UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 19, 2013

Mr. Rafael Flores
Senior Vice President and Chief Nuclear Officer
Attention: Regulatory Affairs
Luminant Generation Company, LLC
P.O. Box 1002
Glen Rose, TX 76043

SUBJECT: COMANCHE PEAK NUCLEAR POWER PLANT, UNITS 1 AND 2 - INTERIM STAFF EVALUATION RELATING TO OVERALL INTEGRATED PLAN IN RESPONSE TO ORDER EA-12-049 (MITIGATION STRATEGIES) (TAC NOS. MF0860 AND MF0861)

Dear Mr. Flores:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12054A736). By letter dated February 28, 2013 (ADAMS Accession No. ML13071A617), Luminant Generation Company, LLC (Luminant, the licensee) submitted its Overall Integrated Plan for Comanche Peak Nuclear Power Plant, Units 1 and 2. in response to Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13252A077), Luminant submitted a six-month update to the Overall Integrated Plan.

Based on a review of Luminant's plan, including the six-month update dated August 28, 2013, and information obtained through the mitigation strategies audit process,[1] the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that the plan, when properly implemented, will meet the requirements of Order EA-12-049 at Comanche Peak Nuclear Power Plant, Units 1 and 2. This conclusion is based on the assumption that the licensee will implement the plan as described, including the satisfactory resolution of the open and confirmatory items detailed in the enclosed Interim Staff Evaluation and Audit Report.

[1] A description of the mitigation strategies audit process may be found at ADAMS Accession No. ML13234A503.

If you have any questions, please contact James Polickoski, Mitigating Strategies Project Manager, at 301-415-5430 or at james.polickoski@nrc.gov.

Sincerely,

Jeremy S. Bowen, Chief
Mitigating Strategies Projects Branch
Mitigating Strategies Directorate
Office of Nuclear Reactor Regulation

Docket Nos. 50-445 and 50-446

Enclosures:
1. Interim Staff Evaluation
2. Technical Evaluation Report

cc w/encl: Distribution via Listserv

UNITED STATES
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INTERIM STAFF EVALUATION AND AUDIT REPORT BY THE OFFICE OF NUCLEAR REACTOR REGULATION RELATED TO ORDER EA-12-049 MODIFYING LICENSES WITH REGARD TO REQUIREMENTS FOR MITIGATION STRATEGIES FOR BEYOND-DESIGN-BASIS EXTERNAL EVENTS

LUMINANT GENERATION COMPANY, LLC

COMANCHE PEAK NUCLEAR POWER PLANT, UNITS 1 AND 2

DOCKET NOS. 50-445 and 50-446

The earthquake and tsunami at the Fukushima Dai-ichi nuclear power plant in March 2011, highlighted the possibility that extreme natural phenomena could challenge the prevention, mitigation and emergency preparedness defense-in-depth layers. At Fukushima, limitations in time and unpredictable conditions associated with the accident significantly challenged attempts by the responders to preclude core damage and containment failure. During the events in Fukushima, the challenges faced by the operators were beyond any faced previously at a commercial nuclear reactor. The U.S. Nuclear Regulatory Commission (NRC) determined that additional requirements needed to be imposed to mitigate beyond-design-basis external events (BDBEEs). Accordingly, by letter dated March 12, 2012, the NRC issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" [Reference 1]. The order directed licensees to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities in the event of a BDBEE.

By letter dated February 28, 2013 [Reference 2], Luminant Generation Company, LLC (the licensee or Luminant) provided the Overall Integrated Plan for compliance with Order EA-12-049 for Comanche Peak Nuclear Power Plant, Units 1 and 2 (CPNPP) (hereafter referred to as the Integrated Plan). The Integrated Plan describes the guidance and strategies under development for implementation by Luminant 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. As further required by the order, by letter dated August 28, 2013 [Reference 3], the licensee submitted the first six month status report since the submittal of the Integrated Plan, describing the progress made in implementing the requirements of the order.

2.0 REGULATORY EVALUATION

Following the events at the Fukushima Dai-ichi nuclear power plant on March 11, 2011, the 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 and methodical review of the NRC's regulations and processes, and with determining if the agency should make 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 [Reference 4]. These recommendations were enhanced by the NRC staff following interactions with stakeholders. Documentation of the NRC 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 [Reference 5] and SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," dated October 3, 2011 [Reference 6].

As directed by the Commission's Staff Requirement Memorandum (SRM) for SECY-11-0093 [Reference 7], 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 NRC staff's prioritization of the recommendations based upon the potential safety enhancements.

After receiving the Commission's direction in SRM-SECY-11-0124 [Reference 8] and SRM-SECY-11-0137 [Reference 9], the NRC staff conducted public meetings to discuss enhanced mitigation strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities following a BDBEE. At these meetings, the industry described its proposal for a Diverse and Flexible Mitigation Capability (FLEX), as documented in the Nuclear Energy Institute's (NEI's) letter, dated December 16, 2011 [Reference 10]. 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 than 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," [Reference 11] to the Commission, including the proposed order to implement the enhanced mitigation strategies. As directed by SRM-SECY-12-0025 [Reference 12], the NRC staff issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" [Reference 1].

Order EA-12-049, Attachment 2,[1] requires that operating power reactor licensees and construction permit holders use a three-phase approach for mitigating BDBEEs. The initial phase requires the use of installed equipment and resources to maintain or restore core cooling, containment and SFP cooling capabilities. The transition phase requires providing sufficient,

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1. Attachment 3 to Order EA-12-049 provides requirements for Combined License holders.

portable, onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from off site. The final phase requires obtaining sufficient offsite resources to sustain those functions indefinitely. Specific operational requirements of the order are listed below:

1) Licensees or construction permit (CP) holders shall develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and SFP cooling capabilities following a beyond-design-basis external event.

2) These strategies must be capable of mitigating a simultaneous loss of all alternating current (ac) power and loss of normal access to the ultimate heat sink and have adequate capacity to address challenges to core cooling, containment, and SFP cooling capabilities at all units on a site subject to the Order.

3) Licensees or CP holders must provide reasonable protection for the associated equipment from external events. Such protection must demonstrate that there is adequate capacity to address challenges to core cooling, containment, and SFP cooling capabilities at all units on a site subject to the Order.

4) Licensees or CP holders must be capable of implementing the strategies in all modes.

5) Full compliance shall include procedures, guidance, training, and acquisition, staging, or installing of equipment needed for the strategies.

On May 4, 2012, NEI submitted document 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision B [Reference 13] to provide specifications for an industry developed methodology for the development, implementation, and maintenance of guidance and strategies in response to the Mitigating Strategies order. On May 13, 2012, NEI submitted NEI 12-06, Revision B1 [Reference 14]. 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) in Section 50.54, "Conditions of licenses" of Title 10 of the *Code of Federal Regulations*.

On May 31, 2012, the NRC staff issued a draft version of the interim staff guidance (ISG) document, 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," [Reference 15] and published a notice of its availability for public comment in the *Federal Register* (77 FR 33779), with the comment period running through July 7, 2012. JLD-ISG-2012-01 proposed endorsing NEI 12-06, Revision B1, as providing an acceptable method of meeting the requirements of Order EA-12-049. The NRC staff received seven comments during this time. The NRC staff documented its analysis of these comments in "NRC Response to Public Comments, JLD-ISG-2012-01 (Docket ID NRC-2012-0068)" [Reference 16].

On July 3, 2012, NEI submitted comments on JLD-ISG-2012-01, including Revision C to NEI 12-06 [Reference 17], incorporating many of the exceptions and clarifications included in the draft version of the ISG. Following a public meeting held July 26, 2012, to discuss the remaining exceptions and clarifications, on August 21, 2012, NEI submitted Revision 0 to NEI 12-06 [Reference 18].

On August 29, 2012, the NRC staff issued the final version of JLD-ISG-2012-01, [Reference 19], endorsing NEI 12-06, Revision 0, as an acceptable means of meeting the requirements of Order EA-12-049, and published a notice of its availability in the *Federal Register* 77 FR 55230.

The NRC staff determined that the overall integrated plans submitted by licensees in response to Order EA-12-049, Section IV.C.1.a should follow the guidance in NEI 12-06, Section 13, which states that:

> The Overall Integrated Plan should include a complete description of the FLEX strategies, including important operational characteristics. The level of detail generally considered adequate is consistent to the level of detail contained in the Licensee's Final Safety Analysis Report (FSAR). The plan should provide the following information:
>
> 1. Extent to which this guidance, NEI 12-06, is being followed including a description of any alternatives to the guidance, and provide a milestone schedule of planned actions.
>
> 2. Description of the strategies and guidance to be developed to meet the requirements contained in Attachment 2 or Attachment 3 of the order.
>
> 3. Description of major installed and portable FLEX components used in the strategies, the applicable reasonable protection for the FLEX portable equipment, and the applicable maintenance requirements for the portable equipment.
>
> 4. Description of the steps for the development of the necessary procedures, guidance, and training for the strategies; FLEX equipment acquisition, staging or installation, including necessary modifications.
>
> 5. Conceptual sketches, as necessary to indicate equipment which is installed or equipment hookups necessary for the strategies. (As-built piping and instrumentation diagrams (P&ID) will be available upon completion of plant modifications.)
>
> 6. Description of how the portable FLEX equipment will be available to be deployed in all modes.

By letter dated August 28, 2013 [Reference 20], the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049. That letter described the process used by the staff in its review, leading to the issuance of this interim staff evaluation (ISE) 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. Additional NRC staff review and inspection may be necessary following full implementation of those actions to verify licensees' compliance with the order.

3.0 TECHNICAL EVALUATION

The NRC staff contracted with MegaTech Services, LLC (MTS) for technical support in the evaluation of the Integrated Plan for CPNPP, submitted by Luminant's letter dated February 28, 2013, as supplemented. NRC and MTS staff have reviewed the submitted information and held clarifying discussions with Luminant in evaluating the licensee's plans for addressing BDBEEs and its progress towards implementing those plans.

A simplified description of the CPNPP Integrated Plan is that the licensee will initially remove the core decay heat by adding water to the steam generators (SGs) and releasing steam from the SGs to the atmosphere. The water will initially be added by the turbine-driven auxiliary feedwater (TDAFW) pump, taking suction from the Condensate Storage Tank (CST). A cooldown of the Reactor Coolant System (RCS) will commence after approximately twelve hours. A high pressure electric FLEX makeup pump will be connected to provide borated makeup water to the RCS, supplied initially from the Boric Acid Tanks and then eventually from the Refueling Water Storage Tank (RWST). A FLEX generator will be used to reenergize the installed battery chargers to keep the necessary direct current (dc) buses energized and also power the electric FLEX RCS makeup pump. In the long-term, additional equipment, such as 4160 volt ac generators, will be delivered from one of two Regional Response Centers (RRCs) established by the nuclear industry to provide supplemental accident mitigation equipment.

CPNPP has a large dry containment building, which contains the RCS. No immediate containment cooling is planned for the postulated extended loss of ac power (ELAP) scenario because the licensee plans to show by analysis that the containment temperature and pressure stay within acceptable levels throughout the postulated event. The licensee is crediting the use of low leakage Reactor Coolant Pump (RCP) seals to minimize the containment energy input.

In the postulated ELAP event, the SFP may reach the boiling point. Initially, the licensee plans to provide a means of SFP makeup from the RWST within 29 hours of event initiation for at power conditions and within 16 hours for a core offload scenario. The licensee will also establish ventilation in the SFP area prior to the initiation of SFP boiling. The makeup and ventilation actions will ensure that sufficient water is maintained in the SFP for cooling and shielding considerations. In later phases of event response, a large diesel generator from the RRC will be used to repower the installed SFP pumps.

By letter dated December 18, 2013 [Reference 21], MTS documented the interim results of the Integrated Plan review in the attached technical evaluation report (TER). The NRC staff has reviewed this TER for consistency with NRC policy and technical accuracy and finds that, in general, it accurately reflects the state of completeness of the Integrated Plan. The NRC staff therefore adopts the findings of the TER with respect to individual aspects of the requirements of order EA-12-049.

4.0 OPEN AND CONFIRMATORY ITEMS

This section contains a summary of the open and confirmatory items identified as part of the technical evaluation. The NRC and MTS have assigned each review item to one of the following categories:

Confirmatory item – an item that the NRC considers conceptually acceptable, but for which resolution may be incomplete. These items are expected to be acceptable, but will require some minimal follow up review, audit, or inspection to verify completion.

Open item – an item for which the licensee has not presented a sufficient basis for the NRC to determine that the issue is on a path to resolution. The intent behind designating an issue as an open item is to document significant items that need resolution during the review process, rather than being verified after the compliance date through the inspection process.

As discussed in Section 3.0, above, the NRC staff has reviewed MTS' TER for consistency with NRC policy and technical accuracy and finds that, in general, it accurately reflects the state of completeness of the licensee's Integrated Plan. The open and confirmatory items identified in the TER are listed in the tables below, with some NRC edits made for clarity from the TER version. In addition to the editorial clarifications, confirmatory item 3.1.4.1.A from the TER was deleted because the NRC staff determined that it was not necessary for CPNPP. Further details for each open and confirmatory item are provided in the corresponding sections of the TER, identified by the item number.

4.1 OPEN ITEMS

Item Number	Description	Notes
3.2.1.2.A	Regarding the RCP seals, the only O-ring of interest with the safe shutdown low-leakage (SHIELD) installed is the RCP seal sleeve to shaft O-ring. Qualification of the RCP seal sleeve to shaft O-ring will be tracked as part of the SHIELD redesign to confirm the delayed cooldown, as documented in the Integrated Plan, is acceptable. CPNPP will align with testing results to be documented in the forthcoming SHIELD white paper.	
3.2.1.2.C	If the RCP seals are changed to the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals, the acceptability of the use of the newly designed Generation 3 SHIELD seals, or non-Westinghouse seals should be addressed, and the RCP seal leakages rates for use in the ELAP analysis should be provided with acceptable justification. During the audit process the licensee stated that CPNPP uses the Westinghouse model 93A RCPs crediting SHIELD for FLEX strategies. Testing and qualification of SHIELD is ongoing and the licensee is closely following the re-design of SHIELD and will modify analyses and FLEX strategies if needed, based on the conclusions of the SHIELD white paper.	
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. ML13235A132, non-public, proprietary), which provides test data regarding boric acid mixing under	

	single-phase natural circulation conditions and outlines 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. However, the NRC staff concluded that the August 15, 2013, position paper was not adequately justified and did not endorse this position paper. As such, ensuring adequate mixing of boric acid into the RCS under ELAP conditions is an open item for CPNPP.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.1.A	In its Six-Month Status Report the licensee provided the location of the planned FLEX storage building but did not provide details of its plans for storage and protection of FLEX equipment for review. Because these plans have not been formalized or implemented, they do not provide sufficient information to conclude that portable FLEX equipment will be protected from seismic hazards in accordance with the guidance of NEI 12-06, Section 5.3.1, considerations 1 through 3.	
3.1.1.2.A	The route to be traveled by portable equipment from its storage location to the site where it will be used should be reviewed for potential soil liquefaction that could impede movement following a severe seismic event	
3.1.1.2.B	In the section of its integrated plan regarding strategies to maintain containment during the initial phase, the licensee indicated that pressure and temperature are not expected to rise to levels that could challenge the containment structure. A containment evaluation will be performed to demonstrate that containment pressure and temperature will stay at acceptable levels and that no containment spray system will be required.	
3.1.1.4.A	Due to the absence of a description of the methods to be used to deliver the equipment to the site, the licensee's plan for the use of offsite resources did not provide sufficient information to conclude that the plan will address the potential impact of all applicable hazards on the transportation of offsite resources as described in NEI 12-06, Section 5.3.4, consideration 1, Section 6.2.3.4, considerations 1 and 2, Section 7.3.4, considerations 1 and 2, and Section 8.3.4. In its Six-Month Status Report the licensee indicated that these details would be addressed in its SAFER Response Plan scheduled for February 2014.	
3.2.1.1.A	Confirm that steam generator makeup requirements have	

	been appropriately defined or revise them to account for the installation of low-leakage RCP seals.	
3.2.1.1.B	Confirm that the licensee is able to provide primary makeup to avoid transitioning to reflux condensation cooling. This includes the specification of an acceptable definition for reflux condensation cooling.	
3.2.1.1.C	Nitrogen Injection. Clarify whether calculations have been performed consistent with the PWROG-recommended methodology in Attachment 1 to the interim core cooling position paper for PA-PSC-0965 (ADAMS Accession No. ML130420011, non-public) to verify that the intended ELAP mitigation strategy will not result in injection of nitrogen from cold leg accumulators. Otherwise, provide justification that the existing calculational methods for determining whether nitrogen injection will occur considers the potential for heating due to the rise of containment temperatures due to loss of normal ventilation, reactor coolant pump seal leakage, etc.	
3.2.1.1.D	Confirm that a symmetric cooldown using all four reactor coolant system loops can be coordinated under ELAP conditions considering environmental effects such as noise and high temperatures on operators manipulating TDAFW flow, Atmospheric Relief Valve positions, and other equipment.	
3.2.1.2.B	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.D	(1) Confirm that stresses resulting from a cooldown of the RCS will not result in the failure of seal materials. (2) As applicable, confirm that reestablishing cooling to the seals will not result in increased leakage due to thermal shock. (3) Confirm that the fluid leaking through the reactor coolant pump seals will originate as single-phase liquid. (4) Confirm conformance with Sections 3.5 and 4.0 of the NRC safety evaluation (ADAMS Accession Nos.: ML110880122 and ML110880131) approving the use of the Westinghouse shutdown seal with Model 93A RCP in the plant Probabilistic Risk Assessment model.	

3.2.3.A.	Confirm that the licensee's containment analysis demonstrates that containment integrity will not be challenged during an ELAP event.	
3.2.4.4.A	Provide information on the use of portable lighting for FLEX strategy implementation (storage location, sufficient quantities, and procedural guidelines).	
3.2.4.4.B	The NRC staff has reviewed the licensee communications assessment (ADAMS Accession Nos. ML12318A100 and ML13071A349) in response to the March 12, 2012 50.54(f) request for information letter for CPNPP and, as documented in the staff analysis (ADAMS Accession No. ML13141A675) has determined that the assessment for communications is reasonable. Confirm that upgrades to the site's communications systems have been completed.	
3.2.4.5.A	The licensee's plans for the development of guidance and strategies with regard to the access to the Protected Area and internal locked areas did not provide sufficient information to conclude that the guidance and strategies developed will conform with Section 3.2.2, Paragraph (9) because the plan lacked any discussion on this topic. Provide information on access to the protected area and internal locked areas as it relates to FLEX strategy implementation.	
3.2.4.8.A	Review the sizing of the Phase 2 portable/FLEX diesel generators when the licensee has finalized their design.	
3.2.4.9.A	The licensee did not address actions to maintain the quality of fuel stored in the tanks of the portable equipment for potentially long periods of time when the equipment (diesel driven pumps and generators) will not be operated. Review this information when it is provided.	
3.2.4.10.A	Review of the final load shed analysis is needed.	
3.3.1.A	In the Integrated Plan, the licensee listed the portable FLEX equipment and noted that maintenance/PM requirements would follow the Electronic Power Research Institute (EPRI) template requirements. During the audit process the licensee stated that they are supporting the EPRI industry program. Verify that the maintenance and testing program is properly implemented at the site.	

Based on this review of Luminant's plan, including the six-month update dated August 28, 2013, and information obtained through the mitigation strategies audit process, the NRC concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that the plan, when properly implemented, will meet the requirements of Order EA-12-049 at CPNPP. This conclusion is based on the assumption that the licensee will implement the plan as described, including the satisfactory resolution of the open and confirmatory items detailed in this ISE and Audit Report.

5.0 SUMMARY

As required by Order EA-12-049, the licensee is developing, and will implement and maintain, guidance and strategies to maintain or restore core cooling, containment, and SFP cooling capabilities in the event of a BDBEE. These new requirements provide a greater mitigation capability consistent with the overall defense-in-depth philosophy, and, therefore, greater assurance that the challenges posed by BDBEEs to power reactors do not pose an undue risk to public health and safety.

The NRC's objective in preparing this ISE and audit report is to provide a finding to the licensee on whether or not their integrated plan, if implemented as described, provides a reasonable path for compliance with the order. For areas where the NRC staff has insufficient information to make this finding (identified above in Section 4.0), the staff will review these areas as they become available or address them as part of the inspection process. The staff notes that the licensee has the ability to modify their plans as stated in NEI 12-06, Section 11.8. However, additional NRC review and/or inspection may be necessary to verify compliance.

The NRC staff has reviewed the licensee's plans for additional defense-in-depth measures. Assuming a successful resolution to the items identified in Section 4.0 above, the NRC staff finds that the proposed measures, properly implemented, will meet the intent of Order EA-12-049, thereby enhancing the licensee's capability to mitigate the consequences of a BDBEE that impacts the availability of alternating current power and the ultimate heat sink. Full compliance with the order will enable the NRC to continue to have reasonable assurance of adequate protection of public health and safety. The staff will issue a safety evaluation confirming compliance with the order and may conduct inspections to verify proper implementation of the licensee's proposed measures.

6.0 REFERENCES

1. Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12054A736)

2. Letter from Luminant to NRC, "Comanche Peak Nuclear Power Plant Docket Nos. 50-445 and 50-446, Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," dated February 28, 2013 (ADAMS Accession No. ML13071AA617)

3. Letter from Luminant to NRC, "Comanche Peak Nuclear Power Plant Docket Nos. 50-445 and 50-446, First Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, (Order Number EA-12-049)," dated August 28, 2013 (ADAMS Accession No. ML13252A077)

4. SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," July 12, 2011 (ADAMS Accession No. ML11186A950)

5. SECY-11-0124, "Recommended Actions to be Taken without Delay from the Near-Term Task Force Report," September 9, 2011 (ADAMS Accession No. ML11245A158)

6. SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," October 3, 2011 (ADAMS Accession No. ML11272A111)

7. SRM-SECY-11-0093, "Staff Requirements – SECY-11-0093 – Near-Term Report and Recommendations for Agency Actions following the Events in Japan," August 19, 2011 (ADAMS Accession No. ML112310021)

8. SRM-SECY-11-0124, "Staff Requirements – SECY-11-0124 – Recommended Actions to be Take without Delay from the Near-Term Task Force Report," October 18, 2011 (ADAMS Accession No. ML112911571)

9. SRM-SECY-11-0137, "Staff Requirements – SECY-11-0137- Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," December 15, 2011 (ADAMS Accession No. ML113490055)

10. Letter from Adrian Heymer (NEI) to David L. Skeen (NRC), "An Integrated, Safety-Focused Approach to Expediting Implementation of Fukushima Dai-ichi Lessons Learned," December 16, 2011 (ADAMS Accession No. ML11353A008)

11. 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," February 17, 2012 (ADAMS Accession No. ML12039A103)

12. SRM-SECY-12-0025, "Staff Requirements – 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," March 9, 2012 (ADAMS Accession No. ML120690347)

13. NEI document NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision B, May 4, 2012 (ADAMS Accession No. ML12144A419)

14. NEI document NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision B1, May 13, 2012 (ADAMS Accession No. ML12143A232)

15. Draft 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," May 31, 2012 (ADAMS Accession No. ML12146A014)

16. NRC Response to Public Comments, JLD-ISG-2012-01 (Docket ID NRC-2012-0068), August 29, 2012 (ADAMS Accession No. ML12229A253)

17. Nuclear Energy Institute, Comments from Adrian P. Heymer on Draft 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," July 3, 2012 (ADAMS Accession No. ML121910390)

18. Nuclear Energy Institute document 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 0, August 21, 2012 (ADAMS Accession No. ML12242A378)

19. Final Interim Staff Guidance, 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," August 29, 2012 (ADAMS Accession No. ML12229A174)

20. Letter from Jack R. Davis (NRC) to All Operating Reactor Licensees and Holders of Construction Permits, "Nuclear Regulatory Commission Audits of Licensee Responses to Mitigation Strategies Order EA-12-049," August 28, 2013 (ADAMS Accession No. ML13234A503)

21. Letter from John Bowen, MegaTech Services, LLC, to Eric Bowman, NRC, submitting "Technical Evaluation Report Related to Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, EA-12-049," for Comanche Peak Nuclear Power Plant Units 1 and 2, Revision 1, dated December 18, 2013 (ADAMS Accession No. ML13352A302)

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Date: December 19, 2013

Enclosure 2

Technical Evaluation Report

(ADAMS Accession No. ML13338A661)

MEGA-TECH SERVICES LLC

Mega-Tech Services, LLC

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

Revision 1

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Luminant Generation Company LLC
Comanche Peak Nuclear Power Plant
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Technical Evaluation Report

Comanche Peak Nuclear Power Plant
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 Plan (hereafter, the Integrated Plan) describing their course of action for mitigation strategies that are to conform with the guidance of NEI 12-06, or provide an acceptable alternative to demonstrate compliance with the requirements of Order EA-12-049.

2.0 EVALUATION PROCESS

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

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

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

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

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

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

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

3.0 TECHNICAL EVALUATION

By letter dated February 28, 2013, (ADAMS Accession No. ML13071A344), and as supplemented by the first six month status report (Six Month Status Report) in letter dated August 28, 2013 (ADAMS Accession No. ML13252A077, the licensee Power (the licensee) provided the Comanche Peak Nuclear Power Plant (CPNPP or Comanche Peak) Unit 1 and 2 Integrated Plan for Compliance with Order EA-12-049. The Integrated Plan describes the strategies and guidance under development for implementation by the licensee for the maintenance or restoration of core cooling, containment, and SFP cooling capabilities following a BDBEE, including modifications necessary to support this implementation, pursuant to Order EA-12-049. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049. That letter described the process used by the NRC staff in its review, leading to the issuance of an interim staff evaluation and audit report. The purpose of the staff's audit is to determine the extent to which the licensees are proceeding on a path towards successful implementation of the actions needed to achieve full compliance with the Order.

3.1 EVALUATION OF EXTERNAL HAZARDS

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

On page 1 of 112, the licensee stated they had reviewed the NEI FLEX guidance and determined the hazards that portable FLEX equipment should be protected from include seismic, external flooding, severe storms with high winds, ice storms, and extreme high temperatures. The licensee has determined the functional threats from each of these hazards. The FLEX storage locations will provide the protection required from these hazards. The licensee is also developing procedures and processes to further address plant strategies for responding to these various hazards.

3.1.1 Seismic Events.

NEI 12-06, Section 5.2 states:

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

On page 1 of its Integrated Plan regarding determination of applicable extreme external hazards, the licensee stated that per the FSAR the seismic criteria for CPNPP include Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE). A conservative SSE having peak horizontal ground acceleration at the top of bedrock of 0.12 g had been selected for design. The Operating Basis Earthquake (OBE) is equal to 1/2 the SSE. The licensee will use design basis values from the FSAR for Comanche Peak's FLEX strategies.

In summary, the seismic hazard applies to CPNPP. The licensee stated that they will assess the portable FLEX equipment storage buildings based on the current CPNPP seismic licensing basis to ensure that the equipment remains accessible and available after a BDBEE and that the FLEX equipment does not become a target or source of a seismic interaction from other systems, structures or components. The licensee will include documentation for the FLEX strategies developed for CPNPP ensuring that any storage locations and deployment routes meet the FLEX seismic criteria.

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

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

3.1.1.1 Protection of FLEX Equipment – Seismic Hazard

NEI 12-06, Section 5.3.1 states:

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

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

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

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

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

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

On pages 17, 28, 42 and 51 of its Integrated Plan regarding the strategies for maintaining core cooling and heat removal, core inventory, SFP cooling and safety functions support during the transition phase (phase 2), the licensee stated that the FLEX equipment will be stored in buildings designed to meet the requirements of the NEI 12-06. Large portable FLEX equipment such as pumps and power supplies will be secured as appropriate to protect them during a seismic event. Stored equipment and structures will be evaluated and protected from seismic interactions to ensure that unsecured and/or non-seismic components do not damage the equipment. The high-pressure pump stored in the auxiliary building near the boric acid tanks. The back-up high-pressure reactor coolant system (RCS) make-up pump will be stored in a FLEX storage building.

In its Six Month Status Report, the licensee reported that they had finalized location and protection requirements the FLEX storage buildings. The licensee did provide a drawing showing the proposed location of the building, but did not provide details of its plans for storage and protection of FLEX equipment for review. The licensee did not provide sufficient information to conclude that portable FLEX equipment will be protected from seismic hazards in accordance with the guidance found in NEI 12-06, Section 5.3.1, considerations 1 through 3. The licensee has identified this as Open Item OI1 in its list of open items on page 73 of its OIP: "Finalize location and protection requirements of FLEX storage buildings. The storage buildings will be designed in accordance with the NEI guidance and the applicable hazards." This has been identified as Confirmatory Item 3.1.1.1.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 Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of FLEX equipment if these requirements are implemented as described.

3.1.1.2 Deployment of FLEX Equipment - Seismic Hazard

NEI 12-06, Section 5.3.2 states:

> 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 1 of its Integrated Plan the licensee stated that soil liquefaction is not an issue at CPNPP as described in FSAR Section 2.5.4.8. A review of the CPNPP FSAR current through Amendment No. 105 revealed that it states the following with regard to soil liquefaction in Section 2.5.4.8:

> The entire Nuclear Power Plant foundation consists of firm, unweathered, Glen Rose Limestone with no liquefaction susceptible soils present.
>
> The cyclic shear strength of all Category I backfill and bedding materials used show that there is no liquefaction potential; all materials used meet or exceed the design criteria for cyclic strain for the ground acceleration of 0.12 g adopted for the Safe Shutdown Earthquake.

While this supports the conclusion that there will be no soil liquefaction for the structures at CPNPP, there is no support for a conclusion that soil liquefaction will not be a factor between storage locations for the portable equipment and the sites where they will need to be used. This has been identified as Confirmatory Item 3.1.1.2.A in Section 4.2.

In its First Six Month Status Report the licensee provided a drawing of the yard tanks available and deployment paths and a drawing of the six planned staging areas. The identified pathways and deployment areas will be accessible during all modes of plant operation (consistent with the timeframe in which the associated FLEX strategy would be implemented). They stated that an administrative program will be developed to ensure pathways will be kept clear or will require actions to clear the pathways. The selected (final) pathways would be evaluated for the applicable hazard(s).

On page 27 of its Integrated Plan describing the deployment of portable equipment for the transition phase of its strategy to maintain RCS inventory control, the licensee stated that the Phase 2 activities for RCS inventory control involve aligning a pump to provide borated coolant for RCS makeup and to maintain the reactor sub-critical. To ensure that the core is maintained sub-critical, the licensee will provide borated injection into the RCS from the high concentration boric acid tanks via a pre-staged portable motor driven pump. This injection also compensates for potential RCS leakage. The licensee will stage a high-pressure electric pump near the boric acid tanks which will discharge at the connections shown on the alignments provided in Attachment 3 (Figures A3-5 through A3-9) of the Integrated Plan. The licensee provided proposed hose routing for the primary and secondary connections and the associated equipment in Attachment 3 (Figures A3-16 through A3-18) of the Integrated Plan. The primary RCS FLEX connections are located along the safety injection (SI) piping from the charging pump discharge in Room 1,2-077B (EL 810'-6"). The connection will be made upstream of valves 8801 A/B. The secondary connection will be located on the charging pump discharge piping. For both Units, the connection will be near isolation valve 1,2-8106 on EL 810'-6". The RCS makeup pump will need to be aligned for boration purposes 14 hours after the event in order to achieve cold shutdown xenon-free conditions prior to 24 hours. Accumulator volume is not credited. When the boric acid tank (BAT) depletes, switchover to the refueling water storage tank (RWST) is required. FLEX equipment will be trailer mounted or on wheels for ease of deployment, as appropriate. In addition to the above described actions the licensee stated that fuel would be provided from the emergency diesel generator fuel oil tanks and the associated day tanks.

On page 28 of its Integrated Plan describing the protection of connection for the transition phase of the strategy to maintain RCS inventory control, the licensee stated that both the primary and secondary connection points for alignment 1 (high pressure) and the primary and secondary alignment points for alignment 2 (low pressure) are located in the safeguards building. During the audit process the licensee stated that all RCS inventory control connection points are located within the Safeguards Bldg. (SGB) and at least as high as Elev. 810.5' which is located above the CPNPP probable maximum flood (PMF) level (considering both current licensing basis (CLB) and Recommendation 2.1 Re-evaluated levels). In addition, the licensee stated that there are no non-seismically robust internal flood sources of sufficient capacity located higher than Elev. 810.5' that can preclude implementation of this strategy. Nor are there any external non-seismic flood sources including tanks of sufficient capacity and proximity to SGB entry points (at Elev 810.5') to result in flow to the location of the connection points. The licensee concluded that all potential groundwater sources are below plant grade at Elev. 810'.

On page 38 of its Integrated Plan regarding strategies to maintain containment during the initial phase, the licensee stated that an analysis will be utilized to demonstrate that containment pressure and temperature will stay at acceptable levels throughout the ELAP event and that the containment spray system will be not be required as part of FLEX mitigating strategies. CPNPP will install low-leakage reactor coolant pump (RCP) seals, which will significantly reduce the amount of energy input to the containment during Modes 1-4 scenarios. Monitoring of containment conditions will still occur. FSGs will include containment monitoring during a FLEX event. There are no Phase I actions required at this time that need to be addressed.

The licensee stated that it would analyze to demonstrate that containment pressure and temperature will stay at acceptable levels throughout the ELAP event and that containment spray system will not be required as part of FLEX mitigating strategies. The licensee has identified this issue as Open Item OI2: "Perform containment evaluation based on the boundary conditions described in Section 2 of NEI 12-06. Based on the results of this evaluation, required actions to ensure maintenance of containment integrity and required instrument function will be developed as necessary". This is Confirmatory Item 3.1.1.2.B.

On page 41 of its Integrated Plan regarding deployment conceptual design to maintain SFP cooling during the transition phase, the licensee stated that the RWST will be aligned with a portable FLEX pump and discharged to one of the two connection locations identified below. The primary strategy utilizes adapters and the fire protection hose stations located around the SFP. The secondary connection will utilize a newly created header. Two connection locations to this header will be available outside the fuel building; therefore, access to inside the fuel building will not be required for this strategy. Alignment of the portable FLEX pump at 29 hours for the normal SFP heat load scenario would ensure 15 feet of water was maintained above the fuel storage racks. Alignment of the portable FLEX pump at 16 hours for the full core offload scenario would ensure 15 feet of water was maintained above the SFP storage racks.

On page 42 of its Integrated Plan the licensee stated that modifications to maintain SFP cooling during the transition phase would include: two penetrations in east wall of fuel building; two penetrations in east wall of auxiliary building to 860' elevation of Fuel building; and other piping as shown in Attachment 3, Figures A3-11 through A3-15 of the Integrated Plan.

On page 43 and 44 of its Integrated Plan regarding protection of connections to maintain SFP cooling during the transition phase, the licensee stated all primary connections are located inside the Fuel Building and two of the four of the secondary connections, two of the four connection points are located inside the auxiliary building to allow use of the fire protection system, if available. The two other connections located outside the Fuel Building will be seismically qualified, missile protected connections and will be located above the sites PMF level.

On page 45 of its Integrated Plan regarding the strategy for during the final phase, the licensee stated the SFP is initially cooled via continued boil-off and make-up. The various sources of coolant from the tanks in the yard will be used for makeup if available or the safe shutdown impoundment (SSI) or Squaw Creek Reservoir (SCR) can be used for makeup in conjunction with the mobile purification system discussed previously. The mobile boration unit would also be available to provide borated coolant for SFP cooling if desired. For long term cooling, CPNPP will be using a large generator from the regional response center (RRC), and the SFP cooling system will be repowered to provide indefinite coping. The installed SFP cooling system pumps are designed to function with the high temperature water that they will encounter in the Phase 3 timeframe.

On page 49 and 50 of its Integrated Plan regarding safety functions support during the transition phase, the licensee stated that panel XB 10-1 will be modified to include FLEX connectors that will be connected directly to the bus. To facilitate FLEX generator connections prior to connecting the generator, the panel main breaker must be opened. A new "800A FLEX panel board" will be installed inside the Unit 2 safeguards building. From the new panel board in the Unit 2 safeguards building, three 400-amp circuits will be permanently installed to existing panels XB10-1-3 and 2B10-1-1. Each of these panels has a spare breaker that will be used to back feed the panel in the event of an ELAP. A ground test well will be installed at the generator staging location to allow a quick access point to the station ground.

On page 55 of its Integrated Plan regarding portable equipment for the final phase, the licensee stated that one RHR and one component cooling water (CCW) pump would be required to cool the RCS. A diesel-driven pump will be used to provide UHS water to the SW system. The medium voltage generator will provide power for the CCW (1000 hp) and RHR (450 hp) pumps. Two 2-MW 4160-Vac generators and step up transformers will provide adequate power to start and operate this equipment. Early in the FLEX implementation, the site will notify the RRC and request equipment. The generators and transformers from the RRC will be delivered to the site. Following delivery, one train of the Class 1E 6900- Vac switchgear in each unit will be energized. The two 2-MW 4160-Vac FLEX generators for Unit 2 will be deployed in staging area 2. The two 2-MW 4160-Vac FLEX generators for Unit 1 will be deployed in staging area 5.

During the audit process the licensee provided updated information on its FLEX storage strategies and its plans for deployment of FLEX equipment. The licensee stated that the CPNPP six Month update (ADAMS Accession No. ML 13252A077) provides details for a new single structure designed in accordance with the NEI guidance to protect stored FLEX equipment under all applicable external events. Debris removal equipment credited to clear deployment pathways including vehicles utilized to tow and/or transport FLEX support equipment will also be stored inside this structure. The licensee also stated that a detailed description would be provided in the February 2014 six month update of its Integrated Plan.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and, subject to the successful closure of issues related to the Confirmatory Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to deployment of FLEX equipment 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 14, 16, and 22 of the sections of its Integrated Plan regarding the strategy for maintaining core cooling and heat removal, the licensee listed the instrumentation credited or recovered for Phases 1, 2, and 3 and stated that the 118 Vac instrumentation bus would provide power for each of these instruments. Readings can be taken in the control room or locally with the use of a Fluke device (except for the core exit thermocouples (CETs) and reactor vessel level instrumentation system (RVLIS). The licensee also stated that Phase 2 FLEX equipment would have installed local instrumentation needed to operate the equipment. The use of these instruments will be in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP. Identical statements are made on pages 26, 28, and 22 of 112 in the sections regarding the strategy for RCS inventory control and on pages 36 and 39 in the sections of its Integrated Plan regarding the strategy for maintaining containment.

On pages 41, 41, and 46 of 112 in the section of its Integrated Plan regarding the strategy for maintaining SFP cooling the licensee added SFP level, which would be powered according to the requirements of NRC Order EA-12-051.

During the audit process the licensee stated that all RCS Inventory Control connection points are located within the safeguards building (SGB) and equal to or greater than elevation 810.5' which is located above the CPNPP PMF level (considering both CLB and Recommendation 2.1 Re-evaluated levels). In addition, there are no non-seismically robust internal flood sources of sufficient capacity that can preclude implementation of this strategy. Nor are there any external non-seismic flood sources including tanks of sufficient capacity and proximity to SGB entry points (at elevation 810.5') to result in flow to the location of the connection points. All potential groundwater sources are below plant grade at elevation 810'. CPNPP is a dry site and groundwater intrusion internal to critical building locations even under Recommendation 2.1 Re-evaluation conditions is minute in nature and cannot inundate locations of FLEX implementation strategies under loss of ac power conditions. The plant's main power block is located upstream and at a higher elevation than its non-safety/non-seismic cooling water reservoir and dam structure. Thus there are no credible gravity drainage pathways into safety related building or FLEX equipment staging areas given a failure of such features. Therefore there is sufficient information to conclude that Sections 5.3.3(2), (3), and (4) of NEI 12-06 will be met.

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

3.1.1.4. Considerations in Using Offsite Resources - Seismic Hazard.

NEI 12-06, Section 5.3.4 states:

> Severe seismic events can have far-reaching effects on the infrastructure in and around a plant. While nuclear power plants are designed for large seismic events, many parts of the Owner Controlled Area and surrounding infrastructure (e.g., roads, bridges, dams, etc.) may be designed to lesser standards. Obtaining off-site resources may require use of alternative transportation (such as air-lift capability) that can overcome or circumvent damage to the existing local infrastructure.
>
> 1. The FLEX strategies will need to assess the best means to obtain resources from off-site following a seismic event.

On page 11 of its Integrated Plan the licensee stated that they would utilize the industry RRCs for Phase 3 equipment. The licensee stated that CPNPP has signed a contract with the Strategic Alliance for FLEX Emergency Response (SAFER) to meet the requirements of NEI 12-06, Section 12. The licensee stated that two industry RRCs will be established to support utilities in response to beyond design-basis external events. Communications would be established between CPNPP and SAFER and the required equipment mobilized as needed. Equipment would initially be moved from a RRC to a local staging area established jointly by SAFER and the licensee. The equipment would be prepared at the staging area prior to transportation to the CPNPP site. The initial arriving equipment would be delivered to CPNPP within 24 hours of initial notification. During the audit process the licensee stated that these details would be provided in the SAFER Response Plan scheduled for February 2014

Review of the Integrated Plan indicated that the licensee had not provided a description of the methods to be used to deliver the equipment to the site and that they had not addressed the potential impact of all applicable hazards on the transportation of offsite resources as described in NEI 12-06, Section 5.3.4, consideration 1, Section 6.2.3.4, considerations 1 and 2, Section 7.3.4, considerations 1 and 2, and Section 8.3.4. In its Six Month Status Report the licensee indicated that these details would be addressed in its SAFER Response Plan scheduled for February 2014. This has been identified as Confirmatory Item 3.1.1.4.A. in Section 4, 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 offsite resources if these requirements are implemented as described.

3.1.2 Flooding

NEI 12-06, Section 6.2 states:

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

NEI 12-06, Section 6.2.1 states in part:

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

On pages 1 and 2 of its Integrated Plan the licensee stated that the calculated probable maximum flood level (PMF) of Squaw Creek Reservoir (SCR) is 789.7 feet. The station, which takes cooling water from one side of a peninsula projecting into the SCR, which the CPNPP UFSAR, Section 1.2.1.2 states was impounded for station cooling by a dam constructed on Squaw Creek, and discharges to the other, has a site grade elevation of 810.0 feet. The licensee stated that the FLEX Phase 1 and Phase 2 strategies will not be affected by external flooding as all strategies occur at grade elevation, above the site's probable maximum flood (PMF) level. In addition, CPNPP is developing strategies for delivery of offsite FLEX equipment during Phase 3, which considers regional impacts from flooding. During the audit process the licensee stated the Six Month Status Report clarified that the PMF level is based on the guidelines of RG 1.102 and is the same as the definition of the Design Basis Flood Level (DBFL) in NEI 12-06 Section 6.2.1. Therefore with a PMF level of 789.7 feet Comanche Peak is considered a dry site. The licensee concluded that the most limiting site PMF level given the spectrum of scenarios evaluated is still less than the proposed FLEX equipment storage and staging areas including onsite deployment paths. In regard to offsite transportation of FLEX Phase III equipment, the impact of potential flooding was screened in and will be addressed separately in the applicable Comanche Peak Phase III Safety Response Plan. This "dry site" clarification regarding the plant site and Offsite considerations will be addressed in the next update of its Six Month Status Report.

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

3.1.2.1 Protection of FLEX Equipment – Flooding Hazard

NEI 12-06, Section 6.2.3.1 states:

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

On page 17, 32, 43 and 51 of its Integrated Plan regarding the strategies for maintaining core cooling, RCS inventory control, SFP cooling, and safety functions support in the transition phase (phase 2), the licensee stated that all FLEX storage locations will be sited above the PMF level. In the first Six Month Status Report, dated August 28, 2013, the licensee provided a drawing showing the location of the planned storage area and confirmed that the planned storage area and the entire owner controlled area be located above the PMF.

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

3.1.2.2. Deployment of FLEX Equipment – Flooding Hazard.

NEI 12-06, Section 6.2.3.2 states:

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

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

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

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

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

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

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

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

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

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

On page 9 of the Integrated Plan, the licensee stated that the final staging locations will be determined as CPNPP progresses through the detailed design process for FLEX modifications.

Staging routes and deployment paths are shown in Figures A3-16 through A3-21 and A3-30 through A3-35 of the Integrated Plan. Routes for transporting FLEX equipment from storage location(s) to deployment areas will be developed as the FLEX storage facility details are identified and finalized. The licensee stated that the identified pathways and deployment areas will be accessible during all modes of plant operation (consistent with the timeframe in which the associated FLEX strategy would be implemented). An administrative program will be developed to ensure pathways will be kept clear or will require actions to clear the pathways. The selected (final) pathways will be evaluated for the applicable hazard(s). In the first Six Month Status Report, the licensee provided drawings showing the locations of the FLEX storage building location and the staging area locations. These are all located in the owner controlled area, which is above the PMF. They also stated that debris removal equipment credited to clear deployment pathways including vehicles utilized to tow and/or transport FLEX equipment will also be stored inside the structure.

On pages 19, 20, 22 and 24, of its Integrated Plan discussing the protection of connections used in the strategy for maintaining core cooling and heat removal with or without the steam generators being available during the transition and final phases, the licensee stated that the connections utilized for Phase 3 are the same as described for Phase 2.

On pages 30, 31 and 32 of its Integrated Plan discussing the protection of connections used in the strategy for maintaining RCS inventory control for the transition and final phases, the licensee stated that the primary and secondary RCS FLEX connection point for alignment 1 (high pressure) and alignment 2 (low pressure) are located in the SGB. The suction and makeup connections to the RWST and BAT will be seismically qualified, missile protected and located above the site's PMF level.

On pages 43 and 44 of its Integrated Plan discussing the protection of connections used in the strategy for maintaining SFP cooling during the transition phase, the licensee stated that all of the primary SFP connection points SFP are located inside the Fuel Building. Two of the four secondary connection points are located inside the auxiliary to allow for use of the fire protection system, if available. The two other secondary connection points are located outside the Fuel Building and will be seismically qualified, missile protected and located above the site's PMF level.

During the audit process the licensee stated that the FLEX equipment storage building, including proposed deployment paths and staging areas, are located above the site's CLB and Recommendation 2.1 Re-evaluation PMF levels and includes considerations for the Local Intense Precipitation (LIP) event and the potential resulting short term ponding effects. Flooding conditions will not affect the connection points and procedurally controlled temporary flooding barriers will not be required to support FLEX implementation strategies. Therefore there is no need incorporate FLEX deployment considerations into existing flooding procedures

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

3.1.2.3 Procedural Interfaces – Flooding Hazard.

NEI 12-06, Section 6.2.3.3 states:

The following procedural interface considerations should be addressed.

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

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

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

On page 10 of the Integrated Plan that identifies how the programmatic controls will be met, the licensee stated that equipment associated with these strategies will be procured as commercial equipment with design, storage, maintenance, testing, and configuration control in accordance with NEI 12-06 Rev. 0 Section 11. The unavailability of equipment and applicable connections that directly performs a FLEX mitigation strategy will be managed using plant equipment control guidelines developed in accordance with NEI 12-06 Rev. 0 Section 11.5. Programs and controls will be established to assure personnel proficiency in the mitigation of beyond-design-basis events is developed and maintained in accordance with NEI 12-06 Rev.0 Section 11.6. The FLEX strategies and basis will be maintained in an overall program document. Existing plant configuration control procedures will be modified to ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies in accordance with NEI 12-06 Rev. 0 Section 11.8.

In the Six Month Status Report, the licensee provided details for a new storage structure in accordance with NEI 12-06 guidance to protect stored FLEX equipment under all applicable external events such as high winds including design basis tornado wind speeds and the effects of tornado generated missiles. The licensee also reiterated that FLEX equipment storage, staging, and connections are located above the PMF and therefore no special guidance is required to address flooded condition or deployment of temporary flood barriers or extraction pumps.

During the audit process the licensee stated that the FLEX equipment storage building including proposed deployment paths and staging areas are located above the site's CLB and Recommendation 2.1 Re-evaluation PMF level and includes considerations for the Local Intense Precipitation (LIP) event and the potential short term ponding effects resulting from that event. There are no differences realized for connection points under potential flooded vs. non-flooded conditions and no procedurally controlled temporary barriers required to be credited to support FLEX implementation strategies.

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

3.1.2.4. Considerations in Using Offsite Resources – Flooding Hazard

NEI 12-06, Section 6.2.3.4 states:

Extreme external floods can have regional impacts that could have a significant impact on the transportation of offsite resources.

1. Sites should review site access routes to determine the best means to obtain resources from off-site following a flood.

2. Sites impacted by persistent floods should consider where equipment delivered from offsite could be staged for use on-site.

On pages 11 and 12 of its Integrated Plan describing the RRC plan, the licensee repeated the statement provided in paragraph 3.1.1.4, above, Considerations in Using Offsite Resources (Seismic Considerations). The licensee's plan for the use of offsite resources did not provide reasonable assurance that the plan will conform with NEI 12-06, Section 6.2.3.4, due to the absence of the methods to be used to deliver the equipment to the site. In its Six Month Status Report dated August 28, 2013, the licensee indicated that these details would be addressed in its SAFER Response Plan scheduled for February 2014 (This has been previously identified as Confirmatory Item 3.1.1.4.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 provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to using offsite resources if these requirements are implemented as described.

3.1.3 High Winds

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

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

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

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

On page 2 of its Integrated Plan regarding the determination of applicable extreme external hazards, the licensee stated that Figures 7-1 and 7-2 from NEI 12-06 were used for this assessment. The licensee concluded that CPNPP is not susceptible to hurricanes as the plant site is a significant distance from the final contour line shown in Figure 7-1 of NEI 12-06. The licensee also concluded that the CPNPP site has the potential to experience damaging winds caused by a tornado exceeding 130 mph. Figure 7-2 of NEI 12-06 indicates a maximum wind speed of 200 mph for Region 1 plants, including CPNPP. However, the FSAR defines the design basis tornado for Comanche Peak as 360 mph winds. Therefore, the licensee determined that a design basis tornado wind speed of 360 mph would be used in analysis for CPNPP's FLEX strategies.

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

3.1.3.1 Protection of FLEX Equipment - High Wind Hazard.

NEI 12-06, Section 7.3.1 states:

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

should be aligned in the North-South arrangement, where possible. Additionally, in selecting diverse FLEX storage locations, consideration should be given to the location of the diesel generators and switchyard such that the path of a single tornado would not impact all locations.

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

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

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

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

On page 19 of its Integrated Plan describing the storage/protection of equipment for the transition phase of its strategy for maintaining core cooling & heat removal, maintaining inventory control, and maintaining SFP inventory, the licensee stated that the FLEX equipment will be stored in a building designed to meet NEI 12-06 guidance and where equipment will be protected from severe weather/high wind events. They reiterated that they are not subject to hurricanes but are subject to high wind speeds due to tornados. During the audit process the licensee stated that the CPNPP 6 Month update dated August 28, 2013 provides details for a new single structure designed in accordance with the NEI guidance to protect stored FLEX equipment under all applicable external events such as high winds including design basis tornado wind speeds and the effects of tornado generated missiles.

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

NEI 12-06, Section 7.3.2 states:

> There are a number of considerations that apply to the deployment of FLEX equipment for high wind hazards:
>
> 1. For hurricane plants, the plant may not be at power prior to the simultaneous ELAP and LUHS condition. In fact, the plant may have been shut down and the plant configuration could be established to optimize FLEX deployment. For example, the portable pumps could be connected, tested, and readied for

use prior to the arrival of the hurricane. Further, protective actions can be taken to reduce the potential for wind impacts. These factors can be credited in considering how the baseline capability is deployed.

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

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

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

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

Because CPNPP is not susceptible to hurricanes, considerations 1, 2, and 5 are inapplicable.

On pages 6 of its Integrated Plan regarding sequence of events and time constraints required for success, the licensee identified the preliminary deployment paths from the storage to staging locations. Equipment required to stage [move] Phase 2 FLEX equipment will be maintained on-site. Such equipment will include vehicles capable of debris removal as necessary to support staging and deployment of FLEX equipment.

CPNPP does have existing procedures that direct actions in anticipation of severe weather, including tornadoes, however, such events are typically fast developing, short term events where deployment of equipment prior to or during the event is not credited nor required to be implemented. Deployment of FLEX equipment from the storage structure designed to withstand the tornado wind speeds and missiles generated from it will only occur after the event has passed. The licensee also identified the location of the proposed FLEX storage building and the staging areas for each of the strategies. The identified pathways and deployment areas will be accessible during all modes of plant operation (consistent with the timeframe in which the associated FLEX strategy would be implemented). An administrative program will be developed to ensure pathways will be kept clear or will require actions to clear the pathways. The selected (final) pathways will be evaluated for the applicable hazard(s).

On page 66 of its Integrated Plan the licensee listed two "Pettibone" (debris removal equipment) to maintain accessibility. On page 67 of the Integrated Plan, the licensee also listed two pickup trucks for use moving FLEX equipment to support Core, SFP, and accessibility purposes. During the audit update process the licensee stated that this equipment would be stored in the FLEX equipment storage structure.

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

3.1.3.3 Procedural Interfaces – High Wind Hazard.

NEI 12-06, Section 7.3.3, states:

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

As stated in section 3.1.3.2, an administrative program will be developed to ensure pathways will be kept clear or will require actions to clear the pathways. The selected (final) pathways will be evaluated for the applicable hazard(s). CPNPP is not subject to hurricanes, which can be predicted days in advance. The licensee does have existing procedures that direct actions in anticipation of severe weather, including tornados, however such events are typically fast developing, short term events where deployment of equipment prior to, or during, the event is not credited nor required to be implemented.

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

3.1.3.4. Considerations in Using Offsite Resources – High Wind hazard.

NEI 12-06, Section 7.3.4 states:

Extreme storms with high winds can have regional impacts that could have a significant impact on the transportation of off-site resources.

1. Sites should review site access routes to determine the best means to obtain resources from off-site following a hurricane.

2. Sites impacted by storms with high winds should consider where equipment delivered from off-site could be staged for use on-site.

As indicated previously, Comanche Peak is not subject to hurricanes and therefore not subject to widespread regional impacts that could have significant impacts on the transportation of off-site resources. The site is subject to impact from tornados but those impacts are likely to be more localized. The licensee does have existing procedures that direct actions in anticipation of severe weather, including tornados, however such events are typically fast developing, short term events where deployment of equipment prior to, or during, the event is not credited nor required to be implemented.

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

3.1.4 Snow, Ice and Extreme Cold

As discussed in NEI 12-06, Section 8.2.1:

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

On page 2 of its Integrated Plan regarding the determination of applicable extreme external hazards, the licensee stated that since both Units of the CPNPP site are South of the 35th parallel, the FLEX strategies need not consider the impedances caused by extreme snowfall with snow removal equipment or the challenges that extreme cold temperatures may present. The licensee concluded that since the Comanche Peak site is not a Level 1 or 2 region as defined by Figure 8-2 of NEI 12-06, the FLEX strategies must consider the impedances caused by low to medium 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 screening for snow, ice, and extreme cold hazard if these requirements are implemented as described.

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

NEI 12-06, Section 8.3.1 states:

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

For example, by storage in a heated enclosure or by direct heating (e.g., jacket water, battery, engine block heater, etc.).

On pages 18, 29, 43 and 52 of its Integrated Plan regarding the strategies for maintaining core cooling and heat removal, RCS inventory, SFP inventory and support systems in the transition phase, the licensee stated that protection of associated portable equipment from snow, ice and extreme cold would be provided. While the ice hazard will apply most directly to staging strategies, CPNPP will consider the site's applicable ice hazard when designing the protection and deployment strategies for FLEX equipment. Maintenance activities keep the station roadways clear of ice throughout the winter season. While the ice hazard will need to be analyzed, extreme cold temperatures have been screened out for the CPNPP site.

During the audit process the licensee stated that the FLEX equipment would be stored in a new structure designed in accordance with the NEI 12-06, Section 8.3.1, to protect against all external events including design basis snowfall or ice storms. These details would be provided in the February 2014 six-month status report. Verification that the FLEX storage building will conform to NEI 12-06, Section 8.3.1 is Confirmatory Item 3.1.4.1.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 protection of FLEX equipment if these requirements are implemented as described.

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

NEI 12-06, Section 8.3.2 states:

There are a number of considerations that apply to the deployment of FLEX equipment for snow, ice, and extreme cold hazards:

1. The FLEX equipment should be procured to function in the extreme conditions applicable to the site. Normal safety-related design limits for outside conditions may be used, but consideration should also be made for any manual operations required by plant personnel in such conditions.

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

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

On page 18 of its Integrated Plan regarding the strategies for maintaining core cooling and heat removal in the transition phase, the licensee stated that protection of associated portable equipment from snow, ice and extreme cold would be provided. While the ice hazard will apply most directly to staging strategies, CPNPP will consider the site's applicable ice hazard when designing the protection and deployment strategies for FLEX equipment. Existing maintenance activities keep the station roadways clear of ice throughout the winter season. The licensee lists two pickup trucks and 4 wheel drive transportation equipment (tow vehicle) and debris clearing equipment (Bobcat) but does not specify whether this equipment would be capable of removing ice.

During the audit process the licensee stated that CPNPP is not susceptible to extreme snowfall events that limit onsite transport of equipment. It can be subjected to severe cold weather and freezing conditions including ice storms for short durations. Existing severe weather procedures provide guidance/manual actions to take in regard to icy site roads that include maintaining the capability to spread sand over site roadways to enhance equipment traction. FLEX equipment will be located in a structure to protect such equipment form anticipated cold weather events such as 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 the deployment of FLEX equipment if these requirements are implemented as described.

3.1.4.3 Procedural Interfaces – Snow, Ice, and Extreme Cold Hazard.

NEI 12-06, Section 8.3.4, 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.

In its Integrated Plan and Audit update the licensee stated that CPNPP is not susceptible to extreme snowfall events that limit onsite transport of equipment. CPNPP can be subjected to severe cold weather and freezing conditions including ice storms for short durations. Existing severe weather procedures provide guidance/manual actions to take in regard to icy site roads that include maintaining the capability to spread sand over site roadways to enhance equipment traction.

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

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

NEI 12-06, Section 8.3.4, states:

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

On page 11 of its Integrated Plan regarding the RRC plan, the licensee stated that CPNPP would utilize the industry RRCs for Phase 3 equipment. CPNPP has a contractual agreement with SAFER. Two industry RRCs will be established to support utilities in response to beyond design-basis external events. Each RRC will hold five (5) sets of equipment: four (4) of which would be able to be fully deployed if requested while the fifth set would be comprised of equipment undergoing maintenance. Communications would be established between CPNPP and SAFER and the required equipment mobilized as needed. Equipment would initially be moved from a RRC to a local staging area established jointly by SAFER and the licensee. The equipment would be prepared at the staging area prior to transportation to the CPNPP site. The initial arriving equipment, as defined in the plant-specific playbook, would be delivered to CPNPP within 24 hours of initial notification.

The licensee's plan for the use of offsite resources did not provide reasonable assurance that the plan will conform with NEI 12-06, Section 8.3.4, due to the absence a description of the methods to be used to deliver the Phase 3 FLEX equipment to the site. This was identified previously as Confirmatory Item 3.1.1.4.A.

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

3.1.5 High Temperatures.

NEI 12-06, Section 9 states:

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

On page 3 of its Integrated Plan regarding the determination of applicable extreme external hazards, the licensee stated that Comanche Peak will consider impacts of high temperatures on FLEX equipment and its deployment.

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

3.1.5.1 Protection of FLEX Equipment – High Temperature Hazard

NEI 12-06, Section 9.3.1, states:

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

On pages 18, 29, 43 and 51 of its Integrated Plan regarding the strategies for maintaining core cooling and heat removal, RCS inventory, SFP cooling and safety functions in the transition phase (phase 2), the licensee stated that FLEX equipment will be maintained at a temperature within a range to ensure its likely function when called upon. Both the primary and secondary FLEX generators will be procured such that they are protected from high temperature events.

During the audit process the licensee stated that applicable FLEX equipment will be stored in a new single structure designed to meet the requirements of the NEI guidance for high temperatures. The building will have forced ventilation to circulate ambient air in order to address expected extremes summertime design temperatures for the plant site. A separate environmentally controlled room internal to the FLEX storage building will be used for the storage of for such items as food, water and communications 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 provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to protection of FLEX equipment from high temperature hazards if these requirements are implemented as described.

3.1.5.2. Deployment of FLEX Equipment – High Temperature Hazard.

NEI 12-06, Section 9.3.2 states:

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

On page 3 of its Integrated Plan regarding the determination of applicable extreme external hazards, the licensee stated that it would consider the impacts of high temperatures on FLEX equipment and its deployment. During the audit process the licensee stated that the FLEX equipment storage building would be designed with forced ventilation and would be used to store equipment necessary to deploy 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 deployment of FLEX equipment if these requirements are implemented as described.

3.1.5.3 Procedural Interfaces – High Temperature Hazard

NEI 12-06, Section 9.3.3 states:

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

On page 3 of its Integrated Plan regarding the determination of applicable extreme external hazards, the licensee stated it would consider the impacts of high temperatures on FLEX equipment and its deployment. During the audit process the licensee stated that the procurement documents for the FLEX equipment would specify that the equipment be capable of operating under the design basis temperature range conditions expected for the CPNPP regional location.

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

3.2 PHASED APPROACH

Attachment (2) to Order EA-12-049 describes the three-phase approach required for mitigating beyond-design-basis external events 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 beyond-design-basis external event that results in the loss of all ac power, with the exception of buses supplied by safety-related batteries through inverters, and loss of normal access to the UHS. As described in NEI 12-06, Section 1.3, "plant-specific analyses will determine the duration of each phase." This baseline coping capability is supplemented by the ability to use portable pumps to provide RPV/RCS/SG makeup in order to restore core or SFP capabilities as described in NEI 12-06, Section 3.2.2, Paragraph (13). This approach is endorsed in NEI 12-06, Section 3, by JLD-ISG-2012-01.

3.2.1 RCS Cooling and Heat Removal, and Inventory Control Strategies

NEI 12-06, Table 3-2 and Appendix D summarize one acceptable approach for the reactor core cooling strategies. This approach uses the installed auxiliary feedwater (AFW) 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 with a portable injection source in order to provide core cooling for the transition and final phases. This approach accomplishes reactor coolant system (RCS) inventory control and maintenance of long-term subcriticality through the use of low leak reactor coolant pump seals and/or borated high pressure RCS makeup with a letdown path.

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

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

Appendix D, Table D-1.

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

3.2.1.1. Computer Code Used for ELAP Analysis.

NEI 12-06, Section 1.3 states:

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

The licensee provided a Sequence of Events (SOE) in its Integrated Plan, which included the time constraints and the technical basis for the site. During the audit process the licensee stated that SOE was based on the analysis in Section 5.7.1 of WCAP-17601-P that was performed with the NOTRUMP computer code. The licensee further stated that CPNPP Units 1 and 2 are four-loop Westinghouse-designed units with Westinghouse model 93A RCPs crediting the use of SHIELD® passive thermal shutdown seals for the development and implementation of strategies responsive to EA-12-049. Section 5.7.1 of WCAP-17601 includes analysis of a four-loop Westinghouse plant with low-leakage SHIELD® seals installed. The analysis for this case assumes 1 gpm leakage per RCP plus 1 gpm unidentified leakage. As such, the NRC staff expects the analyzed case to be sufficiently representative of Comanche Peak to support the sequence of events in its Integrated Plan.

During the audit process the licensee stated that the steam generator makeup requirements had been determined based on the cooldown scenario modeled in Section 5.2.1 of WCAP-17601. Subsequently, a minor potential impact to steam generator makeup requirements when crediting low-leakage seals was identified. Although the licensee did not elaborate as to the cause of the discrepancy, the staff anticipates that it may be associated with aspects such as

(1) increased energy removal from the reactor coolant system via leakage from standard reactor coolant pump seals (WCAP-17601-P, Section 5.2.1) relative to the low-leakage SHIELD® seals credited in the analysis referenced by Comanche Peak (WCAP-17601-P, Section 5.7.1) and
(2) the assumed difference in the timing of the RCS depressurization and cooldown for standard leakage reactor coolant pump seals (i.e., cooldown initiating at two hours) and low-leakage SHIELD® seals (i.e., Comanche Peak's Integrated Plan currently calls for cooldown initiation at 12 hours).

In any case, the licensee stated that a reevaluation of existing conservatisms will be performed to determine the impact, if any, on the FLEX strategies. RCS inventory and shutdown margin control analysis were performed using calculation CN-LIS-12-74, Revision 0. The licensee is tracking Containment analysis Overall Integrated Plan Open Item OI2. Since the licensee is still resolving the discrepancy regarding the effect of seal leakage on steam generator makeup requirements, the staff has designated this issue as Confirmatory Item 3.2.1.1.A in Section 4.2 of this report.

The licensee has elected to reference generic ELAP analysis performed with the NOTRUMP computer code to support the mitigating strategy in its Integrated Plan. Although NOTRUMP has been reviewed and approved for performing small-break loss of coolant accident (LOCA) analysis for pressurized-water reactors (PWRs), the NRC staff had not previously examined its technical adequacy for simulating an ELAP event. In particular, the ELAP scenario is differentiated from typical design-basis small-break LOCA scenarios in several key respects, including the absence of normal emergency core cooling system (ECCS) injection and the substantially reduced leakage rate, which places significantly greater emphasis on the accurate prediction of primary-to-secondary heat transfer, natural circulation, and two-phase flow within the RCS. As a result of these differences, concern arose associated with the use of the NOTRUMP code for ELAP analysis for modeling of two-phase flow within the RCS and heat transfer across the steam generator tubes as single-phase natural circulation transitions to two-phase flow and the reflux condensation cooling mode. Based upon the licensee's current plan to install low-leakage reactor coolant pump seals, the staff expects that the licensee will be readily able to provide primary makeup to avoid transitioning to reflux condensation cooling. Nevertheless, to ensure that the issue is understood and addressed by the licensee, the staff has designated the following Confirmatory Item:

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

During the audit process, the staff questioned whether the generic analysis in WCAP-17601 is capable of resolving whether nitrogen injection from the cold leg accumulators will occur at Comanche Peak under ELAP conditions. In particular, the licensee was requested to (1) clarify whether calculations have been performed consistent with the PWROG-recommended methodology in Attachment 1 to the PWROG's interim core cooling position paper for PA-PSC-0965 (ADAMS Accession Number ML13042A010) to verify that the intended ELAP mitigation strategy will not result in injection of nitrogen from cold leg accumulators or (2) provide justification that the existing calculational methods for determining whether nitrogen injection will occur considers the potential for heating due to the rise of containment temperatures due to loss of normal ventilation, RCP seal leakage, etc. During the audit process the licensee stated that nitrogen injection from the accumulators is prevented by securing SG depressurization at 270 psig as directed by "Comanche Peak Emergency Operating Procedure ECA-0.0, Revision 8, Loss of AC Power." However, the licensee noted that FSG development may support a different depressurization target. The licensee further stated that installation of SHIELD® low-leakage RCP seals will limit containment pressure and temperature such that significant expansion of the accumulator contents due to heat transfer from containment is not expected. Confirmation of the containment pressure and temperature response during an ELAP is identified in the Integrated Plan as open item OI2. The NRC staff agrees with the licensee's expectation regarding containment conditions for plants with low-leakage seals, but notes that the existing steam generator depressurization terminus proposed for Comanche Peak is lower than recommended in WCAP-17601-P and further may be revised. Ultimately, the staff concurs with the licensee's approach to perform a calculation consistent with the methodology in the PWROG's interim core cooling position paper to ensure that nitrogen injection from the accumulators does not occur during the ELAP event. This is identified as Confirmatory Item 3.2.1.1.C in Section 4.2 below.

During the audit process the licensee was asked to clarify whether the Phase 2 mitigating strategy for core cooling provides for a symmetric cooldown of each of the four reactor coolant system loops, or whether it would result in the feeding of a single steam generator. If a symmetric cooldown would be implemented, please further clarify how the flow to each steam generator would be coordinated (e.g., between the main control room and local equipment operators) and controlled. If flow to a single steam generator will be provided, please present analysis demonstrating that this strategy will be successful. The licensee responded that it planned to perform a symmetric cooldown using all RCS loops but noted that the procedure for accomplishing a symmetric cooldown is in development. Because the licensee did not provide sufficient information during the audit to justify that the strategy for symmetric cooldown could be successfully coordinated by plant operators under ELAP conditions. This is identified as Confirmatory Item 3.2.1.1.D in Section 4.2 below.

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

3.2.1.2. RCP Seal Leakage Rates

NEI 12-06, Section 1.3 states:

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

During an ELAP, cooling to the Reactor Coolant Pump's (RCPs) 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 an SOE in its Integrated Plan, which included the time constraints and the technical basis for its 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-Publically Available)).

- A position paper dated August 16, 2013, entitled "Westinghouse Response to NRC

Generic Request for Additional Information (RAI) on Reactor coolant (RCP) Seal Leakage in Support of the Pressurized Water reactor Owners Group (PWROG)" (ADAMS Accession No. ML13190A201 (Non-Publically Available)).

After review of these submittals, the NRC staff has placed certain limitations on Westinghouse designed plants. Those limitations and its corresponding Confirmatory Item number 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 white paper addressing the RCP seal leakage for Westinghouse plants. During the audit process the licensee stated that CPNPP Units 1 and 2 use Westinghouse model 93A reactor coolant pumps and are crediting the use of safe shutdown low leakage seals (SHIELD) for FLEX strategies. Section 5.7.1 of WCAP-17601, models a low-leakage seal (SHIELD) assuming 1 gpm per RCP leakage plus 1 gpm unidentified allowable Technical Specification (TS) leakage and is therefore applicable to CPNPP. Therefore this issue is not applicable to CPNPP.

2. In some plant designs, such as those with 1200 psia to 1300 psia SG design pressures and no accumulator backing of the main steam system power-operated relief valve (PORV) actuators, the cold legs could experience temperatures as high as 580 ^{0}F before cooldown commences. This is beyond the qualification temperature (550 ^{0}F) of the O-rings used in the RCP seals. For those Westinghouse designs, a discussion of the information (including the applicable analysis and relevant seal leakage testing data) should be provided to justify that (1) the integrity of the associated O-rings will be maintained at the temperature conditions experienced during the ELAP event, and (2) the seal leakage rate used in the ELAP analysis is adequate and acceptable. During the audit process the licensee stated that the lowest main steam safety valve setpoint for Comanche Peak is 1200 psia. The only O-ring of interest with the SHIELD package installed is the RCP seal sleeve-to-shaft O-ring. Qualification of the RCP seal sleeve-to-shaft O-ring will be tracked, as part of the SHIELD redesign to confirm that the delayed cooldown documented in the Integrated Plan is acceptable. Comanche Peak will align with testing results to be documented in the forthcoming SHIELD white paper. This is identified as Open Item 3.2.1.2.A in Section 4.1 below.

3. Some Westinghouse plants have installed or will install the SHIELD shutdown seals, or other types of low leakage seals, and have credited or will credit a low seal leakage rate (e.g., 1 gpm/seal) in the ELAP analyses for the RCS response. For those plants, information should be provided to address the impacts of the Westinghouse 10 CFR Part 21 report, "Notification of the Potential Existence of Defects Pursuant to 10 CFR Part 21," dated July 26, 2013 (ADAMS No. ML13211A168), on the use of the low seal leakage rate in the ELAP analysis. During the audit process the licensee stated that Comanche Peak uses Westinghouse model 93A RCPs crediting safe shutdown low-leakage seals (SHIELD) for FLEX strategies. Testing and qualification of the SHIELD design is ongoing. The licensee is closely following the re-design of the SHIELD package and stated that it will modify analyses and FLEX strategies if needed, based on the conclusions of the SHIELD white paper. This is identified as Confirmatory Item 3.2.1.2.B in Section 4.2 below.

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. As noted above, testing and qualification of the SHIELD design is ongoing. The licensee is closely following the re-design of the SHIELD package and stated that it will modify analyses and FLEX strategies if needed, based on the conclusions of the SHIELD white paper. The PWROG is also planning to submit position papers to the NRC staff containing test data regarding the maximum seal leakage rates of Generation 3 SHIELD seals and Flowserv seals. The NRC staff will review these position papers upon receipt. This is identified as Open Item 3.2.1.2.C in Section 4.1 below.

On page 27 of the Integrated Plan regarding maintaining RCS inventory control during the transition phase, the licensee stated that the Phase 2 activities for RCS inventory control involve aligning a pump to provide borated coolant for RCS makeup and to maintain the reactor subcritical. To ensure that the core is maintained subcritical, borated injection into the RCS is provided from the boric acid tanks via a pre-staged portable motor driven pump. This injection also compensates for potential RCS leakage. A high-pressure electric pump will be staged near the boric acid tanks and will discharge at the connections shown on the alignments provided in Attachment 3 to the licensee's Integrated Plan (Figures A3-5 through A3-9). The RCS makeup pump will need to be aligned and injecting14 hours into the event in order to achieve cold shutdown under xenon-free conditions within 24 hours. Accumulator volume is not credited. When the BAT depletes, switchover to the RWST would be implemented.

The NRC staff also requested that the licensee provide additional information regarding the calculation of the seal leakage flow model, as follows: Discuss how the analysis calculates the pressure-dependent RCP seal leakage rates. Discuss whether the size of the break area is changed or not in the analysis for the ELAP event. If the size is changed, discussed the changed sizes of the break area and address the adequacy of the sizes. If the break size remains unchanged, address the adequacy of the unchanged break size throughout the ELAP event in conditions with various pressure, temperature (considering that the seal material may fail due to an increased stress induced by cooldown) and flow conditions that may involve two-phase flow, which is different from the single phase flow modeled for the RCP seal tests that are used to determine the initial seal leakage rate of 1 gpm. During the audit process the licensee stated that Comanche Peak will install and credit SHIELD seals for FLEX strategies. Section 5.7.1 of WCAP-17601 models this configuration. These cases assumed 1 gpm leakage per reactor coolant pump (plus 1 gpm unidentified leakage) at normal operating pressure and temperature. The licensee stated that these leakage rates are established in WCAP-17099. Considering the information provided by the licensee during the audit, the staff concluded that the licensee had not fully addressed these issues. Therefore, the staff designated Confirmatory Item 3.2.1.2.D in Section 4.2, below, for the licensee to:

(1) Confirm that stresses resulting from a cooldown of the RCS will not result in the failure of seal materials.
(2) As applicable, confirm that reestablishing cooling to the seals will not result in increased leakage due to thermal shock.
(3) Confirm that the fluid leaking through the reactor coolant pump seals will originate as single-phase liquid.
(4) Confirm conformance with Sections 3.5 and 4.0 of the NRC safety evaluation (ADAMS Nos.: ML110880122 and ML110880131) approving the use of the shutdown seal with Model 93A RCP in the plant PRA model.

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 and Open Items, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to RCP seal leakage rates, if these requirements are implemented as described.

3.2.1.3 Decay Heat

NEI Section 3.2.1.2 states in part:

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

On page 8 of the Integrated Plan regarding the sequence of events and in Attachment 1A, "Sequence of Events Timeline", the licensee stated that CPNPP will be installing low leakage RCP seal packages, so there is not a time constraint to perform an extensive early RCS cooldown. The licensee stated that a cooldown will be performed when resources are available and plant conditions warrant, nominally at 12 hours. The licensee further stated that a cooldown is initiated to reduce RCS pressure to allow 10-gpm boration from the high-pressure FLEX RCS make-up pump. During the audit process the licensee stated that Westinghouse calculations were performed using the ANS 5.1 1979 + 2 sigma decay heat model. The implementation of this model in the WCAP-17601-P analysis referenced by the licensee includes fission product decay heat resulting from the fission of U-235, U-238, and Pu-239, actinide decay heat from U-239 and Np-239, and a power history that bounds the initial conditions given in Section 3.2.1.2(1) of NEI 12-06.

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

3.2.1.4 Initial Values for Key Plant Parameters and Assumptions

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

On page 3 of the Integrated Plan the licensee stated that the assumptions assumed for the plant specific ELAP analysis were consistent with those detailed in NEI 12-06, Section 3.2.1 and the recommendations contained within the Executive Summary of the Pressurized Water Reactor Owners Group (PWROG) Core Cooling Position Paper, Westinghouse Letter LTR-PCSA-12-92, Rev. 0, "Transmittal of Final PWROG Generic FLEX Support Guidelines and Interfaces (Controlling Procedure Interface and Recommended Instruments) from PA-PSC-0965," Rev. 0, December 17, 2012 (Includes Attachment A). The key industry guidance and site-specific assumptions, derived from NEI 12-06, include:

Initial Plant Conditions

The initial plant conditions are assumed to be the following:

A1. 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.

A2. At the time of the postulated event, the reactor and supporting systems are within normal operating ranges for pressure, temperature, and water level for the appropriate plant condition. All plant equipment is either normally operating or available from the standby state as described in the plant design and licensing basis.

Initial Conditions

The following initial conditions are to be applied:

A3. 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 off-site power system either throughout the grid or at the plant with no prospect for recovery of off-site power for an extended period. The LOOP is assumed to affect all units at a plant site.

A4. All installed sources of emergency on-site ac power and station blackout (SBO) alternate ac power sources are assumed to be not available and not imminently recoverable.

A5. Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, ice, and high winds and associated missiles are available.

A6. As described in the following section, deviation is taken from: Normal access to the ultimate heat sink is lost, but the water inventory in the ultimate heat sink (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.

A7. Fuel for FLEX equipment stored in structures with designs which are robust with respect to seismic events, floods, ice, and high winds and associated missiles, remains available.

A8. Permanent plant equipment that is contained in structures with designs that are robust with respect to seismic events, floods, ice, and high winds, and associated missiles, are available.

A9. Other equipment, such as portable ac power sources, portable back up direct current (dc) power supplies, spare batteries, and equipment for 50.54(hh)(2), may be used provided it is reasonably protected from the applicable external hazards per Sections 5 through 9 and Section 11.3 of NEI 12-06 and has predetermined hookup strategies with appropriate procedures/guidance and the equipment is stored in a relative close vicinity of the site.

A10. Installed electrical distribution system, including inverters and battery chargers, remain available provided they are protected consistent with current station design.

A11. No additional events or failures are assumed to occur immediately prior to or during the event, including security events.

A12. 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, ice, and high winds and associated missiles.

The licensee's plan for initial plant conditions and initial conditions regarding assumption A1 through A12 above, that are assumed for the ELAP event are consistent with NEI 12-06, Section 3.2.1.2 and 3.2.1.3.

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

3.2.1.5 Monitoring Instrumentation and Controls

NEI 12-06, Section 3.2.1.10 states in part:

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

On pages 14, 16, 22, 26, 28, 33, 35, 36, 37, 39, 46 of 112, of its Integrated Plan, the licensee stated that Comanche Peak will credit the following instrumentation for its FLEX coping strategies:

1. RCS Hot Leg Temperature (T_{hot})
2. RCS Cold Leg Temperature (T_{Cold})
3. RCS Wide Range Pressure
4. SG Narrow Range Level
5. Core Exit Thermocouple Temperature
6. Pressurizer Level

7. Reactor Vessel Level Indicating System
8. Containment Pressure
9. AFW Flow Indication
10. SG Pressure
11. CST Level
12. Source-range Neutron Flux
13. SFP Level (The instruments will be powered according to the requirements of NRC Order EA-12-051).

The 118 Vac instrumentation bus will provide power for each of these instruments. Readings can be taken in the control room or locally with the use of a Fluke device (except for the CETs and RVLIS).

Phase 2 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.

During the audit process the licensee stated that all credited instrument locations are designed to meet RG 1.97 accident monitoring requirements. For instruments located inside reactor containment the credited instruments are qualified to a post loss of coolant accident (LOCA) harsh environment for a 100-day duration. When considering taking credit for the RCP SHIELD design and overall 5-gpm leakage (one gpm for each of the four pumps and one gpm allowable unidentified leakage), inside reactor containment heat gain would be minimal and bounded by the above IRC accident event environment. Instruments located outside of the reactor containment are qualified to the worst case environment resulting from either a 30-day Loss of Ventilation Analysis at extreme outside ambient temperature conditions or a High Energy Line Beak event. In all cases, the harsh environment resulting from the above analyzed events where the credited instruments are located will be more limiting than that created by an ELAP event. Thus the credited instruments should remain reliable and functional under postulated ELAP conditions for the duration of the event.

During the audit process the licensee was asked to list the installed non-safety related systems or equipment that are credited in the ELAP analysis for consequence mitigation, discuss the safety functions that are intended to be maintained, and justify that the non-safety related systems or equipment is available and reliable for its intended use. The licensee stated that Comanche Peak has an installed non-safety-related Plant Support Power Distribution System that is typically used during outages as an alternate supply to existing battery chargers and exhaust fans (and other outage loads as needed) so that maintenance can occur on safety systems. This Plant Support Power system is fed from an external to the plant 25KV loop that is used outside of Modes 1 through 4. This Plant Support Power equipment (distribution panelboards, cable and disconnect switches) are permanently installed equipment that is considered to be available since this equipment is located within existing structures that are robust with respect to seismic events, high winds, and associated missiles. This installed Plant Support Power electrical distribution system, including safety related chargers and exhaust fans remain available since they are protected consistent with current plant design. A proposed modification and procedure is planned to make appropriate alignments as necessary to power the critical loads namely battery chargers, battery room exhaust fans and RCS high-pressure injection pumps for both Units 1 and 2, using either the external Plant Support Power system if available during an ELAP event or the Phase 2 500kw generators directly connected to the distribution system. No other non-safety systems, not otherwise credited in a loss of offsite power event, are credited for FLEX strategies.

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

3.2.1.6 Sequence of Events

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

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

On page 6 of its Integrated Plan the licensee stated that the sequence of events and any associated time constraints which occur after steps for the current Comanche Peak Operating Procedure ECA 0.0, Revision 8, "Loss of AC Power" are identified below for Comanche Peak's Modes 1-4 strategies for FLEX Phases 1 through Phase 3.

In its Integrated Plan the licensee stated that within the first 0.25 hours the control room staff are expected verify ELAP entry conditions including verifying that emergency diesel generators are not available, verifying reactor and turbine trip, confirming TDAFW function, and declaring an ELAP within an hour of ELAP initiation. Also within one hour, operators will block open Control Room doors to maintain acceptable control room temperatures for accessibility per current plant abnormal condition procedure ABN-203. During the audit process the licensee stated that loss of control room ventilation had been previously evaluated. The licensee concluded that the operator actions to open internal and external control room doors, as directed by Comanche Peak Emergency Operating Procedure ABN-203, Revision 3, "Control Room Ventilation System Malfunction" are sufficient to provide acceptable control room environmental conditions for habitability. These operator actions will also be directed and prioritized by FLEX procedure FSI-5.0A/B.

During the audit process, the licensee was asked to verify whether the TDAFW pump could continue to operate without air or dc power. The licensee responded that the TDAFWP is designed to start and operate at full speed on loss of all ac power. To satisfy single-failure criteria [R.G. 1.53], steam supply lines to the AFW pump turbine from at least two SGs are provided. Steam admission (supply) valves to the AFW pump turbine are AOVs with Class 1E 125vdc power operated solenoid valves in the air supply lines. These valves are designed as fail open on loss of air supply or electrical power. Existing site procedures provide guidance on manual control on loss of power events.

Regarding action at hour 1, during the audit process the licensee was asked to discuss the operator actions required within 1 hour (i.e., prior to declaration of the ELAP) and show that all the required actions can be completed within in 1 hour in order to provide a basis for the conclusion that the time constraint can reasonably be met as specified in NEI 12-06, Section 3.2.1.7, Item 6). In its Integrated Plan the licensee stated that control room staff could verify ELAP entry conditions and that one hour is a reasonable assumption for plant operators to determine that the EDGs were not available. Declaration of an ELAP provides guidance to operators to perform ELAP actions. During the audit, the licensee stated that in an ELAP event, initial operator actions would be driven by emergency response procedure ECA-0.0. There are no additional operator actions credited in the FLEX strategies that must occur within one hour of the initiating event (i.e., prior to declaration of ELAP). The licensee stated that the Integrated Plan item for opening doors to the TDAFW pump room, control room and battery /inverter rooms is not required within one hour of ELAP initiation.

Regarding the operator actions and associated completion times listed in Attachment 1A to mitigate the consequences of an ELAP event, the licensee was asked to discuss how the plant specific guidance and strategies and the associated administrative controls and training program would be developed and implemented to assure that the required operator actions are consistent with the analysis and reasonably achievable within the required completion times. In the footnotes on page 80 of the Integrated Plan the licensee stated that: 1) Time constraints were based on plant analyses. Additional refinements may be provided in subsequent updates; and, 2) Following completion of staffing studies operator action times will be provided for each time sensitive action. All actions will be completed prior to the time constraint. During the audit, the licensee stated that training development is scheduled to be completed and performed in the Operations training cycle to meet the Fall 2014 date.

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 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 generic concern related to shutdown and refueling requirements is applicable to Comanche Peak. This generic concern has been resolved generically through the NRC endorsement of Nuclear Energy Institute (NEI) position paper entitled "Shutdown/Refueling Modes" (ADAMS Accession No. ML13273A514); and has been endorsed by the NRC in a letter dated September 30, 2013 (ADAMS Accession No. ML13267A382).

The NEI position paper describes how licensees will, by procedure, maintain equipment available for deployment in shutdown and refueling modes. The NRC staff concluded that the position paper provides an acceptable approach for demonstrating that the licensees are capable of implementing mitigating strategies in all modes of operation.

The licensee informed the NRC of its plans to abide by this generic resolution.

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

3.2.1.8. Core Sub-Criticality

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

All plants provide means to provide borated RCS makeup.

On page 8 of the Integrated Plan the licensee stated that CPNPP would be installing low-leakage RCP seal packages, so there is not a time constraint to perform an extensive early RCS cooldown. A cooldown will be performed when resources are available and plant conditions warrant, nominally at 12 hours. Cooldown is initiated to reduce RCS pressure to allow 10-gpm boration from the high-pressure FLEX RCS make-up pump. The licensee also stated that the CPNPP baseline FLEX assessment includes provisions to borate the RCS to xenon-free cold shutdown conditions within the first 24 hours of the event. Based on a 10-gpm flowrate from the BAT via the high pressure RCS make-up FLEX pump, it would take approximately 10 hours to meet the boration requirement. Therefore the action to align the pump must be completed by 14 hours.

On page 27 of its Integrated Plan for Phase 2, Maintain RCS Inventory Control, the licensee stated that the Phase 2 activities for RCS inventory control involve aligning a pump to provide borated coolant for RCS makeup. Utilizing WCAP-17601 methodology. Comanche Peak has evaluated limiting plant-specific scenarios for RCS inventory control, shutdown margin, and Mode 5/Mode 6 boric acid precipitation control with respect to the guidelines set forth in the NEI FLEX implementation guide strategies.

The NRC staff's review of the licensee's mitigating strategy identified that a generic concern associated with the modeling of the timing and uniformity of the mixing of boric acid injected into the reactor coolant system under natural circulation conditions potentially involving two-phase flow was applicable to Comanche Peak.

The PWROG submitted to the NRC a position paper, dated August 15, 2013 which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlines applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available. During the audit process the licensee stated that adequate shutdown margin is demonstrated in calculation CN-LIS-12-74, Revision 0. The licensee stated that the strategy limitations as documented in the PWROG's boron mixing position paper were met in the shutdown margin calculation CN-LIS-12-74, Revision 0. However, the NRC staff concluded that the August 15, 2013, position paper was not adequately justified and did not endorse the position paper. As such, resolution of concerns associated with modeling boron mixing is identified as Open Item 3.2.1.8.A in Section 4.1.

The staff noted that the shutdown margin calculations in CN-LIS-12-74, Revision 0, rely on boration curves that are cycle specific. The calculation itself contains an applicability limit that it will be necessary to confirm the applicability of the boration curves on a cycle-specific basis. The staff considers cycle-specific verification of shutdown margin calculations necessary because the negative reactivity insertion requirements are a function of the core design, which has the potential to be varied for each operating cycle.

The licensee's approach described above, as currently understood, is consistent with the guidance found in NEI 12-06, as endorsed by JLD-ISG-2012-01 and, 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 core sub-criticality, if these requirements are implemented as described.

3.2.1.9. Use of Portable Pumps

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

> Regardless of installed coping capability, all plants will include the ability to use portable pumps to provide RPV/RCS/SG makeup as a means to provide diverse capability beyond installed equipment. The use of portable pumps to provide RPV/RCS/SG makeup requires a transition and interaction with installed systems. For example, transitioning ... 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 that installed equipment degrades or fails. Preparations for reactive use of portable equipment should not distract site resources from establishing the primary coping strategy. In some cases, in order to meet the time-sensitive required actions of the site-specific strategies; the FLEX equipment may need to be stored in its deployed position.
>
> The fuel necessary to operate the FLEX equipment needs to be assessed in the plant specific analysis to ensure sufficient quantities are available as well as to address delivery capabilities.

NEI 12-06 Section 11.2 states in part:

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

On page 15 its Integrated Plan discussing the strategy for maintaining core cooling and heat removal during Phase 2, the licensee stated:

> The Phase 2 core cooling and heat removal strategies will begin once it is necessary to refill the CST. If available, coolant may be transferred from the sources shown in Figure A3-32 of Attachment 3. These sources cannot be credited for all events, however, so the primary strategy consists of staging a pump near the top of the SSI dam and refilling the CST from the SSI subsequent to depletion of the RMWST. This source can be credited for all events.
>
> A portable pump for direct injection to the SGs will be staged outside the safeguards building and connecting hose to the auxiliary feedwater system provided. This capability is provided as a defense-in-depth measure as a contingency for the unavailability of the TDAFW. Primary and secondary alignments are provided which are the same for both units. For both strategies, suction will be taken from the CST and discharged through the FLEX pumps to the connection points shown in Attachment 3 (Figures A3-1 through A3-4). This source will be available for 13 hours, or 20 hours if aligned with the RMWST. A plant-specific alternate water sources assessment outlines the use of other qualified sources. A success path exists for greater than 72 hours with robust sources.

> For an event that occurs when the steam generators are not available to provide core cooling, the transition to Phase 2 strategies will be required as inventory is lost from the RCS. These connection locations have been sized to operate for the FLEX Core Cooling and Heat Removal (Modes 5 and 6 with Steam Generators Not Available) strategies. A diesel pump will be utilized to provide makeup to the connections already identified above. The staging area of the pumps will be staging area 6 for Unit 1 and staging area 1 for Unit 2. In Phase 2, core cooling is maintained via once through heat removal from the RCS via coolant boil off. At some point prior to loss of gravity feed from the RWST, a portable pump is aligned to take suction from the RWST and deliver coolant to the vessel. For this strategy, the RWST will deplete in approximately 56 hours after alignment to the tank is made. A flow rate of 132 gpm is initially required to initiate the flushing flow, which is required at 27 hours after the event based on the decay heat load.

On page 27 of its Integrated Plan discussing the strategy for maintaining RCS inventory control during Phase 2, the licensee stated:

> The Phase 2 activities for RCS inventory control involve aligning a pump to provide borated coolant for RCS makeup and to maintain the reactor sub-critical. To ensure that the core is maintained sub-critical, borated injection into the RCS is provided from the high concentration boric acid tanks via a pre-staged portable motor driven pump. This injection also compensates for potential RCS leakage. A high pressure electric pump will be staged near the boric acid tanks and will discharge at the connections shown on the alignments provided in Attachment 3 (Figures A3-5 through A3-9). The primary RCS FLEX connections are located along the safety injection (SI) piping from the charging pump discharge in Room 1,2-077B (EL 810'-6"). The connection will be made upstream of valves 8801 A/B. The secondary connection will be located on the charging pump discharge piping. For both Units, the connection will be near isolation valve 1,2-8106 on EL 810'-6". The RCS makeup pump will need to be aligned for boration purposes 14 hours after the event in order to achieve cold shutdown xenon-free conditions prior to 24 hours. Accumulator volume is not credited. When the BAT depletes, switchover to the RWST is required.

During the audit process the licensee was asked to clarify the basis for the 52-hour switchover time for RCS makeup from the BAT to the RWST in action item 28 of the Integrated Plan. The licensee responded that switchover at 52 hours is determined by assuming RCS high pressure injection starts at 14 hours at a flowrate of 10 gpm while drawing suction from the BAT. An initial BAT level of 61% is assumed. Normal level in the BAT is maintained greater than the BAT LO level annunciator setpoint of 66%. A normal drawdown rate of the BAT following receipt of annunciator is not expected to challenge the assumed initial level.

During the audit process the licensee stated that for feeding the steam generators a FLEX pomp will be deployed and staged, but will only be placed in service if the TDAFW pump fails. Following staging, the FLEX pump can be placed into service relatively quickly following TDAFW failure. Suction for the high pressure RCS injection FLEX pump will be re-aligned from the BAT to the RWST following boric acid tank (BAT) depletion, however, SHIELD low leakage seals ensure this re-alignment is not a time sensitive activity. The FLEX pump deployed and staged at the SSI dam will be used to provide raw water makeup to each units CST if no other water sources are available. This arrangement includes a flow split therefore a re-alignment is not required. The suction source for the makeup to the SFP may need re-alignment from one unit's RWST to the other unit's RWST. However, based on the SFP boil off rate and available volume in the SFP, timing associated with this re-alignment should not be required for the remaining FLEX strategies. For Phase 2 to Phase 3 equipment rotation, the Phase 3 equipment can be placed into service relatively quickly. The SG FLEX pumps were conservatively sized to provide adequate flow to accommodate decay heat removal at one hour after ELAP Initiation assuming the steam generators were depressurized in accordance with ECA-0.0A/B and consideration the line losses between the SG FLEX pump and the steam generators.

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 SFP Cooling Strategies

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

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

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

On page 40 of its Integrated Plan for maintaining SFP cooling during Phase 1, the licensee stated that adequate SFP cooling and accessibility to the fuel building is maintained early in the event. However, access to the SFP area as a part of Phase 2 response could be challenged due to environmental conditions local to the pool. Therefore, action is required in Phase 1 to establish ventilation in this area and establish any equipment local to the SFP required to accomplish Phase 2 coping strategies (such as the primary SFP cooling strategy discussed below). The SFP vent will be established by creating a chimney effect for air movement and opening a door close to grade elevation and a door, which is at a higher elevation. The SFP (SFP) sloshing and time to boil evaluation determined that there would be no volume lost from the SFP due to sloshing. This results in a time to boil of 7 hours for an initial bulk water temperature in the pool of 100'F. This value was calculated using a conservative overestimation of the normal operating decay heat load. For the maximum design heat load, which includes the contribution from a full core offload, the time to boil is 4 hours for an initial bulk water temperature in the pool of 100°F.

On page 41 of the Integrated Plan the licensee stated that the SFP level instrumentation will be powered in accordance with NRC Order Number EA-12-051.

On page 41 of its Integrated Plan for Phase 2, the licensee stated that In order to keep SFP level above the top of the spent fuel, a FLEX pump will be required to replace the amount of coolant at a rate which exceeds the boil off rate. The RWST will be aligned with a portable FLEX pump and discharged to one of the two connection locations identified below. The primary strategy utilizes adapters and the fire protection hose stations located around the SFP. The secondary connection will utilize a newly created header. Two connection locations to this header will be available outside the fuel building; therefore, access to inside the fuel building will not be required for this strategy. Alignment of the portable FLEX pump at 29 hours for the normal SFP heat load scenario would ensure 15 feet of water was maintained above the SFP storage racks. Alignment of the portable FLEX pump at 16 hours for the full core offload scenario would ensure 15 feet of water was maintained above the SFP storage racks.

On page 45 of its Integrated Plan for Phase 3, the licensee stated that the various sources of coolant from the tanks in the yard will be used for SFP makeup if available or the SSI or SCR can be used for makeup in conjunction with the mobile purification system discussed previously. The mobile boration unit would also be available to provide borated coolant for SFP cooling if desired. For long term cooling, CPNPP will be using a large generator from the RRC, and the SFP cooling system will be repowered to provide indefinite coping. The installed SFP cooling system pumps are designed to function with the high temperature water that they will encounter in the Phase 3 timeframe.

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, if these requirements are implemented as described.

3.2.3 <u>CONTAINMENT FUNCTIONS STRATEGIES</u>

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 pages 36, 38 and 39 of its Integrated Plan for maintaining containment for all Phases, the licensee stated that they intend to use analysis to demonstrate that pressure and temperature will stay at acceptable levels throughout the ELAP event, and that the containment spray system will not be required as part of the mitigation strategy. The containment evaluation will be performed based on the boundary conditions described in Section 2 of NEI 12-06. Based on the results of this evaluation, required actions to ensure maintenance of containment integrity and required instrument function will be developed, if necessary. Monitoring of containment conditions will still occur. FSGs will include containment monitoring during an ELAP event.

Indefinite coping is successfully established once transition to residual heat removal (RHR) system cooling is established. As described for core cooling and heat removal, Phase 3 deployment of a large diesel pump for cooling the component cooling water (CCW) system and subsequently the RHR system will occur. Portable battery packs will be used to open and/or close valves to provide the proper alignment for this strategy.

On page 73 of its Integrated Plan the licensee identified Open Item OI-2 to: perform a containment evaluation based on the boundary conditions described in Section 2 of NEI 12-06. Based on the results of this evaluation, take required actions to ensure maintenance of containment integrity and required instrument function will be developed as necessary. In response to the audit process the licensee stated that Westinghouse would perform containment analyses confirming containment integrity during an ELAP event. By crediting SHIELD installation, it is not expected that containment integrity will be challenged during an ELAP event. NRC review of this analysis is identified as Confirmatory Item 3.2.3.A. (Note: This containment evaluation is likely dependent on the resolution of the Open and Confirmatory Items specified in Section 3.2.1.2, "Reactor Coolant Pump Seal Leakage Rates".)

On page 23 of the Integrated Plan the list of essential instrumentation does not include instrumentation for measuring the temperature of the containment atmosphere. During the audit process the licensee was asked to provide the basis for concluding that qualified and calibrated instrumentation for monitoring the temperature of the containment atmosphere was not required. In its response the licensee stated that when taking credit for the RCP SHIELD design and the overall 5 gpm leakage considered under ELAP conditions, the Inside Reactor Containment (IRC) heat gain and containment environment would be minimal and bounded by the worse case IRC harsh environment created by the Design Basis Accidents previously discussed in (Section 3.2.1.5 above). For this reason and the diversity of other credited instrumentation available to monitor key containment parameters, the licensee concluded that monitoring of the Containment atmosphere temperature parameter is not required to ensure qualification of the credited instruments or survivability of containment penetration assemblies.

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

3.2.4 Support Functions

3.2.4.1 Equipment Cooling – Cooling Water

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

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

or provide a technical justification for continued functionality without the support system.

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

In response to a question during the audit the licensee stated that Comanche Peak does not credit the use of Charging Pumps.

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

3.2.4.2 Ventilation – Equipment Cooling

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

> *Plant procedures/guidance should consider loss of ventilation effects on specific energized equipment necessary for shutdown (e.g., those containing internal electrical power supplies or other local heat sources that may be energized or present in an ELAP).*
>
> ELAP procedures/guidance should identify specific actions to be taken to ensure that equipment failure does not occur as a result of a loss of forced ventilation/cooling. Actions should be tied to either the ELAP/LUHS or upon reaching certain temperatures in the plant. Plant areas requiring additional air flow are likely to be locations containing shutdown instrumentation and power supplies, turbine-driven decay heat removal equipment, and in the vicinity of the inverters. These areas include: steam driven AFW pump room, HPCI and RCIC pump rooms, the control room, and logic cabinets. Airflow may be accomplished by opening doors to rooms and electronic and relay cabinets, and/or providing supplemental airflow.
>
> Air temperatures may be monitored during an ELAP/LUHS event through operator observation, portable instrumentation, or the use of locally mounted thermometers inside cabinets and in plant areas where cooling may be needed. Alternatively, procedures/guidance may direct the operator to take action to provide for alternate airflow in the event normal cooling is lost. Upon loss of these systems, or indication of temperatures outside the maximum normal range of values, the procedures/guidance should direct supplemental air flow be provided to the affected cabinet or area, and/or designate alternate means for monitoring system functions.
>
> For the limited cooling requirements of a cabinet containing power supplies for instrumentation, simply opening the back doors is effective. For larger cooling

loads, such as HPCI, RCIC, and AFW pump rooms, portable engine-driven blowers may be considered during the transient to augment the natural circulation provided by opening doors. The necessary rate of air supply to these rooms may be estimated on the basis of rapidly turning over the room's air volume.

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

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

On page 7 of its Integrated Plan regarding sequence of events, the licensee addressed steps to ensure cooling of the following rooms:

Open Control Room doors - 1 hour; maintain acceptable control room temperatures for accessibility per current plant abnormal condition procedure ABN-203. During the audit process the licensee stated that Technical Requirement 13.7.36 confirms equipment operability for control room temperatures less than or equal to 104°F. Loss of control room ventilation has been previously evaluated with results summarized in the attached Shaw report, filename "CPNPP - ELAP Loss of Ventilation.pdf. The Shaw analysis determined control room temperature at 32 hours to be approximately 104°F, conservatively assuming a constant outside air temperature of 100°F. FLEX procedure FSI-5.0A/B will prioritize deployment of small generators and portable fans to external control room doors well before 32 hours. Capacity of the portable fans is sufficient to maintain control room temperature less than 104°F.

TDAFW Room Ventilation - 1hour; blocking open doors of the TDAFW room will be required to maintain room environmental conditions for operator access to the TDAFW pump and flow control valves. During the audit process the licensee stated that loss of TDAFW pump room ventilation has been previously evaluated with results summarized in the attached Shaw report, filename CPNPP - ELAP Loss of Ventilation.pdf. Review of Shaw report Figures 10 and 11 concludes that operator action to block open the TDAFW pump room door is sufficient to support equipment operation (and accessibility) during an ELAP. Immediate operator action is not required, however the action should be performed within 12 hours of ELAP initiation.

Inverter and Battery Room Ventilation - 1 hour; doors to the inverter and battery rooms will be blocked open to ensure adequate environmental conditions in the rooms. During the audit process the licensee stated that loss of battery room ventilation has been previously evaluated with results summarized in the attached Shaw report, filename CPNPP - ELAP Loss of Ventilation.pdf. This report concludes that neither equipment operability nor operator access is adversely affected by the loss of ventilation. Extreme low temperatures are not a concern for the Comanche Peak battery rooms. The licensee also explained that hydrogen generation only occurs when the batteries are being charged. At Comanche Peak the battery room ventilation is powered from the same busses as the battery chargers; restoring the chargers also restores the normal battery room ventilation.

Block Open SFP Area Doors - 7 hours; the baseline assessment for CPNPP conservatively assumes all actions local to SFP to be completed prior to onset of SFP boiling. The actual constraint for this action would be dependent on the period of time since the most recent refueling outage.

On page 45 of its Integrated Plan regarding SFP cooling, the licensee stated:

> In Phase 3, the SFP is initially cooled via continued boil-off and make-up. The various sources of coolant from the tanks in the yard will be used for makeup if available or the SSI or SCR can be used for makeup in conjunction with the mobile purification system discussed previously. The mobile boration unit would also be available to provide borated coolant for SFP cooling if desired. For long term cooling, CPNPP will be using a large generator from the RRC, and the SFP cooling system will be repowered to provide indefinite coping. The installed SFP cooling system pumps are designed to function with the high temperature water that they will encounter in the Phase 3 timeframe.

On page 47 of its Integrated Plan regarding safety function support during the initial phase, the licensee stated:

> Support to the safety functions is provided by continued observation of conditions by operators using specific instruments and coordinating activities from the control room. Maintaining indications and control requires maintenance of battery power, which is extended by performing a load shed, and also supported by opening doors to the inverter rooms. The CPNPP Class 1E GNB NCX batteries' system provides dc electrical power to Class 1E dc loads and vital instrumentation. Load shedding will begin 30 minutes after the blackout and be completed within 120 minutes in accordance with procedure ECA-0.0 and extend one train of battery life to 24 hours.
>
> Instrument function and control room habitability are supported by establishing appropriate control room ventilation. Self-contained emergency lighting will be available for 2 hours with certain lighting able to last 8 hours. After the emergency fixture batteries are exhausted, portable lighting with flashlights or headlamps will be used as needed.

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

3.2.4.3 Heat Tracing. NEI 12-06, Section 3.2.2, Paragraph (12) provides that:

> Plant procedures/guidance should consider loss of heat tracing effects for equipment required to cope with an ELAP. Alternate steps, if needed, should be identified to supplement planned action.
>
> Heat tracing is used at some plants to ensure cold weather conditions do not

result in freezing important piping and instrumentation systems with small diameter piping. Procedures/guidance should be reviewed to identify if any heat traced systems are relied upon to cope with an ELAP. For example, additional condensate makeup may be supplied from a system exposed to cold weather where heat tracing is needed to ensure control systems are available. If any such systems are identified, additional backup sources of water not dependent on heat tracing should be identified.

In its Integrated Plan, the licensee did not address the loss of heat tracing. The licensee screened out for extreme cold and snow and thus there is no need for the licensee to address loss of heat tracing. However, during the audit process the licensee stated CPNPP maintains a boric acid solution for the boric acid tanks of 7000 - 7700 ppm. Heat tracing and normal area temperature controls are provided to maintain the boric acid solution greater than or equal to 65° F. Upon loss of heat tracing, existing abnormal procedures provide actions to ensure all piping and equipment protected by the affected heat trace circuit is maintained greater than 65° F. In addition, the BATs are located internal to the central most area of the main power block buildings. The ambient temperature of the surrounding building areas even during cold weather conditions is typically maintained between 75-80° F. Loss of ventilation analyses carried out to 30 days suggest the areas containing the BAT and associated piping will slightly increase due to area heat gains attributed to heat losses in nearby process piping, structures and components until thermal equilibrium is attained.

During the audit process the licensee also stated that the RCS high pressure injection starts taking suction from the BAT at 14 hours with switchover to the RWST at 52 hours into the event. Given the combination of the ambient plant conditions prior to the ELAP event, existing procedural guidance to counter a loss of heat tracing, physical geometry and insulating properties of the areas surrounding the BATs and piping locations, expected heat gains in the areas to compensate for heat losses in the BA solution and the relatively short time in the event to initiate suction, it is not expected that the boric acid will precipitate out of solution. Likewise, the RWST and associated piping which is maintained at a boric acid solution of 2400-2600 ppm has a much lower crystallization point, located within concrete building enclosures similar to the BATs and is subjected to the same area heat gain characteristics on loss of ventilation as the BAT/piping locations. Thus, for both the BATs and RWST including the associated piping, it is anticipated that boric acid precipitation upon loss of heat tracing and normal heating will not be credible prior to initiation and utilization of the tanks contents to satisfy FLEX strategies.

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

3.2.4.4. Accessibility – Lighting and Communications

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

Plant procedures/guidance should identify the portable lighting (e.g., flashlights or headlamps) and communications systems necessary for ingress and egress to plant areas required for deployment of FLEX strategies.

Areas requiring access for instrumentation monitoring or equipment operation may require portable lighting as necessary to perform essential functions.

> Normal communications may be lost or hampered during an ELAP. Consequently, in some cases, portable communication devices may be required to support interaction between personnel in the plant and those providing overall command and control.

On page 18 of its Integrated Plan regarding Phase 2 deployment the licensee stated that a strategy to clear debris for FLEX coping strategies would be implemented. Two Pettibone (or similar) vehicles will be utilized to clear debris and deploy the FLEX equipment. Lighting of the deployment paths will be accomplished through the debris removal/deployment vehicles' lights along with a portable light tree for each Unit. Portable lighting will be utilized for the FLEX deployment strategies inside plant buildings, as necessary. The portable lighting may include items for operator and other personnel use such as flashlights, headlamps, and lanterns.

On page 47 of its Integrated Plan regarding safety function support, the licensee stated that instrument function and control room habitability are supported self-contained emergency lighting that will be available for 2 hours with certain lighting able to last 8 hours. After the emergency fixture batteries are exhausted, portable lighting with flashlights or headlamps will be used as needed.

On page 70 of its Integrated Plan regarding Phase 3 Response Equipment/Commodities, the licensee listed portable exterior lighting-self contained light trees, Iridium Satellite Phones and Motorola portable radios to facilitate communications.

The licensee's plan for use of portable lighting to support FLEX strategy implementation did not provide reasonable assurance that the plan conforms to the guidance of NEI 12-06, Section 3.2.2, Paragraph (8) because the licensee did not provide sufficient details on the identification in plant procedures and guidance of portable lighting such as flashlights or headlamps necessary for ingress and egress to plant areas required for deployment of the strategies. This is identified as Confirmatory Item 3.2.4.4.A, in Section 4.2.

The NRC staff has reviewed the licensee communications assessment (ADAMS Accession Nos. ML12318A100 and ML13071A349) in response to the March 12, 2012, 10 CFR 50.54(f) request for information letter for the licensee and, as documented in the staff analysis (ADAMS Accession No. ML13141A675) has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by the licensee will conform to the guidance of NEI 12-06 Section 3.2.2 (8) regarding communications capabilities during an ELAP. This has been identified as Confirmatory Item 3.2.4.4.B in Section 4.2 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 Items, 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, Paragraph (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 licensee's plans for the development of guidance and strategies with regard to the access to the Protected Area and internal locked areas did not provide reasonable assurance that the guidance and strategies developed will conform to Section 3.2.2, Paragraph (9) because the plan lacked any discussion on this topic. During the audit process the licensee noted that this information is security related but also stated that a detailed description would be provided in its August 2014 update. This has been identified as Confirmatory Item 3.2.4.5.A. in Section 4.2.

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

3.2.4.6. Personnel Habitability – Elevated Temperature

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

Plant procedures/guidance should consider accessibility requirements at locations where operators will be required to perform local manual operations.

Due to elevated temperatures and humidity in some locations where local operator actions are required (e.g., manual valve manipulations, equipment connections, etc.), procedures/guidance should identify the protective clothing or other equipment or actions necessary to protect the operator, as appropriate.

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

Section 9.2 of NEI 12-06 states,

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

On page 7 of its Integrated Plan regarding sequence of events, the licensee stated they would open control room doors to maintain acceptable control room temperatures for accessibility per current plant abnormal condition procedure ABN-203. They would also block open doors of the TDAFW room to maintain room environmental conditions for operator access to the TDAFW pump and flow control valves. They would block open doors to the inverter and battery rooms to ensure adequate environmental conditions in the rooms. They would block open SFP Area Doors; the baseline assessment for CPNPP conservatively assumes all actions local to SFP to be completed prior to onset of SFP boiling. The actual constraint for this action would be dependent on the period of time since the most recent refueling outage.

On page 40 of its Integrated Plan regarding SFP cooling, the licensee stated that adequate SFP cooling and accessibility to the fuel building is maintained early in the event. However, access to the SFP area as a part of Phase 2 response could be challenged due to environmental conditions local to the pool. Therefore, action is required in Phase 1 to establish ventilation in this area and establish [pre-stage] any equipment local to the SFP required to accomplish Phase 2 coping strategies (such as the primary SFP cooling strategy discussed below). The SFP vent will be established by creating a chimney effect for air movement. [This will be accomplished by] opening a door close to grade elevation and another door at a higher elevation.

During the audit process the licensee stated that loss of ventilation for control room, TDAFW pump room and ARV room has been previously evaluated with results summarized in the attached Shaw report, filename CPNPP - ELAP Loss of Ventilation.pdf. This report concluded that operator access while implementing FLEX strategies is not a concern during an ELAP event. Acceptable control room and TDAFW pump room environments can be achieved by operator action to block open [doors]. FLEX strategies for SFP makeup requiring access to the SFP area will be performed prior to onset of SFP boiling. Alternate strategies allow SFP makeup via connections external to the fuel building should the SFP area become inaccessible. Charging pumps are not credited in FLEX strategies for Comanche Peak.

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 personnel habitability, if these requirements are implemented as described.

3.2.4.7. Water Sources.

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

> *Plant procedures/guidance should ensure that a flow path is promptly established for makeup flow to the steam generator/nuclear boiler and identify backup water sources in order of intended use. Additionally, plant procedures/guidance should specify clear criteria for transferring to the next preferred source of water.*
>
> Under certain beyond-design-basis conditions, the integrity of some water sources may be challenged. Coping with an ELAP/LUHS may require water supplies for multiple days. Guidance should address alternate water sources and water delivery systems to support the extended coping duration. Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles are assumed to be available in an ELAP/LUHS at its nominal capacities. Water in robust UHS piping may also be available for use but would need to be evaluated to ensure adequate NPSH can be demonstrated and, for

example, that the water does not gravity drain back to the UHS. Alternate water delivery systems can be considered available on a case-by-case basis. In general, all CSTs should be used first if available. If the normal source of makeup water (e.g., CST) fails or becomes exhausted as a result of the hazard, then robust demineralized, raw, or borated water tanks may be used as appropriate.

> Heated torus water can be relied upon if sufficient [net positive suction head] NPSH can be established. Finally, when all other preferred water sources have been depleted, lower water quality sources may be pumped as makeup flow using available equipment (e.g., a diesel driven fire pump or a portable pump drawing from a raw water source). Procedures/guidance should clearly specify the conditions when the operator is expected to resort to increasingly impure water sources.

On page 24 of its Integrated Plan in regards to reactor core cooling and heat removal in phase 3, the licensee stated:

> In Phase 3, if steam generators are available, core cooling is maintained through natural circulation heat removal from the RCS via the steam generators until such a time as the large ac generator(s) is placed in service and RHR cooling is initiated. Heat rejection through the steam generators is maintained via either the TDAFWP or the SG FLEX pump, however, use of non-standard coolant in the SG cannot be maintained indefinitely. Indefinite coping is successfully established once a transition from SG cooling to residual heat removal (RHR) system cooling is established. Deployment of a large diesel pump to provide cooling water to the Service Water side of a component cooling water (CCW) heat exchanger to support operation of the RHR system. Portable battery packs will be used to open and/or close valves to provide the proper alignment for this strategy. Suction will be taken from the SSI for this strategy or could also be taken from the SCR if available after the event.

> In Phase 3, if steam generators are not available, core cooling is maintained by the portable pump, which takes suction from the RWST and delivers coolant to the vessel. For this strategy, the RWST will deplete in approximately 56 hours after alignment to the tank is made. At this time, a mobile boration unit will be required from the RRC to make-up borated coolant to the RWST. The modifications to the RWST are discussed in the Safety Function Support Section and describe the modification made for make-up to the tank. Indefinite coping is successfully established once a transition from SG cooling to residual heat removal (RHR) system cooling is established. Phase 3 deployments of a large diesel pump for cooling the component cooling water (CCW) system and subsequently the RHR system provides the capability.

During the audit process the licensee stated RMWST (Reactor Makeup Water Storage Tank) and the RWST (Refueling Water Storage Tank) are qualified to withstand tornado missile effects. Both tanks are enclosed within a Seismic Category I structural concrete enclosure designed to withstand the effects of a design basis Safe Shutdown Earthquake, tornado winds and tornado generated missiles. Following deployment and staging of a FLEX pump at the SSI dam, raw water makeup will be provided to each unit's CST, if needed. This flow will be simultaneously split between the CSTs. The designated FLEX pump capacity exceeds the flowrate requirements for refill of both CSTs simultaneously. The level in each CST will be monitored via level indication in the control room. Local control will be provided to ensure adequate flowrate is achieved. A similar arrangement may be used for CST makeup from the various yard tanks. Review of the remaining FLEX strategies concludes there is a sufficient number of FLEX pumps available such that flow to multiple destinations from a single pump is not required for any other strategy.

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 49 of its Integrated Plan in regards to safety function support during the transition phase, the licensee stated:

> A key electrical need during Phase 2 is dc power for critical instrumentation. This will be accomplished by energizing the plant support power system and energizing battery chargers on both A and B trains in both Units 1 and 2.
>
> Two 500-kW FLEX generators, as required for N+1, will be stored on site. A generator will be deployed to staging area 2. The FLEX generators will be trailer-mounted to ease deployment; FLEX cables will be stored with each generator.
>
> The FLEX generator will be connected to battery chargers and battery room ventilation fans through a FLEX connector mounted directly to panel XB 10-1 or to a FLEX panel board installed inside the Unit 2 safeguards building. Panel XB 10-1 is the primary connection because of the ease of connecting to an outdoor panel. XB 10-1 will be available in all events except severe weather. The connection to the panel board in the safeguard building is more difficult to connect but is available in severe weather events. This panel board will distribute power to panels XB10-1-3 and 2B10-1-1. Routings internal to plant buildings are via the plant support system (25 KV system), which, while non-safety related, is of a robust design and expected to remain available following a seismic event.
>
> To support RCS inventory, a 10-hp electrical-driven pump will be deployed and energized in Phase 2. The 480-Vac FLEX generators are adequately sized to start and run all the required loads including this 10-hp pump.
>
> The battery charger alignment is shown schematically in Attachment 3, Figures A3- 22 through A3-29.
>
> To facilitate FLEX generator connections, panel XB 10-1 will be modified to include FLEX connectors that will be connected directly to the bus. Prior to connecting the generator, the panel main breaker must be opened. A new 800A FLEX panel board will be installed inside the Unit 2 safeguards building. From the new panel board in the Unit 2 safeguards building, three 400-amp circuits will be permanently installed to existing

panels XB10-1-3 and 2B10-1-1. Each of these panels has a spare breaker that will be used to backfeed the panel in the event of an ELAP.

The licensee plans on using portable diesel generator(s) to power various systems following battery depletion. The licensee initially did not provide any information regarding loading calculations of portable diesel generator(s). As a result, the NRC staff requested the licensee to provide a summary of the sizing calculation for the FLEX generators to show that they can supply the loads assumed in phases 2 and 3. In its response during the audit, the licensee stated that Initial Phase 2 generator sizing resulted in preliminary 500 kW standby diesel generator (625 KVA). This choice was the minimum generator size to supply the Unit 1 and Unit 2 battery chargers, battery room exhaust fans, and high pressure RCS injection pumps. The required loads on this 500 kW machine total to approximately 371 kW of connected load that is approximately 75% of the generator maximum loading for design margin and load starting capability. The licensee noted that the actual loading analysis has not been completed, as this is only a conceptual estimate. Phase 3 generator sizing (4 MW or 5 MVA at 0.8pf) was chosen by the licensee to be similar to the existing Auxiliary Powered Diesel Generators (APDGs). The load limit for the APDGs is 4375 KVA at 0.8pf (3500 kW). The existing loading analysis in calculation EE-CA-0008-4014 Rev 1 justifies the load and starting of the minimum required loads for safe shutdown using the APDGs. The loading in calculation EE-CA-0008-4014 Rev 1 on the APDG is conservative when compared to the loads required to function for the ELAP event. Based on this comparison, the 4 1 MW diesel generators will be capable of carrying the loads when loaded manually (largest load first).

The staff will review the sizing of the Phase 2 portable/FLEX diesel generators when the licensee has finalized their design. This is identified as Confirmatory Item 3.2.4.8.A in Section 4.2.

During the audit process the licensee provided additional information to clarify that the Phase 2 equipment have manual transfer switches from the normal 1E power supply to the plant support power, which have no automatic transfer back. In the event that offsite power is recovered the present ECA-0.0 procedure directs placing the hand switches for the off site power supply and diesel generator in a "pull out" condition until ready in order to prevent the bus from being re-energized automatically.

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, and provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to electrical power sources/isolations and Interactions, if these requirements are implemented as described.

3.2.4.9. Portable Equipment Fuel.

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

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

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

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

NEI 12-06, Section 3.2.1.3, initial condition (5) allows for the assumption that "Fuel for FLEX equipment stored in structures with designs which are robust with respect to seismic events, floods and high winds and associated missiles, remains available."

On pages 15, 16 and 27 of its Integrated Plan regarding Phase 2, the licensee stated that all FLEX equipment will be trailer mounted or on wheels for ease of deployment. Fuel will be provided from the emergency diesel generator fuel oil tanks and the associated day tanks.

On pages 52 through 54 of its Integrated Plan regarding Fuel strategies for Phase 2 Safety Functions Support, the licensee stated:

> Items requiring fuel include, but are not limited to, debris removal equipment, diesel generators, diesel pumps, and FLEX equipment transportation vehicles. The diesel fuel supply for all FLEX equipment will be from the Emergency Diesel Generator Fuel Oil Storage Tanks and the associated Day Tanks, which are protected from each of the applicable external hazards at CPNPP. These tanks are seismically qualified and as they are underground or inside the safeguard building are also missile protected. Failures caused by icing are not considered because of the low freezing point of diesel fuel. The diesel oil system is also protected from high external temperatures. All fuel oil lines are also routed such that they are remote from lines of elevated temperature. The access locations for the tanks have no risk of being flooded because they are located above the PMF level. Battery powered and hand pumps will be utilized to remove oil from these tanks and deliver to the FLEX staged equipment. Trailer mounted fuel caddies will be used to deliver the fuel to the various staging locations. Also, as previously discussed for Phase 3 strategies, a large fuel bladder is proposed to replenish fuel once onsite resources are depleted.
>
> The emergency diesel generator fuel oil storage tanks each store a technical specification minimum of 88,000 gallons of fuel. It also states that the day tanks located in each of the diesel generator rooms store a technical specification minimum of 1823.3 gallons of fuel for Unit 1 and 1791.9 gallons of fuel for Unit 2. Therefore, a total of 366,456 gallons of diesel fuel is available on site at CPNPP for the FLEX equipment. Once all FLEX equipment has been purchased, fuel tank size will be known for each piece of equipment along with the fuel caddies to transfer the fuel. CPNPP will then be able to determine time frames when each piece of equipment will require refueling. An exact fuel consumption rate for the complete FLEX strategy will be developed once all FLEX equipment has been purchased and specifications are available, but total consumption is expected to be well below the available on-site volume.

The licensee did not address actions to maintain the quality of fuel stored in the tanks of the portable equipment for potentially long periods of time when the equipment (diesel driven pumps and generators) will not be operated. This has been identified as Confirmatory Item 3.2.4.9.A in Section 4.2.

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

On page 7 of its Integrated Plan describing the sequence of events and time constraints, the licensee stated that dc Bus FLEX load shedding is consistent with current plant SBO load shedding procedure ECA 0.0. Load shed will begin 30 minutes after the event and complete 2 hours after the event. They would establish battery chargers and battery room exhaust fans within 24 hours. One train of batteries will last for 24 hours. The doors to the battery rooms would have been opened and maintained open as part of the actions associated with the dc bus load shedding. Prior to 24 hours, a FLEX generator will be deployed to charge at least one train of batteries for each unit. Coincident with the establishment of a battery charger, the associated battery room exhaust fan will be started and powered from the FLEX generator.

On page 47 of the overall Integrated Plan for Safety Function Support, Phase 1 PWR Installed Equipment, the licensee stated that support to the safety functions is provided by continued observation of conditions by operators using specific instruments and coordinating activities from the control room. Maintaining indications and control requires maintenance of battery power, which is extended by performing a load shed, and also supported by opening doors to the inverter rooms. The CPNPP Class 1E battery system provides dc electrical power to Class 1E dc loads and vital instrumentation. Load shedding will begin 30 minutes after the blackout and be completed within 120 minutes in accordance with procedure ECA-0.0 and extend one train of battery life to 24 hours.

During the audit process the licensee was asked to confirm that load shed activities will not interfere with required valve positioning or operator action capability that may be credited in establishing ELAP response strategies, including specifically those actions related to isolating RCS leakage paths, including the CBO. In its response the licensee stated that Comanche Peak performs load shed activities in accordance with emergency response procedure ECA-0.0A/B. These activities do not adversely affect FLEX strategy implementation. Isolation of RCS seal leak off is not a concern when SHIELD is installed.

Current regulatory guidance on battery duty cycles for safety-related batteries limits qualification to 8 hours. As the FLEX generator may not necessarily be deployed until hour 24, at which time the battery chargers will be energized, the licensee has provided insufficient information to support a conclusion that the station batteries can meet the battery duty cycles determined by calculation in order to conform to that guidance.

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 Nos. ML13241A186 (position paper) and ML13241A188 (NRC endorsement letter)).

The purpose 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. Position papers provided to the NRC by industry further develop and clarify the guidance provided in NEI 12-06 related to industry's ability to meet the intent of Order EA-12-049, "Order Modifying Licenses With Regard To Requirements for Mitigation Strategies for beyond Design Basis External Events."

The Generic Concern related to extended battery duty cycles required clarification of the capability of the existing vented lead-acid station batteries to perform its 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 its intended function for extended duty cycles (i.e., beyond 8 hours). The NRC staff will evaluate a licensee's application of the guidance (calculations and supporting data) in its development of the final Safety Evaluation documenting review of the licensee's Integrated Plan.

The NRC staff concluded that the position paper provides an acceptable approach for licensees to use in demonstrating that vented lead-acid batteries can be credited for durations longer than 8 hours.

During the audit process the licensee was asked to:

1. Provide the direct current (dc) load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and SFP cooling. In its response during the audit process the licensee stated that battery coping calculations supporting the FLEX strategies are being finalized and will be provided when available.

2. Provide a detailed discussion on the loads that will be shed from the dc bus, the equipment location (or location where the required action needs to be taken), the required operator actions to be performed and the time to complete each action. In your response, explain which functions are lost as a result of shedding each load and discuss any impact on defense in depth and redundancy. In its response during the audit process the licensee stated that they would perform load shed activities in accordance with emergency response procedure ECA-0.0A/B. Load shed activities will be completed within 2 hours of ELAP initiation. While this is considered a reasonable duration for performance, confirmation that these activities can be completed within this timeframe will be achieved by validation or demonstration in the future. Any change in the FLEX load shed strategy will include an appropriate confirmation.

3. Provide the basis for the minimum dc bus voltage that is required to ensure proper operation of all required electrical equipment. In its response during the audit process the licensee stated that during an ELAP event the Comanche Peak batteries are capable of discharge to 105 V dc. Inverter output voltage sufficient for continued electrical equipment operation can be achieved with 105V dc input voltage.

The licensee also stated that they would provide a detailed description of its plans to perform load reduction to conserve dc power would be detailed in its February 2014 update of its Integrated Plan. This is identified as Confirmatory Item 3.2.4.10.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 Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to load shed to conserve dc power, if these requirements are implemented as described.

3.3 PROGRAMMATIC CONTROLS

3.3.1. Equipment Maintenance and Testing.

NEI 12-06, Section 3.2.2, following item (15) states:

> 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 provides that:

1. FLEX mitigation equipment should be initially tested or other reasonable means used to verify performance conforms to the limiting FLEX requirements. Validation of source manufacturer quality is not required.
2. Portable equipment that directly performs a FLEX mitigation strategy for the core, containment, or SFP should be subject to maintenance and testing[1] guidance provided in INPO AP 913, Equipment Reliability Process, to verify proper function. The maintenance program should ensure that the FLEX equipment reliability is being achieved. Standard industry templates (e.g., EPRI) and associated bases will be developed to define specific maintenance and testing including the following:
   a. Periodic testing and frequency should be determined based on equipment type and expected use. Testing should be done to verify design requirements and/or basis. The basis should be documented and deviations from vendor recommendations and applicable standards should be justified.
   b. Preventive maintenance should be determined based on equipment type and expected use. The basis should be documented and deviations from vendor recommendations and applicable standards should be justified.
   c. Existing work control processes may be used to control maintenance and testing. (e.g., PM Program, Surveillance Program, Vendor Contracts, and work orders).
3. The unavailability of equipment and applicable connections that directly performs a FLEX mitigation strategy for core, containment, and SFP should be managed such that risk to mitigating strategy capability is minimized.
   a. The unavailability of installed plant equipment is controlled by existing plant processes such as the Technical Specifications. When installed plant equipment which supports FLEX strategies becomes unavailable, then the FLEX strategy affected by this unavailability does not need to be maintained during the unavailability.
   b. Portable equipment may be unavailable for 90 days provided that the site FLEX capability (N) is available.
   c. Connections to permanent equipment required for FLEX strategies can be unavailable for 90 days provided alternate capabilities remain functional.
   d. Portable equipment that is expected to be unavailable for more than 90 days or expected to be unavailable during forecast site specific external events (e.g., hurricane) should be supplemented with alternate suitable equipment.
   e. The short duration of equipment unavailability, discussed above, does not constitute a loss of reasonable protection from a diverse storage location protection strategy perspective.
   f. If portable equipment becomes unavailable such that the site FLEX capability (N) is not maintained, initiate actions within 24 hours to restore the site FLEX capability (N) and implement compensatory measures (e.g., use of alternate suitable equipment or supplemental personnel) within 72 hours.

On page 10 and 11 of its Integrated Plan discussing programmatic controls, the licensee stated that equipment associated with these strategies would be procured as commercial grade equipment. The storage, maintenance, testing, and configuration control of the equipment will

[1] Testing includes surveillances, inspections, etc.

be in accordance with NEI 12-06, Rev. 0, Section 11.0. The unavailability of equipment and applicable connections that directly perform a FLEX mitigation strategy will be managed using plant equipment control guidelines developed in accordance with NEI 12-06, Section 11.5. Programs and controls will be established to assure personnel proficiency in the mitigation of beyond-design-basis events is developed and maintained in accordance with NEI 12-06 Section 11.6. The FLEX strategies and basis will be maintained in an overall program document. Existing plant configuration control procedures will be modified to ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies in accordance with NEI 12-06 Section 11.8.

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

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

In the table "PWR Portable Equipment Phase 2" on page 66 of the Integrated Plan, the licensee listed the portable FLEX equipment and noted that maintenance/PM requirements would follow EPRI template requirements. During the audit process the licensee stated that they are supporting the EPRI industry program. They have received the latest draft revision for the preventative maintenance and testing and are reviewing it to insure compliance with NEI 12-06 section 11.5. They also stated that they would provide a detailed description of this in its August 2014 update of its Integrated Plan. Review of the licensee's preventive maintenance and testing plans 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 closure of the of issues related to the Confirmatory Item, provides reasonable assurance that the requirements of Order EA-12-049 will be met with respect to maintenance and testing, if these requirements are implemented as described.

3.3.2. Configuration Control.

NEI 12-06, Section 11.8 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 10 and 11 of its Integrated Plan discussing programmatic controls, the licensee stated that equipment associated with these strategies will be procured as commercial grade equipment. The storage, maintenance, testing, and configuration control of the equipment will be in accordance with NEI 12-06, Section 11.0. The unavailability of equipment and applicable connections that directly perform a FLEX mitigation strategy will be managed using plant equipment control guidelines developed in accordance with NEI 12-06, Section 11.5. Programs and controls will be established to assure personnel proficiency in the mitigation of beyond-design-basis events is developed and maintained in accordance with NEI 12-06 Section 11.6. The FLEX strategies and basis will be maintained in an overall program document. Existing plant configuration control procedures will be modified to ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies in accordance with NEI 12-06 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 11 of its Integrated Plan in regards to training, the licensee stated that training plans will be developed for station staff and emergency response personnel. The training plan development will be done in accordance with CPNPP procedures using the Systematic Approach to Training (SAT), and will be implemented to ensure that the required site staff is trained prior to implementation of FLEX. This training program will conform to the requirements outlined in Section 11.6 of NEI 12-06. During the audit process the licensee stated that procedure development for training is in progress and is scheduled to be completed and training performed in Operations training cycle to meet Fall 2014 date.

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

3.4 OFFSITE RESOURCES

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

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

On page 11 of its Integrated Plan the licensee stated that CPNPP will utilize the industry RRCs for Phase 3 equipment. CPNPP has a contractual agreement with SAFER. Two industry RRCs will be established to support utilities in response to beyond design-basis external events. Each RRC will hold five (5) sets of equipment: four (4) of which would be able to be fully deployed if requested while the fifth set would be comprised of equipment undergoing maintenance. Communications would be established between CPNPP and SAFER and the required equipment mobilized as needed. Equipment would initially be moved from a RRC to a local staging area established jointly by SAFER and Luminant. The equipment would be prepared at the staging area prior to transportation to the CPNPP site. The initial arriving equipment, as defined in the plant-specific playbook, would be delivered to CPNPP within 24 hours of initial notification. CPNPP has signed a contract with SAFER to meet requirements of NEI 12-06, Section 12.

During the audit process the licensee was asked to provide sufficient information to ensure that the proposed arrangement will conform to the guidance found in NEI 12-06, Section 12.2, item 1, with regard to the capability to obtain equipment and commodities to sustain and backup the site's coping strategies. In its response the licensee stated that they would establish a means to ensure the necessary resources will be available from off-site conforming to the guidance in NEI 12-06 section 12.2 with agreements with the Regional Response Center. [This would include] generic equipment for the industry and non-generic equipment necessary for long-term coping. The licensee also stated that they would provide a detailed description in its February 2014 update of its Integrated Plan.

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

4.0 OPEN AND CONFIRMATORY ITEMS

4.1 OPEN ITEMS

Item Number	Description	Notes
3.2.1.2.A.	RCP seal O-rings. The only O-ring of interest with SHIELD installed is the RCP seal sleeve to shaft O-ring. Qualification of the RCP seal sleeve to shaft O-ring will be tracked as part of the SHIELD redesign to confirm the delayed cooldown, as documented in the Integrated Plan, is acceptable. Comanche Peak will align with testing results to be documented in the forthcoming SHIELD white paper.	
3.2.1.2.C.	Use of Generation 3 Shield Seals. 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. In its NRC Audit update the licensee stated that Comanche Peak uses the Westinghouse model 93A RCPs crediting safe shutdown low-leakage seals (SHIELD) for FLEX strategies. Testing and qualification of SHIELD is ongoing and the licensee is closely following the re-design of SHIELD and will	

	modify analyses and FLEX strategies if needed, based on the conclusions of the SHIELD white paper.	
3.2.1.8.A	The PWROG submitted to NRC a position paper, dated August 15, 2013, which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlines 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. However, the NRC staff concluded that the August 15, 2013, position paper was not adequately justified and did not endorse this position paper. As such, ensuring adequate mixing of boric acid into the RCS under ELAP conditions is an open item for Comanche Peak.	

4.2 CONFIRMATORY ITEMS

Item Number	Description	Notes
3.1.1.1.A.	(CPNPP Open Item OI-1) Storage of Portable Equipment (Seismic Considerations) In its Six Month Status Report the licensee provided the location of the planned FLEX storage building but did not provided details of its plans for storage and protection of FLEX equipment for review. Because these plans have not been formalized or implemented, they do not provide reasonable assurance that portable FLEX equipment will be protected from seismic hazards in accordance with the guidance of NEI 12-06, Section 5.3.1, considerations 1 through 3. The licensee has identified this as Open Item OI1 in its list of open items on page 73 of its OIP: "Finalize location and protection requirements of FLEX storage buildings. The storage buildings will be designed in accordance with the NEI guidance and the applicable hazards."	
3.1.1.2.A	The route to be traveled by portable equipment from its storage location to the site where it will be used should be reviewed for potential soil liquefaction that could impede movement following a severe seismic event	
3.1.1.2.B.	(CPNPP Open Item OI-2) Deployment of portable equipment (Containment during Initial phase). In the section of its Integrated Plan regarding strategies to maintain containment during the initial phase, the licensee indicated that pressure and temperature are not expected to rise to levels that could challenge the containment structure. A containment evaluation will be performed to demonstrate that containment pressure and temperature will stay at acceptable levels and that no containment spray system will	

	be required as part of FLEX. Completion of this evaluation was identified as open item OI2 in the licensee's overall Integrated Plan.	
3.1.1.4.A.	Utilization of offsite resources. Due to the absence of a description of the methods to be used to deliver the equipment to the site the licensee's plan for the use of offsite resources did not provide reasonable assurance that the plan will address the potential impact of all applicable hazards on the transportation of offsite resources as described in NEI 12-06, Section 5.3.4, consideration 1, Section 6.2.3.4, considerations 1 and 2, Section 7.3.4, considerations 1 and 2, and Section 8.3.4. In its Six Month Status Report the licensee indicated that these details would be addressed in its SAFER Response Plan scheduled for February 2014.	
3.1.4.1.A.	In its Audit update the licensee stated that the FLEX equipment would be stored in a new structure designed in accordance with the NEI 12-06, Section 8.3.1, to protect against all external events including design basis snowfall or ice storms. These details would be provided in the February 2014 six month status report. Verification that the FLEX storage building will conform to NEI 12-06, Section 8.3.1 is Confirmatory Item 3.1.4.1.A in Section 4.2	
3.2.1.1.A.	Confirm that steam generator makeup requirements have been appropriately defined or revise them to account for the installation of low-leakage reactor coolant pump seals.	
3.2.1.1.B.	Reliance on the NOTRUMP code for the ELAP analysis of Westinghouse plants is limited to the flow conditions before reflux condensation initiates. This includes specifying an acceptable definition for reflux condensation cooling.	
3.2.1.1.C.	Nitrogen Injection. Clarify whether calculations have been performed consistent with the PWROG-recommended methodology in Attachment 1 to the interim core cooling position paper for PA-PSC-0965 to verify that the intended ELAP mitigation strategy will not result in injection of nitrogen from cold leg accumulators or provide justification that the existing calculations methods for determining whether nitrogen injection will occur considers the potential for heating due to the rise of containment temperatures due to loss of normal ventilation, reactor coolant pump seal leakage, etc.	
3.2.1.1.D	Confirm that a symmetric cooldown using all four reactor coolant system loops can be coordinated under ELAP conditions considering environmental effects such as noise and high temperatures on operators manipulating TDAFW flow, ARV positions, and other equipment.	
3.2.1.2.B.	SHIELD Part 21 Report. Information should be provided to	

	address the impacts of the Westinghouse 10 CFR Part 21 report, "Notification of the Potential Existence of Defects Pursuant to 10 CFR Part 21," dated July 26, 2013 (ADAMS No. ML13211A168) on the use of the low seal leakage rate in the ELAP analysis. In its NRC Audit update the licensee stated that Comanche Peak uses the Westinghouse model 93A RCPs crediting safe shutdown low-leakage seals (SHIELD) for FLEX strategies. Testing and qualification of SHIELD is ongoing and the licensee is closely following the re-design of SHIELD and will modify analyses and FLEX strategies if needed, based on the conclusions of the SHIELD white paper.	
3.2.1.2.D	(1) Confirm that stresses resulting from a cooldown of the RCS will not result in the failure of seal materials. (2) As applicable, confirm that reestablishing cooling to the seals will not result in increased leakage due to thermal shock. (3) Confirm that the fluid leaking through the reactor coolant pump seals will originate as single-phase liquid. (4) Confirm conformance with Sections 3.5 and 4.0 of the NRC safety evaluation (ADAMS Nos.: ML110880122 and ML110880131) approving the use of the shutdown seal with Model 93A RCP in the plant PRA model.	
3.2.3.A.	(Licensee identified Open Item OI-2) The licensee stated that Westinghouse would perform containment analyses confirming containment integrity during an ELAP event. By crediting SHIELD installation, they did not expect that containment integrity will be challenged during an ELAP event. (Note: This containment evaluation is likely dependent on the resolution of the Open and Confirmatory Items specified in Section 3.2.1.2, "Reactor Coolant Pump Seal Leakage Rates".)	
3.2.4.4.A.	The licensee's plan for use of portable lighting to support FLEX strategy implementation did not provide reasonable assurance that the plan conforms to the guidance of NEI 12-06, Section 3.2.2, Paragraph (8) because the licensee did not provide sufficient details on the identification in plant procedures and guidance of portable lighting such as flashlights or headlamps necessary for ingress and egress to plant areas required for deployment of the strategies. Provide information on the use of portable lighting for FLEX strategy implementation (storage location, sufficient quantities, and procedural guidelines)	
3.2.4.4.B.	The NRC staff has reviewed the licensee communications assessment (ML12318A100 and ML13071A349) in response	

	to the March 12, 2012 50.54(f) request for information letter for DNPS and, as documented in the staff analysis (ML13141A675) 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. Follow up and confirm with the licensee that that upgrades to the site's communications systems have been completed.	
3.2.4.5.A.	The licensee's plans for the development of guidance and strategies with regard to the access to the Protected Area and internal locked areas did not provide reasonable assurance that the guidance and strategies developed will conform with Section 3.2.2, Paragraph (9) because the plan lacked any discussion on this topic. Provide information on access to the protected area and internal locked areas as it relates to FLEX strategy implementation.	
3.2.4.8.A	The staff will review the sizing of the Phase 2 portable/FLEX diesel generators when the licensee has finalized their design. This is identified as Confirmatory Item 3.2.4.8.A in Section 4.2.	
3.2.4.9.A	The licensee did not address actions to maintain the quality of fuel stored in the tanks of the portable equipment for potentially long periods of time when the equipment (diesel driven pumps and generators) will not be operated.	
3.2.4.10.A	Load Reduction to Conserve dc Power. The licensee noted that the station batteries do not require portable supplemental charging before 24 hours. The licensee needs to provide a completed load shed analysis. The licensee stated that they would provide a detailed description of its plans to perform load shedding to preserve dc power would be detailed in its February 2014 update of its Integrated Plan.	
3.3.1.A.	Maintenance and Testing. In the Integrated Plan, the licensee listed the portable FLEX equipment and noted that maintenance/PM requirements would follow EPRI template requirements. During the audit process the licensee stated that they are supporting the EPRI industry program. They have received the latest draft revision for the preventative maintenance and testing and are reviewing it to insure compliance with NEI 12-06 section 11.5. They also stated that they would provide a detailed description of this in its August 2014 update of its Integrated Plan.	

If you have any questions, please contact James Polickoski, Mitigating Strategies Project Manager, at 301-415-5430 or at james.polickoski@nrc.gov.

Sincerely,

/RA/

Jeremy S. Bowen, Chief
Mitigating Strategies Projects Branch
Mitigating Strategies Directorate
Office of Nuclear Reactor Regulation

Docket Nos. 50-445 and 50-446

Enclosures:
1. Interim Staff Evaluation
2. Technical Evaluation Report

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ADAMS Accession Nos.: Pkg ML13353A549, Letter/ISE ML13225A575, TER ML13338A661 *via email

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DATE	12/18/13	12/18/13	12/19/13	12/19/13
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NAME	JBowen	SBailey*	SWhaley*	JDavis* (SWhaley for)
DATE	12/19/13	12/19/13	12/19/13	12/19/13
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DATE	12/19/13			

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