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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

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Technical Evaluation Report

Millstone Power Station, Unit 2 (MPS2)
Order EA-12-049 Evaluation

1.0 BACKGROUND

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

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

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

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

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

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

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

In response to Order EA-12-049, licensees submitted 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 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 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 <u>CONFIRMATORY ITEMS</u>

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.	