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CP-201600329
Log # TXX-16051

REF 10 CFR 2.202

July 28, 2016

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

SUBJECT: Comanche Peak Nuclear Power Plant, Docket No. 50-445, Compliance with NRC Order Modifying Licenses with Regard to Requirements for Mitigating Strategies for Beyond Design-Basis External Events (Order Number EA-12-049) (TAC NOS. MF0860 AND MF0861)

REFERENCE: 1. NRC Order Number EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design-Basis External Events, dated March 12, 2012. (ADAMS No. ML12054A736)

Dear Sir or Madam:

On March 12, 2012, the Nuclear Regulatory Commission ("NRC" or "Commission") issued an order (Reference 1) to Luminant Generation Company LLC (Luminant Power). Reference 1 was immediately effective and required Luminant Power to implement mitigation strategies for beyond-design-basis external events. Specific requirements are outlined in Attachment 2 of Reference 1.

Pursuant to Section IV, Condition C.3 of Reference 1, the Attachment 1 to TXX-16051 provides a summary of Comanche Peak Nuclear Power Plant Unit 1 full compliance with the requirements of Attachment 2 of Reference 1.

This letter contains no new regulatory commitments.

If you have any questions regarding this report, please contact Carl B. Corbin at (254) 897-0121 or carl.corbin@luminant.com.

A151
NRR

I state under penalty of perjury that the foregoing is true and correct.

Executed on July 28, 2016.

Sincerely,

Luminant Generation Company LLC

Kenneth J. Peters

Attachment 1	Comanche Peak Nuclear Power Plant (CPNPP) Unit 1, Summary of Compliance with NRC Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigating Strategies for Beyond Design-Basis External Events
Attachment 2	CPNPP Units 1 and 2 / Responses to NRC Audit Report Open Items and NRC Interim Staff Evaluation Open and Confirmatory Items (for information only)
Attachment 3	Final Integrated Plan Revision 0, Comanche Peak Nuclear Power Plant Units 1 and 2 (for information only)

c - William M Dean, Director, Office of Nuclear Reactor Regulation
Kriss Kennedy, Region IV
Stephen A. Monarque, NRR
Margaret M. Watford, NRR
Resident Inspectors, Comanche Peak

**Comanche Peak Nuclear Power Plant (CPNPP) Unit 1,
Summary of Compliance with NRC Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events**

1. Introduction

Luminant Generation Company LLC (Luminant Power) developed an Overall Integrated Plan (OIP) (References 5, 6 and 7) to provide diverse and flexible strategies (FLEX) in response to Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (References 1 and 3). As required by the order, Luminant Power has submitted OIP status updates at six month intervals (References 11, 12, 13, 17, 19, and 22). The information provided herein summarizes compliance with Order EA-012-049 for Comanche Peak Nuclear Power Plant (CPNPP) Unit 1.

2. Open Item Resolution

FLEX issues from the NRC Audit Report (Reference 18) have been addressed by Luminant Power. The FLEX issues that were identified as open and pending by the NRC Audit Report (Reference 18) are listed below:

ISE Confirmatory Items (ISE CI) - ISE CI 3.2.1.2.A and 3.2.4.4.B

Audit Questions (AQs) – AQ-27, AQ-30

Licensee-identified OIP OIs - CPNPP has no open or pending licensee-identified open items.

Additional SE needed information – SE-2, SE-8

The above six open items have been uploaded to the NRC ePortal. These six open items are considered complete pending NRC review and closure.

As result of communications between the NRC staff and Luminant Power, Attachment 2 to TXX-16051 provides responses (for information only) to (1) the open items in the NRC Staff Audit Report (see list above from Reference 18) and (2) the Open and Confirmatory items from the NRC Interim Staff Evaluation (ISE) (Reference 10). The responses provide a summary response with reference to plant documents as applicable (e.g., procedures) and reflect the information provided on the NRC ePortal. The referenced plant documents are available on the NRC ePortal.

3. Milestone Schedule - Complete

Milestone	Original Target Completion Date	Activity Status
Submit 60 Day Status Report	Oct 2012	Complete
Submit Overall Integrated Plan	Feb 2013	Complete
Submit 6 Month Updates:		
Update 1	Aug 2013	Complete
Update 2	Feb 2014	Complete
Update 3	Aug 2014	Complete
Update 4	Feb 2015	Complete
Update 5	Aug 2015	Complete
Update 6	Feb 2016	Complete
FLEX Strategy Evaluation	*Aug 2013*	*Complete*
Walk-throughs or Demonstrations	*Apr 2015*	*Complete*
Perform Phase 2 Staffing Analysis	Jun 2014	Complete
Modifications:		
Modifications Evaluation	*Aug 2013*	*Complete*
Develop Unit 1 Modifications	Mar 2014	Complete
Unit 1 Implementation Outage (1RF18)	Oct 2014	Complete
Develop Unit 2 Modifications	Mar 2015	Complete
Unit 2 Implementation Outage (2RF15)	Oct 2015	Complete
Storage:		
Storage Design Engineering	*Mar 2014*	*Complete*
Storage Implementation	*Feb 2015*	*Complete*
FLEX Equipment:		
Procure On-Site Equipment (Unit 1/Unit 2)	Jul 2015	Complete/Complete
Develop Site Response Plan with NSRC	Apr 2015	Complete
Install Off-Site Delivery Station (if Necessary)	*Not Required*	*Not Required*
National Safer Response Center Operational	Aug 2014	Complete
Procedures:		
PWROG issues NSSS-specific guidelines	*May 2013*	*Complete*
Issue FSGs	Aug 2014	Complete
Create Maintenance Procedures	Jul 2014	Complete
Training:		
Develop Training Plan	*May 2014*	*Complete*
Implement Training	Apr 2015	Complete
Full Site FLEX Implementation	*Oct 2015*	*Complete*
Submit Completion Report	Feb 2016	Complete

4. Order EA-12-049 Compliance Elements Summary

The elements identified below for CPNPP Unit 1 demonstrate compliance with NRC Order EA-12-049. The Final Integrated Plan (FIP) (Attachment 3) was developed using the Overall Integrated Plan (Reference 7) and the 6-Month Status Reports (References 11, 12, 13, 17, 19, and 22). Luminant Power voluntarily participated in the online NRC ePortal and NRC Audit process (virtual and onsite) (References 8, 9, 10, 15, and 18). Compliance for CPNPP Unit 2 was reported in Reference 21 (fall 2015).

4.1 Strategies - Complete

CPNPP Unit 1 strategies are in compliance with Order EA-12-049. The six open items of Reference 18 have been addressed and uploaded to the NRC ePortal and are considered complete pending NRC closure.

4.2 Modifications - Complete

The modifications required to support the FLEX strategies for CPNPP Unit 1 have been fully implemented in accordance with the station processes.

4.3 Equipment – Procurement and Maintenance & Testing - Complete

The equipment required to implement the FLEX strategies for CPNPP Unit 1 has been procured, received at CPNPP, initially tested and performance verified as recommended in accordance with NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide (Reference 4) and is available for use. Maintenance and testing requirements are included in the CPNPP Preventative Maintenance Program such that equipment reliability is monitored and maintained.

4.4 Protected Storage - Complete

The storage facility required to implement the FLEX strategies for CPNPP Unit 1 has been constructed and provides adequate protection from the applicable site hazards. The equipment required to implement the FLEX strategies for CPNPP Unit 1 is stored in its protected configuration.

4.5 Procedures - Complete

FLEX Support Instructions (FSIs) for CPNPP Unit 1 have been developed and integrated with existing procedures. The FSIs and applicable procedures have been verified and are available for use in accordance with the site procedure control program.

4.6 Training - Complete

Training for CPNPP Unit 1 has been completed in accordance with an accepted training process, as recommended in NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide (Reference 4).

4.7 Staffing - Complete

The CPNPP Phase 2 staffing assessment for CPNPP (References 16 and 23) has been completed in accordance with 10 CFR 50.54(f) letter (Reference 20). The commitments in Reference 16 (which included Phase 2 staffing assessment gaps) have been completed. The NRC staff concluded (Reference 24) that the CPNPP Phase 2 staffing submittal adequately addresses the response strategies needed to respond to a BDBEE using its procedures and guidelines.

4.8 National Safer Response Centers - Complete

Luminant Power has established a contract with Pooled Equipment Inventory Company (PEICo) and has joined the Strategic Alliance for FLEX Emergency Response (SAFER) Team Equipment Committee for off-site facility coordination. It has been confirmed that PEICo is ready to support CPNPP with Phase 3 FLEX equipment stored in the National SAFER Response Centers in accordance with the site specific SAFER Response Plan.

4.9 Validation - Complete

Luminant Power validated FLEX strategies in accordance with the NEI FLEX Validation Process. This consisted of validating the feasibility of individual strategies identified in the Final Integrated Plan (FIP) (Attachment 3) using the graded approach described in the NEI guidance document (Reference 4) and an integrated review to ensure that adequate resources (personnel, equipment, materials) are available to implement the individual strategies to achieve the intended results.

4.10 FLEX Program Document - Complete

The CPNPP FLEX Program Document (STA-250 "Beyond Design Basis External Events (BDBEE) FLEX Program") has been developed in accordance with the requirements of NEI 12-06, Revision 0, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide (Reference 4).

5. References

1. NRC Order Number EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012. (ADAMS No. ML12054A736)

2. NRC Order Number EA-12-051, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," dated March 12, 2012. (ADAMS No. ML12054A679)

3. NRC 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," Revision 0, dated August 29, 2012 (ADAMS No. ML12233A042)

4. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 0, dated August 2012 (ADAMS No. ML12242A377)

5. Luminant Generation Company LLC's Letter TXX-12158, Initial 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 October 25, 2012 (ADAMS No. ML12311A433)

6. NRC Letter from Michele G. Evans to All Operating Power Reactors and Holders of Construction Permits, "Status of 60-Day Response To Orders Modifying Licenses Regarding Recommendations 4.2, 5.1, And 7.1 of The Near-Term Task Force Related To The Fukushima Dai-Ichi Nuclear Power Plant Accident" dated November 29, 2012 (ADAMS No. ML12326A829)

7. 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 No. ML13071A617)

8. NRC Letter from David L. Skeen to All Operating Power Reactors and Holders of Construction Permits, "Online Reference Portal For Nuclear Regulatory Commission Review Of Fukushima Near-Term Task Force Related Documents" dated August 1, 2013 (ADAMS No. ML13206A427)

9. NRC Letter from Jack R. Davis 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 No. ML13234A503)

10. NRC Interim Staff Evaluation, "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)," dated December 19, 2013 (ADAMS No. ML13225A575)

11. 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) (TAC Nos. MF0860 and MF0861), letter TXX-13129 dated August 28, 2013 (ADAMS No. ML13252A077)

12. Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 and 50-446, Second 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) (TAC Nos. MF0860 and MF0861), letter TXX-14025 dated February 27, 2014 (ADAMS No. ML14071A008)

13. Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 and 50-446, Third 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) (TAC Nos. MF0860 and MF0861), letter TXX-14104 dated August 28, 2014 (ADAMS No. ML14254A402)

14. Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 AND 50-446, Compliance with NRC Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051) (TAC NOS. MF0862 AND MF0863), letter TXX-14132 dated December 16, 2014 (ADAMS No. ML15016A188)

15. NRC Letter from Stephen Monarque to Rafael Flores, "Comanche Peak Nuclear Power Plant, Units 1 And 2 – Plan For The Onsite Audit Regarding Implementation Of Mitigating Strategies Related To Order EA-12-049 (TAC NOS. MF0860 AND MF0861)" dated March 26, 2015 (ADAMS No. ML15076A523)

16. Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 And 50-446, Submittal of Phase 2 Staffing Assessment Regarding Recommendation 9.3 (Staffing) and Updated Commitments Regarding Recommendation 9.3 (Communications and Staffing) (TAC NOS. ME8686 and ME8687), letter TXX-15084 dated June 1, 2015 (ADAMS No. ML15161A318)

17. Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 and 50-446, Fourth 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) (TAC Nos. MF0860 and MF0861), letter TXX-15035 dated February 26, 2015 (ADAMS No. ML15069A219)

18. NRC Letter from Stephen Monarque to Rafael Flores, "Comanche Peak Nuclear Power Plant, Units 1 and 2 – Report for the Audit Regarding Implementation of Mitigating Strategies Related to Order EA-12-049 (TAC Nos. MF0860 and MF0861), dated August 5, 2015 (ADAMS No. ML15180A261)

19. Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 and 50-446, Fifth 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) (TAC Nos. MF0860 and MF0861)," letter TXX-15124 dated August 27, 2015 (ADAMS No. ML15253A372)

20. NRC Letter from Eric J. Leeds to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review Of Insights From The Fukushima Dai-Ichi Accident" dated March 12, 2012 (ADAMS No. ML12053A340)

21. Comanche Peak Nuclear Power Plant, Docket No. 50-446, Compliance with NRC Order Modifying Licenses with Regard to Requirements For Mitigation Strategies For Beyond- Design-Basis External Events (Order Number EA-12-049) (TAC Nos. MF0860 and MF0861), letter TXX-15137 dated November 18, 2015 (ADAMS No. ML15331A037)

22. Comanche Peak Nuclear Power Plant Unit 1, Docket No. 50-446, "Sixth 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) (TAC Nos. MF0860 and MF0861)," letter TXX-16027 dated February 24, 2016 (ADAMS No. ML16098A341)

23. Comanche Peak Nuclear Power Plant Unit 1, Docket No. 50-446, "Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 And 50-446, Submittal of Updated Phase 2 Staffing Assessment Regarding Recommendation 9.3 (Staffing)(TAC NOS. ME8686 and ME8687)," letter TXX-16002 dated January 20, 2016 (ADAMS Nos. ML16041A576 and ML16047A330)

24. NRC Letter from Michael A. Brown to Ken J. Peters, "Comanche Peak Nuclear Power Plant, Units 1 and 2 -Response Regarding Phase 2 Staffing Submittals Associated With Near-Term Task Force Recommendation 9.3 Related To The Fukushima Dai-Ichi Nuclear Power Plant Accident (CAC NOS. MF6372 and MF6373)" dated March 22, 2016 (ADAMS No. ML16075A371)

As result of communications between the NRC staff and Luminant Power, this attachment provides responses (for information only) to (1) the open items in the NRC Staff Audit Report dated August 5, 2015 (ML15180A261) and (2) the Open and Confirmatory items from the NRC Interim Staff Evaluation (ISE) dated December 19, 2013 (ML13225A575). The responses provide a summary response with reference to plant documents as applicable (e.g., procedures) and reflect the information provided on the NRC ePortal. The referenced plant documents are available on the NRC ePortal.

Contents

NRC Audit Report Item AQ 27

NRC Audit Report Item AQ 27:

Please provide a detailed summary of the calculation and/or technical evaluation that demonstrates the adequacy of the ventilation provided in the battery room to protect the batteries from the effects of extreme high and low temperatures in each Phase of an ELAP event.

Licensee Input Needed:

The NRC staff has requested that Luminant provide a justification for the EQ of battery rooms for an indefinite duration of ELAP.

Response for NRC Audit Report Item AQ 27:

NRC Audit Report Item AQ 27 originated from NRC Audit Item B-27, previously addressed via the Audit Item B-27 response. However, additional evaluation has been requested as identified in the NRC Audit Report (CP-201500808) and as repeated in the *Licensee Input Needed* section above.

The original response to Audit Item B-27 is repeated here and then clarified relative to the request documented in AQ 27. Additional discussion is also provided regarding inverter room temperature.

<u>From Audit Item B-27 Response</u>

Loss of battery room and inverter room ventilation analyses were performed with results summarized in the Shaw/CB&I report 12048420-R-M-00001 (VDRT-4796567). The analysis results were further evaluated in EV-CR-2012-002652-26. The evaluation concluded that the following actions were sufficient for maintaining battery and inverter room equipment functionality and operator access throughout the event:

1. *Block open the battery room and inverter room doors at 5.5 hours,*
2. *Block open stairwell doors, roof access doors, and the Cable Spreading room door at 12 hours,*
3. *Block open the doors to the outside from the Cable Spreading room at 18 hours, and*
4. *Deploy portable fans at 18 hours.*

The above operator actions are directed per FSI-4.0A/B and FSI-5.0.

Per the Overall Integrated Plan (page 2) and consistent with NEI 12-06, Comanche Peak FLEX strategies do not have to consider the challenge of extreme low temperatures.

<u>Credited Operator Actions</u>
For Items 1 through 3 above, blocking open doors is performed as part of the DC load shed and/or Supplemental DC load shed in FSI-4.0A/B Attachments 2 and/or 3 (Modes 1-4). For item 1, the required completion time of 5.5 hours is documented in FSI-5.0 Attachment 1.A. Assuming ELAP declaration at 4 hours, the ability to complete within 1.5 hours was confirmed via successful performance of Validation Guide 2015-002 where the observed time (duration) to perform this activity was 0.16 hours.

Item 2 is performed using the same attachments as item 1 and will therefore be initiated long before the required completion time of 12 hours. Assuming ELAP declaration at 4 hours, the ability to complete within 8 hours was confirmed via successful performance of Validation Guide 2015-004 where the observed time (duration) to perform this activity was 0.14 hours.

Item 3 is performed using the same attachments as item 1 and will therefore be initiated long before the required completion time of 18 hours. Assuming ELAP declaration at 4 hours, the ability to complete within 14 hours was confirmed via successful performance of Validation Guide 2015-005 where the observed time (duration) to perform this activity was 0.07 hours.

Item 4 above to deploy portable fans is procedurally directed by FSI-5.0 Step 22 and Attachment 8. The associated required completion time of 18 hours is documented in FSI-5.0 Attachment 1.A. Assuming ELAP declaration at 4 hours, the ability to complete within 14 hours was confirmed via successful performance of Validation Guide 2015-027 where the observed time (duration) to perform this activity was 1.11 hours. The short duration for this activity ensures performance can be completed between 6 and 18 hours after event initiation when limited site access has been restored.

Battery and Inverter Room Temperatures

The formal Loss of Ventilation (LOV) analysis (12048420-R-M-00001) modeled the first 72 hours of the event. The rates of temperature change for the battery and inverter rooms determined in the LOV analysis are relatively small at 72 hours. The evaluation contained herein for event times beyond 72 hours is qualitative and dependent upon implications of the observed low rates of room temperature change.

EV-CR-2012-002652-26 documents the inverter room equipment functionality limits and the basis for acceptability of the anticipated inverter room temperature transient during an ELAP.

EV-CR-2012-002652-26 also documents a temperature limit of 116.7°F for battery room equipment functionality, however review of the associated battery specification 2323-ES-008A Revision 2 concludes the actual maximum temperature allowable for steady-state operation is 122°F. The temperature limit of 116.7°F reported previously is the maximum room temperature expected during a LOCA on one Unit, simultaneous cooldown of the opposite Unit coincident with loss of ventilation and is therefore not applicable to ELAP.

From Figure 1 of the LOV analysis (12048420-R-M-00001, VDRT-4796567), battery room temperature is not expected to exceed 110°F within the first 3 days following ELAP initiation. Based on the conservatively assumed linear rate of temperature rise in the limiting battery rooms (X-116 and X-123) present at 3 days and assuming no further operator action, the temperature limit of 122°F is not anticipated to be exceeded until greater than 9 days after ELAP initiation. [NOTE: Though not detailed here, use of a best-estimate approach crediting the *decreasing rate* of temperature increase concludes the temperature limit of 122°F would not be exceeded for greater than 16 days after ELAP initiation.]

Regardless, following restoration of power in Phase 3 at approximately 3 days after ELAP initiation, a single train of room cooling (per Unit) will be restored (FSI-30.0 Step 39) to the *inverter* rooms (X-118 through X-121), which are in open communication with the battery rooms. [NOTE: This single train of inverter room cooling per Unit was *not* credited in the LOV analysis.] Based on the alignment of the portable fans discussed in item 4 above (see page ATT 2 – 30 of 12048420-R-M-00001), outside air will be forced into the inverter rooms, then discharged to the adjoining hallway where some of this air will flow into the battery rooms (X-116 and X-123) and then exhaust via the battery room exhaust fans. Due to the restoration of a single train of inverter room cooling per Unit in Phase 3, the inverter room exhaust will be cooler than that assumed in the LOV analysis, limiting the long-term equilibrium temperature in the battery and inverter rooms (see Figures 1 and 2 of 12048420-R-M-00001) to a value less than approximately 110°F. Battery functionality is confirmed.

Outside air will be forced into the other battery rooms (X-117 and X-124) without the benefit of restored inverter room cooling, however, outdoor temperature is such that battery room temperature is expected to remain below 110°F indefinitely (see Figure 1 of 12048420-R-M-00001), therefore battery functionality is confirmed.

It is noted that the discussion above is considered a limiting approach to maintaining acceptable battery and inverter room temperatures during an ELAP. During Phase 3, sufficient manpower and resources will be available to adjust/optimize forced ventilation flowrates and flowpaths, as needed, to achieve and maintain inverter and battery room temperatures at or below approximately 110 °F. For example, upon restoration of inverter room cooling, air could be recirculated within the battery and inverter rooms rather than drawing in potentially warmer air from the outside, etc.

Battery Electrolyte Level and Monitoring

EV-CR-2012-002652-65 documents evaluation of anticipated changes in battery electrolyte level given environmental conditions anticipated to exist during the event. The evaluation assumed an upper limit on battery room temperature of 110°F. This is a reasonable assumption based on the discussion above. EV-CR-2012-002652-65 concluded that no special monitoring of battery electrolyte level is required beyond the current surveillance frequency specified in the Surveillance Frequency Control Program.

NRC Audit Report Item AQ 30

NRC Audit Report Item AQ 30:

The licensee's plan for personnel habitability/accessibility in an elevated temperature environment did not provide reasonable assurance that the plan conforms to the guidance of NEI 12-06, Section 3.2.2, Paragraph (11), because there is insufficient information to determine that the habitability limits will be maintained and/or operator protective measures will be employed in all Phases of an ELAP to ensure operators will be capable of FLEX strategy execution under adverse temperature conditions. Examples of areas of concern are the control room, TDAFW pump room, ARV manual operator area, SFP area, and charging pump room. Please provide a detailed summary of the analyses and/or technical evaluations on personnel habitability/accessibility in all elevated temperature environments as it relates to execution of FLEX strategies.

Licensee Input Needed:

Licensee to evaluate building room temperature potentially impacting implementation of Phase 2 electrical strategy.

Response for NRC Audit Report Item AQ 30:

NRC Audit Report Item AQ 30 originated from NRC Audit Item B-30, previously addressed via the Audit Item B-30 response. However, additional evaluation has been requested as identified in the NRC Audit Report (CP-201500808) and as repeated in the Licensee Input Needed section above.

Evaluation of the room temperature impact on Phase 2 electrical equipment was performed in two parts. Specifically, evaluations EV-CR-2012-002652-26 and EV-CR-2012-002652-56 documented the anticipated transient room temperatures for all areas of the plant where Phase 2 electrical equipment may be found. Evaluation EV-CR-2012-002652-62 then evaluated the impact of these elevated room temperatures on functionality of Phase 2 electrical equipment including protective devices (circuit breakers and fuses) and cables. Electrical panel structure/raceways are not sensitive to temperature changes and were therefore not evaluated.

Evaluation EV-CR-2012-002652-62 concluded that there is reasonable assurance of functionality for electrical protective devices and cables credited in the Phase 2 FLEX strategies when considering the anticipated temperature transients documented in EV-CR-2012-002652-56. The Phase 2 electrical strategy is therefore capable of providing uninterrupted power to all credited electrical loads, as needed.

NRC Audit Report Item ISE CI 3.2.1.2.A

NRC Audit Report Item ISE-CI-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. Luminant will align with testing results to be documented in the forthcoming SHIELD white paper.

Licensee Input Needed:

Luminant to provide information on O-ring material.

Response for NRC Audit Report Item ISE-CI-3.2.1.2.A:

See response for NRC SE tracker audit item A-09.

NRC Audit Report Item ISE CI 3.2.4.4.B

NRC Audit Report Item ISE-CI-3.2.4.4-B:

The NRC staff has reviewed the licensee's communications assessment in response to the March 12, 2012 10 CFR 50.54(f) request for information letter, and as documented in the NRC staff's analysis, and the NRC staff has determined the communications assessment is reasonable. Confirm that upgrades to the site's communication systems have been completed.

Licensee Input Needed:

Complete the regulatory commitments as described in the June 1, 2015 letter.

Response for NRC Audit Report Item ISE CI 3.2.4.4-B:

NRC Audit Report Item ISE-CI-3.2.4.4-B originated from NRC Audit Item A-16, previously addressed via the Audit Item A-16 response. However, additional evaluation has been requested as identified in the NRC Audit Report (CP-201500808) and as repeated in the *Licensee Input Needed* section above.

From Audit Item A-16 Response

CPNPP has reviewed a modification to the plant Gai-tronics for UPS Power supply and was determined to not be implemented. The Security personnel will perform other duties to assist in making notifications to the plant personnel.

The modification to the sound powered phone system to isolate the non-robust buildings was completed and the control of the switches is in FSI-5.0.

Satellite Phones are Located at the ERO facilities and the Counties EOC.

Hand held portable Radios are located at all ERO facilities

Regulatory Commitments related to Communications are complete

There are three commitments (4508353, 4509320, and 4630681) related to communications in letter TXX-15084, dated June 1, 2015. The commitments are repeated below along with status of their closure.

Commitment 4508353 Description:

A supplemental method to the PA system capability for emergency notification to the plant staff will be implemented as required to support emergency notification to essentially 100% of plant staff within 30 minutes.

Commitment 4508353 Status:

As noted in the CPNPP Phase 2 Staffing Assessment, this commitment / enhancement was being tracked as gap # 11 in Section 9 of the CPNPP Phase 2 Staffing Assessment (Attachment 2 to TXX-15084) (commitment 5061030). ABN-907 'Acts of Nature' has specific statements made from the control room concerning events that would require FLEX implementation. Security procedure SEC-950, 'ATTACHMENT 7 - EVENT/EMERGENCY NOTIFICATIONS' describes the use of bullhorns for announcements and notifications as directed by the OSM or the Emergency Coordinator (AI-CR-2015-003355-31).

Commitment 4509320 Description:

Plant modification to the Intraplant Sound-Powered Telephone System to enhance protection from external events will be implemented as required to support essential communications for event response.

Commitment 4509320 Status:

This modification has been completed as described in Final Design Authorization (FDA) 2013-08-24 (AI-CR-2012-002657-23).

Commitment 4630681 Description:

Identify and Integrate into the ERO notification / activation protocol those non-ERO response personnel (e.g., Operations and Maintenance) necessary to support expanded response capability functions.

Commitment 4630681 Status:

As noted in the CPNPP Phase 2 Staffing Assessment, this commitment / enhancement was being tracked as gap # 5 in Section 9 of the CPNPP Phase 2 Staffing Assessment (Attachment 2 to TXX-15084) (commitment 5061030). The CPNPP Chief Nuclear Officer has issued a site wide communications regarding the response of all personnel (ERO and Non-ERO) to a large scale weather-related event or natural disaster (AI-CR-2013-003355-14). Also, Operations Standing Order (OSO) 007 Rev 0 "Operations Personnel Self Reporting during an Emergency at CPNPP" has been issued to address additional considerations for Operations personnel.

Documents AI-CR-2015-003355-31, AI-CR-2012-002657-23, AI-CR-2013-003355-14, and OSO-007-R0 have been uploaded to the NRC ePortal.

NRC Audit Report Item SE-02

NRC Audit Report Item SE-02:

Provide a discussion on the EQ of equipment located within containment that is relied upon during an ELAP. Specifically, show that the containment pressure/temperature profile bounds the EQ profile for necessary equipment for the duration of the ELAP event.

Licensee Input Needed:

Luminant to provide additional information that shows the design of equipment envelopes ELAP conditions.

Response for NRC Audit Report Item SE-02:

NRC Audit Report Item SE-02 originated from NRC Audit Item E-02, previously addressed via the Audit Item E-02 response. However, additional evaluation has been requested as identified in the NRC Audit Report (CP-201500808) and as repeated in the *Licensee Input Needed* section above.

The original response to Audit Item E-02 is repeated here and then clarified relative to the request documented in SE-02.

From Audit Item E-02 Response

> *This audit question has been previously addressed under responses to NRC SE Tracker Audit Items B-19 (harsh environment), B-45 (temperature) and A-03 (pressure and temperature).*

<u>EQ of equipment is bounded by ELAP event</u>

In the previous response to A-03, Containment analysis was performed using the MAAP code which resulted in no significant heat-up or pressurization of containment as a result of an ELAP initiated in Modes 1-4 when crediting RCP SHIELD implementation. Previous responses to B-19 and B-45 credited the A-03 results to claim that containment heat gain and the overall environment under ELAP conditions would be bounded by the current design basis environmental parameters and that relied upon equipment within containment would remain reliable and functional for the duration of the ELAP event.

In order to further support the conclusions made by the previous responses as they contributed to the original response to Audit Item E-02, additional refinement of the original technical bases was performed with specific regard to the containment equipment relied upon and their relative locations and the ELAP alignment/ restoration of available support equipment as described in the applicable FLEX Support Guidelines.

It was determined that given the overall design basis EQ pressure/temperature profiles, the ELAP environmental profiles as originally documented in containment analysis calculation CN-ISENG-14-3 Rev. 0 [VDRT-4911241] and specific to the various sub-areas within containment were not entirely bounded. This was attributed in part to the extended duration of the ELAP event and the assumptions considered regarding alignment/restoration of FLEX strategy support equipment and any actions taken to implement heat removal capability within containment. Considering these attributes as additional and/or updated inputs, a more refined assessment was performed to better quantify anticipated containment temperature/pressure/relative humidity environmental parameters under ELAP conditions relative to the actual locations of containment equipment relied upon by FLEX strategies. The following provides an overall summary of this refined assessment.

Scope of Relied Upon Containment Equipment

AI-CR-2015-002539-12 documents the scope of equipment and their location within containment that is relied upon by FLEX strategies for the duration of the ELAP event as prescribed and credited within the applicable FLEX Support Guidelines.

Containment Cooling Actions

As described in FSI-30.502 Attachment 1, power will be provided to only one safeguards train on each unit during Phase 3 recovery. As described in EV-CR-2015-002539-15, containment temperatures will continue to increase slowly over time unless further action is taken. Further action to start reducing this temperature increase to ensure relied upon containment equipment is available would require containment heat removal capability which is dependent on alignment of one train of the Component Cooling Water (CCW) system to support specific cooling equipment for both Units.

FSI-30.502 will establish the need to provide CCW flow to the Non-Safety Chilled Water System. Non-Safety Chilled Water will provide cooling to the Containment Cooling and Recirculation System fans as described in FSI-30.814. EV-CR-2012-002652-55 and EV-CR-2015-002539-14 were generated to document the desired cooling equipment lineup and provide the technical bases which demonstrate containment heat removal capacities. The alignment utilizes the proposed equipment restoration strategies as outlined in FSI-30.501, FSI-30.502 and FSI-30.814, including the alignment of 10,000 gpm of SSW to the applicable CCW heat exchanger and a CCW flow limitation of ≤ 14,000 gpm to ensure adequate flow is provided to the required end users and CCW temperature is maintained within normal operating bands. The heat removal capacities include:

- Adequate spent fuel pool cooling restoration including termination of pool boiling
- Control Room A/C restoration
- Safety Chilled Water restoration to support equipment operation.
- Non-Safety (NNS) Chiller and Containment cooling for two-unit containment environment restoration.

These heat removal capacities along with desired cooling system alignments and appropriate boundary conditions as defined in EV-CR-2015-002539-14 are utilized as input in a refinement of the MAAP code and an update of the original containment analysis calculation CN-ISENG-14-3 Rev. 0 as documented in EV-CR-2015-002539-15.

Refined Containment Analysis (Temperature/Pressure/Relative Humidity)

Based on the input from EV-CR-2015-002539-14 and the expected equipment availability at 72 hours, including desired containment cool-down targets of 120° F in 21.5 days or less, evaluation EV-CR-2015-002539-15 provided an updated family of containment temperature profiles under ELAP conditions representing each of the modeled containment compartments. EV-CR-2015-002539-15 also established that the containment relative humidity will not exceed 90% and the peak pressure that results from the ELAP event is less than 10 psig.

Equipment Qualification Assessment

Evaluation EV-CR-2015-002539-16 as supplemented by EV-CR-2015-002539-20 utilizes the resulting temperature, pressure and relative humidity conclusions from EV-CR-2015-002539-15 and assesses the impact to equipment located within containment that is relied upon during an ELAP. In each case, the changes in temperature, pressure and relative humidity are gradual and occur over days not seconds. Considering each of the resulting temperature profiles generated within EV-CR-2015-002539-15, it was determined that the compartment area labeled "Broken S/G Compartment" provided the worst case temperature profile in which equipment required for an ELAP is located. This temperature profile was used as a bounding profile to evaluate all inside containment equipment.

Temperature was evaluated on a component-by-component basis and accomplished by evaluating the bounding ELAP temperature profile against temperature performance data contained in CPNPP utilized qualification test reports, other test reports, equipment specifications or vendor literature.

Relative humidity is not considered a significant environmental stressor for the ELAP event. For the ELAP event the temperature increase is gradual and occurs over 72 hours. This allows the equipment temperature to adjust and change at essentially the same rate as the ambient environment. The moisture that is introduced into containment will remain in solution; with the equipment temperature being above the saturation temperature. The production of condensation on, or within, required equipment would not be a concern. For the ELAP event the relative humidity value will not exceed 90% for any area.

The increase in pressure due to the ELAP event was evaluated based on a comparison of the updated peak pressure and tested or evaluated peak pressure. A containment pressure increase of less than 10 psig is considered relatively low in comparison to the design basis event peak of 45.7 psig. Peak pressure is considered the stressor of primary concern. A lower pressure, for a longer duration, is not considered as significant a failure mechanism as a higher peak pressure. It is also true that pressure in and of itself is not of significant concern, especially when there is not a rapid change in pressure. This is particularly true with mechanical equipment that normally operates at high hydraulic, air or process fluid pressure conditions.

In addition, relied upon containment electrical and some mechanical components generally require the support of common equipment such as cable, terminations, splices, electrical conductor seal assemblies (ECSA) and penetrations to operate. At CPNPP many of these components have been assigned "common" model numbers. While it is possible to determine specific installation data for these individual components, this effort could be very time consuming. Using qualification test reports, EV-CR-2015-002539-16 as supplemented by EV-CR-2015-002539-20 evaluated all cables, terminations, splices, ECSAs and penetrations used in containment.

Summary / Conclusions

As a result of the of evaluations/assessments described above, Evaluations EV-CR-2015-002539-16 and EV-CR-2015-002539-20 established that all equipment and instruments relevant to recovery management of the ELAP event and as identified in AI-CR-2015-002539-12 will remain reliable and perform their intended functions for the duration of the ELAP event. The components have been evaluated by comparing the results of the ELAP event with the current design basis environmental parameters, their applicable equipment qualification reports, test reports or vendor literature and demonstrated that the overall environment under ELAP conditions would be bounded by the current design basis environmental parameters as previously addressed via the NRC Audit Item E-02 response.

NRC Audit Report Item SE-08

NRC Audit Report Item SE-08:

Verify that appropriate human factors are applied for the implementation of the FLEX strategies.

Licensee Input Needed:

Luminant to provide information on qualifications of workers to operate the debris removal equipment.

Response for NRC Audit Report Item SE-08:

NRC Audit Report Item SE-08 originated from NRC Audit Item E-08, previously addressed via the Audit Item E-08 response. However, additional information has been requested as identified in the NRC Audit Report (CP-201500808) and as repeated in the *Licensee Input Needed* section above.

The original response to Audit Item E-08 is repeated here and then addition information provided relative to the request documented in SE-08.

From Audit Item E-08 Response

Procedures for implementation of FLEX strategies will be prepared in accordance with STI-201.01, "Preparation of FLEX Support Instructions". This procedure is in a rough draft form at this time; however it will follow the format of ODA-204, "Preparation of Emergency Response Guidelines".

The following provides a description of reviews performed for a revision to the FSIs.

1) *Multi-discipline Team Review - Due to the complexity of information required in the FSIs, a multi-discipline team with skills drawn from various disciplines is utilized in the preparation of the FSIs. The multi-discipline review, in addition to the lead procedure developer, is at a minimum, comprised of personnel to evaluate the following areas (as needed):*
   - *Operations (Licensed)*
   - *Human Factors*
   - *Radiation Protection*
   - *Chemistry*
   - *Training*
   - *System Engineering*

2) *Plant-Specific Data Review - Plant-specific data required by or supplements the WOG Generic Guideline requires an independent review by Engineering. This data includes setpoints, specific task instruction, list of components, etc. This review by Engineering is in addition to the System Engineering Multi-discipline Team review of each procedure.*

3) *Usability Review - Each CPNPP procedure is reviewed to ensure the procedure is accurate and usable, and that the function or task specified in the FSI instruction can be performed consistent with CPNPP design. This process includes, as applicable, the following:*
   - *Control Room Walk Through - Each FSI is walked through the control room. The walk through is to ensure nomenclature on handswitches, annunciators, monitor light boxes, instrument and control attributes identified in FSI procedures are consistent with CPNPP design, and any verbiage used in the main control room is identical to that used in the FSI procedure.*

- *Desk Top Review - Each FSI should be reviewed as a sequenced related group to determine if all steps can be performed accurately and easily. Each procedure will be reviewed for technical content and readability.*
- *Local Action Walkdown - Actions identified by the FSIs to be performed locally, are walked through the plant. The walk through is to ensure nomenclature on valves, breakers or handswitches, location of components and any verbiage used in the plant is identical to that used in the FSI. In addition, the plant walk through should determine if tools or additional equipment is needed to respond to an emergency and any operational restraints (e.g., lighting, communications, keys, component operating characteristics) that exist which could impact performance of the FSI instruction. This walkdown does not include movement of portable equipment to staging and deployment areas.*
- *Satellite Procedure Review - Procedures used to support FSI action (i.e., procedures referenced by the FSIs) undergo the same usability review as that performed on the FSIs. This review is only required for the portion of the procedure that is used to support the FSI task.*

FLEX Job Aids

1) *FSIs rely heavily on the use of mobile, non-plant equipment. This equipment may be operated by personnel with little or no training on operating.*
2) *The FLEX Equipment Job Aids are expected to provide sufficient guidance to start, operate, monitor, and shutdown most FLEX equipment without task-specific training and qualification.*

An independent review (by someone not immediately involved with the FSI revision) should be performed to evaluate the Human Factors aspect of the FSI procedures. The Human Factors Review Checklist, STI-203.01-8, should be used for this review.

<u>Revised response for Audit Item E-08 and additional information requested by SE-08:</u>

Procedures for implementation of FLEX strategies were prepared in accordance with STI-203.01, "Preparation of FLEX Support Instructions".

The following provides a description of reviews performed for a revision to the FSIs.

1) Multi-discipline Team Review - Due to the complexity of information required in the FSIs, a multi-discipline team with skills drawn from various disciplines is utilized in the preparation of the FSIs. The multi-discipline review, in addition to the lead procedure developer, is at a minimum, comprised of personnel to evaluate the following areas (as needed):
    - Operations (Licensed)
    - Human Factors
    - Radiation Protection
    - Chemistry
    - Training
    - System Engineering

2) Plant-Specific Data Review - Plant-specific data required by or supplements the WOG Generic Guideline requires an independent review by Engineering. This data includes setpoints, specific task instruction, list of components, etc. This review by Engineering is in addition to the System Engineering Multi-discipline Team review of each procedure.

3) Usability Review - Each CPNPP procedure is reviewed to ensure the procedure is accurate and usable, and that the function or task specified in the FSI instruction can be performed consistent with CPNPP design. This process includes, as applicable, the following:
    - Desk Top Review - Each FSI is reviewed as a sequenced related group to determine if all steps can be performed accurately and easily. Each procedure is reviewed for technical content and readability.
    - Plant Walkdown - Actions identified by the FSIs to be performed locally, are walked through the plant. The walk through is to ensure nomenclature on valves, breakers or handswitches, location of components and any verbiage used in the plant is identical to that used in the FSI. In addition, the plant walk through determines if tools or additional equipment is needed to respond to an emergency and any operational restraints (e.g., lighting, communications, keys, component operating characteristics) that exist which could impact performance of the FSI instruction. This walkdown does not include movement of portable equipment to staging and deployment areas. Some of the walkdown requirements may be performed during validation per STI-250.01, FLEX Strategy Validation Process,
    - Satellite Procedure Review - Procedures used to support FSI action (i.e., procedures referenced by the FSIs) undergo the same usability review as that performed on the FSIs. This review is only required for the portion of the procedure that is used to support the FSI task.

4) FLEX Time Constraint Review - STI-250.01, FLEX Strategy Validation Process, Attachment 8.A lists activities that support FLEX strategies and specifies which activities require validation and which activities do not require validation. If new FLEX strategies are incorporated into FSIs or existing strategies are modified, Action Items identified in STI-250.01, FLEX Strategy Validation Process, Attachment 8.A must be reviewed to determine if:
    - Validation should be re-performed
    - A new validation plan should be developed and performed, or
    - Justification for not performing validation remains valid

FLEX Job Aids
- FSIs rely heavily on the use of mobile, non-plant equipment. This equipment may be operated by personnel with little or no training on operating.
- The FLEX Equipment Job Aids are expected to provide sufficient guidance to start, operate, monitor, and shutdown most FLEX equipment without task-specific training and qualification.

An independent review was performed to evaluate the Human Factor aspect of the FSIs. This review was completed using STI-203.01-8, FSI Human Factors Review Checklist.

<u>Qualification of workers to operate debris removal equipment</u>

CPNPP performed two evolutions with two individuals who had no previous experience with either the PettiBone or the Bobcat (one chemistry supervisor and one Nuclear Equipment Operator).

The first evolution was to successfully operate the Bobcat. The Bobcat was staged in a parking lot and equipped with the grapple attachment. Both individuals (independent of each other) were provided a local job aid and given direction to demonstrate operation of the Bobcat to include the grapple. Both individuals successfully started the bobcat, demonstrated movement and grapple use. Minor feedback for improvements in the job aid were provided and have been feed back to the validation team.

The second evolution was to successfully operate the Pettibone. The Pettibone was staged in the parking lot equipped with the fork attachment. Both individuals (independent of each other) were provided a local job aid and given directions to demonstrate operation of the Pettibone to include fork operation required to pick up a pallet, move the pallet, and set the pallet. Both individual successfully performed this evolution only providing minor feedback comments about ways to improve the job aid.

These evolutions demonstrated site personnel's ability to operate this equipment with no prior training or qualifications on this equipment. Both individuals took between 5-10 minutes to work through the job aid and gain enough knowledge to successfully operate the equipment. Both individuals felt confident in their ability to operate the equipment. These evolutions are documented in AI-CR-2015-002539-11.

NRC SE tracker audit item A-01 (ISE CI 3.1.1.1.A)

NRC SE tracker audit item A-01:

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. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-01:

Per FDA-2013-000008-26, the FLEX storage building is designed to withstand the effects of an SSE. Per STI-250.02, the requirements of procedure STA-661 will be applied, ensuring safe storage of FLEX equipment in the FLEX storage building and guarding against the potential of any unacceptable seismic interaction. The design of the FLEX storage building and protection of its contents ensures conformance with NEI 12-06 Section 5.3.1, considerations 1 through 3.

NRC SE tracker audit item A-02 (ISE CI 3.1.1.2.A)

NRC SE tracker audit item A-02:

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. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker audit item A-02:

The route to be traveled by portable equipment from the FLEX Building to Staging Area 'A' (SA-A) is described in FSI-5.0. The travel path can be seen in the Deployment Path Illustration. The preferred path is the shortest path to the Sally Port at the Alternate Access Point (AAP) which would be along 8th Avenue (green hash marks). However, due to the debris potential of the Megawatt Support Center (MSC) on the south side of 8th Avenue, an alternate travel route along 45th Street and 44th Street (purple hash marks) could be used to reach the AAP Sally Port.

The site topography was changed dramatically during the excavation for the plant. Drawing S-0104, Sh. -, Rev. 6, shows the original grade topographical lines along with the rough grading plan. The original grade over the plant's location was EL 852'. The finish grade around the plant is at EL 810' and slopping gradually to EL 800' before dropping off to the Squaw Creek Reservoir. Excavation for the building foundations went down as low as EL 748' per drawing S-0107, Sh. -, Rev. 6. From FSAR Figure 2.5.1-11, it can be seen that the bulk of the material to be excavated was from the Glen Rose formation of limestone and claystone. It is reasonable to expect that there was a topping of some alluvial material, weathered limestone and windblown sands that were also removed. The excavation process used explosives to break up the limestone into pieces suitable to be pushed into the backfill areas to the north of the plant where the FLEX building is situated and portions of the equipment haul route to the plant. No effort was expended to reduce the size of the excavated material to produce a specific gradation suitable for compaction, or for compaction.

Using remaining features such as the raised Construction Storage plateau that is east of the plant, the north-south running ridge is a defining feature. Referring back to the Deployment Path Illustration, knowing the buildings and vehicle barriers that are on the plateau, the FLEX Building's location can be roughly estimated on S-0104. From this approximate location, it can be seen that the northwest corner of the building is situated over substantially more of the excavation fill than the southeast corner. Prior to designing the FLEX building, a consultant was hired to perform a geotechnical investigation. Per LGC13555, nine core borings were made under the proposed building location. Section 5 of LGC13555 documented an evaluation of the liquefaction potential. The consultants conclusion was that based on the core borings and the site specific SSE with a peak ground acceleration of 0.12g, the probability of liquefaction occurring is less than 5-percent.

Referring back to the Deployment Path Illustration and drawing S-0104, it can be seen that most of the equipment's shortest haul path is over shallow depth undisturbed native limestone. The longer equipment haul path can be seen to be mostly over excavation backfill material similar to what is under the FLEX building. Since no attempt was made during the excavation process to engineer the backfill, it is reasonable to assume that the backfill has a variable composition that is represented by the nine core borings taken under the FLEX building. That being the case, the conclusion of the geotechnical investigation under the FLEX building would also apply to the portions of the equipment haul paths that are over excavation backfill.

A lack of established vegetation and a significant over burden could be factors that exacerbate an otherwise favorable location. The slope from the haul path down to the edge of the reservoir can be seen to be heavily foliated with mesquite and junipers. The northern loop of the longer haul path goes around a large employee parking lot. Along the western side of the loop, there is one structure, and its use is for offices. So the over burden is very light and the faces of the slopes have established vegetation for stability. Therefore, liquefaction of the equipment haul path from the FLEX building to the deployment locations around the plant is not a credible concern at CPNPP.

NRC SE tracker audit item A-03 (ISE CI 3.1.1.2.B)

NRC SE tracker audit item A-03:

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. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-03:

Containment analysis was performed using the MAAP code (as endorsed by the NRC in ML13275A318) and is documented in calculation CN-ISENG-14-3, Revision 0 (VDRT-4911241). This calculation concluded no significant heat-up or pressurization of containment within the first 72 hours following ELAP initiation in Modes 1-4 when crediting SHIELD, as discussed in Sections 5.2.2 and 5.3 and as depicted in Figures 5-27 and 5-28 of CN-ISENG-14-3.

As discussed in the response for NRC Audit Report Item SE-02, some cooling of containment will be restored at approximately 72 hours post-ELAP initiation (in Phase 3) by restoring 6.9 kV and 480V power and re-establishing non-safety Ventilation Chilled water flow to two Containment Air Cooling and Recirculation system fans located inside containment. This equipment restoration ensures pressure and temperature limits associated with containment integrity will not be reached during an ELAP event.

NRC SE tracker audit item A-04 (ISE CI 3.1.1.4A)

NRC SE tracker audit item A-04:

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. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker audit item A-04:

NEI 12-06, Section 5.3.4:

1. The FLEX strategies will need to assess the best means to obtain resources from off-site following a seismic event.

Section 1.7 of the SAFER Response Plan (SRP) for CPNPP delineates the site's responsibilities for communicating the travel route conditions to the site from both the off-site staging areas (SA-C and SAD) as well as both NSRC. The selection of the best means to deliver the equipment from the NSRC to the site is the responsibility of SAFER.

The suggested travel routes from the off-site staging areas include both a primary and a secondary route which provides flexibility to accommodate seismically induced damage or debris.

Both off-site staging areas along with the on-site receiving staging area (SA-B) are suitably sized to accommodate semi-trucks with NSRC equipment and if need be, helicopters. Both off-site staging areas are airports with the ability to refuel helicopters and room enough to accommodate the semi-trucks from the NSRC.

If the best transportation option involves flying the equipment from the NSRC into the region, Federal Express has a choice of airports in the Dallas-Fort Worth area that can support the off-loading of the airplane. From the off-loading location, the equipment can either be trucked directly to the site, or to an off-site staging area.

Letters of Agreement have been entered into with Hood County, Granbury and the Texas Department of Public Safety (DPS), in the event that debris removal is required to support delivery of off-site equipment at SA-B, or movement of equipment to SA-A. A Letter of Agreement with the owner/operator of the high-tension lines was entered into so that the site receives priority emergency response.

NEI 12-06, Section 6.2.3.4:

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

The SAFER Response Plan (SRP) describes the suggested direct transportation routes from the NSRC to the site, along with suggested primary and secondary route from the off-site staging areas. All of the travel routes to the site have a low point that theoretically could be flooded. The same decision process describe previously in the response to Section 5.3.4 above will be used to determine the best means for obtaining resources from the NSRC.

NEI 12-06, Section 6.2.3.4:

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

Not applicable to CPNPP. Per FSAR Sections 2.4.2, "Flooding" and 2.4.3, "Probable Maximum Flood", the site area is not prone to persistent flooding.

The NOSF Building is physically located between the NOSF Annex Building parking lot (SA-B) and the CPE Building parking lot (SA-B Alternate). A visual inspection shows that all three buildings are situated within a few feet vertically of being at the same elevation. From the NOSF Construction Drawing it can be seen that the finish elevation is EL 894.5′ which is 84.5′ above the finish plant grade and 120′ above the Squaw Creek Reservoir spillway crest at EL 775′ per FSAR Section 2.5.6.1.1. Therefore, flooding of SA-B and the off-site equipment travel path to SA-A will not flood.

NEI 12-06, Section 7.3.4:

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

Per FSAR Section 2.3.1.2.2, "Hurricanes", CPNPP is situated too far inland for either a hurricane or tropical storm to produce sustained winds of more than 81 mph which is significantly less than the 360 mph wind speed of the design basis tornado presented in FSAR Section 2.3.1.2.3.

NEI 12-06, Section 7.3.4:

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

The SAFER Response Plan (SRP) identifies the preferred on-site staging area (SA-B) to be in the parking lot behind the NOSF Annex Building. An alternate SA-B is defined to be in the parking lot in front of the CPE Building. As a third option, the site access road from the NOSF Annex Building, and within the OCA, could be used as a temporary staging area.

The site access road four lanes of blacktop that has a wide margin to trees, and would be the least likely location to be debris covered due to high winds.

The parking lot in front of the CPE Building has the potential for high tension lines to be blown down on it. However, there is sufficient time before the NSRC equipment arrives for the owner/operator of the high tension lines to ensure that they are de-energized and pulled back off of the parking lot. A Letter of Agreement with the owner/operator of the high-tension lines will be entered into so that the sit receives priority emergency response.

The parking lot behind the NOSF Annex Building is the most accessible to semi-trucks, but also the most likely to have windblown tree or building debris on it. Letters of Agreement were entered into with Hood County and DPS in the event that debris removal is required to support delivery of off-site equipment at SA-B, or movement of equipment to SA-A.

NEI 12-06, Section 8.3.4:

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

The SAFER Response Plan (SRP) describes the suggested direct transportation routes from the NSRC to the site, along with suggested primary and secondary routes from the off-site staging areas. The same decision process describe previously in the response to Section 5.3.4 above will be used to determine the best means for obtaining resources from the NSRC.

The site has routine experience with winter ice storms. Per FSAR Section 2.1.1.1 the site is located below the 35th parallel and postulation of a BDBEE based on a severe winter storm is not required. Per FSAR Section 2.3.2.1.5, the annual expectancy for snow and sleet is only 2.9-inches. The site maintains a stockpile of sand to be spread on icy roads and parking lots just for these winter storms. Since ice storms and tornadoes do not occur at the same time, it is reasonable to expect that the site's sand spreading equipment will be available. As a backup, the Somervell County Highway Department (by way of the DPS Letter of Agreement) has an equipment storage location less than five miles south of the plant on FM-56 which has the necessary equipment to spread sand and plow snow from the equipment haul routes that pass through the county, the equipment travel path roads on-site, and from the on-site staging area, SA-B.

NRC SE tracker audit item A-05 (ISE CI 3.2.1.1.A)

NRC SE tracker audit item A-05:

Confirm that steam generator makeup requirements have been appropriately defined or revise them to account for the installation of low-leakage RCP seals. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-05:

Auxiliary Feedwater (AFW) requirements are documented in LTR-SEE-II-12-70-CP (VDRT-4763736). Section 12 of LTR-SEE-II-12-70-CP concludes that the documented AFW requirements remain bounding even when considering the impact of operation with low-leakage RCP seals.

NRC SE tracker audit item A-06 (ISE CI 3.2.1.1.B)

NRC SE tracker audit item A-06:

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. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-06:

The NOTRUMP computer code was used to simulate reactor coolant system (RCS) responses for the Westinghouse pressurized water reactors (PWRs) during the extended loss of all alternating current (AC) power (ELAP) event. These responses, documented in WCAP-17601-P and WCAP-17792-P demonstrate that the mitigation strategy as documented in the Comanche Peak Overall Integrated Plan (OIP) can provide reasonable assurance that core uncovery and re-criticality will not occur if certain timelines for RCS make-up are followed.

This application is aligned with the methods and guidance as well as the restrictions and limitations specified in PWROG-14064-P. The incorporation of low leakage reactor coolant pump seals does not challenge the time line relating to RCS makeup pump timing and reflux condensation initiation and is evaluated in the plant-specific analysis (CN-LIS-12-74-REDACTED). The generic 4-loop Westinghouse Nuclear Steam Supply System (NSSS) PWR NOTRUMP analysis (PWROG-14064-P) showed that the flow conditions remain single phase and the RCS does not enter a reflux cooling period, i.e. remains below the limit for reflux condensation cooling (one hour centered moving average of flow quality less than 0.1 at steam generator (SG) U-tube bend).

This response is consistent with the Westinghouse response provided via LTR-FSE-15-2 (VDRT-5074586).

NRC SE tracker audit item A-07 (ISE CI 3.2.1.1.C)

NRC SE tracker audit item A-07:

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. ML 130420011, 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. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-07:

Nitrogen injection is prevented by securing steam generator (SG) depressurization at 310 psig per ECA-0.0A/B Step 19. This target SG pressure was confirmed during FSG setpoint development (Setpoint O.11) using the methodology documented in the ERG Footnote Basis Document, a product of PWR Owners Group project PA-PSC-0965, "Final W-NSSS Specific ELAP Response (FLEX) Guidelines." The use of SG pressure instrumentation is unchanged during ELAP scenarios. Venting or isolation of the Safety Injection Accumulators will occur prior to reactor coolant system (RCS) cooldown below SG pressure of 310 psig per ECA-0.0A/B Step 28.

The installation of SHIELD low-leakage RCP seals will limit containment pressure and temperature such that nitrogen injection is not expected to occur as demonstrated in the containment analysis calculation CN-ISENG-14-3, Revision 0 (VDRT-4911241). The containment analysis was performed using the MAAP code (as endorsed by the NRC in ML13275A318). The calculation concluded no significant heat-up or pressurization of containment as a result of an ELAP initiated in Modes 1-4 when crediting SHIELD, as discussed in Sections 5.2.2 and 5.3 and as depicted in Figures 5-27 and 5-28 of CN-ISENG-14-3.

NRC SE tracker audit item A-08 (ISE CI 3.2.1.1.D)

NRC SE tracker audit item A-08:

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. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-08:

CPNPP will use the hand-held radios and sound power phone system for FLEX strategy implementation as follows:

A. Plant Operations staff carry portable radios. The radio system will continue performing as normal for 30 minutes after the loss of power. After this time period the radios will function in line of site mode.

B. Operations' maintains sound powered phone sets in the Control Room (3) and in cabinets throughout the plant (2 on SFDG 790', 2 on AB 810', 4 on SFGD 832', 3 on AB 852', 4 on SFGD 873'). The sound powered phone sets are controlled by procedure OWI-203. The phone storage locations conform to the guidance of NEI 12-06, Section 11.3. The phone sets are inventoried periodically (e.g., quarterly).

C. The sound powered phone system provides multiple loops that can be used for unit specific communications and all plant communications. The Control Room can switch between these loops for coordination.

D. As indicated in the CPNPP OIP, the initial cooldown to approximately 425°F will be completed within 4 hours as directed by ECA-0.0A/B. The ARV accumulators are sized to last 4 hours, allowing remote control from the Control Room during the cooldown. ECA-0.0A/B directs performance of a symmetric cooldown by depressurizing intact SGs. Head sets and outlets are located in close proximity to the TDAFWP area, the SG ARV area and the Control Room for use during the plant cooldown. Each unit Operator will be able to communicate with personnel supplying flow to the SGs from the TDAFWP and with personnel controlling the ARVs.

E. The environment in the TDAFWP rooms and ARV areas have been evaluated for habitability/accessibility during the cooldown. These areas will remain accessible during the entire period when equipment will be used for cooldown. See responses to NRC SE tracker audit items B-29 and B-30 for these evaluations.

NRC SE tracker audit item A-09 (ISE OI 3.2.1.2.A)

NRC SE tracker audit item A-09:

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 0-ring. Qualification of the RCP seal sleeve to shaft 0-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. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-09:

The behavior of the O-ring sealing the No. 1 seal sleeve to the pump shaft has been qualified for service at a full RCS pressure drop. The details of the qualification testing program are provided in Section 7.1.5 of TR-FSE-14-1-P Revision 1.

The shaft sleeve O-ring is qualified for an RCS cold leg temperature of 571°F and the pressure evolution shown in Figure 7.1-2 of TR-FSE-14-1-P Revision 1. The depressurization provided in Figure 7.1-2 was based on a safety analysis simulation that credited natural convective heat losses from the pressurizer.

Generally, the depressurization transient maintained 2250 psia for 24 hours, followed by a step down to 2000 psig for an additional 24 hours. There were two additional steps before the pressure ultimately reaches 1600 psig, where this pressure is maintained until 168 hours.

Finally, Open Item #1 on Page 10-1 of TR-FSE-14-1-P Revision 1 noted that the design pressure may be extended to 2500 psia. Following the issuance of TR-FSE-14-1-P Revision 1, testing was completed to qualify the sleeve O-ring for a two hour period at 2500 psig. This was done to provide assurance that over-pressurization of the RCS in a specific fire scenario would not damage the SDS. Completion of this testing is documented in LTR-RES-14-122 and close-out of the Open Item is documented in LTR-RAM-I-14-057.

It is noted the credited delayed cooldown of 12 hours in the CPNPP OIP has been reduced to 4 hours per the CPNPP Second Six Month Status update (TXX-14025 dated February 27, 2014). This cooldown refers to the initial cooldown to 310 psig SG pressure. Also, see responses to audit items A-10 and E-06.

This response is consistent with the Westinghouse response provided via LTR-FSE-15-2 (VDRT-5074586).

Additional information on O-ring material is available for NRC review on the ePortal (AI-CR-2015-002534-26).

NRC SE tracker audit item A-10 (ISE OI 3.2.1.2.C)

NRC SE tracker audit item A-10:

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. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-10:

The U.S. NRC has formally endorsed the use of the Westinghouse SHIELD® product with some caveats (ML14132A128). These caveats are assessed below against the credit taken for SHIELD®.

1. *Credit for the SHEILD® seals is only endorsed for Westinghouse RCP Models 93, 93A and 93A-1.*

   CPNPP Unit 1 and Unit 2 utilize Westinghouse RCP Model 93A, therefore this criterion is met for Comanche Peak Unit 1 and Unit 2. See response for audit item B-15.

2. *The maximum steady-state RCS cold-leg temperature is limited to 571°F during the ELAP (i.e., the applicable main steam safety valve setpoints results in a RCS cold-leg temperature of 571°F or less after a brief post-trip transient).*

   The lowest main steam safety valve setpoint at CPNPP is 1185 psig +3% due to uncertainty. This corresponds to a maximum cold leg temperature of 571°F (at 1235.7 psia). Therefore, this criterion is met for CPNPP.

3. *The maximum RCS pressure during the ELAP (notwithstanding the brief pressure transient directly following the reactor trip comparable to that predicted in the applicable analysis case from WCAP-17601-P) is as follows: For Westinghouse Models 93 and 93A-1 RCPs, RCS pressure is limited to 2250 psia; for Westinghouse Model 93A RCPs, RCS pressure is to remain bounded by Figure 7.1-2 of TR-FSE-14-1-P, Revision 1.*

   The generic analyses (WCAP-17601-P Revision 1 and WCAP-17792-P Revision 0), upon which the plant specific analysis (CN-LIS-12-74-REDACTED) is based, do not indicate an increase in pressure beyond the brief transient shown in WCAP-17601-P Revision 1. Furthermore, the intended cooldown to a SG pressure of 310 psig at CPNPP, planned to occur within 4 hours of event initiation, will ensure pressure decreases in excess of those required related to the 93A model as given by Figure 7.1-2 of TR-FSE-14-1-P. Therefore this criterion is met for CPNPP. See responses for audit items A-09 and E-06.

4. *Nuclear power plants that credit the SHIELD® seal in an ELAP analysis shall assume the normal seal leakage rate before SHIELD® seal actuation and a constant seal leakage rate of 1.0 gallon per minute for the leakage after SHIELD® seal actuation.*

   The generic analysis considered 1 gpm leakage per seal and 1 gpm of additional RCS leakage (WCAP-17601-P Revision 1). The analysis did not credit reduced leakage due to depressurization. However, normal leakage prior to actuation was not assessed directly. Based on a conservative interpretation of the analysis regarding SHIELD® actuation timing and temperature, normal seal leakage will occur for no more than 1 hour (TR-FSE-14-1-P Revision 1 Figure 6.1-3). Given a potential normal seal leak off rate of at most 5 gpm per seal for CPNPP (SOP-108A, Figure 1) and a 1 gpm technical specification allowed leakage (WCAP-17601-P Revision 1, Section 4.2.1 Item 18), the total leakage rate over the first hour is 21 gpm for CPNPP. This correlates to fluid loss of 1260 gallons. Given normal leakage for the first hour into the event prior to SDS actuation, the leakage rate is 0.04679 ft^3/s. With a RCS subcooled liquid density of 46.406 lbm/ft^3, based on a minimum cold leg temperature of 557°F and a maximum RCS pressure of 2250 psia, the total integrated mass loss is 7,817 lbm for the first hour. Similarly, given an assumed injection start time of 14 hours into the event from the SDS leakage rate is 0.0111 ft^3/s for 13 hours with an RCS density of 52.5942 lbm/ft^3 and results in an integrated mass loss of 35,139 lbm (7,817 lbm for the first hour post ELAP plus 27,322 lbm from Hour 1 to Hour 14 post ELAP). For CPNPP, given the initial RCS mass of 512,500 lbm (PWROG-14027-P Revision 3), a mass loss of 35,139 lbm does not challenge the RCS mass (425,000 lbm, PWROG-14027-P Revision 3) at which reflux cooling is expected to begin.

The time at which make-up is required based on inventory control considering even the limiting case of maintaining single phase natural circulation is significantly less constrictive than the regulatory constraints on inventory maintenance based on boron mixing and boron transport (LTR-LIS-14-79 Revision 0) consistent with the U.S. NRC endorsement of the Pressurized Water Reactor Owners Group (PWROG) boron mixing position (ML13276A183). Thus, the analysis performed by Westinghouse for CPNPP Unit 1 and Unit 2 (CN-LIS-12-74-REDACTED) is considered bounding with respect to the required RCS make-up time since the effective actuation of the Westinghouse SHIELD® product will limit leakage such that boron injection to maintain subcriticality for the no leakage condition is limiting of either the time frame at which reflux conditions would be entered or the time frame at which cold leg velocity would be reduced such that there would be a potential challenge to the assumed time frame for mixing of injected boric acid.

It is therefore concluded that there is significant margin available to any undesirable flow transition based on the planned deployment time of RCS make-up when nominal seal leakage flow is considered prior to SHIELD® seal actuation.

The responses contained herein are consistent with the Westinghouse responses provided via LTR-FSE-15-2 (VDRT-5074586).

NRC SE tracker audit item A-11 (ISE CI 3.2.1.2.B)

NRC SE tracker audit item A-11:

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. ML 13211A168) on the use of the low seal leakage rate in the ELAP analysis. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-11:

Westinghouse completed qualification testing of the Generation III SHIELD® Passive Thermal Shutdown Seal (SDS) which confirmed once the SDS is actuated it will limit Reactor Coolant Pump (RCP) shaft leakage to less than 1 gpm during Loss of All Seal Cooling (LOASC) events, such as under ELAP conditions (TR-FSE-14-1-P, Revision 1).

Westinghouse addressed the deficiencies of the Generation I and II SDS as reported in LTR-NRC-13-52 which noted credit taken by the licensee for the installed SDS could potentially constitute a delivered defect, where the plant would be returned to a condition as though the SDS was never present for 2 conditions:

1. Normal Operation, SDS Inadvertently Deployed
2. Loss of Seal Cooling, SDS Not Deployed When Called On

Following the failures of the prior generations of the SDS, Westinghouse designed a highly improved and reliable product incorporating Operating Experience and Extent of Condition evaluations to address the vulnerabilities identified. The resulting SDS product is simpler, stronger, fortified against inadvertent actuation, highly resistant to RCS chemistry and particulate deposition, and tested in severe conditions exceeding the RCP operating experience collected as documented in TR-FSE-14-1-P, Revision 1.

The United States Nuclear Regulatory Commission (U.S. NRC) has formally endorsed the use of the Westinghouse SHIELD® product for diverse and flexible coping (FLEX) applications as described in the technical report (TR-FSE-14-1-P, Revision 1) and supplemental information (LTR-NRC-14-24 and LTR-NRC-14-16) with limitations as documented in ML14132A128. These limitations are assessed in the response to Open Item 3.2.1.2.C (response for audit item A-10) against the credit taken for SHIELD®.

In addition, LTR-RAM-I-14-057 addresses the two open items listed in TR-FSE-14-1-P, Revision 1. The first open item was related to incorporating a design requirement for the SDS to be capable of withstanding a short duration pressure increase to 2500 psia. This requirement has been incorporated into the SDS design specification, and the first open item has been closed based on the testing performed at 2500 psia. The second open item was related to testing of the internal O-rings of the direct acting actuator. O-ring accelerated aging testing was completed and the O-rings met the requirement for a 9-year SDS service life. Successful completion of this testing closed the second open item.

Per TR-FSE-14-1-P, Revision 1, the SDS is located between the No. 1 and No. 2 seals, just upstream of the No. 1 seal leakoff line. The seal is located within the existing cross section of the No.1 insert and encircles the shaft. The No.1 seal insert is modified by machining out a portion of the inside diameter (ID) at the top flange. Until actuated, the seal is completely contained within the space once taken by the No. 1 insert prior to modification. Thus, the annulus between the No.1 insert and the shaft is unaltered. The leakoff through the No. 1 seal is unimpeded on its way to the No. 1 seal leakoff line. The No. 1 seal leakoff flow is not affected during normal operation of the rotating equipment. Thus, the SDS function is independent of the No. 1 seal.

Luminant plans to install the Generation III SHIELD® SDS at CPNPP Unit 1 and Unit 2; therefore, the qualification testing and leakage rate discussed herein is applicable to the RCP design at CPNPP.

It should also be noted CPNPP is not impacted by Nuclear Safety Advisory Letter NSAL-14-1. Pertaining to ELAP events, NSAL-14-1 concludes the time to initiation of reflux cooling and to core uncovery will be shortened by an increase in RCP seal leakage. The applicable CPNPP RCS seal leakage flow rates as a Category 1 plant are documented in PWROG-14015-P Revision 1 and the impact on the time to reflux cooling to core uncovery is documented in PWROG-14027-P Revision 3. However, the seal leakage and required RCS make-up time as documented in PWROG-14015-P Revision 1 and PWROG-14027-P Revision 3, respectively, are not applicable as CPNPP Unit 1 and Unit 2 will have Generation III SHIELD® SDS installed which maintain a lower leakage.

This response is consistent with the Westinghouse response provided via LTR-FSE-15-2 (VDRT-5074586).

NRC SE tracker audit item A-12 (ISE CI 3.2.1.2.D)

NRC SE tracker audit item A-12:

(1) Confirm that stresses resulting from a cool down 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.: ML 110880122 and ML 110880131) approving the use of the Westinghouse shutdown seal with Model 93A RCP in the plant Probabilistic Risk Assessment model. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-12:

Item (1)

From TR-FSE-14-1-P Revision 1 Section 7.1.6, Lower Lower-Bounding ELAP Tests: The primary purpose of the lower-bound tests was to demonstrate that during a cooldown and depressurization following a LOASC, the polymer ring would remain sealed and continue to limit leakage to less than 1.0 gpm. Each of the 10 lower-bounding tests that were performed satisfied the acceptance criteria for actuation temperature and maximum leakage.

Item (2)

Westinghouse Technical Bulletin TB-04-22 Revision 1 advises that cooling should not be re-established to the seals should temperatures reach levels outside of the normal operational limits of the pump. An excerpt from TB-04-22 Revision 1 states:

> *"To address these concerns, the [Westinghouse Owners Group (WOG)] funded the development of a technical report to present and interpret all of the available information related to RCP seal performance following a loss of all seal cooling event. WCAP-16396-NP was submitted to the NRC in January of 2005. The report included information that had not previously been available, including an RCP seal cold thermal shock test conducted by [Electricite de France (EdF)] in 1986 and the 2001 Maanshan [Station Blackout (SBO)] which resulted in a prolonged loss of all seal cooling. The WCAP concluded, based on analytical information, test data and operational experience, that for cases of prolonged exposure to hot RCS fluid, the Westinghouse shaft sealing systems with Westinghouse high temperature O-rings are expected to stabilize in the range of 21 gpm, as opposed to the 182 gpm postulated by the NRC in some of their inspection findings. Although the data demonstrated that the cold thermal shock of the seals did not result in an uncontrolled leak rate, Westinghouse also concluded that there was not sufficient evidence to support a change to the recommendation of the WOG in References [WOG-97-034) and (OG-00-009]. That recommendation, to cool the seals using RCS natural circulation cooldown if the seal temperature exceeds the shutdown limit specified in the RCP Instruction Book rather than re-establishing seal injection, remains the Westinghouse recommendation."*

The 21 gpm leakage value is no longer the current number to be used, and has been updated by the guidance within PWROG Report PWROG-14027-P Revision 3. Comanche Peak is a Category 1 plant with a maximum expected leakage rate of 17.5 gpm. PWROG-14027-P Revision 3 does not analyze re-establishing seal cooling, as that is against previous guidance (TB-04-22 Revision 1).

Procedurally, per ECA-0.0A/B, the RCP seals are protected during an ELAP event by the following: preventing the charging pumps from auto-starting on power restoration, isolating RCP seal cooling and performing a controlled RCS cooldown at near 100°F/hr. Specifically, per ECA-0.0A/B Step 8, the centrifugal charging pumps switches are placed in the PULL-OUT position so that the charging pumps will not auto-start on restoration of power. Per Step 10, RCP seal cooling is isolated by closing the seal injection throttle valves, closing the seal water return isolation valves, and closing the RCP thermal barrier cooler CCW return valves. Per Steps 19 and 28, the RCS cooldown rate is limited to 100°F/hr to, in part, cool the RCP seals in a controlled manner. Prior to transitioning to a recovery procedure, the NOTE before Step 33 reminds the Operator that if RCP seal cooling was previously isolated, further cooling of the RCP seals will be achieved by natural circulation cooldown as directed in subsequent recovery procedures. *These actions limit the potential for thermal shock of the RCP seals during an ELAP event.*

Item (3)

During normal operation, the fluid is single phase. Certain conditions during a LOASC event can result in two phase conditions. However, the successful actuation of the shutdown seal eliminates or significantly shortens any duration of two phase flow. Once actuated, downstream fluid will equilibrate at the Volume Control Tank (VCT) pressure. Eventually, this fluid may boil from heat transferred through the seal pump components.

Item (4)

The U.S. NRC formally endorsed the use of the Generation I and II Westinghouse SDS with Model 93A RCPs (ML110880122) in the plant Probabilistic Risk Assessment (PRA) model as described in WCAP-17100-P-A. The limitations listed in Sections 3.5 and 4 of ML110880131 are pertaining to the Generation I and Generation II SDS as described in WCAP-17100-P-A. Therefore, they are not applicable to CPNPP which plans to install the Generation III SDS. The NRC is currently reviewing the Generation III SDS PRA model described in PWROG-14001-P and the NRC Safety Evaluation (SE) is forthcoming. The response to Confirmatory Item 3.2.1.2.D Item (4) will be updated to address any limitations and conditions in the NRC SE for the Generation III SDS following its issuance.

The responses contained herein are consistent with the Westinghouse responses provided via LTR-FSE-15-2 (VDRT-5074586).

NRC SE tracker audit item A-13 (ISE OI 3.2.1.8.A)

NRC SE tracker audit item A-13:

The Pressurized Water Reactor Owners Group (PWROG) submitted to NRC a position paper, dated August 15, 2013 (ADAMS Accession No. ML 13235A132, 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. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-13:

CPNPP will abide by the position expressed by the U.S. NRC staff in the letter dated January 8, 2014 regarding the boron mixing issue for PWRs (ML13276A183). The U.S. NRC letter states that the U.S. NRC staff has reviewed the information submitted to date and concluded that use of the industry approach dated August 15, 2013, entitled "Westinghouse Response to NRC Generic Request for Additional Information (RAI) on Boron Mixing in Support of the Pressurized Water Reactor Owners Group (PWROG)," Agencywide Documents Access and Management System (ADAMS) Accession Number ML13235A135, (being withheld from public disclosure for proprietary reasons) is acceptable with clarifications listed in the letter.

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

The CPNPP OIP, calculation CN-LIS-12-74-REDACTED and EV-CR-2012-002652-35 demonstrate that the FLEX RCS make-up pump will be deployed and capable of injecting into the RCS prior to the time when injection is required including the appropriate time margin to ensure adequate sub-criticality for both the maximum seal leakage and no RCS leakage scenarios.

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

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

The analyses and evaluations supporting the OIP (CN-LIS-12-74-REDACTED) demonstrate that the FLEX RCS make-up pump will be aligned at least one hour prior to the loop flow rate decreasing below the loop flow rate corresponding to single-phase natural circulation for the assumed highest applicable leakage rate of 5 gpm for the SDS reactor coolant pump seals and unidentified reactor coolant system leakage. See also the response to NRC SE tracker audit item A-10 item 4.

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

The analyses for CPNPP (CN-LIS-12-74-REDACTED and EV-CR-2012-002652-35) supporting the OIP concludes that a 10 gpm constant injection from the Boric Acid Tank (BAT) will ensure requirements are met with the available head vent capability and considering the plant specific cooldown strategy. The analysis is based on providing borated coolant such that the xenon transient and cooldown effects are mitigated by 24 hours post ELAP. See also the response for NRC SE tracker audit item B-39.

The responses contained herein are consistent with the Westinghouse responses provided via LTR-FSE-15-2 (VDRT-5074586).

NRC SE tracker audit item A-14 (ISE CI 3.2.3.A)

NRC SE tracker audit item A-14:

Confirm that the licensee's containment analysis demonstrates that containment integrity will not be challenged during an ELAP event. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-14:

Containment analysis was performed using the MAAP code (as endorsed by the NRC in ML13275A318) and is documented in calculation CN-ISENG-14-3, Revision 0 (VDRT-4911241). This calculation concluded no significant heat-up or pressurization of containment within the first 72 hours following ELAP initiation in Modes 1-4 when crediting SHIELD, as discussed in Sections 5.2.2 and 5.3 and as depicted in Figures 5-27 and 5-28 of CN-ISENG-14-3.

As discussed in the response for NRC Audit Report Item SE-02, some cooling of containment will be restored at approximately 72 hours post-ELAP initiation (in Phase 3) by restoring 6.9 kV and 480V power and re-establishing non-safety Ventilation Chilled water flow to two Containment Air Cooling and Recirculation system fans located inside containment. This equipment restoration ensures pressure and temperature limits associated with containment integrity will not be reached during an ELAP event.

NRC SE tracker audit item A-15 (ISE CI 3.2.4.4.A)

NRC SE tracker audit item A-15:

Provide information on the use of portable lighting for FLEX strategy implementation (storage location, sufficient quantities, and procedural guidelines). [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-15:

CPNPP lighting will include the following systems (portable and installed) to ensure implementation of FLEX strategies:

A. Emergency lighting systems installed to satisfy Station Blackout and Appendix R requirements will be available for the first 8 hours of the event. These lighting fixtures are positioned strategically around the plant in areas that will be required by the FLEX strategies.

   From DBD-ME-026, Section 5.4c: (8)
   Lighting for access into and egress out of a majority of areas in the unit is provided by emergency DC-powered lighting. In addition, portable lights and batteries which may be required to perform some local actions are provided to the operators in tool kits [12 tool kits located in the SFGD bldg.] that are distributed throughout the plant and marked for "Emergency Use Only". A sufficient number of these tool kits are located in areas illuminated by emergency DC-powered lighting.

   From DBD-EE-047, Section 5.1.3:
   The Emergency Lighting system is designed to provide adequate illumination during safe shutdown of the plant for normal plant shutdown or as a result of fire with the loss of all AC sources. This lighting is provided by 8 hour rated battery packs.

B. CPNPP maintains a tool room inside the RCA that contains dozens of portable lights and hundreds of spare batteries. This equipment is stocked for daily use. While not specifically created as an emergency facility, this equipment would be readily available during an event.

C. Twelve emergency tool kits containing flashlights with batteries are controlled by procedure OWI-203. The tool kits storage locations conform to the guidance of NEI 12-06, Section 11.3 and the contents are periodically audited.

D. A significant supply of battery powered head lamps, LED lanterns, and hand-crank LED flashlights is stored within the FLEX Equipment Storage Building.

E. Four diesel engine powered portable light towers are stored in the FLEX Equipment Storage Building. These light towers will be moved to external staging areas located within the Protected Area to provide exterior illumination. Additional light towers are available from the National SAFER Response Center.

F. Supplemental lighting for the Control Room will be provided by multiple (8 total) LED light strings (150 ft.) powered by two 12 kW portable generators. These generators are stored in the FLEX Equipment Storage Building and will be deployed to the exterior of the Control Room to provide power for forced ventilation, lighting and instrumentation, as needed.

G. Supplemental lighting for deployment and maintenance of the forced ventilation strategy for the battery and inverter rooms will be provided by one LED light string (150 ft.) powered by one 12 kW portable generator. This generator is stored in the FLEX Equipment Storage Building and will be deployed to provide power for forced ventilation and lighting, as needed.

H. FLEX Equipment Storage Building lighting will be initially restored using one 12 kW generator.

I. The Multi-Purpose High Flow FLEX pumps (3) and the SG/AFW Low Pressure FLEX pumps (3) have been equipped with light packages to facilitate night time use.

NRC SE tracker audit item A-16 (ISE CI 3.2.4.4.B)

NRC SE tracker audit item A-16:

The NRC staff has reviewed the licensee communications assessment (ADAMS Accession Nos. ML12318A100 and ML 13071A349) 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. ML 13141A675) has determined that the assessment for communications is reasonable. Confirm that upgrades to the site's communications systems have been completed. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-16:

CPNPP has reviewed a modification to the plant Gai-tronics for UPS Power supply and was determined to not be implemented. The Security personnel will perform other duties to assist in making notifications to the plant personnel.

The modification to the sound powered phone system to isolate the non-robust buildings was completed and the control of the switches is in FSI-5.0.

Satellite Phones are Located at the ERO facilities and the Counties EOC.

Hand held portable Radios are located at all ERO facilities

Note:	An updated response to item "NRC SE tracker audit item A-16 (ISE CI 3.2.4.4.B)" is provided in the response to "NRC Audit Report Item ISE CI 3.2.4.4.B".

NRC SE tracker audit item A-17 (ISE CI 3.2.4.5.A)

NRC SE tracker audit item A-17:

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. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-17:

Specific details of the physical security plan are considered SGI and have been purposely omitted from this response. Below is a general overview regarding protected and vital area access controls following a beyond design basis accident.

Protected Area (PA) Access:

Immediately after a beyond design basis accident security will assess the condition of the physical security program to include PA barriers, PA intrusion detection / assessment equipment, and personnel / package search equipment. Security Management will contact the Control Room Shift Manager to discuss the suspension of safeguards as it applies to the severity and aftermath of the accident.

Appropriate compensatory measures will be established based upon the post accident condition of the facility. Actions will prioritized in order to protect the health and safety of the public.

Security has the ability to provide access to the protected area in alternate locations should the primary and alternate access portals be unavailable. FLEX equipment can be processed into the PA at any established suitable PA pathway. FLEX equipment and responders will not be adversely delayed should portions of the physical security system be unavailable.

Security has alternate methods of searching personnel and packages for PA entry should electronic equipment be unavailable.

Security has alternate methods to authorized and track PA access should the security computer system be unavailable.

Vital Area (VA) Access:

Immediately after a beyond design basis accident security will assess the condition of the physical security program to include the security computer system, and vital area barriers which include locked and alarmed doors. Security Management will contact the Control Room Shift Manager to discuss the suspension of safeguards as it applies to post accident conditions.

Appropriate compensatory measures will be established based upon the post accident condition of the facility. Actions will be prioritized in order to protect the health and safety of the public.

Vital area doors can be manually opened in the event that the security computer system is unavailable. FLEX equipment and responders will not be adversely delayed should the security computer system be unavailable.

Security has alternate methods to authorized and track vital area access.

NRC SE tracker audit item A-18 (ISE CI 3.2.4.8.A)

NRC SE tracker audit item A-18:

Review the sizing of the Phase 2 portable/FLEX diesel generators when the licensee has finalized their design. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-18:

The Phase 2 portable diesel generator sizing was previously documented in FDA-2013-000008-27 but has been superseded by Attachment 6.21 of ER-ME-133.

NRC SE tracker audit item A-19 (ISE CI 3.2.4.9.A)

NRC SE tracker audit item A-19:

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. [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-19:

The CPNPP strategy for monitoring the diesel fuel that is stored in the FLEX equipment will be addressed in the same manner that the site uses for other portable equipment (i.e., Accident mitigation equipment, portable generators for security, alternate service water diesel drive pumps, etc.). Key to this site process is 1) Ensuring the quality of fuel received, 2) running the equipment periodically and 3) sampling as necessary. These efforts would be included in site procedures and also under the site PM program, STA-677, "Preventative Maintenance." During the development of the FLEX PM's, CPNPP also evaluated the storage of fuel in the FLEX portable equipment.

For those identified components, there already exists a PM for draining and replacing the Fuel Oil (PM 348924) on temporary skids and portable equipment. This PM would be used if problems were identified with the fuel during the quarterly runs and quarterly refueling. In addition, one other PM is used to sample all Diesel Fuel Oil deliveries for the site, including fuel for non-plant equipment (i.e., portable skids, portable generators, site vehicles, etc.) (PM 348800). This is a critical evaluation by Chemistry that ensures all fuel is analyzed and approved prior to being unloaded into the site storage tanks. Analysis by Chemistry using procedure COP-610, "General Use Diesel Fuel Oil" ensures that the fuel meets the specification in CHM-550, "Chemistry Control of Diesel Fuel."

During an event the fuel would be supplied using the underground DG storage tanks and these are on a routine run and sampling program to support the site emergency diesel generators. These Chemistry sampling procedures are COP-609 A/B, DIESEL GENERATOR.

These processes are in place and have been used since 2011. Attached for your reference are examples of the work orders and PMs that have been used in the past and are part of the evaluation of the PM's for the FLEX equipment. In addition, CR-2016-002386 created work order 5247453 and PM351135 to refuel the FLEX equipment after the quarterly performance runs. This PM ensures that all tanks are kept topped off and allows for the evaluation of the fuel quality and if necessary replacement of the stored fuel. Historically, the CPNPP procedural guidance that includes: i.e., standards for fuel quality, sampling before acceptance, periodic running of equipment and refueling of equipment on a routine basis has not required a blanket draining and replacement of stored fuel.

Reference:

CR-2011-012654 – CR that initiated PM 348924, PM348800 and COP-610 and CHM-550

- (A-19-02_CR-2011-012654_Request PM Evaluation of Fuel Oil.pdf)
- (A-19-03_CR-2011-012654_AI-01_Request PM Evaluation of Fuel Oil.pdf)
- (A-19-04_CR-2011-012654_AI-02_Request PM Evaluation of Fuel Oil.pdf)
- (A-19-05_CR-2011-012654_AI-03_Request PM Evaluation of Fuel Oil.pdf)
- (A-19-06_CR-2011-012654_AI-04_Request PM Evaluation of Fuel Oil.pdf)
- (A-19-07_CR-2011-012654_3-WO_Evaluation of Fuel Oil.pdf)
- (A-19-08_COP-610_General Use Diesel Fuel.pdf)

- (A-19-09_CHM-550_Chemistry Control of Diesel Fuel.pdf)
- (A-19-10_CHM-550-7_Chemical Sampling Diesel Fuel Form.pdf)
- (A-19-11_CR-2016-002386_CR that created WO and PM to refill FLEX Equipment.pdf)

NRC SE tracker audit item A-20 (ISE CI 3.2.4.10.A)

NRC SE tracker audit item A-20:

Review of the final dc load shed analysis is needed. [this is cut and paste from NRC SE tracker]

The licensee needs to provide a complete load shed analysis. The licensee also stated that they would provide a detailed description of its plans to perform load reduction to conserve dc power.

Response for NRC SE Tracker Audit Item A-20:

Comanche Peak's Second Six Month Status Report TXX-14025, dated February 28, 2014) noted changes in the strategy / compliance method described in the OIP. The changes are described in section 4 of TXX-14025- "Station Battery Life"," Load Shedding Scheme", and "Battery Coping" discussion in TXX-14025 also specifically identifies a position paper and the NRC endorsement letter to be used in support of the battery coping calculations.

Battery coping analyses for the safety-related batteries has been completed. Total coping time for each of the batteries has been assessed at approximately 12 hours (Calculation EE-1E-BT1ED1, EE-1E-BT1ED2, EE-1E-BT1ED3, EE-1E-BT1ED4, EE-1E-BT2ED1, EE-1E-BT2ED2, EE-1E-BT2ED3, EE-1E-BT2ED4).

Comanche Peak performs load shed of DC and 118VAC loads to extend battery availability. Specific DC loads and AC inverter loads to be shed, location of the associated panels, and required operator actions to remove these loads from service are contained in draft procedures ECA -0.0A/B, LOSS OF ALL AC POWER Attachment 2.A Step 1 and Attachment 2.B and FSI-4.0A/B, DC BUS LOAD MANAGEMENT AND PHASE 2 480 VAC GENERATOR ALIGNMENT Attachment 3. Each of these procedures contains a bases associated with these attachments. The bases provide operators with a summary of equipment and capabilities that are maintained available as well as equipment and capabilities that are lost as a result of the load shed activities. FSI-4.0A/B Step 2 bases identifies the assumed completion times to support battery coping analysis. Initial load shed activities will be completed within 2 hours of the loss of power event. Additional load shedding activities will be completed within 5 hours of the loss of power event.

The attached files provide an assessment of DC and 118 VAC loads that are shed to support the battery coping analyses. Each load has been assessed for impact to FLEX strategies and identifies loads that are maintained available to support strategy implementation.

NRC SE tracker audit item A-21 (ISE CI 3.3.1.A)

NRC SE tracker audit item A-21:

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. Confirm that the licensee's Maintenance and Testing program will include acceptance criteria for equipment (e.g., voltage and frequency for DGs) and address shelf life of equipment (e.g., batteries, seals, o-rings, gaskets, tires, etc.) [this is cut and paste from NRC SE tracker]

Response for NRC SE tracker Audit Item A-21:

The FLEX maintenance and testing program uses the existing site processes and procedures for development of the PM's and testing requirements. Equipment identified on a purchase order (PO) or when received by the site receives an equipment tag number (Location Number) in the maintenance/PM database. Once the tag number is assigned to the equipment PM's would be identified to that tag.

For FLEX Equipment that is purchased or identified as part of the FDA process (Design Document), the design document identifies the testing requirements; recommended PM's and identifies a recommended parts list. For equipment that was not from the FDA process, when the equipment is received on-site, the system engineer would establish the requirements for maintenance and testing. All PM's for maintenance and testing of the FLEX equipment would be done through station PM's either identified by the FDA process or the system engineer.

Station procedure, STA-677, "Preventative Maintenance Program," establishes the programmatic requirement for PM's and describes how they are processed. STA-677 includes reference to the EPRI PM Templates. The development of the FLEX PM's by either design or system engineer (See attached Example of PM development) is based on 1) the standard site processes for development of PM's, 2) the intended use of the equipment to support the FLEX strategies, 3) the EPRI FLEX PM Templates 4) the manufacturer information / recommendations identified with the component and 5) Site experience with maintaining equipment under similar conditions. Engineering evaluates these inputs and determines what PM's need to be created to ensure the equipment is available to perform its intended function. The result of this engineering effort was the scope of the work and the recommended frequency for performance. Luminant used a team of retired CPNPP Planners as consultants to develop the PMs and the job plans for the work identified by the engineer. The planners would also perform an expert panel review of the work scope to ensure the job plans were workable. The PMs and associated job plans are then created in the site PM Basis database where the PMs will be electronically processed into work order packages predicated by the PM's scheduled frequencies. Those items not addressed by specific PMs i.e., shelf life, batteries, etc. are addressed in the monthly walkdown PM or the quarterly inventories per STI-250.02, FLEX Equipment Control and Accountability.

EPRI has completed and has issued "Preventive Maintenance Basis for FLEX Equipment - Project Overview Report" (Report 3002000623). Preventative Maintenance Templates for the major FLEX equipment including the portable diesel pumps and generators have also been issued. Luminant, as identified above used the EPRI templates as one of the inputs to development of the FLEX PM's for maintenance and testing of equipment.

In addition to the schedule logic for identification of a PM for the FLEX equipment, attached is an example of a PM developed for a specific piece of flex equipment:

1) List of FLEX 12kW Portable Generators / Applicable Strategies and FLEX Support Instruction (See – Attachment: A-21-02_FLEX 12kW Portable Generators.pdf)

2) Evaluation of PM Program FLEX 12 kv Portable Generators. (CR-2015-003754) (See – Attachment: A-21-03_FLEX 12kW Portable Generators PM Evaluation.pdf)

3) List of PM's for FLEX 12kW Portable Generators (See – Attachment: A-21-04_FLEX PMs 12kW Portable Generators.pdf)

Additional Reference:

- Station Administrative Manual Procedure STA-677, "Preventive Maintenance Program," Revision 11 (Section 6.3.3)

Attachment 3 to TXX-16051

Final Integrated Plan

Revision 0

Comanche Peak Nuclear Power Plant

Units 1 and 2

(For Information Only)

FINAL
INTEGRATED
PLAN

Revision 0

Comanche Peak Nuclear Power Plant

Units 1 and 2

(For Information Only)

July 2016

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1. Background

In 2011, an earthquake-induced tsunami caused Beyond-Design-Basis (BDB) flooding at the Fukushima Dai-ichi Nuclear Power Station in Japan. The flooding caused the emergency power supplies and electrical distribution systems to be inoperable, resulting in an extended loss of alternating current (AC) power (ELAP) in five of the six Units on the site. The ELAP led to (1) the loss of core cooling, (2) loss of spent fuel pool cooling capabilities, and (3) a significant challenge to maintaining containment integrity. All direct current (DC) power was lost early in the event on Units 1 & 2 and after some period of time at the other Units. Core damage occurred in three of the Units along with a loss of containment integrity resulting in a release of radioactive material to the surrounding environment.

The US Nuclear Regulatory Commission (NRC) assembled a Near-Term Task Force (NTTF) to advise the Commission on actions the US nuclear industry should take to preclude core damage and a release of radioactive material after a natural disaster such as that seen at Fukushima. The NTTF report (Reference 1) contained many recommendations to fulfill this charter, including assessing extreme external event hazards and strengthening station capabilities for responding to beyond-design-basis external events.

Based on NTTF Recommendation 4.2, the NRC issued Order EA-12-049 (Reference 2) on March 12, 2012 to implement mitigation strategies for Beyond-Design-Basis External Events (BDBEE). The order provided the following requirements for strategies to mitigate BDBEEs:

1. Licensees shall develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and SFP cooling capabilities following a BDBEE.

2. These strategies must be capable of mitigating a simultaneous loss of all AC power and loss of normal access to the ultimate heat sink (LUHS) 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 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 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.

The order specifies a three-phase approach for strategies to mitigate BDBEEs:

- Phase 1 - Initially cope relying on installed equipment and on-site resources.
- Phase 2 - Transition from installed plant equipment to on-site FLEX equipment

- Phase 3 - Obtain additional capability and redundancy from off-site equipment and resources until power, water, and coolant injection systems are restored or commissioned.

NRC Order EA-12-049 required licensees of operating reactors to submit an overall integrated plan, including a description of how compliance with these requirements would be achieved by February 28, 2013. The Order also required licensees to complete implementation of the requirements no later than two refueling cycles after submittal of the overall integrated plan or December 31, 2016, whichever comes first.

The Nuclear Energy Institute (NEI) developed NEI 12-06 (Reference 3), which provides guidelines for nuclear stations to assess extreme external event hazards and implement the mitigation strategies specified in NRC Order EA-12-049. The NRC issued Interim Staff Guidance JLD-ISG-2012-01 (Reference 4), dated August 29, 2012, which endorsed NEI 12-06 with clarifications on determining baseline coping capability and equipment quality.

NRC Order EA-12-051 (Reference 5) required licensees to install reliable SFP instrumentation with specific design features for monitoring SFP water level. This order was prompted by NTTF Recommendation 7.1 (Reference 1).

NEI 12-02 (Reference 6) provided guidance for compliance with Order EA-12-051. The NRC determined that, with the exceptions and clarifications provided in JLD-ISG-2012-03 (Reference 7), conformance with the guidance in NEI 12-02 is an acceptable method for satisfying the requirements in Order EA-12-051. NRC Order EA-12-051 was implemented for Comanche Peak Units 1 and 2 in the fall of 2014 as reported in Reference 38.

2. NRC Order 12-049 – Mitigation Strategies (FLEX)

2.1 General Elements

2.1.1 Assumptions

The assumptions used for the evaluations of a Comanche Peak ELAP/LUHS event and the development of FLEX strategies are stated below.

Boundary conditions consistent with NEI 12-06 Section 3.2.1 are established to support development of FLEX strategies, as follows:

- The BDB external event occurs impacting both Units at the site.
- Both reactors are initially operating at power, unless there are procedural requirements to shut down due to the impending event. The reactors have been operating at 100% power for the past 100 days.
- Each reactor is successfully shut down when required (i.e., all rods inserted, no ATWS). Steam release to maintain decay heat removal upon shutdown functions normally, and reactor coolant system (RCS) overpressure protection valves respond normally, if required by plant conditions, and reseat.

- On-site staff is at site administrative minimum shift staffing levels.

- No independent, concurrent events, e.g., no active security threat.

- All personnel on-site are available to support site response.

- The reactor and supporting plant equipment are either operating within normal ranges for pressure, temperature and water level, or available to operate, at the time of the event consistent with the design and licensing basis.

The following plant initial conditions and assumptions are established for the purpose of defining FLEX strategies and are consistent with NEI 12-06 Section 3.2.1:

- No specific initiating event is used. The initial condition is assumed to be a loss of off-site power (LOOP) with installed sources of emergency on-site AC power and station blackout (SBO) alternate AC power sources unavailable with no prospect for recovery.

- Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds and associated missiles are available. Permanent plant equipment that is contained in structures with designs that are robust with respect to seismic events, floods, and high winds and associated missiles, are available. The portion of the fire protection system that is robust with respect to seismic events, floods, and high winds and associated missiles is available as a water source.

- 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.

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

- Installed Class 1E electrical distribution systems, including inverters and battery chargers, are located within safety-related, Seismic Category I structures and therefore remain available.

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

- Reactor coolant inventory loss consists of unidentified leakage at the upper limit of Technical Specifications, reactor coolant letdown flow (until isolated), and reactor coolant pump seal leak-off at normal maximum rate.

- For the spent fuel pool, the heat load is assumed to be the maximum design basis heat load. In addition, inventory loss from sloshing during a seismic event does not preclude access to the pool area.

Additionally, key assumptions associated with implementation of FLEX Strategies are as follows:

- Exceptions for the site security plan or other (license/site specific) requirements of 10CFR may be required.

- Deployment resources are assumed to begin arriving at hour 6 and fully staffed by 24 hours.

- This plan defines strategies capable of mitigating a simultaneous loss of all alternating current power and loss of normal access to the ultimate heat sink resulting from a BDB event by providing adequate capability to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities at all Units on a site. Though specific strategies have been developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions. These pre-planned strategies developed to protect the public health and safety have been incorporated into the Unit emergency operating procedures in accordance with established emergency operating procedure (EOP) change processes, and their impact to the design basis capabilities of the Unit evaluated under 10 CFR 50.59.

  The plant Technical Specifications contain the limiting conditions for normal Unit operations to ensure that design safety features are available to respond to a design basis accident and direct the required actions to be taken when the limiting conditions are not met. The result of the BDB event may place the plant in a condition where it cannot comply with certain Technical Specifications and/or with its Security Plan, and, as such, may warrant invocation of 10 CFR 50.54(x) and/or 10 CFR 73.55(p).

2.2 Strategies

The objective of the FLEX Strategies is to establish an indefinite coping capability in order to (1) prevent damage to the fuel in the reactors, (2) maintain the Containment function and (3) maintain cooling and prevent damage to fuel in the spent fuel pool using installed equipment, on-site portable equipment, and pre-staged off-site resources. This indefinite coping capability will address an extended loss of all AC power – loss of off-site power, emergency diesel generators (EDG) and any alternate AC source, but not the loss of AC power to buses fed by station batteries through inverters - with a simultaneous loss of access to the ultimate heat sink. This condition could arise following external events that are within the existing design basis with additional failures and conditions that could arise from a Beyond-Design-Basis external event.

The plant indefinite coping capability is attained through the implementation of pre-determined strategies (FLEX strategies) that are focused on maintaining or restoring key plant safety functions. The FLEX strategies are not tied to any specific damage state or mechanistic assessment of external events. Rather, the strategies are developed to maintain the key plant safety functions based on the evaluation of plant response to the coincident ELAP/LUHS event. A safety function-based approach provides consistency with, and allows coordination with, existing plant EOPs. FLEX strategies are implemented in support of EOPs using FLEX Support Instructions (FSIs).

The strategies for coping with the plant conditions that result from an ELAP/LUHS event involve a three-phase approach:

- Phase 1 - Initially cope by relying on installed plant equipment and on-site resources.
- Phase 2 - Transition from installed plant equipment to on-site FLEX equipment.
- Phase 3 - Obtain additional capability and redundancy from off-site equipment and resources until power, water, and coolant injection systems are restored.

The duration of each phase is specific to the installed and portable equipment utilized for the particular FLEX strategy employed to mitigate the plant condition.

The strategies described below are capable of mitigating an ELAP/LUHS resulting from a BDB external event by providing adequate capability to maintain or restore core cooling, containment, and SFP cooling capabilities at both Units at Comanche Peak. Though specific strategies have been developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions. These pre-planned strategies developed to protect the public health and safety are incorporated into the Comanche Peak procedures in accordance with established change processes, and their impact to the design basis capabilities of the Unit evaluated under 10 CFR 50.59.

2.3 Reactor Core Cooling and Heat Removal Strategy

For an ELAP initiated in Modes 1-4, the FLEX strategy for reactor core cooling and decay heat removal is to release steam from the Steam Generators (SG) using the Atmospheric Relief Valves (ARVs) and the addition of a corresponding amount of feedwater to the steam generators via the Turbine Driven Auxiliary Feedwater Water (TDAFW) pump. The Auxiliary Feedwater (AFW) system includes the Condensate Storage Tank (CST) as the initial water supply to the TDAFW pump. Operator actions to verify and throttle AFW flow are required following an ELAP/LUHS event to prevent SG dryout and/or overfill.

RCS cooldown will be initiated within the first 2 hours and completed within approximately 4 hours (Reference 8) following a BDB external event that initiates an ELAP/LUHS event.

DC bus load shedding will ensure station battery life is extended to 12 hours (Reference 8). Portable generators will repower instrumentation prior to station battery depletion.

RCS makeup and boron addition will be initiated within 14 hours to ensure natural circulation, reactivity control, and boron mixing is maintained.

For an ELAP initiated in Mode 5 or 6, see Section 2.16 for discussion of the reactor core cooling and heat removal FLEX strategies.

2.3.1 Phase 1 Strategy

Following the occurrence of an ELAP/LUHS event, the reactor will trip and the plant will initially stabilize at no-load reactor coolant system temperature and pressure conditions, with reactor decay heat removal via steam release to the atmosphere through the steam generator safety valves and/or SG ARVs. Natural circulation of the reactor coolant system will develop to provide core cooling and the steam turbine driven auxiliary feedwater pump will provide flow from the condensate storage tank to the steam generators to make-up for steam release.

Operators will respond to the event in accordance with emergency operating procedures to confirm reactor coolant system, secondary system, and Containment conditions. A transition to ECA-0.0A/B, "Loss of All AC Power," will be made upon the diagnosis of the total loss of AC power. This procedure directs isolation of reactor coolant system letdown pathways, confirmation of adequate RCS heat sink using the steam generators, verification of Containment isolation, reduction of DC loads on the station batteries, and establishment of electrical equipment alignment in preparation for eventual power restoration. The operators verify auxiliary feedwater flow, establish manual control of the SG ARVs, and initiate a rapid cooldown of the RCS to minimize inventory loss through the RCP seals. ECA-0.0A/B directs local manual control of auxiliary feedwater flow to the steam generators and local manual control of the SG ARVs to control steam release to control the RCS cooldown rate, as necessary.

Steam Generators

The Phase 1 strategy for reactor core cooling and heat removal relies upon installed plant equipment and water sources for AFW supply to the steam generators and steam release to the atmosphere. The TDAFW pump automatically starts on the loss of offsite power condition, and does not require AC or DC electrical power to provide AFW to the steam generators. The AFW system is pre-aligned for flow to all SGs from the TDAFW pump. Manual control of TDAFW pump flowrate to the SGs to establish and maintain proper water levels will be performed locally after the associated instrument air accumulators are depleted. In the event that the TDAFW pump is unable to provide AFW flow, the operator is directed to deploy a portable FLEX pump for feeding the steam generators.

Steam release from the SGs will be controlled remotely from the Control Room using air-operated SG ARVs equipped with local air accumulators. Local manual isolation valves upstream of the SG ARVs will be used to control steam flow when the accumulator air is expended. In accordance with the procedure for response to loss of all AC power, an RCS cooldown will be initiated at a maximum rate of 100°F/hr to a minimum SG pressure of 310 psig, which corresponds to an RCS core inlet temperature of approximately 425°F. The RCS cooldown reduces RCS pressure to allow RCS injection for inventory and reactivity control using a portable RCS injection pump and reduces SG pressure to allow for eventual feedwater injection from a portable pump in the event that the TDAFW pump becomes unavailable. The minimum SG pressure is established high enough to prevent safety injection accumulator nitrogen gas from entering the RCS.

Initially, AFW water supply is provided by the Seismic Category I, missile protected CST. The tank has a minimum usable capacity of approximately 269,700 gallons (Reference 10) and will provide a suction source to the TDAFW pump for a minimum of 16 hours of RCS decay heat removal assuming a concurrent RCS cooldown at 100°F/hr to a minimum SG pressure of 310 psig. Prior to depletion of the CST inventory, the TDAFW pump suction will be cross-tied to the Seismic Category I, missile protected Reactor Makeup Water Storage Tank (RMUWST), allowing simultaneous drawdown of both the CST and RMUWST. The minimum usable RMUWST capacity of approximately 73,900 gallons (Reference 10) will provide an additional suction source to the TDAFW pump for a minimum of 8 hours. Prior to depletion of the CST and RMUWST, CST makeup from the Safe Shutdown Impoundment (SSI) will be aligned during Phase 2 using a Multi-Purpose High Flow FLEX pump utilizing eductor equipment at the Service Water Intake Structure (Reference 8) and deployed ring header (Figure 3).

Reactor Coolant System

The RCS will be cooled down and depressurized until Steam Generator pressure reaches 310 psig. RCS isolation is verified to have occurred, and RCS leakage is assumed to be through the RCP seals (see Section 2.3.8). K_{eff} is calculated to be less than 0.99 at RCS conditions described for the entire event (see Section 2.3.9).

Electrical/Instrumentation

Initial load shedding of all non-essential loads will be initiated and completed within 2 hours after the loss of all AC power occurrence of an ELAP/LUHS. Once ELAP is declared, a second load shed is completed within 5 hours after the loss of AC power occurs. With load shedding, the useable station battery life is calculated to be 12 hours for Unit 1 and Unit 2 station batteries (see Section 2.3.11).

2.3.2 Phase 2 Strategy

The Phase 2 strategy for reactor core cooling and heat removal provides a significant supply of makeup water to the CST for feeding SGs using the deployed Multi-Purpose High Flow FLEX pump with suction from the SSI (see Section 2.15.1).

Additionally, as required by NEI 12-06, backup SG water injection using a portable SG/AFW Low Pressure FLEX pump is provided with primary and secondary connections. Note, these connections are backup connections where use would be required only if the TDAFW pump failed.

RCS makeup is initiated within 14 hours of the ELAP/LUHS event using a portable electric pump in order to both borate the RCS and control RCS inventory. One portable 480 VAC High Pressure RCS Injection FLEX pump for each Unit will be transported from the on-site FLEX Equipment Storage Building and deployed for delivery of RCS inventory, with RCS makeup first from the Boric Acid Tank (BAT) and then from the Refueling Water Storage Tank (RWST) for the remainder of the event.

For each Unit, a suction hose will be connected to a BAT FLEX connection (to the drain line for BAT X-01, sample line for BAT X-02) to provide BAT borated water to the suction of the High Pressure RCS Injection FLEX pump. A high-pressure hose will be routed from the discharge of the High Pressure RCS Injection FLEX pump to the primary or secondary RCS injection connection point to provide RCS inventory makeup until the BAT empties (Figures 6 and 7). Then, suction for the High Pressure RCS Injection FLEX pump will be provided by the RWST via connection to the modified drain lines on the RWST (Figure 8).

The Phase 2 strategy also includes re-powering of battery chargers within 12 hours (Reference 8) to maintain availability of instrumentation monitoring key parameters. Prior to depletion of the 125 VDC station batteries, safety-related battery chargers will be re-powered using a portable 480 VAC diesel generator stored on-site.

The strategy for restoring power and aligning station battery chargers to both the Unit 1 and Unit 2 125 VDC station batteries is the use of one 480 VAC diesel generator (DG) connected to 480 VAC Plant Support Power through permanently installed distribution panels. The portable 480 VAC DG (and connecting power cables) will be deployed from the FLEX Equipment Storage Building to Staging Area A1 near transformer 2ST (Figure 9a). For the primary strategy, the generator will be connected via cables to 480 VAC Plant Support Power distribution panel XB10-1, if intact, located outside the Unit 2 Safeguards building near Staging Area A1 (Figures 9a & 9b). For the secondary strategy, the generator will be connected via cables to the 480 VAC Plant Support Power distribution panel XB10-1-4 located inside the Unit 2 Safeguards Building (Figures 10a & 10b). Both the primary and alternate strategy for 480 VAC Plant Support Power restoration will also power battery room exhaust fans on each Unit and the High Pressure RCS Injection FLEX pump on each Unit.

Deployment of the 480 VAC generator from the FLEX Equipment Storage Building will commence after the declaration of an ELAP event and placement of the 480 VAC generator into service can be completed within 12 hours of loss of all AC power.

2.3.3 Phase 3 Strategy

The Phase 3 Strategy for core cooling and decay heat removal consists of additional pumps available from the National SAFER Response Center (NSRC) to provide backup capability to the Phase 2 FLEX pumps. Also, a portable air compressor will be obtained from the NSRC to restore instrument air to containment in order to vent nitrogen from the SI Accumulators. Following accumulator venting and completion of adequate RCS boration, a second RCS cooldown will be performed to a target SG pressure of 170 psig. Additionally, a water purification system will be provided from the NSRC to remove impurities from alternate water supplies used for CST makeup, as necessary.

Using the steam generators for core cooling and decay heat removal (Reference 8) is dependent upon reactor core decay heat generation rate and the available supply of clean water from onsite sources or from water purification units provided from the NSRC.

2.3.4 Systems, Structures, Components (SSC)

2.3.4.1 Turbine Driven Auxiliary Feedwater Pump

The TDAFW pump will automatically start and deliver AFW flow to all SGs following an ELAP / LUHS event. Two air-operated steam supply valves supply steam to the TDAFW pump turbine. These air-operated valves fail open, ensuring the TDAFW pump starts on loss of air supply or electrical power, but have air accumulators to hold closed, if needed. During an ELAP, procedures ensure that the steam supply valves are open and the TDAFW pump turbine steam flow will be controlled automatically by the mechanical governor. In the event the TDAFW pump fails to start, procedures direct the operators to manually open the steam supply valves to start the pump (which does not require electrical power for motive force or control). The TDAFW pump is sized to provide more than the design basis AFW flow requirements and is located in a structure designed for protection from all applicable external events. Note, the TDAFW pump is not assumed to fail during the ELAP response.

2.3.4.2 Steam Generator Atmospheric Relief Valves

During an ELAP / LUHS event with the loss of all AC power and instrument air, reactor core cooling and decay heat will be removed from the SGs for an indefinite time period by manually opening / throttling the SG ARVs, which are equipped with air accumulators. The SG ARVs are safety-related, missile protected, seismically qualified valves. Power to the SG ARV controllers in the Control Room will be provided by the station batteries in Phase 1 and by the portable 480 VAC diesel generators in Phases 2 and 3. Controlling the SG ARVs from the Control Room will aid in minimizing field action (staffing burden) and maximizing SG ARV control response. Operation of the SG ARVs from the Control Room will continue for approximately 4 hours until air supply from the respective air accumulators is depleted at which time local manual control will be initiated via use of local manual isolation valves.

2.3.4.3 Station Batteries

The safety-related station batteries and associated DC distribution systems are located within safety-related structures designed to withstand all applicable external hazards and will be used to initially power required key instrumentation and applicable DC components. Load shedding of non-essential equipment provides an estimated total service time of at least 12 hours of operations.

2.3.4.4 Condensate Storage Tank

The condensate storage tank provides an AFW water source at the initial onset of the event. The tank is a safety-related, seismic, and missile protected structure therefore designed to withstand all applicable external events. The minimum usable volume is approximately 269,700 gallons.

2.3.4.5 Reactor Makeup Water Storage Tank

The reactor makeup water storage tank provides an additional AFW water source following depletion of the CST. The tank is a safety-related, seismic, and missile protected structure and therefore designed to withstand all applicable external events. The minimum usable volume is approximately 73,900 gallons.

2.3.4.6 Safe Shutdown Impoundment

The SSI is the ultimate heat sink and provides approximately 284 acre-feet of raw water for CST makeup following depletion of the initial contents of the CST and RMUWST. The SSI dam is safety-related and seismically designed, and as an earthen dam it is not susceptible to tornado damage or other extreme environmental events.

2.3.4.7 Boric Acid Tank

Each Unit has access to both BATs (safety-related and seismically designed) located inside the Auxiliary Building. During "at power" operations each BAT's borated water volume is maintained greater than 23,000 gallons at a boron concentration of at least 7,000 ppm. The BAT borated water source will be used initially for the RCS injection strategy.

2.3.4.8 Refueling Water Storage Tank

Each Unit is equipped with one RWST located at grade level just outside of its respective Safeguards Building. The tanks are safety-related, seismic, and missile protected structures and therefore designed to withstand all applicable external events. During "at power" operations each operating

Unit's RWST borated volume is maintained greater than 473,700 gallons at a boron concentration between 2400 and 2600 ppm. The RWST borated water source will be used following BAT depletion for the RCS injection strategy.

2.3.4.9 Structures

The FLEX strategies rely on site structures to provide protection for components, fluid and electrical connections, and deployment paths from all applicable external hazards. Specifically, the FLEX strategies rely on the Containments, Fuel Building, Auxiliary Building and Safeguards Buildings, which are all Seismic Category I structures designed to provide protection from the applicable external hazards.

See Section 2.7 for discussion of the FLEX Equipment Storage Building.

2.3.5 FLEX Connections

2.3.5.1 Primary SG Connections

If the TDAFW pump fails or becomes unavailable, the primary connections for backup SG injection are located on individual AFW injection lines (to each SG) located in the Safeguards 810' main hallway. A flexible hose will be routed from the SG/AFW Low Pressure FLEX pump discharge to a portable manifold staged in the Safeguards hallway. Hoses for feeding individual SGs are routed from the manifold to individual AFW injection lines (Figure 4). These connections are also available for SG injection during an ELAP initiated in Mode 5 or 6.

2.3.5.2 Secondary SG Connections

If the TDAFW pump fails or becomes unavailable, the secondary connection for backup SG injection is located on the TDAFW pump discharge line in the TDAFW pump room (Figure 5). A flexible hose will be routed from the SG/AFW Low Pressure FLEX pump discharge to a TDAFW secondary connection line located in the CST valve room. From the CST valve room at approximately 810' elevation, a dry pipe is routed through a pipe tunnel terminating at approximately 790' elevation in the Safeguard building near the TDAFW pump room. An additional flexible hose will be routed from the TDAFW secondary connection line dry pipe to the FLEX connection located on the TDAFW pump discharge line. This connection is also available for SG injection during an ELAP initiated in Mode 5 or 6.

2.3.5.3 CST Suction Connection

If the TDAFW pump fails or becomes unavailable, a suction connection to the CST is installed to provide a suction source to the portable SG/AFW Low Pressure FLEX pump for backup SG injection. The connection is seismically designed and located inside the CST valve room and is therefore protected from all applicable external hazards. This connection is also available to support SG injection during an ELAP initiated in Mode 5 or 6.

2.3.5.4 CST Makeup Connection

A makeup connection to the CST is installed to provide makeup capability using any available water source and a Multi-Purpose High Flow FLEX pump. The connection is seismically designed and located inside the CST valve room and is therefore protected from all applicable external hazards.

2.3.5.5 Primary RCS Connections

The primary connection for the discharge of the High Pressure RCS Injection FLEX pump is a permanently installed hose connection located upstream of valves 8801A and 8801B (located in each Unit's Safeguards Building) as shown in Figure 6. The High Pressure RCS Injection FLEX pump discharge will be connected via a high pressure hose to this FLEX connection. The High Pressure RCS Injection FLEX pump can deliver borated water from the BAT or RWST via the Safety Injection flow path to the RCS cold legs. Note, an additional adjacent connection is available for low pressure RCS injection at higher flowrates needed during an ELAP initiated in Mode 5 or 6 (Figure 6).

2.3.5.6 Secondary RCS Connections

The secondary connection for the discharge of the High Pressure RCS Injection FLEX pump is a permanently installed hose connection located upstream of valves 8105 and 8106 on the normal charging header, located in each Unit's Safeguards Building as shown in Figure 7. The High Pressure RCS Injection FLEX pump discharge will be connected via a high pressure hose to this FLEX connection if the primary RCS connection is unavailable. The High Pressure RCS Injection FLEX pump can deliver borated water from the BAT or RWST via the normal charging header. Note, an additional adjacent connection is available for low pressure RCS injection at higher flowrates needed during an ELAP initiated in Mode 5 or 6 (Figure 7).

2.3.5.7 BAT Suction Connection

A suction connection from the BAT is installed on the drain line for BAT X-01 (sample line for BAT X-02) allowing borated water from the BAT to be supplied to a portable High Pressure RCS Injection FLEX pump. The BAT is safety-related, seismically designed and located inside the Auxiliary Building and is therefore protected from all applicable external hazards.

2.3.5.8 RWST Suction Connection

A suction connection from the RWST is installed inside the RWST valve room. The suction connection is seismically designed and located inside the RWST valve room and is therefore protected from all applicable external hazards. A gated "wye" or manifold will be installed outside the RWST valve room for a shared suction for both a FLEX pump for SFP makeup and the High Pressure RCS Injection FLEX pump, allowing borated water from the RWST to be supplied to both pumps.

2.3.5.9 Electrical Connection

A single 480 VAC Phase 2 500 kW diesel generator is sized sufficient to simultaneously recharge three 125 VDC station batteries per Unit, to power all required battery room exhaust fans, and to power each Unit's High Pressure RCS Injection FLEX pump (Reference 8). Two 500 kW diesel generators are stored in the FLEX Equipment Storage Building to satisfy the N+1 requirement.

480 VAC Plant Support Power distribution panels feed each required load. The Plant Support Power system satisfies the NEI 12-06 requirements for robustness.

The primary electrical connection is via cables from the 480 VAC Phase 2 diesel generator to 480 VAC Plant Support Power distribution panel XB10-1, located outside the Unit 2 Safeguards building near Staging Area A1. This connection is not protected from all external hazards.

The secondary electrical connection is via cables from the 480 VAC Phase 2 diesel generator to the 480 VAC Plant Support Power distribution panel XB10-1-4 located inside the Unit 2 Safeguards Building. This connection is protected from all external hazards.

Cables required for connection of the 500 kW diesel generator to the 480 VAC Plant Support Power system are stored in the FLEX Equipment Storage Building.

2.3.6 Key Reactor Parameters

Instrumentation monitoring the following key parameters is credited for all phases of the reactor core cooling and decay heat removal strategy and is available in the Control Room for the duration of the event:

- AFW Flowrate - AFW flowrate indication is available for all SGs.
- SG Water Level - SG narrow-range level indication is available for all SGs.
- Main Steam Line Pressure – Main Steam Line pressure indication is available for all SGs.
- RCS Temperature –RCS wide range hot-leg and cold-leg temperature indications are available until completion of the initial RCS cooldown to 310 psig SG pressure and subsequent load shed. Afterwards, only two hot-leg and two cold-

leg temperature indications will be available, with one temperature indication available on each RCS loop.

- Core Exit Thermocouple Temperature
- CST Level
- Pressurizer Level
- Reactor Vessel Level Indication System (RVLIS)
- Source Range Count Rate

The above instrumentation is available prior to and after load shedding of the DC and AC buses during Phases 1, 2 and 3, unless otherwise noted.

Portable FLEX equipment is supplied with the local instrumentation needed to operate the equipment. The use of these instruments is detailed in the associated FSIs or local job aids for use of the equipment. These procedures are based on inputs from the equipment suppliers, operational experience, and expected equipment function during an ELAP.

In the unlikely event that 125 VDC and 118 VAC Vital Bus infrastructure is damaged, FLEX strategy guidelines have been developed for obtaining alternate indication for critical parameters (see Section 2.9.3 for discussion of alternate power for RVLIS and Source Range instrumentation).

2.3.7 Thermal-Hydraulic Analyses

2.3.7.1 Secondary Analysis

Thermal-hydraulic calculations were performed to determine the AFW inventory required to maintain steam generator levels and times associated with the volumes. The conclusions from this analysis showed that the existing CST usable volume of approximately 269,700 gallons would be depleted in approximately 16 hours and the existing RMUWST usable volume of approximately 73,900 gallons would be depleted in approximately 8 hours, at which time another source of water was required. Following depletion of the CST and RMUWST, the SSI can be aligned for CST makeup using a Multi-Purpose High Flow FLEX pump. The SSI provides approximately 284 acre-feet of water for essentially indefinite decay heat removal.

2.3.7.2 RCS Analysis

The model used for determination of RCS response was that used in the generic analysis in WCAP-17601 (Reference 16) and WCAP-17792 (Reference 17). RCS inventory makeup will begin within 14 hours following the onset of the ELAP condition. Based on information from WCAP-17792, reflux cooling is considered to be in progress when the one-hour centered moving average flow quality in the steam generator U-bend region exceeds 0.1. Comanche Peak has installed the SHIELD low-leakage RCP seals, ensuring seal leakage ≤ 1 gpm per RCP such that single-phase natural circulation flow will be maintained prior to and following RCS makeup initiation at 14 hours. The significant borated water volume available in each Unit's protected RWST and the BATs ensures RCS makeup capability will exist until restoration of permanent plant equipment in the recovery phase. Therefore, the reflux cooling condition will be avoided.

2.3.8 Reactor Coolant Pump Seals

Comanche Peak is a Westinghouse 4-Loop plant with Westinghouse SHIELD low-leakage RCP seals. From TR-FSE-14-1-P Revision 1 (Reference 18), RCP seal leakage will be limited to ≤ 1 gpm per RCP following SHIELD actuation during a loss of all RCP seal cooling scenario.

2.3.9 Shutdown Margin Analysis

A shutdown margin analysis was performed confirming a shutdown margin (SDM) of at least 1% (k_{eff} <0.99) is maintained following the loss of power and a reactor trip from full power.

During the RCS cool down, the SI Accumulators will inject borated water at a minimum boron concentration of 2300 ppm. Boration using the High Pressure RCS Injection FLEX pump and BAT (7000 ppm) will begin within 14 hours. Conservative reactivity calculations assuming no xenon show that injection of borated water from the SI Accumulators and the BAT will be adequate to meet shutdown reactivity requirements at the limiting End-of-Cycle condition and the core inlet temperature as low as 350°F. This boron requirement is met within 9 hours (plus one hour for boron mixing, see below) of RCS makeup from the BAT.

The SDM calculation assumes a uniform boron mixing model. Boron mixing was identified as a generic concern by the NRC and was then addressed by the PWR Owner's Group (PWROG) via a position paper. The NRC endorsed the PWROG boron mixing position paper (Reference 19) with the clarification that a one hour mixing time was adequate provided that the flow in all loops is greater than or equal to the corresponding single-phase natural circulation flow rate. Comanche Peak has installed the SHIELD low-leakage RCP seals, ensuring seal leakage ≤ 1 gpm per RCP such that single-phase natural circulation flow will be maintained prior to and following RCS makeup initiation at 14 hours. Consequently, the NRC clarification regarding single-phase flow has been addressed and a one hour mixing time is acceptable.

2.3.10 FLEX Pumps and Water Supplies

2.3.10.1 Multi-Purpose High Flow FLEX Pump

The Multi-Purpose High Flow FLEX pump is shared between several functions. The Multi-Purpose High Flow FLEX Pump (Table 3) is a trailer-mounted, diesel driven centrifugal pump that is stored in the FLEX Equipment Storage Building. The pump is deployed by towing the trailer to one of multiple designated locations near the selected water source. Three Multi-Purpose High Flow FLEX pumps are available to satisfy the N+1 requirement.

2.3.10.2 SG/AFW Low Pressure FLEX Pump

Consistent with NEI 12-06, Appendix D, backup SG water injection capability is provided using a portable FLEX pump through a primary and secondary connection. The SG/AFW Low Pressure FLEX Pump (Table 3) is a trailer-mounted, diesel engine driven centrifugal pump that is stored in the FLEX Equipment Storage Building. The SG/AFW Low Pressure FLEX Pump will provide a backup SG injection method in the event that the TDAFW pump can no longer perform its function due to low turbine inlet steam flow from the SGs or due to equipment failure. Three SG/AFW Low Pressure FLEX pumps are available to satisfy the N+1 requirement.

2.3.10.3 AME Pump

The AME pump (Table 3) is not a credited FLEX pump meeting the requirements of NEI 12-06 as its storage location does not provide protection from all applicable external hazards. However, this pump will be utilized as a spare if it survives the external event.

2.3.10.4 High Pressure RCS Injection FLEX Pump

The High Pressure RCS Injection FLEX pumps are positive displacement triplex type and are electric motor driven powered by the 480 VAC Phase 2 500 kW FLEX DG connected via the 480 VAC Plant Support Power distribution panels. These pumps are stored in the FLEX Equipment Storage Building (Reference 9), are skid mounted on a mobile platform and can be transported by vehicle with a trailer hitch or by hand. Three High Pressure RCS Injection FLEX pumps are available to satisfy the N+1 requirement.

2.3.10.5 Non-Borated Water Supplies

Condensate Storage Tank
See Section 2.3.4.4 for CST description.

Reactor Makeup Water Storage Tank
See Section 2.3.4.5 for RMUWST description.

Safe Shutdown Impoundment
See Section 2.3.4.6 for SSI description.

Non-Robust Water Tanks
Several non-robust water tanks are located within or adjacent to the Protected Area and may provide potentially large volumes of non-borated water if not destroyed or rendered otherwise inaccessible by the external event. These tanks are the Demin Water Storage Tank (DWST), Reverse Osmosis Product Water Storage Tank (RPST), Filtered Water Storage Tank (FWST), and two Fire Protection Storage Tanks (FPST). Potentially available volumes are documented in Table 2. CST makeup path using the non-robust water tanks is depicted in Figure 3.

2.3.10.6 Borated Water Supplies

Boric Acid Tank
See Section 2.3.4.7 for BAT description.

Refueling Water Storage Tank
See Section 2.3.4.8 for RWST description.

2.3.11 Electrical Analysis

The station battery duty cycle of 12 hours for Comanche Peak was calculated in accordance with the IEEE-485 methodology using manufacturer discharge test data applicable to the site's FLEX strategy as outlined in the NEI white paper on Extended Battery Duty Cycles (as endorsed by the NRC in Reference 21).

The strategy to re-power the station's vital AC/DC buses requires the use of a diesel powered generator. The power requirements for both Units are met by a single 480 VAC portable diesel generator. The two 480 VAC diesel generators (N+1) are 500 KW standby rating generators that are trailer-mounted and stored in the FLEX Equipment Storage Building.

Two replacement 480 VAC generators are available from the NSRC in Phase 3 for backup of the Phase 2 strategy. The NSRC generators are adequately sized with performance data listed in Table 4. For interchangeability, the electrical connections for both the site generators and the NSRC generators are identical.

2.4 Spent Fuel Pool Cooling/Inventory

Comanche Peak has two connected spent fuel pools, housed adjacent in the Fuel Building. The basic FLEX strategy for maintaining SFP cooling is to monitor SFP level and provide makeup water to the SFP sufficient to maintain SFP level.

2.4.1 Phase 1 Strategy

Evaluations estimate that with no operator action following a loss of SFP cooling at the maximum design heat load (immediately following completion of core offload), the SFP will reach 212°F in approximately 4 hours and boil off to a level 15 feet above the top of the fuel racks within 16 hours from initiation of the event. During non-refueling outage periods of operation with both Units in Modes 1-4, the SFP heat load will be considerably less with bulk boiling occurring at greater than 14 hours and boil off to a level of 15 feet above the top of the fuel racks at greater than 45 hours (Reference 11). The initial coping strategy for spent fuel pool cooling is to monitor spent fuel pool level using instrumentation installed as required by NRC Order EA-12-051 (Reference 5).

2.4.2 Phase 2 Strategy

The Phase 2 strategy initiates SFP makeup using either an overhead spray header fed via redundant FLEX connections located on the outside of the Fuel Building or deployment of portable spray nozzles near the SFP deck fed from local Fire Protection hose stations (Figure 11). The overhead spray header will be pressurized using a portable FLEX pump with the RWST as a suction source (Figure 8), though any available water source is acceptable. A permanent plant diesel driven fire pump, if available, can be used to pressurize the fire main for feeding the portable spray nozzles.

2.4.3 Phase 3 Strategy

The Phase 2 coping strategy will continue to be performed until additional electrical capability and off-site equipment is obtained from the NSRC, which will be used to restore the SFP cooling system.

Two 1 MW 4160 V diesel turbine generators per Unit will be brought in from the NSRC and will be used to re-energize one 6900 V safeguard AC bus on each Unit. To prevent generator overload and provide optimum flexibility and diversity of equipment, one Train A bus is energized on one Unit and one Train B bus is energized on the opposite Unit. This alignment allows recovery of the train-related 480 VAC buses and both trains of common 480 VAC motor control centers, common 118 VAC distribution panels, and common 125 VDC switch panels.

The two 1MW 4160 V generators per Unit will be connected to an NSRC supplied 4160 V distribution system and then to a 4160 V/6900 V step-up transformer (stored onsite in the FLEX Equipment Storage Building, Reference 9) in order to meet the required 6900 V load requirements. The generators for Unit 1 will be deployed to the area east of the Unit 1 Emergency Diesel Generator building (Figure 12a). The generators for Unit 2 will be deployed to the north and west of the Unit 2 Emergency Diesel Generator building (Figure 12b). One 4160 V/6900 V step-up transformer and one grounding transformer for each Unit will be deployed from the FLEX Equipment Storage Building to be staged at the locations of the 4160 V generators. Three 4160 V/6900 V step-up transformers and three grounding transformers are available to satisfy the N+1 requirement.

For the primary strategy, the 4160 V/6900 V step-up transformers can be connected to existing Alternate Power Generator transfer switches mounted external to the Unit 1 Train A Switchgear Room (Figure 12a) and external to the Unit 2 Train A Switchgear Room (Figure 12b). The transfer switches allow powering one 6900 V safeguards bus per Unit (either Train).

For the secondary strategy, the 4160 V/6900 V step-up transformers can be connected either directly to each Unit's Train A 6900 V safeguards bus via feeder breakers located in each Unit's Train A Switchgear Room, or to each Unit's Train B EDG Generator Exciter panel located in each Unit's Train B EDG Room (Figures 12a and 12b).

Two high flow low pressure diesel driven pumps supplied by the NSRC will be aligned to provide alternate Station Service Water (SSW) flow (10,000 gpm) to one existing site Component Cooling Water (CCW) heat exchanger. The 4160 V generators from the NSRC aligned to power one Class 1E 6900 V bus and associated 480 VAC buses on each Unit will provide power to one CCW pump and one SFP cooling pump. The CCW system will be placed in service to provide cooling water to a SFP heat exchanger and the SFP cooling pump restored to service.

2.4.4 Structures, Systems, and Components

This section discusses equipment and/or systems, not otherwise discussed in prior sections, that are credited to support FLEX strategy implementation (unless noted as not protected from all applicable external events).

2.4.4.1 Diesel Driven Fire Pump

A diesel driven fire pump is not a credited pump meeting the requirements of NEI 12-06 as it is not protected from all external events. However, this pump can be utilized by the secondary SFP makeup strategy if it and a Fire Protection Storage Tank (see Section 2.3.10.5) survive the external event.

2.4.4.2 Primary Electrical Connection

The Phase 3 strategy restores power to one 6900 V safeguards bus per Unit using the 1 MW 4160 V diesel turbine generators supplied by the NSRC and 4160 V/6900 V step-up transformers. The preferred connection for the step-up transformers is the Alternate Power Generator (APG) transfer switches mounted external to each Unit's Train A Switchgear Room (Figures 12a and 12b). These transfer switches allow re-powering either Train of each Unit's 6900 V safeguards bus. However, because these switches are externally mounted, they are not protected from all applicable external events.

2.4.4.3 Secondary Electrical Connections

The 4160 V/6900 V step-up transformers can also be connected either directly to each Unit's Train A 6900 V safeguards bus via feeder breakers located in each Unit's Train A Switchgear Room, or to each Unit's Train B EDG Generator Exciter panel located in each Unit's Train B EDG Room (Figures 12a and 12b). Due to their location within a Seismic Category I structure, the secondary electrical connections are protected from all applicable external events.

2.4.4.4 Class 1E Electrical Distribution System

Primary and secondary electrical connections for the Phase 3 strategies are discussed in Sections 2.4.4.2 and 2.4.4.3, respectively. All associated downstream switchgear providing power to loads used in the Phase 3 strategies are safety-related, Class 1E SSCs and are located within the Auxiliary and/or Safeguards Buildings. All electrical circuits are fully protected and available following all applicable external events.

2.4.4.5 Station Service Water

Station Service Water piping will provide the flowpath for cooling water from the NSRC supplied high flow low pressure pumps for cooling of various plant loads via the CCW heat exchanger. The SSW connection piping is located below grade within the Seismic Category I portion of the Fuel Building SSW tunnel. Two high flow low pressure diesel driven pumps supplied by the NSRC will be aligned to provide alternate SSW flow via suction from the SSI (external to the Service Water Intake Structure, Figure 16) to one SSW train via the Fuel Building SSW tunnel connection. Piping between the NSRC pumps and the tunnel connections will consist of temporary/portable hard plastic piping, flexible hose and a distribution manifold.

The hard plastic piping is stored in three independent locations with adequate separation in accordance with NEI 12-06. The remaining onsite components required to support establishing Service Water flow are located within the FLEX Equipment Storage Building or the Fuel Building SSW tunnel and are therefore fully protected from all applicable external events.

2.4.4.6 Component Cooling Water

The CCW system utilized in the Phase 3 strategy is located within the Safeguards Buildings, Auxiliary Building and Fuel Building; all Seismic Category I structures that fully protect the equipment from all applicable external hazards. The CCW pumps are supplied power from Class 1E safety-related switchgear and associated controls. The CCW pumps themselves are seismically qualified, safety-related SSCs. All CCW SSCs required for the Phase 3 strategies are fully protected and qualified for all applicable external events.

2.4.4.7 Spent Fuel Pool Cooling

The portion of the SFP cooling system required for cooling the SFP in Phase 3 is safety-related, Seismic Category I by design and is located within the Fuel Building, a Seismic Category I structure. The SFP cooling pumps are supplied power from Class 1E safety-related switchgear and associated controls. The SFP cooling pumps themselves are seismically qualified, safety-related SSCs. The SFP cooling system is protected from all applicable external events.

2.4.4.8 Spent Fuel Pools

The spent fuel pools are Seismic Category I structures located within the Fuel Building, also a Seismic Category I structure. The SFPs are protected from all applicable external events.

2.4.4.9 Ventilation

Ventilation requirements to prevent excessive steam accumulation in the Fuel Building are proceduralized in the FLEX FSIs and direct operators to open doors at different elevations in the Fuel Building to establish a chimney effect. Airflow through these doors provides adequate vent pathways through which the steam generated by SFP boiling can exit the Fuel Building.

2.4.5 FLEX Connections

2.4.5.1 Primary SFP Connection

The primary Phase 2 strategy utilizes a permanently installed overhead spray header fed by two redundant FLEX SFP makeup connections located on the outside of the Fuel Building east wall. Each primary SFP make-up connection is sufficiently sized to maintain SFP levels long term with the loss of SFP cooling and a makeup capacity of approximately 250 gpm per SFP for boil off.

The seismically mounted overhead spray header will provide sufficient SFP makeup via two nozzles per SFP. Check valves are installed in each primary connection flow path to permit a FLEX pump to supply either connection without requiring manual isolation of the non-operating connection. The new external connections are seismically qualified, missile protected and are located outside the Fuel Building just above plant grade elevation. Use of these makeup connections to the spent fuel pools will not require entry into the Fuel Building.

The water source for the primary strategy is either Unit's RWST (however, any water source is acceptable) as suction to a FLEX pump connected to either of the FLEX SFP makeup connections outside the Fuel Building.

2.4.5.2 Secondary SFP Connection

The secondary Phase 2 strategy utilizes another spray option to achieve SFP make-up. The strategy provides flow through three portable spray nozzles set up on the deck next to the SFPs, each capable of flowing approximately 167 gpm. The spray nozzles are connected to the fire protection system via three local hose stations. Two spray nozzles will be aligned to the SFP with the highest decay heat load, if known, and one spray nozzle will be aligned to the other SFP (Figure 11).

The water source for the alternate strategy is the pressurized fire main, which can be pressurized by the diesel driven fire pump with suction from a Fire Protection Storage Tank (if available, non-robust). The underground fire main satisfies the NEI 12-06 requirements for robustness.

Deployment of the portable spray nozzles required to execute this strategy will be performed prior to the Fuel Building becoming uninhabitable and regardless of the potential for primary strategy success. If the secondary strategy is subsequently required, it can be executed from outside the Fuel Building.

2.4.6 Key SFP Parameters

The key parameter for the SFP makeup strategy is SFP water level. The SFP water level is monitored by instrumentation installed in response to Order EA-12-051.

2.4.7 Thermal-Hydraulic Analyses

An analysis was performed that determined with the maximum expected SFP heat load immediately following a core offload, the SFP will reach a bulk boiling temperature of 212°F in approximately 4 hours and boil off to a level 15 feet above the top of fuel racks in 16 hours unless additional water is supplied to the SFP. A flowrate of approximately 110 gpm will replenish the water being boiled off. Initiation of either SFP makeup strategy within 16 hours will provide for adequate makeup to restore SFP level and maintain an acceptable level of water for shielding purposes. See Section 2.16 for discussion of SFP makeup capability following ELAP initiation in a shutdown or refueling configuration.

During non-refueling outage periods of operation with both Units in Modes 1-4, the SFP heat load will be considerably less with bulk boiling occurring at greater than 14 hours and boil off to a level of 15 feet above the top of the fuel racks at greater than 45 hours.

2.4.8 FLEX Pump and Water Supplies

2.4.8.1 Primary Strategy Pumps

The AME pump, if available, or any one of the Multi-Purpose High Flow FLEX pumps, can be used to provide a makeup flowrate of 500 gpm to the overhead spray header. See Section 2.3.10.1 and 2.3.10.3 for pump descriptions. Backup pumps from the NSRC are also capable of providing 500 gpm flow to the overhead spray header.

2.4.8.2 Secondary Strategy Pumps

A diesel driven fire pump can be used to pressurize the fire main sufficient to achieve approximately 500 gpm total flow through the local hose stations to the portable spray nozzles. The diesel driven fire pumps (2) are permanent plant equipment (not portable FLEX pumps) and are described in Section 2.4.4.1.

2.4.8.3 Refueling Water Storage Tank

Either Unit's RWST is the primary water source for deployment of the Phase 2 strategy, though any other available water source (Section 2.3.10.5) that can be aligned to a FLEX pump for feeding the SFPs is acceptable. See Section 2.3.4.8 for RWST description.

2.4.9 Electrical Analysis

Spent fuel pool levels will be monitored by instrumentation installed in response to Order EA-12-051. Instrument power for this equipment has backup battery capacity for 72 hours. Within 72 hours, the NSRC 4160 V generators will be connected to permit energizing one Class 1E 6900 V bus on each Unit. Once any Unit 1 or Unit 2 6900 V bus and associated 480 VAC buses are energized, alternate power will be provided via a lighting panel to the Spent Fuel Pool level instrument cabinets to provide power to all four Spent Fuel Pool level instruments and recharge the associated backup batteries.

Additionally, two high flow low pressure diesel driven pumps supplied by the NSRC will be aligned to provide alternate SSW flow to one existing site CCW heat exchanger. The 4160 V generators from the NSRC will be aligned to power one Class 1E 6900 V bus and associated 480 VAC buses on each Unit, which will provide power to one CCW pump and one SFP cooling pump. The CCW system would be placed in service to provide cooling water to a SFP heat exchanger and the SFP cooling pump restored to service.

The 4160 V equipment being supplied from the NSRC will provide adequate power to perform the noted strategies and are included in calculations to support the sizing of the 2 MW electrical power being provided per Unit (Reference 8).

2.5 Containment Integrity

With an ELAP initiated while either Comanche Peak Unit is in Modes 1-4, containment cooling for that Unit is lost for an extended period of time. Containment temperature and pressure will slowly increase. Increasing containment pressure will not challenge structural integrity of the reactor containment building during an ELAP event. However, without cooling in the reactor containment building, temperature in containment is expected to rise sufficient to challenge equipment qualifications if left unmitigated.

The expected rate of containment temperature rise is low such that no immediate actions are required. However, restoration of containment cooling using two Containment Air Cooling and Recirculation (CACRS) fans (on each Unit) at 72 hours post-ELAP initiation ensures temperature limits are not exceeded and necessary equipment located inside containment remains functional throughout the ELAP event.

See Section 2.16 for a discussion of containment integrity during ELAP events initiated in Mode 5 or 6.

2.5.1 Phase 1 Strategy

The Phase 1 coping strategy for containment involves verifying containment isolation per procedure ECA-0.0A/B and monitoring containment pressure using installed instrumentation. Control room indication using containment intermediate range pressure instruments will be available for the duration of the ELAP.

2.5.2 Phase 2 Strategy

Phase 2 coping strategy is to continue monitoring containment pressure using installed instrumentation.

2.5.3 Phase 3 Strategy

Actions to reduce containment temperature and pressure will utilize existing plant systems restored by off-site equipment and resources during Phase 3.

To implement this option, two high flow low pressure diesel driven pumps supplied by the NSRC will be aligned to provide alternate SSW flow to one existing site CCW heat exchanger. The 4160 V generators from the NSRC will be aligned to power one Class 1E 6900 V bus and associated 480 VAC buses on each Unit (as discussed in Section 2.4.3), which will provide power to one CCW pump, one Ventilation chiller and associated chilled water recirculation pumps, and CACRS fan motors on both Units. The CCW system will be placed in service to provide cooling water to a ventilation chiller and the chiller unit restored to service. Ventilation chilled water would then be established to both Units' containments. Containment ventilation flow would be established by starting two CACRS fans per Unit with air flow through the CACRS fan coil unit and recirculating within each Unit's containment.

2.5.4 Structures, Systems, Components

This section discusses equipment and/or systems, not otherwise discussed in prior sections, that are credited to support FLEX strategy implementation.

2.5.4.1 Ventilation Chilled Water (CHN)

The Ventilation Chilled Water system utilized in the Phase 3 strategy is located primarily within the Auxiliary, Safeguards and Containment Buildings; all Seismic Category I structures that fully protect the equipment from all applicable external hazards. However, a portion of the CHN system piping is routed outside of Seismic Category I structures, and may experience failure during an external event. Because the CHN system is not required for the first 72 hours following ELAP initiation, sufficient resources will be available to perform repairs, as necessary, for timely CHN system restoration.

The CHN recirculation pumps and chillers are non-safety Seismic Category II SSCs, and are supplied power from Class 1E safety-related switchgear and associated controls. All CHN SSCs required for the Phase 3 strategies, excluding system piping routed outside of Seismic Category I structures, are fully protected for all applicable external events.

The ventilation chilled water system, excluding system piping routed outside of Seismic Category I structures, satisfies the NEI 12-06 requirements for robustness.

2.5.4.2 Containment Air Cooling and Recirculation System (CACRS)

The Containment Air Cooling and Recirculation system utilized in the Phase 3 strategy is located within the Containment Buildings which are Seismic Category I structures that fully protect the equipment from all applicable external hazards. The CACRS fans and cooling units are non-safety Seismic Category II SSCs, and are supplied power from Class 1E safety-related switchgear and associated controls. All CACRS SSCs required for the Phase 3 strategies are fully protected for all applicable external events. The CACRS satisfies the NEI 12-06 requirements for robustness.

2.5.5 Key Containment Parameters

Instrumentation providing the following key parameter is credited for all phases of the containment integrity strategy:

Containment Pressure - Containment intermediate range pressure indication is available in the Control Room throughout the event.

2.5.6 Thermal-Hydraulic Analyses

Containment analyses were performed using MAAP (as endorsed by the NRC in Reference 20) concluding that containment temperature and pressure will remain below containment design limits and that key equipment subject to the containment environment will remain functional throughout the ELAP event provided two CACRS fans and ventilation chilled water flow are restored at 72 hours post-ELAP initiation.

2.5.7 FLEX Pump and Water Supply

The NSRC is providing two high flow low pressure diesel driven pumps which will be used to provide alternate Station Service Water flow for cooling various plant loads via one CCW heat exchanger.

The Safe Shutdown Impoundment is necessary for establishing alternate SSW flow and is described in Section 2.3.4.6.

2.5.8 Electrical Analysis

Several options described above required the powering of one 6900 V bus on each Unit. The 4160 V equipment being supplied from the NSRC will provide adequate power to perform the noted strategies and are included in calculations to support the sizing of the 2 MW electrical power being provided per Unit (Reference 8).

2.6 Characterization of External Hazards

2.6.1 Seismic

The Comanche Peak seismic hazard is considered to be the earthquake magnitude associated with the design basis Safe Shutdown Earthquake (SSE) seismic event. Per Final Safety Analysis Report (FSAR) Section 2.5.2.6, the design-basis earthquake for structures has a peak ground motion of 0.12g for horizontal ground motion and two-thirds of that value for vertical ground motion, and is illustrated in FSAR Figure 3.7B-1. For the operating basis earthquake (OBE), the peak horizontal ground acceleration is 0.06g.

In the response to the 50.54(f) letter for NTTF 2.1, Seismic Hazards, the Ground Motion Response Spectra was computed (Reference 24). The peak horizontal ground motion was computed to be 0.0582g which is slightly less than the OBE. Therefore, the seismic hazard for the FLEX response is the site's design basis SSE.

For FLEX strategies, the earthquake is assumed to occur without warning and result in damage to non-seismically designed structures and equipment (unless otherwise evaluated). Non-seismic structures and equipment may fail in a manner that would prevent accomplishment of FLEX-related activities (normal access to plant equipment, functionality of non-seismic plant equipment, deployment of BDB equipment, restoration of normal plant services, etc.).

2.6.2 External Flooding

Comanche Peak Nuclear Power Plant (CPNPP) is located on Squaw Creek Reservoir, which has a normal operating water level at the 775 ft. MSL elevation. The watershed for Squaw Creek Reservoir (SCR) is approximately 64 square miles. Adjacent to the SCR and separated by a Seismic Category I rock fill dam is the Safe Shutdown Impoundment which serves as the ultimate heat sink for Comanche Peak Units 1 and 2. The SSI communicates with the main body of the SCR by an excavated equalization channel such that its normal operating elevation is also at the 775 ft. MSL. The CPNPP site grade is at elevation 810 ft. MSL (FSAR Section 2.4.1.1).

The CPNPP current licensing basis Probable Maximum Flood (PMF) level is based on the guidelines of RG 1.102 and is the same as the definition of Design Basis Flood Level in NEI 12-06 Section 6.2.1. At a PMF level of 789.7' (FSAR Section 2.4.3.5), CPNPP is considered a dry site. The current design basis, as presented in the FSAR for CPNPP Units 1&2, indicates that all safety-related structures, except the Service Water Intake Structure (SWIS) and the Electrical and Control Building, do not require flood protection (FSAR Section 2.4.10). The remaining safety-related structures are not subject to flooding, wave action, or wave run-up due to river flooding from the SCR watershed and do not require flood or wave protection. The SWIS is protected from wind wave run-up on the SCR by the SSI Dam, and the operating deck and safety-related equipment are located above the current design basis PMF level of 789.7 ft. MSL. The Electrical and Control Building is protected from flooding through administrative controls and the use of incorporated barriers in the circulating water system. The maximum calculated water level within the SSI during the PMF is 790.5 ft, which leaves a freeboard within the SSI of 5.5 ft with respect to the SWIS operating deck (FSAR Section 2.4.3.7) and SSI Top-of-Dam crest elevations of 796.0 ft. The maximum SCR wave run-up and setup elevation at the CPNPP Units 1&2 Site due to coincident wind wave activity is 794.7 ft and is not located near a safety-related structure. The maximum wave run-up and setup elevations at the Squaw Creek Dam and SSI Dam are 793.7 and 791.3 ft. respectively (FSAR Section 2.4.5.6).

The potential flooding effects on the Comanche Peak site due to dam breach occurrences were evaluated. There are no dams located upstream of SCR on the Squaw Creek watershed that can contribute to flooding of the SCR or SSI due to seismically induced dam failures. Both the SCR and SSI dams are located downstream of safety-related structures. Since the SSI dam is a Seismic Category I structure, the analysis of dam failure did not include the failure of the SSI dam. Squaw Creek downstream of the SCR and SSI dams empties into the Paluxy River which in turn drains into the Brazos River. Although there are a number of small dams located upstream of the confluence in the Paluxy River watershed, failure effects at the confluence to the Brazos River from any combination of these structures would not exceed more critical dam failure permutations on the Brazos River. The dams located on the Brazos River, the flow from the postulated dam failure will only affect the site as backwater to the downstream side of the SCR dam from the confluence point of the Brazos and Paluxy Rivers at an elevation of approximately 700 ft MSL (FSAR Section 2.4.4.3.4) and not the CPNPP site at 810 ft.

Due to historical meteorological conditions, geographic location, and relatively small body of water within the SCR, the CPNPP site is not expected to be subjected to the effects of ice, storm surge, Seiche or Tsunami flooding. Any such events are bounded by the PMF event due to river flooding.

Another potential source of flooding is the local accumulation of water or ponding due to the local Probable Maximum Precipitation (PMP) event. Given the current design basis precipitation event based on HMR No. 33 methods, the onsite drainage system is designed to adequately drain the governing rainfall event in such a way that runoff does not form ponds on the ground surrounding the safety-related structures nor be sufficient to back up into such structures.

Based on the applicable current design basis flood causing mechanisms, FLEX Phase 1 and Phase 2 strategies will not be affected by external flooding as all strategies occur at site grade elevation 810 ft., above the PMF level or within the safety-related structures not subjected to either the PMF level or ponding effects.

Since submittal of the Overall Integrated Plan (Reference 25), CPNPP has completed and submitted the Flood Hazard Reevaluation Report (FHRR, Reference 26) as supplemented by Reference 27, and associated RAI responses (Reference 28). The reevaluation represents the most current flooding analysis for Comanche Peak Units 1 and 2. The PMF reevaluation results were not bounded by the original Comanche Peak FSAR site flooding vulnerabilities but were still reported to be less than the site grade or that of safety-related equipment and structures.

Luminant Power will perform a Mitigating Strategies Assessment by February 11, 2017 using the flooding parameters and assumptions identified in a letter to the NRC dated February 3, 2016 (Reference 29), NRC letter dated February 11, 2016 (Reference 32), and Appendix G of NEI 12-06, Revision 2 (Reference 30) as endorsed by JLD-ISG-2012-01, Revision 1 (Reference 31).

The CPNPP FHRR has been reviewed by the NRC and their interim staff assessment was submitted to CPNPP via NRC letter dated February 11, 2016 (Reference 32). The NRC staff concluded that the licensee's reevaluated flood hazards information is suitable for the assessment of mitigating strategies developed in response to Order EA-12-049 for Comanche Peak.

As part of the overall flood hazards response to the 50.54(f) request, CPNPP will be performing a focused evaluation in accordance with the Flooding Impact

Assessment Process (FIAP) as prescribed by NEI 16-05 (Reference 37). The FIAP provides methods for demonstrating the adequacy of the existing plant design and mitigating strategies for responding to the re-evaluated flooding hazards that exceed a facility's design basis flood level. It is anticipated the NRC will issue guidance (i.e., JLD-ISG-2016-01) for use of NEI 16-05 with clarifications.

2.6.3 Severe Storms with High Wind

Current plant design bases address the storm hazards of high winds and tornados. Seismic Category I structures are designed for a basic maximum wind velocity of 80 mph at 30 ft above ground based on a 100-year period of recurrence (FSAR Section 3.3.1.1).

The design basis tornado has a peripheral tangential velocity of 300 mph, and a translational velocity of 60 mph. Seismic Category I buildings are vented to the atmosphere in the event of a tornado. These buildings are designed to withstand the loadings due to wind, depressurization and re-pressurization, and tornado generated missiles. These buildings are also designed to provide protection from the tornado and its effects to Seismic Category I systems and components within these structures (FSAR Section 3.3.2).

2.6.4 Ice, Snow and Extreme Cold

Average annual snowfall of less than 3 inches is expected (FSAR Section 2.3.2.1.5). Per NEI 12-06, Revision 0, for plants located below the 35th parallel, extreme snowfall need not be considered as an impedance for FLEX strategy deployment. Comanche Peak is located below the 33rd parallel (FSAR Section 2.1.1.1).

Ice storms occur occasionally in the region during the period December through March. Moderate to heavy ice storms can be quite damaging to utility lines and trees as well as being a serious traffic hazard. FSAR Section 2.3.1.2.8 states the worst ice storm on record in the Dallas-Fort Worth area occurred on January 6-9, 1937. As much as two inches of ice formed and did not disappear until January 12. Communications were disrupted and highway traffic was extremely hazardous. Since winter snow and ice storms are not accompanied by tornados, the non-credited normal site snow and ice removal equipment, along with the credited Bobcat, will be able to clear the haul paths for deployment of the Phase 2 FLEX equipment.

Temperatures in the site region occasionally fall below 32°F (FSAR Section 2.3.1.1). The lowest temperature recorded in Fort Worth was 4°F in January 1964 (FSAR Table 2.3-15). The FSAR information is limited to data from 1931 to 1973. From published data for the time period between 1973 and 2011, the lowest temperature recorded in Fort Worth was -1°F in December 1989. Equipment required for FLEX strategy implementation in Phases 2 and Phase 3 is not expected to be challenged when operating at this temperature.

2.6.5 High Temperatures

Summer time outdoor temperatures in the site region often exceed 100°F (FSAR Section 2.3.1.1). The peak temperature recorded in Fort Worth was 108°F in August 1964 (FSAR Table 2.3-15). The FSAR information is limited to data from 1931 to 1973. From published data for the time period between 1973 and 2011, the peak temperature recorded in Fort Worth was 113°F in June 1980. Equipment required for FLEX strategy implementation in Phases 2 and Phase 3 is not expected to be challenged when operating at this temperature.

2.7 Planned Protection of FLEX Equipment

All credited Phase 2 portable FLEX equipment is stored in the FLEX Equipment Storage Building, located northeast of the Protected Area. The FLEX Equipment Storage Building was designed, constructed and built to protect the equipment from all applicable external hazards identified in Section 2.6.

The FLEX equipment and supplies staged in the FLEX Equipment Storage Building will be stored in accordance with existing site procedures to ensure no adverse interactions during a seismic event. This is very conservative in that the site procedures were developed for the highest plant elevations with safety-related equipment whereas the FLEX equipment is located on the basemat of a single story building.

Debris removal equipment is also stored inside the FLEX Equipment Storage Building in order to be reasonably protected from the applicable external events such that the equipment will remain functional and deployable to clear obstructions from the pathway between the FLEX equipment's storage location and its deployment location. This mobile equipment includes one Pettibone and one Bobcat track loader (Reference 8). Tow straps will be provided for the pickup trucks and water trucks to move vehicles and debris. In addition, two acetylene cutting torch setups will be staged to facilitate large debris removal.

Deployment of the FLEX and debris removal equipment from the FLEX Equipment Storage Building is not dependent on off-site power. All actions are accomplished manually with the use of FLEX equipment power sources.

Most of the credited Phase 3 portable FLEX components stored onsite are located in the FLEX Equipment Storage Building. The remaining Phase 3 components are either stored in a hardened structure (Fuel Building Service Water tunnel) capable of surviving all applicable external hazards, or are stored with sufficient separation (see Section 2.4.4.5).

2.8 Planned Deployment of FLEX Equipment

2.8.1 Haul Paths and Accessibility

Pre-determined, preferred haul paths have been identified and documented in the FLEX FSIs. Figure 1 shows the haul path from the FLEX Equipment Storage Building to the Alternate Access Point (AAP). Figure 2 shows the haul paths from the AAP to the various deployment locations within the Protected Area. These haul paths have been reviewed for potential soil liquefaction and have been determined to be stable following a seismic event. Additionally, the preferred haul paths have avoided areas with trees, narrow passages, etc. to the extent possible. However, high winds can cause debris from adjacent or distant sources to interfere with planned haul paths. Debris removal equipment is stored inside the FLEX Equipment Storage Building to be protected from the severe storm and high wind hazards such that the equipment remains functional and deployable to clear obstructions from the pathway between the FLEX Equipment Storage Building and its deployment location.

Transmission lines can impede deployment of FLEX equipment along the pre-determined haul paths. In this case, the power lines will be grounded and moved out of the deployment path.

The potential impairments to required access are: (1) doors and gates, and (2) site debris blocking personnel or equipment access. The coping strategy to maintain site accessibility through doors and gates is applicable to all phases of the FLEX coping strategies, but is immediately required as part of the time sensitive activities required during Phase 1.

Doors and gates serve a variety of barrier functions on the site. One primary function is security and is discussed below. However, other barrier functions include fire, flood, radiation, ventilation, tornado, and HELB. As barriers, these doors and gates are typically administratively controlled to maintain their function as barriers during normal operations. Following a BDB external event and subsequent ELAP event, FLEX coping strategies require the routing of hoses and cables to be run through various barriers in order to connect FLEX equipment to station fluid and electric systems. For this reason, certain barriers (gates and doors) will be opened and remain open. This violation of normal administrative controls is acknowledged and is acceptable during the implementation of FLEX coping strategies.

The ability to open doors for ingress and egress, ventilation, or temporary cables/hoses routing is necessary to implement the FLEX coping strategies. The physical security program utilizes doors and various barriers that rely on electric power to operate opening and/or activate locking mechanisms. Upon loss of power, the security organization will contact the Control Room Shift Manager to evaluate the suspension of security access and controls. Security will implement established instructions in coordination with the suspension of security access and controls to cope with the BDB accident. Access to the Owner Controlled Area, Protected Area, and Vital Areas of the plant will be controlled and implemented by security personnel.

The deployment of onsite FLEX equipment to implement coping strategies beyond the initial plant capabilities requires that pathways between the FLEX Equipment Storage Building and various deployment locations be clear of debris resulting from seismic or high wind (tornado) events.

The stored FLEX equipment includes multiple tow vehicles equipped with rear and/or front tow connections to move debris from the needed travel paths. A Pettibone and a Bobcat track loader will also be available to deal with more significant debris conditions.

Vehicle access to the Protected Area is via the double gated sally-port with pop-up vehicle barrier protection. As part of the security access contingency, the sally-port pop-up barriers will be manually lowered to allow delivery of FLEX equipment and other vehicles such as debris removal equipment into the Protected Area.

Phase 3 of the FLEX strategies involves the receipt of equipment from offsite sources including the NSRC and various commodities such as fuel and supplies. Transportation of these deliveries can be through airlift or via ground transportation. Debris removal for the pathway between the Protected Area and the NSRC receiving location and from the various plant access routes may be required. Regional and/or local offsite resources will be deployed for debris removal between these routes and pathways.

2.9 Deployment of Strategies

2.9.1 AFW Makeup Strategy

The Safe Shutdown Impoundment provides an essentially indefinite supply of water, as make-up to the CST for supply to the TDAFW pump or the portable SG/AFW Low Pressure FLEX pump (if TDAFW pump fails). The SSI will remain available for any of the external hazards listed in Section 2.6. Figure 3 provides a diagram of the flowpath and equipment utilized to facilitate this water supply. A portable, diesel driven Multi-Purpose High Flow FLEX pump will be transported from the FLEX Equipment Storage Building to a location north of the Service Water Intake Structure. A flexible hose and eductor will be routed from the pump suction and lowered into the SSI, south of one of the travelling screens. The trash rack and the eductor inlet provide straining to limit solid debris size for pump protection. A flexible hose will be routed from the Multi-Purpose High Flow FLEX pump discharge to a ring header then to the CST makeup connection.

The CST makeup connection is located inside the Seismic Category I CST valve room. The connection is protected from all applicable external hazards described in Section 2.6.

The SG/AFW Low Pressure FLEX pumps for backup SG injection are stored in the FLEX Equipment Storage Building and are protected against all applicable external hazards. Each pump will be deployed to an area near its discharge connection.

The SG/AFW Low Pressure FLEX pump discharge primary connections for backup SG injection are located within the Seismic Category I, missile protected Safeguards Building. The connections are protected from the external hazards described in Section 2.6.

The SG/AFW Low Pressure FLEX pump discharge secondary connections for backup SG injection are located within the Seismic Category I, missile protected portion of the CST valve room and the Safeguards Building. The connections are protected from the external hazards described in Section 2.6.

In Phase 3, a mobile water purification unit will be received from the NSRC and will be placed in-line with the CST makeup from the SSI. The water purification unit will be installed within 72 hours of event initiation, improving SSI water quality used for CST makeup in order to significantly extend the time to reach SG corrosion and/or precipitate limits.

2.9.2 RCS Strategy

The High Pressure RCS Injection FLEX pumps are stored in the FLEX Equipment Storage Building and are protected against all applicable external hazards. Each pump will be deployed to an area near its discharge connection.

The primary and secondary connections for the High Pressure RCS Injection FLEX pump discharge are located inside of the Safeguards Building of each Unit and provide a flow path to the RCS cold legs of that Unit. These connections are protected against all applicable external hazards.

The supply connections from the BAT for the High Pressure RCS Injection FLEX pumps are located in the Auxiliary Building and are protected against all external hazards. Additional supply is from the protected RWST following BAT depletion. The suction connection from the RWST is located in the RWST valve room and is also protected against all external hazards.

2.9.3 Electrical strategy

Two 120/240 VAC portable 12 kW diesel generators, one for each Unit, will be deployed from the FLEX Equipment Storage Building and positioned as follows:

- Primary, non-credited strategy - Turbine Deck near the Control Room missile door
- Secondary, credited strategy - South or North Turbine Building (TB) 810' entrance.

Each generator will have one output circuit connected to a distribution panel. Each distribution panel will power (Figure 13):

- Three 240 V fans for Control Room forced ventilation (see Section 2.11.1.1)
- One 120 V UPS to power instrumentation (alternate power for RVLIS and Source Range, see Section 2.3.6)
- Multiple outlets to power supplemental Control Room lighting (see Section 2.13).

Another 120/240 VAC portable 12 kW diesel generator will be deployed from the FLEX Equipment Storage Building and positioned at one of the following locations, depending on debris and area accessibility. All of the following deployment locations will require power cables to transit through non-seismic structures:

- Primary - Near U1 TB south 810' entrance
- Alternate 1 – Near U1 Safeguards Building 810' hallway missile door
- Alternate 2 – Near U2 TB north 810' entrance.

The generator will have one output circuit connected to a distribution panel. The distribution panel will power (Figure 14):

- Three 240 V fans for battery/inverter rooms forced ventilation (see Section 2.11.1.3)
- Multiple outlets to power supplemental lighting (see Section 2.13).

The Phase 2 480 VAC generators and cables will be stored in the FLEX Equipment Storage Building. There are two 480V diesel generators, where only one generator is needed to implement this strategy for both Units. The other generator is needed to satisfy the N+1 requirement. Each generator is mounted to its own trailer. One set of generator cables including spare cables will be stored on a single trailer. Each cable is stored on its own cable reel which is mounted to the trailer.

The cable trailer and one 480 VAC diesel generator will be deployed to Staging Area A1 to the east of transformer 2ST. The generator can be connected to a primary or secondary connection point. The primary connection is located outside at panel XB10-1. In the event the primary connection panel is unusable, the generator can be connected to the secondary connection box located in the Unit 2 Train A Switchgear Room at panel XB10-1-4.

The primary connection and the generator cables are equipped with color coded cam lock connectors to ensure proper connection. Once the generator is connected, power can be supplied to designated loads. Although there is the ability to connect four battery chargers, two battery room exhaust fans, and one High Pressure RCS Injection FLEX pump per Unit, the generator is sized to power three battery chargers, two battery room exhaust fans, and one High Pressure RCS Injection FLEX pump per Unit at any given time (Figure 9b).

The secondary connection and the generator cables are also equipped with color coded cam lock connectors to ensure proper connection. When the generator is connected to the secondary connection, Panels XB10-1-3 and 2B10-1-1 can only supply two battery chargers and two battery room exhaust fans each at any given time (Figure 10b).

In Phase 3, two 1 MW 4160 V diesel turbine generators per Unit will be brought in from the NSRC and will be used to re-energize one 6900 V safeguard AC bus on each Unit. To prevent generator overload and provide optimum flexibility and diversity of equipment, one Train A bus is energized on one Unit and one Train B bus is energized on the opposite Unit. This alignment allows recovery of the train-related

480 VAC buses and both trains of common 480 VAC motor control centers, common 118 VAC distribution panels, and common 125 VDC switch panels.

The two 1MW 4160 V generators per Unit will be connected to an NSRC supplied 4160 V distribution system and then to a 4160 V/6900 V step-up transformer (stored onsite in the FLEX Equipment Storage Building) in order to meet the 6900 V load requirements. The generators for Unit 1 will be deployed to the area east of the Unit 1 Emergency Diesel Generator building (Figure 12a). The generators for Unit 2 will be deployed to the north and west of the Unit 2 Emergency Diesel Generator building (Figure 12b). One 4160 V/6900 V step-up transformer and grounding transformer for each Unit will be deployed from the FLEX Equipment Storage Building to be staged at the locations of the 4160 V generators. The NSRC will supply cables for connections between the 4160 V distribution systems, step-up transformers and the Phase 3 bus connections.

Using the primary connection, the 4160 V/6900 V step-up transformers will be connected to existing Alternate Power Generator transfer switches mounted external to the Unit 1 Train A Switchgear Room (Figure 12a) and external to the Unit 2 Train A Switchgear Room (Figure 12b). The transfer switches allow powering one 6900 V safeguards bus per Unit (either Train).

If the primary connections are unavailable, the 4160 V/6900 V step-up transformers can be connected either directly to each Unit's Train A 6900 V safeguards bus via feeder breakers located in each Unit's Train A Switchgear Room, or to each Unit's Train B EDG Generator Exciter panel located in each Unit's Train B EDG Room (Figures 12a and 12b).

2.9.4 Fueling of Equipment

The FLEX strategies for maintenance and/or support of safety functions involve several elements including the supply of fuel to necessary diesel powered generators, pumps, hauling vehicles, compressors, etc. The general coping strategy for supplying fuel oil to diesel driven portable equipment, i.e., pumps and generators, being utilized to cope with an ELAP / LUHS, is to draw fuel oil out of any available existing diesel fuel oil tanks on the Comanche Peak site.

The primary source of fuel oil will be the four underground Diesel Generator Fuel Oil Storage Tanks (DGFOST). Each tank has a nominal storage capacity of 102,000 gallons. The Technical Specification minimum required volume of stored fuel oil is approximately 86,000 gallons (per EDG) and includes fuel oil stored in the DGFOST as well as the small fuel oil day tank. The fuel oil day tank is not credited in the FLEX strategies. As nuclear safety-related, Seismic Category I components, these tanks are protected from high wind tornado missile by virtue of the underground location and are also protected from seismic events. Fuel can be obtained using a fuel transfer pump to pump the fuel oil to suitable fuel containers for transport. Fuel transfer tanks and pumps are stored in the FLEX Equipment Storage Building.

Diesel fuel in the fuel oil storage tanks is routinely sampled and tested to assure fuel oil quality is maintained to ASTM standards. This sampling and testing surveillance program also assures the fuel oil quality is maintained for operation of the station Emergency Diesel Generators.

The DGFOST sources will be used to refill the two trailer mounted fuel tanks stored in the FLEX Equipment Storage Building. Each trailer mounted fuel tank has a capacity of approximately 500 gallons and includes a diesel powered pump for filling the tank from a source and an electric pump for transferring tank contents. These tanks will be deployed from the FLEX Equipment Storage Building in order to refill the fuel tanks of the in-service portable FLEX equipment. All portable equipment stored within the FLEX Equipment Storage Building, including the trailer mounted fuel tanks, will be maintained full of fuel such that refueling from the DGFOSTs will not be required for greater than 30 hours after event initiation.

The DGFOSTs have sufficient capacity to support continuous operation of the major FLEX equipment expected to be deployed and placed into service following a BDB external event. The four underground DGFOSTs, which are protected from all external hazards, have adequate capacity to provide the on-site FLEX equipment with diesel fuel for several weeks following ELAP initiation.

The diesel fuel consumption information above does not include fuel requirements for the large 4160 V generators to be received from the NSRC. Each of the four 1MW diesel turbine generators will consume diesel fuel at the rate of approximately 100 gallons per hour. For these generators, diesel fuel is available on site from the underground DGFOSTs and local offsite resources are available to replenish onsite fuel oil supplies, as needed.

2.10 Offsite Resources

2.10.1 National SAFER Response Center

The industry has established two National SAFER Response Centers to support utilities during ELAP events. Luminant has established contracts with the Pooled Equipment Inventory Company to participate in the process for support of the NSRCs as required. For generic equipment available to all utilities, each NSRC will hold five sets of equipment, four of which will be able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle. For non-generic equipment available to only a subset of utilities, the number of equipment sets maintained at each NSRC may be different than five. On-site FLEX equipment hose and cable end fittings are standardized, where possible, with the equipment supplied from the NSRC, or adapters are provided for fit-up to NSRC equipment.

In the event of an external event and subsequent ELAP/LUHS condition, the required sets of generic and non-generic equipment will be moved from an NSRC to a local assembly area established by the Strategic Alliance for FLEX Emergency Response (SAFER) team. For Comanche Peak, the local assembly area is the NOSF

Annex Building parking lot, Staging Area B. In the event that the NSRC trucks cannot get through to the site, agreements are in place to use the Granbury Regional Airport (Staging Area C) and the Cleburne Regional Airport (Staging Area D) as the off-site staging areas. From there, equipment can be taken to the Comanche Peak site and staged at Staging Area B by helicopter. Communications will be established between the Comanche Peak plant site and the SAFER team via satellite phones and required equipment moved to the site as needed. First arriving equipment will be delivered to the site within 24 hours from the initial request. The order in which equipment is delivered is identified in the Comanche Peak Nuclear Power Plant SAFER Response Plan.

2.10.2 Equipment List

The equipment stored and maintained at the NSRC for transportation to Staging Area B to support the response to an ELAP event at Comanche Peak is listed in Table 4. Table 4 identifies the equipment that is specifically credited in the FLEX strategies for Comanche Peak but also lists the equipment that will be available for backup/replacement should on-site equipment break down. Since all the equipment will be located at Staging Area B, the time needed for the replacement of a failed component will be minimal.

2.11 Habitability and Operations

2.11.1 Equipment Operating Conditions

Following a BDB external event and subsequent ELAP event at Comanche Peak, ventilation providing cooling to occupied areas and areas containing FLEX strategy equipment will be lost. Per the guidance given in NEI 12-06, FLEX strategies must be capable of execution under the adverse conditions (unavailability of installed plant lighting, ventilation, etc.) expected following a BDBEE resulting in an ELAP/LUHS. The primary concern with regard to ventilation is the heat buildup which occurs with the loss of forced ventilation in areas that continue to have heat loads. Loss of ventilation analyses were performed to quantify the maximum transient and steady state temperatures expected in specific areas related to FLEX implementation to ensure the environmental conditions remain acceptable for personnel habitability and within equipment functional limits.

The key areas identified for all phases of execution of the FLEX strategy activities are the Control Room, the TDAFW pump rooms, the battery and inverter rooms, the SG ARV area and the Fuel Building. These areas were evaluated to determine the temperature profiles following an ELAP/LUHS event as discussed below.

2.11.1.1 Control Room

Habitability and equipment functionality are assured for Control Room temperature less than 104°F. Loss of ventilation analysis has determined Control Room temperature will not exceed 104°F for the first 32 hours after

ELAP initiation. The FSIs prioritize deployment of small generators and portable fans to external Control Room doors prior to 32 hours (see Section 2.9.3 and Figure 13) to maintain acceptable Control Room temperature.

2.11.1.2 TDAFW Pump Room

Accessibility and equipment functionality are assured for TDAFW pump room temperatures less than 122°F. Loss of ventilation analysis has determined TDAFW pump room temperature will not exceed 122°F for the first 40 hours after ELAP initiation, and that blocking open the TDAFW pump room door is sufficient to maintain room temperature less than 122°F throughout an ELAP. The FSIs direct blocking open the TDAFW pump room doors relatively soon after ELAP initiation, well before 40 hours after ELAP initiation.

2.11.1.3 Battery and Inverter Rooms

Loss of ventilation analyses for the battery and inverter rooms determined the following operator actions are required to maintain equipment functionality and accessibility.

1. Block open the battery and inverter room doors at 5.5 hours (Reference 8),
2. Block open adjacent stairwell doors, roof access doors, and the Cable Spreading room door at 12 hours,
3. Block open external doors from the Cable Spreading room and deploy portable fans at 18 hours (see Section 2.9.3 and Figure 14).

An additional ventilation concern applicable to Phase 2 is the potential buildup of hydrogen in the battery rooms. Off-gassing of hydrogen from station batteries is only a concern when the station batteries are charging. Once a 480 VAC power supply is restored in Phase 2 and the station batteries begin re-charging, power is also restored to the battery room ventilation fans to prevent any significant hydrogen accumulation.

2.11.1.4 SG ARV Area

Loss of ventilation analysis has determined SG ARV area equipment functionality and accessibility will be maintained throughout an ELAP event with no required operator action.

2.11.1.5 Fuel Building

External doors to the Fuel Building will be opened at different elevations to create a chimney effect for venting the SFP area. Operator action to open these external doors and stage equipment required to implement the alternate SFP makeup strategy will be performed prior to the SFP area becoming inaccessible. The primary SFP makeup strategy does not require

Fuel Building access. SFP level instrumentation required per NRC Order EA-12-051 will remain functional in the Fuel Building environment expected during an ELAP.

2.12 Personnel Habitability

Personnel habitability was evaluated in Section 2.11 and determined to be acceptable.

2.13 Lighting

Emergency lighting systems installed to satisfy Station Blackout and Appendix R requirements will be available for the first 8 hours of the event. These lighting fixtures are positioned strategically around the plant in areas that will be required by the FLEX strategies.

Lighting for access into and egress out of a majority of areas in the Unit is provided by emergency DC-powered lighting. In addition, portable lights and batteries which may be required to perform some local actions are provided to the operators in tool kits that are distributed throughout the plant and marked for "Emergency Use Only". A sufficient number of these tool kits are located in areas illuminated by emergency DC-powered lighting.

The Emergency Lighting system is designed to provide adequate illumination during safe shutdown of the plant for normal plant shutdown or as a result of fire with the loss of all AC sources. This lighting is provided by 8 hour rated battery packs.

CPNPP maintains a tool room inside the RCA that contains dozens of portable lights and hundreds of spare batteries. This equipment is stocked for daily use. While not specifically created as an emergency facility, this equipment would be readily available during an event.

An ample supply of battery powered head lamps, LED lanterns, and hand-crank LED flashlights are staged in the FLEX Equipment Storage Building. Lighting within the FLEX Equipment Storage Building will be restored using one 12kW generator, also stored within the building.

Supplemental lighting for the Control Room will be provided by LED light rope(s). The light rope(s) will be powered from either or both of the two 12 kW portable generators deployed for Control Room forced ventilation and instrumentation (see Section 2.9.3).

Supplemental lighting to assist in the deployment and maintenance of the forced ventilation strategy for the battery and inverter rooms will be provided by LED light rope(s). The light rope(s) will be powered by the 12 kW portable generator deployed for battery/inverter room force ventilation (see Section 2.9.3).

Exterior illumination will be provided by use of the four diesel engine powered portable light towers that are stored in the FLEX Equipment Storage Building and with the diesel powered portable light towers being provided in the Phase 3 response from the NSRC.

Additionally, each of the Multi-Purpose High Flow and SG/AFW Low Pressure FLEX pumps is equipped with a light package for local illumination.

2.14 Communications

The Comanche Peak Units 1 and 2 communications systems and equipment are designed and installed to assure reliability of on-site and off-site communications in the event of a Design Basis Accident scenario. However, in the event of an ELAP, limited communications systems will be available. A standard set of assumptions for a BDB ELAP event is identified in NEI 12-01 (Reference 12).

2.14.1 Onsite

The communications strategy involving permanent plant equipment can use sound-powered phone headsets to communicate between the Control Room and remote equipment locations (e.g., TDAFW pump, SG ARVs, etc.).

The Sound-Powered Phones subsystem is a multiple-channel system connecting all operating areas of Units 1 and 2. The operation of this system is not dependent on the availability of the electric power system. The Sound-Powered Phones subsystem includes disconnect switches allowing isolation of portions of the system located in non-seismic structures from that portion of the system located in Seismic Category I structures, ensuring system availability during an ELAP event.

Headsets consisting of earphones and a microphone are connected to a two-wire channel for direct communication between persons in different areas. There are a sufficient number of dedicated sets of sound-powered phone headsets and cords available for the implementation of the FLEX strategies.

Indoor and outdoor locations where temporary FLEX equipment is used may be served with either hand-held radios, satellite phones, or sound-powered phone headsets connected to nearby jacks.

Hand-held radios are available to facilitate communication and coordination of the FLEX strategies. Sufficient batteries and chargers are also available.

2.14.2 Off-Site

Satellite phones are the only reasonable means to communicate off-site when the telecommunications infrastructure surrounding the nuclear site is non-functional. They connect with other satellite phones as well as normal communications devices.

NEI 12-01, Section 4.1 outlines the minimum communication pathways to the federal, state, and local authorities. Satellite phones are available for offsite communications. These phones are distributed between the Control Room, the Technical Support Center, Alternate Emergency Operating Facility, FLEX Equipment Storage Building, County Emergency Operations Center, Joint Information Center and the Duty Manager.

All of the satellite phones are portable and are to be used outside buildings or structures. The phones will be used for an indefinite time with spare batteries available in the FLEX Equipment Storage Building.

Additionally, a mobile satellite system providing internet access and a wireless hotspot will be deployed locally, enabling communications to provide American Red Cross Safe and Well updates as well as enhanced communications with offsite agencies. The mobile satellite system will automatically create a wired or wireless high-speed network for any in-range device.

2.15 Water sources

2.15.1 Non-Borated Water Sources

Table 2 provides a list of potential water sources that may be used to provide cooling water to the SGs or the SFP, their capacities, and an assessment of availability following the applicable external hazards identified in Section 2.6. As noted in Table 2, at least three water sources would survive all applicable external hazards for Comanche Peak and are credited for use in FLEX strategies. The deployment of each strategy is performed prior to the TDAFW pump losing suction. Non-robust water sources are also identified in Table 2 and are in the sequence in which they would be utilized, based on their availability after an ELAP/LUHS event.

The on-site water sources have a wide range of associated chemical compositions. Therefore, extended periods of operation with the addition of these various on-site water sources to the SGs were evaluated for impact on long term SG performance and SG material (e.g., tube) degradation and potential impact on the heat transfer capabilities of the SGs. Use of the available clean water sources are limited only by their quantities. The water supply from SSI is essentially unlimited by quantity, but is limited by quality.

The results of a water quality evaluation show that raw water from the SSI could be used for 48 hours (after CST/RMUWST depletion) and purified water from the SSI could be used for another 216 hours before the SG design corrosion limit or precipitate limit would be expected to be reached. Exceeding the expected time to reach the SG design corrosion limit would have an insignificant impact on the ability of the SGs to remove core decay heat from the RCS at its reduced temperature/pressure conditions. However, reaching the SGs limiting precipitation levels could potentially impact the SGs heat transfer capabilities.

The results of the water quality evaluation show that the credited, fully protected, on-site water sources provide for an adequate AFW supply source for a longer time than would be required for the delivery and deployment of the Phase 3 NSRC water purification equipment (Figure 15) to remove impurities from the on-site natural water sources. Once the water purification equipment is in operation, the credited, fully protected on-site water sources provide for approximately 12 days (total) of SG feed before SG corrosion or precipitate limits are challenged. The non-protected non-borated water sources provide significant quantities of additional CST makeup, if available following ELAP initiation. It is expected that the Residual Heat Removal system will be restored prior to 12 days post-ELAP initiation.

2.15.2 Borated Water Sources

The available borated water sources are the Boric Acid Tanks and the Refueling Water Storage Tanks. See Sections 2.3.4.7 and 2.3.4.8, respectively, for their descriptions. These tanks are sufficiently sized such that RCS makeup capability will exist until restoration of permanent plant equipment in the recovery phase.

2.16 Shutdown and Refueling Analysis

As discussed in Reference 8, Comanche Peak has incorporated the guidance provided in the NEI position paper entitled "Position Paper: Shutdown/ Refueling Modes" (Reference 33), addressing mitigating strategies in shutdown and refueling modes. The NEI position paper was endorsed by the NRC in Reference 34.

The shutdown mode FLEX strategies were developed using the generic guidance provided in Abnormal Response Guideline ARG-4 (Reference 35) and were further refined using the results of site-specific analyses of the conditions present during the five plant states evaluated in PWROG-14073 (Reference 36). These site-specific strategies identified actions consistent with the supplemental guidance of Reference 33 necessary to further increase safety in the shutdown and refueling modes.

Specifically, the AME pump (Section 2.3.10.3 and Table 3) will be pre-staged near the outage Unit's CST and RWST, allowing for timely makeup to the steam generators or the reactor coolant system using previously discussed FLEX connections (Section 2.3.5), as necessary following initiation of an ELAP. Because the AME pump is not credited in any FLEX strategy as a component of any N+1 set of FLEX pumps, its potential loss during an external event due to its pre-staging does not reduce the availability of credited FLEX pumps (stored in the FLEX Equipment Storage Building).

Additionally, on the outage Unit, the 30-inch Containment Emergency Airlock will have its inner door secured in a partial open position and its outer door staged for opening, to provide an adequate containment vent as necessary following initiation of an ELAP. This vent path is of sufficient size such that significant containment pressurization during an ELAP cannot occur. During a shutdown condition when the Containment Emergency Airlock is the credited containment vent path, responsibility for opening the outer door as directed by the Control Room is assigned to a designated individual each shift by procedure.

These actions are consistent with the following Reference 33 supplemental guidance:

- Maintain FLEX equipment necessary to support shutdown risk processes and procedures readily available,
- Deploy or pre-stage equipment necessary to support maintaining or restoring key safety functions in the event of a loss of shutdown cooling, and

- In cases where FLEX equipment would need to be deployed to locations that would quickly become inaccessible as a result of a loss of decay heat removal from an ELAP event, pre-staging of that equipment is required.

2.17 Sequence of Events

Table 1 presents a Sequence of Events timeline for an ELAP/LUHS event at Comanche Peak. The documented times are considered to be reasonable based on site reviews, completed validation of FLEX strategies, and proximity of the FLEX Equipment Storage Building to the Protected Area access point. Debris removal equipment is stored in the FLEX Equipment Storage Building.

2.18 Programmatic Elements

2.18.1 Overall FLEX Program Document

The FLEX Program Document, contained in station procedure STA-250, "Beyond Design Basis External Events (BDBEE) FLEX Program," is an overview document which provides a description of the FLEX program for Comanche Peak. The program description includes explicitly, or by reference, (1) a list of the BDB FLEX basis documents that will be kept up to date for facility and procedure changes, (2) a historical record of previous strategies and their bases, and (3) the bases for ongoing maintenance and testing activities for the FLEX equipment.

The instructions required to implement the various elements of the FLEX Program and thereby ensure readiness in the event of a Beyond Design Basis External Event are contained in site procedures.

Design control processes ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies. Changes for the FLEX strategies will be reviewed with respect to operations critical documents to ensure no adverse effect.

Future changes to the FLEX strategies may be made without prior NRC approval provided (1) the revised FLEX strategies meet the requirements of NEI 12-06, and (2) an engineering basis is documented that ensures that the change in FLEX strategies continues to ensure the key safety functions (core and SFP cooling, containment integrity) are met.

2.18.2 Procedural Guidance

The inability to predict actual plant conditions that require the use of FLEX equipment makes it impossible to provide specific procedural guidance. As such, the FSIs provide guidance that can be employed for a variety of conditions. Clear criteria for entry into FSIs ensure that FLEX strategies are used only as directed for BDB external event conditions, and are not used inappropriately in lieu of existing procedures. When FLEX equipment is needed to supplement EOP or Abnormal

Procedure (ABN) strategies, the EOP or ABN directs the entry into and exit from the appropriate FSI procedure.

FLEX strategy support instructions were developed in accordance with PWROG guidelines as implemented in STI-203.01, "Preparation of FLEX Support Instructions." FLEX support instructions provide available, pre-planned FLEX strategies for accomplishing specific tasks in the EOPs or ABNs. FSIs are used to supplement (not replace) the existing procedure structure that establishes command and control for the event, as discussed in STI-204.01, "FSI Rules of Usage."

Procedural interface has been incorporated into ECA-0.0A/B, "Loss of All AC Power" for events occurring in Modes 1-4 to the extent necessary to include appropriate reference to FSIs and provide command and control for the ELAP. However, for events initiated in Modes 5 and 6, procedure ABN-601, "Response to 138/345 kV System Malfunction," is initially entered, where command and control of the ELAP response is then transitioned to the FSI procedures.

FSI procedure maintenance is performed by the Operations Procedures group via STA-202, "Nuclear Generation Procedure Change Process." In accordance with STA-707, "10CFR50.59 and 10CFR72.48 Reviews," both NEI 96-07 Revision 1, and NEI 97-04 Revision 1 are to be used to evaluate changes to current procedures including the FSIs, to determine the need for prior NRC approval. However, per the guidance and examples provided in NEI 96-07, Rev. 1, changes to procedures (EOPs, ABNs, Extreme Damage Mitigation Guidelines, Severe Accident Management Guidelines, or FSIs) that perform actions in response to events that exceed a site's design basis should screen out. Therefore, procedure steps which recognize the BDB ELAP/LUHS has occurred and which direct actions to ensure core cooling, SFP cooling, or containment integrity should not require prior NRC approval.

FSIs have been reviewed and validated to the extent necessary to ensure the strategy is feasible. Validation was accomplished in accordance with station procedure STI-250.01, "FLEX Strategy Validation Process."

2.18.3 Staffing

Using the methodology of NEI 12-01, an assessment of the capability of CPNPP on-shift staff and augmented Emergency Response Organization (ERO) to respond to a BDBEE was performed.

The assumptions for the NEI 12-01 Phase 2 scenario postulate that the BDBEE involves a large-scale external event that results in:

1. An extended loss of AC power
2. An extended loss of access to ultimate heat sink
3. Impact on Units (all Units are in operation at the time of the event)
4. Impeded access to the Units by off-site responders as follows:

- 0 to 6 Hours Post Event – No site access.
- 6 to 24 Hours Post Event – Limited site access. Individuals may access the site by walking, personal vehicle or via alternate transportation capabilities (e.g., private resource providers or public sector support).
- 24+ Hours Post Event – Improved site access. Site access is restored to a near-normal status and/or augmented transportation resources are available to deliver equipment, supplies and large numbers of personnel.

A team of subject matter experts from Operations, Maintenance, Radiation Protection, Chemistry, Security, Emergency Preparedness and industry consultants performed an assessment of the staffing required to perform the on-shift actions. The participants reviewed the assumptions and applied existing procedural guidance, including applicable draft FLEX FSIs for coping with a BDBEE using minimum on-shift staffing. Particular attention was given to the sequence and timing of each procedural step, its duration, and the on-shift individual performing the step to account for both the task and time motion analyses of NEI 10-05 (Reference 13).

The on-shift staffing analysis concluded that there were no task overlaps for the activities that were assigned to the on-shift personnel. However, minor gaps in the staffing assessment were identified in the expanded ERO analysis (Reference 22) and entered into the site Corrective Action Program (CAP). Those CAP items were subsequently resolved and closed, confirming response resources, as described in the emergency plan, are sufficient to perform the required plant actions and emergency plan functions, and implement the multi-unit response strategies developed in response to Order EA-12-049 without the assignment of collateral duties that would impact the performance of the assigned emergency plan functions. The NRC concluded (Reference 23) that Comanche Peak adequately addressed the response strategies needed to respond to a BDBEE using site procedures and guidelines.

2.18.4 Training

Comanche Peak Nuclear Power Plant's Nuclear Training Program has been revised to assure personnel proficiency in the mitigation of BDBEE is adequate and maintained. These programs and controls were developed and have been implemented in accordance with the Systematic Approach to Training process.

Initial training has been provided and periodic training will be provided to site emergency response leaders on BDB emergency response strategies and implementing guidelines. Personnel assigned to direct the execution of mitigating strategies for BDB external events have received the necessary training to ensure familiarity with the associated tasks, instructions, and mitigating strategy time constraints.

ANSI/ANS 3.5, "Nuclear Power Plant Simulators for use in Operator Training" certification of simulator fidelity is considered to be sufficient for the initial stages of the BDBEE 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.

Where appropriate, integrated ERO FLEX drills will be organized on a team basis and conducted periodically. It is not required to connect/operate permanently installed equipment during these drills.

2.18.5 Equipment List

The equipment stored and maintained in the Comanche Peak FLEX Equipment Storage Building necessary for the implementation of the FLEX strategies in response to a BDB external event at Comanche Peak is listed in Table 3. Table 3 identifies the quantity, applicable strategy, and capacity/rating for the major FLEX equipment components only, as well as, various clarifying notes. Details regarding fittings, tools, hose lengths, consumable supplies, etc. are not in Table 3.

2.18.6 Equipment Maintenance and Testing

Periodic testing and preventative maintenance of the FLEX equipment conforms to the guidance provided in INPO AP-913 (Reference 14). Luminant uses the existing station procedures as an initiating point for identifying maintenance and testing requirements for the FLEX equipment. Station procedure STA-677, "Preventative Maintenance," is the basis for developing PM's for the FLEX equipment.

FLEX commodities and other small components are inventoried and inspected based on station FLEX administrative procedure, STI-250.02, "FLEX Equipment Control and Accountability." Responsibilities for procedure maintenance and performance are also identified in STI-250.02. This procedure establishes the programmatic controls necessary to ensure the availability of the equipment when needed.

EPRI has completed and issued "Preventive Maintenance Basis for FLEX Equipment - Project Overview Report" (Report 3002000623, Reference 15). Preventative Maintenance templates for the major FLEX equipment including the portable diesel pumps and generators have also been issued.

The PM templates include activities such as:

- Periodic Static Inspections - Monthly walkdown
- Fluid analysis (Annual)
- Periodic operational verifications - Quarterly starts
- Periodic functional verifications with performance tests - Annual 1 hour run with pump flow and head verifications

The EPRI PM Templates for FLEX equipment conform to the guidance of NEI 12-06 providing assurance that stored or pre-staged FLEX equipment are being properly maintained and tested. EPRI Templates are used if available as one of the inputs to development of PMs. Inputs also included manufacturer provided information/ recommendations or other plant experience for maintaining non-plant equipment or equipment that would be in storage for long periods.

Per STI-250.02, the unavailability of equipment and applicable connections that directly perform a FLEX mitigation strategy for core, containment, and SFP will be managed such that risk to mitigating strategy capability is minimized per STI-250.02. Maintenance/risk guidance conforms to the guidance of NEI 12-06 as follows:

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

2.19 NEI 12-06 Revision 2 Clarifications

The Comanche Peak FLEX strategies were developed consistent with the guidance provided in NEI 12-06 Revision 0 (Reference 3). However, the Comanche Peak FLEX strategies credited the following clarifications provided in NEI 12-06 Revision 2 (Reference 30):

2.19.1 Nominal Initial Tank Levels

Item 2 of Section 3.2.1.2 of NEI 12-06 Revision 2 specifies that the minimum conditions for plant equipment Operability or Functionality do not need to be assumed in establishing the capability of that equipment to support FLEX strategies provided there is an adequate basis for the assumed value. Nominal initial levels for various robust tanks credited in the FLEX strategies were determined considering this clarification. This approach is consistent with the guidance documented in item 5 of Section 3.2.2 of NEI 12-06 Revision 0.

2.19.2 Required Number of Sets for Hoses and Electrical Cables

Item 16 of Section 3.2.2 of NEI 12-06 Revision 2 clarifies that each site should have N sets of FLEX hoses and cables with additional spare hose and cable quantities that meet either of the following methods:

2.19.2.1 Method 1

Provide additional hose or cable equivalent to 10% of the total length of each type and size of hose or cable necessary for the N capability. For each type and size of hose or cable needed for the N capability, at least one spare of the longest single section or length must be provided.

2.19.2.2 Method 2

Provide spare cabling and hose of sufficient length and sizing to replace the single longest run needed to support any single FLEX strategy.

For the Comanche Peak FLEX strategies, the required number of sets for FLEX hoses and cables were determined considering the above clarification.

2.19.3 Makeup Requirements for Spent Fuel Pools

Item 14 of Section 3.2.2 of NEI 12-06 Revision 2 clarifies that the sizing of FLEX equipment used to cool the SFPs should be based on the maximum design basis heat load for the site. For the purposes of determining the response time for the SFP FLEX strategies when fuel is in the reactor vessel, the rate of inventory loss of the SFP should be calculated based on the worst case conditions for SFP heat load assuming the plant is at power. Makeup requirements for the SFPs, both equipment sizing and response timing, were determined considering this clarification.

Additionally, as discussed previously in Section 2.6.2, Comanche Peak will perform a Mitigating Strategies Assessment considering new flood hazard information using the flooding parameters and assumptions identified in Reference 29 and guidance of Appendix G of NEI 12-06 Revision 2.

3. References

1. SECY-11-0093, "Recommendations for Enhancing Reactor Safety in the 21st Century; The Near-Term Task Force Review of Insights from the Fukushima Daiichi Accident," U.S. Nuclear Regulatory Commission, July 12, 2011 (ML11186A950)

2. Order EA-12-049, "Issuance of Order to Modify Licenses With Regard To Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," March 12, 2012 (ML12056A045)

3. NEI 12-06, Revision 0, "Diverse and Flexible Strategies (FLEX) Implementation Guide," Revision 0, August 2012 (ML12242A378)

4. JLD-ISG-2012-01, Revision 0, "Compliance with Order EA-1 2-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, Interim Staff Guidance," August 29, 2012 (ML12229A174)

5. Order EA-12-051, "Issuance of Order to Modify Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation," March 12, 2012 (ML12054A679)

6. NEI 12-02, "Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," Revision 1, August 2012 (ML122400399)

7. JLD-ISG-2012-03, Revision 0, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation, Interim Staff Guidance," August 29, 2012 (ML12221A339)

8. TXX-14025, "Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 and 50-446, Second 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) (TAC NOS. MF0860 and MF0861)," February 12, 2014

9. TXX-14104, "Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 and 50-446, Third 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) (TAC NOS. MF0860 and MF0861)," August 28, 2014

10. TXX-15035, "Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 and 50-446, Fourth 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) (TAC NOS. MF0860 and MF0861)," February 26, 2015

11. TXX-15124, "Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 and 50-446, Fifth 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) (TAC NOS. MF0860 and MF0861)," August 27, 2015

12. NEI 12-01, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities," Revision 0, May 2012 (ML12125A412)

13. NEI 10-05, "Assessment of On-Shift Emergency Response Organization Staffing and Capabilities," Revision 0, June 2011 (ML111751698)

14. INPO AP-913, "Equipment Reliability Process Description," November 2001

15. EPRI Report 3002000623, "Preventative Maintenance Basis for FLEX Equipment – Project Overview Report," September 2013

16. WCAP-17601-P, "Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering and Babcock & Wilcox NSSS Designs," Revision 1, January 2013

17. WCAP-17792-P, "Emergency Procedure Development Strategies for the Extended Loss of AC Power Event for all Domestic Pressurized Water Reactor Designs," January 2014

18. TR-FSE-14-1-P, Rev. 1, "Use of Westinghouse Shield Passive Shutdown Seal for FLEX Strategies," March 2014

19. NRC Letter from Mr. Jack Davis to Mr. Jack Stringfellow, January 8, 2014 (ML13276A183)

20. NRC Letter from Mr. Jack Davis to Mr. Joseph Pollock, October 3, 2013 (ML13275A318)

21. NRC Letter from Mr. Jack Davis to Mr. Joseph Pollock, September 16, 2013 (ML13241A188)

22. TXX-16002, "Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 and 50-446, Submittal of Updated Phase 2 Staffing Assessment Regarding Recommendation 9.3 (Staffing)(TAC NOS. ME8686 and ME8687)," January 20, 2016

23. NRC Letter from Mr. Michael A. Brown to Mr. Ken Peters, March 22, 2016 (ML16075A371)

24. TXX-14037, "Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 and 50-446, Seismic Hazard and Screening Report (CEUS Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," March 27, 2014

25. TXX-13030, "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)," February 28, 2013

26. TXX-13053, "Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 and 50-446 Response to March 12, 2012, Request for Information Enclosure 2, Recommendation 2.1, Flood Hazard Reevaluation Report, of the Near Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," March 12, 2013

27. TXX-14094, "Comanche Peak Nuclear Power Plant (CPNPP), Docket Nos. 50-445 and 50-446 Submittal of Fukushima Lessons Learned - Flood Hazard Reevaluation Report Supplement 1 (TAC NOS. MF1099 and MF1100), August 14, 2014

28. TXX-15111, "Comanche Peak Nuclear Power Plant (CPNPP), Docket Nos. 50-445 and 50-446 Submittal of Request for Additional Information Regarding Fukushima Lessons Learned - Flooding Hazard Reanalysis Report (TAC NOS. MF1099 and MF1100)," September 22, 2015

29. TXX-16015, "Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 and 50-446, Submittal of Request for Additional Information Regarding Fukushima Lessons Learned – Flooding Hazard Reanalysis Report (TAC NOS. MF1099 and MF1100), February 3, 2016

30. NEI 12-06, Revision 2, "Diverse and Flexible Strategies (FLEX) Implementation Guide," December 2015 (ML15348A015)

31. JLD-ISG-2012-01, Revision 1, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," January 22, 2016 (ML16020A087 and ML15357A163)

32. NRC Letter from Mr. Victor Hall to Mr. Ken J. Peters, February 11, 2016 (ML16041A228)

33. NEI Position Paper: Shutdown / Refueling Modes (ML13273A514)

34. NRC Endorsement of NEI Position Paper: Shutdown / Refueling Modes (ML13267A382)

35. Abnormal Response Guideline ARG-4, Revision 3, "Loss of All AC Power While on Shutdown Cooling," December 31, 2014

36. PWROG-14073, Revision 0, "Bases for Operator Response to Extended Loss of AC Power in Modes 4, 5 and 6," February 2015

37. NEI 16-05, Revision 0, "External Flooding Integrated Assessment Guidelines," April 2016 (ML16105A327)

38. TXX-14132, "Comanche Peak Nuclear Power Plant, Docket Nos. 50-445 AND 50-446, Compliance with NRC Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051) (TAC NOS. MF0862 and MF0863), December 16, 2014

Figure 1: FLEX Equipment Storage Building Location and Haul Routes

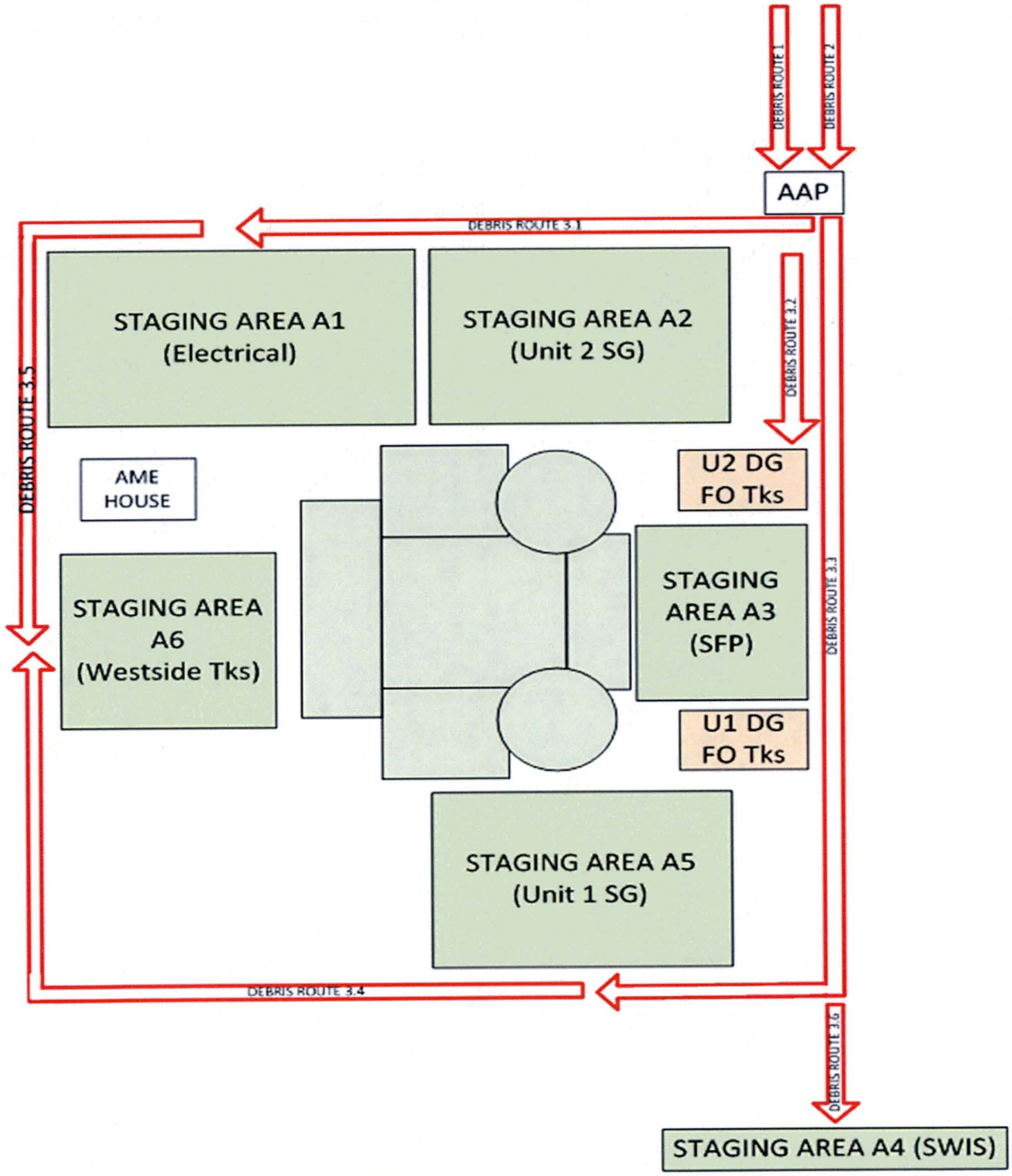

Figure 2: Protected Area Haul Routes

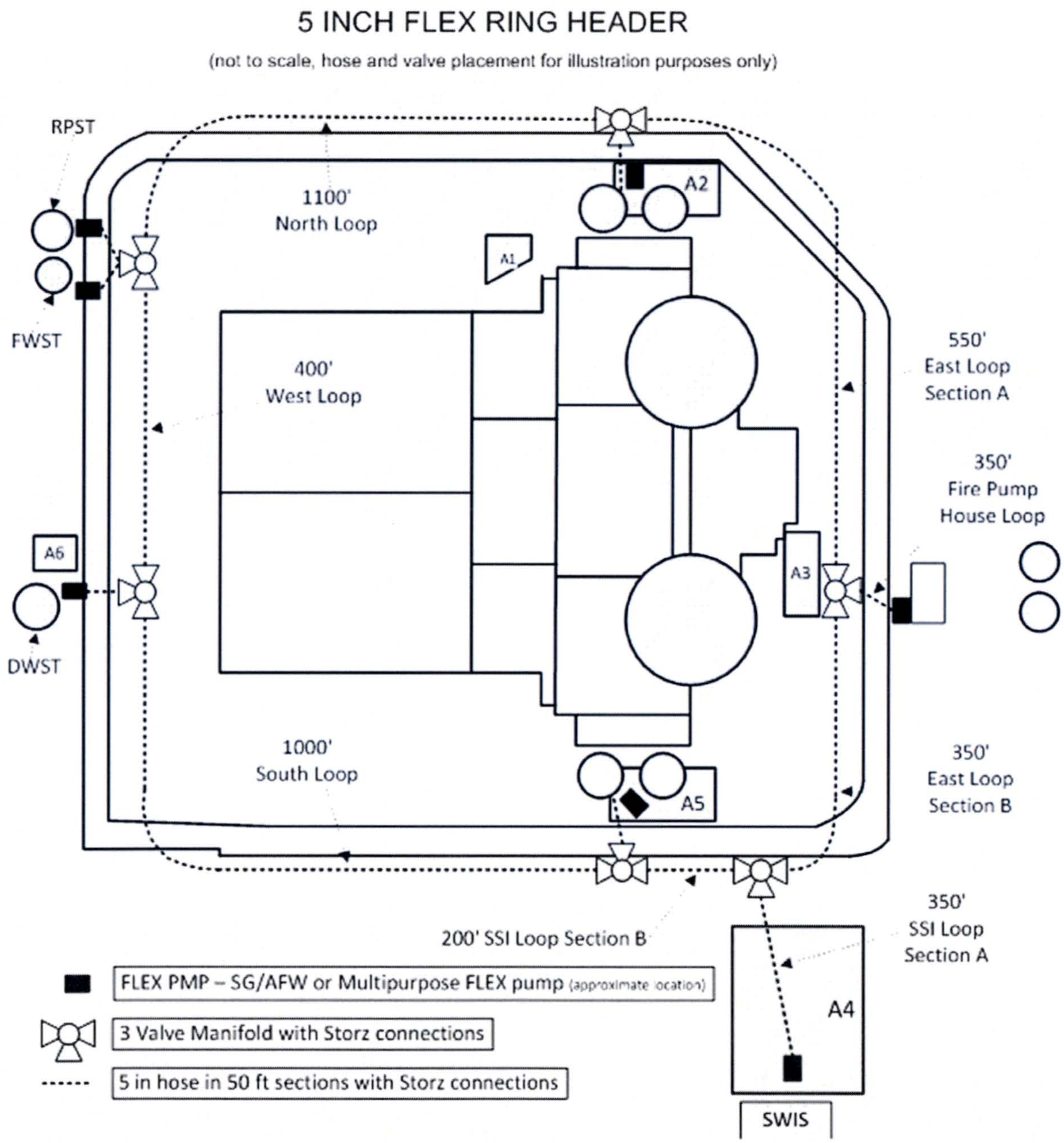

Figure 3: CST Makeup Using Ring Header and Any Available Water Source

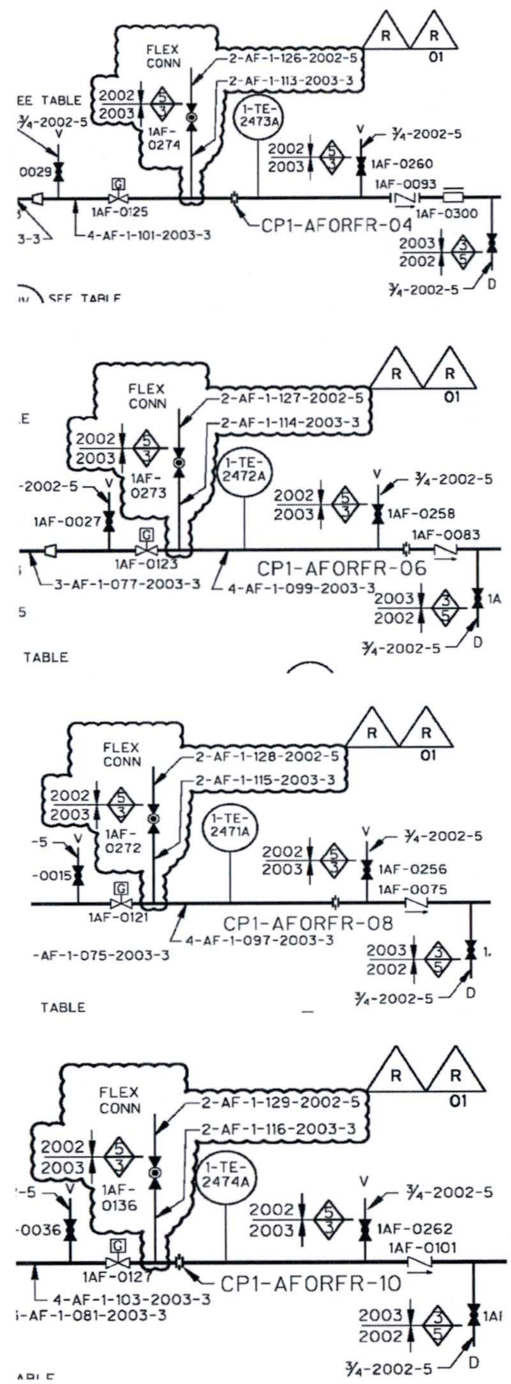

Figure 4: Steam Generator Feed Primary Connections – Unit 1 (Unit 2 is similar)

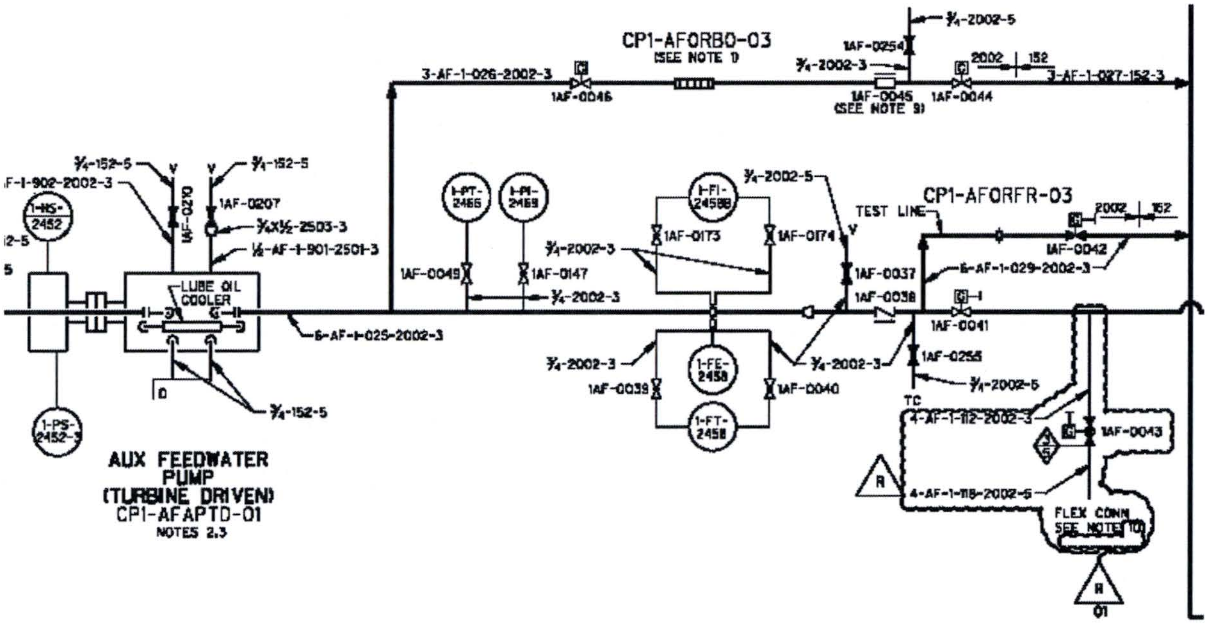

Figure 5: Steam Generator Feed Secondary Connection – Unit 1 (Unit 2 is similar)

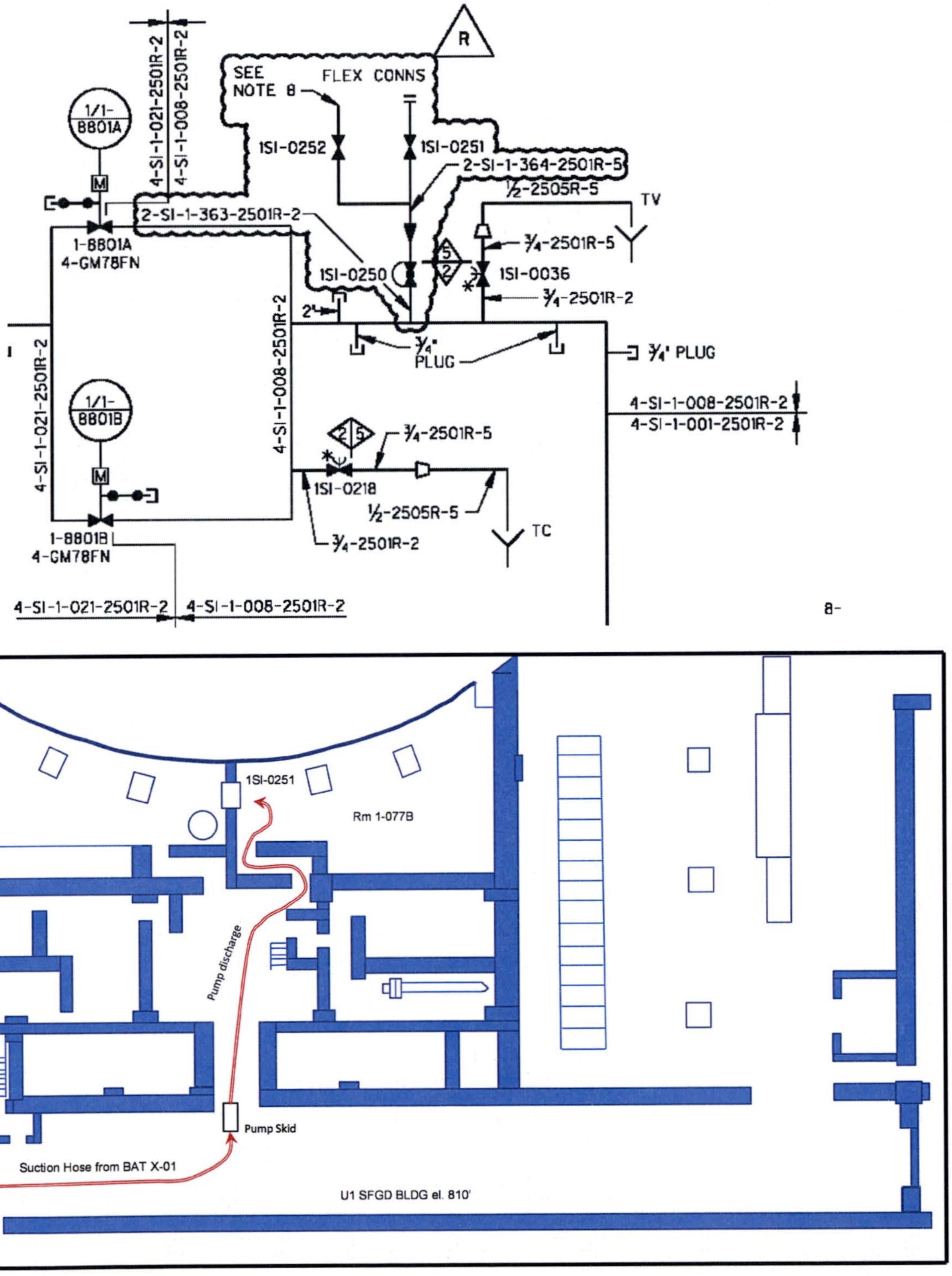

Figure 6: RCS Injection Primary Connection – Unit 1 (Unit 2 is similar)

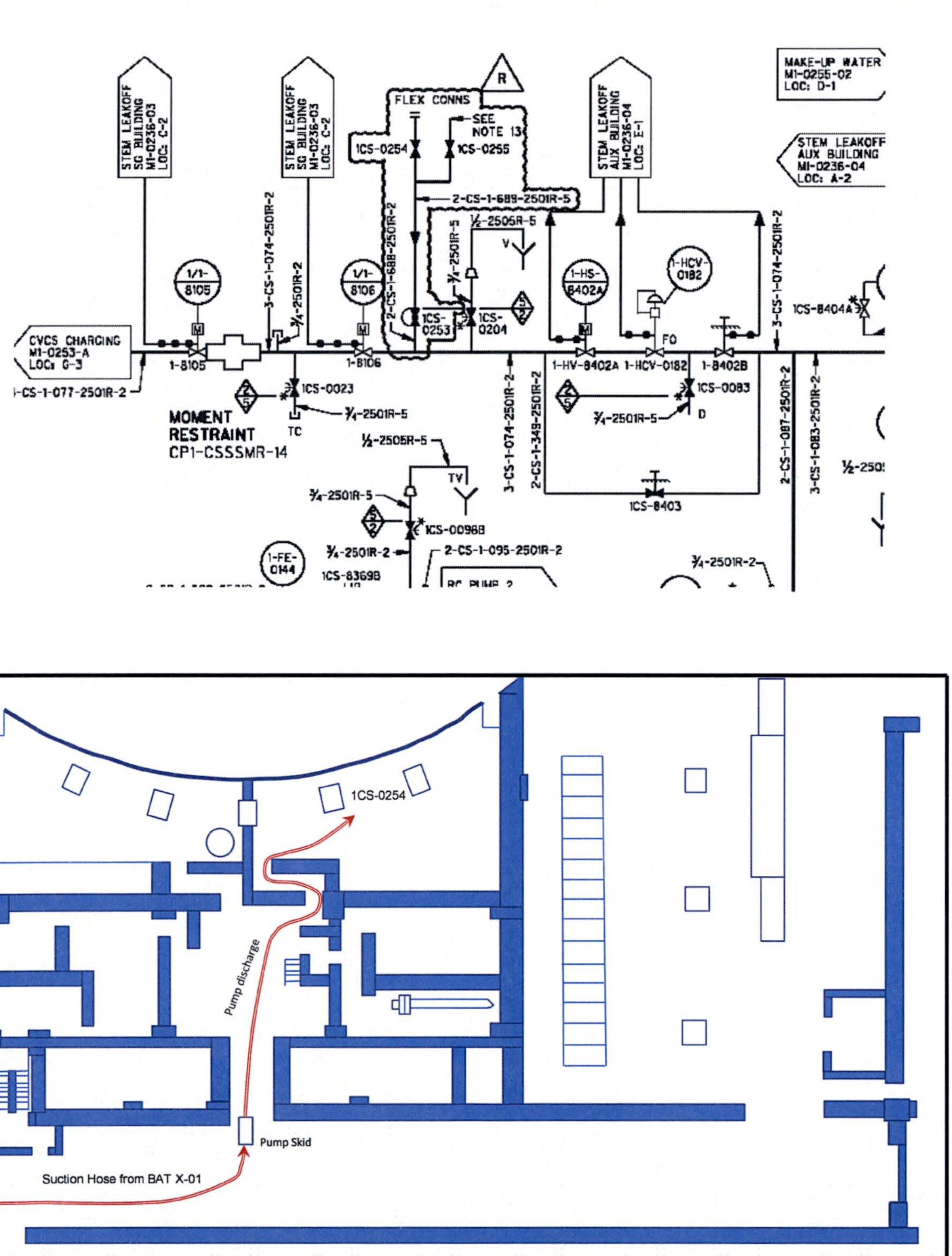

Figure 7: RCS Injection Secondary Connection – Unit 1 (Unit 2 is similar)

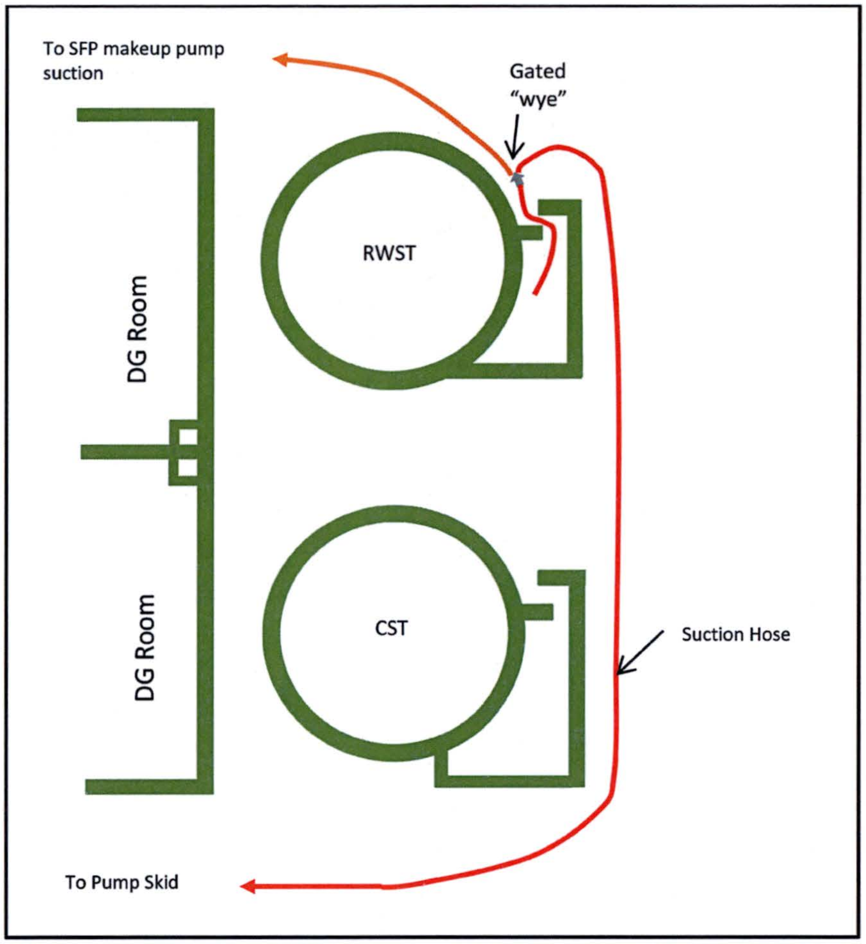

Figure 8: RWST Suction for RCS Injection and SFP Makeup

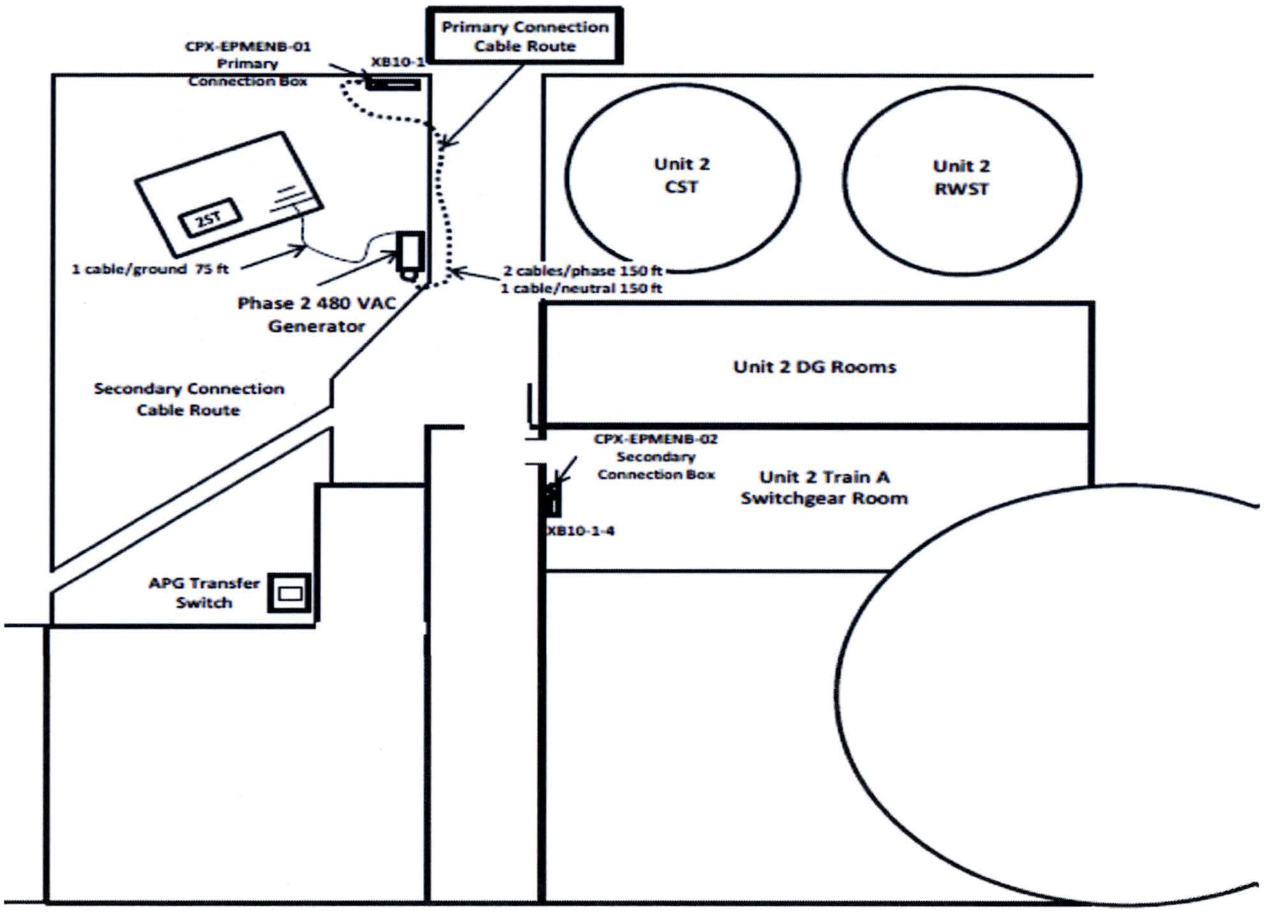

Figure 9a: 480 VAC Primary Connection

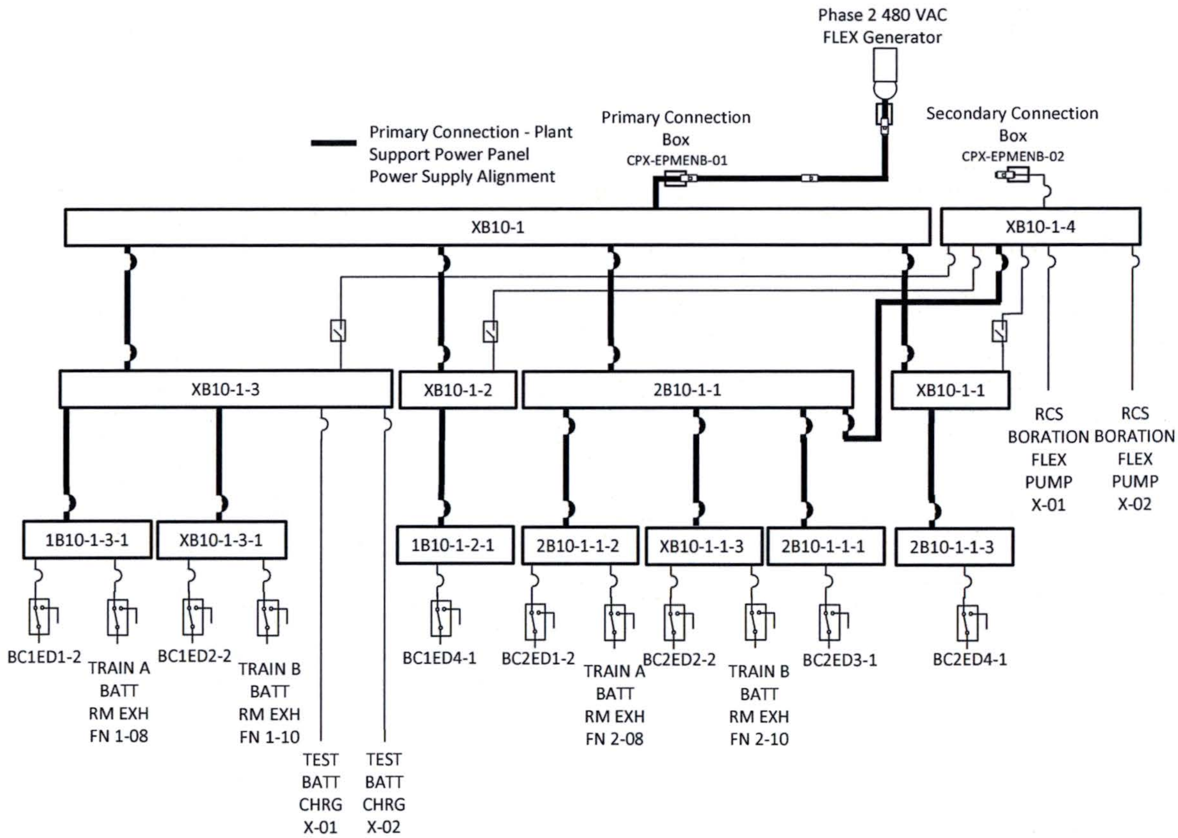

Figure 9b: 480 VAC Primary Connection

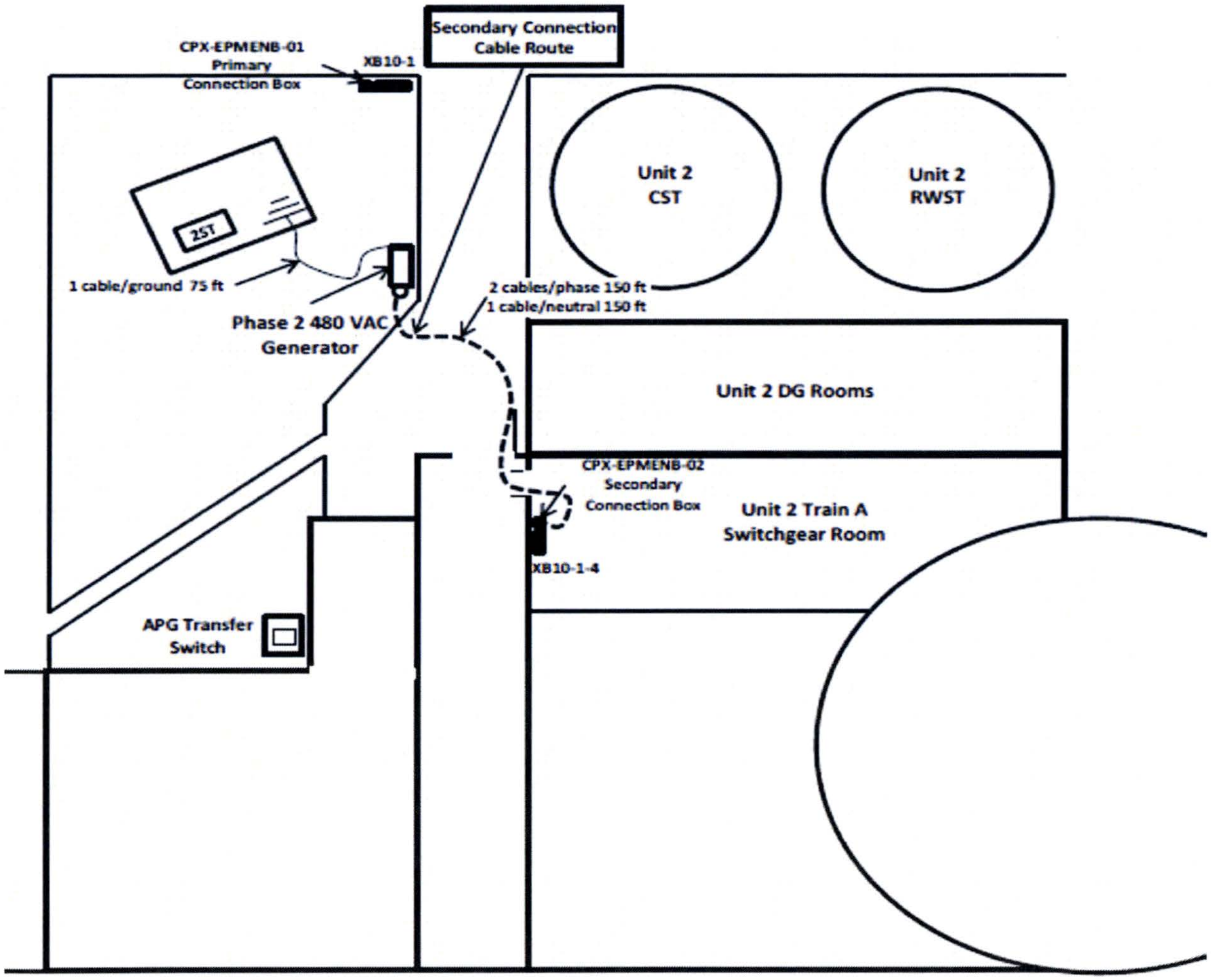

Figure 10a: 480 VAC Secondary Connection

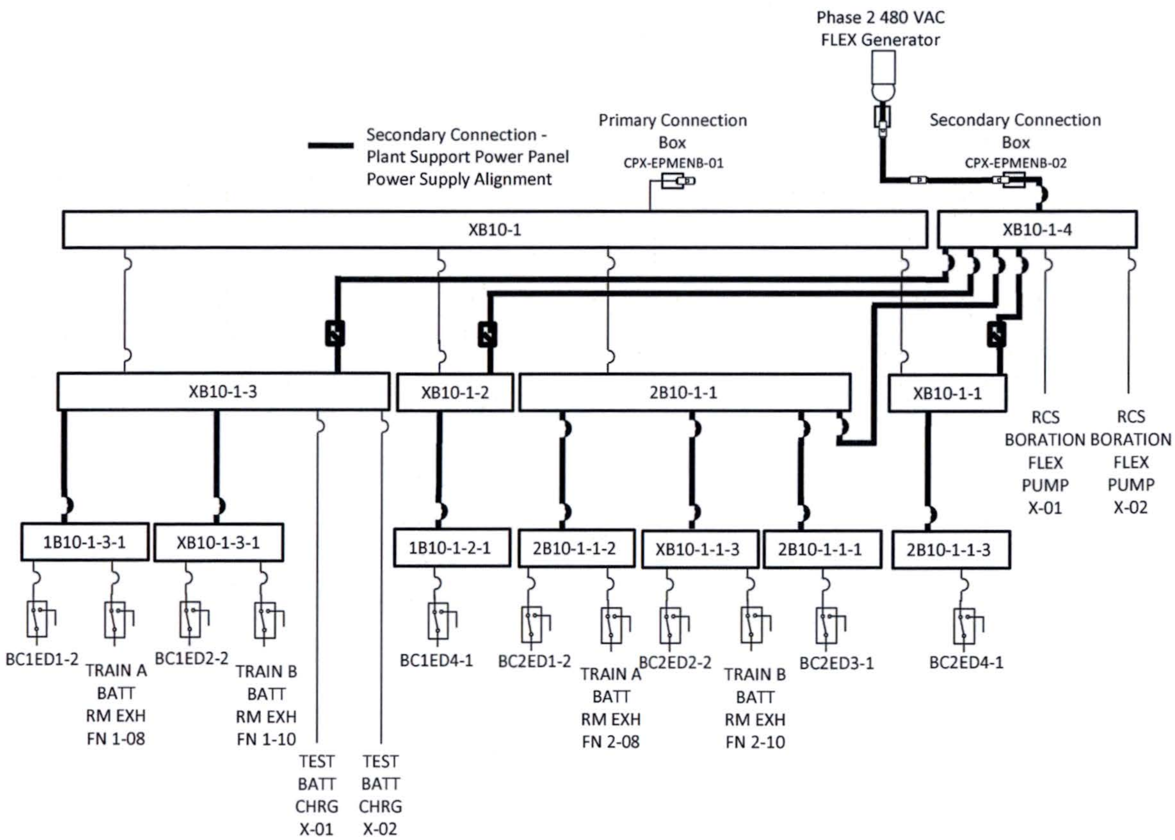

Figure 10b: 480 VAC Secondary Connection

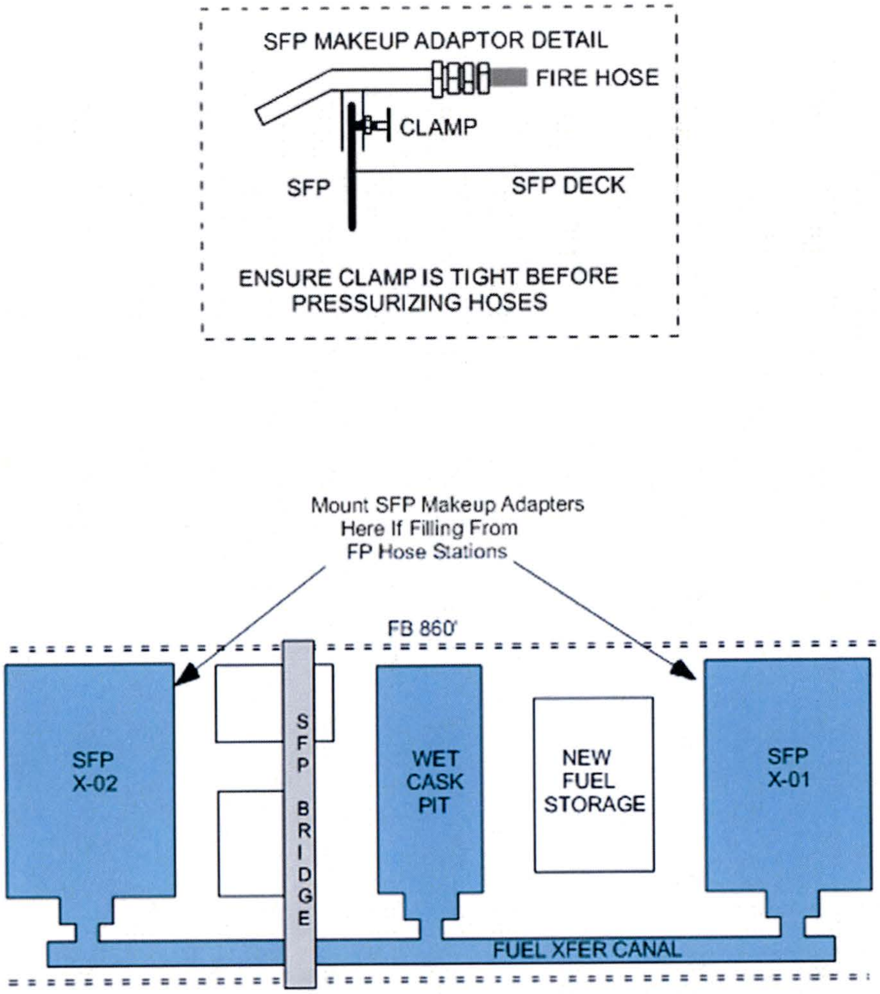

Figure 11: SFP Makeup – Secondary Strategy

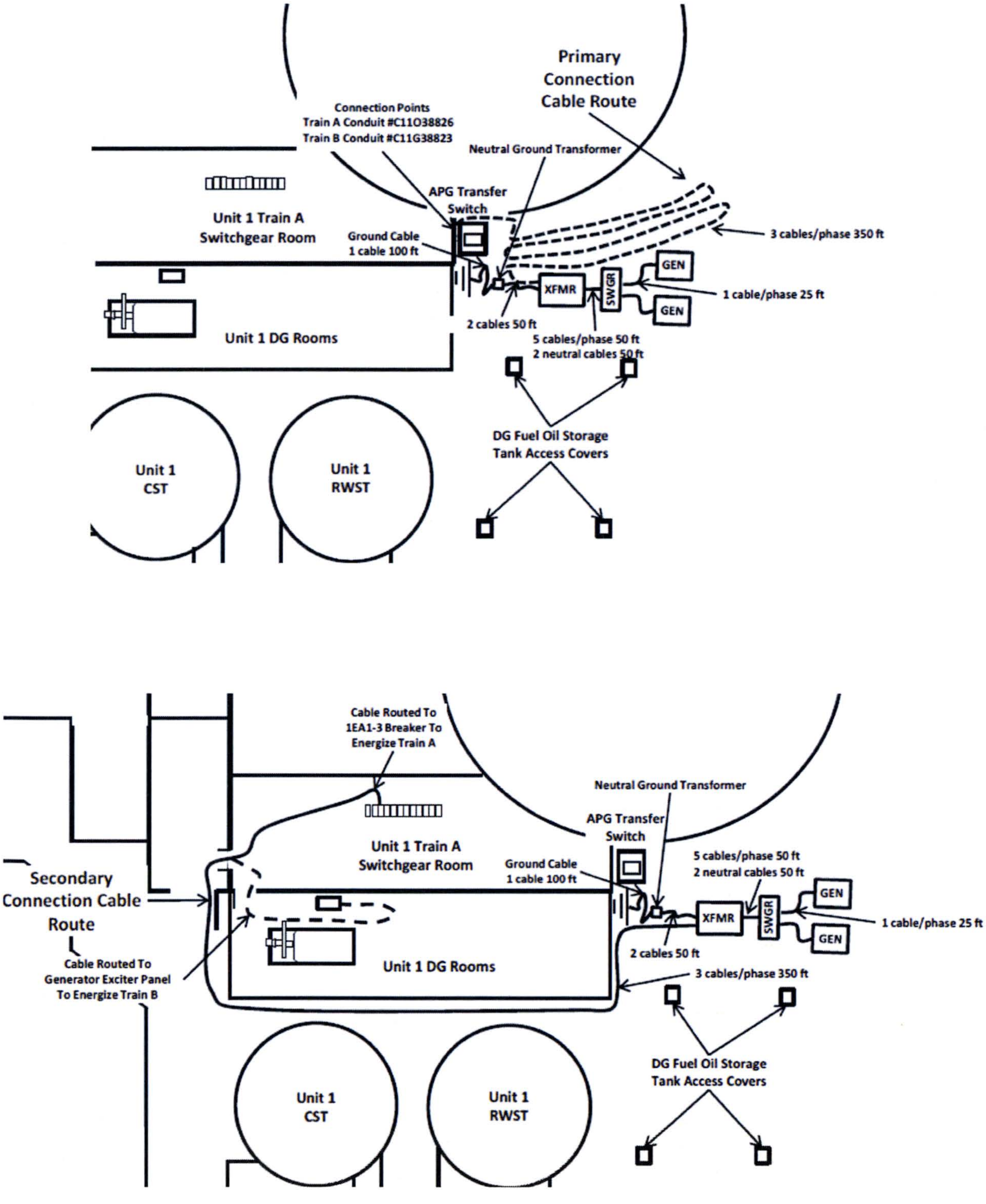

Figure 12a: Phase 3 4160 V Generator Deployment Location – Unit 1

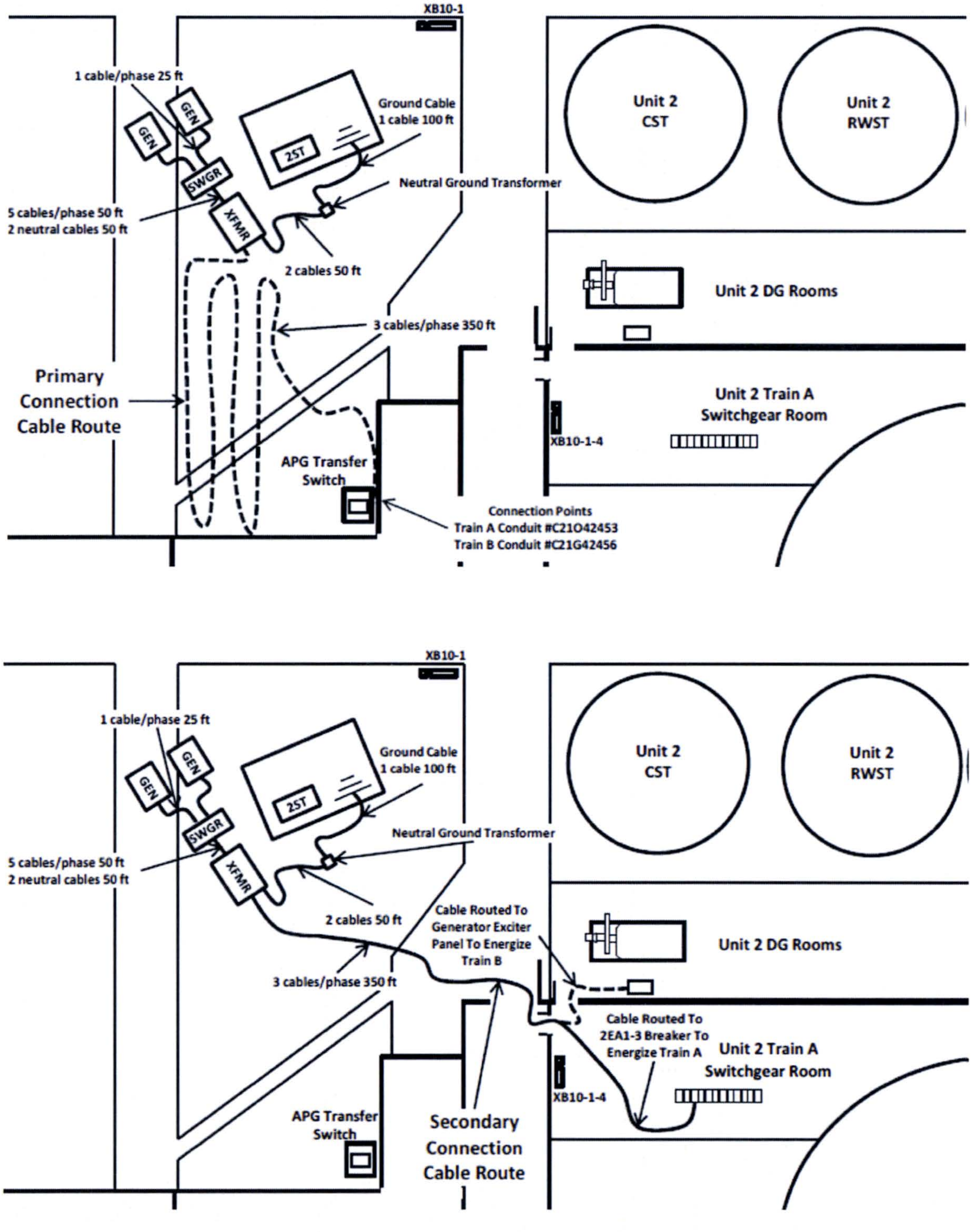

Figure 12b: Phase 3 4160 V Diesel Generator Deployment Location – Unit 2

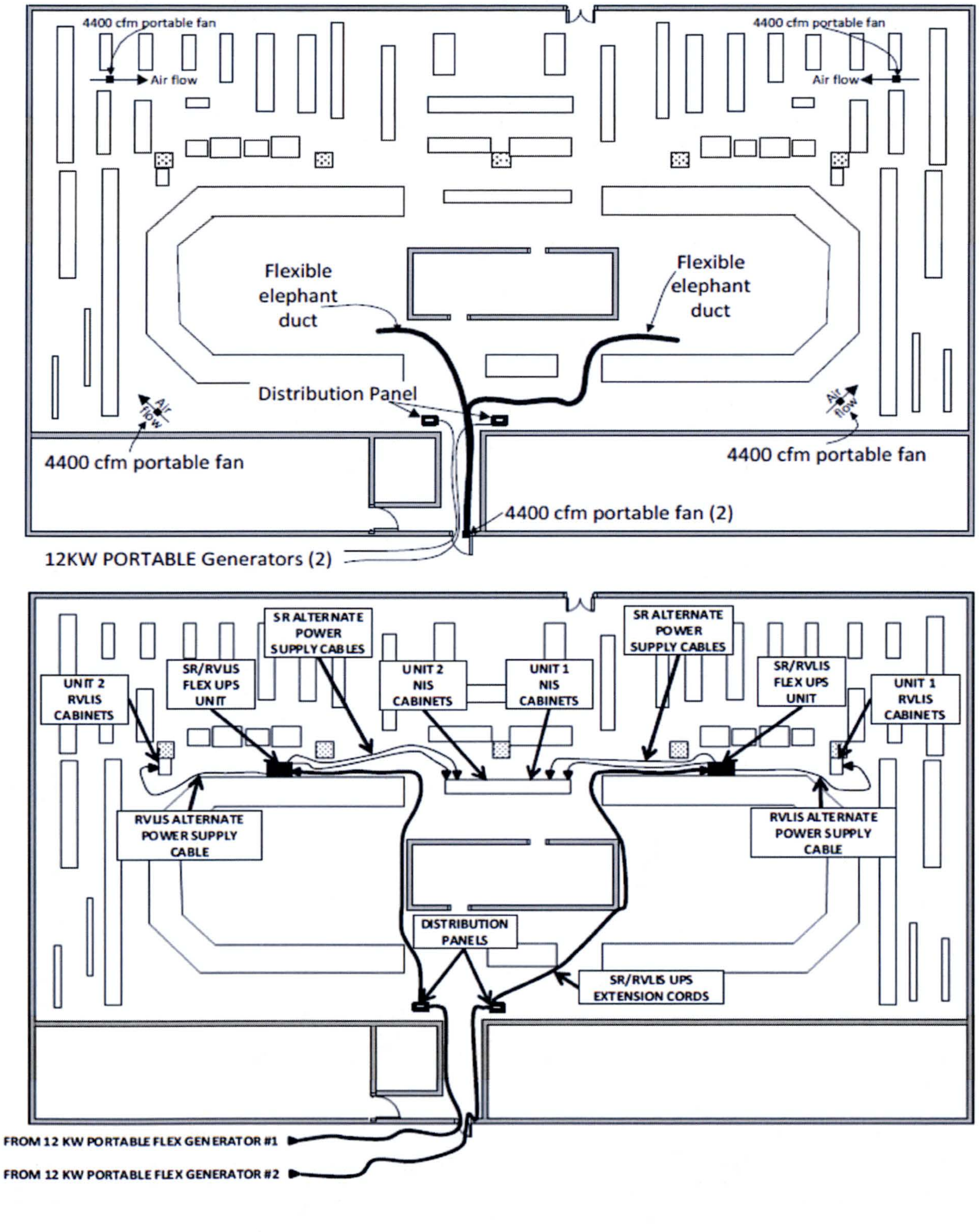

Figure 13. Deployment of 12kW Portable Generators for Control Room

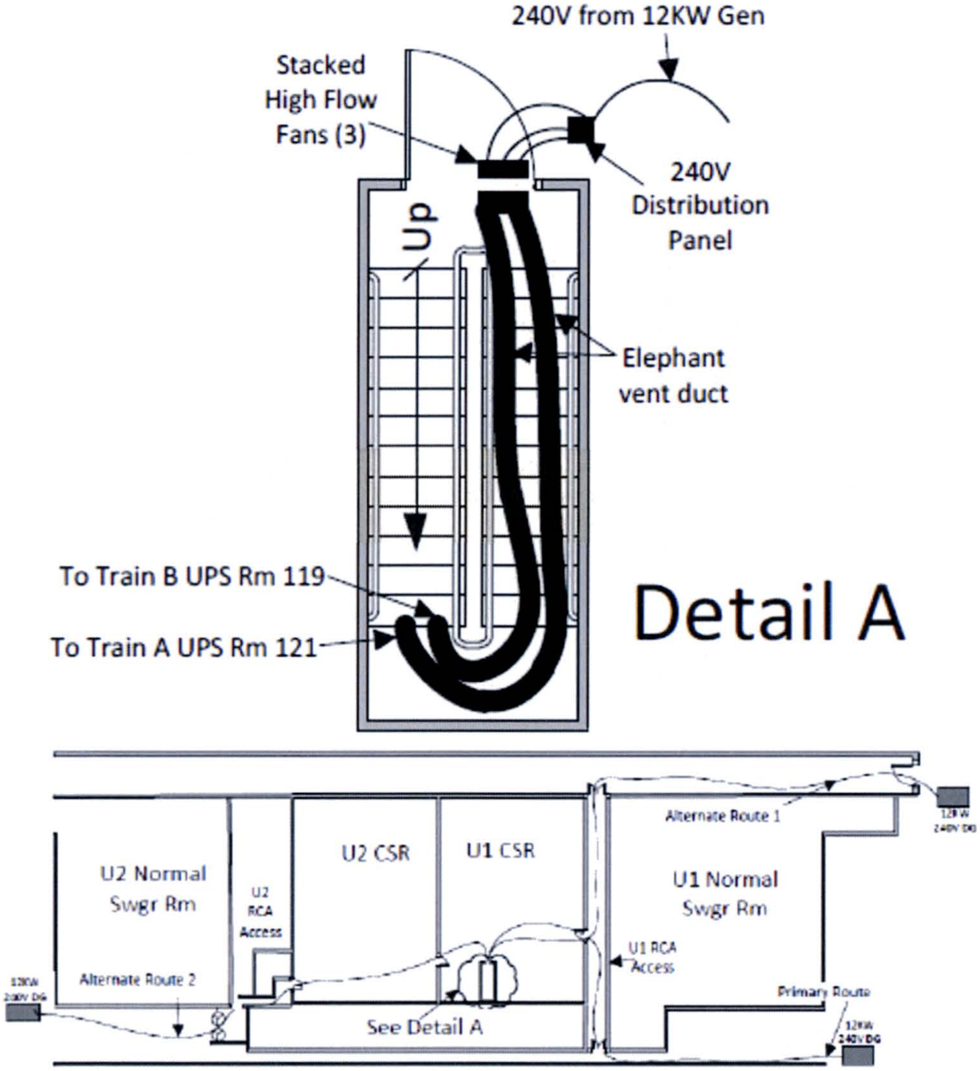

Figure 14. UPS Room Forced Ventilation

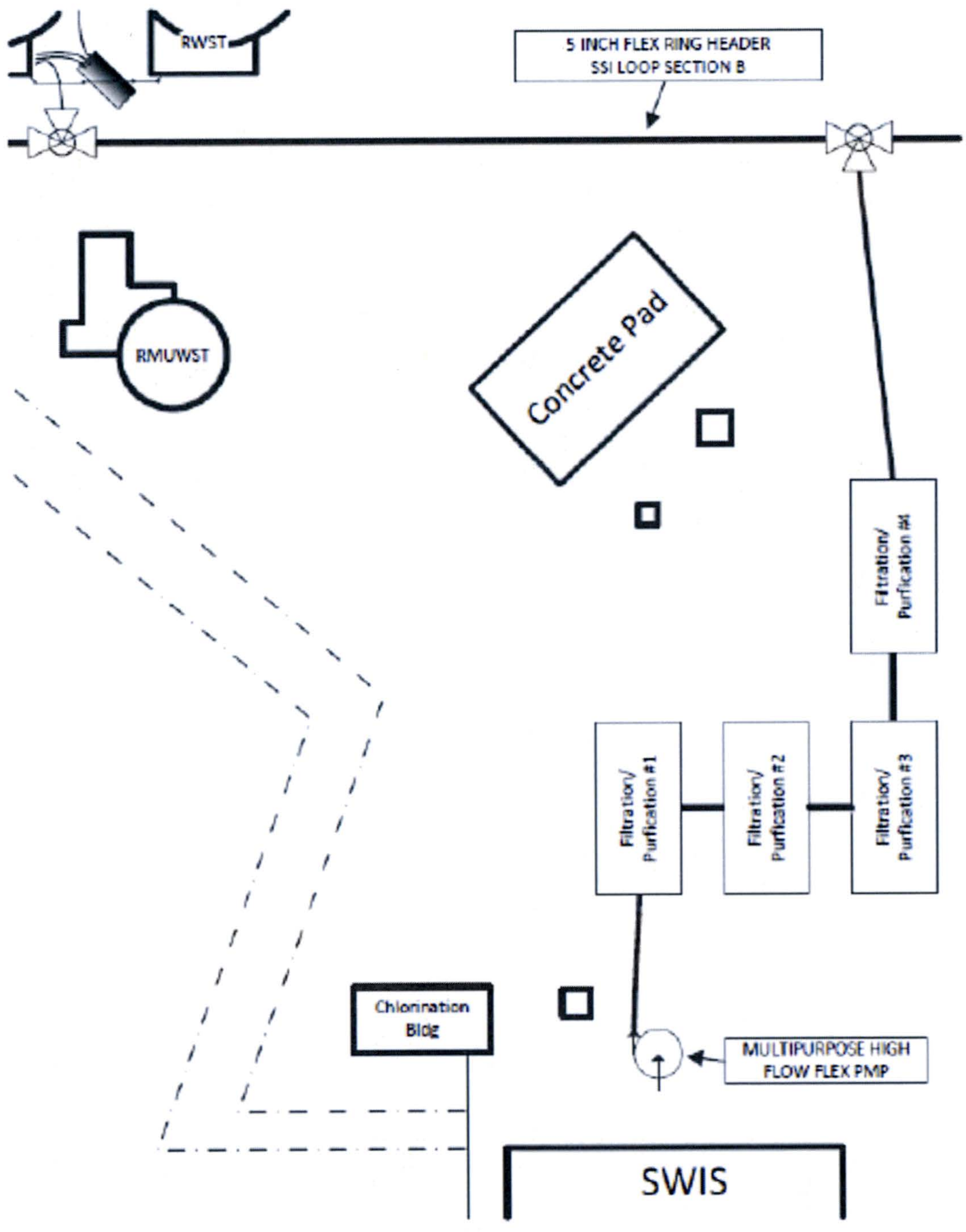

Figure 15. NSRC Supplied Phase 3 Mobile Water Purification Unit

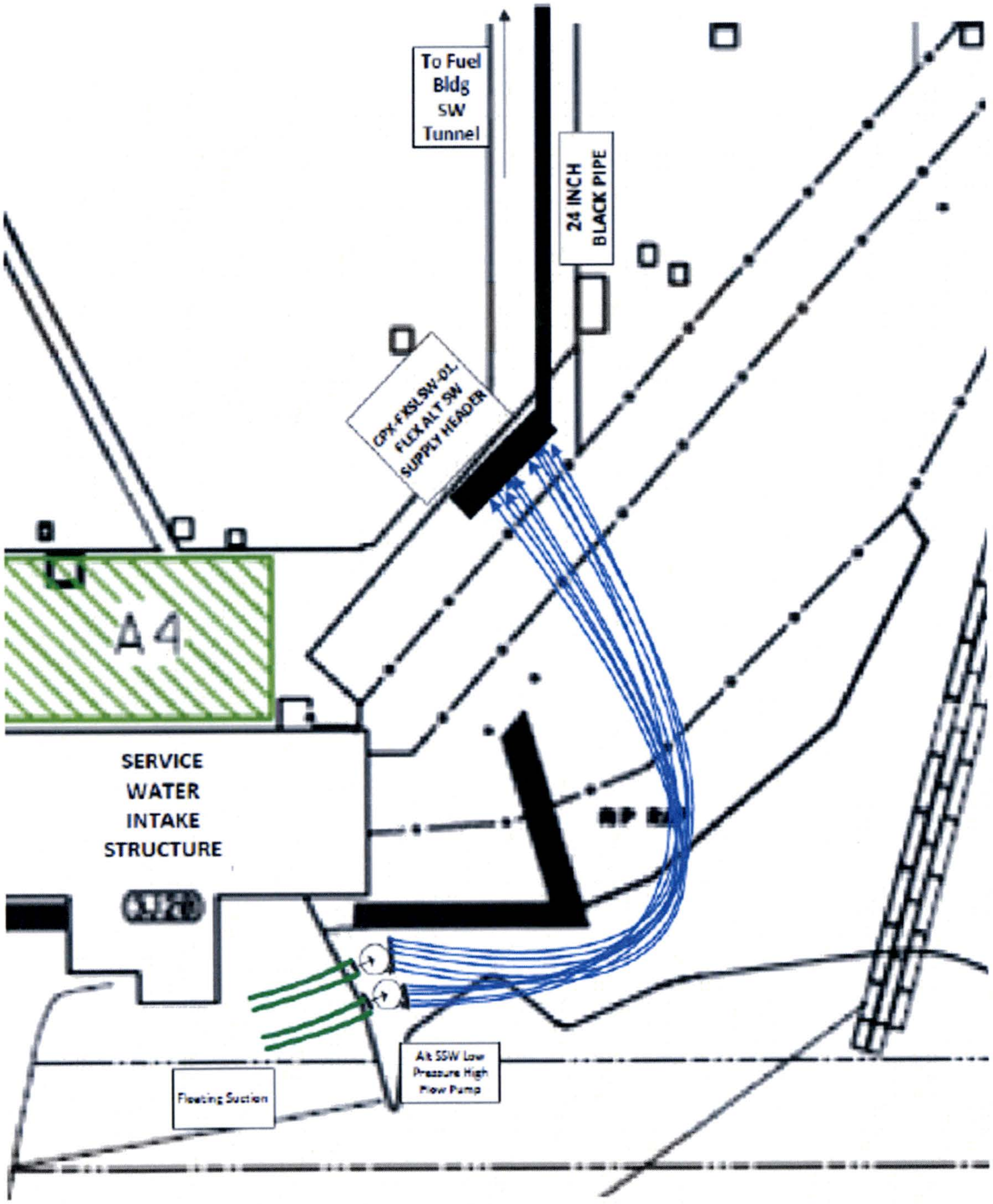

Figure 16. NSRC Supplied Phase 3 Alternate Station Service Water Supply

Table 1: Sequence of Events Timeline

Action Item	Elapsed Time [hrs]	Action	FLEX Time Constraint Y/N	Remarks/Applicability
	0	Event Starts	N/A	Plant at 100% power
1	0.25	Verify Reactor & Turbine Trip	N/A	Automatic response
2	0.25	Confirm TDAFW Function	N/A	ECA-0.0A/B
3	0.25	Verify RCS Isolation	N/A	ECA-0.0A/B
4	0.25	Start EDGs from Control Room – Fail	N	ECA-0.0A/B
5	0.5	Locally Start EDGs – Fail	N	ECA-0.0A/B
6	0.5	Local Control of TDAFW Flow Control Valves	N	ECA-0.0A/B
7	2	Complete Initial Load Shed	Y	ECA-0.0A/B. Complete within 2 hours to ensure station battery service time of 12 hours.
8	4	Complete RCS Cooldown to 310 psig Steam Generator Pressure	Y	RCS cooldown initiated to reduce RCS pressure allowing 10 gpm boration flow using High Pressure RCS Injection FLEX pump.
9	4	Establish Local Control of SG ARVs	N	Accumulators required for remote operation of SG ARVs are sized to permit 4 hours of ARV control.
10	≤ 4	Declare ELAP	Y	ELAP declaration will occur following confirmation of ELAP conditions with no potential for power restoration, and in all cases within 4 hours of event initiation (Reference 8).
11	5	Complete Second Load Shed	Y	Second load shed performed to extend station battery service to 12 hours.
12	5.5	Block Open Doors to the Battery Rooms and Inverter Rooms	Y	Maintain room temperatures below acceptable limits.
13	6	Perform Damage Assessment	Y	Estimated duration used for early staging and deployment of FLEX equipment.

Action Item	Elapsed Time [hrs]	Action	FLEX Time Constraint Y/N	Remarks/Applicability
14	6	<u>*Initiate*</u> Debris Removal for Haul Paths and Deployment Locations	Y	Earliest need for deployment paths and personnel arriving from offsite (Reference 11).
15	12	Deploy 480 VAC Phase 2 FLEX Generator	Y	Earliest need for generator based on station battery service time.
16	12	Establish Battery Chargers and Battery Room Exhaust Fans	Y	Station batteries will deplete in 12 hours. Exhaust fans must be started to vent hydrogen when charging station batteries.
17	12	Block Open Stairwell Doors, Roof Access Doors and Cable Spreading Room Door	Y	Maintain battery and inverter room temperatures below acceptable limits.
18	14	Align FLEX High Pressure RCS Injection Pump from BAT	Y	Time constraint at 14 hours to achieve xenon free $k_{eff} < 0.99$ at 24 hours.
19	14	Block Open Fuel Building Doors	Y	Action to be completed prior to earliest estimated time to boil from Mode 1-4 initial condition.
20	14	Deploy Hoses to SFP Area	Y	Action to be completed prior to earliest estimated time to boil from Mode 1-4 initial condition.
21	15	Stage SG/AFW LP FLEX Pump (Backup)	N	TDAFW pump is assumed to not fail. *Backup pump should be staged when able. Time is <u>approximate</u> (Reference 9).*
22	16	Align gravity make-up from RMUWST to CST	Y	Depletion time of CST.
23	18	Block Open External Cable Spreading Room Doors and Deploy Portable Fans for Battery and Inverter Rooms	Y	Maintain battery and inverter room temperatures below acceptable limits.
24	24	Align CST make-up from the SSI	Y	Depletion of CST and RMUWST based on condensate consumption curve.
25	32	Establish Portable Fans for Control Room Ventilation	Y	Maintain Control Room temperature below acceptable limit.

Action Item	Elapsed Time [hrs]	Action	FLEX Time Constraint Y/N	Remarks/Applicability
26	40	Block Open TDAFW Pump Room Doors	Y	Maintain room temperature below acceptable limit.
27	45	Align FLEX Pump for SFP Makeup	Y	Conservative estimate based on ELAP initiation in Modes 1-4. Time based on SFP level decrease to 15 ft above spent fuel.
28	52	Align FLEX High Pressure RCS Injection Pump from RWST	Y	BAT will deplete at 52 hours assuming boration begins at 14 hours. Re-align pump suction.
29	72	Align Mobile Water Purification Unit	Y	Utilized to replenish water sources such as the CST. Shipment of water purification unit will occur in first wave of equipment from NSRC.
30	72	Align Large 4160 V Generators	Y	Time based on need to provide SFP Level Instrumentation System emergency power supply and to restore Containment cooling and SFP cooling.
31	72	Align NSRC Pump for SSW Flow	Y	Time based on need to restore Containment cooling and SFP cooling.
32	> 72	Establish Alternate Fuel Supply	Y	Adequate onsite fuel supply for indefinite coping.
33	> 72	Establish Large Fuel Bladder	Y	For supplying larger equipment.

Table 2 –Non-Borated Water Sources

Water Sources	Usable Volume	Applicable Hazard				Time Based on Decay Heat	Cumulative Time Based on Decay Heat
		Satisfies Seismic	Satisfies Tornado/High Winds	Satisfies Ice	Satisfies High Temp		
Robust Water Sources							
CST	269,699 gal	Y	Y	Y	Y	16.35 hr	16.35 hr
RMUWST	73,898 gal	Y	Y	Y	Y	8.47 hr	24.82 hr
SSI	284 acre-feet	Y	Y	Y	Y	Indef.	Indef.
Non-Robust Water Sources							
Demin Water Storage Tank	≤ 315,790 gal	N	N	Y	Y	-	-
Reverse Osmosis Product Water Storage Tank	≤ 275,000 gal	N	N	Y	Y	-	-
Filtered Water Storage Tank	≤ 228,000 gal	N	N	Y	Y	-	-
Fire Protection Storage Tanks (2)	≤ 519,000 gal each	N	N	Y	Y	-	-

Table 3 – Portable Equipment Stored On-Site						
Use and (Potential / Flexibility) Diverse Uses						***Design Performance Criteria***
List Portable Equipment	Core	Containment	SFP	Instrumentation	Accessibility	
Multi-Purpose High Flow FLEX (3) and assoc. hoses and fittings	X		X			1288 gpm 258 ft. TDH
SG/AFW Low Pressure FLEX pump (3) and assoc. hoses and fittings	X					370 gpm 1021 ft. TDH
High Pressure RCS Injection FLEX pump (3) and assoc. hoses and fittings	X					10 gpm 3602 ft. TDH
AME Pump (1)* * not stored in the FLEX Equipment Storage Building, not a credited FLEX pump, will use as a spare if pump survives external event	X		X			500 gpm
480 VAC generators (2) and associated cables, connectors	X			X		500 kW

Table 3 – Portable Equipment Stored On-Site

Use and (Potential / Flexibility) Diverse Uses						***Design Performance Criteria***
List Portable Equipment	Core	Containment	SFP	Instrumentation	Accessibility	
Step up transformer (3) 4160 V/6900 V		X	X	X	X	5MVA Transformer
Ground transformer (3) to support the 6900 V side of the step up transformer		X	X	X	X	25kVA 1phase 60Hz 7200/240V grounding transformer
Mobile Light Tower (4)					X	
Pettibone (1) and Bobcat Track Loader (1)					X	Debris removal and towing
Polaris Ranger Utility Vehicle (1)					X	

Table 3 – Portable Equipment Stored On-Site

Use and (Potential / Flexibility) Diverse Uses						***Design Performance Criteria***
List Portable Equipment	Core	Containment	SFP	Instrumentation	Accessibility	
Pickup Truck (2) and Water Truck (2)	X		X	X	X	
Trailer Mounted Fuel Tank with transfer pump (2)	X	X	X	X		
120/240 VAC Portable Generator (6)				X	X	12kW
Portable Fans / Blowers (10)				X	X	
Hose Trailer (4) and 480 V Cable Trailer	X	X	X	X		

Table 4 – Portable Equipment From NSRC											
Use and (Potential / Flexibility) Diverse Uses									**Performance Criteria**		**Notes**
List Portable Equipment	**Quantity Req'd /Unit**	**Quantity Provided / Unit**	**Power**	**Core Cooling**	**Cont. Cooling/ Integrity**	**Access**	**Instrume ntation.**	**SFP**			
Medium Voltage Generators	2	2	Diesel Turbine		**X**	**X**	**X**	**X**	4160 V	1MW (each)	
Low Voltage Generators	0	1	Diesel Turbine		**X**		**X**		480 VAC	1100 KW	
High Pressure Injection Pump	0	1	Diesel	**X**					3000 psi	60 GPM	
S/G RPV Makeup Pump	0	1	Diesel	**X**					500 psi	500 GPM	
Low Pressure / Medium Flow Pump	0	1	Diesel		**X**	**X**		**X**	300 psi	2500 GPM	
Low Pressure / High Flow Pump	1	1	Diesel		**X**	**X**		**X**	150 psi	5000 GPM	

Table 4 – Portable Equipment From NSRC

Use and (Potential / Flexibility) Diverse Uses									Performance Criteria		Notes
List Portable Equipment	Quantity Req'd /Unit	Quantity Provided / Unit	Power	Core Cooling	Cont. Cooling/ Integrity	Access	Instrumentation.	SFP			
Lighting Towers	1	1	Diesel			X			40,000 Lu		
Diesel Fuel Transfer	0	1	Diesel	X	X	X	X	X	500 Gal		
Mobile Water Treatment	1	1	Diesel	X					Variable based on water quality desired		
Air Compressor	1	1	Diesel	X	X	X	X	X	150 psi	300 scfm	
Cables and Hoses for NSRC Equipment	*	*	-	X	X	X	X	X	*		

* As required for the equipment listed in Table 4