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

Revision 1

November 20, 2013

DTE Electric Company
Fermi Unit 2
Docket No. 50-341

Prepared for:

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

Contract NRC-HQ-13-C-03-0039
Task Order No. NRC-HQ-13-T-03-0001
Job Code: J4672
TAC No.: MF0770

Prepared by:

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

1.0 BACKGROUND

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

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

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

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

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

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

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

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

2.0 EVALUATION PROCESS

In accordance with the provisions of Contract NRC-HQ-13-C-03-0039, Task Order No. NRC-HQ-13-T-03-0001, Mega-Tech Services, LLC (MTS) performed an evaluation of each licensee’s Integrated Plan. As part of the evaluation, MTS, in parallel with the NRC staff, reviewed the original Integrated Plan and the first 6-month status update, and conducted an audit of the licensee documents. The staff and MTS also reviewed the licensee’s answers to the NRC staff’s and MTS’s questions as part of the audit process. The objective of the evaluation was to assess whether the proposed mitigation strategies conformed to the guidance in NEI 12-06, as endorsed by the positions stated in JLD-ISG-2012-01, or an acceptable alternative had been proposed that would satisfy the requirements of Order EA-12-049. The audit plan that describes the audit process was provided to all licensees in a letter dated August 29, 2013 from Jack R. Davis, Director, 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. ML13063A262), and as supplemented by the first six-month status report in letter dated August 23, 2013 (ADAMS Accession No. ML13239A121), the DTE Electric Company (DTE or the licensee) provided the Fermi Unit 2 (Fermi) Integrated Plan for Compliance with Order EA-12-049. 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.

In their Integrated Plan the licensee stated that the Fermi site is located in one of the seismically stable regions in the United States, and no earthquake epicenter has been located closer than *25* miles (UFSAR Section 2.5.2.5.1). The Reactor Building, which houses the drywell, suppression chamber, refueling and reactor servicing equipment, and the SFP, consists of reinforced concrete and structural steel supported on the Reactor Building foundation mat (UFSAR Section 3.8.4.1.1.1). The Auxiliary Building (which is part of the same structure as the Reactor Building) houses several major safety-related systems and components and consists of reinforced concrete and structural steel supported on a reinforced concrete mat. The Auxiliary Building is separated from the Turbine Building by a four-inch seismic rattle space (UFSAR Section 3.8.4.1.1.2). Finally, the Residual Heat Removal (RHR) Complex is a reinforced concrete structure supported on a base mat that serves as the Ultimate Heat Sink (UHS) for the reactor during normal shutdown. The complex is divided into two divisions, each with the capacity to safely shut down the reactor during normal and accident conditions (UFSAR Section 3.8.4.1.2).

It should be noted that on page 2 of the Integrated Plan, in the section regarding assumptions for the site, the licensee points out that flood and seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 are not completed and therefore not assumed in this submittal. As the re-evaluations are completed, appropriate issues will be entered into the corrective action system and addressed on a schedule commensurate with other licensing bases changes.

The licensee's 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 14, 20, 27 and 34 in the sections of its Integrated Plan regarding the strategies for maintaining core cooling, containment, SFP 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 requirements 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 of FLEX equipment 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. This concern 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 approach is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of portable equipment from seismic hazards. These questions are identified as open items 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.

On page 7 in the section of its Integrated Plan describing how strategies will be deployed in all modes, the licensee stated that deployment routes shown in Figure 1 are expected to be utilized to transport FLEX equipment to the deployment areas. A liquefaction study will be performed to validate there will be no soil liquefaction along the proposed route due to a seismic event. This item was identified as Confirmatory Item 3.1.1.2.A in Section 4.0.

On page 7, the licensee also stated that the identified paths and deployment areas will be accessible during all modes of operation. This deployment strategy will be included within an administrative program (Flex Support Guidelines) in order to keep pathways clear or actions to clear the pathways. Deployment is initiated upon notification by the National Weather Service for flooding events so accessibility is not challenged. No Flood barriers or post flood dewatering pump are required for FLEX implementation locations. Dewatering capability for the Reactor Building can be restored in Phase 2 after connection of supplemental ac power.

On page 12 of its Integrated Plan describing modifications for the transition phase (Phase 2) of its strategy for maintaining core cooling, the licensee stated that modifications would be required for FLEX equipment to breach the security fence and to enter the Reactor Building. On page 14 of its Integrated Plan describing the protection of connections for the transition phase of core cooling, the licensee stated that structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 Section 11 and that Fermi Station procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to Fermi.

On page 15 of its Integrated Plan describing modifications for the transition phase of its strategy for maintaining SFP cooling, the licensee stated that a modification will be performed to transition FLEX pipe through the security fences and the Reactor Building west wall. On page 27 of its Integrated Plan for the transition phase of SFP cooling, the licensee stated that the connection points will be flood protected, seismically robust, and protected from missiles.

The licensee has indicated that Fermi Station procedures and programs are being developed to address deployment of portable equipment and protection of connections for deployment of portable equipment following a seismic event. Information provided by the licensee as part of the 6-month update process indicates that design engineering is underway.

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

3.1.1.3 Procedural Interfaces – Seismic Hazard

NEI 12-06, Section 5.3.3 states:

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

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

On Page 13 the licensee described the instrumentation credited for the coping evaluation for core cooling. This included Reactor water level - wide range, Reactor Pressure – wide range, RCIC suction and RCIC discharge pressure. On page 24 the licensee described the instrumentation credited for the coping evaluations for containment. This included installed Torus pressure, level and temperature as well as Drywell pressure and temperature.

In its Integrated Plan the licensee has identified the seismically qualified plant instruments that will be used to for obtaining necessary instrument readings to support the implementation of the coping strategies. However, the licensee has not verified that it is possible to determine local readings of key reactor parameters using standard I&C instruments in the event that seismically qualified electrical equipment is affected by beyond-design-basis seismic events. Also, the licensee has not provided sufficient information to determine whether a reference source currently exists for obtaining necessary instrument readings in this manner or whether one will be developed. The licensee has not provided sufficient information to ensure the requirements NEI 12-06, Section 5.3.3, consideration 1, will be met. This is identified as Confirmatory Item 3.1.1.3.A in Section 4.2.

In its Integrated Plan, the licensee has not provided sufficient information to support a conclusion that consideration 2 through 4 of NEI 12-06, Section 5.3.3 will be taken into account in the development of the mitigating strategies pursuant to Order EA-12-049. These considerations address the potential impacts of large internal flooding sources that are not seismically robust and do not require alternating current (ac) power, the potential reliance on ac power to mitigate ground water, and the potential impacts of non-seismically robust downstream dams. This has been identified as Confirmatory Item 3.1.1.3.B. in Section 4.2.

The licensee’s approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and subject to the successful closure of issues related to Confirmatory Items 3.1.1.3.A and 3.1.1.3.B 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 page 9, of its Integrated Plan regarding the Regional Response Center (RRC) plan, the licensee stated that the industry would establish two RRCs to support utilities during design basis event. Equipment will be moved from an RRC to a local assembly area established by the Strategic Alliance for FLEX Emergency Response (SAFER) team and the utility. 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. However, the licensee has not yet provided sufficient details, including method of transportation, to conclude that they conform to the guidance of NEI 12-06, Section 5.3.4, consideration 1, Section 6.2.3.4, considerations 1 and 2, Section 7.3.4, considerations 1 and 2, and Section 8.3.4. The licensee is requested to provide additional information to clarify these issues. This has been identified as Confirmatory Item 3.1.1.4.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 Confirmatory Item 3.1.1.4.A provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to considerations in using offsite 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 of its Integrated Plan the licensee stated that Fermi Station is not a "dry site." Section 1.2.2.3.5 of the UFSAR states that site grade is at 583 ft. but the maximum Stillwater elevation, based on the probable maximum meteorological event is 586.9 ft. However, all category I seismically qualified structures are flood protected (waterproofed) to an elevation of 588 ft. The RHR Complex is watertight to an elevation of 590 ft. The maximum flooding would be due to a storm surge during the maximum monthly mean lake level (UFSAR Section 2.4.3). There is no upstream dam (UFSAR Section 2.4.14.2), and Fermi Station is not susceptible to a tsunami (UFSAR 2.4.6). Any low-amplitude seiche that could occur would be of negligible concern to the site (UFSAR 2.4.6). Therefore, the flooding hazards are applicable at Fermi Station.

On page 3, in the section describing Key Site assumptions to implement NEI 12-06 strategies, the licensee stated flood duration will be 17 hours (UFSAR Section 2.4.5.4.2.3) and there would be early warning for a flooding event (NEI 12-06 Section 6.2.2). Upon receipt of a flood warning the licensee would initiate a reactor shutdown and plant cool down in accordance with existing plant Abnormal Operating Procedures (AOPs).

The licensee's 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 of flooding hazards if these requirements are implemented as described.

3.1.2.1 Protection of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.1 states:

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

On pages 14, 20 and 34, in the sections of its Integrated Plan regarding the strategies for maintaining core cooling; containment integrity; and SFP cooling during the transition phase (Phase 2), the licensee stated that Fermi Station is not susceptible to flooding without warning. The staging areas for the equipment will be above the flood plain or otherwise protected from the maximum probable flood. Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.

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

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

3.1.2.2 Deployment of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.2 states:

> There are a number of considerations which apply to the deployment of FLEX equipment for external flood hazards:
>
> 1. For external floods with warning time, the plant may not be at power. In fact, the plant may have been shut down for a considerable time and the plant configuration could be established to optimize 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 7, in the Integrated Plan describing how strategies will be deployed in all modes, the licensee stated that deployment routes shown in Figure 1 are expected to be utilized to transport FLEX equipment to the deployment areas. The identified paths and deployment areas will be accessible during all modes of operation. This deployment strategy will be included within an administrative program (Flex Support Guidelines) in order to keep pathways clear or actions to clear the pathways. Deployment will be implemented upon Flood watch notification by National Weather Service of impending flooding events so that accessibility is not challenged. No Flood barriers or post flood dewatering pump are required for FLEX implementation locations. Dewatering capability for the Reactor Building can be restored in Phase 2 after connection of supplemental ac power.

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

3.1.2.3 Procedural Interfaces – Flooding Hazard

NEI 12-06, Section 6.2.3.3 states:

The following procedural interface considerations should be addressed.

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

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

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

On Page 7, in its Integrated Plan describing how the strategies will be deployed in all modes, the licensee stated that the deployment routes shown in Figure 1 are expected to be utilized to transport FLEX equipment to the deployment areas. The identified paths and deployment areas will be accessible during all modes of operation. This deployment strategy will be included within an administrative program (Flex Support Guidelines) in order to keep pathways clear or actions to clear the pathways. Deployment is done on Flood watch notification by National Weather Service for flooding events so accessibility is not challenged. No Flood barriers or post flood dewatering pump are required for FLEX implementation locations. Dewatering capability for the Reactor Building can be restored in Phase 2 after connection of supplemental ac power.

The licensee's 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 with respect to procedures to address flood hazards if these requirements are implemented as described.

3.1.2.4 Considerations in Using Offsite Resources – Flooding Hazard

NEI 12-06, Section 6.2.3.4 states:

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

On page 9 of its Integrated Plan regarding the RRC plan, the licensee stated that the licensee will establish contracts with the RRC for delivery of equipment appropriate for the station's Phase 3 strategy. The program will be administered by the site-specific playbook. Equipment will be moved from an RRC to a local assembly area 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 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 procedures to address the impact of flooding hazards on the use of offsite 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 its Integrated Plan regarding the determination of applicable extreme external hazards, the licensee stated that Fermi Station is not susceptible to hurricanes due to location (reference *figure* 7-1 of NEI 12-06). According to the UFSAR, all Category I classified structures are able to withstand a design basis tornado with wind velocities of 300 mph (UFSAR Section 3.3.2.1). The licensee stated that an analysis of tornado missile hazard on the Reactor Building was performed to assess the probability of any design basis missile penetrating the building, resulting in a probability of 1.15 x 10E-7 per year, which was evaluated as acceptable (UFSAR Section 3.5.1.3.2.3). The licensee stated that tornado missile hazards are applicable at Fermi Station.

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

3.1.3.1 Protection of FLEX Equipment - High Winds Hazard

NEI 12-06, Section 7.3.1 states:

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

buildings and limiting pathways for missiles to damage equipment.

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

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

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

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

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

On pages 14, 21, 27, and 34, in the sections of its Integrated Plan regarding the strategies for maintaining core cooling, containment, SFP Cooling and Safety Function Support, respectively, the licensee stated that protection of associated portable equipment from wind 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 7.3.1. (Note: This was addressed previously as Open Item 3.1.1.1.A in Section 4.1.)

In their Integrated Plan the licensee stated that Fermi Station procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to Fermi. They also stated that the ac and dc generators would be stored in accordance with the NEI 12-06 guidelines to be protected from all applicable 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 protection of FLEX equipment from a high wind hazard if these requirements are implemented as described.

3.1.3.2 Deployment of FLEX Equipment – High Wind Hazard

NEI 12-06, Section 7.3.2 states:

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

Because Fermi is not subject to the hurricane hazard, considerations 1, 2 and 5 are not applicable.

On page 15, of its Integrated Plan describing how FLEX equipment will be deployed to the point of use the licensee stated a fuel truck or trailered tank will be required, along with debris clearing, to refuel the pumps within 8 hours of their operation. On page 3 of its Integrated Plan describing key assumptions associated with implementation of the strategies, the licensee stated that all Phase 3 components will be available consistent with considerations of Section 3.3 of NEI 12-06.

On page 5 of its Integrated Plan the licensee stated they had performed a MAAP analysis to determine key parametric values versus time and a tabletop exercise showed that these actions could be accomplished in the required time frames. The licensee stated that this analysis would be validated using Fermi Station Time Critical Operator Action Validation/Verification Process once all procedures, training, and equipment have been implemented. Until these procedures, training and equipment have been implemented and the verification and validation are completed, insufficient information is available on to conclude that these critical actions could be completed in the time required. This has been identified as Confirmatory Item 3.1.3.2.A. in Section 4.2.

On page 15, in the section listing BWR Portable Equipment for Phase 2, the licensee stated that dedicated FLEX trucks would be used to deploy the FLEX hoses to the connection points.

These trucks will be housed with the primary FLEX equipment, which will be stored in the location of its expected use. Backup FLEX equipment will be stored in a diverse location with a clear travel path to a suitable location for connection.

The licensee's 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 Confirmatory Item 3.1.3.2.A, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to deployment of portable equipment as related to a high wind hazard if these requirements are implemented as described.

3.1.3.3 Procedural Interfaces – High Wind Hazard

NEI 12-06, Section 7.3.3, states:

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

On page 7 of the Integrated Plan describing how the strategies will be deployed in all modes, the licensee states that the deployment routes shown in Figure 1 are expected to be utilized to transport FLEX equipment to the deployment areas. The identified paths and deployment areas will be accessible during all modes of operation. This deployment strategy will be included within an administrative program (Flex Support Guidelines) in order to keep pathways clear or actions to clear the pathways. (Note: This was previously identified as Confirmatory Item 3.1.2.2.A in Section 4.2.)

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

3.1.3.4 Considerations in Using Offsite Resources – High Wind Hazard

NEI 12-06, Section 7.3.4 states:

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

Because Fermi is not subject to the hurricane hazard, consideration 1 is inapplicable.

On page 9 of the Integrated Plan describing the RRC plan the licensee stated that the industry will establish two RRCs to support utilities during beyond design basis events. 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 the maintenance cycle. Equipment will be moved from an RRC to a local assembly area established by the Strategic Alliance for FLEX Emergency Response (SAFER) team and the utility. 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. Prior to implementation, the licensee will have contracts established with the RRC for delivery of equipment appropriate for the station's Phase 3 strategy. The program will be administered by the site-specific playbook.

The licensee has not yet implemented their plans for the use of offsite resources. They do not provide the location of the local staging area and do not provide a description of the methods to be used to deliver the equipment to the site. (Note: This has been combined with previously identified Confirmatory Item 3.1.1.4.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 provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedures to address high wind hazards 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 of its Integrated Plan regarding the determination of applicable extreme external hazards, the licensee stated that according to NEI 12-06 figure 8-2, Fermi Station is susceptible to Level 5 ice severity. This is a catastrophic destruction of power lines and/or existence of extreme amounts of ice. The greatest ice accumulation on record is three inches (UFSAR 2.3.1.3.5). The lowest temperature on record was -19 °F (UFSAR 2.3.1.2). Extreme snow, ice, and cold are applicable at Fermi Station.

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

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

NEI 12-06, Section 8.3.1 states:

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

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

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

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

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

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

On pages 14, 21, 27 and 34, in the sections of its Integrated Plan regarding the strategies for maintaining core cooling, containment, SFP 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. (Note: This was addressed previously in Open Item 3.1.1.1.A in Section 4.1).

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

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

NEI 12-06, Section 8.3.2 states:

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

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

On page 7 of its Integrated Plan describing how strategies will be deployed in all modes, the licensee stated deployment routes shown in Figure 1 are expected to be utilized to transport FLEX equipment to the deployment areas. The identified paths and deployment areas will be accessible during all modes of operation. This deployment strategy will be included within an administrative program (Flex Support Guidelines) in order to keep pathways clear or actions to clear the pathways.

On page 8 of the Integrated Plan the licensee stated that Fermi Station will implement a FLEX administrative program (FLEX Support Guidelines). The equipment for ELAP will be dedicated and will have unique identification numbers. FLEX equipment will be procured in accordance with the NEI 12-06 guidelines. Fermi Station will establish PMs for the FLEX related components and testing procedures will be developed and frequencies established based on type of equipment and considerations made within EPRI and NEI 12-06 guidelines. Fermi Station will assess the addition of program descriptions into UFSAR and Technical Requirements Manual. Fermi Station will comply with Section 11 of NEI 12- 06. The FLEX administrative program will ensure FLEX routes are maintained for use.

On page 38, in the section of its Integrated Plan describing portable equipment for the transition phase (Phase 2), the licensee lists two Red Devil Blowers but it is not clear if these are snow blowers or ventilation blowers. No other equipment capable of removing snow or ice is listed.

On page 40, in the section of its Integrated Plan describing response equipment and commodities necessary in the final phase (Phase 3), the licensee does not list any equipment that would be capable of removing snow or ice.

The licensee's plans for implementation of the strategies to deploy portable equipment in the context of snow, ice, and extreme cold, do not provide sufficient information to conclude that the administrative program elements or required equipment is available to ensure the pathways are clear will include snow or ice removal. This has been 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 Confirmatory Item 3.1.4.2.A, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to deployment of FLEX equipment for snow, ice and extreme cold hazards if these requirements are implemented as described.

3.1.4.3 Procedural Interfaces – Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.3, states:

> The only procedural enhancements that would be expected to apply involve addressing the effects of snow and ice on transport the FLEX equipment. This

> includes both access to the transport path, e.g., snow removal, and appropriately equipped vehicles for moving the equipment.

As discussed in Section 3.1.4.2, the licensee has supplied insufficient information with regard to clearing pathways to demonstrate that its program adequately address the effects of snow and ice on transporting the equipment. (Note: This was previously 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 provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedure interfaces to address snow, ice and extreme cold hazard if these requirements are implemented as described.

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

NEI 12-06, Section 8.3.4, states:

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

On page 9 of its Integrated Plan regarding the RRC plan, the licensee stated that the industry would establish two RRCs to support utilities during design basis events. Equipment will be moved from an RRC to a local assembly area established by the Strategic Alliance for FLEX Emergency Response (SAFER) team and the utility. 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 description of their plans for the use of offsite resources do not provide reasonable assurance that the plans will conform with NEI 12-06, Section 8.3.4 and Order EA-12-049 due to the absence of further details including a description of the methods to be used to deliver the equipment to the site. Through the audit process the licensee provided additional information describing the site standard procedures for removal of ice and snow due to their common occurrence in the region.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to considerations in using 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 its Integrated Plan regarding the determination of applicable extreme external hazards, the licensee states that the highest temperature ever recorded at the Fermi site was 105 °F (UFSAR 2.3.1.2). Thus high temperature considerations are applicable at Fermi Station.

The licensee's 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 consideration of high temperatures 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 pages 14, 27 and 34 of its Integrated Plan regarding the strategies for maintaining core cooling, containment, and SFP cooling the licensee stated that protection of associated portable equipment from hazards from high temperatures would be provided by storage structures that are ventilated; active cooling systems are not required, as normal room ventilation will be utilized. Fermi Station procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to Fermi. The ac and dc generators will be stored in accordance with the NEI I2-06 guidelines to be protected from all applicable 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 protection of FLEX equipment from high temperature hazards if these requirements are implemented as described.

3.1.5.2 Deployment of FLEX Equipment – High Temperature Hazard

NEI 12-06, Section 9.3.2 states:

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

On page 7 of its Integrated Plan describing how strategies will be deployed in all modes, the licensee stated that the identified paths and deployment areas will be accessible during all modes of operation. This deployment strategy will be included within an administrative program (Flex Support Guidelines) in order to keep pathways clear or actions to clear the pathways.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to deployment of FLEX equipment 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 pages 14, 27 and 34 of its Integrated Plan regarding the strategies for maintaining core cooling, containment, and SFP cooling the licensee stated that protection of associated portable equipment from hazards from high temperatures would be provided by storage structures that are ventilated; active cooling systems are not required, as normal room ventilation will be utilized. Fermi Station procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to Fermi. The ac and dc generators will be stored in accordance with the NEI I2-06 guidelines to be protected from all applicable hazards.

The licensee has described plans for the procedural interfaces associated with the effects of high temperatures on portable equipment. The effects of high temperatures on the storage of the equipment have been addressed generally in Section 3.1.5.1 and other sections. This item was discussed in an August 21, 2013 telephone clarification call with the licensee who provided sufficient information on this question for the reviewers to conclude that this issue is resolved and did not need a further response from the licensee. Therefore there is sufficient information to conclude there is reasonable assurance that the requirements of Order EA-12-049 with regard to the use of portable equipment in the context of high temperatures will be met.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to regard to the use of portable equipment in the context of high temperatures 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 provided a Sequence of Events (SOE) in Attachment 1A, on pages 42 through 44 of their Integrated Plan, which included the time constraints and the technical basis for the

Fermi site. The SOE is based on an analysis using the industry-developed Modular Accident Analysis Program (MAAP) Version 4 computer code. MAAP4 was written to simulate the response of both current and advanced light water reactors to loss of coolant accident (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) event. While the NRC staff does acknowledge that MAAP4 has been used many times over the years and in a variety of forums for sever and beyond design basis analysis, MAAP4 is not an NRC approved code, and the NRC staff has not examined its technical adequacy for performing thermal hydraulic analyses. Therefore, during the review of the Integrated Plan, the issue of using MAAP4 was raised as Generic Concern and was addressed by NEI in their position paper dated June 2013, entitled “Use of Modular Accident Analysis Program (MAAP4) in Support of Post-Fukushima Applications” (ADAMS Accession No. ML13190A201). After review of this position paper, the NRC staff endorsed a resolution through letter dated October 3, 2013 (ADAMS Accession No. ML13275A318). This endorsement contained five limitations on the MAAP4 computer code’s use for simulating the Extended Loss of ac Power (ELAP) event for Boiling Water Rectors (BWRs). Those limitations and their corresponding Confirmatory Item numbers 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. During the audit process the licensee stated that Fermi 2 intends to benchmark the use of MAAP against a suitable plant specific analysis such as a SUPERHEX analysis of Station Blackout. 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. During the audit process the licensee stated that The Fermi 2 FLEX response follows the execution of the EOPs and thus the reactor cool down rate will not necessarily remain within Technical Specification limits. They also stated that RPV water level is documented in the preliminary MAAP analysis cited in the OIP. Figures presenting RPV conditions in NJPR-13-0028 (available on document e-portal) include RPV pressure, water level, and peak fuel temperature. 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. During the audit process the licensee stated that it would utilize the MAAP code in a manner consistent with the NRC letter of October 3, 2013 that endorsed 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. During the audit process the licensee stated that the Fermi 2 FLEX response follows the execution of the EOPs and thus the reactor cool down rate will not necessarily remain within Technical Specification limits. This is Confirmatory Item 3.2.1.1.E in Section 4.2.

During the audit process the licensee stated that the final MAAP analysis of the BDBEE/ELAP is expected to be completed by second quarter 2014 and will include RPV water level.

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

3.2.1.2. Recirculation Pump Seal Leakage Models

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

On page 7, in step 4 of the section of its Integrated Plan describing a sequence of events required for success including the technical basis for the time constraint, the licensee stated that Drywell Pressure control in response to Reactor Recirculation Pump (RRP) Seal leakage (assumed at 41 gpm per pump) is accomplished with FLEX Phase 2 ac generators installed within 6 hours.

The licensee also discussed seal leakage in other sections as to their effect on Drywell Pressure control. However, the licensee did not provide information on the impact of this assumed seal leakage would have on the ability to maintain core cooling. Also, they did not provide the technical basis for the assumed 41gpm seal leakage and primary leakage from other sources. In addition, the licensee did not clarify whether the leakage was determined or assumed to be single-phase liquid, two-phase mixture, or steam at the donor cell and discuss how mixing of the leakage flow with the drywell atmosphere is modeled.

In a September 13, 2013 update the licensee provided additional information regarding recirculation pump seal leakage. They stated that an allowable leakage of 18 gpm per recirculation pump is from UFSAR section 8.4.2.2, SBO Coping Analysis Assumptions, which is based on TDEC 4 098/GE-NE-523-A140-0994. An additional 5 gpm leakage rate is based on the Technical Specification allowable unidentified leakage rate (T.S. 3.4.4) and was assumed in the Overall Integrated Plan (NRC-13-0009). The total recirculation seal leakage rate of 41 gpm was assumed for the preliminary ELAP analysis in MAAP. The total assumed leakage would be validated as part of the final MAAP analysis that is expected to be complete by second quarter 2014. The reviewer concluded that the revised leakage rate is reasonable. However, questions still remain unanswered regarding pressure dependence of the assumed leakage rates, assumed leakage phase, i.e. single phase liquid, two phase, or steam, and other questions presented in the audit. Therefore, the information available, at this time, is not sufficient to conclude that the specifications of NEI 12-06, Section 3.2.1.2 concerning recirculation pump seal leakage models and reactor coolant inventory loss in the ELAP analysis will be met. This is identified as Confirmatory Item 3.2.1.2.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 recirculation pump seal leakage models 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

Fermi Station includes a discussion of time constraints on pages 5 through 7 and two Sequence of Events Timelines, Attachment 1A, on pages 46 through 49. The licensee performed a MAAP analysis to determine that key parametric values versus time. As previously indicated in Open Item 3.2.1.1.A, the licensee was requested to provide adequate technical basis to support the conclusions for the intended strategies.

In addition, the licensee stated on page 5 that the time required to implement these strategies would be validated using Fermi Station Time Critical Operator Validation/Verification Process once all procedures, training, and equipment have been implemented. The licensee has identified six of the nine strategies listed on page 5 and 6 as time critical actions. Because these Verification/Validation actions have not yet been performed, the licensee does not have assurance that these time critical actions can be completed as described.

Also, the licensee did not state that it had reviewed BWROG document NEDC-33771P, "GEH Evaluation of FLEX Implementation Guidelines." Nor did the licensee indicate that it had performed, or plans to perform, an 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.

Because the final Verification and Validation of the time required to implement these strategies has not been completed and because the licensee has not reviewed these strategies using NEDC-33771P "GEH Evaluation of FLEX Implementation Guidelines" there is insufficient information to determine if the action time constraints can be met for all strategies. Pending submittal of additional information by the licensee, this is identified as Confirmatory Item 3.2.1.3.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and, subject to the successful closure of issues related to Confirmatory Item 3.2.1.3.A, 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 8 of their Integrated Plan the licensee stated that the Fermi Station will implement a FLEX administrative program (FLEX Support Guidelines). The equipment for ELAP will be dedicated and will have unique identification numbers. FLEX equipment will be procured in accordance with the NEI 12-06 guidelines. Fermi Station will comply with Section 11 of NEI 12-06. The FLEX administrative program will ensure FLEX routes are maintained for use.

On page 12 of the Integrated Plan regarding Portable Equipment to Maintain Core Cooling, Phase 2, the licensee stated that two diesel driven pumps in series will move water from the FLEX water sources (preferred suction is the Circulating Water Pond) into the Reactor Building and into the RHR system for RPV injection. The lift pump is a 3,000 gpm, 150 psi pump capable of taking water from the FLEX water source and boosting pressure for transit to a second pump. The second pump is a 3,000 gpm, 150 psi rated booster pump, which will boost the pressure into the Reactor Building. Diverse connection points are provided by tapping into the Division 1 RHR system and the Division 2 RHR system. The Division 1 and 2 FLEX connections are shown in Figure 2.

In their submittal of September 13, 2013, the licensee provided the following information to provide justification that that the rated pump pressure of 150 psig is sufficient to ensure injection of water into the RPV to maintain core cooling:

> Fermi's strategy will include procedural direction to depressurize the reactor fully prior to use of the FLEX pumps. This will be accomplished using the SRV's and can be expected to reduce reactor pressure to no greater than 50 psig. Analysis will show there is sufficient pressure at 150 psig (FLEX discharge) to maintain reactor vessel water level during these conditions.

In their submittal of September 13, 2013, the licensee provided the following information to confirm that backup water sources have been identified in the order of their intended use as discussed in NEI 12-06, Section 3.2.2, Guideline (5):

> Phase 1 makeup water is from the CST (if available) or the suppression pool. During Phase 2, makeup water for feeding the RPV may come from either the CST or the circulating water pond, if the CST is unavailable. Whereas the CST is a source of clean water, the circulating water pond is exposed to the elements, has some turbidity and a degree of vegetation that grows on its periphery. In order to minimize the potential for introduction of large debris into the FLEX cooling water, a duplex strainer (with mesh openings of approximately 30 mil) is to be installed between the FLEX booster pump (DOMINATOR) and the RHR tie-in connection. The hydraulic analysis will be required to establish operating limits on the duplex strainer differential pressure necessary to direct operator action for swapping and backwashing. For clarification of Fermi's pumping system the suction pump (NEPTUNE) is composed of a floating lift pump placed in the pond, away from the periphery, and the main Neptune pump located on a trailer. These provide source water to the booster pump (DOMINATOR)

In their submittal of September 13, 2013, the licensee provided the following information to confirm that the FLEX pumps can supply adequate flow and pressure and clarify whether the pumped flow will be split and simultaneously supplied to all destinations or whether the flow will be alternated between them:

> Fermi plans to supply flow to one location at a time. The FLEX pumps have adequate capability to supply each location. Level for each indication will be the controlling parameter. For the SFP, it is the SFP level as monitored with the SFP instrumentation being supplied in response to the SFP order. For the reactor, it is reactor level as monitored by the wide range reactor vessel water level instruments. And for the torus, it is the torus wide range water level instruments. A separate valve associated with the RHR system supplies each location. MOVs are used for the reactor and torus, and a manual valve is used for the SFP.

Based on the information provided in their initial Integrated Plan and the clarifications provided in their September 13, 2013 submittal, the staff concluded that the licensee had adequately addressed the staff's questions regarding systems and components for consequence mitigation.

The licensee's 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 systems and components 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

On pages 11, 13, and 16, of the Integrated Plan, the licensee provides a list of instrumentation required for maintaining core cooling (wide range reactor water level, wide range reactor pressure, RCIC suction and discharge pressures). On page 18, the licensee states that all containment parameters are expected to remain within design values during Phase 1 coping period. However, coping modifications will be made to increase initial coping times by using generators to preserve vital instruments or increase operating times on battery powered equipment. On page 19, the licensee listed instrumentation credited to Maintain Containment during Phase 1 (Torus pressure, Drywell Pressure, Torus Level, Drywell Temperature, Torus Temperature). On Page 20, the licensee provides a list of instrumentation credited or recovered to Maintain Containment during Phase 2 (Torus pressure, Drywell pressure, Torus level, Torus temperature, Drywell temperature and HPCI suction and discharge pressure). On pages 25, 26, and 29, Maintain SFP Cooling, the licensee stated that it would install instruments required by Order EA-12-051.

There is insufficient information provided regarding instrumentation to demonstrate that key parameters for suppression pool conditions will be available to support the reactor level control coping strategies. Because there is insufficient information provided for suppression pool instrumentation including their associated measurement tolerances/accuracies and the existing list may be updated, there is no reasonable assurance the plans will conform with NEI 12-06 Section 3.2.1.10. This is identified as Confirmatory Item 3.2.1.5.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 3.2.1.5.A, 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. Specifically, NEI 12-06, Section 12.1 states:

> 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.
>
> 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.

NEI 12-06, Table 12-1 includes "Portable air compressor or nitrogen bottles & regulators (if required by plant strategy)

On page 19 of the Integrated Plan in the section on maintaining containment using portable equipment Phase 2, the licensee states:

> The Phase 2 strategy is to control the Containment pressure and temperature by performing a feed-and-bleed of the Torus water. If this strategy is insufficient, the Torus hardened vent will be used as a backup.

Fermi procedure 29.ESP.ExtSBO covers the operation in an extended SBO condition, dc load shedding, ac load shedding and supplemental ac power, closure of DW valves to eliminate RRP seal leakage (if required), operation of Torus Hardened Vent (if required) and provides a cross reference to available instrumentation/power sources and redundant instrumentation/power supplies.

In their submittal of September 13, 2013, the licensee stated that the reactor recirculation valves are motor operated valves (do not require compressed air). Fermi's strategy does not rely on the Torus Hardened Vent. However, AOV operation is required to restore some torus and drywell required instrumentation (torus level, torus pressure and drywell pressure). Fermi is currently preparing modifications to provide bottled gas for operation of these valves. The modification package will include sizing of the bottles to allow proper operation until off-site equipment arrives to supplement the air supply. This is identified as Confirmatory Item 3.2.1.6.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and subject to the successful closure of issues related to the Confirmatory Item 3.2.1.6.A, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to motive power, valves 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.

On pages 5 through 7 the licensee provided a sequence of events with time constraints including the technical basis for the time constraints. The sequence of events timeline is also provided in Attachment 1A to the Integrated Plan.

Review of the Integrated Plans for Fermi 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.

During the audit process, 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 ELAP during 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 16 of the Integrated Plan the licensee stated that at some point greater than 72 hours, decay heat will no longer be able to operate high pressure coolant injection (HPCI) or reactor core isolation cooling (RCIC), and the Phase 2 FLEX pumps will be shifted from torus feed-and-bleed to makeup to the reactor for core cooling. Figure 2 on page 50 and the description provided on page 26 of the Integrated Plan suggest that 2 FLEX pumps in series supply all the water needs for core cooling, containment cooling, and SFP cooling.

The licensee was asked to clarify what shifting from torus feed-and-bleed to core cooling means and how this is different than the strategy discussed for Phase 2 of Maintaining Core Cooling, which indicates both pumps are already supplying RPV injection. The licensee was also asked to provide analysis and data to show that the Phase 2 FLEX pumps would be able to provide makeup to the reactor at the maximum reactor pressure that would exist after RCIC is no longer able to provide makeup to the reactor.

In their response dated September 13, 2013, the licensee stated:

> The FLEX pumps are capable of supplying all the water needs for core cooling, containment cooling, and spent fuel pool cooling (make-up).
>
> Clarification on “what shifting from torus cooling to core cooling means”:
> For the sake of this question the initiation of Phase 2 occurs when FLEX pumps are installed, and are ready for use.
>
> DTE’s “Feed and Bleed” strategy will limit the peak torus water temperature during the ELAP event to maintain RCIC operation (vessel injection) for the duration of Phase 2. During Phase 2 FLEX pumps will inject into the torus. Although DTE maintains the capability to directly inject water into the vessel

using FLEX pumps this is not required since RCIC will maintain core cooling during Phase 2.

The section entitled Maintain Core Cooling: BWR Portable Equipment Phase 2 on page 12 of the Integrated Plan defined the distinction of phases based on the equipment used for the core cooling function only. Hence, when RCIC is injecting to the vessel the strategy was considered in Phase 1 because RCIC is an installed plant system. Phase 2 for Core Cooling was initiated when the portable FLEX equipment injects directly into the vessel (although the direct injection is not required).

In regards to the statement on page 16 of the Integrated Plan, the timeframe in question is later in the scenario, beyond 30 hours, when decay heat may not be sufficient for HPCI/RCIC operation. Although offsite resources will be available at this time, this is the point where the FLEX pumps will now provide vessel injection. The FLEX pumps have sufficient capacity to supply both the torus and vessel on an intermittent basis.

The requisite hydraulic calculation to demonstrate FLEX pumping capability will be available in the third quarter of 2014.

Development of a technical basis for demonstrating RCIC operability and confirmation that loss of CST will not cause a loss of suction is identified as Confirmatory Item 3.2.1.8.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 Confirmatory Item 3.2.1.8.A 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 6 of the Integrated Plan, the licensee states that for a recent full core offload, water in the SFP begins to boil after 4.2 hours with a maximum boiling water loss rate of 90.77 gpm or approximately 6 inches per hour. From the time of the event, there will be approximately 28 hours until ten feet above top of the racks is reached, and FLEX pumps must be in place to provide makeup to the SFP. Installation of the FLEX water sources is required for RPV makeup and containment heat removal in time frames much less than this 28-hour period.

On page 25 of the Integrated Plan, the licensee states that the only Phase 1 action required is to monitor SFP level based on adequate SFP level and bounding heat load of a full core off-load.

On page 25 of the Integrated Plan, the licensee states that venting the Reactor Building (RB), RB-5 area is not done per NEI 12-06 Table C-3 based on proper qualification of Hardened Containment Vent System (HCVS) components on RB-5 and the lack of a monitored path to the environment. Opening doors to the RB area would challenge the RB environment further and thus challenge RCIC and other RB located equipment utilized in FLEX Phase 1. Also the licensee stated that based on qualifications of RB-5 located components AND the challenge to FLEX Phase 1 required systems, venting of RB-5 will not be done.

In a September 13, 2013 update the licensee provided additional information regarding venting of the Reactor Building the licensee stated:

> DTE's actions in support of FLEX, the SFP order, and the anticipated vent order do not require operator action on RB-5. Blow-away panels that open at approximately 0.5 psig are provided on RB-5 and will prevent pressurization of RB-5. Based on this, it is DTE's conclusion that specific action for venting is not required and is taking exception to this aspect of Table C-3 in NEI 12-06. DTE will include this in a six-month update.

Review indicated that this was not included in the licensee's first six-month update dated August 26, 2013. Until the issue of relying on blow-away panels to prevent over pressurization of the RB-5 is provided there is no reasonable assurance that the plan will conform with NEI 12-06, Table C-3. Addressing the adequacy of this strategy and taking exception to this aspect of Table C-3 in NEI 12-06 is identified as Open Item 3.2.2.A in Section 4.1.

On page 26 of the Integrated Plan; the licensee states that the FLEX pumps that are hooked up to the RHR system for the Core Cooling strategy will provide Makeup for the SFP. Sufficient capacity exists with the FLEX pumps to provide the required flow rates for concurrent Containment Cooling, Core Cooling, and SFP makeup. SFP monitoring described in Phase 1 will continue to be used to monitor water level to determine whether water needs to be added via FLEX equipment. A manual-operated valve located near the SFP level monitor available on the 2nd floor of the Reactor Building provides control of makeup flow to the SFP.

On page 26 of the Integrated Plan: the licensee stated that additional methods to provide makeup to the SFP using spray cooling via portable monitor nozzles are detailed in procedure 29.EDM.03, Revision 3, as previously developed for 10 CFR 50.54(hh)(2). However, the Integrated Plan provided insufficient information to demonstrate that the equipment required for this additional coping strategy (per 10 CFR 50.54(hh)(2)) will comply with the NEI 12-06 requirements for protection and deployment of the screened in hazards such as seismic and flooding.

In a September 13, 2013 update the licensee provided additional information regarding additional methods to provide makeup to the SFP including:

> Fermi has elected to tie the FLEX pumps into the RHR system. The FLEX pumps have a capacity of about 400 gpm at sufficient discharge pressure to deliver this flow to the SFP via the RHR to SFP cooling line. This capacity exceeds the maximum boil-off rate of 90.77 gpm stated in the Integrated Plan. As RHR is a safety related system this ensures the tie to the SFP will be available regardless of the external event. Thus, the 400 gpm makeup will keep the fuel in the SFP covered regardless of the event.
>
> The equipment procured for 50.54(hh)(2) was in response to a potential air strike that caused a loss of SFP integrity. Thus this equipment also has a spray capability at a value of about 500 gpm. The equipment procured for 50.54(hh)(2) is required to be stored at a specific distance from the RB. There are no requirements from NEI 06-12 to protect this equipment from external hazards. As such, it was mentioned as supplemental, non-credited equipment that could aid spraying the SFP, if the equipment was available after the BDBEE. The only credited pathway to the SFP under the FLEX ELAP scenario is through the RHR to SFP cooling line. The 50.54(hh)(2) equipment is listed for completeness of response only and is not credited in the current FLEX design and strategy. DTE will be taking exception to the spray capability required by Table C-3 of NEI 12-06. This will be included in a six-month update.

The licensee's first six-month update, dated August 26, 2013, did not address the issue of using the 50.54(hh)(2) SFP spray strategy as a supplemental, non-credited strategy. The licensee's subsequent six-month updates will be reviewed to confirm that they have addressed whether the SFP spray strategy is credited or whether the strategy to use the FLEX pumps tied into the RHR system is sufficient. This is identified as Open Item 3.2.2.B in Section 4.1.

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the approach is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to SFP cooling strategies. These questions are identified as Open Items 3.2.2.A and 3.2.2.B in Section 4.1.

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 18 of the Integrated Plan, in the section on Phase 1, Maintain Containment, the licensee states: All Containment parameters are expected to remain within design values during the Phase 1 coping period (MAAP run 605). See Section 3.2.1: Reactor Core Cooling Strategies, above, for discussion of the capabilities and general applicability of the MAAP code.

On page 19 of the Integrated Plan, in the section Phase 2, Maintain Containment, the licensee states: The Phase 2 strategy is to control the containment pressure and temperature by performing a feed-and-bleed of the Torus water. HPCI and/or FLEX pumps will supply cool water to the Torus and HPCI/RCIC will pump out the hot water. The FLEX pumps water supply will be the Circulating Water Pond. The CST, if available, would supply HPCI/RCIC. The water will be rejected to a controlled location. During the audit process, the licensee indicated that the CST, CRT, Condenser Hotwell, and Circulating Water Pond had been identified as potential locations for the rejected water. Of these, the CST is the only one that has been evaluated as seismically rugged, and the CST and CRT are the only locations susceptible to missile strikes. Operations personnel will assess the state of the locations following an event to determine which is the appropriate location to utilize.

However, the licensee has not demonstrated that there is sufficient minimum free volume available in the locations that are postulated to survive each applicable BDBEE such that the "bleed" volume of water can be properly contained to support this strategy for the duration of the coping time, which is required. This is identified as Confirmatory Item 3.2.3.A in Section 4.2.

Also on page 19, the licensee stated that if the feed-and-bleed of the Torus water is insufficient; the Torus hardened vent will be used as a backup. In the Integrated Plan, the licensee has not discussed the development of procedures for venting the containment or the process by which decisions will be made to switch the function of systems from injection (feed) to inventory removal (bleed). During the audit process, the licensee stated that their current MAAP run showed a maximum Torus temperature of 192°F with a successful feed-and-bleed strategy. However, if the Torus temperature was to exceed 220°F, the licensee has indicated that they will employ EPG/SAG, Revision 3, acceptable strategies for venting the containment. It is important to note, though, that the primary containment heat removal strategy for Fermi 2 is to feed-and-bleed the Torus. During the audit process the licensee stated: Trigger points for shift from Feed and Bleed strategy to Containment Vent strategy:□Torus Temperature (trigger point) is at 220 F (2.5 psig). This is a change from 230F in the OIP:□Torus/DW pressure (trigger point from EOPs) will be to allow Anticipatory Venting at > 1.68 psig (DW High Pressure SCRAM setpoint)□Technical justification for trigger point: Meets required DW/Torus Pressure value in EPG Rev 3 for Anticipatory Venting (e.g. > 1.68 psig). 220 F is saturation pressure for 2.5 psig. 220 F is below the GE BWROG study value for RCIC long term function with higher than normal Torus Temperatures. Anticipatory venting is under review by NRC FLEX Directorate as a Generic Issue. Fermi 2 primary strategy is Torus Feed and Bleed with MAAP runs showing maximum Torus temperature at 192 F. This (if successful) should preclude reaching Containment Vent trigger points. Actions for both Feed and Bleed and Containment Venting strategies will be in 29.ESP.ExtendedSBO.

The NRC staff considers the adoption of Revision 3 to the Boiling Water Reactor Owner's Group (BWROG) Emergency Procedures Guidelines/Severe Accident Guidelines (EPG/SAG) by licensees to be a Generic Concern because the BWROG has not addressed the potential for the revised venting strategy to increase (relative to currently accepted venting strategies) the likelihood of detrimental effects on containment response for events in which the venting strategy is invoked. In particular it has not been shown that the potential for negative pressure transients, hydrogen combustion, or loss of containment overpressure (as needed for pump NPSH) is not significantly different when implementing Revision 3 of the EPG/SAG vs. Revision 2 of the EPG/SAG. Revision 3 provides for earlier venting than previous revisions. The BWR procedures are structured such that the new venting strategy is not limited to use during the BDBEEs that are the subject of EA-12-049, but could also be implemented during a broad range of events. Acceptance of EPG/SAG Revision 3, including any associated plant-specific evaluations, is identified as Open Item 3.2.3.B in Section 4.2.

On page 23 of the Integrated Plan, in the section on Phase 3, Maintain Containment, the licensee stated that at the point where steam pressure will not support HPCI and RCIC operation, Torus Water Management (TWMS) in conjunction with the FLEX pumps, will be used to maintain containment cooling. Fermi Station will deploy Phase 3 FLEX generators to power the Torus Water Management (TWMS) Pumps. These TWMS pumps will then supplant HPCI and provide a method to reduce Torus inventory. This cycle can continue for an indefinite period of time as the decay heat load decreases. If TWMS is not sufficient to control cooling, containment venting will be used to prevent exceeding containment design pressure. Additionally, to prevent uncontrolled heat up of the hotwell (location for heat transfer from TWMS), Fermi Station would deploy a FLEX pump to establish flow through the Circulation Water (CW) system and the hotwell to prevent over-pressurization of the main condenser as needed.

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the approach is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to containment functions. These questions are identified in Confirmatory Items 3.2.3.A and 3.2.3.B in Section 4.2.

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.

In its Integrated Plan, the licensee did not identify any equipment used in the coping strategies that required an alternate cooling water supply.

The licensee's 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 support functions if these requirements are implemented as described.

3.2.4.2 Ventilation – Equipment Cooling

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

Plant procedures/guidance should consider loss of ventilation effects on specific energized equipment necessary for shutdown (e.g., those containing internal electrical power supplies or other local heat sources that may be energized or present in an ELAP.

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

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

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

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

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

On page 31 of the Integrated Plan the licensee stated that installed equipment is the Division 1 and Division 2 direct current (dc) supply and distribution system. The dc distribution system supplies the power to the equipment necessary to achieve the FLEX strategy outlined in the above sections. Equipment utilized for this coping includes: HPCI, RCIC, SRVs, inverters, and some Control Room instrumentation. AC power is unavailable. Access for Phase 1 involves the Division 1 and Division 2 ESF Switchgear Room, Relay Room, dc battery and Motor Control Center (MCC) area and Control Room only. These areas are located in non-steam environments, and are not expected to have any appreciable increase in temperature, and have been previously evaluated per the previous SBO rulemaking (UFSAR 8.4.2.3.4, UFSAR 6.4.1.2).

On page 33 of the Integrated Plan, the licensee stated that execution of the Phase 2 FLEX strategy involves short-term access to the Reactor Building 1st floor, 2nd floor, and the Auxiliary Building Basement. Access to these areas is only for a short period of time and is conducted prior to significant torus heat up (less than five hours for the deployment of the Phase 2 FLEX strategy). Access for Phase 2 involves the Division 1 and Division 2 ESF Switchgear Room, Relay Room, dc battery and MCC area and Control Room. These areas are located in non-steam environments, and are not expected to have any appreciable increase in temperature, and have been previously evaluated per the previous SBO rulemaking (UFSAR 8.4.2.3.4, UFSAR 6.4.1.2).

On page 33, of the Integrated Plan, the licensee states that to address hydrogen buildup, long term ventilation for the dc battery areas will be established through portable fans. The staff requested the licensee to provide a discussion on the hydrogen gas exhaust path for this strategy. The staff also requested the licensee to discuss the accumulation of hydrogen when the batteries are being recharged during Phase 2 and 3.

In a September 13, 2013 update the licensee provided additional information regarding hydrogen buildup:

An evaluation of the hydrogen gas concentration buildup is in progress and will be completed in conjunction with FLEX modifications, with completion by second quarter 2014. Although Fermi is committed to maintain hydrogen concentration less than 2%, as shown in existing plant calculations, the evaluation for the FLEX strategy will consider the minimum time for buildup to 1% concentration. The

> current strategy includes the use of portable fans and provision to power the battery room exhaust fans prior to the time when the calculated concentration is at 1%.
>
> Portable fans are to be stored in the dc MCC room area within the Auxiliary Building and are powered by the same FLEX power supply that provides power to the battery chargers that are energized during FLEX. With the battery room doors open, portable fans are positioned at the doorway from the Division 2 dc MCC room to the Division 1 MCC room and at the doorway between the Division 1 dc MCC room and the Auxiliary Building third floor hallway outside the Control Room.
>
> As stated in the response to question 44 [3.2.4.8.A], Fermi is reviewing the current strategy to provide charging of the essential batteries, with a potential change to power the normal plant chargers earlier in the process. If this strategy change were implemented, battery room exhaust fans would be energized prior to the calculated time that 1% hydrogen concentration is reached. For this strategy, portable ac fans and a means to power them may be provided as defense in depth.

Completion of the licensee's evaluation of the hydrogen gas buildup is identified as Confirmatory Item 3.2.4.2.A in Section 4.2.

On page 35 of the Integrated Plan the licensee stated:

> The dc generators are on handcarts and will be wheeled out to the roof of the building for ventilation. Extension cords will be run from the generators to the batteries.

On page 36 of the Integrated Plan the licensee stated:

> As Phase 3 equipment becomes available and installed, it is expected that there will be a restoration of plant cooling and ventilation systems as needed to allow access for the implementation of the Phase 3 FLEX strategy.

On pages 31, 33, 35 and 36 of the Integrated Plan, the licensee did not identify any equipment cooling or habitability concerns for any of the areas associated with the implementation of these coping strategies. The licensee did not provided sufficient detailed information regarding how these determinations were made to ensure that they conform to the guidance in NEI 12-06 Section 3.2.2.3 paragraph (10). The licensee did not provide additional information to clarify how it was determined that no additional ventilation is required to ensure adequate equipment cooling and habitability of all areas associated with these coping strategies. If the previous SBO coping evaluations are to be used in this justification, the licensee was requested to include a detailed discussion of why the results of the 4-hour SBO coping evaluations are applicable to the entire duration of all Phases of an ELAP event.

In a September 13, 2013 update, the licensee provided additional information regarding support systems ventilation:

> In regards to Div. 1 & 2 ESF Switchgear Rooms, Relay Room, dc Battery/MCC Areas, and Control Room Habitability: A post-ELAP/BDBEE extended

environmental response analysis will be prepared to establish the accessibility of these spaces for performing the specified Operator/Response team actions. The analysis will identify which areas are likely to require compensatory measures to enable long-term actions to proceed. Compensatory measures may include the use of ice vests, implementing emergency ventilation or fans, establishing alternate vent pathways, or mandating stay times. The analysis will demonstrate the effectiveness of emergency ventilation actions. Areas to be evaluated for habitability/equipment conditions include: Control Room, dc/MCC areas, division 1 switchgear room, division 2 switchgear room, relay room, auxiliary building basement, reactor building first floor, reactor building second floor, turbine building basement, the FLEX storage buildings. Areas to be evaluated to ensure equipment operation include: HPCI Room, RCIC Room, and Torus Room. This analysis is not yet in progress, a scheduled completion date will be provided when available.

The licensee's completion of their post ELAP/BDEE extended environmental response Analysis is identified as Confirmatory Item 3.2.4.2.B in Section 4.2.

A discussion is needed on the effects of extreme high and low temperatures (i.e., temperatures above/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 identified as Confirmatory Item 3.2.4.2.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 Items, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to ventilation and equipment cooling if these requirements are implemented as described.

3.2.4.3 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.

During the audit process the licensee stated:

Coping systems used for FLEX are: RCIC/HPCI in phase 1: Both of these systems are entirely contained in the RB/AB which is temperature controlled prior to the event and is pumping water at > ~80 F after the event (up to Torus temperature). No heat trace will be required for these systems. FLEX Water supplies are not connected at the start of the event and therefore have no connected piping with water in it. The Pumps are stored in buildings heated to at least 40F so no heat trace is required on these. FLEX Water supply connection points are drained and outside the West RB wall (no heat trace required). FLEX Generators are stored in the heated buildings with the Pumps so no heat trace is required. All instrumentation used for RPV Level/Pressure, Torus Level/Pressure, DW Pressure, and CST level complies with current design and license basis without heat trace so no new heat trace is needed. Based on the above, no heat trace was included in the OIP because none was needed.

The licensee's 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.

During the audit process the licensee provided information regarding emergency lighting. They stated that operators are trained on the use of 12 Hour Emergency Battle lamps, which are currently available for Appendix R Dedicated Shutdown response. In addition, emergency lights are available in locations where FLEX activities are occurring in the first two hours. Specific evaluation of paths and emergency lights is on-going as part of the Operator action evaluation process. Changes to emergency light placement/aiming may be made as a result of this review. The capability of the emergency lighting is 8 hours, which is greater than the time frame when approximately 50% of the Reactor Building/Auxiliary Building lighting is restored on the FLEX AC generator. The licensee's completion of their evaluation of paths and emergency lights as part of the Operator action evaluation process is sufficient to provide reasonable assurance that coping strategies for portable and emergency lighting will conform to the guidance of NEI 12-06, Section 3.2.2, consideration (8). This is identified as Confirmatory Item 3.2.4.4.A in Section 4.2.

The NRC staff has reviewed the licensee communications assessment (ML12305A290 and ML13053A496) required by in response to the March 12, 2012 50.54(f) request for information letter for Fermi 2 and, as documented in the staff analysis (ML13156A266) has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by the licensee will conform to the guidance of NEI 12-06 Section 3.2.2 (8) regarding communications capabilities during an ELAP. This has been identified as Confirmatory Item 3.2.4.4.B in Section 4.2 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 Open Item and the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to accessibility 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.

During the audit process the licensee provided additional information regarding the effects of an ELAP on access to protected and internal locked areas. The licensee stated that the electrical power to the security system at Fermi is maintained by security UPS and security EDGs until the plant bus is restored. The Operators normal access the security areas are by keycard use and as a contingency can use Security keys. A Security key locker is in the Control Room for this purpose. Verification that the security UPS and security UPS will remain available and that backup use of Security keys will be adequate to ensure required access to implement FLEX strategies, and that guidance is provided in appropriate procedures, is identified as Confirmatory Item 3.2.4.5.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 protected and internal locked area access, if these requirements are implemented as described.

3.2.4.6 Personnel Habitability – Elevated Temperature

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

> *Plant procedures/guidance should consider accessibility requirements at locations where operators will be required to perform local manual operations.*
>
> Due to elevated temperatures and humidity in some locations where local operator actions are required (e.g., manual valve manipulations, equipment connections, etc.), procedures/guidance should identify the protective clothing or other equipment or actions necessary to protect the operator, as appropriate.

> FLEX strategies must be capable of execution under the adverse conditions (unavailability of installed plant lighting, ventilation, etc.) expected following a BDBE resulting in an ELAP/LUHS. Accessibility of equipment, tooling, connection points, and plant components shall be accounted for in the development of the FLEX strategies. The use of appropriate human performance aids (e.g., component marking, connection schematics, installation sketches, photographs, etc.) shall be included in the FLEX guidance implementing the FLEX strategies.

Section 9.2 of NEI 12-06 states,

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

On page 31 of the Integrated Plan the licensee stated that installed equipment is the Division 1 and Division 2 dc supply and distribution system. The dc distribution system supplies the power to the equipment necessary to achieve the FLEX strategy outlined in the above sections. Equipment utilized for this coping includes: HPCI, RCIC, SRVs, inverters, and some Control Room instrumentation. AC power is unavailable. Access for Phase 1 involves the Division 1 and Division 2 ESF Switchgear Room, Relay Room, dc battery and Motor Control Center (MCC) area and Control Room only. These areas are located in non-steam environments, and are not expected to have any appreciable increase in temperature, and have been previously evaluated per the previous SBO rulemaking (UFSAR 8.4.2.3.4, UFSAR 6.4.1.2).

On page 33 of the Integrated Plan, the licensee stated that execution of the Phase 2 FLEX strategy involves short-term access to the Reactor Building 1st floor, 2nd floor, and the Auxiliary Building Basement. Access to these areas is only for a short period of time and is conducted prior to significant Torus heat up (less than five hours for the deployment of the Phase 2 FLEX strategy). Access for Phase 2 involves the Division 1 and Division 2 ESF Switchgear Room, Relay Room, dc battery and MCC area and Control Room. These areas are located in non-steam environments, and are not expected to have any appreciable increase in temperature, and have been previously evaluated per the previous SBO rulemaking (UFSAR 8.4.2.3.4, UFSAR 6.4.1.2). Long-term ventilation for the dc battery areas will be established through portable fans to mitigate hydrogen buildup.

On page 35 of the Integrated Plan, the licensee stated that the dc generators are on handcarts and will be wheeled out to the roof of the building for ventilation. Extension cords will be run from the generators to the batteries.

On page 36 of the Integrated Plan, the licensee stated that as Phase 3 equipment becomes available and is installed, it is expected that there will be a restoration of plant cooling and ventilation systems as needed to allow access for the implementation of the Phase 3 FLEX strategy.

On pages 31, 33, 35 and 36 of the Integrated Plan, the licensee did not identifiy any equipment cooling or habitability concerns for any of the areas associated with the implementation of these coping strategies. The licensee did not address protective clothing or other equipment or actions necessary to protect the operator in the development of the FLEX strategies. The licensee also did not address accessibility of equipment, tooling, connection points, and plant components or the use of appropriate human performance aids (e.g., component marking, connection schematics, installation sketches, photographs, etc.) in the implementing the FLEX strategies and therefore does not meet the guidance of NEI 12-06 Section 3.2.2.3 (11). This is Confirmatory Item 3.2.4.6.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and, subject to the successful closure of issues related to Confirmatory Item 3.2.4.6.A, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to personnel habitability/area access 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 page 10 regarding RCIC, which will take suction from either the CST if available, or the Torus. The two diesel driven pumps in series will move water from the Flex water sources (preferred suction is the Circulating Water Pond) into the RHR system for RPV injection. As described on page 16, Fermi Station will continue to utilize Phase 2 equipment to cool the core until decay heat can no longer produce enough steam to operate HPCI and eventually RCIC. When this occurs, the Phase 2 FLEX pumps will be shifted from Torus feed-and-bleed to makeup to the reactor for core cooling. Page 26 states that the FLEX pumps that are hooked up to the RHR system for the Core Cooling strategy will provide makeup for the SFP. Sufficient capacity exists with the FLEX pumps to provide the required flow rates for concurrent Containment Cooling, Core Cooling, and SFP makeup.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 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 page 35 of its Integrated Plan, in the section Safety Functions Support Phase 2, the licensee states that the ac generators will have the ability to connect to a local disconnect switch which is in turn tapped into the 480 v buses. However, no other information was provided regarding electrical isolations and interactions and whether they are addressed in procedures/guidance. It was not clear how the portable/FLEX diesel generators and the Class 1E diesel generators are isolated to prevent simultaneously supplying power to the same Class 1E bus. Because of this, there is no reasonable assurance that the licensee's plans will conform to the guidance of NEI 12-06, Section 3.2.2, paragraph (13). This is identified as Confirmatory Item 3.2.4.8.A., in Section 4.2.

The licensee plans on using 480V AC and 4160V AC portable diesel generator(s) to power various systems during Phase 2 and 3, respectively. The licensee did not provide any information regarding loading calculations of portable diesel generator(s). It was determined that there was insufficient information available to conclude that there is reasonable assurance that the licensee will ensure that portable/FLEX diesel generators are adequately sized and that they can supply the loads assumed in Phase 2 and 3. This is identified as Confirmatory Item 3.2.4.8.B, in Section 4.2.

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

3.2.4.9 Portable Equipment Fuel.

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

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

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

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

On page 15, in the section of its Integrated Plan regarding Deployment Conceptual Modifications, the licensee stated that fuel capacity in installed fuel tank of the FLEX pumps will support 8 hours of operation. A fuel truck or trailered tank will be required, along with debris clearing, to refuel the pumps within 8 hours of their operation. This information is also provided on pages 15, 17, 22, 24, 27, 28, 29, 30, 35, and 37. The staff requested the licensee to provide a discussion on the diesel fuel oil supply (e.g., fuel oil storage tank volume, fuel oil capacity of the fuel truck, supply pathway, etc.) for the diesel driven FLEX pumps and generators and how continued operation to ensure core and SFP cooling is maintained indefinitely (i.e., Phase 2 and 3). Also, the staff requested that the licensee explain how fuel quality be assured if stored for extended periods of time.

In a September 13, 2013 update, the licensee stated that it would develop a diesel fuel oil management plan to include control of fuel inventory and fuel quality. The scheduled completion date for the plan is yet to be determined. The licensee's completion of the fuel oil management plan is identified as Confirmatory Item 3.2.4.9.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to Confirmatory Item 3.2.4.9.A and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to portable equipment fuel supply 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 5 of the Integrated Plan, Item 2 states, in part: dc battery voltage drops below the minimum required to sustain the necessary loads at 8 hours (Reference 6). dc load shedding (Reference 7) must be accomplished for the strategies of containment heat removal, Safety Relief Valve (SRV) operation, and monitoring of required instrumentation.

The licensee was requested to: provide the dc load profile for the mitigating strategies to maintain core cooling, containment, and SFP cooling during all modes of operation; 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); the required operator actions; and, the time required to complete each action. The licensee was also requested to explain which functions are lost as a result of shedding each load and discuss any impact on defense-in-depth and redundancy.

The licensee was also requested to address the following:

> Are there any plant components that will change state if vital ac or dc is lost, de-energized, during this evolution of dc load shed? When the operators manipulate dc breakers to load shed, will plant components actuate, de-energize pumps, etc.? The staff is particularly interested that a safety hazard is not created, such as de-energizing the dc powered seal oil pump for the main generator, which would allow the hydrogen to escape to the atmosphere, which may cause an explosion or fire, and may be compounded by high heat from the main turbine bearings if not cooled.
>
> Which breakers will operators open as part of the load shed evolutions? Will the dc breakers to be opened be physically identified by special markings to assist operators manipulating the correct breakers?

In a September 13, 2013 update, the licensee provided additional information:

> A preliminary listing of dc equipment utilized for mitigating strategies and the associated dc load profile is shown in Study Number 29827-1050-17-Study-001, Evaluation of Battery Coping Time for an Extended Loss of ac Power Event, which is available from the e-portal. The evaluation of dc loading and voltage profiles is to be finalized in conjunction with modifications associated with the FLEX ac and dc strategies, with an expected completion of second quarter 2014.
>
> Operator actions for dc load stripping are performed in the dc MCC rooms on the Auxiliary Building 3rd floor (adjacent to the Control Room) and the Relay Room on the Auxiliary Building 2nd floor (accessible from the Control Room). Actions consist of opening breakers and switches at dc distribution equipment to isolate power. Preliminary estimates are for these actions to be performed between one and two hours following the loss of power. Breakers/switches to be opened will be uniquely identified. Details of this physical identification have not yet been determined and are being developed in conjunction with FLEX modifications.
>
> The detailed review of functions associated with dc load shedding is not complete and is being performed in conjunction with the development of modifications associated with the FLEX ac and dc strategies, with an expected completion date of second quarter 2014. This includes the review of resulting component states and defense in depth following a loss of ac or dc power or load shed actions to isolate power.

> Fermi is in the process of reviewing the currently identified strategy to provide charging of the essential batteries, with a potential change to power the normal plant chargers earlier in the process and avoid the need for dc load stripping. If this strategy change is implemented, individual circuits may still be de-energized, but this would be done for a specific purpose related to the operation of that circuit and not for the purpose of reducing battery loading. The impact of these actions to isolate circuits would be evaluated.

The licensees' completion of these evaluations is identified as Confirmatory Item 3.2.4.10.A in Section 4.2.

On page 5 of the Integrated Plan, Item 3 the licensee states, in part that "[c]onnection of FLEX dc equipment must be accomplished before the dc battery voltage drops below the minimum voltage required to maintain necessary loads." The licensee was requested to provide the minimum voltage that must be maintained and the basis for the minimum voltage on the dc bus.

In a September 13, 2013 update, the licensee provided additional information:

> Minimum required battery voltages are based on identified component operating minimum voltages in the existing plant electrical calculation that provides an evaluation of the dc system for SBO conditions. The distribution system model and load information included in this calculation are used in the evaluation of minimum battery voltages. The minimum voltages are to be finalized in conjunction with FLEX ac and dc modifications, with completion by second quarter 2014.

The licensee's completion of these evaluations is identified as Confirmatory Item 3.2.4.10.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 Confirmatory Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to dc load reductions 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 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.

[1] Testing includes surveillances, inspections, etc.

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

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

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

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

On page 8, of the Integrated Plan the licensee stated that Fermi would implement a FLEX administrative program (FLEX Support Guidelines). The licensee further stated that industry PMs for the FLEX related components and testing procedures will be developed and frequencies established based on type of equipment and considerations made within EPRI and NEI 12-06 guidelines.

Review of the Integrated Plan 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.

During the audit process the licensee stated that the SAFER Site-specific Response Plan will contain information on the specifics of generic and site specific equipment obtained from the RRC. It will also contain the logistics for transportation of the equipment, staging area set up, and other needs for ensuring the equipment and commodities sustain the site's coping strategies. Offsite equipment will be procured through the SAFER organization. SAFER plans to align with the EPRI templates for maintenance, testing and calibration of the equipment.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to 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 8, of the Integrated Plan, the licensee states that Fermi will implement a FLEX administrative program (FLEX Support Guidelines). The equipment for ELAP will be dedicated and will have unique identification numbers. FLEX equipment will be procured in accordance with the NEI 12-06 guidelines. Since the licensee did not provide specific information on configuration control, the staff requested the licensee to provide details of their plans for maintaining configuration control. This is identified as Confirmatory Item 3.3.2.A in Section 4.2.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and, subject to the successful closure of issues related to Confirmatory Item 3.3.2.A, 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

[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.

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 8, in the in the section of its Integrated Plan describing the training plan, the licensee stated that Training elements of the FLEX order will be performed using a systematic approach to training. All training will be completed prior to startup from refueling outage 17 (no later than December 2016). Fermi Station will comply with Section 11.6 of NEI 12-06.

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

3.4 <u>OFF SITE RESOURCES</u>

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

1) A capability to obtain equipment and commodities to sustain and backup the site's coping strategies.
2) Off-site equipment procurement, maintenance, testing, calibration, storage, and control.
3) A provision to inspect and audit the contractual agreements to reasonably assure the capabilities to deploy the FLEX strategies including unannounced random inspections by the Nuclear Regulatory Commission.
4) Provisions to ensure that no single external event will preclude the capability to supply the needed resources to the plant site.
5) Provisions to ensure that the off-site capability can be maintained for the life of the plant.
6) Provisions to revise the required supplied equipment due to changes in the FLEX strategies or plant equipment or equipment obsolescence.
7) The appropriate standard mechanical and electrical connections need to be specified.

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

On page 9 in the Integrated Plan in the section describing the RRC plan, the licensee states that the industry will establish two RRCs to support utilities during beyond design basis events. Each RRC will hold five (5) sets of equipment, four (4) to be fully deployed when requested, the fifth set will have equipment in the maintenance cycle. Equipment will be moved from an RRC to a local assembly area, established by the Strategic Alliance for FLEX Emergency Response (SAFER) team and the utility. 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. Prior to implementation, the licensee will have contracts established with the RRC for delivery of equipment appropriate for the station's Phase 3 strategy. The program will be administered by the site-specific playbook.

The licensee's 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 offsite 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.	Significant
3.2.2.A	Until the issue of relying on blow-away panels to prevent [over] pressurization of the RB-5 is provided there is no reasonable assurance that the plan will conform with NEI 12-06, Table C-3.	Significant
3.2.2.B	Adequacy of whether the SFP spray strategy is credited or whether the strategy to use the FLEX pumps tied into the RHR system is sufficient.	Significant
3.2.3.B	Revision 3 to the BWROG EPG SAG is a Generic Concern because the BWROG has not addressed the potential for the revised venting strategy to increase the likelihood of detrimental effects on containment response for events in which the venting strategy is invoked.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.2.A	Plans for the deployment of portable equipment following a seismic event require a liquefaction study for the proposed route.	
3.1.1.3.A	Plans for strategies have insufficient information to demonstrate alternate sources of instrument readings and adequate tolerances/accuracies if there is seismic impact to primary sources.	
3.1.1.3.B	Internal flooding, reliance on ac power for pumping, impact of downstream dam failure from a seismic event still being evaluated.	
3.1.1.4.A	Plans for the use of offsite resources do not provide sufficient details including a description of the methods to be used to deliver the equipment to the site.	
3.1.3.2.A	Validate Key Parametric Values verses time using Fermi Station Time Critical Operator Action Validation/Verification Process once all procedures, training, and equipment have been implemented.	
3.1.4.2.A	Equipment to clear ice and snow from haul pathways not identified in plan.	
3.2.1.1.A	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.	
3.2.1.1.B	The collapsed level must remain above Top of Active Fuel (TAF) and the cool down rate must be within technical specification limits.	
3.2.1.1.C	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.	
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). 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 a. Decay heat (fission products / actinides / etc.)	

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. In either case, the analysis should include a plot of the collapsed vessel level to confirm that TAF is not reached (the elevation of the TAF should be provided) and a plot of the temperature cool down to confirm that the cool down is within tech spec limits.	
3.2.1.2.A	Include a discussion of the assumed pressure-dependence of the leakage rate, and clarify whether the leakage was determined or assumed to be single-phase liquid, two-phase mixture, or steam at the donor cell and discuss how mixing of the leakage flow with the drywell atmosphere is modeled.	
3.2.1.3.A	Final Verification and Validation of the time required to implement these strategies has not been completed and because the licensee has not reviewed these strategies using NEDC-33771P “GEH Evaluation of FLEX Implementation Guidelines” there is insufficient information to determine if the action time constraints can be met for all strategies.	
3.2.1.5.A	Insufficient information on instrumentation for suppression pool conditions will be available to support the reactor level control coping strategies.	
3.2.1.6.A	Fermi is currently preparing modifications to provide bottled gas for operation of these valves which will include proper sizing of the bottles to allow operation until off-site equipment arrives to supplement the air supply.	
3.2.1.8.A	Development of a technical basis for demonstrating RCIC operability and confirmation that loss of CST will not cause a loss of suction.	
3.2.3.A	Demonstrate that there is sufficient minimum free volume available in the locations that are postulated to survive each applicable BDBEE such that the “bleed” volume of water can be properly contained to support this strategy for the duration of the coping time which is required.	
3.2.4.2.A	Completion of the licensee’s evaluation of the hydrogen gas buildup and strategy, including exhaust path.	
3.2.4.2.B	Complete post ELAP/BDEE extended environmental response analysis for Support System Ventilation and equipment operation in RCIC and HPCI pump rooms.	
3.2.4.2.C	A discussion is needed on the effects of extreme high and low temperatures (i.e., temperatures above/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.	
3.2.4.3.A	Confirm whether or not freezing of piping or instrument lines have been addressed (heat tracing).	
3.2.4.4.A	Specific evaluation of paths and emergency lights is on-going as part of the Operator action evaluation process. Changes to emergency light placement/aiming may be made as a result of	

	this review. The licensee's completion of their evaluation of paths and emergency lights as part of the Operator action evaluation process is sufficient to provide reasonable assurance that coping strategies for portable and emergency lighting will conform to the guidance of NEI 12-06, Section 3.2.2, consideration (8).	
3.2.4.4.B.	Confirm guidance and strategies for communications strategies will conform to the guidance of NEI 12-06 Section 3.2.2 (8)	
3.2.4.5.A	Verification that the security UPS and security UPS will remain available and that backup use of Security keys will be adequate to ensure required access to implement FLEX strategies, and that guidance is provided in appropriate procedures, is identified as Confirmatory Item 3.2.4.5.A in Section 4.2.	
3.2.4.6.A	Address protective clothing or other equipment or accessibility of equipment, tooling, connection points, and plant components or the use of appropriate human performance aids	
3.2.4.8.A	Insufficient information provided regarding isolation of busses and regarding minimum bus voltages.	
3.2.4.8.B	The licensee did not provide sufficient information regarding loading/sizing calculations of portable diesel generator(s).	
3.2.4.9.A	Develop a diesel fuel oil management plan to include control of fuel inventory and fuel quality.	
3.2.4.10.A	Complete detailed review of functions associated with dc load shedding being performed in conjunction with the development of modifications associated with the FLEX ac and dc strategies. This includes the review of resulting component states and defense in depth following a loss of ac or dc power or load shed actions to isolate power.	
3.2.4.10.B	Evaluation of minimum required dc bus voltages are to be finalized in conjunction with FLEX ac and dc modifications,	
3.3.2.A	Establish Configuration Control program	