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

January 31, 2014

Pacific Gas and Electric Company
Diablo Canyon Power Plant, Units 1 & 2
Docket No. 50-275 and 50-323

Prepared for:

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

Contract NRC-HQ-13-C-03-0039
Task Order No. NRC-HQ-13-T-03-0001
Job Code: J4672
TAC Nos.: MF0958 and MF0959

Prepared by:

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

Technical Evaluation Report

Diablo Canyon Power Plant, Units 1 & 2
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

- Spent Fuel Pool Cooling Strategies
- Containment Function Strategies
- Programmatic Controls
    - Equipment Protection, Storage, and Deployment
    - Equipment Quality

The technical evaluation 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 27, 2013 (ADAMS Accession No. ML13059A501, and as supplemented by the first six-month status report in letter dated August 22, 2013 (ADAMS Accession No. ML13235A097), Pacific Gas and Electric Company (the Licensee or PG&E) provided the Integrated Plan for Compliance with Order EA-12-049 for Diablo Canyon Power Plant (DCPP) Units 1 & 2. The Integrated Plan describes the strategies and guidance under development for implementation by the Licensee for the maintenance or restoration of core cooling, containment, and SFP cooling capabilities following a BDBEE, including modifications necessary to support this implementation, pursuant to Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the NRC staff is conducting audits of their responses to Order EA-12-049. That letter described the process used by the NRC staff in its review, leading to the issuance of an interim staff evaluation and audit report. The purpose of the staff's audit is to

determine the extent to which the licensees are proceeding on a path towards successful implementation of the actions needed to achieve full compliance with the Order.

3.1 EVALUATION OF EXTERNAL HAZARDS

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

3.1.1 Seismic 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 2 of the Integrated Plan, the licensee stated that the seismic hazard applies to DCPP. As a result, the FLEX equipment will be evaluated to ensure that the equipment remains accessible and available after a BDB seismic event and that the FLEX equipment will not become a target or source of a seismic interaction from other systems, structures or components. The FLEX strategies developed will include documentation ensuring that FLEX equipment, any storage locations, and deployment routes meet applicable seismic criteria.

On page 8 of the Integrated Plan the licensee stated that seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012, are not completed and therefore not assumed in it. As the re-evaluations are completed, seismic issues identified that could potentially affect FLEX strategies will be entered into the corrective action program.

The licensee’s 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 events, 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 page 15 of the Integrated Plan, the licensee stated that equipment associated with FLEX strategies would be stored in accordance with the storage requirements of NEI 12-06, Section 11. (Section 11 encompasses the storage guidelines in NEI 12-06, Section 5.3.1)

On pages 21, 35, 48, and 56 of the Integrated Plan, the licensee stated that two FLEX storage locations will be provided for the storage of the related FLEX equipment and that the FLEX equipment will be protected in accordance with NEI 12-06, Section 5.3.1. During the NRC audit process the licensee was requested to provide additional information on FLEX the storage structures. In response, the licensee stated that PG&E has decided to replace the planned area 10 FLEX storage location with warehouse B, which is an existing facility. Warehouse B will be upgraded to meet ASCE 7-10. The FLEX storage facility located in lot 11 will consist of a concrete storage pad with provisions for a metal building at a later date. The pad and the metal building will be designed to ASCE 7-10. Until a metal building is added, FLEX equipment stored on the pad will be evaluated for seismic interactions to ensure the equipment is not damaged by non-seismically robust components or structures. Preliminary geologic studies have been performed at both storage facility locations, and no liquefaction potential was identified at either location. In addition, the licensee indicated that both FLEX equipment storage locations may be subject to seismically-induced small landslide debris flows, which will be accommodated into the design of the facilities. Incorporation of the capability to withstand seismically-induced small landslide debris flows is identified as Confirmatory Item 3.1.1.1.A, in Section 4.2.

There was no discussion in the Integrated Plan about consideration 2 in regards to securing large portable FLEX equipment such as pumps and power supplies to protect them during a seismic event. During the NRC audit process, the licensee was requested to address consideration 2. In response, the licensee stated that large portable FLEX equipment stored in

the FLEX equipment storage areas will be evaluated for seismic concerns and secured as appropriate in accordance with NEI 12-06, Section 5.3.1.2. The licensee stated that the equipment will be evaluated and protected from potential seismic interactions in accordance with NEI 12-06, Section 5.3.1.3. In addition, the licensee stated that seismic tie-downs will be provided for FLEX equipment while in storage.

The licensee's 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 protection of FLEX equipment – seismic hazard, if these requirements are implemented as described.

3.1.1.2 Deployment of FLEX Equipment – Seismic Hazard

NEI 12-06, Section 5.3.2 states:

> The baseline capability requirements already address loss of non-seismically robust equipment and tanks as well as loss of all AC. So, these seismic considerations are implicitly addressed.
>
> There are five considerations for the deployment of FLEX equipment following a seismic event:
>
> 1. If the equipment needs to be moved from a storage location to a different point for deployment, the route to be traveled should be reviewed for potential soil liquefaction that could impede movement following a severe seismic event.
>
> 2. At least one connection point for the FLEX equipment will only require access through seismically robust structures. This includes both the connection point and any areas that plant operators will have to access to deploy or control the capability.
>
> 3. If the plant FLEX strategy relies on a water source that is not seismically robust, e.g., a downstream dam, the deployment of FLEX coping capabilities should address how water will be accessed. Most sites with this configuration have an underwater berm that retains a needed volume of water. However, accessing this water may require new or different equipment.
>
> 4. If power is required to move or deploy the equipment (e.g., to open the door from a storage location), then power supplies should be provided as part of the FLEX deployment.
>
> 5. A means to move FLEX equipment should be provided that is also reasonably protected from the event.

On page 14 of the Integrated Plan, the licensee stated that PG&E has differentiated between the route from a storage location to its staging location and the path from a staging location to the source and/or supply plant connections. The staging routes will be followed to transport the FLEX equipment to the required staging locations. The deployment paths will be followed to

connect the FLEX equipment to the associated plant structures, systems, and components to allow the strategies to be implemented. The routes and paths applicable to the plant mode in which the plant is operating will be maintained available in accordance with plant procedures.

On pages 1 and 2 of the Integrated Plan regarding determining applicable extreme external hazards, the licensee stated that based on the information discussed in the Diablo Canyon Power Plant (DCPP) Updated Final Safety Analysis (UFSAR), the FLEX staging routes and deployment paths are not subject to liquefaction hazards.

During the audit, the licensee stated that the transport route from lot 11 storage facility to the staging locations may be subject to seismically-induced small landslide debris flows, which could easily be removed using debris removal equipment should the small landslide debris flows impact deployment of equipment. On page 11 of the Integrated Plan, the licensee stated that debris removal will be initiated using onsite equipment, however, there was no discussion about how the debris removal equipment will be protected from an extreme seismic event. During the audit, the licensee was requested to explain how debris removal equipment would be protected from an extreme seismic event. In response, the licensee stated that large debris removal equipment will be protected from an extreme seismic event by either: (1) storing the equipment outside and separate from other equipment and structures to ensure there is no seismic interaction or (2) storing the equipment in a facility designed to or evaluated equivalent to ASCE 7-10. Other smaller debris removal equipment will also be stored in a facility designed to or evaluated equivalent to ASCE 7-10. All debris removal equipment will be evaluated for seismic concerns and secured as appropriate. Specific storage locations of the debris removal equipment will be provided in a future six-month update.

On page 24, of the Integrated Plan, regarding protection of connection points for the reactor core cooling and heat removal strategy during Phase 2, the licensee stated that the connections are within and can be accessed through Seismic Category I structures, all connection points will be designed to meet the seismic requirements of the associated system, and all of the connections, piping, and the equipment will be evaluated for adverse seismic interaction.

Similar statements regarding protection of connections are included on pages 24, 30, 59, 62, and 63 for other Phase 2 and Phase 3 strategies.

DCPP relies on a raw water reservoir (RWR) as their water supply. On page 19 of the Integrated Plan, the licensee stated that the RWR has two sections, each capable of containing 2.5 million gallons of water. One section of the RWR with a nominal 90 percent full volume (approximately 2.25 million gallons) of seismically-evaluated water is capable of supplying both Units' coping strategies for approximately 75 hours at the expected strategy flow rates.

Based on the above, DCPP does not rely on a water source that is not seismically robust and therefore consideration 3 is not applicable.

In various sections of the Integrated Plan, the licensee stated that it will deploy FLEX equipment, but did not provide any information on how the portable FLEX equipment will be moved and did not discuss how the means to move the FLEX equipment is reasonably protected as provided in consideration 5 above.

During the audit the licensee stated that the major pieces of FLEX portable equipment such as pumps and generators will be provided on trailers that will be capable of being towed by trucks currently included in the on-site inventory. The licensee stated that at least two trucks are

required to support the movement of the FLEX equipment within the required timeframes. The site has five trucks currently in the inventory, all appropriately sized for transporting the FLEX portable equipment. These trucks are part of the standard fleet of vehicles at the site, and are used on a daily basis. PG&E will park the required trucks when not in use as discussed below. The other trucks should be available if one of the dedicated trucks is not available. Parking locations of the required trucks will be provided in a future six-month update. In order to protect the required trucks that will be used to tow the major pieces of FLEX portable equipment, the parking locations of these vehicles will be outside, in diverse storage locations not susceptible to seismic interactions. Alternatively, the parking locations of these required vehicles may be in a structure designed or evaluated equivalent to ASCE 7-10. The required trucks in the parking locations will be evaluated for seismic concerns and secured as appropriate.

The licensee's 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 – seismic hazard, if these requirements are implemented as described.

3.1.1.3 Procedural Interfaces – Seismic Hazard

NEI 12-06, Section 5.3.3 states:

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

On pages 18, 21, and 28 of the Integrated Plan regarding the strategy for maintaining core cooling and heat removal key reactor parameters for the initial, transition, and final phases, the

licensee stated that PG&E will develop procedures to read this instrumentation locally, where applicable, using a portable instrument.

During the audit, the licensee stated that DCPP has instructions in the Extreme Damage Mitigating Guidelines (EDMGs) to obtain both control room (CR) and non-CR instrumentation readouts, including measuring key readings at containment penetrations (where applicable) using a portable instrument. EDMG EDG-7, "Manually Depressurize the SG's to minimize RCS Inventory Loss," Attachment 5, "Monitoring Core Exit T/C's," contain instructions on obtaining portable equipment, and obtaining core exit thermocouple temperatures at the containment penetrations. The data obtained at the containment penetrations will be transmitted to the CR via portable radios. The guidance to perform critical actions until alternate instrumentation can be connected is contained in current plant procedures. The licensee stated that additional instructions will be contained in the FLEX Support Guidelines (FSGs), as they are developed. For example, if steam generator (SG) pressure indication was lost during the time portable instruments to read SG pressure are being connected; plant procedures will provide alternative instructions to obtain the required information. Guidance exists in plant procedures on how to control the turbine-driven auxiliary feedwater pump without control power. Guidance exists in plant procedures to manually or locally dump steam to control SG pressure.

The Integrated Plan did not address considerations 2 and 3 associated with large internal flooding sources that are not seismically robust and do not require ac power and the use of ac power to mitigate ground water in critical locations, respectively. During the audit the licensee was asked to describe how conform to the guidance of considerations 2 and 3.

In response, the licensee stated that the FLEX strategies do not use ac power for dewatering at any critical locations that would have an effect on the storage, deployment, or operations of any FLEX equipment. However, as discussed in the Integrated Plan on page 27, the use of the emergency alternate saltwater (EASW) pumps requires a tie in to the auxiliary saltwater (ASW) piping in an underground vault between the ASW pumps and the plant. The ASW piping may be initially full of water and breaching this piping may result in the vaults flooding. The location of this vault is above any flood levels at the plant site, and the amount of water capable of entering the vaults is limited to the residual water remaining in the ASW lines. The primary strategy to remove the residual water remaining in the ASW lines will be to open the flanged 4-inch drains located inside the intake structure. The licensee stated that the drains are well below the level of the underground vault, and will allow the ASW piping to drain well below the level of the vault. Should the intake structure be inaccessible, portable sump pumps will be maintained as FLEX equipment along with adequate amounts of flexible hose to dewater the vaults and access the ASW piping tie-in point, as required. The EASW components are a required support function to provide long term cooling of the reactors and SFPs and are expected to be available approximately 105 hours following the occurrence of an ELAP event.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to procedural interface – seismic hazard, 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 16 of the Integrated Plan regarding the regional response plan, the licensee stated that the industry will establish two regional response centers (RRCs) to support utilities during BDB external events. Each RRC will hold five sets of equipment. Four of the sets 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 Strategic Alliance for FLEX Emergency Response (SAFER) team and DCPP. Communications will be established between DCPP and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of DCPP's SAFER Response Plan (playbook), will be delivered to the site within 24 hours from the initial request. PG&E will establish a contract with the RRC vendor that will meet the requirements of NEI 12-06, Section 12. The designation of delivery methods and locations in the playbook is identified as Confirmatory Item 3.1.1.4.A, in Section 4.2.

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

3.1.2 Flooding

NEI 12-06, Section 6.2 states:

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

NEI 12-06, Section 6.2.1 states in part:

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

On page 2 of the Integrated Plan, the licensee stated the DCPP design basis addresses external flooding. The licensee stated that the UFSAR, Section 2.4 indicates the maximum

flood level for the site is so low that it cannot affect the plant and results in the majority of the site not being susceptible to external flooding. The one area of the site that may be exposed to external flooding from storm or tsunami is the intake structure and specifically the ASW pump vaults. The potential for this area to be affected has been mitigated with watertight vaults and ventilation snorkels. The licensee's six-month update (August 2013) clarified on page 3 that the EASW pumps are staged in an area potentially susceptible to storm and tsunami flooding events. However, in the Integrated Plan, the licensee stated that DCPP is a "dry" site, implying that the plant is built above the design bases flood level.

During the audit, the licensee stated that that DCPP is a dry site in that the plant is located above the design basis maximum flood level. However, to establish the UHS in support of the Phase 3 strategies, the EASW pumps will be located down near the intake structure cove to allow suction to be taken directly from the ocean. The placement of these pumps will be close to sea level and will occur approximately 72 hours after the event. And although the staged location could have been initially affected by a tsunami, it would not be expected to be susceptible to tsunami flooding 72 hours after the event. This is based on the occurrence of seismic activity naturally reducing over time, which would limit the potential for an additional tsunami. In addition, redundant EASW pumps are stored on site if the pumps were damaged after being staged.

On page 8 in the section of its Integrated Plan regarding site assumptions specific to the DCPP site, the licensee stated that flood re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012, are not completed and therefore not assumed in it. As the re-evaluations are completed, appropriate issues will be entered into the corrective action system.

The licensee's 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 flood hazards, if these requirements are implemented as planned.

3.1.2.1 Protection of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.1 states:

> These considerations apply to the protection of FLEX equipment from external flood hazards:
>
> 1. The equipment should be stored in one or more of the following configurations:
>
>   a. Stored above the flood elevation from the most recent site flood analysis. The evaluation to determine the elevation for storage should be informed by flood analysis applicable to the site from early site permits, combined license applications, and/or contiguous licensed sites.
>
>   b. Stored in a structure designed to protect the equipment from the flood.
>
>   c. FLEX equipment can be stored below flood level if time is available and plant procedures/guidance address the needed actions to relocate the equipment. Based on the timing of the limiting flood scenario(s), the FLEX equipment can be relocated [footnote 2 omitted] to a position that is

protected from the flood, either by barriers or by elevation, prior to the arrival of the potentially damaging flood levels. This should also consider the conditions on-site during the increasing flood levels and whether movement of the FLEX equipment will be possible before potential inundation occurs, not just the ultimate flood height.

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

DCPP is considered a 'dry site' and therefore protection of FLEX equipment from the flooding hazard is not applicable.

3.1.2.2 Deployment of FLEX Equipment - Flooding Hazard

DCPP is considered a 'dry site' and therefore deployment of FLEX equipment for the flooding hazard is not applicable.

3.1.2.3 Procedural Interfaces - Flooding Hazard

DCPP is considered a 'dry site' and therefore procedural interface considerations in a flooding hazard are not applicable.

3.1.2.4 Considerations in Using Offsite Resources - Flooding Hazard

DCPP is considered a 'dry site' and therefore considerations in using off-site resources for the flooding hazard are not applicable.

3.1.3 High Winds

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

The screening for high wind hazards associated with hurricanes should be accomplished by comparing the site location to NEI 12-06, Figure 7-1 (Figure 3-1 of 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 NRC, "Tornado Climatology of the Contiguous United States," NUREG/CR-4461, Rev. 2, February 2007; if the recommended tornado design wind speed for a 10^{-6}/year probability exceeds 130 mph, the site should address hazards due to extreme high winds associated with tornadoes.

On pages 2 and 3 of the Integrated Plan, the licensee stated that as discussed in NEI 12-06, Section 7.2, hurricanes are extremely uncommon on the west coast of the United States and are not considered to affect the DCPP site. In accordance with NEI 12-06, Figure 7-2, DCPP is

not susceptible to tornadoes that generate wind speeds of 130 mph or more. The reviewer noted that NEI 12-06, Figure 7-1 does not depict the west coast of the United States, but does depict the contour line for the 10^{-6} per year recurrence frequency of hurricanes with wind speeds in excess of 130 mph generally runs parallel to the Atlantic and Gulf coasts of the United States at some margin inland and that the DCPP site location is North and West of this contour line. This is the direction of diminishing wind speeds.

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

3.1.3.1 Protection of FLEX Equipment – High Wind Hazard

DCPP screened out for the hazards of high winds and therefore protection of FLEX equipment from a high winds hazard is not applicable.

3.1.3.2 Deployment of FLEX Equipment – High Wind Hazard

DCPP screened out for the hazards of high winds and therefore deployment of FLEX equipment in a high winds hazard is not applicable.

3.1.3.3 Procedural Interfaces – High Wind Hazard

DCPP screened out for the hazards of high winds and therefore procedural interface considerations in a high winds hazard are not applicable.

3.1.3.4 Considerations in Using Offsite Resources – High Wind Hazard

DCPP screened out for the hazards of high winds and therefore considerations in using off-site resources in a high winds hazard are not applicable.

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 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. NEI 12-06, Section 8.2.1, further specifies that 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 NEI 12-06, Figure 8-2 should address the impact of ice storms.

The reviewer noted that the latitude for the DCPP site is 35°12'38"N, which is above the 35th Parallel. As such, the site should not screen out from consideration of snow and extreme cold. During the NRC audit process, the licensee was requested to provide additional rationale why the DCPP site is not subject to the potential for extreme snowfall and severe cold, or provide an alternative to the guidance in NEI 12-06.

During the audit, the licensee stated that the DCPP site is 12 minutes above the 35th parallel. As stated in the Integrated Plan, page 3, NEI 12-06, Section 8.2.1, Figure 8-1 provides a visual

representation of the maximum 3-day snowfall records across the U.S. NEI 12-06, Figure 8-1 shows that DCPP is not susceptible to a large amount of snow that could be a significant problem for deployment of the FLEX equipment. NEI 12-06 Section 8.2.1, Figure 8-2 indicates that DCPP is a level 2 (Green) plant with the possibility of existence of small amounts of ice. The NEI 12-06, Section 8.2.1 guidance for Figure 8-2 provides the following:

> The white and green regions (Levels 1 and 2) identify regions that are not susceptible to severe ice storms that may impact the availability of offsite power. Sites in all other regions (i.e., yellow, purple and red) should consider ice storm impacts on their FLEX strategies, as outlined in Sections 8.3.1 through 8.3.4.

The licensee further stated that DCPP has no site history of significant ice or snow events that would impede the deployment and operation of the FLEX equipment. The licensee further clarified that the extreme low temperature along the central coast may be as low as 24 degrees F in the winter. This is discussed further in UFSAR Section 2.3.2.2.2, which indicates the lowest hourly temperature recorded at the DCPP site through the year 2000 was 33 degrees F in December 1990. UFSAR Section 2.3.2.1 indicates that since the nearest National Weather Service Station is located approximately 30 airline miles southeast of the DCPP site, and since other offsite sources are separated from the site by rugged terrain, data from other sources are not considered indicative of site conditions. The only representative local data source is the onsite meteorological measurement program data. NEI 12-06 Revision 0, Section 8.3.2 states that 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. A review of actual DCPP meteorological data at the site through October 2013 indicates the lowest temperature is 32 degrees F. However for conservatism DCPP FLEX equipment will be designed and procured to function continuously at the lowest regional temperature of 24 degrees F described in UFSAR Section 1.2.1.3. The FLEX storage facilities will have adequate insulation and ventilation capability to ensure that the FLEX equipment will not experience temperatures outside their specified design range.

The licensee's 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 snow, ice, and extreme cold, 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.).

As previously discussed in Section 5.3.1, the site will have two FLEX storage areas. Warehouse B, which is an existing facility that will be upgraded to meet ASCE 7-10, and the FLEX storage facility located in lot 11, that will consist of a concrete storage pad with provisions for a metal building at a later date. The pad and the metal building will be designed to ASCE 7-10.

It was not clear from the Integrated Plan whether jacket water, batteries, etc. that can be disabled by low temperatures (e.g. 24 degrees F or lower in an extreme cold event) will be able to function if stored in the FLEX storage locations.

During the audit, the licensee stated that for conservatism, FLEX equipment will be designed and procured to function continuously at the lowest regional temperature of 24°F described in UFSAR Section 1.2.1.3. The FLEX storage facilities will have adequate insulation and ventilation capability to ensure that the FLEX equipment will not experience temperatures outside their specified design range.

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

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

NEI 12-06, Section 8.3.2 states:

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

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

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

During the audit the licensee stated that for conservatism, FLEX equipment will be designed and procured to function continuously at the lowest regional temperature of 24°F described in UFSAR Section 1.2.1.3.

The Integrated Plan did not address snow removal.

During the audit the licensee stated that NEI 12-06, Section 8.2.1, Figure 8-1 provides a visual representation of the maximum 3-day snowfall records across the U.S and shows that the site is not susceptible to a large amount of snow that could be a significant problem for deployment of the FLEX equipment. NEI 12-06, Section 8.2.1, Figure 8-2 indicates that DCPP is a level 2 plant with the possibility of existence of small amounts of ice. The NEI 12-06 Section 8.2.1 guidance for Figure 8-2 provides the following:

> The white and green regions (Levels 1 and 2) identify regions that are not susceptible to severe ice storms that may impact the availability of offsite power.

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

3.1.4.3 Procedural Interfaces - Snow, Ice and Extreme Cold Hazard

NEI 12-06, Section 8.3.3, states:

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

As provided in Section 3.1.4.3 above, the licensee stated that the site is not susceptible to a large amount of snow that could be a significant problem for deployment of the FLEX equipment and the small amount of ice will not impact the availability of offsite power.

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

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

NEI 12-06, Section 8.3.4, states:

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

As discussed above, the DCPP site is not susceptible to severe snow and ice storms.

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

3.1.5 High Temperatures

NEI 12-06, Section 9.2 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 4 in the section of its Integrated Plan regarding the determination of applicable extreme external hazards, the licensee stated that in accordance with NEI 12-06, all sites must address high temperatures, and PG&E will consider the site maximum expected temperatures in its specifications, storage, and deployment requirements for FLEX equipment, 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 high temperatures, if these requirements are implemented as planned.

3.1.5.1 Protection of FLEX Equipment - High Temperature Hazard

NEI 12-06, Section 9.3.1, states:

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

On page 4 of the Integrated Plan, the licensee stated that the site maximum expected temperatures will be considered in its specifications, storage, and deployment requirements for FLEX equipment, including ensuring adequate ventilation or supplementary cooling, if required.

On pages 21, 35, 48, and 56 of the Integrated Plan, regarding protection of FLEX equipment from high temperature, the licensee stated that based on the available local data (UFSAR,

Section 1.2.1.3) and industry estimates included in NEI 12-06, the site is not exposed to temperatures over 104 degrees F. However, for the design of storage locations for the FLEX equipment, PG&E will consider the site maximum expected temperature. All of the storage locations will be evaluated for temperature effects and adequate ventilation will be provided as required to ensure no adverse effect 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 - high temperature hazard, if these requirements are implemented as described.

3.1.5.2 Deployment of FLEX Equipment - High Temperature Hazard

NEI 12-06, Section 9.3.2 states:

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

On page 4 of the Integrated Plan, the licensee stated that the the site maximum expected temperatures will be considered in its specifications, storage, and deployment requirements for FLEX equipment, including ensuring adequate ventilation or supplementary cooling, if required.

During the audit, the licensee was asked to address how the effects of excessive high temperatures on the deployment of FLEX equipment will be mitigated, including discussion of the effects on pathways. In response, the licensee stated that deployment pathways and staging locations will not be adversely impacted by a maximum temperature of 104 degrees F.

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

3.1.5.3 Procedural Interfaces - High Temperature Hazard

NEI 12-06, Section 9.3.3 states:

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

On page 4 of the Integrated Plan, the licensee stated that the site maximum expected temperatures will be considered in its specifications, storage, and deployment requirements for FLEX equipment, 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 procedural interfaces - high temperature hazard, if these requirements are implemented as planned.

3.2 PHASED APPROACH

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

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

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

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

NEI 12-06, Table 3-2 and Appendix D summarize one acceptable approach for the reactor core cooling & heat removal, and RCS inventory control strategies. This approach uses the installed auxiliary feedwater (AFW)/emergency feedwater (EFW) system to provide 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 to the RCS with a portable injection source in order to provide core cooling for the transition and final phases. This approach accomplishes RCS inventory control and maintenance of long term subcriticality through the use of low leak reactor coolant pump (RCP) 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 BDB event, the analysis used to provide the technical basis for time constraints for the mitigation strategies may use nominal initial values (without uncertainties) for plant parameters, and best-estimate physics data. All equipment used for consequence mitigation may be assumed to operate at nominal setpoints and capacities. NEI 12-06, Section 3.2.1.2 describes the initial plant conditions for the at-power mode of operation; Section 3.2.1.3 describes the initial conditions; and Section 3.2.1.4 describes boundary conditions for the reactor transient.

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

The approach described for Phase 1 in NEI 12-06 is used in Phase 1 at DCPP. The NRC staff

reviewed the size of the backup nitrogen supply sources for the SG atmospheric dump valves (ADVs) and the required time for their use as motive force to operate the SG ADVs for mitigating an ELAP event. The NRC staff sought clarification on the analysis determining the size of the subject nitrogen supply to show that the nitrogen sources are available and adequate, lasting for the required time. In addition, the NRC staff reviewed electrical power supplies that are required for operators to throttle steam flow through the SG ADVs within the required time as well as the operator actions that are required to operate SG ADVs manually. During the audit the licensee stated that DCPP uses nitrogen as a backup to the plant instrument air system, automatically supplying nitrogen pressure to the SG ADVs if instrument air pressure decays to 85 pounds per square inch gauge (psig). Both of these systems are non safety-related systems. DCPP uses backup air bottles as the Class 1 backup. Each SG ADV has two 2200 psig bottles in parallel, with only one bottle valved-in at a time as the backup. The backup air bottle is maintained at greater than 1,000 psig. The technical specification (TS) minimum pressure of 260 psig ensures sufficient pressurized gas to operate the SG ADVs for the time required for RCS cooldown to residual heat removal (RHR) entry conditions. In addition, hand-wheels are provided for local ADV manual operation. The design basis of the ADVs is established by the capability to cool the unit to RHR entry conditions at the maximum allowable rate of 100 degrees F per hour. The ADVs support the AFW cooldown function from normal zero-load temperature in the RCS to a hot-leg temperature of 350 degrees F, which is the maximum temperature allowed for placing the RHR system in service. The applicable cooldown rate is 25 degrees F per hour for a natural circulation cooldown event utilizing the cooling water supply available in the condensate storage tank. The ADVs are assumed to be used by the operator to cool down the unit to RHR entry conditions for events accompanied by a loss-of-offsite power. Prior to operator actions to cool down the unit, the ADVs and main steam safety valves are assumed to operate automatically to relieve steam and maintain the SG pressure below the design value. Should bottles not be available, operators can manually operate the valves using hand-wheels and can appropriately control the cooldown.

During the audit the licensee stated that the electrical power supply for the ADVs is from the vital Instrument ac Inverters. During an ELAP event, ac power is lost to the inverters. The inverter will continue to operate on its vital dc power supply. DCPP will load shed two vital dc batteries from service at T+1.5 hours, and load will be reduced on the remaining battery to extend the life of the battery. Operators will be dispatched to locally control SG ADVs prior to the load shed at T+1.5 hours. Emergency Operating Procedure (EOP) ECA-0.0, “Loss of all AC Power,” contains instructions to locally operate SG 10 percent steam dump valves to depressurize / control SG pressures. This is performed in accordance with operating procedure (OP) C-2:II, “Main Steam and Steam Dump Systems – Local Operation of Steam Dumps.” As discussed in PG&E Letter DCL-13-040, “Response to March 12, 2012, NRC 10 CFR 50.54(f) Request for Information Regarding Recommendation 9.3. Phase 1 Staffing Assessment,” dated April 24, 2013, ADAMS Accession No. ML13115A083, PG&E conducted a task analysis using the DCPP Simulator to simulate actions from EOP ECA-0.0, “Loss of all AC Power” for the Phase 1 Staffing Study. The Phase 1 Staffing Study used the minimum staffing specified by the Emergency Plan. It was determined that the actions required to perform load shedding activities would not interfere with operator actions required to perform other ELAP response actions for an ELAP event on both units, including operating the SG ADVs locally.

Table 3-2 in NEI 12-06 provides guidance that the SGs should be depressurized for makeup by portable injection sources. As described in the Integrated Plan, Phase 2 RCS cooling and heat removal relies on injection into the SGs using a combination of a common diesel-driven RWR pump and an emergency auxiliary feedwater (EAFW) pump. These approaches remove RCS stored and decay heat. The Integrated Plan describes the use of the RHR system in Phase 3 to

remove decay heat.

On page 27 of the Integrated Plan, the licensee describes that core cooling will be maintained during Phase 3 by using the RHR system. Two portable diesel-driven EASW pumps, one for each unit, and rigid piping segments will be used to restore the UHS function. The flow from the EASW pump will provide cooling water to the component cooling water (CCW) heat exchangers. One 4-kV generator for each unit will be used to repower one train of cooling for that unit. The Licensee noted that RHR suction valves, accumulator isolation valves, and other valves inside containment must be manipulated. In the DCPP six-month update (August 2013) the licensee stated that RHR suction valves and accumulator isolation valves inside containment that are required to be manipulated to implement Phase 3 strategies will be operated manually. The licensee stated that conditions inside containment following an ELAP event will not preclude personnel entry to allow manual actions to be taken.

NEI 12-06, Table 3-2 and Appendix D summarize one acceptable approach for RCS inventory control. The approach uses a combination of low-leak RCP seals and a means to provide borated makeup to the RCS. On page 32 in the DCPP Integrated Plan, in the section on maintaining RCS inventory control during Phase 1, the Licensee stated that PG&E will install low-leakage RCP seals prior to full implementation of FLEX to reduce the potential seal leakage. The licensee stated RCS inventory is not a significant concern for the ELAP scenario due to the installation of low-leakage RCP seals. A high-pressure FLEX pump would be required approximately 49 hours after the ELAP to ensure that single phase natural circulation is maintained. However, boration of the RCS is required within 24 hours after reactor shutdown to ensure subcriticality, which makes the necessity for a high pressure FLEX pump at 49 hours superfluous. Section 3.2.1.2 in this technical evaluation discusses RCP seal leakage rates.

On page 34 of the Integrated Plan, the licensee discussed maintaining RCS inventory control in Phase 2 using portable equipment (i.e., the ERCS pump and the 480-V diesel-driven generator). The licensee stated that the Phase 2 strategy provides RCS makeup from an ERCS pump, one for each Unit, staged in the vicinity of the associated Unit's boric acid storage tank (BAST) in the auxiliary building. Both emergency RCS (ERCS) pumps will be powered by a 480v generator. For boration, an ERCS pump would be required to be deployed and capable of drawing borated water from the BAST and injecting it into the RCS cold leg through high pressure hoses at approximately 16 hours after the ELAP to conservatively ensure the core remains subcritical. The depletion time of the BAST has been determined as 23 hours. At 39 hours, suction of the ERCS pump will need to be switched to the refueling water storage tank (RWST) to ensure the RCS inventory and subcriticality is adequately maintained.

On page 12 of the Integrated Plan, the licensee stated that the beginning of depressurization of the SGs, and therefore the RCS, may be delayed until approximately 8 hours after an ELAP event occurs, rather than beginning as early as one hour after the event. On page 70 of the Integrated Plan, the licensee stated that plant cooldown and depressurization will begin at 3.5 hours. The timing of depressurization is important and needed to be more clearly established. During the audit the licensee stated that the estimated elapsed time for the initiation of cooldown and depressurization is 3.5 hours. This represents the time when PG&E anticipates having adequate personnel available to perform the cooldown. This timing will be verified as part of the Phase 2 staffing study scheduled to be performed in 2015. On page 32 of the Integrated Plan, the licensee stated that they will install low-leakage RCP seals prior to full implementation of FLEX to reduce the potential seal leakage. WCAP-17100-NP, “PRA Model for the Westinghouse Shut Down Seal,” ADAMS Accession No. ML092170349, documents tests that show the SHIELD seals are able to support an 8-hour coping time while staying at full system

pressure and temperature. This documentation is where the 8 hour time constraint on the initiation of plant cooldown was derived. The draft Pressurized Water Reactor Owners Group (PWROG) Emergency Response Guidelines, Revision 2+, dated August 12, 2013, for ECA-0.0 provides guidance on this new cooldown timing. This new guidance will be incorporated into the DCPP emergency operating procedures when the shut down seals have been installed.

NEI 12-06, Section 3.2.1.5, on reactor coolant inventory loss, states sources of expected reactor coolant inventory loss includes "losses from letdown unless automatically isolated or until isolation is procedurally directed." The Integrated Plan does not discuss letdown losses. This item is identified as Confirmatory Item 3.2.1.A, in Section 4.2.

During the audit the licensee was requested to specify which analysis performed in WCAP-17601-P is being applied. 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 DCPP and appropriate for simulating the ELAP transient. The licensee has provided information in response to these requests as noted here and in sections below. The NRC staff will review this information to ensure the licensee sufficiently justifies the analysis being applied. Additional information may be needed to confirm the appropriate use of the analysis. This is identified as Confirmatory Item 3.2.1.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 RCS cooling and heat removal, and RCS inventory Control Strategies, if these requirements are implemented as described.

3.2.1.1 Computer Code Used for the ELAP Analysis

NEI 12-06, Section 1.3 states, in part:

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

On page 74 of the Integrated Plan, the licensee stated PG&E has evaluated WCAP-17601-P considering site-specific parameters and determined the conclusions of that document are applicable to DCPP. PG&E has performed analysis consistent with the recommendations of the PWROG Core Cooling Position Paper. There are no deviations in the FLEX conceptual design with respect to the PWROG guidance.

The licensee provided a sequence of events (SOE) in its Integrated Plan, which included the time constraints and the technical basis for the site. That SOE is based on an analysis using the industry-developed NOTRUMP computer code. NOTRUMP was written to simulate the response of 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, staff concern arose associated with the use of the NOTRUMP code for ELAP analysis for modeling of two-phase flow within the RCS and heat transfer across the steam generator tubes as single-phase natural circulation transitions to two-phase flow and the reflux condensation cooling mode. This concern resulted in the following Confirmatory Item:

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

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

3.2.1.2 RCP Seal Leakage Rates

NEI 12-06, Section 1.3 states:

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

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

The licensee provided a SOE in its Integrated Plan, which included the time constraints and the technical basis for their site. The SOE is based on an analysis using specific RCP seal leakage rates. The issue of RCP seal leakage rates was identified as 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-Publicly Available for proprietary reasons)).

- A position paper dated August 16, 2013, entitled "Westinghouse Response to NRC Generic Request for Additional Information (RAI) on Reactor Coolant Pump (RCP) Seal Leakage in Support of the Pressurized Water Reactor Owners Group (PWROG)" (ADAMS Accession No. ML13235A151 (Non-Publicly Available for proprietary reasons)).

After review of these submittals, the NRC staff has placed certain limitations for Westinghouse Designed Plants. Those limitations and their corresponding Confirmatory Item number(s) for this TER are provided as follows:

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

(2) In some plant designs, such as those with 1200 to 1300 pounds per square inch absolute (psia) SG design pressures and no accumulator backing of the main steam system power-operated relief valve (PORV) actuators, the cold legs could experience temperatures as high as 580 degrees F before cooldown commences. This is beyond the qualification temperature (550 degrees F) of the O-rings used in the RCP seals. For those Westinghouse designs, a discussion of the information (including the applicable analysis and relevant seal leakage testing data) should be provided to justify that the integrity of the associated O-rings will be maintained at the temperature conditions experienced during the ELAP event. This is identified as Confirmatory Item 3.2.1.2.A in Section 4.2.

(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 Accession No. ML13211A168) on the use of the low seal leakage rate in the ELAP analysis. This is identified as Confirmatory Item 3.2.1.2.B in Section 4.2.

(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. This is identified as Confirmatory Item 3.2.1.2.C in Section 4.2.

During the audit the licensee stated that the a representative ELAP transient for a 4-loop Westinghouse nuclear steam supply system (NSSS) with low-leakage RCP seals is presented in WCAP-17601-P, Section 5.7.1. This NOTRUMP case utilizes the SGs for decay heat removal and does not consider RCS makeup flow from a FLEX pump. The representative cases of WCAP-17601-P, Section 5.7.1 do not model operator action to cooldown and depressurize the plant; the cold leg accumulator cover pressure is not reached and injection does not occur. Therefore, the modeling covers the ELAP mitigation strategy at DCPP where the operators will isolate the accumulators, which would prevent the accumulators from discharging to the RCS. Based on the NOTRUMP results for a four-loop plant with shut-down RCP seals presented in WCAP-17601-P, Section 5.7.1, DCPP would not experience core uncovery during the analyzed timeframe of 7 days following the event initiation if no inventory additions were made to the RCS.

During the audit the licensee stated that the DCPP Units 1 and 2 are four-loop Westinghouse NSSS design units with model 93A RCPs. The SHIELD® safe shutdown low-leakage seals will be installed and credited for FLEX strategies at DCPP. The ELAP analysis performed in Section 5.7.1 of WCAP-17601-P models a low-leakage seal (SHIELD) assuming 1 gpm per RCP plus 1 gpm unidentified allowable technical specification leakage and is therefore applicable to DCPP with low-leakage seals installed. The referenced analysis was performed using the NOTRUMP computer code. The licensee considered NOTRUMP to be well within its capabilities for modeling ELAP. The SHIELD safe shutdown low-leakage seals will be installed and credited for FLEX strategies. Therefore, Information Notice 2005-14 statements are not applicable to the ELAP analysis. The lowest main steam safety valve setpoint is 1,080 pounds-per-square-inch atmospheric, which correlates to a saturation temperature of 554 degrees F. The licensee will initiate an RCS cooldown and depressurization within 8 hours following initiation of the ELAP. The qualification of the RCP seal to shaft O-ring will be tracked as part of the SHIELD seal re-design to confirm the delayed cooldown, as documented in the Integrated Plan is acceptable. The only O-ring of interest with the SHIELD seal installed is the RCP seal sleeve to shaft O-ring. PG&E will align with testing results to be documented in the forthcoming SHIELD seal white paper. This item will be tracked concurrently with Confirmatory Item 3.2.1.2.A in Section 4.2.

DCPP does not intend to cooldown using less than all SGs following an ELAP event. Following an ELAP, cooldown will be initiated within 8 hours and completed within 12 hours. All four SGs will be fed by the TDAFW pump, which has adequate water from seismically qualified sources to provide makeup to the SGs for 30 hours. No considerations are needed for idle loops or loop stagnation since all four SGs will be used during cooldown. Boration will be started within 16 hours following ELAP such that it will be completed within 24 hours, in line with the RCS makeup calculation. All four SGs will be fed by the TDAFW pump through the RCS cooldown and boration process, which will maintain natural circulation in all loops.

During the audit the licensee stated that the testing and qualification of SHIELD® is ongoing. PG&E is closely following the re-design of SHIELD and will modify analyses and FLEX strategies, as needed, based on the conclusions of the SHIELD white paper. The low-leakage SHIELD seals are still anticipated to perform at or less than the leak rate of 1 gpm per seal assumed in the RCS makeup analysis following re-design. If the performance is confirmed in testing following the re-design of SHIELD, portable boration units will not be needed. A new licensee identified open item will be created in a later six-month update to confirm that performance of SHIELD, following the re-design, will not preclude personnel entry into the containment to allow manual actions to be taken or result in additional heat added to

containment in Modes 1-4 than was assumed in the ELAP event containment integrity analysis.

Following the re-design of SHIELD, if the performance of the RCP low-leakage seals is confirmed to be at or less than the assumed leak rate of 1 gpm, the current strategy to manipulate valves to isolate the accumulators prior to cooldown will remain unchanged. Nitrogen injection from the accumulators will not be an issue with the accumulators isolated. Westinghouse calculation CN-FSE-13-2-NP, Revision 0, "Diablo Canyon Unit 1 and Unit 2 (PGE/PEG) Reactor Coolant System (RCS) Inventory and Shutdown Margin Analyses to Support the Diverse and Flexible Coping Strategy (FLEX) NEI 12-06," dated February 19, 2013, Figures 5-1 and 5-2 demonstrate that at the selected RCS cooldown temperatures and pressures that the maximum injection at adverse containment conditions does not result in a complete emptying of the liquid volume from the accumulators and therefore precludes nitrogen injection. The setpoint indicated in ECA-0.0, is designed to prevent nitrogen injection from the accumulators during rapid depressurization and is at a lower temperature than that selected for the FLEX mitigation strategy. Operators will monitor pressurizer level and RCS subcooling with RCS cold leg temperature readings and pressurizer level readings.

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

3.2.1.3 Decay Heat

NEI Section 3.2.1.2 states in part:

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

On page 5 of the Integrated Plan, the licensee stated that prior to the event the reactor has been operating at 100 percent rated thermal power for at least 100 days or has just been shut down from such a power history as required by plant procedures in advance of the impending event..

The Integrated Plan did not address the applicability of assumption 4 on page 4-13 of WCAP-17601-P. The Integrated Plan did not discuss if the ANS 5.1-1979 + 2 sigma model is used in the ELAP analysis and did not address the adequacy of the use of the decay heat model in terms of the plant-specific values of the certain key parameters.

During the audit the licensee stated that there are two areas where the ANS 5.1-1979 +2 sigma decay heat standard was applied. WCAP-17601-P forms the primary engineering evaluation basis for the ELAP analyses and Assumption 4 applies in those cases that credit WCAP-17601-P. PG&E has also performed a MAAP evaluation to assess the adequacy of water inventory for AFW. This MAAP evaluation also utilizes the ANS 5.1-1979 +2 sigma decay heat standard, but uses different inputs.

The licensee further stated that the Westinghouse NSSS calculations documented in WCAP-17601-P using the NOTRUMP code were performed with the ANS 5.1 1979 + 2 sigma decay

heat model and assumed the reactor is initially operating at 100 percent power (NOTRUMP reference case core power is 3,723 megawatts thermal (MWt)). Implementation of this model includes fission product decay heat resulting from the fission of U-235, U-238, and Pu-239 and actinide decay heat from U-239 and Np-239. The power fractions are typical values expected for each of the three fissile isotopes through a three region burn-up with an enrichment based on typical fuel cycle feeds that approach 5 percent. With that, a conversion ratio of 0.65 was used to derive the decay power of the two actinides U-239 and Np-239. Fission product neutron capture is treated per the ANS 5.1-1979 standard. The decay heat calculation utilizes a power history of three 540-day cycles separated by two 20-day outages that bounds initial condition 3.2.1.2 (1) of NEI 12-06, Section 3.2.1.2 (minimum assumption of NEI 12-06 is that the reactor has been operated at 100 percent power for at least 100 days prior to event initiation). Therefore, the decay heat curve assumed in the Westinghouse calculations in WCAP-17601-P is representative of DCPP.

The licensee further stated that the MAAP evaluation was performed as scoping and verification of the amount of AFW inventory used during the ELAP event. The decay heat calculation performed in MAAP is based on the ANS 5.1-1979 +2 sigma decay heat standard and is a function of reactor power and eight specific inputs. The inputs used are as follows:

(1) Initial core full power (QCR0) - 1.1642e10 British thermal unit (BTU) per hour = 3,411 MWt
(2) Average effective irradiation time (TIRRAD) – 26,280 hours
(3) Ratio of the capture cross section to the total macroscopic fission cross-section (FALPHA) - 1.3
(4) Ratio of the capture cross section of U-238 to the total macroscopic absorption cross section (FCR) - 0.323
(5) Average fuel exposure (or burnup) at time of reactor shutdown (EXPO) – 23,682.5 megawatt-days per metric ton of uranium (MWD/MTU)
(6) Fuel initial enrichment (ENRCH) - 0.026
(7) Fission power fraction of U-235 and PU-241 (FQFISS(1)) - 0.5
(8) Fission power fraction of Pu-239 (FQFISS(2)) - 0.42
(9) Fission power fraction of U-238 (FQFISS(3))- 0.08

The licensee further stated that no specific inputs were utilized to increase core thermal power or to include additional uncertainties such as the ANS 5.1-1979 +2 sigma uncertainty. The decay heat calculation for this model is based on a nominal reactor operating power (3,411 MWt), an end-of-life burn-up (23,682 MWD/MTU) and a long operating time (approximately 3 years) for the core. The use of an end-of-cycle burn-up and a long operating time results in higher inventories of long-lived radioisotopes and a correspondingly higher calculated decay heat output. The use of the other inputs listed above is reasonable for use in the AFW usage evaluation discussed above. The overall fuel enrichment has no direct impact on the calculated decay heat and the selection of the fission power is relatively insensitive to fission power fractions selected above. As such, small variations in these inputs would not be expected to significantly affect the calculated decay heat output.

The licensee further stated that the use of the calculated decay heat without an additional penalty or reactor power uncertainty results in a best-estimate value for the amount of water required by the AFW system for the cooldown of the RCS. The best-estimate water consumption rate will be slightly lower than if the consumption rate had factored in an additional uncertainty value. Application of additional uncertainties would increase the AFW consumption rate and reduce the amount of time to exhaust AFW by a corresponding amount.

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

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 pages 5 through 7 in the section of its Integrated Plan in regards to key site assumptions to implement NEI 12-06 strategies, the licensee listed assumptions in its analysis. The Integrated Plan stated that the following initial conditions are to be applied:

(1) 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.
(2) All installed sources of emergency onsite alternating current (ac) power and station blackout (SB0) alternate ac power sources are assumed to be not available and not imminently recoverable.
(3) 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.
(4) Normal access to the ultimate heat sink (UHS) is lost, but the water inventory in the UHS remains available and robust piping connecting the UHS to plant systems remains intact. The motive force for UHS flow, i.e., pumps, is assumed to be lost with no prospect for recovery.
(5) Fuel for FLEX equipment stored in structures with designs that are robust with respect to seismic events, floods and high winds and associated missiles, remains available.
(6) Permanent plant equipment that is contained in structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles, are available.
(7) Other equipment, such as portable ac power sources, portable back up direct current (dc) power supplies, spare batteries, and equipment for 10 CFR 50.54(hh)(2), may be used provided it is reasonably protected from the applicable external hazards in accordance with NEI 12-06, Sections 5 through 9 and Section 11.3 and has predetermined hookup strategies with appropriate procedures/guidance and the equipment is stored in a relative close vicinity of the site.
(8) Installed electrical distribution system, including inverters and battery chargers, remain available provided they are protected consistent with current station design.
(9) No additional events or failures are assumed to occur immediately prior to or

during the event, including security events.

(10) Reliance on the fire protection system ring header as a water source is acceptable only if the header meets the criteria to be considered robust with respect to seismic events, floods, and high winds, and associated missiles.

The baseline assumptions included in the Integrated Plan include the entire relevant baseline assumptions assumed in NEI 12-06, Sections 3.2.1.2, 3.2.1.3, 3.2.1.4, and 3.2.1.5.

The Integrated Plan, on pages 5 through 7, did not include a listing of the initial plant parameters and assumptions used within the code analyses. Because the codes and assumptions used in these analyses can greatly influence the sequence of events and various time constraints, it is important that the input parameters to these analyses appropriately reflect the initial plant conditions and assumptions.

During the audit the licensee stated that they plan to install low leakage/shut-down RCP seals. As demonstrated and discussed in WCAP-17601-P, Section 5.7.1, the installation of low leakage RCP seals limits the rate of RCS mass loss such that inventory related complications were not analyzed to occur within the first week of the initiating event. A representative ELAP response for a 4-loop Westinghouse designed NSSS with RCP shut-down seals (1 gpm of leakage per RCP) is provided in WCAP-17601-P, Section 5.7.1. The assumptions supporting the 4-loop RCP shut-down seal NOTRUMP case are consistent with assumptions provided in WCAP-17601-P, Sections 4.2.1 and 4.2.2, with the exception of those related to the cooldown and depressurization evolution and the seal leakage flow rates associated with traditional RCP seal packages. These assumptions are applicable to DCPP. The NOTRUMP computer code used for this demonstration is the same as that used for all of the Westinghouse NSSS designed plant analyses presented in WCAP-17601-P.

During the audit the licensee stated that it used the MAAP code in performing its ELAP analyses. Aspects of the MAAP code analyses, such as boundary conditions, nodalization, and the selection of code options for modeling key physical phenomena, were not discussed in the Integrated Plan. Understanding of these issues is necessary when assessing the technical adequacy of the code and determining the code's range of applicability. This item is identified as Open Item 3.2.1.4.A, in Section 4.1.

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

3.2.1.5 Monitoring Instrumentation and Controls

NEI 12-06, Section 3.2.1.10 states in part:

> The parameters selected must be able to demonstrate the success of the strategies at maintaining the key safety functions as well as indicate imminent or actual core damage to facilitate a decision to manage the response to the event within the Emergency Operating Procedures and FLEX Support Guidelines or within the SAMGs. Typically these parameters would include the following:

- SG Level
- SG Pressure
- RCS Pressure
- RCS Temperature
- Containment Pressure
- SFP Level

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

On pages 18, 20, and 28 of the Integrated Plan regarding maintaining RCS core cooling & heat removal during Phase 1, Phase 2, and Phase 3, the licensee listed the installed instrumentation credited during an ELAP. The licensee also stated that for the instruments listed, the normal power source and long-term power source are the 125-Vdc vital batteries and include the following parameters:

(1) SG wide range level or narrow range level with AFW flow indication
(2) SG pressure
(3) CST level (listed for Phase 1 only)

On pages 33, 34, 35, and 39 of the Integrated Plan regarding maintaining RCS inventory control during Phase 1, Phase 2, and Phase 3, the licensee listed the installed instrumentation credited during an ELAP. The licensee also stated that for the instruments listed, the normal power source and long-term power source are the 125-Vdc vital batteries and include the following parameters:

(1) Core exit thermocouple (CET) temperature
(2) RCS hot leg temperature (T hot) if CETs not available
(3) RCS cold leg temperature (Tcold)
(4) RCS wide range temperature
(5) Wide range accumulator level indication (RCS passive injection level)
(6) Pressurizer level
(7) Reactor vessel level indicating system (RVLIS) (backup to pressurizer level)
(8) Neutron flux

On page 41, 42, and 44 of the Integrated Plan, the licensee listed containment pressure and containment temperature as key instruments available for Phase 1, 2, and 3 for maintaining containment. On page 5 of the six-month update to the Integrated Plan (August 2013), the licensee stated it "Deleted containment temperature as a key containment parameter to be monitored during all phases, which is consistent with NEI 12-06, Section 3.2.1.10." The review sought to understand why DCPP did not need to include containment temperature since containment seals and other equipment are temperature-sensitive, and containment temperature is a key to anticipating containment failure.

During the audit, the licensee stated that containment temperature instruments are design class II, are not seismically qualified, and are not powered by vital buses. Containment temperature is listed in the PWROG Generic FLEX Support Guidelines and Interfaces list of recommended instruments with a recommended timeframe of plant specific and to-be-determined. If the temperature elements and related equipment survive the BDB event, the instruments could be read using portable equipment including a 120-V generator to power the elements and a

multimeter to read the instrument output. Procedures will be revised to provide guidance on how to read these instruments, if available and required. Containment seals and other safety-related equipment located inside containment are environmentally qualified for a design basis loss-of-coolant accident and main steam line break inside containment. Peak temperatures in these accidents exceed 250 degrees F. In the ELAP scenario, containment temperature will increase very slowly as a majority of the decay heat being generated will be removed by the SGs. PG&E will be installing the Westinghouse SHIELD RCP shutdown seals, so RCS leakage will be minimal. Therefore, it is unlikely that containment integrity and other safety-related equipment will be affected by adverse temperatures.

The licensee's 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 planned.

3.2.1.6 Sequence of Events

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

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

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

The SOE is discussed in the Integrated Plan on pages 10 to 14 and in Attachment 1A on pages 69 through 73. On page 10 of the Integrated Plan, the licensee stated that the time constraints listed in Attachment 1A are derived from analysis requirements. The times stated are taken to be the time constraint by which the action must be completed. The elapsed time to perform activities listed in Attachment 1A are estimates based on simulator runs and input from licensed operators.

The plan identifies 22 time constraints that must be met, based on analysis.

On page 9 of the Integrated Plan, in the section on assumptions specific to the site, the licensee stated that to perform time sensitive FLEX actions, required staffing levels will be verified by performing walkthrough, table tops, and simulations of identified FLEX strategies.

On pages 70 through 73 in the Integrated Plan, the licensee listed elapsed times and time constraints in different columns in Attachment 1A, which lists the SOE Timeline. The review

determined that the times listed in the elapsed times column and the time constraint column often are the same. As depicted this provides no margin between the elapsed time and the time constraint time. This table provides no guidance on how early a step must be begun to meet the time constraint, does not state when the licensee actually expects to begin performing the step, and therefore provides no information on what margin exists for these critical actions and whether the times can be reasonably met. This item is identified as Confirmatory Item 3.2.1.6.A, in Section 4.2.

The Integrated Plan did not Identify the non-safety related installed systems or equipment that are credited in establishing ELAP mitigation strategies. During the audit the licensee stated that the licensee does not credit any non-safety related installed equipment in establishing ELAP mitigation strategies with the exception of the seismically-evaluated raw water reservoir, which is discussed in Section 3.2.4.7 in this technical evaluation.

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

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

During the audit the licensee stated that DCPP strategies will be developed consistent with the NEI position paper addressing mitigating strategies in shutdown and refueling modes.

The licensee's 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 and 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.

On page 12 of the Integrated Plan, the licensee specifies that within 8 hours after an ELAP, operators will initiate depressurization of the SGs to achieve RCS cooldown and depressurization. The licensee stated that this allows sufficient time for RCS depressurization prior to when borated makeup must be started for maintaining sub-criticality at the most limiting core conditions.

Cooldown of the RCS will result in a decrease in loss of the RCS inventory from RCP seal leakages, and, in turn, an increase in available time for the operator to take action and maintain the core covered with water. In the presence of a negative moderator temperature coefficient, the cooldown by steaming through the ADVs increases positive reactivity in the core. If the control rod worth from the inserted control rods following a reactor trip and the boron concentration from the safety injection is not sufficient to overcome the positive reactivity addition from the cooldown, the reactor will return back to power. As a result of the power increase and RCS pressure decrease, the calculated departure from nucleate boiling ratios (DNBRs) may decrease, possibly causing fuel damage.

On page 34 of the Integrated Plan, in the section for RCS inventory control during Phase 2, the licensee stated that for boration, an ERCS pump would be required to be deployed and capable of injecting borated water into the RCS at approximately 16 hours after the ELAP to conservatively ensure that subcriticality is maintained in the core when borated water is supplied from the BAST

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

The PWROG submitted a position paper, dated August 15, 2013 (withheld from public disclosure due to proprietary content), which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlined applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available. In an endorsement letter dated January 8, 2014 (ADAMS Accession No. ML13276A183), the NRC staff concluded that the August 15, 2013, position paper constitutes an acceptable approach for addressing boric acid mixing under natural circulation during an ELAP event, provided that the following additional conditions are satisfied:

(1) The required timing for providing borated makeup to the primary system should consider conditions with no reactor coolant system leakage and with the highest applicable leakage rate for the reactor coolant pump seals and unidentified reactor coolant system leakage.

(2) For the condition associated with the highest applicable reactor coolant system leakage rate, two approaches have been identified, either of which is acceptable to the staff:

a. Adequate borated makeup should be provided such that the loop flow rate in two-phase natural circulation does not decrease below the loop flow rate corresponding to single-phase natural circulation.

b. If loop flow during two-phase natural circulation has decreased below the single-phase natural circulation flow rate, then the mixing of any borated primary makeup added to the reactor coolant system is not to be credited until one hour after the flow in all loops has been restored to a flow rate that is greater than or equal to the single-phase natural circulation flow rate.

(3) In all cases, credit for increases in the reactor coolant system boron concentration should be delayed to account for the mixing of the borated primary makeup with the reactor coolant system inventory. Provided that the flow in all loops is greater than or equal to the corresponding single-phase natural circulation flow rate, the staff considers a mixing delay period of one hour following the addition of the targeted quantity of boric acid to the reactor coolant system to be appropriate.

At the time the audit was conducted, the licensee had neither (1) committed to abide by the generic approach discussed above, including the additional conditions specified in the NRC's endorsement letter, nor (2) identified an acceptable alternate approach for justifying the boric acid mixing assumptions in the analyses supporting its mitigating strategy. As such, resolution of this concern for DCPP is identified as Open Item 3.2.1.8.A in Section 4.1.

The licensee's approach described above, as currently understood, has raised concerns which must be addressed before confirmation can be provided that the approach is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01, such that there would be reasonable assurance that the requirements of Order EA-12-049 will be met with respect to core sub-criticality. These concerns are identified as Open Item 3.2.1.8.A above and in Section 4.1.

3.2.1.9 Use of Portable Pumps

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

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

plant specific analysis to ensure sufficient quantities are available as well as to address delivery capabilities.

NEI 12-06 Section 11.2 states in part:

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

There are numerous references in the Integrated Plan on the use of portable pumps, hoses, pipe runs, and connection hardware to facilitate the implementation of coping strategies. However, there was insufficient information regarding calculations and analyses to verify adequate flow would be delivered to meet strategy objectives.

During the audit the licensee stated that the estimated elapsed time between the beginning of an ELAP event and when the pumps are installed, and the time constraints for each pump are listed below:

i. Emergency auxiliary feedwater (EAFW) pump
Elapsed time: 24 hours
Required time: 31 hours
ii. Raw water reservoir (RWR) supply pump
Elapsed time: 24 hours
Required time: 31 hours
iii. Emergency reactor coolant system (ERCS) makeup pump
Elapsed time: 14 hours
Required time: 16 hours
iv. Emergency spent fuel pool (ESFP) makeup pump
Elapsed time: 48 hours
Required time: 67 hours
v. Emergency auxiliary salt water (EASW) pump
Elapsed time: >72 hours
Required time: 105 hours

The licensee further stated that PG&E Calculation STA-294, Revision 3, determines the required pump flow rate and corresponding head for the EAFW pump, RWR supply pump, ERCS makeup pump, and ESFP pump. PG&E Calculation STA-286, Revision 0, determines the required pump flow rate and corresponding head for the EASW pump. All assumptions, design inputs, and methods of analysis are discussed in their respective sections in the calculations. During the audit the licensee stated that the EAFW pump is sized to provide adequate feedwater flow to remove decay heat at 1 hour after reactor trip and has adequate head assuming a plant cooldown has occurred per current station blackout (SBO) EOPs. As determined in PG&E Calculation RE-20111111, Revision 1, the required time for the EAFW pump to be in service does not occur until 24 hours into the event at which time the decay heat and SG pressure will be substantially lower than the design capacity. The RWR supply pump is sized to provide 100 percent flow required for core cooling at 1 hour after reactor trip, as discussed above, and SFP makeup for both units simultaneously. The RWR pump is not required to be in service until 24 hours into the event, at which time the core cooling heat removal and SFP makeup requirements will be substantially lower than the RWR supply pump

design capacity.

The licensee further stated that the ERCS makeup pump is sized to provide adequate boration within 24 hours to maintain sub-criticality and has adequate head assuming a plant cooldown has occurred per current SBO EOPs as well as taking into account potential voiding of the reactor vessel head. As described in Westinghouse calculation note CN-FSE-13-2-NP, the required time for the ERCS pump to be in service was determined by requiring all boration to occur within the period that xenon is above equilibrium, which is approximately 24 hours after reactor trip. The most limiting condition at end of core life requires injection of approximately 4,500 gallons of 7,000 parts per million (ppm) borated water which, at an injection flow rate of 10 gpm, takes 7.5 hours. Therefore, injection is required to begin no later than 16 hours after reactor trip. The ESFP makeup pump is sized to provide adequate makeup/spray to the SFP assuming a full hot core offload and has adequate head to overcome the static head required to reach the SFP. In the scenario where a full core offload has occurred, then resources would be directed to expedite the deployment of the ESFP makeup equipment. The EASW pump is sized to provide adequate flow through the saltwater side of the CCW heat exchanger to bring the unit to cold shutdown and has adequate head to reach the CCW heat exchanger. As described in Westinghouse calculation note CN-SEE-I-13-25, the EASW pump is capable of cooling the RCS from 350 to 200 degrees F starting as early as 24 hours after an ELAP event, although the current strategy does not require its use until 105 hours.

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

3.2.2 Spent Fuel Pool Cooling Strategies

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

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

NEI 12-06, Section 3.2.1.1 provides the acceptance criterion for the analyses serving as the technical basis for establishing the time constraints for the baseline coping capabilities

described in NEI 12-06, which provide an acceptable approach to meeting the requirements of EA-12-049 for maintaining SFP cooling. This criterion is keeping the fuel in the SFP covered.

On page 45 of the Integrated Plan, the licensee stated that in accordance with NRC Order EA-12-051, PG&E will be installing reliable wide-range SFP instrumentation to monitor the SFP level.

On page 45 of the Integrated Plan, the licensee stated that access to the SFP area as part of the Phase 2 response could be challenged due to environmental conditions near the pool. If the air environment in the SFP area requires the building to be ventilated, doors will be opened and any other actions required inside the FHB should be completed before boiling occurs.

On page 45 of the Integrated Plan, the licensee stated that for the post refueling decay heat load and considering the results of the sloshing evaluation, boiling in the SFP will occur at approximately 13 hours at DCPP. Boil off decreases the water level to 10 feet above the fuel in approximately 67 hours. For the maximum design heat load and considering the results of the sloshing evaluation, boiling in the SFP will occur at approximately 6 hours. It is estimated to take 30 hours to boil off SFP inventory to decrease the SFP water level to 10 feet above the fuel, where 10 feet of water above the top of the fuel provides adequate radiation shielding for a person standing on the SFP operating deck.

On page 47 of the Integrated Plan in regards to maintaining SFP cooling during the Phase 2, the licensee stated that to maintain SFP cooling and inventory in each unit, a portable ESFP pump will be capable of providing sufficient makeup assuming the design basis heat load. The assumed heat load is with the SFP full, including a recent full core offload. A portable diesel-driven RWR pump, capable of supplying water for all coping strategies simultaneously, will supply water through flexible hoses to a portable FLEX suction header. Each of the ESFP pumps will draw water from the portable FLEX suction header and inject water directly into the top of the associated SFP through flexible hoses. The end of the hoses will be restrained at the edge of the pool to ensure that they remain capable of makeup to the pool. Due to potential accessibility concerns, the ESFP hoses and portable spray monitor nozzles will be deployed prior to bulk boiling of the SFP. In addition the licensee stated that two portable spray monitor nozzles for each Unit will be available to provide spray capability. These spray monitor nozzles will be stored in a FLEX storage facility, and will be attached to the same hoses provided to the pool and supplied by the same pumps discussed above. A redundant set of portable spray monitor nozzles will be stored in a FLEX storage facility.

On page 52 in its Integrated Plan in regards to maintaining SFP cooling during Phase 3, the licensee stated that as discussed in the maintain core cooling and heat removal during Phase 3, it is expected that one 4-kV generator, for each Unit, will be used to repower one train of RHR and CCW for that Unit. Additionally, an EASW pump will be used to restore the UHS function. The Phase 3 strategy is also to repower an SFP cooling pump, which will provide indefinite heat removal.

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

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. One of these acceptable approaches is by analysis.

On page 41 of its Integrated Plan regarding maintaining containment during Phase 1, the licensee stated that it will perform a containment evaluation based on the boundary conditions described in NEI 12-06, Section 2. Based on the results of this analysis, the licensee will develop required actions to ensure maintenance of containment integrity and required instrument function.

On page 42 of its Integrated Plan regarding maintaining containment during Phase 2, the licensee stated that no additional strategy for Phase 2 is required, and referred readers to Phase 1 for a description. Once the analysis for Phase 1 was complete, the NRC staff requested verification if any actions will be required for Phase 2 to ensure the containment remains within temperature and pressure limits.

During the audit the licensee stated that PG&E calculation RE-20111111, "Coping Time Estimates for IER L1-11-4, Item 1", Rev. 1, evaluates, in part, the response of containment pressure to an ELAP event. The MAAP4 model used in the calculation assumes an initial RCS leakage rate of 84 gpm, which decreases after RCS depressurization. This is conservative because DCPP will be installing the Westinghouse SHIELD RCP shutdown seals that will significantly reduce the seal leakage rate compared to that assumed. The calculation concludes that the containment pressurization rate after RCS depressurization is approximately 2 psig every 3 days. At this rate, it would take over 30 days to reach the containment design pressure of 47 psig. From this, DCPP concludes that no actions will be required to protect containment integrity during Phase 2 from overpressure. For the shutdown modes, DCPP will be following industry guidance as it is developed. DCPP will be developing its strategies in accordance with the shutdown modes whitepaper. The licensee stated that further information will be submitted in a future six-month update.

On page 44 of its Integrated Plan regarding maintaining containment during the Phase 3, the licensee stated that the RRC will provide a portable diesel-driven 4-kV generator for each Unit with the capability to supply 2 megawatts (MW) electric. Each 4-kV generator will be used to repower one train of RHR and CCW in a Unit and will also repower one containment fan cooler unit (CFCU) for containment cooling.

The licensee's 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 planned.

3.2.4 Support Functions

3.2.4.1 Equipment Cooling – Cooling Water

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

> *Plant procedures/guidance should specify actions necessary to assure that equipment functionality can be maintained (including support systems or*

alternate method) in an ELAP/LUHS or can perform without ac power or normal access to the UHS.

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

On page 27 of the Integrated Plan in regards to maintaining core cooling and heat removal in Phase 3, the licensee stated the Phase 3 strategy is to maintain core cooling by using the RHR system. Two portable diesel-driven EASW pumps, one for each Unit, and rigid piping segments will be used to restore the UHS function. The piping segments will be connected to the ASW piping. The flow from the EASW pump will provide cooling water to the CCW heat exchangers. The Integrated Plan did not address if the RHR pump is cooled by CCW and did not address whether the emergency pumps for Phases 2 and 3 and the TDAFW pump are self-cooled. During the audit the licensee stated that pumps for Phases 2 and 3 will be self-cooling or air-cooled and will require support cooling, while the emergency saltwater pumps are self-cooling and will not require support cooling. In addition, the licensee stated that the TDAFW pump is self-cooled and provides cooling from its discharge to the governor and bearing heat exchangers. The water is recirculated to the TDAFW pump suction line. The TDAFW pump recirculation line and steam drains are safety-related seismically-qualified Category I, and remain functional throughout the use of the TDAFW pump.

In the six-month update to the Integrated Plan (August 2013), the licensee clarified in regards to maintaining spent fuel pool cooling in Phase 3, that it is expected that each 4-kV generator set will be used to repower one train of cooling in a unit, which includes one CCW pump, one RHR pump, and any 480-V loads required to support repowering for that unit. The Maintain Spent Fuel Pool Cooling Phase 3 strategy is to repower an SFP cooling pump.

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

3.2.4.2 Ventilation – Equipment cooling

NEI 12-06, Section 3.2.2, Guideline 10 provides that:

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

ELAP procedures/guidance should identify specific actions to be taken to ensure that equipment failure does not occur as a result of a loss of forced ventilation/cooling. Actions should be tied to either the ELAP/LUHS or upon reaching certain temperatures in the plant. Plant areas requiring additional air flow are likely to be locations containing shutdown instrumentation and power supplies, turbine-driven decay heat removal equipment, and in the vicinity of the

> inverters. These areas include: steam driven AFW pump room, …, the control room, and logic cabinets. Air flow may be accomplished by opening doors to rooms and electronic and relay cabinets, and/or providing supplemental air flow.
>
> Air temperatures may be monitored during an ELAP/LUHS event through operator observation, portable instrumentation, or the use of locally mounted thermometers inside cabinets and in plant areas where cooling may be needed. Alternatively, procedures/guidance may direct the operator to take action to provide for alternate air flow in the event normal cooling is lost. Upon loss of these systems, or indication of temperatures outside the maximum normal range of values, the procedures/guidance should direct supplemental air flow be provided to the affected cabinet or area, and/or designate alternate means for monitoring system functions.
>
> For the limited cooling requirements of a cabinet containing power supplies for instrumentation, simply opening the back doors is effective. For larger cooling loads, such as … AFW pump rooms, portable engine-driven blowers may be considered during the transient to augment the natural circulation provided by opening doors. The necessary rate of air supply to these rooms may be estimated on the basis of rapidly turning over the room's air volume.
>
> Actuation setpoints for fire protection systems are typically at 165-180°F. It is expected that temperature rises due to loss of ventilation/cooling during an ELAP/[LUHS] will not be sufficiently high to initiate actuation of fire protection systems. If lower fire protection system setpoints are used or temperatures are expected to exceed these temperatures during an ELAP/[LUHS], procedures/guidance should identify actions to avoid such inadvertent actuations or the plant should ensure that actuation does not impact long term operation of the equipment.

On page 13 of the Integrated Plan, in the section listing time constraints identified in Attachment 1A, the Licensee stated it would establish battery room ventilation by 24 hours after an ELAP since battery room cooling/ventilation must be started when battery charging begins.

On page 53 of the Integrated Plan, in the section on safety functions support for Phase 1, the licensee stated that the ventilation strategy includes propping open the control room doors within the first hour.

On page 55 of the Integrated Plan, in the section on safety functions support for Phase 2, the licensee stated that three 120/240-V portable diesel-driven generators and associated electrical connection cables will be available to power miscellaneous loads (portable lighting, ventilation, etc.) as needed. Although not credited for FLEX, miscellaneous portable ventilation fans and ac powered portable lights that can be powered by these generators are available at the site to support area ventilation, if needed.

The licensee's plan for ventilation cooling as it relates to equipment protection 1) did not provide specific information on why opening an outside door to the control room during an extreme heat event constitutes adequate cooling, and 2) did not address the potential effect of high temperatures on equipment in logic cabinets or the control room as is called for in NEI 12-06, Section 3.2.2.

During the audit the licensee stated that the PG&E calculation STA-295, “GOTHIC Evaluation of Heat Removal through Natural Convection in the Battery Charger/Inverter Room, Battery Room and Control Room”, Revision 0 evaluates the effectiveness of natural convection in cooling various rooms of the plant including the control room. This analysis assumes the outside temperature is a constant 78 degrees F. PG&E calculation HVAC 83-7, “Outside Air Design Temperature for Cooling Calculations”, Revision 1, evaluates historical temperature data to determine what air temperature should be used for cooling calculations. The calculation determines that, on average, DCPP experiences a dry bulb temperature of 78 degrees F or greater for approximately 9 hours per year, 81 degrees F or greater for 3.5 hours per year, and 85 degrees F or greater for 1.5 hours per year. The licensee stated that while the Integrated Plan on page 4 states that the highest hourly temperature recorded at DCPP through the year 2000 was 97 degrees F, based on the conclusions of HVAC 83-7, it is very unlikely for the event to occur concurrent with a temperature exceeding 78 degrees F. Therefore, the conclusions of STA-295 are valid concerning anticipated control room temperatures using natural convection to remove heat. In the unlikely event that an extended loss of ac power event occurs coincident with an extreme temperature event, ventilation fans powered by portable diesel generators (DGs) can be used.

The Integrated Plan did not state if the ventilation path in the battery rooms was different than the design basis path, did not discuss what criteria would be used to determine if hydrogen buildup required forced ventilation, and did not discuss how hydrogen concentrations would be measured during an ELAP event.

During the audit the licensee stated that PG&E calculation HVAC 83-46, “Battery Rooms Exhaust During a LOOP and/or Loss of Class II Ventilation System”, Revision 0, evaluates the effectiveness of the plant’s ventilation ducts of removing hydrogen from the battery rooms using only natural ventilation. The calculation concludes that, under both design basis summer and winter conditions, with airflow only through the supply and exhaust vents with no fans running, there is sufficient natural ventilation to maintain the battery rooms at a hydrogen concentration of less than 1 percent by volume with no operator action. This is conservative since the doors would be opened following an ELAP, providing additional ventilation. PG&E calculation STA-295, “GOTHIC Evaluation of Heat Removal through Natural Convection in the Battery Charger/Inverter Room, Battery Room and Control Room”, Revision 0, evaluates the effectiveness of natural convection in cooling various areas of the plant including the battery rooms. STA-295 concludes that opening the doors as described in the calculation will maintain the room temperature below the manufacturer’s recommended maximum temperature. In the unlikely event that an ELAP event occurs coincident with an extreme temperature event that exceeds the assumed values of STA-295, ventilation fans powered by portable DGs can be used to provide forced ventilation. If an ELAP were to occur concurrent with outside conditions nearing extreme low temperatures, as discussed in the DCPP UFSAR, Section 2.3.2.2.2, and having the doors open begins to challenge the minimum battery electrolyte temperature of 60 degrees F, the doors will be closed.

NEI 12-06, Section 3.2.1.8 states that the effects of loss of HVAC in an ELAP event can be addressed consistent with NUMARC 87-00 or by plant-specific thermal hydraulic calculations, e.g., GOTHIC calculations. NEI 12-06, Section 3.2.2 Item 2 states in part that plant procedures/guidance should recognize the importance of AFW during the early stages of the event and direct the operators to invest appropriate attention to assuring its initiation and continued, reliable operation during the transient.

On page 13 of the Integrated Plan, the licensee implies that core cooling and heat removal will be dependent on continued operation of the TDAFW pump for up to 30 hours. In addition, the Integrated Plan indicates the TDAFW pump and 10-percent steam dump valves will be manually controlled. The industry standard for the maximum temperatures tolerated in an easy work environment is given in NUMARC 87-00 guidance. At other stations, calculations have determined that the TDAFW pump room would heat up to 123 degrees F during the first hour of the SBO coping period and remain below 125 degrees F during the initial 24 hours. The Integrated Plan did not discuss the temperature in the TDAFW room and the steam dump valve room(s) following an ELAP event; did not discuss any cliff-edge effects associated with temperature including the TDAFW pump and the steam dump valve room(s), its controls, or other equipment in the room that could have a negative effect on the ability of the TDAFW pump and the steam dump valves to deliver reliable flow to the SGs not only in the first 24 hours, but also for an extended and indeterminate period; did not specify whether the initial temperature condition assumed the worst-case outside temperature with the plant operating at full power; and did not provide the list of electrical components that are located in the TDAFW pump room that are necessary to ensure successful operation of the pump.

During the audit the licensee stated that PG&E calculation M-912, “HVAC Interactions for Safe Shutdown, Room Heat-up Due to Loss of HVAC,” in part, evaluates the effects of loss of ventilation in the TDAFW pump room. This analysis is conservative when compared to an ELAP as it assumes that one motor-driven AFW pump is also running, most electrical loads are energized, all but one door is closed, and that there are additional heat loads from adjacent rooms. The calculation concludes that the room will reach a temperature of approximately 153 degrees F at 36 hours into the event and approximately 166 degrees F at 72 hours into the event. PG&E calculation M-911, “Evaluation of Safe-Shutdown Equipment Operability during Loss of HVAC,” evaluates the effects of loss of ventilation on equipment relied upon for safe shutdown, including the TDAFW pump. It concludes that the operation of the TDAFW pump is not a concern at temperatures below 180 degrees F. Therefore, the TDAFW pump is expected to be able to meet its required operation time of approximately 30 hours without any impact by elevated temperature.

The licensee further stated that associated electrical equipment including instrumentation and valve actuators in the AFW pump room are qualified to operate in harsh environments resulting from an auxiliary steam line break as analyzed in PG&E calculation EZ-002, “Environmental Qualification Requirements.” However, these will not be relied upon during an ELAP as the pump and valves will be controlled manually and monitored using SG level instrumentation. All four steam dump valves in each unit are located outside and are therefore not susceptible to high temperatures caused by the event. All four AFW SG level control valves in each unit are located either outside or in penetration areas that are open to the outside air and are therefore not susceptible to high temperatures caused by the event.

The licensee further stated that it is not anticipated that operators will need to enter the TDAFW pump room to perform any manual operator actions. Therefore, no operator actions will be impacted by the increased room temperature as the event progresses. All four steam dump valves in each Unit are located outside and are therefore not susceptible to high steam temperatures. All four AFW SG level control valves in each Unit are located either outside or in penetration areas that are open to the outside air and are therefore not susceptible to high temperatures caused by the event.

Additional discussion on the elevated temperatures in the TDAFW pump room in regards to personnel habitability in an elevated temperature is contained in Section 3.2.4.6.

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

3.2.4.3 Heat Tracing

NEI 12-06, Section 3.2.2, Guideline 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.

The licensee did not address the loss of heat tracing in the Integrated Plan. During the audit the licensee stated that the licensee has decided, as a prudent measure, to consider a minimum design temperature of 24 degrees F. As a result, the effect of the lower temperature on the BASTs is being re-evaluated. The results will be provided in the next six-month update. This item is 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 tracking, if these requirements are implemented as described.

3.2.4.4 Accessibility – Lighting and Communications

NEI 12-06, Section 3.2.2, Guideline 8 provides that:

> *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.

Lighting

On page 53 of the Integrated Plan regarding safety functions support for Phase 1, the licensee stated that various areas of the plant including the control room are equipped with emergency backup lighting, which is verified to be capable of illumination for at least 8 hours.

On page 55 of the Integrated Plan regarding safety functions support during Phase 2, the licensee stated three 120/240-V portable diesel-driven generators and associated electrical connection cables will be available to power miscellaneous loads, including portable lighting, as needed. Portable battery operated lights will be available for deployment in various areas (control room, technical support center/operational support center, SFP, etc.) as necessary.

On page 69 of the Integrated Plan, the licensee lists control room portable lighting as being available for 8 hours, with personal lighting available in the control room.

The licensee's Integrated Plan for use of portable lighting to support FLEX strategy implementation lacked a discussion on areas requiring access for instrumentation monitoring or equipment operation and the lighting needs for these areas. The Integrated Plan: 1) did not identify the portable lighting needed for use in the main control room following an ELAP as well as portable lighting needed in other parts of the plant (consider that the ELAP may occur during or extend into night time hours.) and 2) did not identify the length of time the battery voltage will remain adequate in the portable lighting to provide needed lumens. During the audit the licensee stated that areas of the plant that will need to be accessed for instrumentation monitoring or equipment operation include the pipe racks, auxiliary buildings, fuel handling buildings, turbine buildings, and the main control room. Seismically-qualified (Hosgri), 10 CFR 50, Appendix R battery-operated lights (BOLs) are located in the areas that require equipment operation or instrumentation monitoring. In addition, operators dispatched into the plant to perform these actions will be provided headlamps, flashlights, and battery-operated lanterns. The main control room is equipped with 10 CFR 50, Appendix R BOLs that are seismically qualified (Hosgri) and will function following a seismic event. In addition, portable lighting will be available to supplement the installed BOLs. Control room operators will also have headlamps and flashlights available.

Communication

The NRC staff has reviewed the licensee communications assessment (ADAMS Accession Nos. ML12305A427 and ML13053A203) in response to the March 12, 2012 50.54(f) request for information letter for DCPP and, as documented in the staff analysis (ADAMS Accession No. ML13154A007) has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by the licensee will conform to the guidance of NEI 12-06 Section 3.2.2 (8) regarding communications capabilities during an ELAP. Confirmation of the proposed communications enhancements has been identified as Confirmatory Item 3.2.4.4.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 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.

The Integrated Plan did not discuss the effects of loss of ac power on access and any plans/procedures for addressing such issues. During the audit the licensee stated that locked security doors can be operated manually with keys that are located in the control room and at the access control near the radiation protection foreman's office and is controlled by a security procedure. Security also has the option of posting a guard at security doors that are out of service. Other security features, such as vehicle barriers, can be manually operated to facilitate equipment entrance into the protected area (PA). A security procedure for operational emergencies provides for access to the site and the PA. Communications between operations and security will be maintained via handheld radios.

The licensee's 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 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 3.2.1.9, states that areas requiring personnel access should be evaluated to ensure that conditions will support the actions required by the plant-specific strategy for responding to the event.

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 11 of the Integrated Plan, the licensee stated that doors to control room and battery charger/inverter rooms are to be blocked open at least 1 hour after an ELAP event to limit temperature build-up and habitability concerns

On page 12 of the Integrated Plan, the licensee stated that the doors are opened in the FHB for ventilation and to facilitate deployment of equipment used in the SFP makeup strategies. Should bulk boiling of the SFP occur prior to deployment of SFP makeup equipment, personal protective equipment is available that will allow deployment of equipment in a high temperature and humidity environment.

Review of the Integrated Plan did not disclose a discussion of the accessibility of the SFP equipment room during Phase 2 if the SFP has begun boiling. During the audit the licensee stated that ice vests may also be employed if necessary, to protect the operator from elevated temperatures in the SFP areas. The ice vest storage locations will be equipped with uninterruptable power supplies capable of at least a 24-hour power supply. Since the alternate SFP connection points are not located in an area susceptible to high temperature, humidity, or radiological conditions, they will remain accessible.

The Integrated Plan did not list operator actions needed to control the TDAFW pump and maintain SG levels, or discuss the time it will take operators to perform these functions in the TDAFW pump room, or discuss contingencies if, for example, there is a malfunction during the multi-day performance of the TDAFW pump while it is being operated either automatically or manually. The Integrated Plan did not address ventilation needs and accessibility issues for the TDAFW pump room during an ELAP event, where the TDAFW pump may need to be manually controlled for 30 or more hours.

During the audit the licensee stated that a calculation concludes that the TDAFW pump room will reach a temperature of approximately 153 degrees F at 36 hours into the event and approximately 166 degrees F at 72 hours into the event. PG&E calculation M-911, "Evaluation of Safe-Shutdown Equipment Operability during Loss of HVAC," evaluates the effects of loss of ventilation on equipment relied upon for safe shutdown, including the TDAFW pump. Based on the calculation, the licensee concludes that the operation of the TDAFW pump is not a concern at temperatures below 180 degrees F. Therefore, the licensee stated that TDAFW pump is expected to be able to meet its required operation time of approximately 30 hours without any impact on equipment by elevated temperature. Although the temperatures cited by the licensee exceeds the 110 degrees F criterion, which is the limit discussed in MIL-STD-1472C and NUMARC 87-00, Revision 1, the licensee stated that it does not anticipate operators needing to enter the TDAFW pump room to perform manual actions to control the TDAFW pump.

Although the licensee concludes that it is not anticipated that operators would need to enter the TDAFW pump room to perform manual actions to control the TDAFW pump, that potential need

exists as is demonstrated by the inclusion of a strategy for local manual initiation of TDAFW in NEI 12-06, Table D-1. Information is necessary on the personnel protection measures that would be employed for operator protection, should the need for entry into the TDAFW pump room be necessary following an ELAP. This is identified as Confirmatory Item 3.2.4.6.A in Section 4.2.

In the six-month update to the Integrated Plan (August 2013), the licensee stated that PG&E has determined that RHR suction valves and accumulator isolation valves inside containment that are required to be manipulated to implement Phase 3 strategies will be operated manually, as conditions inside containment following an ELAP event will not preclude personnel entry to allow manual actions to be taken.

The licensee's 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 personnel habitability – elevated temperature, if these requirements are implemented as described.

3.2.4.7 Water Sources

NEI 12-06, Section 3.2.2, Guideline 5 provides that:

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

The licensee addressed water sources for coping strategies in its Integrated Plan for RCS cooling, RCS inventory control, SFP cooling, and safety function support. Makeup flow is

immediately established to the SG during the initial phase of the ELAP strategies.

On page 17 in its Integrated Plan in regards to maintaining core cooling and heat removal during Phase 1 with SGs available, the licensee stated that the initial alignment of the TDAFW pump suction is from the seismically qualified CST for that unit. If necessary, the TDAFW pump suction can then be manually transferred to the seismically qualified firewater storage tank (FWST). The licensee stated that its analysis demonstrates that there is sufficient seismically protected inventory to provide AFW for at least 30 hours after the initiating event

During the audit the licensee stated that the RWR has two sections, each capable of containing 2.5 million gallons of water. During normal operation one section is in service and the other section is isolated to maintain a seismically evaluated source of water. The FLEX Phase 1 and 2 coping time of 105 hours is based on 30 hours of seismically qualified water from the CST and FWST, and an additional 75 hours of seismically evaluated water (1.5 million gallons) being available in the isolated section of the RWR that is not in service. The 105-hour coping time is conservative since the coping time estimate only relied upon 60 percent of the isolated RWR section. In addition, the in-service section of the RWR would be isolated by closing a sluice valve at the RWR as part of the post-seismic plant walkdown, which would result in additional water remaining in the in-service section.

In the six-month update to the Integrated Plan, the licensee clarified that the current strategy is to use the BASTs and RWSTs as the borated water sources for the RCS inventory control/long-term subcriticality function.

On page 7 of 14, in the six-month update to the Integrated Plan (August 2013), the licensee stated that it will not need portable water processing units as it has enough seismically qualified water supplies on site. The licensee did not specify which water sources it now intended to rely upon to provide sufficient inventory.

During the audit the licensee stated that the prioritized list of feedwater sources is as follows:

1. CST - Seismically qualified volume: 222,600 gallons per unit. Normal tank inventory: 300,000 gallons per unit. Expected duration of use: 20.5 hours assuming seismically qualified volume.
2. FWST - Seismically qualified category I (Hosgri)
Seismically qualified volume: 300,000 gallons shared between units.
Minimum tank inventory: 270,000 gallons shared between units.
Expected duration of use: 10.5 hours assuming normal tank volume
3. RWRs - Seismically evaluated (Hosgri)
Seismically evaluated volume: 5,000,000 gallons shared between units.
Normal reservoir inventory: greater than 4,000,000 gallons shared between units
Assumed volume of 1,500,000 gallons shared between units.
Expected duration of use: 75 hours using assumed volume

On page 19 of the Integrated Plan, in the section on maintaining core cooling and heat removal, the licensee stated that the Phase 2 strategy for each unit will be to continue the use of the SGs using a combination of a common diesel-driven RWR pump and an EAFW pump to continue to supply cooling water. The RWR pump will be staged at the RWR. The RWR pump will supply water through flexible hoses to a portable FLEX suction header located at the 115-foot elevation bench area.

The Integrated Plan did not address requirements for the treatment of water from the RWR such that the water will have been adequately treated to remove debris and sediment so the RWR water is useful for decay heat removal via the SGs.

During the audit the licensee stated that the suction hose connected to the RWR pump and dropped into the RWRs will have a strainer. Additional information on the strainer design will be provided in a future six-month update.

On page 27 of the Integrated Plan, in the section on maintaining core cooling and heat removal, the licensee stated that the Phase 3 strategy is to maintain core cooling by using the RHR system. Two portable diesel-driven EASW pumps, one for each unit, and rigid piping segments will be used to restore the UHS function. The rigid piping segments will be connected to the ASW piping in the ASW vacuum breaker vault by removing a spool piece in the ASW piping. The flow from the EASW pump will provide cooling water to the CCW heat exchangers. Removal of the spool piece and installation of riser pipe and flange requires a crane or other heavy lifting equipment. Several of these cranes and forklifts are located onsite. One 4-kV generator for each unit will be used to repower one train of cooling for that unit. This includes an RHR pump and a CCW pump.

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

3.2.4.8 Electrical Power Sources/Isolations and Interactions

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

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

On page 13 in its Integrated Plan in regards to discussion of time constraints associated with Attachment 1A, the Licensee stated that the 480-V generator will be put in service to repower battery chargers within 24 hours of an ELAP event. The 480-V DG repowers a vital dc battery charger on each Unit.

On page 34 of its Integrated Plan, the licensee stated that Phase 2 of the RCS inventory control strategy will utilize 480-V generator located at the 115-ft elevation bench area to power the emergency reactor coolant system (ERCS) pump. The licensee updated the performance criteria design information for these diesel-driven generators to be 49.4 kW.

On page 55 of the Integrated Plan, the licensee stated that Phase 2 maintains dc power for critical dc loads and selected instrument ac loads. A diesel-driven 480-V generator will power a battery charger in each unit and selected critical communication equipment as needed. The generator and associated electrical connection cables will be stored in a FLEX storage facility. A backup generator and associated electrical connection cables will also be stored in a FLEX storage facility. Three 120/240-V portable diesel-driven generators and associated electrical connection cables will be stored in a FLEX storage area. The generators will be available to power miscellaneous loads (portable lighting, ventilation, etc.) as needed.

On page 61 of the Integrated Plan, as clarified in the 6-month update to the Integrated Plan, the licensee stated that for Phase 3 the RRC will provide a portable diesel-driven 4-kV generator for each unit, with the capability to supply 2 MW. Each 4-kV generator will be used to repower one train of cooling in a unit, which includes one CCW pump, one RHR pump, and any required 480-V loads for that unit.

The Integrated Plan did not address the adequacy of the sizing of the portable generators.

During the audit the licensee stated that the FLEX diesel-driven generator support for Phases 2 and 3 is as follows:

> 4.2 to 5.6 kilowatt (kW) load on the 10-kW, 120/240-volt (V) diesel-driven generators
> 191-kW load on a 250-kW, 480-V diesel-driven generator
> 87.4-kW load on a 100-kW, 480-V diesel-driven generator
> 1,012-kW load on a 2,000-kW 4,160-V diesel-driven generator

The licensee referenced three evaluations completed for detailed sizing criteria for the FLEX generators to show that each of the above generators can supply the loads assumed in Phase 2 and 3.

On page 56 of the Integrated Plan, in the section on safety functions support needed for Phase 2, the licensee stated that for the primary connection, the 480-V generator will be connected to a dedicated quick connection point in the vital 480-V switchgear areas. A manual transfer switch installed in the same area will be used to disconnect the normal plant power circuit from the battery charger and align the generator to the charger.

The Integrated Plan did not contain sufficient information on electrical isolations and interactions to determine how the portable FLEX generators and other loads are isolated to prevent simultaneously supplying power to the same bus from different sources.

During the audit the licensee stated that electrical isolation will be maintained such that Class 1E equipment is protected from faults in portable/FLEX equipment by safety-related transfer switches and/or circuit breakers between the safety and portable non-safety related equipment. The Class 1E battery charger is isolated from the FLEX DG though a FLEX load center circuit breaker, which is a PG&E-approved Class 1E isolation device. A transfer switch between the 480-V Class 1E bus and the FLEX power supply ensures that multiple sources cannot power the Class 1E electrical equipment as the transfer switch assures isolation of the load from its normal source prior to connecting the FLEX generator. The safety-related transfer switch is described the licensee's Integrated Plan on page 59. The 4160-V Class 1E bus is protected from the FLEX DG through a safety-related circuit breaker (52HG5) on the 4160-V Class 1E Bus G. The connection to this circuit breaker is made by disconnecting the Class 1E emergency DG field cables from the generator, and connecting them to the FLEX DG output breaker. The Class 1E electrical interlocks in the 4160-V switchgear prevent the closing of a normal power supply circuit breaker while fed from the FLEX DG, preventing multiple sources attempting to power the electrical bus. All protective features of the Class 1E circuit breaker will be evaluated by engineering calculation to adequately protect the bus. Plant procedures will be revised to require that all feeder breakers be isolated from the bus, and all load breakers be disabled (dc switch open) prior to energizing the 4-KV bus with the FLEX DG. This is identified as Confirmatory Item 3.2.4.8.A in Section 4.2.

During the audit the licensee stated that PG&E has established a minimum acceptance criterion for dc bus voltage at 105 V. Design calculation 369-DC, evaluated battery performance under a station blackout event. The calculation determined that 105Vdc provided adequate voltage to required components so that they remain functional. The calculation specifies the minimum device voltage requirements, the voltage available at the device with a 105Vdc battery, and the node voltage at the breaker feeding the device or devices.

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

3.2.4.9 Portable Equipment Fuel

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

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

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

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

On page 73 of the Integrated Plan, the licensee stated that depletion of main fuel oil storage tanks occurs some time beyond 72 hours after an ELAP event occurs.

The licensee's Integrated Plan did not provide or reference a plant specific assessment to ensure sufficient quantities of portable equipment fuel are available as well as to address delivery capabilities.

During the audit the licensee stated that PG&E has performed a preliminary evaluation using equipment that will be similar to the equipment that will be procured for the FLEX strategies. This evaluation concludes that the DCPP has sufficient diesel fuel oil (DFO) in its underground, seismically-qualified (Hosgri) DFO storage tanks to run the Phase 2 FLEX equipment for greater than seven days. Following FLEX equipment procurement, the evaluation will be revised to use the DFO consumption values of the actual FLEX equipment. New DFO will be supplied to the site from an offsite DFO supplier. The DFO will be transported via existing roads if they are passable. The RRC has the capability to airlift DFO via helicopter to the site. In addition, PG&E has a memorandum of agreement with a company to obtain additional DFO via a barge. New DFO for the portable pumps, generator, and other uses will be analyzed for water and sediment. This analysis will be performed either onsite using existing chemistry laboratory equipment powered by a portable 120/240-V DG if site power is unavailable, offsite prior to delivery to the site by the DFO supplier, or by a visual Clear and Bright test on site if water and sediment measurement cannot be performed due to no power or equipment. Delivery capabilities for the fuel stored onsite consist of two existing onsite DFO delivery trucks and two dedicated FLEX DFO caddies. The DFO caddies will be stored as FLEX equipment. PG&E is not relying upon any gasoline-powered equipment for meeting FLEX coping strategies requirements.

The NRC staff noted that UFSAR page 9.5-21 discusses fuel oil supply trenches that collect water from surface runoff. It was not clear if water from these trenches could get into the diesel fuel oil tanks or pump vaults. During the audit the licensee stated that the DFO tanks and piping are sealed systems with a vent pipe on each tank approximately 2 feet above local grade (as discussed the UFSAR, Section 9.5.4.3.1, page 9.5-21) and therefore not subject to flooding. Additionally, as identified in PG&E's response to NTTF Recommendation 2.3 on flooding (Reference PG&E Letter DCL-12-114, "Final Response to Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.3 Flooding," dated November 27, 2012), the DFO piping in the trenches are equipped with penetration seals where the piping enters the DFO vault. The potential for water to enter the DFO vault was evaluated during flooding walkdowns to address NTTF Recommendation 2.3. The DFO piping penetration seals were inspected and determined to be in good condition such that flooding of the vaults from the DFO trenches was not a concern.

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

3.2.4.10 Load Reduction to Conserve DC Power

NEI 12-06, Section 3.2.2, Guideline 6 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 and MOVs. Emergency lighting may also be powered by safety-related batteries. However, for many plants, this lighting may have been supplemented by Appendix R and security lights, thereby allowing the emergency lighting load to be eliminated. ELAP procedures/guidance should direct operators to conserve dc power during the event by stripping nonessential loads as soon as practical. Early load stripping can significantly extend the availability of the unit's Class 1E batteries. In certain circumstances, AFW/HPCI /RCIC operation may be extended by throttling flow to a constant rate, rather than by stroking valves in open-shut cycles.
>
> Given the beyond-design-basis nature of these conditions, it is acceptable to strip loads down to the minimum equipment necessary and one set of instrument channels for required indications. Credit for load-shedding actions should consider the other concurrent actions that may be required in such a condition.

The NRC staff reviewed the licensee's Integrated Plan and determined that the generic concern related to battery duty cycles beyond 8 hours is applicable to the plant. This generic concern has been resolved generically through the NRC endorsement of NEI position paper entitled "Battery Life Issue" (ADAMS Accession No. ML13241A188 (position paper) and ML13241A186 (NRC endorsement letter)).

The purpose of the generic concern and associated endorsement of the position paper was to

resolve concerns associated with Integrated Plan submittals in a timely manner and on a generic basis, to the extent possible, and provide a consistent review by the NRC staff. Position papers provided to the NRC by industry further develop and clarify the guidance provided in NEI 12-06 related to industry's ability to meet the requirements of Order EA-12-049.

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

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

The licensee has not informed the NRC of their plan to abide by the generic resolution related to extended battery duty cycles, or their plans to address potential plant-specific issues associated with implementing this resolution. This item is identified as Confirmatory Item 3.2.4.10.A in Section 4.2.

The NRC staff determined that it required information on the dc load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling. The NRC staff also investigated the loads that would be shed and any functions that would be lost. During the audit the licensee stated that as discussed in the Integrated Plan on pages 11 and 12, PG&E provided the battery load shedding strategy. PG&E determined that based on NEI 12-06, Section 3.2.1.10, the following loads will be maintained after completing battery load shedding:

> Batteries 1-3 (subsequently 1-2 will be sequenced to provide one channel of power for one set of loads)
> SG level
> SG pressure
> RCS pressure
> RCS temperature
> Containment pressure
> Reactor head vent valve control power
> Reactor head vent valve position indication

During the audit the licensee stated that the load shedding strategy removes two of three batteries from service and load is reduced on the remaining battery by opening individual load breakers to extend the life of the battery. A second battery is restored to service when the first reaches full discharge. This ensures that vital instruments and controls are maintained for at least 24 hours. A third battery is available, along with portable instruments, to provide vital instruments and control after the first two batteries are exhausted. Almost all loads will be shed

from Class 1E dc buses except for a minimum of one set (one channel) of instruments required by NEI 12-06. The load shed activity involves opening circuit breakers in the vital dc switchgear rooms. A total of 42 breakers on each unit are opened to affect the load shed. Batteries 11 and 12 are completely unloaded, and saved for future use. Battery 13 is partially unloaded so the circuits still in service provide instrumentation required for the FLEX strategies. The time to perform this initial load shed will be less than 30 minutes. This time will be verified by a walkthrough / simulation as specified in the Integrated Plan. There will be no installed redundancy. If redundant or alternate instrument readings are needed, they will be taken with portable equipment.

The NRC staff investigated whether there would be any safety consequences of performing a load shed on the dc buses, to include the strategy to prevent an uncontrolled hydrogen gas release from the main generator if the backup seal oil pump is to be shed. During the audit the licensee stated that dc-powered oil pumps associated with the main turbine / generator are powered from a separate non-vital battery, so they will not be affected by the stripping of the Vital, Class 1E buses. In an ELAP, main generator hydrogen pressure is maintained by the air side seal oil backup pump, which is powered from the non-vital battery, and is further backed up by a regulated oil supply from the main turbine shaft oil pump. The procedure in effect during an ELAP is EOP ECA-0.0, “Loss of all AC Power.” EOP ECA-0.0, step 11, directs operators to perform an emergency purge of the main generator to remove hydrogen. The valves used to perform the emergency purge are all manual valves. EOP ECA-0.0 contains steps to prevent a main generator hydrogen fire. These steps will not be changed by the FLEX response and the FLEX response will not change the potential for a main generator hydrogen fire.

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

3.3 PROGRAMMATIC CONTROLS

3.3.1 Equipment Maintenance and Testing

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

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

3-2 (i.e., that equipment that directly supports maintenance of the key safety functions). Other FLEX support equipment only requires an N capability.

NEI 12-06, Section 11.5 states:

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

2. Portable equipment that directly performs a FLEX mitigation strategy for the core, containment, or SFP should be subject to maintenance and testing guidance provided in INPO AP 913, Equipment Reliability Process, to verify proper function. The maintenance program should ensure that the FLEX equipment reliability is being achieved. Standard industry templates (e.g., EPRI) and associated bases will be developed to define specific maintenance and testing including the following:

   a. Periodic testing and frequency should be determined based on equipment type and expected use. Testing should be done to verify design requirements and/or basis. The basis should be documented and deviations from vendor recommendations and applicable standards should be justified.

   b. Preventive maintenance should be determined based on equipment type and expected use. The basis should be documented and deviations from vendor recommendations and applicable standards should be justified.

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

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

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

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

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

   d. Portable equipment that is expected to be unavailable for more than 90 days or expected to be unavailable during forecast site specific external

events (e.g., hurricane) should be supplemented with alternate suitable equipment.

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

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

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

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

During the audit the licensee stated that maintenance of all equipment associated with all FLEX strategies will be in accordance with NEI 12-06, Section 11. Preventive maintenance (PM) requirements for this equipment will be established in accordance with the requirements of EPRI Technical Report No. 3002000623, "Preventative Maintenance Basis for FLEX Equipment" and all associated data reports. In the event that certain equipment does not fall under this technical report, the applicable standard EPRI technical report will be used to establish the PM program in accordance with existing plant processes, with critical attributes of the PM template set similar to the FLEX-related technical report and applicable vendor requirements would be determined by the design change process. It is unclear if the referenced report is the same report that was endorsed by the NRC staff. Clarification of what is the appropriate title of the referenced report and whether the referenced report is the same as that endorsed by the NRC staff is identified as Confirmatory Item 3.3.1.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 equipment maintenance and testing, if these requirements are implemented as described.

3.3.2 Configuration Control

NEI 12-06, Section 11.8 states:

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

On page 16 in the section of its Integrated Plan discussing programmatic controls, the licensee stated that the FLEX strategies' bases will be documented and maintained in controlled plant documents. 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, 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, Training, states:

1. Programs and controls should be established to assure personnel proficiency in the mitigation of beyond-design-basis events is developed and maintained. These programs and controls should be implemented in accordance with an accepted training process.
2. Periodic training should be provided to site emergency response leaders on beyond- design-basis emergency response strategies and implementing guidelines. Operator training for beyond-design-basis event accident mitigation should not be given undue weight in comparison with other training requirements. The testing/evaluation of Operator knowledge and skills in this area should be similarly weighted.

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

4. “ANSI/ANS 3.5, Nuclear Power Plant Simulators for use in Operator Training”

certification of simulator fidelity (if used) is considered to be sufficient for the initial stages of the beyond-design-basis external event scenario until the current capability of the simulator model is exceeded. Full scope simulator models will not be upgraded to accommodate FLEX training or drills.

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

On page 16 in its Integrated Plan in regards to training, the licensee stated that training plans will be developed for plant groups such as the emergency response organization, fire, security, emergency planning, operations, engineering, and maintenance. The training plan will be developed in accordance with DCPP procedures using the systematic approach to training and will be implemented to ensure that the required DCPP staff will be 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 planned.

3.4 OFFSITE RESOURCES

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

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

reduce the likelihood of extended equipment maintenance (requiring in excess of 90 days for returning the equipment to operational status).

On page 16 in the section of its Integrated Plan regarding the RRC plan, the Licensee stated the industry will establish two RRCs to support utilities during BDB external events. Each RRC will hold five sets of equipment. Four of the sets 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 strategic alliance for FLEX emergency response (SAFER) team and DCPP. Communications will be established between DCPP and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of DCPP's playbook, will be delivered to the site within 24 hours from the initial request. PG&E will establish a contract with the RRC vendor that will meet the requirements of NEI 12-06, Section 12. The implementation of Guidelines 2 through 10 above is identified as Confirmatory Item 3.4.A, in Section 4.2.

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

4.0 OPEN AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

This section contains a summary of the Open Items identified as part of this evaluation.

Item Number	Description	Notes
3.2.1.4.A	The licensee used the MAAP code in performing its ELAP analyses. Aspects of the MAAP code analyses, such as boundary conditions, nodalization, and the selection of code options for modeling key physical phenomena, were not discussed in the Integrated Plan. Provide an understanding of the above issues to assess the technical adequacy of the code and determining the code's range of applicability.	
3.2.1.8.A	The Pressurized-Water Reactor Owners Group (PWROG) submitted to NRC a position paper, dated August 15, 2013 (ADAMS Accession No. ML 13235A135 (non-public for proprietary reasons)), which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlined applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available. Since the audit discussions, the NRC endorsed the PWROG guidance with several clarifications in the letter dated January 8, 2014. The licensee should address commitment to the generic approach and the clarifications in alignment with the NRC endorsement letter for the development of an adequate model for determining the mixing of boric acid in the reactor coolant system during natural	

	circulation with the potential for two-phase flow conditions.	

4.2 CONFIRMATORY ITEMS

This section contains a summary of the Confirmatory Items identified as part of this evaluation.

Item Number	Description	Notes
3.1.1.1.A	The licensee's response to the NRC audit process noted that both FLEX equipment storage locations may be subject to seismically-induced small landslide debris flows, which will be accommodated into the design of the facilities. Confirm incorporation of the capability to withstand seismically-induced small landslide debris flows.	
3.1.1.4.A	Off-Site Resources – Confirm RRC local staging area, evaluation of access routes, and method of transportation to the site.	
3.2.1.A	NEI 12-06, Section 3.2.1.5, on reactor coolant inventory loss, states sources of expected reactor coolant inventory loss includes "losses from letdown unless automatically isolated or until isolation is procedurally directed." Provide discussion and/or analysis regarding letdown losses.	
3.2.1.B	RCS cooling and heat removal, and RCS inventory control - The licensee provided information regarding the analysis from WCAP-17601 applicable to DCPP in response to NRC staff requests. The NRC staff is continuing to review this information to ensure the licensee sufficiently justifies the analysis being applied. Additional information may be needed to confirm the appropriate use of the analysis.	
3.2.1.1.A	Due to the concern that the reliance on NOTRUMP code for the ELAP analysis of Westinghouse plants is limited to the flow conditions prior to reflux condensation initiation, provide an acceptable definition for reflux condensation cooling in the context of this analysis.	
3.2.1.2.A	Provide justification (to include the applicable analysis and relevant seal leakage testing data) that the integrity of the associated O-rings will be maintained at the temperature conditions experienced during the ELAP event.	
3.2.1.2.B	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. 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 Accession No. ML13211A168) on the use of the low seal leakage rate in the ELAP analysis.	
3.2.1.2.C	Should the seals be changed to the newly designed Generation 3 SHIELD seals or non-Westinghouse seals, the licensee should address the acceptability of the use of the newly designed	

	Generation 3 SHIELD seals or non-Westinghouse seals and justification for the RCP seal leakages rates for use in the ELAP analysis.	
3.2.1.6.A	On pages 70 through 73 in the Integrated Plan, the licensee listed elapsed times and time constraints in different columns in Attachment 1A (SOE timeline). The review determined that the times listed in the elapsed times column and the time constraint column often are the same and provide no margin between the elapsed time and the time constraint time. Provide clarification on how early a step must be begun to meet the time constraint, when the licensee actually expects to begin performing the step, and information on what margin exists for these critical actions, and whether the times can be reasonably met.	
3.2.4.3.A	Heat Tracing – The licensee is considering a minimum design temperature of 24 degrees F. As a result, the effect of the lower temperature on the BASTs is being re-evaluated. Provide the results of the re-evaluation.	
3.2.4.4.A	Communications - Confirm that upgrades to the site's communications systems have been completed.	
3.2.4.6.A	Confirm personnel protective measures for operator protection should entry into the TDAFW pump room be necessary following an ELAP.	
3.2.4.8.A	Confirm protective features of the Class 1E circuit breaker will be evaluated by engineering calculation to adequately protect the bus, and that all load breakers be disabled (dc switch open) prior to energizing the 4-KV bus with the FLEX DG.	
3.2.4.10.A	The licensee has not informed the NRC of their plan to abide by the generic resolution related to extended battery duty cycles, or their plans to address potential plant-specific issues associated with implementing this resolution.	
3.3.1.A	During the audit the licensee stated that maintenance of all equipment associated with all FLEX strategies will be in accordance with NEI 12-06, Section 11. Preventive maintenance (PM) requirements for this equipment will be established in accordance with the requirements of EPRI Technical Report No. 3002000623, "Preventative Maintenance Basis for FLEX Equipment" and all associated data reports. Provide clarification of the alignment of the licensee referenced reports with those endorsed by NRC staff.	
3.4.A	NEI 12-06, Section 12.2 lists minimum capabilities for offsite resources for which each Licensee should establish the availability. Discuss implementation of Guidelines 2 through 10 in NEI 12-06, Section 12.2.	