Mega-Tech Services, LLC

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

Revision 1

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Exelon Generation Company, LLC
Dresden Nuclear Power Station Units 2 and 3
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Technical Evaluation Report

Dresden Nuclear Power Station Units 2 and 3
Order EA-12-049 Evaluation

1.0 BACKGROUND

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

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

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

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

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

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

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

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

2.0 EVALUATION PROCESS

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

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

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

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

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

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

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

3.0 TECHNICAL EVALUATION

By letter dated February 28, 2013, (ADAMS Accession No. ML13063A320, and as supplemented by the first six-month status report in letter dated August 28, 2013 (ADAMS Accession No. ML13241A282), Exelon Generation Company, LLC (the licensee or Exelon) provided the Integrated Plan for Compliance with Order EA-12-049 for Dresden Nuclear Power Station (DNPS), Units 2 and 3. The Integrated Plan describes the strategies and guidance under development for implementation by the licensee for the maintenance or restoration of core cooling, containment, and SFP cooling capabilities following a BDBEE, including modifications necessary to support this implementation, pursuant to Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049. That letter described the process used by the NRC staff in its review, leading to the issuance of an interim staff evaluation and audit report. The purpose of the staff's audit is to determine the extent to which the licensees are proceeding on a path towards successful implementation of the actions needed to achieve full compliance with the Order.

3.1 EVALUATION OF EXTERNAL HAZARDS

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

3.1.1 Seismic Events.

NEI 12-06, Section 5.2 states:

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

On page 1 of the Integrated Plan, the licensee described the screening for seismic hazards. The licensee confirmed that seismic hazards are applicable to DNPS and that the design basis safe shutdown earthquake (SSE) is 0.2g horizontal ground motion with a simultaneous vertical acceleration of 0.133g; and associated spectra are included in DNPS Updated Safety Analysis Report (USAR). The licensee stated that a safety factor of 5 was calculated for liquefaction potential and, because of the low probability, was not considered for assessment in the mitigation strategies. The licensee also stated on page 3 that the seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 had not been completed and therefore was not assumed in their Integrated Plan.

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

3.1.1.1 Protection of FLEX Equipment – Seismic Hazard

NEI 12-06, Section 5.3.1 states:

1. FLEX equipment should be stored in one or more of following three configurations:

   a. In a structure that meets the plant's design basis for the Safe Shutdown Earthquake (SSE)(e.g., existing safety-related structure).

   b. In a structure designed to or evaluated equivalent to [American Society of Civil Engineers] ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures*.

   c. Outside a structure and evaluated for seismic interactions to ensure equipment is not damaged by non-seismically robust components or structures.

2. Large portable FLEX equipment such as pumps and power supplies should be secured as appropriate to protect them during a seismic event (i.e., Safe Shutdown Earthquake (SSE) level).

3. Stored equipment and structures should be evaluated and protected from seismic interactions to ensure that unsecured and/or non-seismic components do not damage the equipment.

On pages 20, 31, 39, and 49 in the sections of the Integrated Plan regarding the strategies for maintaining core cooling, containment, spent fuel cooling and for safety systems support, respectively, the licensee stated that protection of associated portable equipment from seismic hazards in the transition phase (phase 2) would be provided by constructing structures that meet the guidelines of NEI 12-06 Section 11. Section 11 provides general storage design guidance but does not provide the details for protection from the seismic hazards as delineated in NEI 12-06, Section 5.3.1 above. This comment is generic. Each section of the Integrated Plan describing storage protection from hazards makes reference to Section 11 rather than to the specific protection requirements described in NEI 12-06 for the applicable hazard; for example, Section 6.2.3.1 for floods, Section 7.3.1 for wind, etc. This is identified as Open Item 3.1.1.1.A in Section 4.1.

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the Integrated Plan is consistent with the guidance found in NEI 12-06, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of FLEX equipment. These questions are identified as an open item above and in Section 4.1.

3.1.1.2 Deployment of FLEX Equipment - Seismic Hazard

NEI 12-06, Section 5.3.2 states:

> The baseline capability requirements already address loss of non-seismically robust equipment and tanks as well as loss of all AC. So, these seismic considerations are implicitly addressed.
>
> There are five considerations for the deployment of FLEX equipment following a seismic event:

1. If the equipment needs to be moved from a storage location to a different point for deployment, the route to be traveled should be reviewed for potential soil liquefaction that could impede movement following a severe seismic event.

2. At least one connection point for the FLEX equipment will only require access through seismically robust structures. This includes both the connection point and any areas that plant operators will have to access to deploy or control the capability.

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

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

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

Regarding consideration 1 above, as discussed previously in this report, the licensee considered soil liquefaction during the seismic screening process and concluded that liquefaction need not be addressed for the Dresden site because of the low probability of occurrence.

On page 16 and 17, in the section of the Integrated Plan describing modifications for the transition phase of the strategy for maintaining core cooling, reactor pressure vessel (RPV) pressure control, the licensee described a strategy configuration to be installed in the basement of the makeup pump house. During the audit process, the licensee stated that the makeup pump house configuration is no longer part of the Dresden Integrated Plan. The new configuration is both seismically protected and accessible, in conformance with consideration 2.

The potential for a downstream dam failure, consideration 3, was discussed with the licensee as part of the audit process. In response, the licensee stated that a downstream dam failure will be evaluated for FLEX strategy impact during the design phase and resulting information will be presented in a future 6 month update. This is identified as Confirmatory Item 3.1.1.2.A in Section 4.2.

The review of the Integrated Plan confirmed the licensee has identified FLEX equipment, a "Heavy Duty Truck", to move equipment as necessary to address consideration 5. However, there was no discussion to address whether or not power supplies will be necessary for deployment of FLEX equipment as discussed in consideration 4 above. This is identified as Confirmatory Item 3.1.1.2.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 equipment deployment 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.

With respect to consideration 1 above, the licensee provided lists of local instruments on pages 14, 20, 24, and 25, of the Integrated Plan in the sections describing Key Reactor Parameters, to supplement remote instrumentation for coping with plant conditions. However, there are no local instruments (no power required) listed in the section for monitoring containment pressure Key Parameters on pages 27 and 30. Updated information provided by the licensee in response to the audit process explained that although there are no local instruments for monitoring containment pressure, a revised plan will restore ac power to the battery chargers prior to the loss of dc batteries thus providing power for continued use of the remote instruments. The development of a reference source for obtaining necessary instrument readings in the event of seismic damage to electrical equipment as described in NEI 12-06, Section 5.3.3, consideration 1, is identified as Confirmatory Item 3.1.1.3.A.

With regard to NEI 12-06, Section 5.3.3 considerations 2 through 4 noted above, the licensee's plans did not adequately address the procedural interface considerations for seismic hazards associated with large internal flooding sources that are not seismically robust and do not require ac power, the use of ac power to mitigate ground water in critical locations, or the existence of non-seismically robust downstream dams. Updated information provided by the licensee as part of the audit response addresses this issue in part by explaining that the Dresden plant is not susceptible to internal flooding issues, and, a downstream dam failure during a seismic event is being evaluated and updates will be provided in the 6-month update process. The use of, or need for, ac power to mitigate ground water is not addressed. The issue of downstream dam failure has been previously identified as Confirmatory Item 3.1.1.2.A. The concern regarding mitigation of ground water is identified as Confirmatory Item 3.1.1.3.B.

The licensee's 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 procedural interfaces 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 pages 9 and 10, of the Integrated Plan, the licensee's described the general approach regarding the Regional Response Center (RRC) support for the Dresden site. Each RRC will hold five (5) sets of equipment, four (4) of which will be able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle. Equipment will be moved from an RRC to a local Assembly Area, established by the SAFER team and the utility. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request.

The licensee's plans for the use of offsite resources did not provide sufficient information regarding the identification of the local arrival staging area and a description of the methods to be used to deliver the equipment to the site. The licensee response to the audit addressed this issue by stating that additional information will be provided as part of the 6-month update process. This is identified as Confirmatory Item 3.1.1.4.A in Section 4.2.

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

3.1.2 Flooding

NEI 12-06, Section 6.2 states:

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

NEI 12-06, Section 6.2.1 states in part:

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

On page 1, in the section of the Integrated Plan regarding the determination of applicable extreme external hazards, the licensee presented information regarding the flood analysis. The Probable Maximum Flood (PMF) is described in the Dresden Updated Final Safety Analysis Report (UFSAR). The flood produces a peak flood to elevation 528'-0" at the Dresden site where the grade elevation is 517'-0". Because the event is a precipitation based event, time is available to relocate equipment and stage necessary measures to support plant response to rising water levels.

Review of the licensee’s integrated plan with respect to screening for extreme external flooding shows that the licensee has screened in the flooding hazard, which conforms to the guidance found in NEI 12-06. The external flooding re-evaluation, pursuant to the 10 CFR 50.54(f) letter of March 12, 2012, has yet to be completed and therefore was not assumed in their Integrated Plan.

The licensee has screened this external hazard and identified the hazard levels for reasonable protection of the portable equipment. However, while the licensee has identified the limiting source of flooding as regional precipitation, the applicable flooding hazard is not characterized in terms of persistence. Updated information provided by the licensee as part of the audit process addresses this issue by stating that the persistence of the flood will not impact the ability to keep the portable diesel engines fueled but does not address whether staging of equipment will be impacted. This is identified as Confirmatory Item 3.1.2.A in Section 4.2.

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

3.1.2.1 Protection of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.1 states:

These considerations apply to the protection of FLEX equipment from external flood hazards:

1. The equipment should be stored in one or more of the following configurations:

    a. Stored above the flood elevation from the most recent site flood analysis. The evaluation to determine the elevation for storage should be informed by flood analysis applicable to the site from early site permits, combined license applications, and/or contiguous licensed sites.

    b. Stored in a structure designed to protect the equipment from the flood.

    c. FLEX equipment can be stored below flood level if time is available and plant procedures/guidance address the needed actions to relocate the equipment. Based on the timing of the limiting flood scenario(s), the FLEX equipment can be relocated [footnote 2 omitted] to a position that is protected from the flood, either by barriers or by elevation, prior to the arrival of the potentially damaging flood levels. This should also consider the conditions on-site during the increasing flood levels and whether movement of the FLEX equipment will be possible before potential inundation occurs, not just the ultimate flood height.

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

On page 3 of the Integrated Plan, in the section regarding key assumptions associated with implementation of FLEX strategies, the licensee specifies that the primary and secondary storage locations have not been selected and that once locations are finalized, implementation routes will be defined. This is previously identified as Confirmatory Item 3.1.1.4.A in Section 4.2.

On page 21, 31, 40, and 49, in the sections of the Integrated Plan regarding the strategies for maintaining core cooling, containment, spent fuel cooling and safety function support, respectively, the licensee stated that protection of associated portable equipment from flooding hazards would be provided to meet the guidance of NEI 12-06 Section 11. The Integrated Plan also addressed storage below flood levels by pointing out that sufficient warning time is available to relocate and/or deploy the equipment. Nonetheless, as previously discussed in this report, although the Integrated Plan references NEI 12-06, Section 11, it is not clear that the plan will address the specific protection guidance considerations provided in NEI 12-06, Section 6.2.3.1. This was captured in previously identified Open Item 3.1.1.1.A in Section 4.1.

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the Integrated Plan is consistent with the guidance found in NEI 12-06, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of FLEX equipment. These questions are identified as a previous open item noted above and in Section 4.1.

3.1.2.2 Deployment of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.2 states:

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

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

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

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

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

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

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

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

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

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

On page 8 in the section of the Integrated Plan, the licensee describes how strategies will be deployed, and that transportation routes will be developed from the equipment storage area to the FLEX staging areas. The plan further stated that an administrative program will be developed to ensure pathways remain clear or compensatory actions will be implemented to ensure all strategies can be deployed during all modes of operation. Because the administrative program is yet to be developed, conformance with the general guidance of consideration 1 above cannot be assessed. This is identified as Confirmatory Item 3.1.2.2.A in Section 4.2.

As previously discussed in Section 3.1.2, above, the licensee has not provided a characterization of the persistence of the external flooding hazard. As a result, there is no assurance that the considerations for movement of equipment and restocking of supplies in the context of a flood with long persistence, consideration 2, will be met. This is previously documented as Confirmatory Item 3.1.2.A in Section 4.2.

On pages 21, 31, 40 and 50, of the Integrated Plan, consideration 4, diesel fuel, is addressed by stating that a least one fuel oil storage tank will be protected from flooding. Similarly, consideration 9 regarding a means to move FLEX equipment was addressed in the Integrated Plan equipment list by describing a "Heavy Duty Truck" in the equipment list on page 55.

On several pages of the Integrated Plan, for example pages 16 and 17, the licensee makes reference to portable equipment located in “an area near the Cribhouse.” This area is denoted for locating portable FLEX pumps in strategies associated with core cooling, maintaining containment, and SFP cooling. Insufficient information was provided to demonstrate that the “area near the Cribhouse” specified in the Integrated Plan would be available and functional in the event of the postulated flooding hazard. Information provided by the licensee as part of the 6-month update process provides additional details of the configuration and location of the piping and connections originally described as being in "an area near the Cribhouse". The additional details describe using permanent piping and connections to permanent piping. The additional information addresses consideration 5 above.

The Integrated Plan does not address loss of normal access to the UHS due to flooding, the need for powering sump pumps, and the potential use of flood barriers to support the implementation of mitigation strategies (considerations 3, 7 and 8 respectively). These concerns are identified as Open Item 3.1.2.2.B

The licensee’s 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/open items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to deployment if these requirements are implemented as described.

3.1.2.3 Procedural Interfaces – Flooding Hazard

NEI 12-06, Section 6.2.3.3 states:

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

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

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

On page 8 in the section of the Integrated Plan describing how the strategies will be deployed in all modes, the licensee stated that an administrative program will be developed to ensure pathways remain clear or compensatory actions will be implemented to ensure all strategies can be deployed during all modes of operation. Because the administrative program and, procedures and plans are pending, the Integrated Plan does not provide reasonable assurance that all considerations of NEI 12-06, Section 6 will be met. This is identified as Confirmatory Item 3.1.2.3.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 procedural interfaces 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 pages 9 and 10, of the Integrated Plan, the licensee described the general approach regarding the RRC support for the Dresden site. Each RRC will hold five (5) sets of equipment, four (4) of which will be able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle. Equipment will be moved from an RRC to a local Assembly Area, established by the SAFER team and the utility. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request.

The licensee's plans for the use of offsite resources did not provide sufficient information regarding the identification of the local arrival staging area and a description of the methods to be used to deliver the equipment to the site. The licensee's response to the audit process addressed this issue by stating that additional information will be provided as part of the 6-month update process. This was previously 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 previously identified confirmatory item noted above, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to off site resources if these requirements are implemented as described.

3.1.3 High Winds

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

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

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

On page 2 in the section of the Integrated Plan regarding the determination of applicable extreme external hazards, the licensee explained that the Dresden site is located at 88°16'09" W longitude and 41°23'23" N latitude. Furthermore, they referenced NEI 12-06 for guidance related to tornado hazards and concluded that tornado hazards are applicable to Dresden and that DNPS screens in for an assessment for High Wind Hazard. Although the Integrated Plan was silent regarding a hurricane impact, the Dresden site is well beyond the range of high winds from a hurricane per NEI 12-06 Figure 7-1. The reviewer concluded that a hurricane hazard is not applicable and need not be addressed.

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

3.1.3.1 Protection of FLEX Equipment - High Winds Hazard

NEI 12-06, Section 7.3.1 states:

> These considerations apply to the protection of FLEX equipment from high wind hazards:
>
> 1. For plants exposed to high wind hazards, FLEX equipment should be stored in one of the following configurations:

a. In a structure that meets the plant's design basis for high wind hazards (e.g., existing safety-related structure).

b. In storage locations designed to or evaluated equivalent to ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures* given the limiting tornado wind speeds from Regulatory Guide 1.76 or design basis hurricane wind speeds for the site.

   - Given the FLEX basis limiting tornado or hurricane wind speeds, building loads would be computed in accordance with requirements of ASCE 7-10. Acceptance criteria would be based on building serviceability requirements not strict compliance with stress or capacity limits. This would allow for some minor plastic deformation, yet assure that the building would remain functional.

   - Tornado missiles and hurricane missiles will be accounted for in that the FLEX equipment will be stored in diverse locations to provide reasonable assurance that N sets of FLEX equipment will remain deployable following the high wind event. This will consider locations adjacent to existing robust structures or in lower sections of buildings that minimizes the probability that missiles will damage all mitigation equipment required from a single event by protection from adjacent buildings and limiting pathways for missiles to damage equipment.

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

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

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

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

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

On page 21, 32, 40, and 50, in the sections of the Integrated Plan regarding the strategies for maintaining core cooling, containment, spent fuel cooling and safety function support, respectively, the licensee stated that protection of associated portable equipment from wind hazards would be provided to meet the guidance of NEI 12-06 Section 11. As previously discussed in this report, although the Integrated Plan references NEI 12-06, Section 11, it is not clear that the plan will address the specific protection guidance considerations provided in NEI 12.06, Section 7.3.1. This was captured in previously identified Open Item 3.1.1.1.A in Section 4.1.

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the Integrated Plan is consistent with the guidance found in NEI 12-06, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of FLEX equipment. These questions are identified as a previous open item noted above and in Section 4.1.

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.

As discussed earlier in this section, the Dresden site is not susceptible to hurricane hazards and therefore, considerations 1 and 2 above are not applicable.

On page 55 of the Integrated Plan, in the table for phase 2 response equipment, the licensee lists “Heavy Duty Truck.” for the use of transport and debris clearing. This equipment addresses considerations 3 and 4 above. With regard to consideration 5; on page 21, the licensee discussed the intention to address storage structure construction, and procedures and programs to address storage, haul path and FLEX equipment considerations relative to the external hazards.

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

3.1.3.3 Procedural Interfaces – High Wind Hazard

NEI 12-06, Section 7.3.3, states:

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

On page 8 in the section of the Integrated Plan describing how the strategies will be deployed in all modes, the licensee stated that an administrative program would be developed to ensure pathways remain clear or compensatory actions will be implemented to ensure all strategies can be deployed during all modes of operation. Because the administrative program and procedures and plans are pending, the Integrated Plan does not provide reasonable assurance that requirements of NEI 12-06 will be met. This was previously identified as Confirmatory Item 3.1.2.3.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 previously identified confirmatory item noted above, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedural interfaces 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.

Consideration 1 is not applicable since Dresden is not subject to hurricanes.

On pages 9 and 10, of the Integrated Plan, the licensee described the general approach regarding the RRC support for the Dresden site. 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.

The licensee's plans for the use of offsite resources did not provide sufficient information regarding the identification of the local arrival staging area and a description of the methods to be used to deliver the equipment to the site. The licensee’s response to the audit addressed this issue by stating that additional information will be provided as part of the 6-month update process. This was previously 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 previously identified confirmatory item noted above, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to offsite resources if these requirements are implemented as described.

3.1.4 Snow, Ice and Extreme Cold

As discussed in NEI 12-06, Section 8.2.1:

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

On page 2 in the section of the Integrated Plan regarding the determination of applicable extreme external hazards, the licensee explained that the site is located at 88°16'09" W longitude and 41°23'23" N latitude. The guidelines provided in NEI 12-06 include the need to consider extreme snowfall at plant sites above the 35th parallel. DNPS is located above the 35th parallel and thus the capability to address impedances caused by extreme snowfall with snow removal equipment is required. The licensee concluded that DNPS is located within the region characterized by EPRI as ice severity level 5 (Figure 8-2). As such, DNPS is subject to severe icing conditions that could also cause catastrophic destruction to electrical transmission lines, and therefore screens in for this 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 if these requirements are implemented as described.

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

NEI 12-06, Section 8.3.1 states:

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

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

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

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

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

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

On page 21, 32, 40, and 50, in the sections of the Integrated Plan regarding the strategies for maintaining core cooling, containment, spent fuel cooling and safety function support, respectively, the licensee stated that protection of associated portable equipment from snow, ice and extreme cold hazards would be provided to meet the requirements of NEI 12-06 Section 11. As previously discussed in this report, although the Integrated Plan references NEI 12-06, Section 11, it is not clear that the plan will address the specific protection guidance considerations provided in NEI 12.06, Section 8.3.1. This was captured in previously identified Open Item 3.1.1.1.A in Section 4.1.

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the Integrated Plan is consistent with the guidance found in NEI 12-06, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of FLEX equipment. These questions are identified as a previous open item noted above and in Section 4.1.

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

NEI 12-06, Section 8.3.2 states:

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

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

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

On page 9 of the Integrated Plan, the licensee discusses procurement and stated that the equipment associated with the mitigation strategies will be procured as commercial equipment with design control as outlined in NEI 12-06, Section 11. This approach is consistent with consideration 1 above.

Regarding consideration 3, there was no discussion in the Integrated Plan regarding potential of surface icing existing on sources of makeup water on which FLEX pumps will take suction. Neither was there discussion on the potential for freezing of water in exposed equipment during an extreme cold event (e.g., installed piping, instrument lines, and tanks, FLEX piping and hoses.) Updated information provided by the licensee as part of the audit process addresses this issue by stating that all makeup water sources are from underground piping and no external tanks or piping segments are relied upon for the current Dresden plan.

On page 54 through 61, in the sections of the Integrated Plan describing portable equipment for the phases 2 and 3, the licensee does not address equipment capable of removing snow or ice. Although the licensee's plan identified equipment for clearing debris, there is insufficient information to conclude that the administrative program elements to ensure the pathways are clear, will include snow or ice removal. It is not clear that the licensee's plans will conform to guidance in NEI 12-06 Section 8.3.2, consideration 2 with respect to the removal of ice and snow from haul pathways and staging areas. It should be noted that the Integrated Plan stated, "An administrative program will be developed…" Removal of ice and snow is identified as Confirmatory Item 3.1.4.2.A in Section 4.2.

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

3.1.4.3 Procedural Interfaces – Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.3, states:

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

As discussed in Section 3.1.4.2, the licensee has supplied insufficient information with regard to clearing pathways to demonstrate that the program adequately address the effects of snow and ice on transporting the equipment. This is previously identified as Confirmatory Item 3.1.4.2.A in Section 4.2.

Review of licensee's approach, as described above, confirms that the Integrated Plan is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the previously identified confirmatory item noted above, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedure interfaces if these requirements are implemented as described in licensee's Integrated Plan.

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 pages 9 and 10, of the Integrated Plan, the licensee described the general approach regarding the RRC support for the Dresden site. Equipment will be moved from an RRC to a local Assembly Area, established by the SAFER team and the utility.

The licensee's plans for the use of offsite resources did not provide sufficient information regarding the identification of the local arrival staging area and a description of the methods to be used to deliver the equipment to the site. The licensee's response to the audit addressed this issue by stating that additional information will be provided as part of the 6-month update process. This was previously 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 previously identified confirmatory item noted above, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to offsite resources if these requirements are implemented as described.

3.1.5 High Temperatures

NEI 12-06, Section 9 states:

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

On page 2 of the Integrated Plan regarding the determination of applicable extreme external hazards, the licensee referred to the guidelines provided in NEI 12-06 that stated the need to consider high temperature at all plant sites in the lower 48 states. The licensee confirms that DNPS screens in for an assessment for extreme high temperature.

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

3.1.5.1 Protection of FLEX Equipment – High Temperature Hazard

NEI 12-06, Section 9.3.1, states:

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

On page 22, 32, 40, and 51, in the sections of the Integrated Plan regarding the strategies for maintaining core cooling, containment, spent fuel cooling and safety function support, respectively, the licensee stated that protection of associated portable equipment from high temperature would be provided to meet the requirements of NEI 12-06 Section 11. As previously discussed in this report, although the Integrated Plan references NEI 12-06, Section 11, the plan did not specifically address the high temperature guidance considerations provided in NEI 12.06, Section 9.3.1. This was captured in previously identified Open Item 3.1.1.1.A in Section 4.1.

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the Integrated Plan is consistent with the guidance found in NEI 12-06, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of FLEX equipment. These questions are identified as a previous open item noted above and in Section 4.1.

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 8 of the Integrated Plan describing how the strategies will be deployed in all modes, the licensee discussed the development of an administrative program to ensure strategies can be implemented in all modes. The licensee further stated that the creation of the administrative program is a self identified open item and will be closed in a 6-month update. This is identified as Confirmatory Item 3.1.5.2.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 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.

On page 22, 32, 40, and 51, in the section of the Integrated Plan regarding the strategies for maintaining core cooling, containment, spent fuel cooling, and safety function support, respectively, the licensee stated that protection of associated portable equipment from high temperatures would be provided, and that procedures and programs will be developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the external hazards applicable to DNPS. This is identified as Confirmatory Item 3.1.5.3.A in Section 4.2.

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

3.2 PHASED APPROACH

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

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

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

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

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

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

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

3.2.1.1. Computer Code Used for ELAP Analysis.

NEI 12-06, Section 1.3 states in part:

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

The licensee 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 Modular Accident Analysis Program (MAAP) Version 4 computer code. MAAP4 was written to simulate the response of both current and advanced light water reactors to LOCA and non-LOCA transients for probabilistic risk analyses as well as severe accident sequences. The code has been used to evaluate a wide range of severe accident phenomena, such as hydrogen generation and combustion, steam formation, and containment heating and pressurization.

The licensee has decided to use the MAAP4 computer code for simulating the Extended Loss of AC Power (ELAP) transient. While the NRC staff does acknowledge that MAAP4 has been used many times over the years and in a variety of forums for severe and beyond design basis analysis, MAAP4 is not an NRC approved code, and the NRC staff has not examined its technical adequacy for performing thermal hydraulic analyses. Therefore, during the review of the integrated plan, the issue of using MAAP4 was raised as generic concern and was addressed by the Nuclear Energy Institute (NEI) in their position paper dated June 2013, entitled “Use of Modular Accident Analysis Program (MAAP4) in Support of Post-Fukushima Applications” (ADAMS Accession No. ML13190A201). After review of this position paper, the

NRC staff endorsed a resolution through letter dated October 3, 2013 (ADAMS Accession No. ML13275A318). This endorsement contained five limitations on the MAAP4 computer code's use for simulating the ELAP event for Boiling Water Rectors (BWRs). Those limitations and their corresponding Confirmatory Item number for this TER are provided as follows:

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

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

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

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

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

This is Confirmatory Item 3.2.1.1.D in Section 4.2.

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

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the confirmatory 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. Recirculation Pump Seal Leakage Models

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

On page 16, in the section of the Integrated Plan describing coping strategies to maintain core cooling, the licensee stated that if the isolation condenser is placed in service prior to HPCI being secured, the core will remain covered for at least 72 hours without makeup. The only inventory losses during this time will be the assumed 12.5 gpm leakage from the Reactor Recirculation Pump seals.

The technical basis for the assumed 12.5 gpm leakage from the reactor recirculation pump seals was not provided in the Integrated Plan. The licensee responded to the audit process regarding the seal leakage issue and explained that the seal leakage rates have been revised upwards. The revised reactor pressure vessel (RPV) leakage value assumed in the 6-month update is 61 gpm. The audit response explained that seal leakage used is the same as that assumed in the Dresden Station Blackout Response and that the Technical Specification leakage of 25 gpm was added to the leakage rate.

The licensee’s 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 seal leakage rate if these requirements are implemented as described.

3.2.1.3 Sequence of Events

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

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

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

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

In response to the need to identify expected time constraints, the licensee's Integrated Plan for DNPS includes a discussion of time constraints on pages 5 through 7 and a Sequence of

Events Timeline, Attachment 1A, on pages 62 through 65. On page 5 of the plan, the licensee stated the issuance of BWROG document NEDC-33771P, "GEH Evaluation of FLEX Implementation Guidelines" on 01/31/2013 did not allow sufficient time to perform the analysis of the deviations between the licensee's engineering analyses and the analyses contained in the BWROG document prior to commencing regulatory reviews of the Integrated Plan. Information provided by the licensee in the 6-month update confirms that the BWROG document referenced above has been reviewed and the deviations to the assumptions that were used in the test case are itemized on Attachment 1B. Nonetheless, the results and the impact on the sequence of events timeline are still dependent on the MAAP4 analysis. As stated earlier in this report, there are Confirmatory Items regarding the use of the MAAP4 analysis. Any changes to the MAAP4 analysis results will need to be reviewed for impact on the sequence of events timeline. On page 5 of the Integrated Report, the licensee stated that the final timeline will be time validated once detailed designs are completed, procedures are developed, and the results will be provided in a future six (6) month update. This is identified as Confirmatory Item 3.2.1.3.A in Section 4.2.

On page 64 of the Integrated Plan, Attachment 1A, Sequence of Events Timeline, the licensee stated in Item 15, that the actions are complete for loss of main control room ventilation at the elapsed time of 2 hours. In the remarks column of that item, the licensee stated that further analysis is required. Because the analysis for the rise in main control room temperature is incomplete, there is insufficient information to determine if the coping action time constraint will be met by completing the action in 2 hours. Updated information provided in the 6-month update relative to the control room habitability indicates that additional information will be provided in a future 6-month update. This is identified as Confirmatory Item 3.2.1.3.B in Section 4.2.

On page 64 of the Integrated Plan, Attachment 1A, the licensee stated in Item 19 that the HPCI is secured at hour 6 due to dc battery depletion. Suppression pool temperature is expected to exceed the UFSAR temperature limit for HPCI pump suction within 2.5 hours. Updated information provided by the licensee as part of the audit response addressed this issue by stating that reliance on the HPCI to operate at higher suppression pool temperature has been deleted from the revised plan. The revised timeline provided in the 6-month update indicates the HPCI fails at T = 2.5 hours to avoid reaching the temperature limit.

The licensee’s 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 sequence of events if these requirements are implemented as described.

3.2.1.4 Systems and Components for Consequence Mitigation

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

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

And,

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

NEI 12-06, Section 3.2.1.12 states:

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

On page 9, the licensee stated that equipment associated with the mitigation strategies will be procured with design, storage, maintenance, testing and configuration control as outlined in NEI 12-06 Section 11.

With regard to design, the Integrated Plan cites several configurations utilizing FLEX pumps for mitigation strategies. Although the proposed pump locations, hose routing and connection points are discussed in the plan, insufficient information is presented to confirm the ability of the portable FLEX pumps to deliver the required flow through the system of flex hoses, couplings, valves, elevation changes, etc. for either the primary or the alternate strategy. The licensee stated in a note on page 22 that detailed designs will be developed to validate the plant modifications, and that equipment selected will support the mitigation strategies. Because pump and flow technical data is not yet finalized, further review is required to confirm that the plan will comply with NEI 12-06, Section 11. Information provided in the 6-month update indicates the results of the final design analysis will be provided in a future 6-month update. This is identified as Confirmatory Item 3.2.1.4.A in Section 4.2.

With regard to the guideline of NEI 12-06, Section 3.2.1.12 noted above, the licensee stated in the Integrated Plan (page 10 for example), that analysis will be performed to validate that the plant modifications, selected equipment, and identified mitigating strategy can satisfy the safety function requirements of NEI 12-06. Once these designs and mitigating strategies have been fully developed, Exelon will update the integrated plan for DNPS during a scheduled six (6) month update. This is identified as Confirmatory Item 3.2.1.4.B in Section 4.2.

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

3.2.1.5 Monitoring Instrumentation and Controls

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

> The parameters selected must be able to demonstrate the success of the strategies at maintaining the key safety functions as well as indicate imminent or actual core damage to facilitate a decision to manage the response to the event

within the Emergency Operating Procedures and FLEX Support Guidelines or within the SAMGs. Typically these parameters would include the following:

- RPV Level
- RPV Pressure
- Containment Pressure
- Suppression Pool Level
- Suppression Pool Temperature
- SFP Level

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

Although the lists of instrumentation provided in the Integrated Plan are consistent with the guidance provided above, concerns exist regarding proper function during the postulated scenarios. On page 11 in the Integrated Plan, in the section describing the reactor level control, the licensee stated that initial reactor water level control would be accomplished using the HPCI system with normal suction from the condensate storage tanks (CST). If the CSTs are unavailable, HPCI suction can be transferred to the Torus (suppression pool).

There was insufficient information provided to demonstrate that the switchover instrumentation will remain operational and that HPCI injection to RPV will remain uninterrupted. It is not clear whether switchover function is automatic, fail-safe, and whether function logic and hardware, related piping, valves, systems, structures, and components (SSCs) to support the switchover function are of safety grade and are qualified for all criteria including tornado/high winds. Updated information provided by the licensee as part of the audit response addresses this issue by stating that the control logic, level sensors and valve motors involved in the transfer are dc powered and do not lose power during the event. Also, because the valves are dc powered, operators can perform a manual transfer from the control room if required.

On page 27 of the Integrated Plan, the licensee lists instrumentation for key containment parameters. However, no location or range is provided for the instruments for measuring containment pressure. Depending on the location (drywell versus wetwell) and range of the available instruments, as well as other factors such as the amount of seal leakage and its mixing with the drywell atmosphere, a large uncertainty may exist for assessing pump net positive suction head (NPSH) and other parameters. Updated information provided by the licensee as part of the audit response addresses this issue by stating that pressure instruments are permanent instruments, with commensurate accuracy and quality, providing both narrow and wide range readings, and that they measure drywell pressure.

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

3.2.1.6 Motive Power, Valve Controls and Motive Air System

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

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

And,

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

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

On page 26 of the Integrated Plan in the section on maintaining containment, the licensee discusses the process of venting the containment using the Reliable Hardened Vent System. The licensee also references the use of plant procedure DOA 1600-09, Emergency Containment Venting. That procedure directs operators to use an AOV Operation Rig that includes bottled gas for valve actuation. Although an air compressor is identified in the phase 3 portable equipment table on page 60 of the plan, and that the portable equipment is assumed to be available in 24 hours, it is not clear that the AOV Operation Rig has the capacity to support the emergency containment venting until the portable compressor is on site and available. Updated information provided by the licensee as part of the audit response addresses this issue by stating that containment pressure, per the MAAP4 analysis, will remain below design limits and venting will not be required. Although the response addresses the issue, because the MAAP4 analysis is used to predict containment conditions, and because of the pending outstanding issues regarding the acceptability of MAAP4, the concern is identified as Confirmatory Item 3.2.1.6.A.

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

3.2.1.7 Cold Shutdown and Refueling

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

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

Review of the Integrated Plans for the Dresden plant 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 Nuclear Energy Institute (NEI) position paper entitled “Shutdown/Refueling Modes” (ADAMS Accession No. ML13273A514); and has been endorsed by the NRC in a letter dated September 30, 2013 (ADAMS Accession No. ML13267A382).

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

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

3.2.1.8 Use of Portable Pumps

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

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

NEI 12-06 Section 11.2 states in part:

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

On page 54 of the Integrated Plan, the licensee identifies in table "BWR Portable Equipment phase 2" that three low pressure high capacity self prime pumps will be used during phase 2 for the core, containment, and SFP cooling functions. Information provided in the 6-month update identifies two submersible pumps rather than three self prime pumps. However, the licensee does not specifically identify the flow rate needed for each of the three functions. Further review of design information will be required to provide assurance of conformance with NEI 12-06 Section 11.2 regarding the flow and configuration of the planned pump usage. The adequacy of pump capacities and flows is previously identified as Confirmatory Item 3.2.1.4.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 previously identified confirmatory item noted above, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to the use of portable pumps if these requirements are implemented as described.

3.2.2 Spent Fuel Pool Cooling Strategies

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

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

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

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

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

On page 36 of the Integrated Plan, the licensee stated that the most limiting condition resulting from an ELAP for the spent fuel cooling strategy is during a refueling outage. As per the licensee's reference document EC 37913, Revision 2, Time to Boil Curves, the licensee concludes that in the worst case configuration, the time to boil in the SFP is 3.58 hours and 41.36 hours for water level to reach the to top of active fuel. Using those assumptions, the licensee concludes that no phase 1 actions are required and their plan is to move directly to phase 2 strategies.

On page 38 of the Integrated Plan regarding SFP cooling phase 2, the licensee stated that

FLEX pumps will supply water to the SFP with suction from the ultimate heat sink (UHS). Information regarding the ability to attain desired flows using FLEX equipment has been previously identified as Confirmatory Item 3.2.1.4.A. And again on page 38, the licensee stated that the evaluation of the SFP area for steam and condensation has not yet been performed. Because the evaluation of the SFP area for steam and condensation has not yet been performed, insufficient information is available to demonstrate reasonable assurance that the plan will comply with NEI 12-06, Table C-3 regarding access and venting. This is identified as Confirmatory Item 3.2.2.A in Section 4.2.

The licensee states on page 43 that the phase 2 strategy will provide sufficient capability such that phase 3 strategies will not be required. Nonetheless, the licensee provides a description of phase 3 equipment available as a contingency.

Review of licensee's approach, as described above, confirms that the Integrated Plan is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the confirmatory items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to SFP if these requirements are implemented as described in licensee's Integrated Plan.

3.2.3 Containment Functions Strategies

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

On page 26 of the Integrated Plan in the section on maintaining containment, the licensee discusses the process of venting the containment using the Reliable Hardened Vent System. Updated information provided by the licensee as part of the audit response revises this approach by stating that containment pressure, per the MAAP4 analysis, will remain below design limits and venting will not be required. The information provided by the audit process states that HPCI will only be operating for 2.5 hours before the isolation condenser is restored to service and removing decay heat from the reactor. Consequently, the licensee's MAAP4 run indicates containment pressure will stabilize at 30 psig. Although the response addresses the containment heat removal issue, the analytical capability of MAAP4 is still a concern. The concerns related to MAAP4 were previously identified as Confirmatory Item 3.2.1.6.A due to pending outstanding issues regarding the acceptability of the MAAP4 analysis used to predict containment conditions. The potential for impact of MAAP4 results on the containment heat removal strategy is identified as Confirmatory Item 3.2.3.A in Section 4.2.

Review of licensee's approach, as described above, confirms that the Integrated Plan is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the confirmatory items noted above, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to containment functions if these requirements are implemented as described in licensee's Integrated Plan.

3.2.4 Support Functions

3.2.4.1 Equipment Cooling – Cooling Water

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

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

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

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

3.2.4.2 Ventilation – Equipment Cooling

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

> *Plant procedures/guidance should consider loss of ventilation effects on specific energized equipment necessary for shutdown (e.g., those containing internal electrical power supplies or other local heat sources that may be energized or present in an ELAP.*
>
> ELAP procedures/guidance should identify specific actions to be taken to ensure that equipment failure does not occur as a result of a loss of forced ventilation/cooling. Actions should be tied to either the ELAP/LUHS or upon reaching certain temperatures in the plant. Plant areas requiring additional air flow are likely to be locations containing shutdown instrumentation and power supplies, turbine-driven decay heat removal equipment, and in the vicinity of the inverters. These areas include: steam driven [auxiliary feedwater] AFW pump room, HPCI and RCIC pump rooms, the control room, and logic cabinets. Air flow may be accomplished by opening doors to rooms and electronic and relay cabinets, and/or providing supplemental air flow.

Air temperatures may be monitored during an ELAP/LUHS event through operator observation, portable instrumentation, or the use of locally mounted thermometers inside cabinets and in plant areas where cooling may be needed. Alternatively, procedures/guidance may direct the operator to take action to provide for alternate air flow in the event normal cooling is lost. Upon loss of these systems, or indication of temperatures outside the maximum normal range of values, the procedures/guidance should direct supplemental air flow be provided to the affected cabinet or area, and/or designate alternate means for monitoring system functions.

For the limited cooling requirements of a cabinet containing power supplies for instrumentation, simply opening the back doors is effective. For larger cooling loads, such as HPCI, RCIC, and AFW pump rooms, portable engine-driven blowers may be considered during the transient to augment the natural circulation provided by opening doors. The necessary rate of air supply to these rooms may be estimated on the basis of rapidly turning over the room's air volume.

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

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

On pages 45, in the section of the Integrated Plan regarding safety function support, the licensee discussed the battery room ventilation for phase 1. The licensee concluded that the safety related battery rooms would not be adversely affected by a loss of ventilation. The conclusion was based on an engineering calculation, EC 350067, "The Effects of Elevated Temperatures on Unit 3 Station Batteries." A review of that document indicated that the calculation did not address the potential temperature increases due to loss of ventilation resulting from an ELAP, especially if that ELAP is due to a high temperature hazard. Updated information provided by the licensee as part of the audit response addressed this issue by clarifying that the temperature effect on the battery is on the battery life but not the function. The licensee also stated that the plan calls for restoring the chargers within approximately 3 hours, with the implication being that battery life is not an issue. A discussion is needed on the effects of extreme low temperatures (i.e., temperatures below those assumed in the sizing calculation for each battery) on each battery's capability to perform its function for the duration of the ELAP event. This is Confirmatory Item 3.2.4.2.A in Section 4.2.

Also, the analysis in the EC 350067 document is limited to the temperature effect on battery performance and does not address potential hydrogen accumulation. Consideration needs be given to hydrogen when the batteries are being recharged during phase 2 and 3. Updated information provided by the licensee as part of the audit response addresses this issue by stating that procedures will address the necessary venting of the battery room to control hydrogen levels. The licensee also stated the current plan is to open battery room doors and ventilate the battery room into larger spaces surrounding the rooms utilizing fans. This is Confirmatory Item 3.2.4.2.B in Section 4.2 below.

On page 48 in the section of the Integrated Plan regarding safety function support, phase 2, the licensee discussed the auxiliary equipment electric room (AEER) and battery room ventilation and stated that current DNPS procedures provide direction for loss of ventilation in various areas. The licensee also stated that further evaluation will be conducted to determine if actions such as staging portable fans are required for long term ELAP. This is identified as Confirmatory Item 3.2.4.2.C in Section 4.2.

In general, there is insufficient information provided in the plan to evaluate whether or not the impact of elevated temperatures, as a result of loss of ventilation and/or cooling, on electrical equipment being credited as part of the ELAP strategies (e.g., RCIC pump room) is being addressed. For example, information is needed regarding whether the initial temperature condition assumed the worst-case outside temperature with the plant operating at full power. Also, it is not clear what electrical components necessary to ensure successful operation of required pumps are located in the pump rooms. It is also unclear regarding the qualification level for temperature and pressure for these electrical components for the duration that the pumps are assumed to perform the mitigating strategies function. Updated information provided by the licensee as part of the audit response discusses this issue by stating that detailed information to address these issues will not be available until the detailed design phase is completed. This issue is identified as Confirmatory Item 3.2.4.2.D in Section 4.2.

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

It was not clear from the information provided in the Integrated Plan whether or not freezing of piping or instrument lines had been adequately addressed. Updated information provided by the licensee as part of the audit response addresses this issue by stating that all makeup water sources are from underground piping and no external tanks or piping is relied upon for the current Dresden 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 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.

The Integrated Plan did not address portable lighting to facilitate access into plant areas when permanent lighting has been lost. Additional review of the licensee's implementing procedures will be necessary to confirm that provisions for portable lighting have been addressed to demonstrate conformance with the guidance of NEI 12-06 Section 3.2.2.3 (8). This is identified as Confirmatory Item 3.2.4.4.A. in Section 4.2.

The NRC staff has reviewed the licensee's communications assessment (ML12306A199 and ML13056A135) in response to the March 12, 2012 50.54(f) request for information letter for DNPS and, as documented in the staff analysis (ML13114A067) has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by the licensee will conform to the guidance of NEI 12-06 Section 3.2.2 (8) regarding communications capabilities during an ELAP. This is identified as Confirmatory Item 3.2.4.4.B in Section 4.2 for confirmation that upgrades to the site's communications systems have been completed.

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

3.2.4.5 Protected and Internal Locked Area Access

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

> *Plant procedures/guidance should consider the effects of ac power loss on area access, as well as the need to gain entry to the Protected Area and internal locked areas where remote equipment operation is necessary.*
>
> At some plants, the security system may be adversely affected by the loss of the preferred or Class 1E power supplies in an ELAP. In such cases, manual actions specified in ELAP response procedures/guidance may require additional actions to obtain access.

The licensee's Integrated Plan provided insufficient information regarding the development of guidance and strategies with regard to the access to the protected area and internal locked areas. Updated information provided by the licensee as part of the audit response addresses this issue by describing a means to access plant areas that is available for plant personnel that need to perform local manual actions.

The licensee's 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 locked areas if these requirements are implemented as described.

3.2.4.6 Personnel Habitability – Elevated Temperature

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

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

Section 9.2 of NEI 12-06 states,

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

On page 27 of the Integrated Plan, in the section listing instrumentation for the phase 1 coping strategy to maintain containment, the licensee stated that temperature will be taken locally at the torus using a surface pyrometer. The licensee did not address the potential for high temperatures in the area with regard to access/habitability. This is identified as Confirmatory Item 3.2.4.6.A in Section 4.2.

On page 45 of the Integrated Plan, the licensee discussed HPCI Room "Habitability" and indicated that the preliminary GOTHIC analysis confirmed that opening doors at 2 hours will result in acceptable room temperature values to support operation of HPCI for at least 6 hours. Updated information provided by the licensee as part of the audit response addresses this issue by stating that the revised plan calls for operation of the HPCI for a maximum of 2.5 hours. Also, the licensee stated that formal analysis results will be presented in a 6-month update. This is identified as Confirmatory Item 3.2.4.6.B in Section 4.2.

Also on page 45 of the Integrated Plan regarding the safety support functions for phase 1, the licensee stated that habitability in the main control room will be maintained by opening multiple doors inside and outside the main control room to establish an air flow path through the room. The applicable actions are initiated after main control room temperature exceeds 95°F and are expected to maintain temperature less than 120°F. The 120°F temperature limit identified is of concern. At a steady-state condition of "less than 120°F", the environmental conditions within the main control room could remain beyond the uppermost habitability temperature limit defined in NUMARC 87-00 for efficient human performance. NUMARC 87-00 provides the technical basis for this habitability standard as MIL-STD-1472C, which concludes that 110°F is tolerable for light work for a 4 hour period while dressed in conventional clothing with a relative humidity of ~30%. It is noted on page 48 that the licensee has not yet completed the control room analysis for habitability conditions and is expected to provide these in a future update. This is identified as Confirmatory Item 3.2.4.6.C in Section 4.2.

On page 36 of the Integrated Plan, the licensee indicates that the completion of system alignments and the initiation of flow to the SFP may occur after the pool has begun to boil for the worst-case SFP heat load. It was not clear whether operator actions in the vicinity of the SFP would be necessary to set up equipment and initiate flow following the initiation of boiling in the SFP. Because of this, there is insufficient information to demonstrate conformance with NEI 12-06, Section 3.2.2, paragraph (11) regarding habitability in the SFP area. Updated information provided by the licensee as part of the audit response addresses this issue by stating that modifications are planned such that no actions are required on the refuel floor to initiate SFP cooling. Nonetheless, the Integrated Plan and the 6-month update note that the portable monitor and hoses of the 50.54 (hh)(2) strategy are available to provide spray into the pool. This would likely require access onto the refuel floor. Concerns regarding adverse conditions in this area have been previously 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 items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to personnel habitability if these requirements are implemented as described.

3.2.4.7 Water Sources.

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

> *Plant procedures/guidance should ensure that a flow path is promptly established for makeup flow to the steam generator/nuclear boiler and identify backup water*

sources in order of intended use. Additionally, plant procedures/guidance should specify clear criteria for transferring to the next preferred source of water.

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

The licensee has addressed water sources for coping strategies in the Integrated Plan on page 11 and 12 regarding HPCI suction from the suppression pool, and on pages 13, 16, 17, 29, and 38 where reference is made to portable pumps taking suction from the ultimate heat sink. There is also discussion of the HPCI taking suction from the condensate storage tank for the early stages of core cooling for phase 1 on page 17. In each case, the Integrated Plan explains the configuration, and diagrams are provided for clarification in an attachment to the 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 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.

On pages 47 of the Integrated Plan, in the section discussing phase 2 safety function support, the licensee stated that portable generators will be utilized to maintain safety functions. Modifications are being proposed for Unit 2 to connect a portable generator to provide power to critical loads and similar modifications are proposed for Unit 3. On page 56 of the 6-month update, dated August 28, 2013 (ML13241A282), the licensee states that they are proposing to connect a pre-staged generator to supply all FLEX related loads for both units simultaneously for Phase 2 mitigating strategies. This is an alternative approach for satisfying the Mitigating Strategies Order. Guidance for accepting this approach, using a pre-staged generator, has not been developed to date. Therefore, this is identified as Open Item 3.2.4.8.A in Section 4.1.

The Integrated Plan stated on page 47 that the modifications above are "conceptual." There was no discussion regarding expected load requirements. Updated information provided by the licensee as part of the audit response addressed this issue by stating detailed designs will identify comprehensive load list and that conceptual design reviews have been completed and identify major load requirements as 530kW and that generators are required to supply a minimum of 550kW. This is identified as Confirmatory Item 3.2.4.8.B in section 4.2.

There was insufficient information presented in the Integrated Plan regarding electrical isolations and interactions. It was not clear how the FLEX diesel generators and the plant Class 1E diesel generators are isolated to prevent simultaneously supplying power to the same Class 1E bus. Also, there was no discussion of minimum voltages to be maintained on the busses. This is identified as Confirmatory Item 3.2.4.8.C in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the 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 electrical power 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 48 in the section of the Integrated Plan regarding phase 2 of the safety function support strategy to maintain core cooling, the licensee stated that fuel oil to FLEX pumps and generators will be supplied by the quantity of fuel in the tanks located on the skids of the portable equipment. This will then be supplemented by fuel tanks contained on the FLEX truck. When required, fuel can then be pumped from the FLEX truck storage tanks to the portable equipment. It is not clear from the information presented how the portable generators and pumps will be provided with fuel indefinitely. Updated information provided by the licensee as part of the audit response addresses this issue by stating that underground sources of fuel oil will be available to support strategies for 8 days. This provides time to acquire additional supplies if necessary. The licensee also stated in its 6-month update (ML13241A282) that a modification has been proposed to allow transfer of fuel oil from the 2/3 Emergency Diesel Generator main fuel oil storage tank to the area of the proposed FLEX diesel generators. This is identified as Open Item 3.2.4.9.A in Section 4.1.

No information was provided regarding assuring and maintaining fuel oil quality. This is identified as Confirmatory Item 3.2.4.9.B 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 fuel oil if these requirements are implemented as described.

3.2.4.10 Load Reduction to Conserve DC Power.

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

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

On page 6 of the Integrated Plan, the licensee stated that a preliminary review of battery availability identifies the 125 and 250VDC batteries will operate for at least 6 hours before dropping to unacceptable voltage levels if deep load shed is performed. The licensee stated that further review and analysis will be performed to support this assumption and that the information will be provided in a future update if changes to the Dresden plan are required.

The final analysis needs to address the following:

a) Provide the direct current (dc) load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and SFP cooling.

b) Provide a detailed discussion on the loads that will be shed from the dc bus, the equipment location (or location where the required action needs to be taken), and the required operator actions needed to be performed and the time to complete each action. In your response, explain which functions are lost as a result of shedding each load and discuss any impact on defense in depth and redundancy.

The “preliminary” status of the battery operation evaluation and the tentative conclusion for battery operation is identified as Confirmatory Item 3.2.4.10.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 DC load reduction if these requirements are implemented as described.

3.3 PROGRAMMATIC CONTROLS

3.3.1 Equipment Maintenance and Testing.

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

> In order to assure reliability and availability of the FLEX equipment required to meet these capabilities, the site should have sufficient equipment to address all functions at all units on-site, plus one additional spare, i.e., an N+1 capability, where “N” is the number of units on-site. Thus, a two-unit site would nominally have at least three portable pumps, three sets of portable ac/dc power supplies, three sets of hoses & cables, etc. It is also acceptable to have a single resource that is sized to support the required functions for multiple units at a site (e.g., a single pump capable of all water supply functions for a dual unit site). In this case, the N+1 could simply involve a second pump of equivalent capability. In addition, it is also acceptable to have multiple strategies to accomplish a function (e.g., two separate means to repower instrumentation). In this case the equipment associated with each strategy does not require N+1. The existing 50.54(hh)(2) pump and supplies can be counted toward the N+1, provided it meets the functional and storage requirements outlined in this guide. The N+1 capability applies to the portable FLEX equipment described in Tables 3-1 and 3-2 (i.e., that equipment that directly supports maintenance of the key safety functions). Other FLEX support equipment only requires an N capability.

NEI 12-06, Section 11.5 states:

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

2. Portable equipment that directly performs a FLEX mitigation strategy for the core, containment, or SFP should be subject to maintenance and testing[1] guidance provided in INPO AP 913, Equipment Reliability Process, to verify proper function. The maintenance program should ensure that the FLEX

[1] Testing includes surveillances, inspections, etc.

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.

Review of the Integrated Plans for licensee 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 preventive maintenance of FLEX equipment, submitted by NEI by letter dated October 3, 2013 (ADAMS Accession No. ML13276A573). The endorsement letter from the NRC staff is dated October 7, 2013 (ADAMS Accession No. ML13276A224).

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

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

3.3.2 Configuration Control.

NEI 12-06, Section 11.8 provides that:

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

On page 9, in the section of the Integrated Plan regarding programmatic controls, the licensee stated that DNPS will implement an administrative program related to configuration management. A plant system designation will be assigned to FLEX equipment that requires configuration controls associated with systems. The licensee stated that equipment associated with these strategies will be procured as commercial equipment with design, storage, maintenance, testing, and configuration control as outlined in JLD-ISG-2012-01 Section 6 and NEI 12-06 Section 11.

The licensee's plans for development and implementation of a configuration control process for the strategies is consistent with normal plant configuration control processes. Because the plan for configuration control is consistent with normal plant configuration control programs, the reviewer concludes that it is reasonable to assume the considerations noted above will be addressed.

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

3.3.3 Training.

NEI 12-06, Section 11.6 provides that:

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

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

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

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

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

On page 9, in the section of the Integrated Plan describing the training plan, the licensee stated that training materials for FLEX will be developed for all station staff involved in implementing FLEX strategies. For accredited training programs, the Systematic Approach to Training, SAT, will be used to determine training needs. For other station staff, a training overview will be developed per the change management plan. The reviewer concluded that use of the licensee's existing proceduralized site training regimen as described, provides reasonable

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

assurance of a training program to meet the considerations above.

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

On page 9 of the Integrated Plan, the licensee provided a description of planned arrangements for off site resources and stated that contractual agreements are in place with the Strategic Alliance for the FLEX emergency response. Review of the licensee's use of off site resources, as described in the integrated plan, provides reasonable assurance that the proposed arrangement will conform to the guidance found in NEI 12-06, Section 12.2, with regard to the capability to obtain equipment and commodities to sustain and backup the site's coping strategies (guideline 1). However, the plan failed to provide any information as to how conformance with NEI 12-06, Section 12.2 guidelines 2 through 10 will be met. This is identified as Confirmatory Item 3.4.A in Section 4.2.

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

4.0 OPEN AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number	Description	Notes
3.1.1.1.A	Each section of the Integrated Plan describing storage protection from hazards makes reference to Section 11 rather than to the specific protection requirements described in NEI 12-06 for the applicable hazard; that is Section 6.2.3.1 for floods, Section 7.3.1 for wind, etc. As a result, the specific guidelines for each hazard are not addressed.	Significant
3.1.2.2.B	The Plan is silent regarding normal access to UHS due in flood hazard conditions, the need to provide electrical power for sump pumps, and whether or not flood barriers will be utilized.	
3.2.4.8.A	Updated information provided by the licensee as part of the 6-month update states that they are proposing to install a pre-staged generator to supply all FLEX related loads for both units simultaneously for Phase 2 mitigating strategies. This appears to be an alternative approach for satisfying the Mitigating Strategies order. Insufficient information has been provided by the licensee in order to determine whether this provides an equivalent level of protection as would be provided through conformance with NEI 12-06.	
3.2.4.9.A	The licensee also stated in its 6-month update that a modification has been proposed to allow transfer of fuel oil from the 2/3 Emergency Diesel Generator main fuel oil storage tank to the area of the proposed FLEX diesel generators. This is an open item pending a decision on the part of the licensee as to whether the proposed modification will be made.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.2.A	A postulated downstream dam failure from a seismic event still being evaluated.	
3.1.1.2.B	Plans for strategies did not address whether electrical power would be required to move or deploy FLEX equipment (e.g. to open a door from a storage location.)	
3.1.1.3.A	Development of a reference source for obtaining necessary instrument readings in the event of seismic damage to electrical equipment as described in NEI 12-06, Section 5.3.3, consideration 1.	

3.1.1.3.B	Use of, or need for ac power to mitigate ground water intrusion was not addressed.	
3.1.1.4.A	Regarding off site resources, detailed plans for local staging areas and transport of FLEX equipment to overcome hazards are to be provided in 6-month update.	
3.1.2.A	Impact of persistence of flooding to staging of FLEX equipment not fully addressed.	
3.1.2.2.A	Administrative program and procedures for on site FLEX equipment storage locations and transport routes not yet established.	
3.1.2.3.A	Administrative program and procedures related to implementation of mitigation strategies not yet developed.	
3.1.4.2.A	Equipment to clear ice and snow from haul pathways is not identified in plan.	
3.1.5.2.A	Procedures to assure equipment can be deployed in a high temperature context have not been developed. Specifically, address high temperature effects on storage locations (e.g. expansion of sheet metal, swollen seals, etc.)	
3.1.5.3.A	Procedures to address high temperature impacts not yet developed.	
3.2.1.1.A	Need benchmarks to demonstrate MAAP4 is the appropriate code for simulation of ELAP.	
3.2.1.1.B	Collapsed level must remain above Top of Active Fuel and cool down rate must meet technical specifications.	
3.2.1.1.C	MAAP4 use must be consistent with June 2013 position paper.	
3.2.1.1.D	In using MAAP4, the licensee must identify and justify the subset of key modeling parameters cited from Tables 4-1 through 4-6 of the "MAAP4 Application Guidance, Desktop Reference for Using MAAP4 Software, Revision 2" (Electric Power Research Institute Report 1020236).	
3.2.1.1.E	The specific MAAP4 analysis case that was used to validate the timing of mitigating strategies in the integrated plan must be identified and should be available on the ePortal for NRC staff to view. Alternately, a comparable level of information may be included in the supplemental response.	
3.2.1.3.A	Outstanding Confirmatory Items regarding the use of the MAAP4 analysis may impact the sequence of events timeline. Any changes to the MAAP4 analysis results will need to be reviewed for impact on the sequence of events timeline. The licensee stated that the final timeline will be time validated once detailed designs are completed, procedures are developed, and the results will be provided in a future six (6) month update.	
3.2.1.3.B	Sequence of Events timing for compensatory actions to control temperature rise in the Main Control room not resolved.	
3.2.1.4.A	Detailed engineering analyses to confirm the ability of FLEX pumps to provide required flow and head capacities are not complete.	
3.2.1.4.B	Analysis needs to be performed to validate that the plant modifications, selected equipment, and identified mitigating strategy can satisfy the safety function requirements of NEI 12-	

	06. To be provided in a future six (6) month update.	
3.2.1.6.A	Whether or not backup compressed air for valve actuation is required, is contingent on the MAAP4 analyses conclusions. The MAAP4 conclusions will determine if containment venting is necessary.	
3.2.2.A	Final analysis of fuel pool area for steam and condensation impacts regarding access is not complete.	
3.2.3.A	There are outstanding issues regarding the acceptability of the MAAP4 analysis. The potential for impact of MAAP4 results on the containment heat removal strategy needs to be reviewed.	
3.2.4.2.A	A discussion is needed on the effects of extreme low temperatures (i.e., temperatures below those assumed in the sizing calculation for each battery) on each battery's capability to perform its function for the duration of the ELAP event.	
3.2.4.2.B	Procedure will be developed to address controlling battery room hydrogen concentration.	
3.2.4.2.C	Evaluations to address loss of ventilation in the auxiliary equipment electric room and Battery Rooms are not complete.	
3.2.4.2.D	Insufficient information to address impact on elevated temperatures in areas critical to mitigation strategies. For example, initial temperatures assumed in the analyses is not clear, critical components in pump rooms are not identified, etc. Detailed design information is needed.	
3.2.4.4.A	Provisions for portable lighting for area access not clear. More information required.	
3.2.4.4.B	Confirm upgrades to communication system that resulted from the licensee communications assessment. ADAMS Accession Nos. ML12306A199 and ML13056A135.	
3.2.4.6.A	Surface pyrometer temperature readings are required in the torus area. The licensee needs to address habitability and access to the torus area.	
3.2.4.6.B	Final GOTHIC analysis for the HPCI room temperature rise is not complete.	
3.2.4.6.C	Habitability of the control room should consider temperature limits of NUMARC 87-00 and MIL-STD-1472C.	
3.2.4.8.B	Detailed designs will identify comprehensive load lists to confirm conceptual load assumptions.	
3.2.4.8.C	Insufficient information provided regarding FLEX diesel generators and the plant Class 1E diesel generators isolation to prevent simultaneously supplying power to the same Class 1E bus and regarding minimum bus voltages during the use of FLEX generators.	
3.2.4.9.B	Assessing and maintaining fuel oil quality for FLEX equipment use was not addressed.	
3.2.4.10.A	Final analysis for battery operation with load shed not complete. Need detailed load profile for all mitigating strategies and a detailed discussion of loads that will be shed, how they will be shed, and what are the effects of the shed.	
3.4.A	Details not provided to demonstrate the minimum capabilities for offsite resources will be met per NEI 12-06 Section 12.2.	