Mega-Tech Services, LLC

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

Revision 1

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Entergy Nuclear Operations, Inc.
Indian Point Nuclear Generating Unit Nos. 2 and 3
Docket Nos. 50-247 and 50-286

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Technical Evaluation Report

Indian Point Nuclear Generating Unit Nos. 2 and 3
Order EA-12-049 Evaluation

1.0 BACKGROUND

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

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

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

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

Guidance and strategies required by the Order would be available if a loss of power, motive force and normal access to the ultimate heat sink needed to prevent fuel damage in the reactor and SFP affected all units at a site simultaneously. The Order requires a three-phase approach for mitigating BDBEEs. The initial phase requires the use of installed equipment and resources

to maintain or restore key safety functions including core cooling, containment, and SFP cooling. The transition phase requires providing sufficient portable onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from offsite. The final phase requires obtaining sufficient offsite resources to sustain those functions indefinitely.

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

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

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

2.0 EVALUATION PROCESS

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

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

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

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

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

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

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

3.0 TECHNICAL EVALUATION

By letter dated February 28, 2013, (ADAMS Accession No. ML13079A348), and as supplemented by the first six month status report (ADAMS Accession No. ML13247A032) in letter dated August 27, 2013, Entergy Nuclear Operations, Inc. (Entergy or the licensee) provided the Indian Point Nuclear Generating Unit Nos. 2 and 3 (Indian Point Energy Center (IPEC) or Indian Point) 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.

On page 1 of the Integrated Plan, the licensee stated that per NEI 12-06, seismic hazards must be considered for all nuclear sites. As a result, the credited FLEX equipment will be assessed based on the current IPEC seismic licensing basis to ensure that the equipment remains accessible and available after a BDBEE, and that the FLEX equipment does not become a target or source of a seismic interaction from other structures, systems or components (SSCs). The FLEX strategies developed for the IPEC will include documentation ensuring that any storage locations and deployment routes meet the FLEX seismic criteria.

The licensee’s 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 16, 27, 38 and 46 of the Integrated Plan the licensee stated that the storage location of IPEC's FLEX equipment is the existing Unit 1 Chemical Systems Building. The licensee further stated that the storage location is designed equivalent to ASCE 7-10; large portable FLEX equipment will be secured as appropriate during SSE and will be protected from seismic interactions with other components; and no components will be stacked or at a raised elevation as to cause interference with the deployment of any of the FLEX 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 protection of FLEX equipment if these requirements are implemented as described.

3.1.1.2. Deployment of FLEX Equipment – Seismic Hazard

NEI 12-06, Section 5.3.2 states:

There are five considerations for the deployment of FLEX equipment following a seismic event:

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

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

3. If the plant FLEX 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 9 of the Integrated Plan, the licensee stated that the deployment strategies from the storage areas to the staging areas are identical for all operating modes and include debris removal, equipment transport, fuel transport, and power sources. The only difference is the discharge connection location for the FLEX pumps. The primary and secondary connection locations for reactor coolant system (RCS) inventory control are the same for all modes whether the steam generators are available or not. The electrical coping strategies are the same for all modes.

During the audit the licensee stated that there are no dams on the Hudson River downstream of Indian Point Unit 2 and 3 (IP2 and IP3 UFSAR Chapter 2.5).

On pages 14 and 15 of the Integrated Plan, the licensee states that for the strategy to maintain core cooling and heat removal in Phase 2 the primary connection will be protected from high winds, floods, and seismic events. This connection is located downstream of the Turbine Driven Auxiliary Boiler Feedwater Pump (TDABFP) discharge check valve BFD-31. The secondary connections will feed all four steam generators through the 2" drain valves BFD-22 on the auxiliary feedwater (AFW) system. However, the licensee has not stated whether these connections are accessible. Also, the licensee has stated that the pump will be staged outside the auxiliary building but has not indicated if these connections are located inside the Auxiliary building. The licensee has not confirmed if the Auxiliary building is seismically robust. Verification that at least one connection point is accessible and located in a seismically robust structure is identified as Confirmatory Item 3.1.1.2.A in Section 4.2 below.

On page 17 of the Integrated Plan, the licensee stated that deployment of equipment for the core cooling strategies from the Unit 1 Chemical Systems Building would necessitate the use of trucks or forklifts capable of pulling the FLEX pumps. The deployment routes are shown in Figures A3-15 and A3-16 of Attachment 3 of the Integrated Plan with structures that may present a debris source in a seismic event shown in red.

On page 28 of the Integrated Plan, the licensee stated that deployment of equipment for the RCS inventory control strategies from the Unit 1 storage area would necessitate the use of trucks or forklifts capable of pulling the FLEX pumps. Paths for deployment of this equipment to each staging area are shown in green in Figure A3-36 of Attachment 3 of the Integrated Plan.

On page 28 of the Integrated Plan, the licensee stated that the connections for RCS inventory control are located in a building that is protected from high winds, missiles, flooding, and seismic events.

On page 39 of the Integrated Plan, the licensee stated that deployment of equipment for the SFP cooling strategies from the Unit 1 Storage area would necessitate the use of trucks or

forklifts capable of pulling the FLEX pumps. Deployment paths for this equipment are shown in Figure A3-46 and Figure A3-47 of Attachment 3 of the Integrated Plan.

On pages 50 and 51 of the Integrated Plan regarding portable equipment for the final phase, the licensee stated that the electrical portion of the Phase 3 coping strategy has the main goal of repowering the 480 VAC equipment to aid in cooling down the plant to a stable, Mode 5 condition. This will be achieved through the same spare breaker connection points in Bus 2A or 6A as presented for Phase 2. Locations to tie into will be identical to those shown in Figure A3-60 and Figure A3-61 in Attachment 3 of the Integrated Plan. The connections will be located in buildings that are protected from external hazards.

On page 52, the licensee listed pickup trucks or forklifts that would be used for deployment of the portable equipment for implementing FLEX strategies. However, the licensee has not stated whether the equipment used to deploy the portable equipment would will be reasonably protected from the event as described in Consideration 5 of NEI 12-06, Section 5.3.2. This is identified as Confirmatory Item 3.1.1.2.B in Section 4.2 below.

Implementing the various strategies will required access to the equipment stored in the various FLEX storage areas and also access to various structures for making connections. NEI 12-06, Section 5.3.2 consideration 5 states that 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 deployment. The licensee has not addressed whether power supplies will be required and, if so, what provisions will be made to ensure that access to all required areas will be assured in the event of a power failure. This is identified as Confirmatory Item 3.1.1.2.C in Section 4.2.

The licensee stated in the Integrated Plan that plans for deployment of FLEX equipment do not include the effects of soil liquefaction on the transportation routes to the site or intermediate staging areas. Confirmation that soil liquefaction is either not applicable to the licensee's deployment routes or that its effects have been considered for routes to the site or intermediate staging areas is necessary. This item has been identified as Confirmatory Item 3.1.1.2.D in Section 4.2.

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

3.1.1.3. Procedural Interfaces - Seismic Hazard

NEI 12-06, Section 5.3.3 states:

> There are four procedural interface considerations that should be addressed.
>
> 1. Seismic studies have shown that even seismically qualified electrical equipment can be affected by BDB [beyond-design-basis] seismic events. In order to address these considerations, each plant should compile a reference source for the plant operators that provides approaches to obtaining necessary instrument readings to support the implementation of the coping strategy (see Section 3.2.1.10). This reference source should

include control room and non-control room readouts and should also provide guidance on how and where to measure key instrument readings at containment penetrations, where applicable, using a portable instrument (e.g., a Fluke meter). Such a resource could be provided as an attachment to the plant procedures/guidance. Guidance should include critical actions to perform until alternate indications can be connected and on how to control critical equipment without associated control power.

2. Consideration should be given to the impacts from large internal flooding sources that are not seismically robust and do not require ac power (e.g., gravity drainage from lake or cooling basins for non-safety-related cooling water systems).

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

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

On pages 14, 16, and 21 of the Integrated Plan, the licensee stated that it would develop procedures to read plant instrumentation locally, where applicable, using a portable instrument.

During the audit process the licensee stated that procedures and FLEX Support Guidelines (FSGs) will be developed in accordance with NEI 12-06, Section 5.3.3 detailing reference sources for operators to obtain necessary instrument reading to support implementation of the coping strategy; how and where to measure key readings at containment penetrations (where applicable) using a portable instrument; critical actions that may be necessary to perform until alternate indications can be connected (measures); and, instructions on how to control critical equipment without control power, if required.

During the audit process the licensee stated that regarding considerations 2, 3 and 4:

Consideration 2 - Review of the potential impacts of large internal flooding sources that are not seismically robust and do not require ac power (this will be based on the current licensing basis internal flooding analysis) for Unit 2 has not begun and for Unit 3 is underway but has not been completed at this time. Completion of a review to determine the impacts of large internal flooding sources has been identified as Confirmatory Item 3.1.1.3.A in Section 4.2.

Consideration 3 - Indian Point Units 2 and 3 do not rely on ac power to mitigate ground water intrusion.

Consideration 4 - There are no dams on the Hudson River downstream of Indian Point.

The licensee’s 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 seismic procedural interfaces considerations, 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 12 of the Integrated Plan, the licensee stated that the industry will establish two Regional Response Centers (RRCs) to support utilities during beyond-design-basis events. Equipment will be moved from an RRC to a local Assembly Area; 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.

During the audit process the licensee stated that in all cases their plans are to deliver equipment from offsite sources via truck or airlift. These vehicles will follow pre-selected routes directly to the plant site staging area or to an intermediate staging area approximately 25 miles from the site. The delivery of equipment from the intermediate staging area will use the same methodology. Helicopter landing considerations are accounted for in selection of the areas. There areas are designed to accommodate the equipment being delivered from the RRC. The RRC personnel will commence delivery of preselected equipment sent from the RRC upon notification from the site. Typically, it will go by truck with preselected routes and necessary escort to ensure timely arrival at one of the staging areas. Depending on time constraints equipment can be flown commercially to a major airport near the plant site (Stewart Airport (primary) or Westchester County Airport (Secondary) and trucked or airlifted from there to the staging areas. The use of helicopters for delivery is typically considered when routes to the plant are impassible and time considerations for delivery will not be met using ground delivery. Multiple pre-selected routes are one method to circumvent the effects of seismic issues and floods. Bridges, rivers, heavily wooded areas, and towns are considered in the route selection. The drivers will have the routes marked and be in communication with the RRC to ensure that the equipment arrives on time.

Review of the Integrated Plan and information provided during the audit process indicates that the licensee's preliminary plans would address the delivery capabilities specified by Section 5.3.4 of NEI 12-06. However, the licensee's selection of an intermediate staging area and development of implementing procedures remain to be completed. This has been identified as Confirmatory Item 3.1.1.4.A in Section 4.2.

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

> 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 the Integrated Plan the licensee stated that a three-pronged evaluation of external flooding was performed. The IPEC site is not considered a "dry" site and is therefore, susceptible to external flooding. Accordingly, FLEX strategies will be developed for consideration of external flooding hazards. The types of events evaluated to determine the worst potential flood included (1) runoff generated by a probable maximum precipitation over the entire Hudson River drainage basin upstream of the site, (2) occurrence of any upstream dam failure concurrent with heavy runoff generated by a standard project flood, and (3) the occurrence of a probable maximum hurricane concurrent with a spring high tide in the Hudson River. The maximum flood level from any of the events listed above was determined to be 15 feet, which would not flood the safety related buildings.

However, during the audit process the licensee stated that it would perform a new analysis of the flooding levels described in the Integrated Plan. The levels described in the Integrated Plan for Unit 2 and Unit 3 is based on Section 2.5 of each unit’s UFSAR. The licensee also stated that following the completion of the new external flooding analysis and integration evaluation, design of storage facilities, specification of FLEX equipment, protection of FLEX equipment, control of FLEX equipment, implementation of FLEX strategies, and protection of safety related plant structures from FLEX equipment will be determined during the design development and procedure development phase. These procedures will address warning times and the persistence of an external flooding hazard. Studies to date characterize flooding times in days (typically associated with hurricanes) and a persistence of less than a day; this will be confirmed when the evaluations are completed. Review of the licensee’s flooding level evaluation results and its potential impact on the flooding hazard analyses previously provided in their Integrated Plan and during the audit process is identified as Open Item 3.1.2.A in Section 4.1 of this report.

The licensee’s approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Open Item provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to screening for flooding hazard 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/guidelines address the needed actions to relocate the equipment. Based on the timing of the limiting flood scenario(s), the FLEX equipment can be relocated to a position that is protected from the flood, either by barriers or by elevation, prior to the arrival of the potentially damaging flood levels. This should also consider the conditions on-site during the increasing flood levels and whether movement of the Flex equipment will be possible before potential inundation occurs, not just the ultimate flood height.
>
> 2. Storage areas that are potentially impacted by a rapid rise of water should be avoided.

On pages 17, 27, 38 and 46 of the Integrated Plan, the licensee stated that the storage location for the portable equipment is located above the maximum flood level of 15 feet above mean sea 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 protection of FLEX equipment during flood hazards 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 that 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 [reactor coolant pump] seal leak off, obtaining dewatering pumps, creating temporary flood barriers, etc. These factors can be credited in considering how the baseline capability is deployed.

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

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

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

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

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

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

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

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

On page 17 of the Integrated Plan, the licensee specified that deployment from the Unit 1 Chemical Systems Building would necessitate the use of trucks or forklifts capable of pulling the FLEX pumps. The primary connection deployment discussion applies to the secondary staging area.

On pages 18 and 21 of the Integrated Plan, the licensee discussed protection of connections used in the strategy for maintaining core cooling and heat removal with or without the steam generators available during Phases 2 and 3. For all phases, the connections are located in buildings protected from high winds, floods, and seismic events. The secondary connections,

which are on the 18 ft. elevation of the turbine building, will be evaluated for susceptibility to flooding. Each of the Phase 3 strategies will utilize common connections as described for Phase 2 connections to prevent compatibility issues with the offsite equipment.

On pages 28 and 38 of the Integrated Plan, the licensee stated that the Phase 2 connections are located in a building that is protected from high winds, missiles, flooding and seismic events. Phase 3 SFP connections will be made either inside the fuel building or on an exterior wall.

On page 47 of the Integrated Plan the licensee stated that for safety functions support the onsite portable equipment will be deployed from the FLEX equipment storage locations, staged in the designated staging areas, connected to the applicable cables, (electrical) or hoses (coolant), and begin performing the FLEX functions.

Review of the drawings provided in Appendix A3 of the licensee's Integrated Plan for the deployment of portable equipment from external flooding hazards indicates that the elevation of the storage and deployment paths for the FLEX equipment are above the expected maximum flooding level. However, the Integrated Plan did not address: whether procedures have been established for actions to be taken upon receipt of a hurricane warning; ensuring that fuel in oil storage tanks would not be inundated or damaged by flooding; and, whether the means (e.g., trucks) for moving FLEX equipment is reasonably protected from the event. Review of the licensee's plans to address these considerations has been identified as Confirmatory Item 3.1.2.2.A in Section 4.2. However, as stated in Section 3.1.2 of this report (Open Item 3.1.2.A) the licensee is performing a review of the flooding level evaluation. If the flooding levels are modified based on the results of this review, it may affect this evaluation of the deployment of FLEX equipment described in this section.

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

3.1.2.3 Procedural Interfaces – Flooding Hazard.

NEI 12-06, Section 6.2.3.3 states:

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

On page 10 of the Integrated Plan the licensee stated that the FLEX strategies and basis will be maintained in an overall program document. They are a participant in the Pressurized Water

Reactor Owners Group (PWROG) and will implement the FLEX Support Guidelines (FSGs) in a timeline to support the implementation of FLEX.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06 as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedural interfaces for 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 offsite resources.
>
> 1. Sites should review site access routes to determine the best means to obtain resources from off-site following a flood.
>
> 2. Sites impacted by persistent floods should consider where equipment delivered from offsite could be staged for use on-site.

On page 12 of the Integrated Plan regarding the RRC plan, the licensee stated that the industry will establish two RRCs to support utilities during beyond design basis events. The licensee has signed a contract with SAFER to meet the requirements of NEI 12-06, Section 12.

Reviews of the licensee's plan for the use of offsite resources indicated that it did not identify the local staging area or provide a description of the methods to be used to deliver the equipment to the site. This has been combined with previously identified Confirmatory Item 3.1.1.4.A. in Section 4.2.

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

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

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

High wind event considerations are treated in four primary areas: protection of portable equipment, deployment of portable equipment, procedural interfaces, and considerations in using off-site resources. These areas are discussed further in Sections 3.1.3.1 through 3.1.3.4, below.

On pages 1 and 2 of the Integrated Plan regarding the determination of applicable extreme external hazards, the licensee stated that Figures 7-1 and 7-2 from the NEI 12-06 were used for this assessment. It was determined that the IPEC site has the potential to experience coastal winds exceeding 130 mph. Figure 7-2 of NEI 12-06 indicates a maximum tornado wind speed of 170 mph for IPEC; therefore high-wind hazards are applicable to the IPEC site.

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

3.1.3.1. Protection of FLEX Equipment - High Wind Hazard

NEI 12-06, Section 7.3.1 states:

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

adjacent to existing robust structures or in lower sections of buildings that minimizes the probability that missiles will damage all mitigation equipment required from a single event by protection from adjacent buildings and limiting pathways for missiles to damage equipment.

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

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

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

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

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

On pages 17, 27, 38 and 46 of the Integrated Plan describing the storage/protection of equipment for the transition phase of its strategy for maintaining core cooling & heat removal, RCS inventory control, cooling and safety functions support the licensee stated that portable equipment to implement the FLEX strategies will be maintained in storage locations that are protected from high winds.

The licensee's 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 from high wind hazards if these requirements are implemented as described.

3.1.3.2 Deployment of FLEX Equipment - High Wind Hazard

As discussed in NEI 12-06, Section 7.3.2, the following five considerations for the deployment of FLEX equipment for high wind hazards should be addressed:

1. For hurricane plants, the plant may not be at power prior to the simultaneous ELAP and LUHS condition. In fact, the plant may have been shut down and

the plant configuration could be established to optimize FLEX deployment. For example, the portable pumps could be connected, tested, and readied for use prior to the arrival of the hurricane. Further, protective actions can be taken to reduce the potential for wind impacts. These factors can be credited in considering how the baseline capability is deployed.

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

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

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

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

On pages 62 through 67, Attachment 1A, Sequence of Events Timeline, in the Integrated Plan regarding the sequence of events and time constraints required for success, the licensee stated that the earliest need for debris removal to facilitate access to deploy the RCS makeup pump would be at 3 hours into the event. At hour 24 the licensee would begin large debris removal to accommodate arrival of RRC equipment to the site.

On pages 52 through 56, in the tables identifying portable equipment for Phase 2 and Phase 3, the licensee lists: debris removal equipment; large debris removal equipment; and, transportation equipment including a four wheel drive tow vehicle but omitted a discussion of the protection to be afforded this vehicle from high winds.

During the audit process the licensee stated that procedures and programs to be developed will consider proactive actions such as testing, connecting, and readying portable equipment for the deployment in high winds that include optimizing FLEX deployment by connecting portable pumps and equipment prior to the arrival of the hurricane and by providing a means to move FLEX equipment that is also reasonably protected from the high winds.

The licensee's 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 due to high wind hazards if these requirements are implemented as described.

3.1.3.3 Procedural Interfaces – High Wind Hazard

NEI 12-06, Section 7.3.3, states:

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

deployment considerations identified above should be incorporated into those procedures.

The licensee stated that it planned to incorporate deployment considerations into hurricane procedures.

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

3.1.3.4 Considerations in Using Offsite Resources - High Wind Hazard

NEI 12-06, Section 7.3.4 states:

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

On page 12 of the Integrated Plan regarding the RRC plan, the licensee stated that the industry will establish two RRCs to support utilities during beyond design basis events. The licensee has signed a contract with SAFER to meet the requirements of NEI 12-06, Section 12.

During the audit process the licensee provided information regarding its use of the offsite resources through the industry SAFER program. The licensee stated that plans are to deliver equipment from offsite sources via truck or airlift. These vehicles will follow pre-selected routes directly to the plant site staging area or to an intermediate staging area approximately 25 miles from the site. The delivery of equipment from the intermediate staging area will use the same methodology. Helicopter landing considerations are accounted for in selection of the areas. These areas are designed to accommodate the equipment being delivered from the RRC.

The licensee's 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 using offsite resources during 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, in the section of the Integrated Plan regarding the determination of applicable extreme external hazards, the licensee stated that based on the available local data and Figures 8-1 and 8-2 of NEI 12-6, the IPEC site does experience significant amounts of snow or ice, and extreme cold temperatures; therefore, this hazard is screened in.

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

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

NEI 12-06, Section 8.3.1 states:

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

On pages 17, 27, 39 and 47 of the Integrated Plan, the licensee stated that portable equipment would be maintained in climate controlled storage locations to protect it from snow, ice and extreme cold.

The licensee's 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 considering snow, ice and extreme cold events, if these requirements are implemented as described.

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

NEI 12-06, Section 8.3.2 states:

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

On page 56 of the Integrated Plan the licensee listed a four-wheel drive tow vehicle and debris clearing equipment but did not specify whether this equipment would be capable of removing snow and ice.

During the audit process the licensee stated that it would:

1. Determine the temperatures and FLEX equipment heat dissipation affects in the areas where equipment will be stored and operated for procurement requirements. The equipment specifications for procurement of this equipment will specify these potentially extreme conditions.

2. Address the removal of snow, ice, and debris in the response procedures under development. This will include identification and location of any needed 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 the deployment of FLEX equipment 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.

During the audit process the licensee stated that it would address the removal of snow, ice, and debris in the response procedures under development. This will include identification and location of any needed 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 the enhancement of procedural interfaces regarding snow, ice and extreme cold events if these requirements are implemented as described.

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

NEI 12-06, Section 8.3.4, states:

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

On page 12, in the section of the Integrated Plan regarding the RRC plan, the licensee stated:

> The industry will establish two Regional Response Centers (RRC) to support utilities during beyond design basis events. The licensee has signed a contract with SAFER to meet the requirements of NEI 12-06, Section 12.

During the audit process the licensee provided information regarding its use of the offsite resources through the industry SAFER program. The licensee stated that plans are to deliver equipment from offsite sources via truck or airlift. These vehicles will follow pre-selected routes directly to the plant site staging area or to an intermediate staging area approximately 25 miles from the site. The licensee also stated that it would address the removal of snow, ice, and debris in the response procedures under development. This will include identification and location of any needed equipment. This has been combined with Confirmatory Item 3.1.1.4.A. in Section 4.2.

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

3.1.5 High Temperature Hazard

NEI 12-06, Section 9 states:

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

On page 2 of the Integrated Plan licensee stated that per NEI 12-06, all sites will address high

temperatures. Therefore, for FLEX equipment, IPEC will consider the site maximum expected temperatures in their specification, storage, and deployment requirements, including ensuring adequate ventilation or supplementary cooling, if required.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to screening for 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 17, 27, 39 and 47 of the Integrated Plan, the licensee stated that all of the storage locations will be evaluated for high temperature effects and ventilation will be provided as required to assure no adverse effects on the FLEX 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 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 2 of the Integrated Plan the licensee stated that, for FLEX equipment, IPEC will consider the site maximum expected temperatures in their specification, storage, and deployment requirements, including ensuring adequate ventilation or supplementary cooling, if required.

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

On page 2 of the Integrated Plan the licensee stated that IPEC will consider the site maximum expected temperatures in their specification, storage, and deployment requirements, including ensuring adequate ventilation or supplementary cooling, for portable equipment if required.

During the audit process the licensee stated that procedures would be developed or enhanced to address the effects of temperature extremes (both high and low) on FLEX equipment and will meet the requirements of NEI 12-06, Section 9.3.3. Also, NEI 12-06, Section 9.3.2, states that the FLEX equipment should be procured to function, including the need to move the equipment, in the extreme conditions applicable to the site. IPEC will determine the temperatures and FLEX equipment heat dissipation affects in the areas where equipment will be stored and operated for procurement requirements. The equipment specifications for procurement of this equipment will specify these potentially extreme conditions.

The licensee's 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 to regard to procedural interfaces for high temperature hazard if these requirements are implemented as described.

3.2 PHASED APPROACH

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

To meet these EA-12-049 requirements, Licensees will establish a baseline coping capability to prevent fuel damage in the reactor core or spent fuel pool and to maintain containment capabilities in the context of a beyond-design-basis external event that results in the loss of all ac power, with the exception of buses supplied by safety-related batteries through inverters, and loss of normal access to the UHS. The UHS at Indian Point is the Hudson River.

As described in NEI 12-06, Section 1.3, "plant-specific analyses will determine the duration of each phase."

3.2.1 RCS Cooling and Heat Removal, and Inventory Control Strategies

NEI 12-06, Table 3-2 and Appendix D summarize one acceptable approach for the reactor core cooling strategies. This approach uses the installed auxiliary feedwater (AFW)/emergency feedwater (EFW) system to provide steam generator (SG) makeup sufficient to maintain or restore SG level in order to continue to provide core cooling for the initial phase. This approach relies on depressurization of the SGs for makeup with a portable injection source in order to provide core cooling for the transition and final phases. This approach accomplishes reactor coolant system (RCS) inventory control and maintenance of long-term subcriticality through the use of low leakage reactor coolant pump seals and/or borated high pressure RCS makeup with a letdown path.

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

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

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

During the NRC audit process the licensee was requested to specify which analysis performed in WCAP-17601-P is being applied to Indian Point. Additionally, the licensee was requested to justify the use of that analysis by identifying and evaluating the important parameters and assumptions demonstrating that they are representative of Indian Point and appropriate for simulating the ELAP transient. In their response the licensee stated that the response to this question would be provided later in the design process as additional plant specific analyses are being performed and that this information will be submitted in a future update. This has been identified as Confirmatory Item 3.2.1.A in Section 4.2.

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

3.2.1.1 Computer Code Used for the ELAP Analysis

NEI 12-06, Section 1.3 states:

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

On page 6 of the Integrated Plan the licensee stated that the sequence of events and any associated time constraints are identified in Attachment 1A for IPEC Modes 1-4 strategies for FLEX Phases 1 through Phase 3. In Attachment 1B, NSSS Significant Reference Analysis Deviation Table, the licensee stated that it had evaluated WCAP-17601-P considering IPEC 2 and 3 site-specific parameters and determined that the conclusions of that document are applicable to IPEC 2 and 3. The licensee has performed analysis consistent with recommendations of the core cooling position paper, provided as an attachment to LTR-PCSA-12-92. Only one deviation, initiating cooldown in one hour rather than two hours, was identified as part of this evaluation and justification is provided based on the direction contained in NEI 12-06. No other deviations have been identified with respect to the PWROG recommendations for the FLEX program.

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

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

During the audit process the licensee stated that information regarding this issue would be provided later in the design process as additional plant specific analyses are being performed and that this information will be submitted in a future update

Reliance on the NOTRUMP code for the ELAP analysis of Westinghouse plants is limited to the flow conditions prior to reflux condensation initiation. This includes specifying an acceptable definition for reflux condensation cooling. Verification that the licensee is using NOTRUMP, and that its limitations are taken into account, has been identified as Confirmatory Item 3.2.1.1.A in Section 4.2 below.

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

3.2.1.2. RCP Pump Seal Leakage Rates

NEI 12-06, Section 1.3 states:

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

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

The licensee provided an SOE in their Integrated Plan that included the time constraints and their technical basis. The SOE is based on an analysis using specific RCP seal leakage rates. The issue of RCP seal leakage rates was identified as a generic concern and addressed by NEI in the following submittals:

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

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

After review of these submittals, the NRC staff has placed certain limitations on Westinghouse designed plants:

1. For the plants using Westinghouse RCPs and seals that are not the SHIELD shutdown seals, the RCP seal initial maximum leakage rate should be greater than or equal to the upper bound expectation for the seal leakage rate for the ELAP event (21 gpm/seal) discussed in the PWROG white paper addressing the RCP seal leakage for Westinghouse plants.

   During the audit process the licensee stated that IPEC Units 1 and 2 use Westinghouse model 93A RCPs and are not crediting the use of safe shutdown low leakage seals (SHIELD) for FLEX strategies. They stated that the analysis is still under development. However, the current plan is to use 21 gpm per pump + 1 gpm unidentified = 85 gpm leakage (per table 4.1.1.1-1 of WCAP-17601-P) until RCS pressure reaches 320 psia, at which point total RCS leakage may be reduced.

2. In some plant designs, such as those with 1200 to 1300 psia SG design pressures and no accumulator backing of the main steam system power-operated relief valve (PORV) actuators, the cold legs could experience temperatures as high as 580 ^{0}F before cooldown commences. This is beyond the qualification temperature (550 ^{0}F) of the O-rings used in the RCP seals. For those Westinghouse designs, a discussion of the information (including the applicable analysis and relevant seal leakage testing data) should be provided to justify that (1) the integrity of the associated O-rings will be maintained at the temperature conditions experienced during the ELAP event, and (2) the seal leakage rate of 21 gpm/seal used in the ELAP is adequate and acceptable.

   During the audit process the licensee stated that IPEC has accumulator backing of its main steam system power-operated relief valves and will commence plant cooldown within 1/2 hour of the start of the event in accordance with existing SBO procedures. Given that the O-rings for the #1 seals would not exceed 550°F until 13 minutes following the ELAP at the earliest (per WCAP-17601-P, Section 4.4.1.1), exposure of the RCP seals to temperatures in excess of their design limits would be minimal (less than 17 minutes based on the expected timeline for the SBO procedure and the minimum of 13 minutes for the RCP internal temperature to reach 550°F) and certainly less than the "several hours" at 570°F and normal operating pressure during which it has been judged that the O-rings would remain intact (per WCAP-17601-P, Section 4.4.1.1).

3. Some Westinghouse plants have installed or will install the SHIELD shutdown seals, or other types of low leakage seals, and have credited or will credit a low seal leakage rate (e.g., 1 gpm/seal) in the ELAP analyses for the RCS response. For those plants, information should be provided to address the impacts of the Westinghouse 10 CFR Part 21 report, "Notification of the Potential Existence of Defects Pursuant to 10 CFR Part 21," dated July 26, 2013 (ADAMS No. ML13211A168) on the use of the low seal leakage rate in the ELAP analysis.

   During the audit process the licensee stated that it is not installing the SHIELD low leakage shutdown seals. Therefore this limitation is not applicable to IPEC.

4. If the seals are changed to the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals, the acceptability of the use of the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals should be addressed, and the RCP seal leakages rates for use in the ELAP analysis should be provided with acceptable justification.

   During the audit process the licensee stated that their RCPs are Westinghouse Model # 93-93ANS-93AS and supplied with Westinghouse seals. This combination is explicitly addressed in section 5.3.1.2 of WCAP-17601. Since they are not installing the SHIELD shutdown seals, this limitation is not applicable to IPEC.

The licensee's 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 RCP seal leakage rates, if these requirements are implemented as described.

3.2.1.3 Decay Heat

NEI Section 3.2.1.2 states in part:

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

During the audit process the licensee was asked to address the applicability of Assumption 4 on page 4-13 of WCAP-17601 which states that decay heat is per ANS 5.1-1979 + 2 sigma, or equivalent. If the ANS 5.1-1979 + 2 sigma model is used in the Indian Point ELAP analysis, address the adequacy of the use of the decay heat model in terms of the plant-specific values of the following key parameters: (1) initial power level, (2) fuel enrichment, (3) fuel burnup, (4) effective full power operating days per fuel cycle, (5) number of fuel cycles, if hybrid fuels are used in the core, and (6) fuel characteristics (addressing whether they are based on the beginning of the cycle, middle of the cycle, or end of the cycle). If a different decay heat model is used, describe the specific model and address the adequacy of the model and the analytical results. During the audit process the licensee stated that the information regarding the applicability of assumption 4 on page 4-13 of WCAP-17601 regarding the use of ANS 5.1-1979 + 2 sigma is not readily available at this time. The requested information will be provided in a future update. This has been identified as Confirmatory Item 3.2.1.3.A.

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

3.2.1.4 Initial Values for Key Plant Parameters and Assumptions

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

On page 3 of the Integrated Plan the licensee stated that assumptions are consistent with those detailed in NEI 12-06, Section 3.2.1. The initial plant conditions are assumed to be the following:

- Prior to the event the reactor has been operating at 100 percent rated thermal power for at least 100 days or has just been shut down from such a power history as required by plant procedures in advance of the impending event.

- At the time of the postulated event, the reactor and supporting systems are within normal operating ranges for pressure, temperature, and water level for the appropriate plant condition.

- No specific initiating event is used. The initial condition is assumed to be a loss of offsite power (LOOP) at a plant site resulting from an external event that affects the offsite power system either throughout the grid or at the plant with no prospect for recovery of offsite power for an extended period. The LOOP is assumed to affect all units at a plant site.

- All installed sources of emergency onsite ac power and SBO Alternate ac power sources are assumed to be not available and not imminently recoverable.

- Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles are available.

- Normal access to the UHS is lost, but the water inventory in the UHS remains available and robust piping connecting the UHS to plant systems remains intact. The motive force for the UHS flow, i.e., pumps, is assumed to be lost with no prospect for recovery.

The licensee's plan for initial plant conditions and initial conditions are consistent with NEI 12-06, Section 3.2.1.2 and 3.2.1.3.

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

3.2.1.5 Monitoring Instrumentation and Controls

NEI 12-06, Section 3.2.1.10 states in part:

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

On page 14, of the Integrated Plan, the licensee listed the installed instrumentation credited or recovered for maintaining core cooling and heat removal during phase 1 of an ELAP.

Steam Generators Available

1. SG Wide Range Level or Narrow Range Level
2. AFW Flow indication
3. SG Pressure
4. CST [condensate storage tank] Level (local level indication only)
5. Subcriticality

Steam Generators Not Available

1. Core Exit Thermocouple (CET) Temperature
2. Reactor Vessel Level Indicating System

Indian Point will develop procedures to read this instrumentation locally, where applicable, using a portable instrument, as required by Section 5.3.3 of NEI 12-06.

On page 16, of the Integrated Plan, the licensee listed the installed instrumentation credited or recovered for maintaining core cooling and heat removal during phase 2 of an ELAP.

Steam Generators Available

1. SG Wide Range Level or Narrow Range Level
2. AFW Flow indication
3. SG Pressure
4. CST Level (local level indication only)

Steam Generators Not Available

1. Core Exit Thermocouple (CET) Temperature
2. Reactor Vessel Level Indicating System
3. Neutron Flux

Indian Point will develop procedures to read this instrumentation locally, where applicable, using a portable instrument, as required by Section 5.3.3 of NEI 12-06.

Wide range RCS pressure instrumentation appears necessary to verify core cooling consistent NEI 12-06, Section 3.2.1.10. During the audit process the licensee stated that RCS wide range pressure indication has been identified as credited instrumentation in the Maintain RCS Inventory Control sections of the Integrated Plan. Therefore, this instrumentation would also be available for the core cooling function if required.

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

3.2.1.6 Sequence of Events

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

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

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.

On pages 6, 7 and 8 and in Attachment 1A of the Integrated Plan the licensee stated: At 8.0 hours align FLEX RCS makeup pump from boric acid storage tank (BAST). RCS boration is required for shutdown margin at 23.3 hours. RCS makeup is required for inventory at 5.2 hours assuming cooldown is commenced at 1 hour or 2.5 hours assuming cooldown is commenced at 2 hours. Since the FLEX RCS pump takes approximately 2 hours to deploy, the cooldown will be commenced at 1 hour (assumption). Therefore, 5.2 hours becomes the limiting time. However, further evaluation is expected to extend the current requirement for inventory. It is assumed the accumulators are isolated. Controlling the RCS makeup pump is a continuous action.

During the audit process the staff noted that as part of their mitigating strategy the licensee planned to isolate the RCS SI accumulators after they inject but before nitrogen gas escapes into the RCS. Since the accumulators are located inside containment the licensee was asked to explain how it planned to isolate the accumulators. The licensee responded that the specific strategy has not been finalized. In general, the reactor coolant system pressure will be controlled to prevent nitrogen from escaping into the RCS until the isolation valves can be closed. This information will be provided in a future update. This has been identified as Confirmatory Item 3.2.1.6.A in Section 4.2.

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

3.2.1.7 Cold Shutdown and Refueling

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

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

The NRC staff determined that the licensee had addressed some issues related to shutdown and refueling (operating modes 5 and 6) requirements in their description of their Sequence of

Events in their Integrated Plan. These are discussed in paragraph 3.2.1.8, Core Sub-Criticality below.

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

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

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

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

3.2.1.8. Core Sub-Criticality

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

> All plants provide means to provide borated RCS makeup.

During the audit process the licensee stated that the question regarding boron mixing was identified as a generic concern which the nuclear industry will resolve generically through the NEI and the applicable industry groups (e.g., PWROG, EPRI, etc.). Once this generic concern is resolved, the licensee will provide additional information in a future update. NEI will be coordinating with the NRC on the schedule for resolution.

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

The Pressurized Water Reactor Owners Group submitted a position paper, dated August 15, 2013 (withheld from public disclosure due to proprietary content), which provided test data regarding boric acid mixing under single-phase natural circulation conditions and outlined applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available. During the audit process the licensee informed the NRC staff that it would provide additional information a future update. The NRC staff concluded that the August 15, 2013, position paper was not adequately justified and has not endorsed this position paper. As such, resolution of this concern for Indian Point is identified as Confirmatory Item 3.2.1.8.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 core sub-criticality, if these requirements are implemented as described.

3.2.1.9 Use of Portable Pumps

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

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

NEI 12-06 Section 11.2 states in part:

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

On pages 14 and 15 of the Integrated Plan regarding activities for Core Cooling and Heat Removal the licensee stated, in part, that the transition into Phase 2 will be required once the operating conditions of the TDABFP cannot be maintained. The primary strategy involves staging the portable pump outside the auxiliary building and running hose to a primary or secondary connection point to the auxiliary feedwater system. This strategy involves taking suction first from the CST and then from an alternate water source. The CST contains enough water to maintain core cooling for approximately 32 hours. After the CST is exhausted, a transition to increasingly impure water sources will occur. A line loss evaluation was performed which shows the expected line losses for both the primary and alternate configurations.

On page 25 of the Integrated Plan, the licensee stated: The Phase 2 activities for RCS inventory control involve aligning a pump to provide borated coolant for RCS makeup and to maintain the reactor subcritical. The FLEX pump will be deployed at a time consistent with the loss of single-

phase natural circulation. This pump will provide core make-up such that a limited period of two phase natural circulation cooling occurs maintaining the respective flow conditions desired in order to provide adequate core cooling. Given the reactor coolant pump characteristics of the Model 93 seal configuration, including the limited leakage expected at reduced inventory conditions, it is reasonable to be in two-phase natural circulation for a small period of time. Without a letdown path, contraction of the RCS inventory during the plant cooldown and depressurization is the only means in which available space is made to borate the RCS. A letdown path can be provided, if required, by opening the head vent to allow for increased boration capabilities. To ensure that the core is maintained subcritical, borated injection into the RCS is provided from the installed, high concentration boric acid tanks via a FLEX pump. This injection also compensates for RCS leakage and contraction, enabling refill of the RCS, and eventually establishing level in the pressurizer.

During the audit process the licensee was asked to specify the required time for the operator to realign each of the above discussed pumps (Phase 2 of maintaining core cooling, heat removal and RCS inventory control) and confirm that the required times are consistent with the results of the ELAP analysis. The licensee was also asked to discuss the analyses that are used to determine the required flow rate and corresponding total developed head (TDH) for each of the portable pumps and also to justify that that the required capacities of each of the above-discussed portable pumps are adequate to maintain core cooling and sub-criticality during phases 2 and 3 of ELAP. The licensee was also asked to discuss and justify the computer codes/methods and assumptions used in the analyses above. During the audit process the licensee stated that IPEC is using a site-specific analysis to justify the required actions, pump design parameters and criticality requirements. The requested information will be provided in a future update. This has been identified as Confirmatory Item 3.2.1.9.A in Section 4.2.

During the audit process the staff noted that the licensee proposed an alternate SG FLEX pump connection to feed all four generators through a 2-inch drain valve (BFD-22). The staff requested the licensee provide an evaluation that demonstrates flow through a 2-inch connection will be sufficient to provide adequate flow to maintain the SG level. The licensee responded that the design of the alternate SG FLEX pump connection is in progress, therefore, the evaluation of flow through the connection has not been completed. This information will be provided in a future 6-month update. This has been identified as Confirmatory Item 3.1.1.9.B in Section 4.2.

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

3.2.2 Spent Fuel Pool Cooling Strategies

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

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

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

On pages 37, 38 and 41 of the Integrated Plan the licensee stated:

> With the plant operating and the SFP at 100ºF, the licensee determined that the volume lost from the SFP corresponded to a 2.42 ft. loss in the SFP level and a time to boil of 12.6 hours for a seismic event.
>
> With fuel in transfer or a full core offload, and the SFP at 140ºF, SFP sloshing and time-to-boil evaluation determined the volume lost corresponded to a 2.42 ft. loss in the SFP level and a time to boil of 4.04 hours.
>
> An analysis determined that the pump for supplying SFP makeup required a flow rate of 114 gpm, which is conservative.
>
> For events occurring with the steam generators available and during a full core offload the RWST [refueling water storage tank] is the primary makeup source for the SFP FLEX pump. For events occurring when the steam generators are not available the CST is the primary makeup source for the SFP FLEX pump. This is dictated by the timing and deployment evaluation.
>
> An analysis was performed indicating NPSH [net positive suction head] concerns when using the 2" drain line as a source connection for this strategy for both units. This analysis shows that a 3" drain line would allow for sufficient NPSH. Therefore, IPEC will modify the RWSTs to include a 3" connection. A secondary source of coolant is the CST. The CSTs for both plants will also be modified to include a 3" or greater suction source connection.
>
> A device to anchor the hose at the edge of the SFP must be installed to keep the hose stationary once deployed.
>
> All sites that do not have spent fuel pools that are capable of being drained must have provisions for SFP spray. This means that in addition to the provision for 114 gpm makeup to the SFP discussed above, a 250 gpm SFP spray capability will be required as part of FLEX. The connection point, staging area, and hose

routing are almost identical to those described for SFP Cooling above. The exception being that the discharge hose will not be placed in the pool, but attached to a nozzle placed on the walkways surrounding the pool.

During the audit process the staff asked the licensee to explain their strategy to provide a secondary connection for SFP makeup if the building is inaccessible, and explain where these valves are and if access to these valves will be available during an ELAP event. During the audit process the licensee stated that the design of the Spent Fuel Pool alternate connection is under development. The alternate connection point will be designed such that any operator actions required for implementing SFP makeup can be achieved. This has been identified as Confirmatory Item 3.2.2.A in Section 4.2.

The reviewer notes that Indian Point Unit 2 was determined to have an SFP that is not capable of being drained in the course of the evaluations and assessments pursuant to Order EA-02-026, “Issuance of Order for Interim Safeguards and Security Compensatory Measures,” Section B.5.b. Those evaluations and assessments lead to the imposition of license conditions to clarify the requirements; the requirements of EA-02-026, Section B.5.b and the license conditions were subsequently made generically applicable as 10 CFR 50.54(hh)(2). Indian Point Unit 3 includes a license condition related to SFP mitigation measures because the Indian Point Unit 3 SFP is considered drainable; the corresponding license condition is absent from the license condition for Unit 2 because the SFP is not capable of being drained. The provision for SFP spray is therefore not considered to be part of the mitigating strategies for Indian Point Unit 2.

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

3.2.3 Containment Functions Strategies

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

On pages 32, 33 and 35 of the Integrated Plan regarding maintaining containment during all Phases, the licensee stated that containment pressure and temperature are expected to increase during an ELAP due to loss of containment cooling and RCS leakage into containment. By performing an early cooldown, the rate of leakage and heat rejection to containment are reduced and the pressure and temperature are not expected to rise to levels that could challenge the containment structure. A containment evaluation will be performed based on the boundary conditions described in Section 2 of NEI 12-06. Based on the results of this evaluation, required actions to ensure maintenance of containment integrity and required instrument function will be developed. This has been identified as Confirmatory Item 3.2.3.A in Section 4.2.

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

requirements of Order EA-12-049 will be met with respect to containment functions strategies, if these requirements are implemented as described.

3.2.4 Support Functions

3.2.4.1 Equipment Cooling – Cooling Water

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

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

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

During the audit process the licensee confirmed that cooling for the TDABF pump bearings are cooled by the pump discharge and do not require external cooling water.

The licensee's 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 cooling water, if these requirements are implemented as described.

3.2.4.2 Ventilation – Equipment Cooling

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

> *Plant procedures/guidance should consider loss of ventilation effects on specific energized equipment necessary for shutdown (e.g., those containing internal electrical power supplies or other local heat sources that may be energized or present in an ELAP).*
>
> ELAP procedures/guidance should identify specific actions to be taken to ensure that equipment failure does not occur as a result of a loss of forced ventilation/cooling. Actions should be tied to either the ELAP/LUHS or upon reaching certain temperatures in the plant. Plant areas requiring additional air flow are likely to be locations containing shutdown instrumentation and power supplies, turbine-driven decay heat removal equipment, and in the vicinity of the

inverters. These areas include: steam driven ABFW pump room, HPCI [High Pressure Coolant Injection, a Boiling Water Reactor system] and RCIC [Reactor Core Isolation Cooling, a Boiling Water Reactor system] pump rooms, the control room, and logic cabinets. Airflow may be accomplished by opening doors to rooms and electronic and relay cabinets, and/or providing supplemental airflow.

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 airflow 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 ABFW 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 airflow 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.

During the audit process the licensee stated that assessment of the habitability/accessibility requirements at locations where operators will be required to perform local manual operations for FLEX strategies have not been completed at this time. Response to this question will be provided in a future update. This has been identified as Confirmatory Item 3.2.4.2.A in Section 4.2.

During the audit process the licensee stated that the FLEX strategy would ensure that hydrogen concentration in the battery rooms during battery recharging would be maintained below the current licensing basis level of 4 percent. Design and analysis for FLEX implementation is in progress but not been completed at this time. This information will be provided in a future update. This has been identified as Confirmatory Item 3.2.4.2.B, in Section 4.2.

On page 13 of the Integrated Plan the licensee states that for the TDABFW pump room, existing procedures contain steps to open ventilation paths to maintain acceptable local temperatures while the pump is in service. In addition, the procedure background document indicates the ABFW pump room roll-up door is opened to dissipate heat. During the audit process the licensee was asked to provide a detailed summary of the analysis and/or technical evaluation performed to demonstrate the adequacy of the ventilation provided in the TDABFW pump room to maintain room temperature and support equipment operation throughout all phases of an ELAP. In their response the licensee stated that for Unit 2, this information will be provided in a future update. For Unit 3, preliminary results of calculation IP-CALC-13-00064 are available. This calculation uses the results of the Station Blackout calculation (IP-CALC-07-00193) to linearly extrapolate the maximum temperature of the Auxiliary Feedwater Pump Room with an ambient temperature of 115°F to determine the maximum temperature rise in the Unit 3 Auxiliary Feedwater Pump Room. The Station Blackout calculation uses a GOTHIC model to determine the temperature rise in the Auxiliary Feedwater Pump Room for an ambient temperature of 93°F. For ELAP conditions (assumed 115°F ambient), the maximum temperature during the initial 8 hours is 133°F with the roll-up door closed and 129°F with the roll-up door open. The room temperature after seven days (with the roll up door open) is extrapolated to be 123°F. As stated by the licensee during the audit process, these room temperatures are acceptable for the Turbine Driven Auxiliary Feed Pump to operate and do not exceed the 143°F steam supply isolation temperature setpoint.

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

3.2.4.3 Heat Tracing.

NEI 12-06, Section 3.2.2, Paragraph (12) provides that:

> *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.

Other than a discussion of the strategy for FLEX RCS makeup from the BAST in the Integrated Plan, and a discussion of the RWST and CST during the audit process, the licensee did not adequately address heat tracing. During the audit process the licensee stated that the need for heat tracing would be addressed in the design development and procedure development phase. Response to this audit question will be provided in a future update. This has been identified as Confirmatory Item 3.2.4.3.A in Section 4.2.

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

3.2.4.4. Accessibility – Lighting and Communications

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

> *Plant procedures/guidance should identify the portable lighting (e.g., flashlights or headlamps) and communications systems necessary for ingress and egress to plant areas required for deployment of FLEX strategies.*
>
> Areas requiring access for instrumentation monitoring or equipment operation may require portable lighting as necessary to perform essential functions.
>
> Normal communications may be lost or hampered during an ELAP. Consequently, in some cases, portable communication devices may be required to support interaction between personnel in the plant and those providing overall command and control.

On page 7, in the Integrated Plan regarding sequence of events, the licensee stated that the Control Room & Emergency Lighting is provided by emergency lighting Batteries, but beyond Phase 1 will require new strategies.

On page 44 of the Integrated Plan the licensee stated that additional equipment might be required to be powered during this event such as portable lighting and ventilation fans. These are not conveniently powered via the FLEX generator. Small portable generators are available onsite if this additional lighting and ventilation is deemed necessary. Small Battery packs for these items are also a possibility.

On page 56 of the Integrated Plan, the licensee listed portable lighting including flashlights, headlamps, batteries, and exterior lights with emergency generators.

During the audit process the licensee stated that the standard gear/equipment of operators with duties in the plant (outside the central control room (CCR)) includes flashlights. This requirement is currently in procedure EN-OP-115-01, "Operator Rounds." Additional evaluations will be performed to ensure that adequate lighting is provided to the operators and other personnel as required, and procedures may be revised if necessary to ensure operators have adequate portable lighting.

The NRC staff has reviewed the licensee communications assessment (ADAMS Accession Nos. ML12319A016 and ML13064A360) in response to the March 12, 2012 50.54(f) request for information letter for the licensee and, as documented in the staff analysis (ADAMS Accession No. ML13127A115) 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.

The licensee's 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 lighting and portable communications, if these requirements are implemented as described.

3.2.4.5. Protected and Internal Locked Area Access

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

> *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 stated that procedures already exist or will be developed to ensure that operators can access the required areas in the event of a loss of power. Additional details on procedural controls for access to security controlled or internal locked areas where ELAP would disable normal controlled access will be provided later in the design / procedure development process.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to 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 6 and 7, in the Integrated Plan the licensee stated in part:

> 1. Control Room Ventilation (Open Room/Cabinet Doors); at 0.5 hours Indian Point Plant procedure ECA-0.0, Loss of All AC Power, directs opening control room doors and/or cabinet doors.
>
> 2. TDABFP Room Ventilation; at 0.5 hours Indian Point Plant procedure ECA-0.0, Loss of All AC Power, directs opening TDABFP room doors within 30 minutes of a loss of all ac power. The temperature in the TDABFP room will be less than 120°F for at least 72 hours if the door is open by the first hour after the event.
>
> 10. Deploy Miscellaneous Lighting and Ventilation; at 8 hours additional lighting and ventilation is not easily powered from the 480V bus and will require use of Batteries and/or small portable generators as deemed necessary.
>
> 11. Deploy Battery Room Ventilation for Unit 3; at 8 hours Unit 3 Battery room ventilation must occur shortly after Battery charging is initiated to vent Hydrogen.
>
> 13. Establish SFP Area Vent; at 8.04 hours establish SFP vent area such as opening the large rollup door. Need time based on SFP time to boil without a break. This time to boil is based on an initial SFP temperature of 140°F and assumes all pipe penetrating the SFP remains intact.

On page 36, in the Integrated Plan regarding spent fuel pool cooling, the licensee stated in part:

> Spent Fuel Pool cooling is not challenged early in the event; however, access to the SFP area as part of Phase 2 response could be challenged due to environmental conditions local to the pool, so action is required to establish ventilation in this area and establish any equipment local to the spent fuel pool required to accomplish coping strategies. For these reasons, most of the actions required for Phase 2 occur outside of the Fuel Building. The SFP vent will be established by opening a large roll up door.

During the audit process the licensee stated that the Integrated Plan references procedure ECA-0.0, “Loss of All AC Power” for actions to mitigate control room and TDABFP room heat up. Assessment of the habitability/accessibility requirements at locations where operators will be required to perform local manual operations for FLEX strategies have not been completed at this time.

The licensee’s plan for personnel habitability/accessibility in an elevated temperature environment did not provide reasonable assurance that the plan conforms to the guidance of NEI 12-06, Section 3.2.2, Guideline (11), because there is insufficient information to determine that the habitability limits will be maintained and/or operator protective measures will be employed in all Phases of an ELAP to ensure operators will be capable of FLEX strategy execution under adverse temperature conditions. Examples of areas of concern are the control room, TDABFW pump room, SFP area, and charging pump room. This has been identified as

Confirmatory Item 3.2.4.6.A, in Section 4.2.

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

3.2.4.7 Water Sources

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

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

On page 66, in Attachment 1A, Sequence of Events Timeline, action item 19 stated that use of CST inventory for SFP makeup occurs after 32 hours when the CST makeup is aligned from the UHS, the Hudson River. This assumes the TDABFP Recirculation line returning to the CST is intact. Other preferred water sources may be used prior to using the UHS as a source if available; however, the UHS is used here as the limiting scenario since this source will be available during all seismic and natural phenomena events.

During the audit process the NRC asked about the seismic qualification and tornado missile qualification of the RWSTs and CSTs. The licensee stated the following:

> The Unit 2 and Unit 3 RWSTs and CSTs are seismically qualified. Protection from tornado missile is provided by alternate supplies. IPEC is currently compiling historical tornado information to determine historical tornado diameter and axis of movement. The steam generator feed requirements are assured by alternate water supplies: CST, City Water Tank, and Hudson River. The water requirements of the primary systems are assured by the boric acid storage tanks (which are missile protected) and the refueling water tank. This is consistent with what is credited for the current licensing basis.

It is noted that NEI 12-06 guidance only credits water supplies that are robust with respect to seismic events, floods, and high winds, and the associated missiles. The licensee should determine if a water supply for the SGs and RCS would be available after a tornado event by analyzing the tornado characteristics for the site compared to the separation characteristics of the tanks. In the Integrated Plan, the licensee discussed the capability to use the Hudson River as a water source in Phase 2, but not in Phase 1. This is an alternate approach from the strategies identified in NEI 12-06. This has been identified as Open Item 3.2.4.7.A in Section 4.1.

The NRC staff noted that on pages 25 and 28 of the Integrated Plan the licensee indicated that the missile protection of the BAST for Unit 2 requires evaluation. The licensee's evaluation for the missile protection of the Unit 2 BAST is identified as Confirmatory Item 3.2.4.7.B.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and subject to the successful closure of issues related to the Open Item and Confirmatory Item, 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 44 of the Integrated Plan for safety function support during the transition phase, the licensee stated: The electrical portion of the Units 2/3 Phase 2 coping strategy has the main goal of repowering the vital 480 Vac buses. A single FLEX generator will be designated to achieve this goal. Repowering essential instrumentation will be achieved by repowering Battery chargers. The 480 Vac buses are also necessary to power fuel oil transfer pumps (FOTPs) and Battery room exhaust fans. By utilizing color-coded cables and connectors, operators would be able to perform this action without requiring additional personnel, such as an electrician.

On page 50 of the Integrated Plan for safety function support during Phase 3, the licensee stated: The electrical portion of the Phase 3 coping strategy has the main goal of repowering the 480 Vac equipment to aid in cooling down the plant to a stable, Mode 5 condition. This will be achieved through the same spare breaker connection points in Bus 2A or 6A used for Phase 2. However, new breakers with a larger current capacity rating will need to be used in the same breaker slot. After repowering from one of these locations, buses may be cross-tied through operator manipulation of breakers to allow powering of any of the RHR or CCW pumps in

addition to the Phase 2 loads. A single, large generator deployed from the Regional Response Center will be placed in the Unit 2 staging area shown in order to achieve this goal. Repowering the RHR and the CCW pumps will be achieved by powering the 480 Vac vital buses.

During the audit process the licensee stated that electrical isolation would be maintained such that Class 1E equipment is protected from faults in portable/FLEX equipment by implementing appropriate controls for the equipment in procedures to ensure compliance with NEI 12-06 section 3.2.2. Guideline (13). However, the primary goal of FLEX diesel generators is to power components credited in the FLEX strategy and not to protect Class 1E equipment.

Also during the audit process the licensee stated that it would ensure that multiple sources do not attempt to power electrical buses. In addition to existing electrical interlocks, procedural controls, such as inhibiting diesel generator start circuits and breaker rack-outs, will be employed to prevent simultaneous connection of both the FLEX generators and Class 1E diesel generators to the same ac distribution system or component. Should the Class 1E DGs become available during the BDBEE, they could be restarted to provide power to their associated busses to repower divisional loads where safe and appropriate; this would also be procedurally controlled. FLEX strategies, including the transition from installed sources to portables sources (and vice versa) and provisions for equipment and personnel protection, will be addressed in the FLEX procedures and guidance which are in the development stage.

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

3.2.4.9. Portable Equipment Fuel.

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

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

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

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

NEI 12-06, Section 3.2.1.3, initial condition (5) allows for the assumption that "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 8, in the Integrated Plan regarding sequence of events, the licensee stated:

> Establish FLEX equipment fuel deployment at 13 hours. This is an assumption. Indian Point will provide a more exact basis once all FLEX equipment has been purchased and equipment specifications (fuel consumption rate) are known.
>
> Establish large fuel truck delivery service at 72 hours. This is based on the

> assumption regarding the depletion of on-site supply and supplying larger equipment. Indian Point will provide a more exact basis once all FLEX equipment has been purchased and equipment specifications are known.

On page 14, in the section of the Integrated Plan that describes core cooling with steam generators available, the licensee stated "The diesel fuel supply for all FLEX equipment will be from the Emergency Diesel Generator Fuel Oil Storage Tanks."

On page 18, in the section of the overall Integrated Plan that discusses Core Cooling and heat removal during Phase 2, the licensee stated, in part:

> Items requiring fuel include, but are not limited to, debris removal equipment, diesel generators, diesel pumps, and FLEX equipment transportation vehicles. The diesel fuel supply for all FLEX equipment will be from the Emergency Diesel Generator Fuel Oil Storage Tanks.

During the audit process the license was asked to describe plans for supplying fuel oil to FLEX equipment (i.e., fuel oil storage tank volume, supply pathway, etc.). The licensee was also asked to explain how fuel quality will be assured if stored for extended periods of time. The licensee stated that the main sources of fuel oil for FLEX equipment are the Emergency Diesel Generator Fuel Oil Storage Tanks, which are maintained in accordance with the Technical Specifications. The quality of fuel oil in potential stored sources of fuel oil is maintained such that it can be used to fuel the emergency diesel generators. Fuel oil in the fuel tank for each portable FLEX equipment will be maintained in the Preventative Maintenance program in accordance with the manufacturer's guidance and existing site maintenance practices. The fuel transportation routes will avoid any areas subject to external flooding. The method of supplying fuel oil to FLEX equipment has not been finalized; this information will be provided in a future update.

The NRC staff determined that the licensee did not specify the fuel consumption rates for each FLEX piece of equipment that was used to calculate total fuel usage and thus demonstrate that sufficient fuel with margin exists on site. This has been 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 the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to portable equipment fuel, if these requirements are implemented as described.

3.2.4.10. Load Reduction to conserve dc power.

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

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

safety-related batteries. However, for many plants, this lighting may have been supplemented by Appendix R and security lights, thereby allowing the emergency lighting load to be eliminated. ELAP procedures/guidance should direct operators to conserve dc power during the event by stripping nonessential loads as soon as practical. Early load stripping can significantly extend the availability of the unit's Class 1E batteries. In certain circumstances, AFW/HPCI /RCIC operation may be extended by throttling flow to a constant rate, rather than by stroking valves in open-shut cycles.

Given the beyond-design-basis nature of these conditions, it is acceptable to strip loads down to the minimum equipment necessary and one set of instrument channels for required indications. Credit for load-shedding actions should consider the other concurrent actions that may be required in such a condition.

On page 6 and 7 of the Integrated Plan the licensee described the sequence of events and time constraints, and stated that it would declare ELAP entry in one hour and would begin deep load shedding within two hours. This would increase battery life for the duration of Phase 1, which is 8 hours. The use of the phase 2 480 Vac generator would be initiated at 8 hours and the use of the Phase 3 480 Vac generator would be initiated at 72 hours.

During the audit process the NRC staff asked the licensee to:

a. Provide the direct current (dc) load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling.
b. Provide a detailed discussion on the loads that will be shed from the dc bus, the equipment location (or location where the required action needs to be taken), and the required operator actions and the time to complete each action. In your response, explain which functions are lost as a result of shedding each load and discuss any impact on defense in depth and redundancy.
c. Provide the basis for the minimum dc bus voltage that is required to ensure proper operation of all required electrical equipment. In their response the licensee stated that preliminary analysis to determine minimum battery voltage has been performed for IP3 (IP2 analysis has not been developed at this time). Preliminary results indicate that the minimum voltage that is required for the four batteries range from 105V to approximately 110V depending on the battery, the limiting load and associated voltage drop in the distribution system.

The licensee stated that the analysis of the dc power requirements for implementing the FLEX strategies would be made available as they are finalized. This is identified as Confirmatory Item 3.2.4.10.A in Section 4.2.

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

3.3 PROGRAMMATIC CONTROLS

3.3.1 Equipment Maintenance and Testing.

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

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

NEI 12-06, Section 11.5 states:

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

2. Portable equipment that directly performs a FLEX mitigation strategy for the core, containment, or SFP should be subject to maintenance and testing[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.

[1] Testing includes surveillances, inspections, etc.

c. Existing work control processes may be used to control maintenance and testing. (E.g., PM Program, Surveillance Program, Vendor Contracts, and work orders).

3. The unavailability of equipment and applicable connections that directly performs a FLEX mitigation strategy for core, containment, and SFP should be managed such that risk to mitigating strategy capability is minimized.

   a. The unavailability of installed plant equipment is controlled by existing plant processes such as the Technical Specifications. When installed plant equipment which supports FLEX strategies becomes unavailable, then the FLEX strategy affected by this unavailability does not need to be maintained during the unavailability.

   b. Portable equipment may be unavailable for 90 days provided that the site FLEX capability (N) is available.

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

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

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

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

On page 10 and 11, in the section of the Integrated Plan discussing programmatic controls, the licensee stated:

> Equipment associated with these strategies will be procured as commercial equipment with design, storage, maintenance, testing, and configuration control in accordance with NEI 12-06 Rev.0 Section 11.0.
>
> The unavailability of equipment and applicable connections that directly performs a FLEX mitigation strategy will be managed using plant equipment control guidelines developed in accordance with NEI 12-06 Rev.0 Section 11.5.
>
> The IPEC intends to maintain and test the FLEX equipment consistent with the requirements of Fire Protection and SBO maintenance. The licensee will review the maintenance and testing template upon issuance by the Electric Power Research Institute (EPRI) to ensure alignment with their Fire Protection and SBO

maintenance procedures. Additionally, the IPEC will ensure that their maintenance and testing procedures meet the FLEX guidelines established in Section 11.5 of Reference 2.

The NRC staff reviewed the licensee's Integrated Plan and determined that the Generic Concern related to maintenance and testing of FLEX equipment is applicable to the plant. This Generic Concern has been resolved through the NRC endorsement of the EPRI technical report on preventive maintenance of FLEX equipment, submitted by NEI by letter dated October 3, 2013 (ADAMS Accession No. ML13276A573). The NRC staff's endorsement letter is dated October 7, 2013 (ADAMS Accession No. ML13276A224).

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

The licensee's 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 10 of the Integrated Plan, the licensee states that the FLEX strategies and basis will be maintained in an overall program document. 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 in accordance with NEI 12-06 Rev.0 Section 11.8.

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

3.3.3 Training.

NEI 12-06, Section 11.6 provides that:

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

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

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

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

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

On page 11 of the Integrated Plan the licensee stated that training plans will be developed for plant groups such as the Emergency Response Organization (ERO), Fire, Security, Emergency Preparedness (EP), Operations, Engineering, Mechanical Maintenance, and Electrical Maintenance. The training plan development will be done in accordance with the IPEC procedures using the Systematic Approach to Training and will be implemented to ensure that the required IPEC staff is trained prior to implementation of FLEX.

The licensee's 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 OFF SITE RESOURCES

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

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

On page 12, in the section of the Integrated Plan regarding the RRC plan, the licensee stated:

> The industry will establish two Regional Response Centers (RRC) to support utilities during beyond design basis events. Each RRC will hold five sets of equipment, four of which will be able to be fully deployed when requested; the fifth set will have equipment in a maintenance cycle. Equipment will be moved from an RRC to a local Assembly Area, established by the SAFER team and the utility. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request.
>
> The licensee has signed a contract with SAFER to meet the requirements of NEI 12-06, Section 12.

Review of the licensee's use of off-site resources, as described above, provides reasonable assurance that the proposed arrangement will conform to the guidance found in NEI 12-06,

Section 12.2, with regard to the capability to obtain equipment and commodities to sustain and backup the site's coping strategies (item 1). However, insufficient information was provided to assure that guidance will be established to conform to items 2 through 10 of NEI 12-06, Section 12.2.

During the audit process the licensee was asked to provide additional discussion to show how considerations (2) through (10) of NEI 12-06, Section 12.2 are met. In their response the licensee stated that Entergy is actively involved in industry initiatives to establish the RRCs, which are described in the OIP and required for implementation of Phase 3 per the IPEC FLEX strategy. The industry has contracted with the SAFER organization through Pooled Equipment Inventory Company (PEICo) to establish and operate the Regional Response Centers as part of the PEICo's existing Pooled Inventory Management (PIM) Program. 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. Off site equipment will be procured through the SAFER organization. SAFER plans to align with the EPRI templates for maintenance, testing and calibration of the equipment.

During the audit process the license was also asked to provide further technical basis or a supporting analysis for the 480 V portable/Flex diesel generator capabilities considering the capacity of the equipment. This should include providing a summary of the sizing calculation for the 480 V FLEX diesel generators to show that they can supply the loads assumed in phase 2. The licensee responded that a sizing calculation of the proposed generators for Phase 2 had not been completed yet but the generators will be sized in accordance with industry criteria and capable of carrying the calculated loads, with margin. This information would be submitted in a future update. This has been identified as Confirmatory Item 3.4.A in Section 4.2.

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

4.0 OPEN AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number	Description	Notes
3.1.2.A	Review of the licensee's new flooding level evaluation results and its potential impact on the flooding hazard analyses previously provided in their Integrated Plan and during the audit process is identified as an Open Item. If the flooding levels are modified based on the results of this review, it may affect the evaluation of the deployment described in Section 3.1.2.2 of this evaluation.	
3.2.4.7.A	It is noted that NEI 12-06 guidance only credits water supplies that are robust with respect to seismic events, floods, and high winds, and the associated missiles. The licensee should	Significant

	determine if a water supply for the SGs and RCS would be available after a tornado event by analyzing the tornado characteristics for the site compared to the separation characteristics of the tanks. This is an alternate approach from the strategies identified in NEI 12-06.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.2.A	Confirm that at least one connection point for the FLEX AFW pump is accessible and is located inside a building that is seismically robust as described in Consideration 2 of NEI 12-06, Section 5.3.2.	
3.1.1.2.B	Confirm that the pickup trucks, forklifts or any other equipment that will be used to deploy the portable equipment for implementing FLEX strategies will be reasonably protected from the event as described in Consideration 5 of NEI 12-06, Section 5.3.2.	
3.1.1.2.C	Confirm provisions will be made to ensure that access to all required areas will be assured in the event of a power failure as described in Consideration 5 of NEI 12-06, Section 5.3.2.	
3.1.1.2.D	Confirm that the licensee has reviewed that deployment paths from the near site storage areas to the site and from the onsite storage areas to the deployment location to verify that these paths are not subject to soil liquefaction concerns as described in Consideration 1 of NEI 12-05, Section 5.3.2.	
3.1.1.3.A	Confirm that the licensee's review of the potential impacts of large internal flooding sources that are not seismically robust and do not require ac power has been completed per consideration 2 of NEI 12-06, Section 5.3.3.	
3.1.1.4.A	Confirm that the intermediate staging area has been selected and implementing procedures have been developed.	
3.1.2.2.A	Confirm that evaluations address: whether procedures have been established for actions be taken in upon receipt of a hurricane warning; ensuring that fuel in oil storage tanks would not be inundated or damaged by flooding; and, whether the means (e.g., trucks) for moving FLEX equipment is reasonably protected from the even	
3.2.1.A	Confirm which analysis performed in WCAP-17601 is being applied to Indian Point. Also confirm the licensee has adequately justified the use of that analysis by identifying and evaluating the important parameters and assumptions demonstrating that they are representative of Indian Point and appropriate for simulating the ELAP transient.	
3.2.1.1.A	Confirm that licensee is using NOTRUMP and that its limitations are taken into account. Reliance on the NOTRUMP code for the ELAP analysis of Westinghouse plants is limited to the flow	

	conditions prior to reflux condensation initiation. This includes specifying an acceptable definition for reflux condensation cooling.	
3.2.1.3.A	Confirm that the licensee has satisfactorily addressed the applicability of Assumption 4 on page 4-13 of WCAP-17601 which states that decay heat is per ANS 5.1-1979 + 2 sigma, or equivalent. If the ANS 5.1-1979 + 2 sigma model is used in the Indian Point ELAP analysis, address the adequacy of the use of the decay heat model in terms of the plant-specific values of the following key parameters: (1) initial power level, (2) fuel enrichment, (3) fuel burnup, (4) effective full power operating days per fuel cycle, (5) number of fuel cycles, if hybrid fuels are used in the core, and (6) fuel characteristics (addressing whether they are based on the beginning of the cycle, middle of the cycle, or end of the cycle). If a different decay heat model is used, describe the specific model and address the adequacy of the model and the analytical results.	
3.2.1.6.A	Confirm that the licensee has finalized their strategy for controlling the reactor coolant system pressure to prevent nitrogen from escaping from the SI accumulators into the RCS until the isolation valves can be closed.	
3.2.1.8.A	Confirm that the licensee has provided additional information regarding justification of test data regarding boric acid mixing under single-phase natural circulation conditions.	
3.2.1.9.A	Confirm that the licensee has specified the required time for the operator to realign each of the above discussed pumps and confirm that the required times are consistent with the results of the ELAP analysis. Confirm that the licensee discussed the analyses that are used to determine the required flow rate and corresponding TDH for each of the portable pumps and also to justify that that the required capacities of each of the above-discussed portable pumps are adequate to maintain core cooling, and sub-criticality during phases 2 and 3 of ELAP. Confirm that the licensee has included a discussion and justification of computer codes/methods and assumptions used in the analyses above.	
3.2.1.9.B	Confirm that the licensee has provided an evaluation that demonstrates flow through a 2-inch connection will be sufficient to provide adequate flow to maintain the SG level using the alternate SG FLEX pump.	
3.2.2.A	Confirm that the licensee has satisfactorily explained their strategy to provide a secondary connection for SFP makeup if the building is inaccessible, and explain where these valves are and if access to these valves will be available during an ELAP event.	
3.2.3.A	Confirm that a containment evaluation has been completed and, based on the results of this evaluation; required actions to ensure maintenance of containment integrity and required instrument function will be developed.	
3.2.4.2.A	Confirm that the assessment of the habitability/accessibility	

	requirements at locations where operators will be required to perform local manual operations for FLEX strategies have been completed.	
3.2.4.2.B	Confirm that hydrogen concentration in the battery rooms during battery recharging would be maintained below the current licensing basis level.	
3.2.4.3.A	Confirm that the need for heat tracing has been evaluated for the BAST and all other equipment necessary to ensure that all FLEX strategies can be implemented successfully	
3.2.4.6.A	Confirm that habitability limits will be maintained and/or operator protective measures will be employed in all Phases of an ELAP to ensure operators will be capable of FLEX strategy execution under adverse temperature conditions. Examples of areas of concern are the control room, TDABFW pump room, SFP area, and charging pump room.	
3.2.4.7.B	Confirm that the licensee has evaluated the acceptability of the missile protection for the Unit 2 BAST.	
3.2.4.9.A	Confirm that method for supplying fuel oil has been finalized. Also confirm that the fuel required for each FLEX piece of equipment has been established and that the total fuel usage has been calculated to demonstrate that sufficient fuel with margin exists on site.	
3.2.4.10.A	Confirm that analysis of the following aspects of the dc power requirements have been identified and evaluated: a. The direct current (dc) load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling; b. The loads that will be shed from the dc bus, the equipment location (or location where the required action needs to be taken), and the required operator actions and the time to complete each action c. The basis for the minimum dc bus voltage that is required to ensure proper operation of all required electrical equipment.	
3.4.A	Confirm that the 480V portable/FLEX generators are adequately sized to supply loads assumed for implementing Phase 2 strategies.	