REFERENCES

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

2. Letter from Dominion to NRC, "Overall Integrated Plan In Response to March 12, 2012 Commission Order Modifying Licenses With Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated February 28, 2013 (ADAMS Accession No. ML13064A265)

3. Letter from Dominion to NRC, "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 23, 2013 (ADAMS Accession No. ML13242A011)

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

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

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

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

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

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

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

11. SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," February 17, 2012 (ADAMS Accession No. ML12039A103)

12. SRM-SECY-12-0025, "Staff Requirements – SECY-12-0025 - Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," March 9, 2012 (ADAMS Accession No. ML120690347)

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

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

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

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

17. NEI, Comments from Adrian P. Heymer on Draft Interim Staff Guidance JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,", July 3, 2012 (ADAMS Accession No. ML121910390)

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

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

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

21. Letter from John Bowen, MegaTech Services, LLC, to Eric Bowman, NRC, submitting "Technical Evaluation Reports Related to Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, EA 12-049," dated January 8, 2014 (ADAMS Accession No. ML14009A475)

22. Letter from Dominion to NRC, "Supplement to 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 April 30, 2013 (ADAMS Accession No. ML13126A206)

Principal Contributors: S. Sun
J. Kaizer
K. Bucholtz
G. Singh
J. Boska
S. Gardocki
E. Bowman
B. Heida

Date: January 31, 2014

Enclosure 4

Millstone Power Station, Unit 3

Technical Evaluation Report

MEGA-TECH SERVICES LLC

Mega-Tech Services, LLC

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

Dominion Nuclear Connecticut, Inc
Millstone Power Station, Unit 3
Docket No. 50-423

Revision 1

January 08, 2014

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. MF0859

Prepared by:

Mega-Tech Services, LLC
11118 Manor View Drive
Mechanicsville, Virginia 23116

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, Mitigation 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. ML13064A265), as supplemented by a letter dated April 30, 2013, (ADAMS Accession No. ML13126A206), and as supplemented by a letter dated August 23, 2013, (ADAMS Accession No. ML13242A011), Dominion Nuclear Connecticut, Inc (hereinafter referred to as the licensee) provided the Integrated Plan for Compliance with Order EA-12-049 for Millstone Power Station Unit 3 (MPS3). The Integrated Plan describes the strategies and guidance under development for implementation by the licensee for the maintenance or restoration of core cooling, containment, and SFP cooling capabilities following a BDBEE, including modifications necessary to support this implementation, pursuant to Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the NRC 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 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 (LUHS). These hazards are broadly grouped into the categories discussed below in Sections 3.1.1 through 3.1.5 of this evaluation. Characterization of the applicable hazards for a specific site includes the identification of realistic timelines for the hazard; characterization of the functional threats due to the hazard; development of a strategy for responding to events with warning; and development of a strategy for responding to events without warning.

3.1.1 Seismic Hazard

NEI 12-06, Section 5.2 states:

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

On page 1 of the Integrated Plan the licensee stated that the MPS3 seismic hazard is considered to be the earthquake magnitude associated with the design basis seismic event. Per the FSAR, the safe shutdown earthquake (SSE) produces a maximum horizontal ground acceleration of 0.17g and a vertical ground acceleration of 0.11 g. Thus, MPS3 screens in for the seismic hazard.

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.

In the August 2013 Integrated Plan update, the licensee stated that a single 10,000 sq-ft. Type 1 building will be constructed for storage of BDB equipment. Per licensee engineering evaluation ETE-CPR-2012-0008 Rev. 1, a Type 1 building is a concrete, tornado missile protected building that meets SSE requirements.

Additionally the licensee stated in the Integrated Plan that the BDB pumps, necessary hoses and fittings, debris clearing equipment, supplemental lighting/communications equipment, are protected from seismic events while stored in the BDB storage building or in protected areas of the plant. In ETE-CPR-2012-0008 Rev. 1, the licensee stated that stored equipment and the structures will be evaluated and protected from seismic interactions, and that large portable equipment will be secured inside the storage building to protect them during a seismic event.

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

3.1.1.2 Deployment of FLEX Equipment - Seismic Hazard

NEI 12-06, Section 5.3.2 states:

> 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.

On pages 29-31 of the Integrated Plan, the licensee stated that the BDB High Capacity pump will be stored in the BDB storage building. The BDB demineralized water storage tank (DWST) suction/fill connection consists of a piping tee fitting installed in the turbine driven auxiliary feedwater (TDAFW) pump suction line. The connection will be located within the engineered safety features (ESF) building. The BDB DWST suction/fill and discharge connections will be located within the seismic Category 1, tornado missile protected ESF building.

The alternate auxiliary feedwater (AFW) pump discharge BDB connection will be located within the seismic Category 1 missile protected main steam valve building (MSVB). The steam generator blow down (SGBD) piping is not seismically-designed; therefore, this connection may not be available following a seismic event. The connection will be protected from the other external hazards.

On pages 43 and 44 of the Integrated Plan, the licensee stated that the portable BDB reactor coolant system (RCS) injection pump will be transported from a BDB storage building and positioned in the protected area (PA) adjacent to the DWST. The primary suction and discharge connections located in the "A" Safety Injection (SI) Pump cubicle and are seismically designed and located inside the ESF building, which provides high wind and associated missile protection. The RCS alternate makeup connection is seismically designed and located inside the ESF building, which provides high wind and associated missile protection.

On page 56 of the Integrated Plan, the licensee stated that the primary coping strategy for SFP cooling is to utilize the fire truck or BDB high capacity pump to provide makeup water flow to the pool. The water will be drawn from the barge slip to the pool through a flexible hose connected to the pre-installed seismically designed and robustly missile protected SFP makeup connection installed on the south wall of the Fuel Building (FB) loading bay area which provides flow directly into the pool.

A new BDB pipe connection on south interior wall of the FB loading bay will be installed. The piping will be seismically designed and missile protected. The BDB pipe connection for the SFP will tie into an existing open ended line which will discharge directly into the SFP.

In the August 6-month update the licensee provided a revised strategy for deployment of the portable diesel generators (DGs) used to re-power the 120VAC vital bus circuits. Two 120/240VAC DGs will be pre-staged in separate areas of an existing protected MPS3 building (building 322). The DGs do not require transport to be placed in service.

The licensee also stated that the connection strategy is changed in that permanently installed cables from receptacles located by the 120/240VAC DGs in building 322 will be run to receptacles located in switchgear room A. Additionally, receptacles will be permanently connected to the vital bus panels VIAC1 and VIAC3, and the connections between the DG and the nearby receptacles and between the switchgear room receptacles and the vital bus panels will be made with plug-in jumper cables. The 480VAC DG, which is the alternate approach to re-power the 120VAC vital buses, will be stored in the BDB storage building and transported to its deployment location when needed. The 480VAC DG will be connected directly to bus 32T via an installed spare breaker cubicle.

On page 67 of the Integrated Plan, the licensee stated that the 4160 VAC portable DG will be brought in from the Regional Resource Center (RRC) and deployed to an area between the MPS3 emergency diesel generator building. The 4160 VAC BDB connections receptacles will be mounted in a Class 1 structure protected from wind, generated missiles, flooding and extreme temperatures. Therefore, the connection will be protected from the applicable extreme external hazards.

On page 71 of the Integrated Plan, the licensee stated that the connection to access the primary fuel supply in the refueling strategy are the connections from the drain valves of the MPS2 diesel day tanks located on the 38 ft. 6 in. level of the MPS2 Auxiliary Building (AB). These tanks are seismically designed and are located in structures that are protected from the extreme external hazards.

On page 101 of the Integrated Plan, the licensee identified two tow vehicles, hose trailers and utility vehicles as part of the Phase 2 equipment located in the storage building.

On page 93 of the Integrated Plan, the licensee stated that a potential impairment to required access is various doors and gates. Following an ELAP event, FLEX coping strategies require the routing of hoses and cables to be run through various barriers in order to connect BDB equipment to station fluid and electric systems. The licensee also stated that for this reason, certain barriers (gates and doors) will be opened and remain open, and that this violation of normal administrative controls is acknowledged and is acceptable during the implementation of FLEX coping strategies.

The security doors and gates of concern are those barriers that rely on electric power to operate opening and/or locking mechanisms. The Security force will initiate an access contingency upon loss of the Security Diesel and all AC/DC power as part of the Security Plan. Access to the Owner Controlled Area, site PA, and areas within the plant structures will be controlled under this access contingency. Vehicle access to the PA is via the double gated sally-port at the Security building. As part of the Security access contingency, the sally-port gates will be manually controlled to allow delivery of BDB equipment (e.g., generators, pumps) and other vehicles such as debris removal equipment into the PA.

On page 110 of the Integrated Plan, the licensee stated that preferred travel pathways will be determined using the guidance contained in NEI 12-06. The pathways will attempt to avoid areas with trees, power lines, and other potential obstructions and will consider the potential for soil liquefaction. However, debris can still interfere with these preferred travel paths. Debris removal equipment will be kept in the BDB Storage Building so that it is protected from the severe storm, earthquake and flood hazards. Therefore, the debris removal equipment remains functional and deployable to clear obstructions from the travel pathways to the BDB equipment's deployed location(s). During the audit process the licensee stated that the haul path from the BDB storage building to the MPS3 equipment deployment locations and the building foundation design evaluations are proceeding for Millstone. If the results of the evaluations identify that the potential for soil liquefaction is a concern, alternate deployment routes or pathway repairs will be evaluated to eliminate this deployment issue. The evaluations are scheduled to be completed by the first quarter 2014. Results of the evaluations will be provided in a subsequent 6-month status update. This has been identified as Confirmatory Item 3.1.1.2.A in Section 4.2.

NEI 12-06, Section 5.3.2, Consideration 3, does not apply to MPS3 as the site is located adjacent to Long Island Sound and therefore downstream dams are not considered.

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

3.1.1.3 Procedural Interfaces - Seismic Hazard

NEI 12-06, Section 5.3.3 states:

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

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

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

On page 17 of the Integrated Plan, the licensee stated that FLEX Support Guidelines (FSG's) will be developed in accordance with Pressurized Water Reactors Owners Group (PWROG) guidance and that existing Emergency Operating Procedures (EOPs) and Abnormal Operating Procedures (AOPs) will be revised. The licensee stated that plant procedures EOP ECAO.0, "Loss of All AC Power," AOP 3569, "Severe Weather Conditions," AOP 3570, "Earthquake," and EOP 3505A, "Loss of Spent Fuel Pool Cooling," will be revised to the extent necessary to include appropriate reference to FSGs.

The licensee stated that Regulatory Screening/Evaluation NEI 96-07, Revision 1, and NEI 97-04, Revision 1, will be used to evaluate the changes to existing procedures as well as to the FSG to determine the need for prior NRC approval and that changes to procedures that perform actions in response events that exceed a site's design basis should, per the guidance and examples provided in NEI 96-07, Rev. 1, screen out. Therefore, procedure steps which recognize the BDB ELAP/LUHS has occurred and which direct actions to ensure core cooling, SFP cooling, or containment integrity should not require prior NRC approval.

The licensee was requested to provide information regarding NEI 12-06, Section 5.3.3, considerations 1, 2 and 3. During the audit process, the licensee stated that FLEX Support Guideline 7, "Loss of Vital Instrumentation or Control Power" is being developed to enable plant personnel to obtain instrument readings locally at the containment penetrations. The guideline will provide the penetration number and cable contacts to be used to determine a parameter's value. Portable meters will be used to produce a display which will then be compared to a conversion chart included in the guideline to determine the converted parametric value of the readout. Key instrumentation required to implement the FLEX strategies can be accessed using this method. The guideline will include conditions required to access the areas needed to get the readings and special tools and equipment required to take the readings.

Additionally, the licensee stated that the review for internal flooding sources that could result from seismic induced failures and engine-driven or gravity-drain water sources has not been completed. Also the licensee stated that MPS3 does not have a permanent safety-related groundwater removal system installed. However, the ESF building does have a sump to control groundwater in-leakage. In ETE-CPR-2012-0008, Section 11.1.3.3, the licensee stated that they also have several small pumps and hoses on site for this purpose, however an evaluation of the impact of this in-leakage has not been completed. The results of these evaluations will be included in a future 6-month update to the Integrated Plan. These issues have been identified as Confirmatory Item 3.1.1.3.A in Section 4.2.

Consideration 4 does not apply to MPS3 as the site is located adjacent to Long Island Sound.

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 seismic hazards, if these requirements are implemented as described.

3.1.1.4 Considerations in Using Offsite Resources - Seismic Hazard

NEI 12-06, Section 5.3.4 states:

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

On page 20 of the Integrated Plan, the licensee stated that they will participate in the process for support of the RRCs as required for additional Phase 3 equipment. Equipment will be moved from an RRC to a local Assembly Area, established by the Strategic Alliance for FLEX Emergency Response (SAFER) team and the utility. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request. In ETE-CPR-2012-0008 Rev. 1, the licensee stated that in the event of damage to roadways, arrangements have been made with the state of Connecticut for use of helicopters for delivery of RRC equipment to the site.

The licensee's plan for implementing the use of off-site resources is not complete. The local assembly areas have not been identified. The licensee is also evaluating the possibility of boat transport for personnel. This has been identified as Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.2 Flooding Hazard

NEI 12-06, Section 6.2 states:

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

NEI 12-06, Section 6.2.1 states:

> Susceptibility to external flooding is based on whether the site is a "dry" site, i.e., the plant is built above the design basis flood level (DBFL). For sites that are not "dry", water intrusion is prevented by barriers and there could be a potential for those barriers to be exceeded or compromised. Such sites would include those

that are kept "dry" by permanently installed barriers, e.g., seawall, levees, etc., and those that install temporary barriers or rely on watertight doors to keep the design basis flood from impacting safe shutdown equipment.

On pages 1 and 2 of the Integrated Plan the licensee stated the only sources of flooding that could affect MPS are direct rainfall and storm surge, and that since there are no major rivers or streams in the vicinity of the station, the effects of potential dam failures are not applicable. The highest flooding has resulted from the passage of hurricanes. For a probable maximum hurricane, the maximum still water level was determined to be +19.7 feet Mean Sea Level (MSL) with an associated wave runup elevation of +23.8 feet MSL.

The licensee also stated that the effect of local intense precipitation has been evaluated for existing structures containing safety-related equipment, and that it was determined that the water accumulation from this precipitation would not have an adverse effect on safety related equipment per MPS3 FSAR Section 2.4.1. Additionally MPS is located on the North Atlantic coastline where there is an extremely low probability of tsunamis per MPS3 FSAR Section 2.4.6, and therefore, tsunamis are not considered to be credible natural phenomena which might affect the safety of either unit at the MPS site.

During the audit process, the licensee stated that the MPS Unit 3 FSAR does include seiche conditions, but states that the Probable Maximum Hurricane (PMH) surge is the more significant flooding event at the MPS site. Additionally, the licensee stated that preliminary results of the Flooding Hazards Re-evaluation being performed in response to NTTF Recommendation 2.1 regarding flooding have concluded that: potential forcing mechanisms for seiches in the discharge basin are generally weak and not capable of forcing a significant seiche. Additionally, potential seiches would be damped by irregularities in the basins, and therefore the licensee does not consider a seiche as a beyond-design-basis external event applicable to MPS3.

In ETE-CPR-2012-0008 Rev. 1, the licensee stated that flooding from a precipitation event would last only as long as the precipitation occurred and that rainfall would drain from the site rapidly through storm drains and by runoff, and that the site would have days of warning before a hurricane and the flooding conditions would also rapidly dissipate.

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.

In the August 2013 Integrated Plan update, the licensee stated that a single 10,000 sq-ft. Type 1 building will be constructed for storage of BDB equipment. Per licensee engineering evaluation ETE-CPR-2012-0008 Rev. 1, a Type 1 building is a concrete, tornado missile protected building that meets SSE requirements. The building will be located above the flood elevation from the most recent site flood analysis.

On pages 28, 70, 71 and 77 of the Integrated Plan, the licensee stated that the BDB pumps, necessary hoses and fittings, equipment for clearing potential obstructions which could inhibit mobility of the fuel carts and fuel transfers, light and communications equipment are protected from flooding events while stored in the BDB Storage Building or in protected areas of the plant.

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

3.1.2.2 Deployment of FLEX Equipment - Flooding Hazard

NEI 12-06, Section 6.2.3.2 states:

There are a number of considerations which apply to the deployment of FLEX equipment for external flood hazards:

1. For external floods with warning time, the plant may not be at power. In fact, the plant may have been shut down for a considerable time and the plant configuration could be established to optimize deployment. For example, the portable pump could be connected, tested, and readied for use prior to the arrival of the critical flood level. Further, protective actions can be taken to reduce the potential for flooding impacts, including cooldown, borating the RCS, isolating accumulators, isolating reactor coolant pump (RCP) seal leak off, obtaining dewatering pumps, creating temporary flood barriers, etc. These factors can be credited in considering how the baseline capability is deployed.

2. The ability to move equipment and restock supplies may be hampered during a flood, especially a flood with long persistence. Accommodations along these lines may be necessary to support successful long-term FLEX deployment.

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

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

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

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

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

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

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

During the audit process, the licensee stated that since MPS3 is designated as a "Dry" site, there are no pre-deployment activities or pre-staged equipment required for successful implementation of the FLEX mitigation strategies. A figure providing the location of the storage building on the MPS site and the depiction of the main and alternate haul routes was provided, which shows the difference in the Unit 2 and 3 site elevations and the flooding associated with the MPS3 CLB hurricane storm surge stillwater level. The licensee provided MPS3-Q8, "BDB Haul Route", which depicts additional site haul route details.

On pages 26 and 27 of the Integrated Plan, the licensee stated that the primary AFW pump discharge connection for SG injection will be located on the TDAFW pump discharge header in the TDAFW pump cubicle located in the ESF building. The licensee also stated that a flexible hose will be routed from the BDB AFW pump discharge to the primary connection through the ESF building, which is a seismic Category 1, tornado missile protected structure.

The licensee also stated that in the event that the primary AFW pump discharge connection is not available, an alternate connection will be provided, which will be located in the SGBD system at the 56 ft. elevation of the MSVB, which is separate from the TDAFW pump cubicle.

The licensee also stated that a flexible hose is routed from the BDB AFW pump discharge to the alternate connection hose adapter through the MSVB, located inside the seismic Category 1, tornado missile protected MSVB. The licensee also stated that portions of the SGBD piping are not seismically-designed and some piping enters the Turbine Building (TB), therefore, this connection may not be available following a seismic or tornado event, and that the alternate connection is protected against the other external hazards and provides diversity from the primary connection which is protected against all hazards.

On pages 29 to 31 of the Integrated Plan, the licensee stated that the fire truck or the BDB High Capacity pump will be deployed to transfer water from Long Island Sound to fill the DWST or directly provide the suction for the BDB AFW pump. Figure 1 in the Integrated Plan identifies the deployed location of BDB equipment and routing of hoses, relative to plant structures and other features, necessary to implement this strategy."

The licensee stated that the BDB high capacity pump will be deployed near the barge slip and that a flexible hose will be routed from the pump discharge quick-connect hose fitting to a distribution manifold. From this manifold, a hose will be routed to the BDB DWST suction/fill connection located in the TDAFW pump cubicle. The pump discharge hose will be routed along the ground and access to the BDB DWST suction/fill connection is through the ESF building.

On page 56 of the Integrated Plan, the licensee stated that the new BDB pipe connections on the south interior wall of the Fuel Building loading bay area will not be subject to flooding and will be seismically designed.

In the August 6-month update the licensee provided a revised strategy for deployment of the portable diesel generators (DGs) used to re-power the 120VAC vital bus circuits. Two 120/240VAC diesel generators (DGs) will be pre-staged in separate areas of an existing protected MPS3 building No. 322. The DGs do not require transport to be placed in service.

The licensee also stated that the connection strategy is changed in that permanently installed cables from receptacles located by the 120/240VAC DGs in building 322 will be run to receptacles located in switchgear room A. Additionally, receptacles will be permanently connected to the vital bus panels VIAC1 and VIAC3, and the connections between the DG and the nearby receptacles and between the switchgear room receptacles and the vital bus panels will be made with plug-in jumper cables. The 480VAC DG, which is the alternate approach to re-power the 120VAC vital buses, will be stored in the BDB storage building and transported to its deployment location when needed. The 480VAC DG will be connected directly to Bus 32T via an installed spare breaker cubicle.

On page 67 of the Integrated Plan, the licensee stated that the 4160 VAC portable DG will be brought in from the RRC and deployed to an area between the MPS3 Emergency Diesel Generator Building. From there the cables will be run to the 4160 VAC BDB connection receptacles which will be accessible through the service building.

On page 69 of the Integrated Plan, the licensee stated that fuel is required for BDB equipment during Phase 2 and Phase 3 of the coping strategy. The primary source of fuel oil for portable equipment will be the MPS2 diesel day tanks. These tanks contain 26,000 gallons of diesel fuel, are seismically mounted and missile protected, and are located on the 38 ft.6 in. level of the MPS2 AB, so they are well above the flood plain. Additionally, being approximately 24 feet above the MPS2 grade, gravity can be used to transfer the oil to drums for transporting the fuel to the portable equipment.

On page 98 of the Integrated Plan, the licensee stated that Phase 3 involves the receipt of equipment from offsite sources including the RRC and various commodities such as fuel and supplies, and that transportation of these deliveries can be through airlift or via ground transportation.

During the audit process the licensee stated that FLEX equipment will include two John Deere 6125M cab tractors and one Caterpillar 924H front-end Loader and will be located in the BDB storage facility.

The licensee did not specifically address NEI 12-06 Section 6.2.3.2, consideration 7 regarding the need for dewatering or extraction pumps, and consideration 8 regarding the need for temporary flood barriers. During the audit process the licensee provided the following information: 1) no subsurface groundwater drainage pumping system is installed, and per FSAR Section 2.4.12.5, there is no safety related dewatering system for groundwater, and 2) safety related structures are designed for water pressure and buoyancy forces applied from their respective foundation levels, therefore dewatering is not necessary to ensure the stability of any structure; however enough leakage occurs to require pumping for equipment protection. The licensee stated that they have several small pumps and hoses on site for this purpose. Per licensee engineering evaluation ETE-CPR-2012-0008 Rev. 1, the licensee stated that currently there is no planned deployment of flood barriers required at MPS3 as the site is a dry site, and that the need is unlikely because the current precipitation rates will not change for the new evaluation. However the licensee stated that pending completion of the flooding re-evaluation, temporary flood barriers may be required. Review of the flood re-evaluations regarding the potential need for temporary flood barriers has been identified as Confirmatory Item 3.1.2.2.A in Section 4.2.

During the audit process, the licensee stated that, regarding consideration 6, MPS3 is above the potential MPH storm surge and would not be impacted by flooding concerns. Per the specifications for the BDB diesel powered components, 12 hour fuel tanks will be provided with the BDB components and these components will be stored with fuel in their tanks in the BDB storage building, and 12 hours is more than sufficient time to allow the storm conditions to subside and will facilitate refueling of BDB components from available onsite fuel sources when required.

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

3.1.2.3 Procedural Interfaces - Flooding Hazard

NEI 12-06, Section 6.2.3.3 states:

> The following procedural interface considerations should be addressed.

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

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

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

Section 3.1.1.3 above discusses various procedures to be revised and/or developed for the ELAP regarding environmental hazards. Additionally, Regulatory Screening/Evaluation NEI 96-07, Revision 1, and NEI 97-04, Revision 1, will be used to evaluate the changes to existing procedures as well as to the FSG to determine the need for prior NRC approval.

During the audit process, the licensee stated that no subsurface groundwater drainage pumping system is installed. Per FSAR Section 2.4.12.5, there is no safety related dewatering system for groundwater. Safety related structures are designed for water pressure and buoyancy forces applied from their respective foundation levels. Dewatering is not necessary to ensure the stability of any structure; however enough leakage occurs to require pumping for equipment protection. The licensee stated that they have several small pumps and hoses on site for this purpose.

Additionally per licensee engineering evaluation ETE-CPR-2012-0008 Rev. 1, the licensee stated that there are no flood barriers required at MPS3 as the site is a dry site, but that the need is unlikely because the current precipitation rates will not change for the new evaluation. Pending completion of the flooding re-evaluation, guidance for potential use of temporary flood barriers may be required, however this evaluation is not complete. This has been combined with Confirmatory Item 3.1.2.2.A in section 4.2.

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

3.1.2.4 Considerations in Using Offsite Resources - Flooding Hazard

NEI 12-06, Section 6.2.3.4 states:

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

The licensee's plan for implementing the use of off-site resources is not complete. The local assembly areas have not been identified. The licensee is also evaluating the possibility of boat transport for personnel. This has been combined with Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.3 High Wind Hazard

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

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 pages 3 and 4 of the Integrated Plan, the licensee stated that plant design bases address the storm hazards of hurricanes, high winds and tornadoes. Storms of tropical origin occasionally affect the region during the summer and fall months. The licensee stated that according to a statistical study by Simplon and Lawrence (1971), the 50-mile segment of coastline on which MPS is located, was crossed by five hurricanes during the 1886 to 1970 period and that based on observations from Montauk Point (located about 23 miles southeast of MPS on the eastern tip of Long Island), the maximum reported wind speed in the region was associated with the passage of a hurricane during which sustained winds of 115 mph, with short-term gusts up to 140 mph (Dunn and Miller 1960) were observed. For the period from 1961 through 1990, the "fastest-mile" wind speed recorded at Bridgeport was 74 mph occurring with a south wind in September 1985 per the MPS3 FSAR Section 2.3.1.2.

The licensee also stated that according to MPS3 FSAR Section 2.3.1.2.4, a study of tornado occurrences during the period of 1955 through 1967 (augmented by 1968-1981 storm data reports), the mean tornado frequency in the one-degree (latitude-longitude) square where the MPS site is located is determined to be approximately 0.704 per year, per the MPS3 FSAR Section 2.3.1.2. Therefore, MPS3 screens in for high wind hazards.

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

3.1.3.1 Protection of FLEX Equipment - High Wind Hazard

NEI 12-06, Section 7.3.1 states:

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

that are adequately tied down to foundations or slabs to prevent protected equipment from being damaged or becoming airborne. (During a tornado, high winds may blow away metal siding and metal deck roof, subjecting the equipment to high wind forces.)

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

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

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

In the August 2013 Integrated Plan update, the licensee stated that a single 10,000 sq-ft. Type 1 building will be constructed for storage of BDB equipment. Per licensee engineering evaluation ETE-CPR-2012-0008 Rev. 1, a Type 1 building is a concrete, tornado missile protected building that meets SSE requirement, and will meet the plant's design basis for high wind hazards.

On pages 28, 70, 71 and 77 of the Integrated Plan, the licensee stated that the BDB pumps, necessary hoses and fittings, equipment for clearing potential obstructions which could inhibit mobility of the fuel carts and fuel transfers, light and communications equipment are protected from high wind hazards while stored in the BDB storage building or in protected areas of the plant.

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

3.1.3.2 Deployment of FLEX Equipment - High Wind Hazard

NEI 12-06, Section 7.3.2 states:

> There are a number of considerations which apply to the deployment of FLEX equipment for high wind hazards:

1. For hurricane plants, the plant may not be at power prior to the simultaneous ELAP and LUHS condition. In fact, the plant may have been shut down and the plant configuration could be established to optimize FLEX deployment. For example, the portable pumps could be connected, tested, and readied for use prior to the arrival of the hurricane. Further, protective actions can be taken to reduce the potential for wind impacts. These factors can be credited in considering how the baseline capability is deployed.

2. The ultimate heat sink may be one of the first functions affected by a hurricane

due to debris and storm surge considerations. Consequently, the evaluation should address the effects of ELAP/LUHS, along with any other equipment that would be damaged by the postulated storm.

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

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

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

During the audit process, the licensee stated that existing MPS3 hurricane preparation procedures require shutdown of the unit based on projected storm surge and wind speeds. Since MPS3 is designated as a "Dry" site, there are no pre-deployment activities or pre-staged equipment required for successful implementation of the FLEX mitigation strategies.

On page 98 of the Integrated Plan, the licensee stated that Phase 3 involves the receipt of equipment from offsite sources including the RRC and various commodities such as fuel and supplies. Transportation of these deliveries can be through airlift or via ground transportation. Debris removal for the pathway between the site and the RRC receiving location and from the various plant access routes may be required. The same debris removal equipment used for on-site pathways would be used.

On page 96 of the Integrated Plan, the licensee stated that the BDB equipment for removing debris (tractors and front-end loader) will be protected from severe storms with high wind events while stored in the BDB storage building. One set of miscellaneous debris removal equipment is listed in the Phase 2 equipment table on page 101 of the Integrated Plan.

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

Section 3.1.1.3 above discusses various procedures to be revised and/or developed for the ELAP regarding environmental hazards. Additionally, Regulatory Screening/Evaluation NEI 96-07, Revision 1, and NEI 97-04, Revision 1, will be used to evaluate the changes to existing procedures as well as to the FSG to determine the need for prior NRC approval.

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 high wind hazards, 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's plan for implementing the use of off-site resources is not complete. The local assembly areas have not been identified. The licensee is also evaluating the possibility of boat transport for personnel. This has been combined with Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.4 Snow, Ice and Extreme Cold Hazard

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 4 of the Integrated Plan the licensee stated that measurable snowfall has occurred in the months of November through April, although heavy snowfall occurrences are usually confined to the months of December through March. The MPS3 FSAR Section 3.2.1 provides additional information on snow fall amounts. Additionally, freezing rain (ice) and drizzle are occasionally observed during the months of December through March, and only rarely observed in November and April, with an average of 18.5 hours of freezing rain and 8.5 hours of freezing drizzle occur annually in the region.

The licensee also stated that winters are moderately cold, but seldom severe, and minimum daily temperatures during the winter months are usually below freezing, but subzero degrees F readings are observed, on the average, less than one day every two years. Therefore MPS3 screens in for snow, ice and extreme cold hazards.

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

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

NEI 12-06, Section 8.3.1 states:

> These considerations apply to the protection of FLEX equipment from snow, ice, and extreme cold hazards:
>
> 1. For sites subject to significant snowfall and ice storms, portable FLEX equipment should be stored in one of the two configurations.
>
>   a. In a structure that meets the plant's design basis for the snow, ice and cold conditions (e.g., existing safety-related structure).
>
>   b. In a structure designed to or evaluated equivalent to ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures* for the snow, ice, and cold conditions from the site's design basis.
>
>   c. Provided the N sets of equipment are located as described in a. or b. above, the N+1 equipment may be stored in an evaluated storage location capable of withstanding historical extreme weather conditions such that the equipment is deployable.
>
> 2. Storage of FLEX equipment should account for the fact that the equipment will need to function in a timely manner. The equipment should be maintained at a temperature within a range to ensure its likely function when called upon. For example, by storage in a heated enclosure or by direct heating (e.g., jacket water, battery, engine block heater, etc.).

In the August 2013 Integrated Plan update, the licensee stated that a single 10,000 sq-ft. Type 1 building will be constructed for storage of BDB equipment. Per licensee engineering evaluation ETE-CPR-2012-0008 Rev. 1, a Type 1 building is a concrete, tornado missile protected building that meets SSE requirements, and will meet the plant's design basis for snow, ice and extreme cold conditions,

On pages 28, 70, 71 and 77 of the Integrated Plan, the licensee stated that the BDB pumps, necessary hoses and fittings, equipment for clearing potential obstructions which could inhibit mobility of the fuel carts and fuel transfers, light and communications equipment are protected from extreme cold hazards while stored in the BDB storage building or in protected areas of the plant.

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

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

NEI 12-06, Section 8.3.2 states:

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

The licensee was requested to identify any specific equipment that could be deployed for ice or snow removal. During the audit process the licensee stated that; FLEX equipment will include two John Deere 6125M cab tractors and one Caterpillar 924H front-end Loader, these three pieces of equipment have buckets that are capable of snow and ice removal, and will be located in the BDB storage facility.

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

Section 3.1.1.3 above discusses various procedures to be revised and/or developed for the ELAP regarding environmental hazards. The licensee stated that Regulatory Screening/Evaluation NEI 96-07, Revision 1, and NEI 97-04, Revision 1, will be used to evaluate the changes to existing procedures as well as to the FSG to determine the need for prior NRC approval.

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 and extreme cold hazards, if these requirements are implemented as described.

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

NEI 12-06, Section 8.3.4, states:

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

The licensee's plan for implementing the use of off-site resources is not complete. The local assembly areas have not been identified. The licensee is also evaluating the possibility of boat transport for personnel. This has been combined with Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.5 High Temperatures

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 due to the proximity of Long Island Sound and the Atlantic Ocean, the heat of summer is moderated. Additionally, temperatures of 90 degrees F or greater occur an average of seven days per year at Bridgeport, while temperatures of 100 degrees F or greater have occurred only in July and August; with an extreme maximum of 104 degrees F occurring in July 1957.

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.

In the August 2013 Integrated Plan update, the licensee stated that a single 10,000 sq-ft. Type 1 building will be constructed for storage of BDB equipment. Per licensee engineering evaluation ETE-CPR-2012-0008 Rev. 1, a Type 1 building is a concrete, tornado missile protected building that meets SSE requirements.

On pages 28, 70, 71 and 77 of the Integrated Plan, the licensee stated that the BDB pumps, necessary hoses and fittings, equipment for clearing potential obstructions which could inhibit mobility of the fuel carts and fuel transfers, light and communications equipment are protected from extreme heat hazards while stored in the BDB storage building or in protected areas of the plant.

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

3.1.5.2 Deployment of FLEX Equipment - High Temperature Hazard

NEI 12-06, Section 9.3.2 states:

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

During the audit process, the licensee stated that the FLEX equipment storage building will be temperature controlled and it will have two large steel equipment doors located on opposite sides of the building and two personnel entry/exit doors. These equipment doors will be designed to resist penetration after impact by the missiles without perforation, penetration, or loss of operability and function. Because of the massive size of these steel doors and the short duration of time between when they will need to be opened following the on-set of a beyond-design-basis event, door operability issues due to extreme outdoor temperatures (heat or cold) are not expected. The licensee also stated that the final storage building design is considering the potential impact of high temperatures on the equipment and access doors consistent with NE 21-06 Section 9.3.2. Additionally, plant doors that are needed for access to implement FLEX strategies are also not expected to be significantly impacted by extreme heat conditions. Tolerances on roll-up doors are generally not tight and personnel doors generally have sufficient gaps to accommodate thermal expansion. In the event that an access door may be jammed, sufficient tools will be available in the BDB storage building or in the plant shops to free or remove a door to allow access.

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

3.1.5.3 Procedural Interfaces - High Temperature Hazard

NEI 12-06, Section 9.3.3 states:

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

Section 3.1.1.3 above discusses various procedures to be revised and/or developed for the ELAP regarding environmental hazards. Additionally, Regulatory Screening/Evaluation NEI 96-07, Revision 1, and NEI 97-04, Revision 1, will be used to evaluate the changes to existing procedures as well as to the FSGs to determine the need for prior NRC approval.

The licensee stated in ETE-CPR-2012-0008, Rev. 1 that the equipment will be procured to operate at -2 to +120 degrees F applicable to outside ambient temperatures, and that other portable equipment will be set up in areas outside of the buildings where the connections will be made.

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

3.2 PHASED APPROACH

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

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

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

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

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

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

As described in NEI 12-06, Section 1.3, plant-specific analyses determine the duration of the phases for the mitigation strategies. In support of its mitigation strategies, the licensee 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).

The licensee stated in the Integrated Plan that preliminary analyses have been performed to determine the time to steam generator overfill without operator action to reduce AFW flow, time to steam generator dryout without AFW flow, and time to depletion of the useable volume of the DWST, and that the final durations will be provided when the analyses are completed.

In the April 30, 2013 supplement the licensee stated that the analysis for secondary side inventories and heat removal has been finalized. The licensee stated that slight changes were observed from the preliminary values reported in the Integrated Plan. These changes are as follows:

1) The time to steam generator (SG) overfill decreased from 2.0 hours to 1.3 hours. As stated in the Integrated Plan, operators would be assigned within the first 15 minutes of the event to control flow in order to maintain proper SG

level. AFW flow rate can be controlled by locally throttling the AFW header isolation valves. Operators could access the area in less than 5 minutes to begin to control AFW flow in order to maintain SG levels. Therefore, the basis for acceptability stated in the Integrated Plan remains valid for the reduced SG overfill time of 1.3 hours.

2) The time for SG dryout increased from 1 hour to 1.1 hours. This provides additional time, if needed, to perform a manual start of the TDAFW pump as part of the Phase 1 core cooling strategy.

3) The time to depletion of the water supply from the DWST increased from 20.9 hours to 22.7 hours. This provides additional time to setup and engage Phase 2 BDB equipment as part of the long-term core cooling strategy. The finalized analysis also confirmed the statement that the site pond is capable of providing core cooling supply for greater than 20 days to each unit.

During the audit process, the licensee was requested to provide the basis and supporting analyses used to determine: (1) the required time of 1.3 hours to control the AFW flow for SG overfill prevention, and (2) the required DWST- Long Island Sound switchover time of no greater than 22.7 hours, and did not address the analyses including the computer codes/methods and assumptions used.

During the audit process, the licensee stated that: calculations of secondary side flow requirements were performed with a mass and energy balance for the steam generator (SG) secondary side using a Microsoft EXCEL® spreadsheet, which uses finite differences to solve the conservation of mass and energy equations for the SG. The licensee stated that the analysis shows that the minimum usable volume of the DWST is adequate to (1) fill the SG secondary to the no-load value; (2) cool the RCS from hot zero power to approximately 440 degrees F(corresponds to the ECA-0.0 target pressure of 290 psig) and (3) remove decay heat for the 1st approximately 22.7 hours of the event. Additionally the licensee stated that; for the steam generator overfill case, the calculation showed that throttling of AFW flow is modeled and no cooldown is imposed, and that the time to overfill with no operator action is calculated to be approximately 1.3 hours.

WCAP-17601-P is a technical report that is discussed in greater detail in Section 3.2.1.2 of this evaluation. The licensee was requested to specify which analysis performed in WCAP-17601 is being applied to MPSS3 and to justify the use of that analysis by identifying and evaluating the important parameters and assumptions demonstrating that they are representative of MPS3 and appropriate for simulating the ELAP transient. During the audit process the licensee stated that Westinghouse Letter LTR-LIS-13-515, Attachment 1, page 4 of 4, addresses this question and concludes that NOTRUMP analysis provided in Section 5.2.1 of WCAP-17601-P, Revision 1 is applicable to MPS3, and that the applicability of this reference case to MPS3 is evaluated in detail in ETE-NAF-2012-0150, Rev. 0 Section 6.2. Because this material is still under review, this has been identified as Confirmatory Item 3.2.1.A in Section 4.2.

During the audit process, the licensee was requested to discuss their position on each of the recommendations discussed in Section 3.1 of WCAP-17601-P for developing the FLEX mitigation strategies. The licensee was also requested to list the recommendations that are applicable to the plant, provide rationale for the applicability, address how the applicable recommendations are considered in the ELAP coping analysis, and discuss the plan to implement the recommendations. Additionally, the licensee was requested to provide a rationale for each of the recommendations that are determined to be not applicable to the plant. The licensee provided a brief notation of each of the ten Section 3.1 WCAP-17601 recommendations (underlined) followed by a response to each recommendation as follows:

1) Develop a Reference Case which assumes standard RCP seal packages to determine the minimum adequate core cooling time with respect to inventory. Operators are directed to initiate a RCS cooldown using the installed SG atmospheric relief bypass valves at a rate not to exceed 100 deg F/hr until the pressure in each intact SG reaches 290 psig. Cooling the reactor at that rate to the prescribed minimum target SG pressure (290 psig) minimizes RCS leakage.

2) Develop inventory coping times beyond the Reference Case. Millstone Unit 3 currently has Westinghouse RCP seals installed in all four of its RCPs. Estimated time before natural circulation flow breakdown and subsequent core uncovery is approximately 33 hours with assumed 21 gpm RCP seal leakage. Therefore, the Phase 1 strategy for RCS makeup for the first 16 hours after the initiation of the ELAP/LUHS event is to rely on the RCP seals to maintain adequate RCS water inventory. Within 16 hours after the start of an ELAP/LUHS event, a portable diesel driven BDB RCS Injection pump will be deployed from the on-site BDB Storage Building and positioned for delivery of RCS inventory makeup from the reactor water storage tank (RWST) or another borated suction source for the remainder of the event.

3) Develop high-level list of instrumentation for the RCS in order to confirm/maintain adequate core cooling. Instrumentation includes:
   AFW flow
   SG level for each SG (wide range and narrow range)
   SG pressure for each SG
   RCS Hot Leg Temperature
   RCS Cold Leg Temperature
   Indication of AFW flow, SG level and SG pressure will provide the necessary information for manually controlling the TDAFW pump / AFW system for proper AFW delivery to the SGs. Indication of RCS temperature will be used to control steam release from the SGs.

4) Study reactor sub-critical aspects under ELAP conditions. Operators are directed to initiate a RCS cooldown using the installed SG atmospheric relief bypass valves at a rate not to exceed 100 deg F/hr until the pressure in each intact SG reaches 290 psig. Reactor sub-criticality is procedurally monitored during the cooldown and the cooldown is halted if required. Boron additions are made as required to ensure the unit is sub-critical. Sub-criticality is monitored using excore nuclear instruments to verify reactivity. Dominion has performed detailed studies for recent Millstone 3 cores which develop the required boron concentration to maintain K-effective less than 0.99 as a function of time after trip and RCS temperature (Steam Generator Pressure). These studies will form the basis for developing guidance in FLEX Support Guideline FSG-8, Alternate RCS Boration. Draft guidance is expected to be available by December 2013. Dominion will also develop core reload checks to perform ongoing validation of the procedural guidance for new cores.

5) Investigate various aspects of RCS make-up with regard to maintaining core cooling and a sub-critical state in the reactor core. For Millstone Unit 3, the required delivery pressure for the RCS Injection pump is approximately the saturation pressure of 561 degrees F (1143 psia) plus 100 psi or 1243 psia. The RCS Injection pump will be capable of delivering at least 40 gpm at a discharge pressure of at least 2,000 psig. Hydraulic analysis of the BDB RCS Injection pump with the associated hoses and installed piping systems confirms appropriate system pressure distribution. Deployment of the BDB RCS Injection pump prior to 16 hours meets all requirements with substantial margin. Two RCS Injection pumps will be available on-site to provide batch injection. Evaluations of sub-criticality shows that, because of post trip Xenon buildup and decay, for the limiting EOC case, assuming cooldown to the steam generator pressure of 290 psig, boration is not needed before about 25 hours. Deployment of BDB RCS Injection pump for makeup and boration will begin at approximately 14 hours so that injection can be initiated by 16 hours; therefore, adequate margin will be maintained. The expected flow from the BDB RCS Injection pump, around 40 gpm, will provide additional shutdown margin. The RWST, if available, has a usable volume of approximately 1,000,000 gallons of borated water at a concentration between 2700 and 2900 ppm. A 1000 gallon portable tank for batching boron will also be available as an alternate suction supply of borated water for RCS makeup. The portable tank will be deployed to a location adjacent to the BDB RCS injection pump.

6) Quantify RCS response with SDS/low-leakage seals. Millstone Unit 3 currently has Westinghouse RCP seals installed in all four of its RCPs. The estimated time before natural circulation flow breakdown and subsequent core uncovery is approximately 33 hours with assumed 21 RCP seal leakage. As noted above, Millstone 3 currently has Westinghouse RCP seals installed. Current plans are to replace these seals with Flowserve N-seals. Two seals will be replaced in 2014 and two more in 2016. Once the low leakage seals are installed, the times to natural circulation flow breakdown and core uncovery will be extended significantly.

7) Quantify (on a rough order) what acceptable amount of time exists for feedwater flow interruption early in the transient. Dominion has performed calculations to estimate the time to steam generator dryout following a flow interruption for several conditions: For failure of the TDAFWP to start at the initiation of the event, time to steam generator dryout is approximately 1 hour. This is considered sufficient time to deploy personnel to locally start the pump. For a flow interruption following depletion of the Demineralized Water Storage Tank (DWST) at 22.7 hours, about 7 hours are available before SG dryout to deploy an alternate supply. These considerations will be incorporated into the FLEX support guidelines.

8) Develop more proof of concept of feeding a single steam generator with a low-pressure portable pump. Also, develop high-level functional requirements for the feed pump. Heat removal from the RCS is accomplished by supplying feed water from the DWST to the SGs using the TDAFW pump. Feed rate can be controlled by local manual operation of the SG feed line manual operated isolation valves. Throttling of the feed flow

within approximately 1.3 hours will avoid overfilling the steam generators. The Phase 2 strategy for core heat removal is to indefinitely extend AFW suction supply by deploying the portable diesel driven BDB High Capacity pump within 22.7 hours. For Millstone Unit 3, the BDB AFW pump has been designed to deliver a minimum of 300 gpm to the SGs at a pressure of 300 psig. This flow rate is adequate to establish adequate core cooling in the event the TDAFW pump is unavailable. Capability exists to monitor levels and flow rates for the SGs individually.

9) Quantification of accumulator makeup capability and isolation/venting to prevent cover gas injection. In accordance with ECA-0.0, maintaining SG pressure above 190 psig will preclude the injection of the nitrogen cover gas into the RCS. The controlling setpoint for Millstone 3 procedures will be 290 psig to account for instrument uncertainties and containment temperature increases. In preparation for further cooldown, procedural guidance will be provided for isolating the accumulators to preclude nitrogen injection into the RCS. FLEX Support Guideline (FSG)-10 will provide direction to deploy equipment that is needed to re-energize the accumulator isolation valves so that they can be closed. FSG-10 will also provide direction for venting the accumulators. The associated provision of electrical power to those isolation valves will be included in the 480-volt recovery plan. FLEX Support Guideline (FSG)-8 provides direction for monitoring accumulator level, monitoring the amount of water that has been injected into the RCS, and determining the amount of boration required to maintain sub-criticality. This FSG provides direction for using the reactor vessel head vent for RCS depressurization that may be needed to accommodate additional boration.

10) Evaluate and quantify the effects of TDAFW pump heat load and ambient heat loss on the ability to maintain the NSSS at normal operating temperature. FSG-10 will provide direction for deploying equipment to re-energize the accumulator isolation valves so that the valves can be closed. FSG-10 will also provide direction for venting the accumulators

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 core cooling and heat removal, if these requirements are implemented as described.

3.2.1.1. Computer Code Used for the ELAP Analysis

NEI 12-06, Section 1.3 states:

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

On page 106 of the Integrated Plan, the licensee stated that the applicable computer code for NSSS analysis is NOTRUMP, and that WCAP-17601-P Section 4.1.1.1 is applicable and that the reference plant case from Section 5.2.1 of WCAP-17601-P is representative of MPS3.

The licensee has provided a Sequence of Events (SOE) in their Integrated Plan, which included the time constraints and the technical basis for the site. That SOE is based on an analysis using the industry-developed NOTRUMP computer code. NOTRUMP was written to simulate the response of pressurized water reactors (PWRs) to small break loss of coolant accident (LOCA) transients for licensing basis safety analysis.

The licensee has decided to use the NOTRUMP computer code for simulating the ELAP event. Although NOTRUMP has been reviewed and approved for performing small break LOCA analysis for PWRs, the NRC staff had not previously examined its technical adequacy for simulating an ELAP event. In particular, the ELAP scenario is differentiated from typical design-basis small-break LOCA scenarios in several key respects, including the absence of normal ECCS injection and the substantially reduced leakage rate, which places significantly greater emphasis on the accurate prediction of primary-to-secondary heat transfer, natural circulation, and two-phase flow within the RCS. As a result of these differences, concern arose associated with the use of the NOTRUMP code for ELAP analysis for modeling of two-phase flow within the RCS and heat transfer across the steam generator tubes as single-phase natural circulation transitions to two-phase flow and the reflux condensation cooling mode. This concern resulted in the following Confirmatory Item:

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

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

3.2.1.2 RCP Seal Leakage Rates

NEI 12-06, Section 1.3 states:

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

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

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

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

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

After review of these submittals, the NRC staff has placed certain limitations for Westinghouse designed plants. Those limitations and their corresponding Confirmatory Item numbers for this TER are provided as follows:

(1) For the plants using Westinghouse RCPs and seals that are not the SHIELD shutdown seals, the RCP seal initial maximum leakage rate should be greater than or equal to the upper bound expectation for the seal leakage rate for the ELAP event (21 gpm/seal) discussed in the PWROG position paper addressing the RCP seal leakage for Westinghouse plants (Reference 2). If the RCP seal leakage rates used in the plant-specific ELAP analyses are less than the upper bound expectation for the seal leakage rate discussed in the position paper, justification should be provided. If the seals are changed to non-Westinghouse seals, the acceptability of the use of non-Westinghouse seals should be addressed, and the RCP seal leakage rates for use in the ELAP analysis should be provided with acceptable justification. This is identified as Confirmatory Item 3.2.1.2.A in Section 4.2.

(2) In some plant designs, such as those with 1200 to 1300 psia SG design pressures and no accumulator backing of the main steam system power-operated relief valve (PORV) actuators, the cold legs could experience temperatures as high as 580 degrees F before cooldown commences. This is beyond the qualification temperature (550 degrees F) of the O-rings used in the RCP seals. For those Westinghouse designs, a discussion of the information (including the applicable analysis and relevant seal leakage testing data) should be provided to justify that (1) the integrity of the associated O-rings will be maintained at the temperature conditions experienced during the ELAP event, and (2) the seal leakage rate of 21 gpm/seal used in the ELAP is adequate and acceptable. The PWROG is working on these issues and will submit to the NRC position papers that will contain test data regarding the maximum seal leakage rates of Westinghouse traditional and Generation 3 SHIELD seals, and Flowserve seals at higher cold-leg temperatures. The NRC will review the position papers when received. As such, resolution of this concern is identified as Open Item 3.2.1.2.B in Section 4.1 below.

(3) Some Westinghouse plants have installed or will install the SHIELD shutdown seals, or other types of low leakage seals, and have credited or will credit a low seal leakage rate (e.g., 1 gpm/seal) in the ELAP analyses for the RCS response. For those plants, information should be provided to address the impacts of the Westinghouse 10 CFR Part 21 report, "Notification of the Potential Existence of Defects Pursuant to 10 CFR Part 21," dated July 26, 2013 (ADAMS No. ML13211A168) on the use of the low seal leakage rate in the ELAP analysis. As indicated in the licensee's Integrated Plan and response to the audit process, MPS3 has Westinghouse RCP seals currently installed and they will replace the Westinghouse seals with Flowserve N-seals. Therefore, this issue is not applicable to MPS3.

(4) If the seals are changed to the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals, the acceptability of the use of the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals should be addressed, and the RCP seal leakages rates for use in the ELAP analysis should be provided with acceptable justification. The PWROG is working on these issues and will submit to the NRC position papers that will contain test data regarding the maximum seal leakage rates of Generation 3 SHIELD seals and Flowserve seals. The NRC will review the position papers when received. As such, resolution of this concern is identified as Open Item 3.2.1.2.C in Section 4.1 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 and Open Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to the RCP seal leakage rates if these requirements are implemented as described.

3.2.1.3 Decay Heat

NEI Section 3.2.1.2 states in part:

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

The licensee's Integrated Plan did not address the applicability of assumption 4 on page 4-13 of WCAP-17601, which states that "Decay heat is per ANS 5.1-1979 + 2 sigma, or equivalent." The licensee was requested to provide a discussion regarding the decay heat model used in the ELAP, and to specify the values of the following key parameters used to determine the decay heat: (1) initial power level, (2) fuel enrichment, (3) fuel burnup, (4) effective full power operating days per fuel cycle, (5) number of fuel cycles, if hybrid fuels are used in the core, and (6) fuel characteristics are based on the beginning of the cycle, middle of the cycle, or end of the cycle. In addition, the discussion should also address the adequacy of the values used.

During the audit process the licensee stated that Westinghouse Letter LTR-LIS-13-515, Attachment 1, page 4 of 5, addresses the applicability of assumption 4 on page 4-13 of WCAP-17601, and concludes that the values used for the requested parameters in the Westinghouse calculations that were performed using the ANS 5.1 1979 +2 sigma decay heat model bound initial condition 3.2.1.2(1) of NEI 12-06, Section 3.2.1.2. Review of the letter is needed to confirm this conclusion. This has been identified Confirmatory Item 3.2.1.3.A in Section 4.2.

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

3.2.1.4 Initial Values for Key Plant Parameters and Assumptions

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

On pages 6 and 7 of the Integrated Plan, the licensee stated that boundary conditions are established to support development of FLEX strategies, as follows:

- The reactor is initially operating at power, unless there are procedural requirements to shut down due to the impending event. The reactor has been operating at 100% power for the past 100 days.
- The reactor is successfully shut down when required (i.e., all rods inserted, no Anticipated Transient Without Scram (ATWS)). Steam release to maintain decay heat removal upon shutdown functions normally, and RCS overpressure protection valves respond normally, if required by plant conditions, and reseat.
- The reactor and supporting plant equipment are either operating within normal ranges for pressure, temperature and water level, or available to operate, at the time of the event consistent with the design and licensing basis.

The following plant initial conditions and assumptions are established for the purpose of defining FLEX strategies:

- 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 available. Permanent plant equipment that is contained in structures with designs that are robust with respect to seismic events, floods, and high winds and associated missiles, are available. The fire protection system ring header is not relied upon as a water source since it is not considered to be robust with respect to seismic events.
- Normal access to the ultimate heat sink is lost, but the water inventory in the UHS remains available and robust piping connecting the ultimate heat sink to plant systems remains intact. The motive force for ultimate heat sink flow, i.e., pumps, is assumed to be lost with no prospect for recovery.

- Reactor coolant inventory loss consists of unidentified leakage at the Technical Specifications (TS) limit, reactor coolant letdown flow (until isolated), and reactor coolant pump (RCP) seal leak-off at normal maximum rate.
- For the SFP, the heat load is assumed to be the maximum design basis heat load. In addition, inventory loss from sloshing during a seismic event does not preclude access to the pool area.

The licensee noted on page 44 of the Integrated Plan that the information provided in the section regarding Maintaining RCS Inventory Control Phase 2, is based on the following reference(s): Engineering Technical Evaluation, ETE-CPR-2012-0008, "Beyond Design Basis - FLEX Strategy Overall Integrated Plan Basis Document," Revision 0. This reference refers to two calculations relative to this issue as follows: 1) CALC-MISC-11787, "Evaluation of Secondary Heat Removal Requirements Following ELAP", and 2) CALC-MISC-11790, "Investigate Reactivity Control during Extended Station Blackout," for MPS3. These calculations provide additional plant specific data for reactor and core conditions existing during 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 initial values for key plant parameters and assumptions, if these requirements are implemented as described.

3.2.1.5 Monitoring Instrumentation and Controls

NEI 12-06, Section 3.2.1.10 states in part:

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

Note: SFP level is addressed in Section E.1.3 of the integrated plan.

On pages 24, 27, and 34 of the Integrated Plan, the licensee, in part, provided the following regarding instrumentation credited for ELAP analysis: AFW flow rate to each SG is available in the main control room (MCR) and on the auxiliary shutdown panel (ASP) throughout the event. SG water level, wide range (WR) and narrow range (NR), and SG pressure are available for all SGs from the MCR and the ASP throughout the event. RCS hot-leg temperature indication is available from the MCR and the ASP throughout the event. RCS cold-leg temperature can be inferred from SG pressure. Core Exit Thermocouple indications are available throughout the event at the Inadequate Core Cooling (ICC) cabinets. DWST water level indication is available from the MCR and locally at the tank throughout the event.

On pages 37 and 38 of the Integrated Plan, the licensee, in part, provided the following regarding instrumentation credited for ELAP analysis: SG pressure indication from the MCR and the ASP is available throughout the event. RCS Hot Leg and Cold Leg Temperature indication from the MCR and the ASP is available throughout the event. Pressurizer level indication from the MCR and the ASP is available throughout the event. RCS wide range pressure indication from the Control Room and ASP is available throughout the event. Reactor Vessel Level Indication System from the MCR and the ICC cabinet is available throughout the event.

On pages 27, 41 and 45 of the Integrated Plan, the licensee stated that the Phase 2 and Phase 3 strategies utilize the same Key Reactor Parameters and associated indications as described for Phase 1.

On pages 47 and 51 of the Integrated Plan, the licensee stated that containment pressure indication is available in the MCR throughout the event.

The licensee was requested to provide justification that the instrumentation listed above and the associated indications are reliable and adequate to provide the desired functions on demand during the ELAP with the containment harsh conditions at high moisture, temperature and pressure levels. See TER Section 3.2.3 "Containment Functions Strategies" for resolution of this issue.

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

3.2.1.6 Sequence of Events

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

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

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

commissioned.

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

On page 104 of the Integrated Plan, the licensee stated that for Action Item 1, at the elapsed time of 15 seconds, the TDAFW pump starts and AFW flow is verified, and the original design basis for an SBO event is 50 minutes to SG dryout. The licensee also noted that this was previously evaluated in response to 10 CFR 50.63 and is in accordance with existing procedures. The licensee was requested to; clarify whether the TDAFW pump is automatically or manually actuated, and if automatically actuated, provide the actuation signal used and address the adequacy of the actuation time of 15 seconds, to determine whether the above information regarding pump starting time is consistent with that listed in Table 5.2.2-1 of WCAP-17601, Sequence of Events for the reference case applicable to MPS3, to provide the basis to support that the TDAFW pump can start at 15 seconds and that the AFW flow can be supplied to all SGs in 60 seconds, and to clarify any inconsistencies between the WCAP and the licensee's noted action times.

During the audit process the licensee provided the following information regarding this issue: A loss of all ac power the TDAFW pump starts automatically given the two of four Low-Low water level signals in any two of four SGs, or an AMSAC auto-start signal. The TDAFW pump can also be started manually from the MCR or from the auxiliary shutdown panel. The actuation time of 15 seconds was intended to be a best estimate time for TDAFW pump start time based on simulator response times. The required time for pump actuation and flow to the steam generators is documented in the Technical Requirements Manual (TRM). TRM Table 3.3-5, "Engineered Safety Features Response Times" states that given an initiation signal of Steam Generator Water Level - Low-Low, the TDAFW pump response time is to be less than or equal to 90 seconds. Reviewing the latest surveillance (SP 3622.3-001) for TDAFW Pump Operational Readiness the recorded response time was 52.19 seconds (which is the time interval from test signal initiation until TDAFW discharge pressure is greater than 1650 psig). This approximately 60 second start time for flow to the SGs, is further documented in Engineering Record of Correspondence 25212-ER-97-093 dated 8-1-1997, provided as MPS3_Q20. Both these documents show a consistency with the 60 second "AFW flow begins" time stated in Table 5.2.2-1 of WCAP-17601.

On page 104 of the Integrated Plan, the licensee stated that for Action Item 2 in Attachment 1A, at the elapsed time of 15 seconds, "SBO procedures are entered." The licensee was requested to provide justification for the SBO procedures entry time of 15 seconds. During the audit process the licensee stated that; 1) EOP 35 ECA-0.0, Loss of All AC Power (SBO) entry condition is a loss of voltage on all AC Emergency Buses, which is recognizable from the MCR in approximately 15 seconds, 2) this is not a time critical operator action but is a best estimate based on response times routinely demonstrated on the control room simulator, 3) EOP 35 ECA-0.0, Loss of All AC Power is entered immediately upon recognition of loss of voltage on both 4160 Safeguards Buses per operations standards, which is consistent with the generic Westinghouse NSSS Emergency Response Guideline (ERG) guidance.

SOE Action Item 5 shows that the ELAP/LUHS is declared at 45 minutes, and SOE Action Item 6 shows that at 50 minutes (5 minutes after the declaration of the ELAP), the operator controls SG atmospheric relief bypass valves and AFW flow as an on-going action for cooldown and decay heat removal, operations personnel remain stationed locally. The above early initiation of cooldown (5 minutes following ELAP declaration) at 50 minutes appears inconsistent with the information in Item 6 of Attachment 1B, on page 106 of the Integrated Plan, that indicates that based on the analysis of the plant reference case in Section 5.2.1 of the WCAP-17601, the plant cooldown begins 2 hours with cooldown rate of less than 100 degrees F/hr until the SG pressure reaches 290 psig. Regarding the above action item, the licensee was requested to; clarify this apparent inconsistency for cooldown initiation time, to discuss the operator actions required to control SG atmospheric relief bypass valves and AFW flow and justify that all the required operator actions are reasonably achievable within the required time constraint of 50 minutes during the ELAP conditions, and to specify the required cooldown completion time that is supportable by analysis, and discuss the required action to complete the cooldown and justify that the all the required actions can be accomplished within the completion time.

During the audit process, the licensee provided the following information regarding this issue: The initiation time of 50 minutes that is listed in SOE Action Item 6 is being revised to a time of 2 hours to provide consistency with the reference plant case provided in Section 5.2.1 of WCAP-17601, which is applicable to MPS3. The correct time for initiation of cooldown is listed in Attachment 1B of the Integrated Plan for MPS3. As stated in the sixth line of Attachment 1B, the initiating time for cooldown is at 2 hours with a rate less than 100 degrees F/hr to a SG pressure of 290 psig. The revision of the initiation time from 50 minutes to 2 hours will be provided in the February 2014 6-month status update, and the 2 hours is considered more than adequate time to dispatch an operator to the MSVB, establish communication with the control room and initiate the cooldown. Personnel will be able to access the MSVB and initiate cooldown prior to 2 hours. Steam release from the SGs will be controlled locally within the MSVB using the handwheels installed on the motor-operated SG atmospheric relief bypass valves.

The licensee also stated the following: The time constraint to begin cool down and operate the SG Atmospheric Relief Bypass Valves is 2 hours rather than 50 minutes. In order for operators to control the Atmospheric Dump Bypass Valves, they must enter the MSVB and proceed up the stairs to the location of the valves. The MSVB is located adjacent to the Control Building (CB) and is protected from missile impacts. There are very few potential restrictions to entry into the building. This action is directed by EOP 35 ECA-0.0, if a loss of power requires manual operation of the valves. Heat up rates of the MSVB are contained in MP-CALC-ENG-NAI-1731-001. The calculation has indicated that additional actions are needed to ensure entry of the building and/or remote operation of the valves can be accomplished. FSGs will be developed to ensure safe entry and operation can be accomplished within the required 2 hour period. Upon Initiation of the event, operators will be dispatched to the AFW pump room to take manual control of steam generator level. The path to the AB, AFW pump area is direct and expected to contain minimal debris. TDAFW pump speed and feeding will initially be controlled from the MCR. Before load shedding is started, operators will be dispatched to gain local manual control of both the TDAFW pump and the AFW flow isolation valves. The FSG for load shedding will include a step to ensure AFW flow is being locally controlled prior to commencement of load shedding. Initial MCR actions will prevent the overfilling of the SGs and maintain level in the normal band until personnel are stationed in the pump area to locally control flow.

The TDAFW pump will be protected from damage at low flow rates by the installed seismically designed and tornado-generated missile protected recirculation line. Communications will be conducted using sound powered phones between the MCR and remote operating locations, such as the MSVB and the AFW pump area.

During the audit process, the licensee was requested to provide the required cooldown completion time that is supported by analysis and to include a discussion of the required action to complete the cooldown and justify that all of the required actions can be accomplished within the completion time.

During the audit process, the licensee provided the following information regarding this issue: The reference analysis presented in Section 5.2.1 of WCAP-17601-P is applicable to MPS3 as stated in ETE-NAF-2012-0150, which models a cooldown starting at 2 hours after initiation of the event and a cooldown rate of approximately 70 degrees F/hr. The cooldown is terminated when secondary steam pressure reaches the ECA-0.0 target of approximately 300 psia, and occurs at approximately 4 hours after initiation of the event, when the RCS average temperature reaches approximately 425 degrees F. This is directly comparable to the MPS3 case. The ECA-target SG pressure for termination of the cooldown is 290 psig or approximately 305 psia. Initiation of the cooldown at a time earlier than 2 hours would not invalidate the conclusions of the generic analysis. This would result in more rapid depressurization of the RCS and less leakage through the RCP seals. As stated in ETE-NAF-2012-0150, the commencement and termination times of the cooldown have no impact on the core cooling coping time. The MPS3 deployment of a BDB RCS Injection pump for RCS make-up is within 16 hours, which is well before the transition to reflux condensation mode of cooling at 33 hours in the reference case (see WCAP-17601-P, Table 5.2.2-1). The 16 hours allows movement of the pump from the storage building to the location within the PA using augmented staff and after debris removal activities are completed. The commencement is expedited at approximately 10-14 hours and completed prior to 16 hours.

The licensee was requested to provide the bases for using a cooldown rate of 100 degrees F/hr that deviates from the cooldown rate of 70 degrees F/hr stated in Table 5.2.2-1 of WCAP-17601, and the sequence of events for the reference case applicable to MPS-3.

During the audit process, the licensee provided the following information regarding this issue: The 100 degrees F/hr value is a representative value for the cooldown rate discussed in the Generic ERGs Background Document and is the target rate in MPS3 ECA-0.0. It is specified to ensure the integrity of reactor coolant pump RCP seals and to avoid undue thermal stresses on the NSSS. The 70 degrees F/hr value used in the WCAP-17601 analysis is considered representative of what might actually be achieved given remote operation and control of the steam generator ADV's and AFW flow. The results and conclusions of our supporting analyses, including the WCAP-17601 reference analysis, would not be invalidated by using 100 vs. 70 degrees ^{F}/hr. For example, using the more rapid rate would result in slightly earlier RCS depressurization, less calculated leakage out of the RCP seals and therefore delay natural circulation breakdown and support a delay in the RCS makeup strategy. The reactivity calculations (Calc MISC-11790) show that boron addition is not required for several hours after the cooldown step is completed, therefore the cooldown rate has no impact on the reactivity management strategy.

On page 106 of the Integrated Plan, the licensee stated that the minimum SG pressure of 290 psig is consistent with the existing EOP setpoint to prevent SI accumulator nitrogen gas from entering the RCS. The licensee was requested to provide a discussion regarding the analysis used to support the SG pressure of 290 psig in preventing the nitrogen from entering into the core.

During the audit process, the licensee stated that the MPS3 ELAP response is consistent with the PWROG Core Cooling Management Interim Position Paper with respect to the methodology for preventing nitrogen injection from accumulators during an ELAP event. From the PWROG Core Cooling Management Interim Position Paper: the current Westinghouse NSSS SBO EOPs use SG pressure as a parameter to prevent cold leg accumulators (CLA) nitrogen injection into the RCS. The Westinghouse methodology used to develop the target SG pressure contains uncertainties to provide margin against nitrogen injection from the CLAs. These uncertainties include maximum initial CLA pressure, minimum initial CLA water level, operating margin, and the effects of containment heat-up as discussed in ERG DW 06-014. Specifically, the MPS3 EOP Setpoint used in ECA-0.0, Loss of All AC Power was revised in October, 2008 to implement the guidance in ERG DW Item 06-014.

During the audit process, the licensee was requested to confirm that operator actions with the associated time constraints, and portable equipment credited in the ELAP analysis are correctly reflected in the SOE documented on page 104 of the MPS3 Integrated Plan.

Regarding this issue the licensee provided the following information: As documented in the MPS3 August 2013 six-month status update, initiation of RCS makeup will occur at 16 hours, which is prior to the time calculated for initiation of reflux cooling with margin. The initiation of deployment of portable equipment will begin when the augmented staff arrives at Millstone which is expected to occur at approximately 6 hours. There is sufficient time with margin for augmented staff to support deploying the BDB RCS pump from the BDB storage building, located in the owner controlled area, to the east side of MPS3. Debris removal will be initiated at 6 hours and is estimated to take approximately 2 hours using on site equipment. Deployment of the equipment and initiation of RCS injection is estimated to take approximately 2 hours and will be initiated to ensure injection begins at 16 hours with adequate margin.

On page 104 of the Integrated Plan, the licensee stated that for Action Item 11 that, the portable boric acid batching tank will be deployed at 12 - 18 hours, if the RWST tank is not available. Justification is needed for the portable tank deployment time of 12 - 18 hours. 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 the SOE timeline if these requirements are implemented as described.

3.2.1.7 Cold Shutdown and Refueling

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

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

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

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

During the audit process, the licensee stated that, "Millstone Power Station Unit 3 will abide by the Nuclear Energy Institute position paper entitled "Shutdown / Refueling Modes" addressing mitigating strategies in shutdown and refueling modes that is dated September 18, 2013 and has been endorsed by the NRC staff."

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 Core Sub-Criticality

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

> All plants provide means to provide borated RCS makeup

The licensee stated in the Integrated Plan that reactivity evaluations for the most limiting core conditions indicate that for cooldown and depressurization to the current target SG pressure of 290 psig, no boration is required within the first 25 hours to maintain Keff <0.99. Additionally the most limiting core conditions occur at the highest core burnup, e.g., end of cycle (EOC), therefore, RCS make-up to ensure adequate Shutdown Margin (SDM) is maintained should begin no later than 25 hours after the start of the ELAP/LUHS event.

The licensee also stated that deployment of the BDB RCS Injection pump will start approximately 18 hours after the event, and by this time, the path from the BDB storage building will have been cleared for deployment of other BDB equipment. Allowing 2 hours to transport the pump from the BDB storage building and connect the suction and discharge hoses, the pump could begin flow to the RCS within 20 hours. This is well before the 25-hour required time identified in Section C.1 to reactivity is maintained at K-eff less than 0.99.

The licensee stated that analysis of reactivity requirements determined that because of post trip xenon buildup and decay, for the limiting EOC case, assuming cool down to the SG pressure of 290 psig, boration is not needed before about 25 hours. Since deployment of BDB RCS Injection pump for makeup and boration is expected before 20 hours, adequate margin is maintained. Additionally the studies also show that very small RCS makeup flows (approximately 5 gpm) at a boron concentration of 2700 ppm or greater provide adequate boration rates to offset the cool down and xenon decay. The licensee also stated that the expected flow from the BDB RCS Injection pump, around 40 gpm, will provide additional shutdown margin, and a total injection of 6500 gallons of 2700 ppm boric acid solution will offset xenon buildup for an indefinite period at a SG pressure of 290 psig, however to offset the reactivity effect of further cooling, additional boration should be performed prior to resuming the cool down.

The NRC staff reviewed the licensee's Integrated Plan and determined that the Generic Concern associated with the modeling of the timing and uniformity of the mixing of a liquid boric acid solution injected into the RCS under natural circulation conditions potentially involving two-phase flow was applicable to MPS3.

The PWROG submitted a position paper, dated August 15, 2013 (withheld from public disclosure due to proprietary content), which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlined applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available. The licensee was requested to discuss the boron mixing model for MPS3. During the audit process the licensee stated that the uniform mixing model is used for the MPS3 ELAP analysis, and this analysis is consistent with the method in the PWROG white paper related to the boron mixing model. The inventory control strategy will deploy the BDB RCS Injection pump for RCS make-up with borated water by approximately 16 hours into the event. Mass addition will forestall natural circulation flow breakdown and the transition to reflux cooling and restore levels into the pressurizer. The MPS3 analysis (CAL-MISC-11790) shows that addition of boron is not required until 25 hours into the transient with the RCS cooled to a core inlet temperature corresponding to a secondary steam generator pressure of approximately 290 psig. The NRC staff concluded that the August 15, 2013, position paper was not adequately justified and has not endorsed this position paper. As such, resolution of this concern for MPS3 is identified as Open Item 3.2.1.8.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 approach 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 core sub-criticality. This is Open Item 3.2.1.8.A in Section 4.1.

3.2.1.9 Use of Portable Pumps

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

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

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

NEI 12-06 Section 11.2 states in part:

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

On pages 15 and 16 of the Integrated Plan, the licensee stated that; design requirements and supporting analysis will be developed for portable equipment that directly performs a FLEX mitigation strategy for core cooling, RCS inventory, containment function, and SFP cooling, and that the design requirements and supporting analysis provide the inputs, assumptions, and documented analysis that the mitigation strategy and support equipment will perform as intended. The licensee provided the following basis for flow requirements which considers the following factors:

a) Pump design output performance (flow/pressure) characteristics.
b) Line losses due to hose size, coupling size, hose length, and existing piping systems.
c) Head losses due to elevation changes, especially for spray strategies.
d) Back pressure when injecting into closed/pressurized spaces (e.g., RCS, containment, SGs).
e) Capacity, temperature, boron concentration, water quality (suspended solids content, etc.) and availability of the suction sources given the specific external initiating events (DWST)/ (RWST)/fire main/Long Island Sound, etc.) to provide an adequate supply for the BDB pumps (fire engines, portable pumps, fire protection system pumps, etc.).
f) Potential detrimental impact on water supply source or output pressure when using the same source or permanently installed pump(s) for makeup for multiple simultaneous strategies.
g) Availability of sufficient supply of fuel on-site to operate diesel powered pumps and generators for the required period of time.
h) Potential clogging of strainers, pumps, valves or hoses from debris or ice when using rivers, lakes, or ocean as a water supply.
i) Environmental conditions (e.g., extreme high and low temperature range) in which the equipment would be expected to operate.

On pages 25 and 26 of the Integrated Plan, the licensee stated in part that the Phase 2 strategy for reactor core cooling and heat removal provides indefinite supply of water for feeding SGs and a portable, diesel driven backup BDB AFW pump for use in the event that the TDAFW pump becomes unavailable. Initial evaluations indicate that the TDAFW pump will operate long-term until reactor decay heat is reduced to a point where adequate SG steam pressure and flow cannot be provided to the turbine inlet to support pump operation (120 psia at turbine inlet per MPS3 FSAR Section 10.4.9.2).

The licensee stated that MPS site has multiple fresh water supplies which will be deployed to add water to the DWST or provide suction directly to the BDB AFW pump, which include the 3,000,000 gallon site pond which can provide core cooling supply for greater than 20 days to each unit, and Long Island Sound will only be used as a last resort. The portable, diesel driven

BDB high capacity pump will be transported from the BDB storage building to a location near the water source. A flexible hose will be routed from the pump suction to the water source where water will be drawn through a strainer limit solid debris size to prevent damage to the TDAFW or BDB AFW pump. A flexible hose will be routed from the fire truck or the BDB High Capacity pump discharge to the BDB DWST suction/fill connection or to the suction of the portable BDB AFW pump via a distribution manifold that also provides water to the SFP as described in Section E.2 and the RCS as described in Section C.2. The BDB High Capacity pump will be sized to provide 300 gpm AFW water supply and 250 gpm make-up to the SFP to both MPS Unit 2 and 3 simultaneously. Hydraulic analysis of the flowpath from the Long Island Sound to the DWST and to the BDB AFW pump suction will be performed to confirm that applicable performance requirements are met.

Consistent with NEI 12-06, Appendix D, a backup SG water injection capability will be provided using a portable AFW pump through a primary and alternate connection. The portable, diesel-driven BDB AFW pump (Table 1) will provide a back-up SG injection method in the event that the TDAFW pump can no longer perform its function due to low SG pressure. Hydraulic analyses will be performed to confirm that the BDB AFW pump is sized to provide the minimum required SG injection flowrate to support reactor core cooling and decay heat removal.

The BDB AFW pump will be transported from the BDB Storage Building(s) to a location near the system connection established for discharge to the SG (described below). A flexible hose will be routed from the pump suction to align either the BDB DWST suction/fill connection or the discharge of the fire truck or the BDB High Capacity pump. The BDB AFW pump discharge can be aligned to either a primary or alternate pump discharge connection for SG injection.

On pages 39 and 40 of the Integrated Plan, the licensee stated in part that in order to ensure RCS inventory and reactivity controls are maintained, a portable, diesel powered, BDB RCS injection pump will be available to add borated water from the RWST to the RCS beginning at approximately 20 hours into the event. The pump will be capable of providing a flow rate of 40 gpm with high pressure (greater than nominal operating pressure) discharge capability. This will ensure adequate shutdown margin is maintained and RCS inventory can be restored to the pressurizer.

The portable BDB RCS injection pump will be transported from the BDB Storage Building and positioned in the PA adjacent to the DWST. A high pressure hose will be routed from the pump discharge to a permanent hose connection, which provides a flow path to the RCS. A second hose will be routed from the pump suction to another permanent hose connection that provides a flow path from the RWST.

Deployment of the BDB RCS Injection pump will start approximately 18 hours after the event. By this time, the path from the BDB Storage Building(s) will have been cleared for deployment of other BDB equipment.

Discharge from the BDB RCS Injection pump will be into a high pressure hose which will be routed to the primary discharge hose connection in the "A" SI cubicle for RCS makeup. This hose connection will be on the discharge side of SI pump 3SIH*P1A.

The alternate connection for RCS makeup is through check valve 3SIH*V18 located in the "B" SI pump cubicle. The valve cap shall be removed from the check valve and a 2 1/2-inch hose adapter and gasket stored in the BDB Storage Building(s) shall be used to provide an alternate flow path.

In addition, the licensee stated that for Phase 3, additional pumps will be provided from the RRC to provide backup to the BDB AFW pumps as well as the BDB high capacity pumps. The installed TDAFW pump has the capability to operate for an extended period of time. Failure of the pump can be mitigated by the on-site BDB AFW pump. The RRC pumps provide backup capability should multiple failures occur during extended operation after several days or weeks from the event.

Not all of the RRC pumps required by the Phase 3 strategies are included in Table 2 of the Integrated Plan that lists the portable pumps required during the Phase 3 of ELAP. Only the BDB portable RCS injection pump is listed. During the audit process the licensee stated that a proposed revision to Table 2 of the Integrated Plan, which reflects all equipment being received from the Regional Response Center (RRC), has been developed The table includes "generic" equipment (received by any site declaring an ELAP event) and "non-generic" equipment (plant specified equipment identified in the MPS2 SAFER playbook). The licensee noted that not all of the equipment listed in Table 2 is credited in the Phase 3 response strategies, however all of the equipment listed in Table 2 will be shipped to the MPS site upon declaration of an ELAP event. RRC Equipment that has not been credited for Phase 3 response strategies will provide "defense in depth" for other FLEX strategies. An updated Table 2 will be provided in the February 2014 6-month status update to the Integrated Plan.

The licensee has provided strategies using portable pumps for RCS cooling and maintaining RCS inventory. Tables 1 and 2 (pages 100 and 102) of the Integrated plan list the phases 2 and 3 portable equipment required for the ELAP mitigation. Table 1 lists two BDB high capacity pumps, four BDB AFW pumps, four BDB RCS injection pumps, and four portable boric acid batch tanks that are required during the phase 2 of ELAP. The required capacities are 1200 gpm, 300 gpm and 40 gpm for each of the BDB high capacity pumps, BDB AFW pumps and BDB RCS injection pump, respectively. However, no required pressures are specified for the corresponding pump flow rate. The required volume of the boric acid batching tank is 1000 gallons. Table 2 of the Integrated Plan lists one BDB RCS injection pump that is required during the phase 3 of ELAP. The required capacities of the respective pumps are 40 gpm with no corresponding required pressure specified.

The licensee was requested to provide the following Information:

1) The required times for the operator to realign each of the above discussed pumps and confirm that the required times are consistent with the results of the ELAP analysis.

2) The required pressures corresponding to the flow rates for each of the above discussed pumps.

3) Discussions related to the analyses that are used to determine the required flow rates and corresponding pressures of the portable pumps,

4) The required power supply for each of the pumps discussed above.

5) Justification that the capacities of each of the above discussed pumps and the volume of boric acid batching tanks are adequate to maintain core cooling and sub-criticality during phases 2 of ELAP.

During the audit process, the licensee stated that per the revision to the equipment list for Phase 2 equipment provided in the August 2013 6-month status update, the number of BDB high capacity pumps, BDB AFW pumps, and BDB RCS injection pumps is 2, 3, and 2, respectively. Likewise, the number of portable boric acid batch tanks was reduced to 2. The change was due to the decision to have a single BDB storage building versus two buildings assumed in the Integrated Plan.

1) Per the supplemental information provided by letter dated April 30, 2013, the Demineralized Water Storage Tank (DWST) has sufficient water to provide core cooling for a minimum of 22 hours. Action Item 12 in Section A.4 of the Integrated Plan provides the basis for deployment of the BDB High Capacity pump within 3 hours. However, Millstone Unit 2 has a more limiting deployment time than does Unit 3. Since only one pump is required to service both Millstone units, it is concluded that the BDB High Capacity pump is available well before makeup to the DWST would be required.

The TDAFW pump is assumed to be available for Millstone Unit 3. If the BDB AFW pump would be needed as a backup to the installed TDAFW pump, it will be transported to its deployment location and used as a backup in the event the TDAFW pump fails to operate or when steam pressure decreases below the required operating pressure much later on in the scenario.

Per the revision to the RCS Inventory strategy reported in the Six-Month Status Update dated August 23, 2013, the RCS Injection pump is to be deployed and available for use by 16 hours into the ELAP event. This time is conservative by a factor of 2 to the ELAP analysis value of 33 hours as reported in the OIP. Per Action Item 14 in Section A.4 of the Integrated Plan, debris removal should be complete within the first couple of hours and then two hours is allowed to transport the pump from the BDB Storage Building and to connect the suction and discharge hoses. In the event of an RCS Injection pump failure, the second (N+1) RCS Injection pump can be used to provide necessary inventory and boration control for MPS3 while MPS2 can use the alternate strategy using the repowered charging pumps. The conservatism in the start time can sufficiently accommodate the time needed for movement of the second RCS injection pump. Additionally, the RRC can provide a RCS Injection pump in the approximately 26 hour time frame.

2) The BDB High Capacity pumps are designed to provide 1200 gpm at 150 psig. The BDB AFW pumps are designed to provide a minimum of 300 gpm at a SG pressure of greater than 300 psig (Reference Calculation MISC-11787). The BDB RCS Injection pump sizing criterion for Westinghouse plants is based on the PWROG Core Cooling Position Paper (Letter OG-13-26). The recommended formula establishes a pressure criteria of 1243 psia. The selected RCS Injection pump is capable of delivering a minimum flow of 40 gpm at a pressure >2000 psig.

3) The BDB high capacity, BDB AFW, and BDB RCS injection pumps require no external power. These are self-contained diesel powered pumps.

4) Required pump flows and corresponding pressures were qualified in Calculation No. 13-015, "MP2 & MP3 FLEX Strategy Hydraulic Calculations", Rev. 0, which is available in the Dominion ePortal.

5) The flow requirement to maintain core cooling is met by the 1200 gpm BDB high capacity pump. The capacity of 1200 gpm, includes 300 gpm for AFW flow for MPS2 and 300 gpm for AFW flow for MPS3 for core cooling. These flow rates are sufficient to remove core heat as

determined in Calculation MISC-11787. In addition, the capacity is also adequate to provide 250 gpm make-up for the MPS2 SFP and 250 gpm make-up for the MPS3 SFP. These capacities exceed the boil-off rate for the SFPs per Calculation MISC-11792. The BDB high capacity pump capacity also includes a 100 gpm flow for miscellaneous makeup water to replenish tanks.

The RCS inventory control strategy will deploy the BDB RCS injection pump for RCS make-up with borated water by approximately 16 hours. This make-up flow will be in excess of the RCP seal leakage at that time. Mass addition via the BDB RCS injection pump will forestall natural circulation flow breakdown and the transition to reflux cooling, restore levels into the pressurizer, and facilitate turbulent mixing of any added boron. It is anticipated that the RWST will be available for inventory addition. At the RWST minimum TS value of 2,700 ppm, approximately 6,500 gallons of borated water would provide for adequate boration of the RCS to offset Xenon decay (which occurs at a time greater than 100 hours). The addition of this borated water is required to begin prior to 25 hours and can easily be accomplished prior to Xenon depletion.

The licensee stated in the Integrated Plan that the alternate strategy for connecting the diesel driven BDB AFW pump is to remove the bonnet off of a SGBD valve. The licensee was requested to provide more discussion on how operators will accomplish this task, to include tools, chain falls, staging of necessary equipment, complexity of task, and time.

During the audit process the licensee provided the following information regarding this issue: The disassembly of the steam generator blowdown (SGBD) valves and installation of the valve bonnet adapter to establish the AFW alternate connection will be performed by augmented staff that will arrive on site approximately 6 hours into the event. The required tools, rigging, bonnet hose adapter, bolting and gaskets are being identified and will be stored in the BDB storage building. Per the SOE timeline, the BDB AFW pump is deployed at 12-24 hours into the event as a back-up to the installed TDAFW pump. At this time, the primary and alternate AFW connections will be evaluated for use and tie-in preparations will be performed. The alternate connection task will be procedurally controlled and will be performed while the BDB AFW pump is staged. Only manual tools are required for disassembly of the SGBD valve and installation of the valve bonnet adapter. No hydraulic or electric tools are necessary to complete this task.

Section 3.2.4.9 "Portable Equipment Fuel", below addresses the fuel necessary to operate the FLEX equipment needs. The discussion in this section provides reasonable assurance that sufficient quantities of fuel as well as delivery capabilities are available.

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

3.2.2 Spent Fuel Pool Cooling Strategies

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

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

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

On page 52 of the Integrated Plan, the licensee stated that following the occurrence of an ELAP/LUHS event, normal SFP cooling capability is lost which can result in SFP boiling and loss of adequate SFP level for adequate spent fuel cooling. The licensee stated that conservative analysis has shown that, based on the limiting fuel storage scenario resulting in maximum design heat load, with no operator action, the SFP will reach 212 degrees F in approximately 10 hours and boil off to a level 10 feet above the top of fuel in approximately 50 hours from initiation of the event. The licensee stated that based on the extended time available for action to supplement SFP cooling, the Phase 1 coping strategy is to monitor SFP level, using instrumentation to be installed as required by NRC Order EA-12-051.

On page 55 of the Integrated Plan, the licensee stated that Phase 1 coping for maintaining the fuel in the SFP adequately cooled following an ELAP/LUHS will be accomplished by monitoring SFP level using the BDB SFP instrumentation installed as required by NRC Order EA-12-051. The licensee also stated that SFP cooling will be maintained by providing makeup to the pool using on-site portable equipment stored in the BDB storage building, and that makeup to the SFP will be required prior to 50 hours, at which time continued pool boiling is calculated to reduce the pool level to within ten feet of the top of stored fuel.

The licensee stated that the primary coping strategy for SFP cooling is to utilize the fire truck or BDB high capacity pump, deployed to provide makeup water flow to the pool. The water will be draw from the barge slip and pumped to the pool through a flexible hose connected to the pre-installed, seismically-designed, and robustly missile protected SFP makeup connection installed on the south wall of the Fuel Building (FB) loading bay area. The licensee also stated that the flow path for SFP make-up is through an existing open ended line which provides flow directly into the pool, and since the BDB SFP makeup connection is protected, and other necessary equipment is deployed from the BDB storage building, this SFP makeup capability will be available for the applicable external hazards.

The licensee stated that the alternate capability for SFP makeup utilizes methods developed for compliance with 10 CFR 50.54(hh)(2) (consistent with NEI 12-06 Table D). The fire truck or the BDB high capacity pump would provide flow from the barge slip through portable spray nozzles that will be set-up on the deck near the SFP, or through a flexible hose that will be routed over the edge of the pool. The licensee stated that the staging of equipment within the FB can be accomplished before the SFP area becomes inaccessible since pool boiling is not anticipated until after 10 hours and FB access is expected to be available for a considerable time after boiling begins. The licensee stated that the fire truck or the BDB high capacity pump will provide SFP makeup capability of up to 250 gpm, which exceeds the calculated boil-off rate of 88 gpm, and hydraulic analysis of the flow paths from the barge slip to the SFP for each of the makeup methods described above will be performed to confirm that applicable performance requirements are met.

Per NEI 12-06, a vent pathway for removal of steam and condensate from the SFP area is recommended as steam from pool boiling can condense and cause access and equipment problems in other parts of the plant. The licensee stated that following a BDB event, a vent pathway would be required in the event of SFP bulk boiling and can be established by opening the FB roll-up doors for inlet and outlet air flow.

The licensee identified an open item to complete an analysis for fluid components performance requirements to confirm fluid hydraulic strategy objectives are met. During the audit process the licensee stated that the flow requirement to maintain core cooling is met by the 1200 gpm BDB high capacity pump. The capacity of 1200 gpm includes 300 gpm for AFW flow for Unit 2 and 300 gpm for AFW flow for Unit 3 for core cooling. These flow rates are sufficient to remove core heat as determined in Calculation MISC-11787 and in addition the capacity is also adequate to provide 250 gpm make-up for the MPS2 SFP and 250 gpm make-up for the MPS3 SFP. These capacities exceed the boil-off rate for the SFPs per Calculation MISC-11792. The BDB high capacity pump capacity also includes a 100 gpm flow for miscellaneous makeup water to replenish tanks.

The licensee's strategy for providing air flow to remove steam generated from pool boiling was not described in any detail in the Integrated Plan. The path for inlet and exhaust air is apparently the same i.e., the FB rollup doors. It was not clear to the staff from the discussion provided in the Integrated Plan on how this will enable a flow path to vent the steam and condensate from the FB.

During the audit response, the licensee stated that the available ventilation path uses 5 doors (3 rollup and 2 personnel doors). Two of the rollup doors are on the 24 ft. 6 in. elevation of the FB. They are the railroad enclosure to outside door (east side of FB) and the new fuel receiving area to outside door (north side of FB). The third door is also a rollup door which connects the east side of the shipping cask area on the 52 ft. elevation to the lower 24 ft. 6 in. elevation of the FB. Additionally, the licensee stated that there is a personnel door from the north side of the SFP cask area on the 55 ft. 9 in. elevation into a stairwell and another door from the stairwell to the roof at the same elevation. The licensee stated that the opening of these doors will provide both a vent path for steam and allow for a flow path of cool air to enter the area from the rollup doors on the 24 ft. 6 in. elevation and exit through the shipping cask area door on the 55 ft. 9 in. elevation of the FB. If needed, portable fans can also be positioned at the new fuel receiving area door to enhance the ventilation. The licensee stated that the MPS3 strategies for connection of SFP makeup and sprays are performed from the lower elevation of the SFP (24 ft. 6 in.) and prior to initiation of significant evaporation and/or boiling from the pool surface, and since subsequent initiation of makeup or spray into the SFP requires no operator action from within the building, habitability is not anticipated to be a concern for this 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 provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to SFP cooling if these requirements are implemented as described.

3.2.3 Containment Functions Strategies

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

On pages 47 and 49 of the Integrated Plan, the licensee stated that the Phase 1 coping strategy for containment involves verifying containment isolation per ECA-0.0, "Loss of All AC Power," and continuing to monitoring containment pressure using installed instrumentation. The licensee stated that evaluations have been performed and conclude that containment temperature and pressure will remain below design limits and key parameter instruments subject to containment environment will remain functional for at least 7 days, and therefore, actions to reduce containment temperature and pressure and ensure continued functionality of the key parameters will not be required prior to this time and will utilize off-site equipment and resources during Phase 3.

The licensee stated that referenced evaluations and calculations show no strategies are required in Phase 1 or 2 to maintain containment temperature and pressure below design limits and that key parameter instruments subject to the containment environment will remain functional for at least 7 days. The licensee did not provide any supporting details in the Integrated Plan regarding actual containment pressures and temperatures to be experienced during the ELAP based on these calculations, which used the GOTHIC code.

During the audit process, the licensee stated that as indicated in section 5.1.2 of the ETE-CPR-2012-0008, the long term containment pressure and temperature analysis for MPS Unit 3 has been documented in Calculation MISC-11793. Pages 23 and 24 of the calculation document the long term pressure and temperature profiles for the initial 7 days of the post ELAP scenario. The licensee stated that as documented on page 16 of the calculation, at the end of 7 days, the MPS3 containment pressure and temperature are calculated to be 28.46 psia and 203.1 degrees F respectively, and as documented on page 15 of the calculation, the calculated peak pressure and temperature, at the end of seven days following ELAP, are calculated to be well below the containment design pressure and temperature limits of 45 psig and 260 degrees F respectively.

The licensee stated that containment response analysis has been performed utilizing the same approved GOTHIC licensing model and methodology that was used for FSAR Chapter 6 containment integrity analysis, and is documented in topical report DOM-NAF-3-0.0-P-A. This topical report describes, in detail, the assumptions to be used and the mathematical formulations employed for containment integrity analysis for all of the licensee's fleet. The NRC has approved the use of the GOTHIC code and the analysis methodology described in this topical report in a letter dated August 30, 2006.

Additionally, the licensee stated that the details of the long term containment cooldown and depressurization strategies for MPS Unit 3 are still under development, and upon selection of

the preferred strategy, detailed GOTHIC analysis will be performed to document and validate the strategy and also to provide operators with timelines and guidelines for actions to insure the long term integrity of the containment throughout the Phase 3 of the postulated ELAP/LUHS scenario.
The strategy for containment cooldown and depressurization will be completed per the schedule given in the August 23, 2013 Six-Month Status Update. The detailed validation analysis will be completed later this year and the results will be provided in the February 2014 Six-Month Status Update. This has been identified as Confirmatory Item 3.2.3.A in Section 4.2.

NEI 12-06, Section 3.2.1.1 states in part that: Procedures and equipment relied upon should ensure that satisfactory performance of necessary fuel cooling and containment functions are maintained. NRC Order EA-12-049 states in part that: Licensees or CP holders must be capable of implementing the strategies in all modes. The NRC has received analysis results from other licensees with large, dry containments which show that an ELAP event occurring in Modes other than 1-4 have the most potential to exceed the pressure and temperature limits of the containment (i.e. Mode 5 may be the worst case). The licensee was requested to clarify whether the containment analysis associated with Open Item No. 4 of the Integrated Plan will include scenarios which show that containment functions will be (potentially) restored and maintained in response to an ELAP event occurring in all Modes of operation, and to provide an explanation is needed of how the proposed strategies for containment; including situations such as mid-loop operation, operation with an open SG, and operation with the reactor head de-tensioned or off in Modes 5 and 6, including mid-loop operation, SG hatch open, and the reactor vessel head de-tensioned or off, provide additional defense-in-depth for the containment safety functions. This has been identified as Confirmatory Item 3.2.3.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 Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to maintaining containment functions, if these requirements are implemented as planned.

3.2.4 Support Functions

3.2.4.1 Equipment Cooling - Cooling Water

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

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

The licensee did not provide sufficient information regarding cooling functions provided by such systems as auxiliary building cooling water, service water, or component cooling water cooling when cc is lost during the ELAP for Phase 1 and 2. For example, the potential need for cooling water for the TDAFW pump bearings was not discussed.

During the audit process, the licensee stated that the MPS3 TDAFW pump bearings are cooled by circulating auxiliary feedwater from the TDAFW pump fluid through the TDAFW pump oil cooler, and the pump does not rely on cooling support systems. Additionally, other than general room ventilation requirements which have been addressed separately, FLEX-credited plant equipment does not rely on the cooling functions provided by cooling support systems in order to provide their FLEX functions.

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

3.2.4.2 Ventilation – Equipment Cooling

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

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

> Actuation setpoints for fire protection systems are typically at 165-180 degrees Fahrenheit. 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 pages 87 through 91 of the Integrated Plan, the licensee stated that the FLEX strategies for maintenance and/or support of safety functions involve several elements, and that one element is to ensure that ventilation, heating, and cooling is adequate to maintain acceptable environmental conditions for equipment operation and personnel habitability. The licensee stated that details of the ventilation strategy are under development and will conform to the guidance given in NEI 12-06 and that the details of this strategy will be provided at a later date. Additionally ventilation related modifications procedures, strategies, and/or guidelines needed to support implementation of the Phase 1 (2 and 3) coping strategies will also be identified and developed at a later date.

During the audit process, the licensee stated that the areas of the plant that are expected to be affected by the loss of ventilation following ELAP/LUHS scenario at MPS3 have been preliminarily identified to be the MCR, Instrument Rack Room, TDAFW Pump Room, MCC Rod Control Area, East Switchgear Room, Battery Room and the Main Steam Valve Building. The analyses to evaluate the effects of loss of ventilation in these areas are currently underway. The licensee stated that upon completion of the analysis, detailed strategies and operator action timelines will be developed for the implementation of compensatory measures to maintain the area temperatures below the applicable design limits, if necessary. The MPS3 Integrated Plan, Table 1 identifies 2 set of fans, blowers and heaters to be available from the BDB Storage Building. The licensee stated that this number will be revised as necessary based on the results of the final ventilation analysis and finalized strategy. The ventilation evaluation is in progress and the results will be provided in the February 2014 6-month update. This has been identified as Confirmatory Item 3.2.4.2.A in Section 4.2.

During the audit process, the licensee also stated that the analysis to evaluate the effects of loss of ventilation in the TDAFW Pump Room, including identification of assumed initial temperature conditions, is currently underway. The licensee stated that preliminary results of a GOTHIC analysis indicate that no compensatory measures are required to maintain the area temperatures below the design Maximum Allowable Excursion (MAE) temperature limit of 162 F during the initial 12 hours of the ELAP/LUHS scenario. The licensee stated that this time frame has been judged to be adequate for the operation staff to establish compensatory measures to cool the room and maintain temperatures well below the applicable qualification limits. The licensee stated that compensatory measures that are currently being investigated include the opening of the East and South access doors of the TDAFW Pump Room to provide a direct vent path to the outside atmosphere, and if needed, portable fan(s) could be utilized to enhance the natural convection cooling inside the room. The licensee also stated that they intend to use the results of this analysis to develop detailed strategies and operator action timelines to maintain the room temperature to well below the MAE temperature limits, thus, providing a reasonable assurance that all required electrical and mechanical components will continue to operate and not experience thermal induced failures due to the anticipated temperature transients during the ELAP/LUHS event.

The areas of the plant that would most likely be affected by loss of ventilation and cooling systems are the ones that will be necessary to be occupied (MCR, TDAFW Pump Room) during the ELAP or will require ventilation for situations like hydrogen generation in the battery rooms.

The NRC has identified the following issues regarding habitability of the MCR during the ELAP. Without ventilation the MCR would most likely heat up. If temperatures approach a steady-state condition of 110 degrees 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 degrees F is tolerable for light work for a 4 hour period while dressed in conventional clothing with a relative humidity of ~30%. The licensee did not supply sufficient information to conclude that the habitability limits of the MCR 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.

The NRC has also identified issues with hydrogen accumulation in the battery rooms. With no ventilation for the battery rooms, hydrogen gas building could become an issue. As the strategy for providing ventilation to the battery room has not been developed, additional discussion on the hydrogen gas exhaust path is needed, and a discussion of the accumulation of hydrogen with respect to national standards and codes which limit hydrogen concentration to less than 2% (IEEE Standard 484 as endorsed by Regulatory Guide 1.128, "Installation Design and Installation of Vented Lead-Acid Storage Batteries for Nuclear Power Plants") and less than 1% (National Fire Code) when the batteries are being recharged during Phases 2 and 3.

During the audit process, the licensee stated that: hydrogen gas generation from the charging batteries will be dispersed by the normal battery room exhaust flowpaths, 2) when Bus 32-2T is energized from the BDB 480 VAC portable diesel generator (via Bus 32T), the battery chargers for the 301A batteries will be started. Bus 32-2T also supplies power to an MCC for the battery room exhaust fans. When power is restored to the battery chargers, the exhaust fans will also be started. The normal flowpath for exhausting hydrogen gas will be used.

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

3.2.4.3 Heat Tracing

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

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

such systems are identified, additional backup sources of water not dependent on heat tracing should be identified.

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, Section 3.2.2 paragraph 13, has been adequately addressed

During the audit process, the licensee stated that heat tracing is used to maintain highly concentrated soluble boron solutions above the temperature where the soluble boron will precipitate out of solution, and that heat tracing is also used to protect piping systems and components from freezing in extreme cold weather conditions.

The licensee stated that FLEX strategies developed do not depend on highly concentrated soluble boron solutions. FLEX strategies developed will use borated water sources with boron concentrations below 4000 PPM. The licensee stated that at these levels boron precipitation is not expected to occur.

The licensee stated that FLEX strategies have also been developed to protect piping systems and components from freezing, and that commercially available Heat Tape and insulation rolls have been identified and will be procured and maintained in the FLEX Storage facility for use on piping systems and components that will be used during an ELAP event where freezing is a concern in extreme cold weather conditions. In addition the licensee stated that major components being procured for FLEX strategies will be provided with cold weather packages and small electrical generators to power the heat tape circuits as well as protect the equipment from damage due to extreme cold weather and help assure equipment reliability.

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

3.2.4.4 Accessibility - Lighting and Communications

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

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

On page 74 of the Integrated Plan, the licensee stated that the FLEX strategies for maintenance and/or support of safety functions involve several elements. The licensee stated that one necessary element is maintaining sufficient lighting in areas needed to successfully implement the planned FLEX strategies. MPS3 initially relies on emergency lighting installed for Fire

Protection/Appendix R to perform Phase 1 coping strategy activities. However, Appendix R lighting is powered by battery packs at each light and is rated for only 8 hours. This lighting also does not provide 100% coverage of areas involving FLEX strategy activities including ingress and egress from task areas. In these areas and areas poorly lit, portable lighting and head lamps are available for use. Portable lighting is currently staged throughout the site, mainly for use by the Fire Brigade.

The licensee stated that there are no procedures, strategies, or guidelines needed with regard to use or restoration of lighting in Phase 1 of an ELAP/LUHS event. Portable lighting is currently staged throughout the site, mainly for use by the Fire Brigade. The location of these lights will be identified in the FLEX Guidelines.

On page 76 of the Integrated Plan, the licensee stated that the there are three methods of providing light in areas needed to successfully implement Phase 2 and 3 FLEX strategies.

First, is the continued use of the Appendix R lighting discussed in Section F3.1 of the Integrated Plan however, as previously stated, this lighting is limited to approximately 8 hours. Additionally, the use of portable hand held lighting or head lamps will continue to be available for use in dark or poorly lit areas.

Second, will be the use of supplemental lights that will be available as stored BDB equipment. This includes additional small portable sources (such as flashlights and head lamps) for personal use, as well as larger portable equipment (such as self-powered light plants). The larger lighting equipment would be typically deployed in outside areas to support deployment of BDB pumps and generators. In some cases, BDB equipment will be equipped with independent lighting sources.

Third, is the restoration of power to various lighting panels in the electrical distribution system. Connections for selected lighting are discussed in Section F1.2 of the Integrated Plan.

The licensee stated that a lighting study will be performed to validate the adequacy of existing lighting and the adequacy and practicality of using portable lighting to perform FLEX strategy actions. Review of the result of these studies has been identified as Confirmatory Item 3.2.4.4.A in Section 4.2.

The NRC staff has reviewed the licensee communications assessment (ADAMS Accession No. ML12307A024 and ML13058A038) in response to the March 12, 2012, 50.54(f) request for information letter, and as documented in the staff analysis (ADAMS Accession No. ML13189A155) has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by the licensee will conform to the guidance of NEI 12-06 Section 3.2.2 (8) regarding communications capabilities during an ELAP. Confirmation will be required that upgrades to the site's communications systems have been completed. This has been identified as Confirmatory Item 3.2.4.4.B in Section 4.2.

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

On page 94 of the Integrated Plan, the licensee stated that an access contingency in the MPS Security Plan for loss of power situations ensures the ability of plant personnel and BDB equipment to access areas inside the plant structures as well as access from areas outside the site PA to implement the planned FLEX strategies. The FLEX strategies for maintenance and/or support of safety functions involve several elements. One element is the ability to access site areas required to successfully implement the planned FLEX strategy.

The potential impairments to required access are doors and gates blocking personnel or equipment access. The coping strategy to maintain site accessibility through doors and gates is applicable to all phases of the FLEX coping strategies, but is immediately required as part of Phase 1.

The licensee stated that doors and gates serve a variety of barrier functions on the site. One primary function is security and is discussed below, and that these doors and gates are typically administratively controlled to maintain their function as barriers during normal operations. The licensee also stated that following an ELAP/LUHS event, FLEX coping strategies require the routing of hoses and cables to be run through various barriers in order to connect BDB equipment to station fluid and electric systems. For this reason, certain barriers (gates and doors) will be opened and remain open.

The licensee stated that the security doors and gates of concern are those barriers that rely on electric power to operate opening and/or locking mechanisms, and that the ability to open doors for ingress and egress, ventilation, or temporary cables/hoses routing is necessary to implement the FLEX coping strategies. Additionally the security force will initiate an access contingency upon loss of the security diesel and all ac/dc power as part of the Security Plan, and access to the Owner Controlled Area, site PA, and areas within the plant structures will be controlled under this access contingency.

The licensee stated that vehicle access to the PA is via the double gated sally-port at the security building. As part of the security access contingency, the sally-port gates will be manually controlled to allow delivery of BDB equipment (e.g., generators, pumps) and other vehicles such as debris removal equipment into the PA.

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

NEI 12-06 Section 9.2 states,

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

During the audit process, the licensee stated that the areas of the plant that are expected to be affected by the loss of ventilation following ELAP/LUHS scenario at MPS3 have been preliminarily identified to be the MCR, Instrument Rack Room, TDAFW Pump Room, MCC Rod Control Area, East Switchgear Room, Battery Room and the Main Steam Valve Building, and that the analyses to evaluate the effects of loss of ventilation in these areas are currently underway. The licensee stated that upon completion of the analysis, detailed strategies and operator action timelines will be developed for the implementation of compensatory measures to maintain the area temperatures below the applicable design limits, if necessary. The licensee also stated that the MPS3 Integrated Plan, Table 1 identifies 2 set of fans, blowers and heaters to be available from the BDB Storage Building, and that this number will be revised as necessary based on the results of the final ventilation analysis and finalized strategy. The ventilation evaluation is in progress and the results will be provided in the February 2014 6-month update. This has been combined with Confirmatory Item 3.2.4.2.A in Section 4.2.

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

3.2.4.7 Water Sources

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

Plant procedures/guidance should ensure that a flow path is promptly established for makeup flow to the steam generator/nuclear boiler and identify backup water sources in order of intended use. Additionally, plant procedures/guidance should specify clear criteria for transferring to the next preferred source of water.

Under certain beyond-design-basis conditions, the integrity of some water sources may be challenged. Coping with an ELAP/LUHS may require water supplies for multiple days. Guidance should address alternate water sources and water delivery systems to support the extended coping duration. Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles are assumed to be available in an ELAP/LUHS at their nominal capacities. Water in robust UHS piping may also be available for use but would need to be evaluated to ensure adequate NPSH can be demonstrated and, for example, that the water does not gravity drain back to the UHS. Alternate water delivery systems can be considered available on a case-by-case basis. In general, all CSTs should be used first if available. If the normal source of makeup water (e.g., CST) fails or becomes exhausted as a result of the hazard, then robust demineralized, raw, or borated water tanks may be used as appropriate.

Finally, when all other preferred water sources have been depleted, lower water quality sources may be pumped as makeup flow using available equipment (e.g., a diesel driven fire pump or a portable pump drawing from a raw water source). Procedures/guidance should clearly specify the conditions when the operator is expected to resort to increasingly impure water sources.

On page 7 of the Integrated Plan, the licensee stated that the following plant initial conditions and assumptions are established for the purpose of defining FLEX strategies:

1) 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 available. Permanent plant equipment that is contained in structures with designs that are robust with respect to seismic events, floods, and high winds and associated missiles, are available.
2) The fire protection system ring header is not relied upon as a water source since it is not considered to be robust with respect to seismic events.
3) Normal access to the ultimate heat sink (UHS) is lost, but the water inventory in the UHS remains available and robust piping connecting the UHS to plant systems remains intact.

On pages 9 thru 11 of the Integrated Plan, the licensee stated that the procedure for SBO provides direction to start the TDAFW pump and close the RCS isolation valves. At MPS3, the TDAFW pump is aligned to supply water from the DWST to the SG's. The credited supplemental source of AFW is water from Long Island Sound. To supply makeup to the DWST from the Long Island Sound, a BDB high capacity pump or a fire truck will be positioned at the barge slip. A temporary hose would be run to the DWST to provide a supplemental source of AFW.

The licensee also stated that a BDB RCS injection pump will be transported from an onsite BDB Storage Building to the staging location. The BDB RCS injection pump will be deployed taking suction from the RWST and discharging into the RCS. Deployment of the pump is to start at 18 hours after start of the ELAP event. Allowing 2 hours for transport and hose hookup to the connection points, flow into the RCS should start in about 20 hours after start of the event.

To provide makeup to the SFP, a fire hose will be connected to the discharge of the BDB High Capacity pump or fire truck located at the barge slip. This pump discharge hose will tie into a water thief located outside the Fuel Building loading bay.

On page 23 of the Integrated Plan, the licensee stated that initially, AFW water supply will be provided by the installed DWST. The tank has a minimum usable capacity of 312,800 gallons and will provide a suction source to the TDAFW pump for a minimum of 22.7 hours.

On page 25 of the Integrated Plan, the licensee stated that the MPS site has multiple fresh water supplies which will be deployed to add water to the DWST or provide suction directly to the BDB AFW pump. These include the 3,000,000 gallon site pond which can provide core cooling supply for greater than 20 days to each unit. The Long Island Sound will only be used as a last resort. The licensee also stated that if needed as an indefinite water source, the Long Island Sound will remain available for any of the external hazards listed in Section A.1 of the Integrated Plan.

On page 39 of the Integrated Plan, the licensee stated that the RWST is the preferred borated water source. A hose will be run from the suction of the portable BDB RCS injection pump to the suction side of SI pump 3SIH*P1A to supply borated water from the RWST. The RWST is a safety related, seismically qualified storage tank, but is not missile protected. The tank contains a minimum of 1,166,000 gal of borated water at a concentration of greater than 2700 ppm. In the event the RWST is damaged or should become unavailable as a borated water source for RCS make-up, a FLEX strategy to support using a 1000 gallon portable boric acid mixing tank has been developed. This mixing tank would be transported from the on-site BDB Storage Building and positioned near the BDB RCS injection pump. The tank would be filled with water, and powdered boric acid would be added and mixed to the proper boric acid concentration needed to maintain adequate shutdown margin and RCS inventory. Bags of powdered boric acid are easy to deploy to any area of the plant where the batching tanks are required.

The licensee's Integrated Plan describes the sources of water to support the mitigating strategies as noted above. The licensee plans on using the DWST's, the 3 million gallon site pond, and the UHS (Long Island Sound) as makeup water supplies for the Steam Generators, the UHS as makeup for the SFP, and the RWST or a portable 1,000 gallon batching tank for RCS makeup. The licensee noted that 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 will be available. The licensee provided alternate sources of water for core cooling and RCS makeup in the event the initial sources fail. The licensee has supplied adequate information regarding water supplies for SG, SFP and RCS makeup.

The licensee noted for the alternate strategy for RCS makeup, that water would be added to a batching tank and that "Bags of powdered boric acid are easy to deploy to any area of the plant where the batching tanks are required. Water for mixing would be supplied by the BDB High Capacity pump." The water supplies in this instance would be water from either a 3 million gallon site pond or the UHS. Both of these makeup water supplies could potentially contain debris or foreign material. The licensee was requested to discuss the possible consequences of injecting this potentially impure water into the RCS or the SG's.

During the audit process, the licensee stated that the RWST is a seismically installed safety-related tank; however, it is not tornado missile protected. In the unlikely event that a tornado missile strikes the base of the tank such that the water content is unavailable, another borated water source would be required. The licensee also stated that the boric acid batch tank is only required if the qualified borated water source, the RWST is not available. Millstone FSGs will provide direction to use available clean water sources for mixing in the batching tank, and that the clean water sources include the condenser hotwell and the city water supplies as specified in ETE-CPR-2012-0008, Chapter 2. Additionally, the licensee stated that although these sources are not fully protected, they would be expected to survive from a tornado event which damages the RWST because the condenser is located in the lower elevations of the TB providing a tortuous path for a missile and the city water storage tank is located several miles from the site which would not be damaged by the same tornado event damaging the on-site RWST.

The licensee stated that usage of the site pond or the UHS for supplying Auxiliary Feedwater to the steam generators will be used only as a last resort. The licensee stated that Westinghouse is currently performing analysis which will determine the consequences of usage of these water sources in the steam generators and that the results of the analysis are expected to provide the allowed time limits on usage of these sources. The licensee stated that the RRC will provide equipment to initiate residual heat removal and water treatment equipment such that heat removal can be ensured for extended durations, and that this equipment is expected to be available within the 24-72 hour timeframe. The licensee also stated that they will ensure that the strategies being developed will provide adequate margin to ensure core cooling is maintained. Updated strategies for RCS Inventory and Core Cooling utilizing the RRC equipment will be provided in the February 2014 6-month update. The final results of the Westinghouse analysis are expected in March 2014 and will be provided in a subsequent 6-month update. This has been identified as Confirmatory Item 3.2.4.7.A in Section 4.2.

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

In the Integrated Plan the licensee did not provide any information regarding how portable generators would be electrically isolated from plant equipment.

The licensee's Integrated Plan did not address electrical isolation of portable equipment. During the audit process the licensee stated that for permanently connected BDB equipment, such as connection receptacles, conduits, and cables, the BDB electrical equipment is procured and installed to the requirements of safety related equipment or is isolated from the class IE buses in accordance with the approved design standards per the licensing basis for the unit. For the portable BDB generators, each generator is to be provided with output electrical protection (e.g., breakers, fuses, relays) that will provide protection for the output cables and the connections to the station buses. Existing load circuit protection will be used for the bus loads.

The licensee also stated that electrical isolation to prevent simultaneously supplying power to the same bus from different sources will be administratively controlled. The FSGs will be written to ensure the breakers from other potential supply sources are racked out and tagged before power is supplied to the bus by use of a BDB portable diesel generator which is to be connected directly to the buses through a spare breaker.

The licensee was requested to provide a summary of the sizing calculation for the FLEX generators to show that they can supply the loads assumed in phases 2 and 3. During the audit process the licensee stated that the phase 2 strategy for MPS3 is based on using a 120 VAC portable diesel generator and a 480 VAC portable diesel generator as a back-up. The phase 3 strategy is based on using 4160 VAC portable diesel generators. The load requirements are summarized in the body of Calculation 2013-ENG-04503E3 Rev. 0 "Millstone Station Unit 3 Beyond Design Basis - FLEX Electrical 4160 VAC System Loading Analysis" on page 24, and a more detailed breakdown of the loads is provided in Attachment 1 of this calculation.

In Section F1.2 of the Integrated Plan, the licensee stated that the BDB electrical receptacles will be connected to a transfer switch in the supply cable to the 120 VAC vital bus panels. However, a new 1600A breaker is identified in Figure 8. The licensee was requested to clarify if this new breaker is the transfer switch mentioned in the Section F1.2. During the audit process the licensee stated that as stated in Section F1.2 of the Integrated Plan, the transfer switch is shown on Figure 7, and that the 1600A breaker shown on Figure 8 of the Integrated Plan is not the transfer switch.

The licensee was requested to list the non-safety related installed systems or equipment that are credited in the ELAP analysis supporting the FLEX mitigation strategies. Also the licensee was requested to specify the functions of each system or equipment credited in the ELAP analysis, and for all the systems or equipment listed, justify that they are available and reliable to provide the desired functions on demand during the ELAP conditions. Finally the licensee was requested to specify the evaluations were made to assume that the non-vital bus will be available after ELAP, and to be robust to be available for Phase 3.

During the audit process, the licensee stated that Non Safety Related equipment taken credit for in the ELAP Analysis consists of Non-Vital 4160 Bus 34A, which is located in the Switchgear Room at the 4 ft. 6 in. level of the CB. This room also contains Vital 4160 VAC Bus 34C. As indicated in Table 3.2-1 of the MPS3 FSAR, the CB is seismically qualified as well as tornado missile protected. The switchgear in this room is installed to prevent physical interaction during a seismic event. Bus 34A is in a seismic structure; tornado missile protected, and is flood protected. Since use of the 4160 VAC non-vital bus is a Phase 3 action, significant time (days) would be available to repair or bypass the bus should it become damaged as a result of a seismic event.

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

3.2.4.9 Portable Equipment Fuel

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

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

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

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

On page 7 of the Integrated Plan, the licensee stated that fuel for BDB equipment stored in structures with designs that are robust with respect to seismic events, floods and high winds and associated missiles, remains available.

On page 68 of the Integrated Plan, the licensee stated that the FLEX strategies for maintenance and/or support of safety functions involve several elements. One element is maintaining fuel for necessary diesel powered generators, pumps, hauling vehicles, compressors, etc. The general coping strategy for supplying fuel oil to diesel driven portable equipment, i.e., pumps and generators, being utilized during Phases 2 and 3, is to draw fuel oil out of any of the existing diesel fuel oil tanks on the MPS site that are available. The coping strategy for supplying fuel oil to BDB equipment indefinitely is not unit specific. Fuel oil from any storage tank on site will be available to refill BDB equipment being utilized for either MPS2 or MPS3 service.

The license was requested to describe the fuel oil supply to all FLEX equipment and flow paths for the fuel oil associated with the diesel driven pump (i.e., fuel oil storage tank volume, supply pathway, and to also provide a description of how fuel quality will be ensured if stored for extended periods of time.

During the audit process, the licensee stated that fuel sources for the BDB portable pumps and generators used for the FLEX strategies during Phase II and Phase III of an ELAP event are provided from the following on-site fuel sources:

1) Two 12,000 gallon (TS Minimum) seismically installed, missile protected storage tanks located on the 38 ft. 6 in. elevation in the MPS2 AB, which are located well above the maximum postulated flood elevation so they can reasonably be expected to survive following a BDBEE.

2) Two below-ground fuel oil (FO) storage tanks, each containing 32,670 gallons (TS Minimum), are located outside the Unit 3 Emergency Diesel Generator facility, which are seismically installed, missile protected, and located above the maximum postulated flood elevation. The licensee stated that these storage tanks can be reasonably expected to survive following a BDBEE. The "Portable Fuel Tank" will be a fuel oil tanker truck with a self-powered pump that will be stored in the BDB Storage Building. The licensee also provided a discussion applicable for both MPS2 and MPS3 with details regarding the plant profile, storage building location, and haul route details. The licensee stated that the fuel oil tank information provided above is correct and is applicable for both Units 2 and 3, and that Section F2.2 of the Integrated Plan provided tank capacities and not the TS minimum values.

Diesel fuel in the above ground FO storage tanks is routinely sampled and tested to assure FO quality is maintained to ASTM standards. This sampling and testing surveillance program also assures the FO quality is maintained for operation of the station Emergency DGs (EDGs).

The licensee stated that the above fuel sources will be used to fill a portable FO tank that will be procured and stored in the BDB Storage Building, and that the portable FO tank will be deployed from the BDB Storage Building facility to the east side of the MPS2 AB and will be gravity filled from the Unit 2 12,000 gallon storage tanks.

The licensee stated that as an alternate fuel source, the portable FO tank can be dispatched to the west side of the Unit 3 EDG facility where it can be filled from underground fuel sources using a portable 12VDC pump. The licensee also stated that to facilitate deployment of the BDB portable pumps and generators the equipment is expected to be stored in a fueled condition. The licensee stated that as a part of the Preventative Maintenance (PM) templates being created by the Electric Power Research Institute (EPRI), the oil tanks on this FLEX equipment will also be routinely sampled and tested to assure proper FO quality is maintained.

On page 70 of the Integrated Plan, the licensee stated that the BDB fuel carts, pumps, necessary hoses, fittings, and containers will be protected from all hazards while stored in the BDB Storage Building or in protected areas of the plant.

On page 71 of the Integrated Plan, the licensee stated that fuel oil can also be removed from the MPS3 underground storage tanks using a portable fuel pump assembly to fill suitable fuel containers for distribution, and that these tanks are seismically designed and are located in structures that are protected from the extreme external hazards identified in Section A.1 of the Integrated Plan

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

3.2.4.10 Load Reduction to Conserve DC Power

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

> *Plant procedures/guidance should identify loads that need to be stripped from the plant dc buses (both Class 1E and non-Class 1E) for the purpose of conserving dc power.*
>
> DC power is needed in an ELAP for such loads as shutdown system instrumentation, control systems, and dc backed AOVs and MOVs. Emergency lighting may also be powered by safety-related batteries. However, for many plants, this lighting may have been supplemented by Appendix R and security lights, thereby allowing the emergency lighting load to be eliminated. ELAP procedures/guidance should direct operators to conserve dc power during the event by stripping nonessential loads as soon as practical. Early load stripping can significantly extend the availability of the unit's Class 1E batteries. In certain circumstances, AFW 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.

During the audit process, the licensee stated that a) ETE-CEE-2012-1001 which documented a battery life of 5 hours has been superseded by Calculation No. 13-ENG-04501E3, "MP3 BDB Battery Calculation", b) this calculation documents an extended battery life of 14 hours 19 minutes, and uses the ETAP Battery Discharge Analysis module to determine the performance of the dc system, c) the battery duty cycle is calculated from load flow calculations, including correction factors for battery temperature and aging, which are applied to the load duty cycles rather than the battery duty cycle or battery capacity, and the output records from this module are used to determine the battery terminal voltage and the battery capacity at each time during discharge of the battery.

The licensee was requested to provide the following information regarding the station batteries:

1) A detailed list and discussion on the loads that will be shed from the dc bus, the equipment location (or location where the required action needs to be taken), and the required operator actions and the time to complete each action. In your response,
2) Explain which functions are lost as a result of shedding each load and discuss any impact on defense in depth and redundancy.
3) Discuss which components change state when loads are shed and actions needed to mitigate resultant hazards (for example, allowing hydrogen release from the main generator, disabling credited equipment via interlocks, etc.).
4) List which breakers operators will open as part of the load shed evolutions.
5) Specify if the dc breakers to be opened be physically identified by special markings to assist operators manipulating the correct breakers.
6) Provide the minimum dc voltage that must be maintained, and the basis for the minimum voltage on the dc bus, to ensure proper operation of all required electrical equipment.
7) Describe what modification is required if batteries 301A-1 and 301B-1 and 301A-2 and 301B-2 are cross connected.

The licensee stated that the extended battery life analysis is based on the approach that isolates the Train B battery and runs the Train A battery on reduced loads until near depletion. The licensee stated that at that time, Train B is brought back with reduced loads and Train A is isolated. Accordingly, the licensee stated that the extended battery life analysis is based on the following actions:

- Initially, Train A and Train B batteries are both energized; loads consist of both BDB required and non-BDB required loads.
- Starting at 45 minutes from the onset of the ELAP event, the process of isolating Train B and de-energizing Train A loads not required during BDB begins.
- At 55 minutes, Train B is isolated to preserve capacity. The Train B batteries, battery 2 and battery 4, are disconnected from the Train B busses at this time. Train A is sufficient to support required BDB loads.
- On or before 75 minutes, Train A loads not required during BDB conditions are de-energized. The two inverters, 3VBA*INV-1 and 3VBA*INV-3, are now the only loads energized on the A Train batteries.
- Train A operates until the voltage or capacity of either battery 1 or battery 3 reach limiting values. The process of transferring loads to the Train B batteries takes 30 minutes and,

therefore, must start 30 minutes prior to either Train A battery reaching its limiting voltage or capacity.

- Following the re-connection of the Train B batteries, the Train A inverters are de-energized and the two inverters, 3VBA*INV-2 and 3VBA*INV-4, are now the only loads energized on the Train B batteries.
- Train B then operates until voltage or capacity of either battery 2 or battery 4 reach limiting values and are considered depleted or until power is restored to the battery chargers.

The licensee also stated that stripping of dc loads will be performed using FSGs. Lists of dc bus loads to be stripped are provided in Calculation No. 13-ENG-04501E3, Tables 1 and 2 for Trains A and B, respectively, with additional details provided in the associated Tables 3A and 3B. The licensee stated that all breaker/fuse manipulations to be performed are located in either the Train A or Train B Switchgear Rooms in the 4 ft. 6 in. elevation of the CB. The licensee stated that these rooms are accessible from several paths from the MCR through areas protected from flooding and tornado missile damage, and that operators will strip all loads from the Train B battery bus, and strip selected non-BDB loads from the Train A battery bus. The licensee stated that the dc load stripping evolution will start 45 minutes after the initiating event and take a total of 30 minutes to complete, and that the total time from the initiating event to the completion of load stripping is 75 minutes.

The licensee stated that load stripping FSGs will also include the guidance to strip selected 120 VAC vital bus loads to preserve the emergency batteries. Breaker/fuse panel manipulations for stripping of vital 120 VAC bus loads being powered from the Train A batteries will be performed on the 120 VAC Panels VIAC1 and VIAC3, which are located in the East AC Switchgear Room. The licensee stated that breaker/fuse panel manipulations for stripping of vital 120 VAC bus loads being powered from the Train B batteries will be performed on the 120 Vital VAC Panels VIAC2 and VIAC4, which are located in the West AC Switchgear Room. Tables providing the 120 VAC loads that are to being stripped are provided in Calculation No. 13-ENG-04501E3, Tables 4A and 4B for buses VIAC1 and VIAC3 (Train A) and VIAC2 and VIAC4 (Train B), respectively. These AC bus load tables are provided to identify the additional loads being stripped to extend the Unit 3 Class 1E battery life.

The licensee also stated that load stripping will result in the loss of several channels of plant instrumentation, and that this action will leave sufficient channels available for monitoring plant parameters to implement FLEX strategies. Additionally the licensee stated that due to the Class 1E battery extension approach taken, when the battery Trains A and B are switched, the channels available for monitoring plant parameters will also switch to the newly powered train. The only dc loads that are not stripped are the feeds to the inverters which supply power to the 120 VAC vital buses. Most loads are stripped from the 120 VAC vital buses, however, the loads that remain were carefully selected to ensure all plant safety functions can be monitored during Phase 1 of an ELAP event using either of the battery trains. Many of the isolated loads are solenoid valves that have no impact on systems important to plant safety. The licensee provided the following three statements regarding the effects of the load stripping:

1) Upon a loss of power, safety related components are designed to fail to their failsafe condition. During the dc load stripping evolution, the components and circuits which are de-energized will not change state in a manner which results in a plant transient or safety hazard. The existing loss of ac power procedural requirement to verify Containment isolation will be performed prior to starting FLEX load stripping activities. Also, MPS3 main turbine-generator has a separate battery that supplies power to emergency seal oil and lubricating pumps for the main turbine-generator. This battery is not included in the load

stripping strategy, nor is it required for any plant safety systems. This battery is designed to provide the necessary turbine-generator loads for 2 hours. Hydrogen will be vented off the main turbine -generator and then these pumps will be secured. If the non-safety/non-seismic normal dc distribution equipment remains functional during the event, the main generator will be vented using existing plant procedures.

2) The circuits to be opened and fuses to be pulled as part of the load stripping evolution are described in Calculation No. 13-ENG-04501E3, Tables 1 and 2 for the dc battery bus Trains A and B, respectively, with additional details provided in Tables 3A and 3B. The fuses to be pulled to strip AC loads are described in Table 4A for ac panels VIAC1 and VIAC3 and Table 4B for the AC panels VIAC2 and VIAC4. Table 4A is applicable while the Train A batteries are connected and Table 4B is applicable while Train B batteries are connected.

3) The circuits/fuses to be opened/pulled as part of the load stripping evolution on either the dc battery busses or the 120 VAC vital buses have identification numbers and are labeled per plant labeling requirements. At this time, there is no plan to provide any special markings to further identify the breakers. Personnel rely on the proper use of human performance tools, such as procedure use and adherence, and self-checking to ensure the correct breakers are opened/closed.

The licensee also stated that the voltage at the battery terminals must be; 1) above the minimum battery voltage, as well as, 2) be sufficient to ensure adequate voltage at the terminal of any BDB required equipment, and that from Section 5.5 of calculation 2013-ENG-04501 E3, the four plant inverters, each require 101 VDC to function properly. Additionally the licensee stated that for conservatism, an additional 1 VDC was added to the required voltage, yielding 102 VDC as the minimum required voltage at the input of the inverters, and that the inverter ac output voltage will not change appreciably over the allowable input voltage range of the inverter, so the BDB required vital ac bus panel loads will have adequate voltage with a minimum of 102 VDC at the terminals of the inverters. There are no cross connections between batteries on MPS3 and none are required to execute the strategy for extended battery life.

The licensee was requested to provide the dc load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling. During the audit process the licensee stated that calculation 2013-ENG-04501E3, Rev. 0, "MPS3 BDB Battery Calculation," provides the dc load profiles for the MPS3 Class 1E batteries for the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling.

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

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

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

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

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

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

3.3 PROGRAMMATIC CONTROLS

3.3.1 Equipment Maintenance and Testing

NEI 12-06, Section 3.2.2, following item (15) provides that:

> 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 pages 17 and 18 of the Integrated Plan, the licensee stated that periodic testing and preventative maintenance of BDB equipment will follow guidance provided in Institute of Nuclear Power Operations (INPO) AP-913. Testing and maintenance recommendations will be developed by EPRI and EPRI guidance documents will be used to develop testing frequencies and maintenance schedules. The unavailability of equipment and applicable connections that directly performs a FLEX mitigation strategy for core, containment, and SFP will be managed such that risk to mitigating strategy capability is minimized. Maintenance / risk guidance will be developed as follows: Portable BDB equipment may be unavailable for 90 days provided that the site FLEX capability (N) is available. 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. Work Management procedures will be revised to reflect AOTs (Allowed Outage Times) as outlined above.

On page 107 of the Integrated Plan, the licensee stated that EPRI guidance documents will be used to develop periodic testing and preventative maintenance procedures for BDB equipment. Procedures will be developed to manage unavailability of equipment such that risk to mitigating strategy capability is minimized.

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

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

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

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

3.3.2 Configuration Control

NEI 12-06, Section 11.8 provides that:

1. The FLEX strategies and basis will be maintained in an overall program document. This program document will also contain a historical record of previous strategies and the basis

for changes. The document will also contain the basis for the ongoing maintenance and testing programs chosen for the FLEX equipment.

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

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

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

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

On pages 18 and 19 of the Integrated Plan, the licensee stated that the FLEX strategy and its basis will be maintained in an overall program document. The program document will address the key safety functions to; provide reactor core cooling and heat removal, RCS inventory and reactivity control, SFP cooling, indication of key parameters, provide reactor core cooling (Modes 5 and 6) and ensure containment integrity,

In addition to the key safety functions listed above, support functions have been identified that provide support for the implementation of the FLEX strategies. Those support functions include: providing load stripping of 125 VDC and 120 VAC vital buses to extend battery life, re-powering ac and dc electrical buses, providing ventilation for equipment cooling and area habitability, lighting, communications capability, fueling of portable equipment, and plant and area access.

The program document will also contain a historical record of previous strategies and their bases. The program document will include the bases for ongoing maintenance and testing activities for the BDB equipment.

Existing design 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. Changes for the FLEX strategies will be reviewed with respect to operations critical documents to ensure no adverse effect.

Future changes to the FLEX strategies may be made without prior NRC approval provided; the revised FLEX strategies meet the requirements of NEI 12-06, and an engineering basis is documented that ensures that the change in FLEX strategies continues to ensure the key safety functions (core and spent fuel pool cooling, containment integrity) are met.

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

3.3.3 Training

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

1. Programs and controls should be established to assure personnel proficiency in the

mitigation of beyond-design-basis events is developed and maintained. These programs and controls should be implemented in accordance with an accepted training process

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

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

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

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

On page 21 of the Integrated Plan, the licensee stated that the Nuclear Training Program will be revised to assure personnel proficiency in the mitigation of BDB events is developed and maintained. These programs and controls will be developed and implemented in accordance with the Systematic Approach to Training (SAT). Initial and periodic training will be provided to site emergency response leaders on BDB emergency response strategies and implementing guidelines. Personnel assigned to direct the execution of mitigation strategies for BDB events will receive necessary training to ensure familiarity with the associated tasks, considering available job aids, instructions, and mitigating strategy time constraints. Operator training will include use of equipment from the RRC.

The licensee stated that "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 BDB 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.

The licensee also stated that where appropriate, integrated FLEX drills will 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 and that it is not required to connect/operate permanently installed equipment during these drills.

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

3.4 OFFSITE RESOURCES

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

1) A capability to obtain equipment and commodities to sustain and backup the site's coping strategies.

2) Off-site equipment procurement, maintenance, testing, calibration, storage, and control.

3) A provision to inspect and audit the contractual agreements to reasonably assure the capabilities to deploy the FLEX strategies including unannounced random inspections by the Nuclear Regulatory Commission.

4) Provisions to ensure that no single external event will preclude the capability to supply the needed resources to the plant site.

5) Provisions to ensure that the off-site capability can be maintained for the life of the plant.

6) Provisions to revise the required supplied equipment due to changes in the FLEX strategies or plant equipment or equipment obsolescence.

7) The appropriate standard mechanical and electrical connections need to be specified.

8) Provisions to ensure that the periodic maintenance, periodic maintenance schedule, testing, and calibration of off-site equipment are comparable/consistent with that of similar on-site FLEX equipment.

9) Provisions to ensure that equipment determined to be unavailable/non-operational during maintenance or testing is either restored to operational status or replaced with appropriate alternative equipment within 90 days.

10) Provision to ensure that reasonable supplies of spare parts for the off-site equipment are readily available if needed. The intent of this provision is to reduce the likelihood of extended equipment maintenance (requiring in excess of 90 days for returning the equipment to operational status).

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). This has been identified as Confirmatory Item 3.4.A in Section 4.2.

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

4.0 OPEN AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number	Description	Notes
3.2.1.2.B	For those Westinghouse designs, a discussion of the information (including the applicable analysis and relevant seal leakage testing data) should be provided to justify that (1) the integrity of the associated O-rings will be maintained at the temperature conditions experienced during the ELAP event, and (2) the seal leakage rate of 21 gpm/seal used in the ELAP is adequate and acceptable.	
3.2.1.2.C	If the seals are changed to the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals, the acceptability of the use of the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals should be addressed, and the RCP seal leakages rates for use in the ELAP analysis should be provided with acceptable justification.	
3.2.1.8.A	During the audit process, the licensee informed the NRC staff that Millstone 3 uses the uniform mixing model and that it is consistent with the method in the PWROG white paper. The NRC staff concluded that the August 15, 2013, position paper was not adequately justified and has not endorsed this position paper.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.2.A	The licensee stated that the haul path from the BDB Storage Building to the MPS3 equipment deployment locations and the building foundation design evaluations are proceeding for Millstone. If the results of the evaluations identify that the potential for soil liquefaction is a concern, alternate deployment routes or pathway repairs will be evaluated to eliminate this deployment issue.	
3.1.1.3.A	The licensee stated that the review for internal flooding sources that could result from seismic induced failures and engine-driven or gravity-drain water sources has not been completed. Also MPS3 does not have a permanent safety-related groundwater removal system installed. However, the ESF building does have a sump to control groundwater in-leakage. In ETE-CPR-2012-0008, Section 11.1.3.3, the licensee stated that they also have several small pumps and hoses on site for this purpose. An evaluation of the impact of this in-leakage has not been completed.	
3.1.1.4.A	The licensee's plan for implementing the use of off-site resources is not complete. The local assembly areas have not been identified. The licensee is also evaluating the possibility of boat transport for personnel.	

Item Number	Description	Notes
3.1.2.2.A	The licensee stated that currently there are no flood barriers required to be deployed at MPS3 as the site is a dry site, and that the need is unlikely because the current precipitation rates will not change for the new evaluation. However the licensee stated that pending completion of the flooding re-evaluation, temporary flood barriers may be required. Review of the flood re-evaluations and the potential need for temporary flood barriers is needed.	
3.2.1.A	The licensee was requested to specify which analysis performed in WCAP-17601 is being applied to MPSS3 and to justify the use of that analysis by identifying and evaluating the important parameters and assumptions demonstrating that they are representative of MPS3 and appropriate for simulating the ELAP transient. In response, the licensee stated that Westinghouse Letter LTR-LIS-13-515, Attachment 1, page 4 of 4, addresses this question and concludes that NOTRUMP analysis provided in Section 5.2.1 of WCAP-17601-P, Revision 1 is applicable to MPS3, and that the applicability of this reference case to MPS3 is evaluated in detail in ETE-NAF-2012-0150, Rev. 0 Section 6.2. This material is still under review.	
3.2.1.1.A	Reliance on the NOTRUMP code for the ELAP analysis of Westinghouse plants is limited to the flow conditions prior to reflux condensation initiation. This includes specifying an acceptable definition for reflux condensation cooling.	
3.2.1.2.A	If the RCP seal leakage rates used in the plant-specific ELAP analyses are less than the upper bound expectation for the seal leakage rate discussed in the position paper, justification should be provided. If the seals are changed to non-Westinghouse seals, the acceptability of the use of non-Westinghouse seals should be addressed, and the RCP seal leakage rates for use in the ELAP analysis should be provided with acceptable justification.	
3.2.1.3.A	During the audit process the licensee stated that Westinghouse Letter LTR-LIS-13-515, Attachment 1, page 4 of 5, addresses the applicability of assumption 4 on page 4-13 of WCAP-17601, and concludes that the values used for the requested parameters in the Westinghouse calculations that were performed using the ANS 5.1 1979 +2 sigma decay heat model bound initial condition 3.2.1.2(1) of NEI 12-06, Section 3.2.1.2. Review of the letter is needed to confirm this conclusion.	
3.2.1.6.A	The licensee stated that for Action Item 11 that, the portable boric acid batching tank will be deployed at 12 - 18 hours, if the RWST tank is not available. Justification is needed for the portable tank deployment time of 12 - 18 hours.	
3.2.3.A	The strategy for containment cooldown and depressurization will be completed per the schedule given in the August 23, 2013 Six-Month Status Update. The detailed validation analysis will be completed later this year and the results will be provided in the February 2014 Six-Month Status Update.	
3.2.3.B	Clarification is needed regarding whether the containment analysis associated with Open Item No. 4 of the Integrated Plan will include	

Item Number	Description	Notes
	scenarios which show that containment functions will be (potentially) restored and maintained in response to an ELAP event occurring in all Modes of operation. An explanation is needed of how the proposed strategies for containment; including situations such as mid-loop operation, operation with an open SG, and operation with the reactor head de-tensioned or off in Modes 5 and 6, including mid-loop operation, SG hatch open, and the reactor vessel head de-tensioned or off, provide additional defense-in-depth for the containment safety functions.	
3.2.4.2.A	Analyses to evaluate the effects of loss of ventilation in various areas are currently underway. Upon completion of these analyses, detailed strategies and operator action timelines will be developed for the implementation of compensatory measures to maintain the area temperatures below the applicable design limits, if necessary. The results will be provided in the February 2014 6-month update.	
3.2.4.2.B	The licensee did not supply sufficient information to conclude that the habitability limits of the main control room will be maintained in all Phases of an ELAP.	
3.2.4.4.A	A lighting study will be performed to validate the adequacy of existing lighting and the adequacy and practicality of using portable lighting to perform FLEX strategies.	
3.2.4.4.B	The staff has reviewed the licensee's communications assessment however confirmation will be required that upgrades to the site's communications systems have been completed.	
3.2.4.7.A	The usage of the site pond or the UHS for supply to the steam generators will be used only as a last resort. Westinghouse is currently performing analysis which will determine the consequences of usage of these water sources in the steam generators. The results of the analysis are expected to provide the allowed time limits on usage of these sources. The final results of the Westinghouse analysis are expected in March 2014 and will be provided in a subsequent 6-month update	
3.4.A	The licensee's plans for the use of off-site resources conform to the minimum capabilities specified in NEI 12-06 Section 12.2, with regard to the capability to obtain equipment and commodities to sustain and backup the site's coping strategies (item 1 above), however the licensee did not address the remaining items (2 through 10 above).	

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

Sincerely,

/RA/

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

Docket Nos. 50-336 and 50-423

Enclosures:
1. Interim Staff Evaluation for Millstone Unit 2
2. Technical Evaluation Report for Millstone Unit 2
3. Interim Staff Evaluation for Millstone Unit 3
4. Technical Evaluation Report for Millstone Unit 3

cc w/encl: Distribution via Listserv

DISTRIBUTION:
PUBLIC
LPL1-1R/F
RidsNrrDorlLpl1-1 Resource
RidsNrrPMMillstone Resource
RidsNrrLASLent Resource
RidsRgn1MailCenter Resource
JPolickoski, NRR/MSD
JBowen, NRR/MSD
RidsAcrsAcnw_MailCTR Resource

ADAMS Accession Nos.: Pkg ML13338A424, Letter/ISEs ML13338A433,
TER Unit 2 ML13357A398, TER Unit 3 ML14006A159 *via e-mail

OFFICE	NRR/MSD/PM	NRR/MSD/LA	NRR/MSD/SA*	NRR/MSD/MSPB/BC*
NAME	JBoska	SLent	EBowman	JBowen
DATE	01/29/14	01/27/14	01/29/14	01/29/14
OFFICE	NRR/MSD/MESB/BC*	NRR/MSD/MRSB/BC*	NRR/MSD/D	NRR/MSD/MSPB/BC
NAME	SBailey	SWhaley	JDavis	JBowen
DATE	01/29/14	01/29/14	01/30/14	01/31/14

OFFICIAL RECORD COPY