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Joseph M. Farley Nuclear Plant – Units 1 and 2
Notification of Full Compliance of Required Action for NRC Order EA-12-049
Mitigation Strategies for Beyond-Design-Basis External Events

Ladies and Gentlemen:

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-049, *Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events*, to Southern Nuclear Operating Company (SNC). This Order was immediately effective and directs the Joseph M. Farley Nuclear Plant (FNP) - Units 1 and 2 to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities in the event of a beyond-design-basis external event. This letter provides the notification required by Item IV.C.3 of Order EA-12-049 that full compliance with the requirements described in Attachment 2 of the Order has been achieved for both FNP Units 1 and 2 on October 31, 2016 as Unit 1 completed refueling outage U1R27. SNC previously notified the NRC of the Unit 2 compliance with the Order on June 22, 2016.

Enclosure 1 summarizes FNP Units 1 and 2's compliance with Order EA-12-049. Enclosure 2 contains the FNP Units 1 and 2 Final Integrated Plan (FIP) which provides strategies to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities in the event of a beyond-design basis external event. Prior to the issuance of Order EA-12-049, the Nuclear Energy Institute notified the NRC of an industry initiative on procurement of equipment for the diverse and flexible coping strategy (letter dated February 24, 2012). The FNP Units 1 and 2 FIP includes a list of equipment used for implementation of this Order which is more refined and supersedes the list which was procured for the 2012 initiative.

The FNP FIP is based on NEI 12-06, Rev. 2 with the exception of Appendix E which was finalized after the validation process was completed. Other aspects of NEI 12-06, Rev. 2, while not applicable to this Order compliance, will be utilized for upcoming submittals (e.g., use of re-evaluated hazards, Appendix G and Appendix H) and rulemaking (e.g., references to NEI 13-06 and NEI 14-01).

This letter contains no new NRC commitments. If you have any questions, please contact John Giddens at 205.992.7924.

Mr. C. R. Pierce states he is the Regulatory Affairs Director for Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and, to the best of his knowledge and belief, the facts set forth in this letter are true.

Respectfully submitted,

C. R. Pierce

C. R. Pierce
Regulatory Affairs Director

CRP/JMG/MRE

Sworn to and subscribed before me this 13th day of December, 2016.

Notary Public

My commission expires: 1/2/2018

Enclosures: 1. Compliance with Order EA-12-049
2. Joseph M. Farley Nuclear Plant Final Integrated Plan

cc: <u>Southern Nuclear Operating Company</u>
Mr. S. E. Kuczynski, Chairman, President & CEO
Mr. D. G. Bost, Executive Vice President & Chief Nuclear Officer
Mr. C. A. Gayheart, Vice President – Farley
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<u>U. S. Nuclear Regulatory Commission</u>
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<u>Alabama Department of Health</u>
David Walter, Director, Alabama Office of Radiation Control

Joseph M. Farley Nuclear Plant – Units 1 and 2
Notification of Full Compliance of for NRC Orders EA-12-049
Mitigation Strategies for Beyond-Design-Basis External Events

Enclosure 1

Compliance with Order EA-12-049

Introduction

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Reference 1), to Southern Nuclear Operating Company (SNC). This Order was effective immediately and directed the Joseph M. Farley Nuclear Plant (FNP) - Units 1 and 2 to provide diverse and flexible strategies (FLEX) in response to Order EA-12-049. SNC developed an Overall Integrated Plan (OIP) (Reference 2 and revised in Reference 11) to provide FLEX. The information provided herein, as well as the implementation of the OIP, documents full compliance for FNP Units 1 and 2 in response to the Order (Reference 1).

Open Item Resolution

Following issuance of the NRC Audit Report (Reference 13), there were no open items from either it or the NRC Interim Staff Evaluation (ISE) (Reference 7). All identified items in the audit have been addressed and documented in the site CAP program.

- Interim Staff Evaluation (ISE) Open Items - FNP Units 1 and 2 has no open or pending items
- Licensee Identified Open Items - FNP Units 1 and 2 has no open or pending licensee identified open items
- Audit Questions/Audit Report Open Items - FNP Units 1 and 2 FLEX has no open or pending items

Milestone Schedule - Items Complete

FNP Unit 1 & 2 Milestone	Completion Date
Submit 20 Day Letter Acknowledging Receipt of Order	March 2012
Submit Overall Integrated Plan	February 2013
Unit 2 - 1st Refueling Outage	May 2013
1st 6 Month Update	August 2013
Unit 1 - 1st Refueling Outage	October 2013
2nd 6 Month Update	February 2014
3rd 6 Month Update	August 2014
4th 6 Month Update	February 2015
5th 6 Month Update	August 2015
Develop Modifications	December 2015
Develop Training Material	December 2015
Develop Strategies (Farley Response Plan) with National SAFER Response Center	December 2015
Develop Operational Procedure Changes	December 2015
Develop FSGs	December 2015
6th 6 Month Update	February 2016

FNP Unit 1 & 2 Milestone	Completion Date
Phase 2 Equipment Procurement Complete	March 2016
Implement Training	March 2016
Unit 2 Walk-throughs or Demonstrations	March 2016
Issue FSGs	May 2016
Unit 2 - 2nd Refueling Outage / Implementation Complete	**May 2016**
7th 6 Month Update	August 2016
Unit 1 Walk-throughs or Demonstrations	September 2016
Unit 1 - 2nd Refueling Outage / Implementation Complete	October 31, 2016

Order EA-12-049 Compliance Elements Summary

The elements identified below for FNP Units 1 and 2 are included in the Final Integrated Plan (FIP) (Enclosure 2) and demonstrate compliance with Order EA-12-049.

Strategies - Complete

FNP Units 1 and 2 strategies are in compliance with Order EA-12-049. There are no strategy related Open Items, Confirmatory Items, or Audit Questions/Audit Report Open Items.

Modifications - Complete

The modifications required to support the FLEX strategies for FNP Units 1 and 2 have been fully implemented in accordance with the station processes.

Equipment - Procured and Maintenance & Testing - Complete

The equipment required to implement the FLEX strategies for FNP Units 1 and 2 has been procured, initially tested, received at FNP, site acceptance tested and performance verified as recommended in accordance with NEI 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide*, and is available for use.

Maintenance and testing requirements are included in the FNP Preventative Maintenance Program such that equipment reliability is monitored and maintained. All maintenance and testing activities have been identified. All six month or less PM's have been developed and performed. Greater than 6 month PMs have been developed and will be performed on their scheduled due date.

Protected Storage - Complete

The storage facility required to implement the FLEX strategies for FNP Units 1 and 2 has been constructed and provides adequate protection from the applicable site hazards. The equipment required to implement the FLEX strategies for FNP Units 1 and 2 is stored in its protected configuration.

Procedures - Complete

FLEX Support Guidelines (FSGs) for FNP Units 1 and 2 have been developed and integrated with existing procedures. The FSGs and applicable procedures have been verified and are available for use in accordance with the site procedure control program.

Training - Complete

Training for FNP Units 1 and 2 personnel has been completed in accordance with an accepted training process, as recommended in NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide.

Staffing - Complete

The Phase 2 staffing study for FNP (Reference 15) has been completed in accordance with 10 CFR 50.54(f) letter (Reference 16). The NRC has reviewed the Phase 2 staffing study and concluded that it adequately addresses the response strategies needed to respond to a beyond design basis external event using FNP procedures and guidelines. This is documented in NRC letter dated September 29, 2014 (Reference 17). After completion of the validation plan, SNC reviewed the phase 2 staffing study to ensure it remained effective.

Communications - Complete

FNP committed to compliance with the communications capabilities in accordance with the 10 CFR 50.54(f) letter (Reference 16). Implementation of the backup satellite service ultimately did not include shared cellular or data capability as originally planned; however, those capabilities were not relied on for compliance. The Rapidcom system has the capability to provide data communications should the TSC deem it is needed.

National SAFER Response Centers - Complete

SNC has established a contract with Pooled Equipment Inventory Company (PEICo) and has joined the Strategic Alliance for FLEX Emergency Response (SAFER) Team (Equipment Committees) for off-site facility coordination. It has been confirmed that PEICo is ready to support FNP Units 1 and 2 with Phase 3 FLEX equipment stored in the National SAFER Response Centers in accordance with the site specific SAFER Response Plan.

Validation - Complete

SNC has completed validation in accordance with industry developed guidance to assure required tasks, manual actions and decisions for FLEX strategies are feasible and may be executed within the constraints identified in the FLEX OIP and FIP for Order EA-12-049.

FLEX Program Document - Established

The SNC FNP FLEX Program Document has been developed in accordance with the requirements of NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide.

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.
2. Joseph M. Farley Nuclear Plant - Units 1 and 2 Overall Integrated Plan in Response to Commission Order with Regard to Mitigation Strategies for Beyond-Design-Basis External Events (EA-12-049), dated February 27, 2013.
3. NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, dated August 2012.
4. 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.
5. Joseph M. Farley Nuclear Plant - Units 1 and 2 Initial Status Report in Response to Commission Order with Regard to Mitigation Strategies for Beyond-Design-Basis External Events (EA-12-049), dated October 23, 2012.
6. Joseph M. Farley Nuclear Plant - Units 1 and 2 First Six-Month Status Report of the Implementation of the Requirements of the Commission Order with Regard to Mitigation Strategies for Beyond-Design-Basis External Events (EA-12-049), dated August 27, 2013.
7. NRC Letter, Joseph M. Farley Nuclear Plant, Units 1 and 2 - Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049 (Mitigation Strategies) (TAC NOS. MF0716 and MFO717), dated January 17, 2014.
8. Joseph M. Farley Nuclear Plant - Units 1 and 2 Second Six-Month Status Report of the Implementation of the Requirements of the Commission Order with Regard to Mitigation Strategies for Beyond-Design-Basis External Events (EA-12-049), dated February 26, 2014.
9. Joseph M. Farley Nuclear Plant – Units1and 2 Request for Relaxation of Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049) dated February 26, 2014.
10. NRC Letter, Relaxation of Certain Schedule Requirements for Order EA-12-049, dated April 14, 2014.
11. Joseph M. Farley Nuclear Plant - Units 1 and 2 Third Six-Month Status Report of the Implementation of the Requirements of the Commission Order with Regard to Mitigation Strategies for Beyond-Design-Basis External Events (EA-12-049) dated August 26, 2014, including Enclosure 2 – Farley Units 1&2 Mitigation Strategies (FLEX) Overall Integrated Implementation Plan (OIP), Revision 4.
12. Joseph M. Farley Nuclear Plant - Units 1 and 2 Fourth Six-Month Status Report of the Implementation of the Requirements of the Commission Order with Regard to Mitigation Strategies for Beyond-Design-Basis External Events (EA-12-049), dated February 26, 2015.
13. NRC letter, Joseph M. Farley Nuclear Plant, Units 1 and 2 - Report for the Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049 and EA-12-051 (TAC NOS. MF0714, MF0715, MF0723, and MF0724), dated February 8, 2015.

14. Joseph M. Farley Nuclear Plant - Units 1 and 2 Fifth Six-Month Status Report of the Implementation of the Requirements of the Commission Order with Regard to Mitigation Strategies for Beyond-Design-Basis External Events (EA-12-049), dated August 27, 2015.
15. Joseph M. Farley Nuclear Plant – Units 1 and 2 Response to Request for Information Pursuant to Title 10 CFR 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the NTTF Review of Insights from the Fukushima Daiichi Accident, dated March 12, 2012, dated June 6, 2014.
16. NRC Letter, 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.
17. NRC Letter, Response Regarding Licensee Phase 2 Staffing Submittals Associated With Near-Term Task Force Recommendation 9.3 Related To The Fukushima Dai-Ichi Nuclear Power Plant Accident, dated September 29, 2014.
18. Joseph M. Farley Nuclear Plant Notification of Commitment Completion - NTTF Recommendation 9.3, dated May 6, 2016.
19. Joseph M. Farley Nuclear Plant - Unit 2, Completion of Required Action for NRC Orders EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, dated June 22, 2016.
20. NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 2, dated December 2015.
21. 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 1, dated January 22, 2016.

Joseph M. Farley Nuclear Plant – Units 1 and 2
Notification of Full Compliance of for NRC Orders EA-12-049
Mitigation Strategies for Beyond-Design-Basis External Events

Enclosure 2

Joseph M. Farley Nuclear Plant
Final Integrated Plan

(94 pages)

FINAL INTEGRATED PLAN
U.S. NUCLEAR REGULATORY COMMISSION
ORDER EA-12-049
STRATEGIES FOR BEYOND DESIGN BASIS EXTERNAL EVENTS

FARLEY NUCLEAR PLANT
Units 1 & 2

November 2016

Table of Contents

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 on four of the units. All direct current (dc) power was lost early in the event on Units 1 and 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 3.1) 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 3.2) on March 12, 2012 to implement mitigation strategies for Beyond-Design-Basis (BDB) External Events (BDBEEs). 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 spent fuel pool (SFP) cooling capabilities following a BDBEE.

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

3. Licensees 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 - The initial phase requires the use of installed equipment and resources to maintain or restore core cooling, containment and spent fuel pool (SFP) cooling capabilities.
- Phase 2 - The transition phase requires providing sufficient, portable, onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from off site.
- Phase 3 - The final phase requires obtaining sufficient offsite resources to sustain those functions indefinitely.

NRC Order EA-12-049 (Reference 3.2) 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 which provided 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 3.4), dated August 29, 2012, which endorsed NEI 12-06, Rev. 0 with clarifications on determining baseline coping capability and equipment quality. Since that time, NEI 12-06, Rev. 2 was issued (Reference 3.3) and endorsed by the NRC (JLD-ISG-2012-01, Rev. 1) on January 22, 2016 (Reference 3.17).

NRC Order EA-12-051 (Reference 3.5) 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 3.1).

NEI 12-02 (Reference 3.6) 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 3.7), conformance with the guidance in NEI 12-02 is an acceptable method for satisfying the requirements in Order EA-12-051.

This Final Integrated Plan (FIP) addresses compliance with NRC Order EA-12-049. Compliance with Order EA-12-051 can be found in References 3.45 and 3.46.

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

2.1 General Elements

2.1.1 General Criteria and Baseline Assumptions

The assumptions used for the evaluations of a Farley Nuclear Plant (FNP) ELAP/loss of normal access to the ultimate heat sink (LUHS) event and the development of FLEX strategies are stated below.

Key assumptions associated with implementation of FLEX strategies for FNP are described below:

- The applicable PWR Criteria and Initial Plant Conditions listed in NEI 12-06, Revision 2 (Reference 3.3), Sections 3.2.1.1 - 3.2.1.6, are applicable to FNP without exception.
- BDBEE hazards, when referred to in this document, are the applicable hazards from NEI 12-06, Section 2.2. The applicable hazards for Farley are described in Section 2.7 in this document.
- Additional staff resources are expected to begin arriving at 6 hours and the site will be fully staffed 24 hours after the event (References 3.37 and 3.38).
- Temperature is not expected to impact the utilization of off-site resources or the ability of personnel to implement the required FLEX strategies.
- Seismically qualified is used in this FIP to describe criteria as defined in FNP FSAR Section 3.7 (Reference 3.24).
- FNP has installed low leakage reactor coolant pump (RCP) seals. RCP seal leakage is assumed to be 1 gpm per RCP after seal actuation. An additional 1 gpm of unidentified leakage is included in the total RCS leakage (the Technical Specifications maximum allowed unidentified leakage, Reference 3.13, TS 3.4.13) (Reference 3.8).

2.2 Strategies

2.2.1 Objective and Approach

The objective of the FLEX strategies is to establish an indefinite coping capability to prevent damage to the fuel in the reactor and SFPs and to maintain the containment function using installed equipment, on-site portable equipment, and off-site resources. This indefinite coping capability will address an extended loss of all ac power (ELAP) – loss of off-site power, emergency diesel generators and any alternate ac source (as defined in 10 CFR 50.2) 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 (LUHS).

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 concurrent with LUHS event. A safety function-based approach provides consistency with, and allows coordination with, existing plant emergency operating procedures (EOPs). FLEX strategies are implemented in support of EOPs using FLEX Support Guidelines (FSGs) and Strategy Implementation Guides (SIGs). SIGs were developed to have operator actions in the field included in a separate "operator friendly" procedure format. The FSGs and SIGs together are equivalent to the PWROG generic FSGs.

The strategies for coping with the plant conditions that result from an ELAP concurrent with 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 or commissioned.

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.

NOTE: The strategy descriptions below are the same for both of the Farley units. Any differences and/or unit specific information is included where appropriate.

2.2.2 Method of Compliance with NRC Order EA-12-049

Core decay heat is removed by adding water to the steam generators (SGs) and releasing steam from the SGs to the atmosphere. The water will initially be added by the turbine-driven auxiliary feedwater (TDAFW) pump, taking suction from the condensate storage tank (CST). Eventually, the reactor coolant system (RCS) will be cooled down, which will reduce the RCS and SG pressures. When the TDAFW pump can no longer be operated due to the lowering SG pressure, a SG FLEX pump (also taking suction from the CST) will be used to add water to the SGs. If the CST is depleted, the reactor makeup water storage tank (RMWST) can supply makeup water to the CST via the SG FLEX pump. The refueling water storage tank (RWST) serves as an alternate supply of makeup water to the CST and RMWST. The long term water supply can be provided from the seismically qualified service water pond utilizing the NSRC supplied water purification skid to limit the impact of raw water injection on the SGs.

Borated water will be added to the RCS for reactivity control. Initially, boron will be injected using the safety injection accumulators, followed by injection using a motor-driven boron injection (BI) FLEX pump, powered by a FLEX generator, taking suction from the boric acid tank (BAT) or RWST. If required, offsite support equipment can supplement any BI needs.

FLEX generators will be used to reenergize the installed battery chargers to keep the necessary direct current (dc) buses energized, which will then keep the 120 volt ac instrument buses energized. FNP will utilize the industry National SAFER Response Centers (NSRCs) for supplies of Phase 3 equipment.

In the postulated ELAP event, the SFPs will initially heat up due to the unavailability of the normal cooling system. A spent fuel pool (SFP) FLEX pump will be aligned and used to add water from the service water (SW) pond to the SFPs of both units to maintain or restore level as the pools boil. Three paths will be available for SFP makeup: hoses directly discharging into the pools, connections to the existing SFP cooling lines, and via hoses directed to portable spray monitors positioned around the SFPs. Makeup will maintain a sufficient amount of water above the top of the fuel assemblies for cooling and shielding. The long term strategy for SFP makeup is to continue the strategies described above. When supplemented by portable equipment delivered from off-site (NSRC), water from the Chattahoochee River can be used to replace depleted on-site seismically qualified water inventories. However, the associated actions are not relied upon in the FLEX strategy during the first 72 hours following ELAP.

Farley has a large dry containment building. Farley utilizes low-leakage seals on the reactor coolant pumps. Should the event occur with the plant in MODES 1-4 (power operation, startup, hot standby, hot shutdown), the low leakage seals will limit the leakage inside the containment. This ensures that containment pressure and temperature remain within design limits without active containment cooling until well beyond 72 hours. The long term strategy is to continue to utilize 600V and 480V power, supplemented by the NSRC equipment, indefinitely. Additional 4kV generators are available from the NSRC and may be used as desired but are not required for Phase 3 coping strategies. Since no time sensitive Phase 3 actions have been identified, instructions for connection and utilization of NSRC equipment for long term coping or recovery will be provided by Technical Support Center (TSC) personnel who will have assessed the condition of the plant and infrastructure, plant accessibility, and additional available offsite resources (both equipment and personnel) following the BDBEE.

Should the event occur with the plant in MODES 5 (cold shutdown) or 6 (refueling), local manual actions are credited to establish a vent flow path from containment through one of the two installed lines provided for integrated leak rate testing.

The specific strategies described in Sections 2.3, 2.4, 2.5, and 2.6 below are capable of mitigating an ELAP concurrent with LUHS resulting from a BDBEE by providing adequate capability to maintain or restore core cooling, containment, and SFP cooling capabilities at FNP. 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. As previously discussed, these strategies, in the form of FSGs and SIGs, have been incorporated into the FNP emergency operating 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 Electric Power

2.3.1 Phase 1 Strategy

Following an ELAP, inverters maintain main control room (MCR) instrumentation and required control features with power supplied from the station batteries. Critical 125V dc loads are also maintained from the batteries. In order to extend battery life for all Station Blackout (SBO) events, operators are directed to take steps to minimize the load on the station batteries by shedding unnecessary loads in accordance with station procedures; load shedding is completed by 60 minutes after the start of the event, thus ensuring the station batteries are available for a minimum of 8.5 hours (Reference 3.15). Bus voltage will be monitored to track battery conditions.

Operators will utilize portable lights for MCR lighting between the time of load shed and the repowering via the FLEX diesel generator (DG) in Phase 2. Local control of the TDAFW turbine is discussed in section 2.4.1. Communications equipment utilizes onboard battery capacity or propane generators to allow communications.

2.3.2 Phase 2 Strategy

At or before 8 hours after the start of the event (time sensitive at 8.5 hours), a 600V FLEX DG will be deployed to power an installed 600V FLEX terminal box mounted inside Unit 2 auxiliary building. This terminal box provides power to selected loads on the Train A emergency load centers "1D" and "2D". As an alternative, the 600V FLEX DG can be used to power an installed 600V FLEX terminal box mounted inside the Unit 1 auxiliary building. This terminal box provides power to selected loads on the Train B emergency load centers "1E" and "2E". Either 600V FLEX terminal box will power both Unit's required FLEX loads (see Figure 2 and Figure 4).

The loads to be powered by the 600V FLEX DG include continuity of power for critical instrumentation, fuel oil transfer pumps, accumulator discharge motor operated valves (MOV), FLEX ventilation fans, MCR lighting, and SFP level indication system. The 600V FLEX DG is capable of starting without external equipment. One 600V FLEX DG is capable of supporting required loads for both units.

At or before 14 hours after the start of the event (time sensitive at 19 hours), a 480V FLEX DG will be deployed to power the RCS makeup or boron injection FLEX pump skids for both units. The 480V FLEX DG connects to a 480V FLEX terminal box mounted inside the hot machine shop. The 480V FLEX terminal box is permanently wired to receptacles in the Unit 1 and Unit 2 areas where the pump skids are to be staged. As an alternate, a 480V FLEX terminal box, along with receptacles, is mounted on a portable cart that can be used to connect the 480V FLEX DG to the pumps.

The electrical phase rotation for Farley is reverse phase rotation (i.e., 3-2-1), and the equipment to support FLEX Phase 2 is standard rotation (i.e., 1-2-3). The design of the 600V FLEX terminal box has accounted for this difference in phase rotation with rolled leads. The 480V FLEX terminal box utilizes a direct feed-through to the BI/RCS makeup FLEX pumps. Phase rotation for the portable equipment was verified during site acceptance testing.

2.3.3 Phase 3 Strategy

The long term strategy is to continue to utilize 600V and 480V power, supplemented by the NSRC equipment, indefinitely. Additional 4kV generators are available from the NSRC and may be used as desired but are not required for Phase 3 coping strategies. Since no time sensitive Phase 3 actions have been identified, instructions for connection and utilization of NSRC equipment for long term coping or recovery will be provided by TSC personnel who will have assessed the condition of the plant and infrastructure, plant accessibility, and additional available offsite resources (both equipment and personnel) following the BDBEE. An example of this follows:

Two 1 MW 4kV turbine generators from the NSRC per unit may be connected together using NSRC provided paralleling equipment and necessary cables. The NSRC 4kV power can be connected to either A or B Train 4kV 1E buses. TSC procedures contain instructions to address phase rotation.

2.3.4 Systems, Structures, Components

2.3.4.1 Installed dc Electrical Power

The 125V dc system for each unit consists of two 125V dc switchgear assemblies, three 125V dc battery chargers (one charger can supply either train), two 125V dc batteries, and six dc distribution cabinets. These dc systems are credited in the Phase 1 coping strategies to maintain critical instrumentation loads until supplied by a 600V FLEX DG. Refer to FNP FSAR (Reference 3.24) Section 8.3.2 for a description of the 125V dc system.

The Class 1E 125V dc systems are safety related, seismically qualified components which are protected from BDBEE hazards (Reference 3.24, Section 3.5).

2.3.5 FLEX Connections

2.3.5.1 600V FLEX Electrical Connections

Safety-related transfer switches connect to load centers 1D, 2D, or 1E, and 2E to the 600V FLEX DG following an ELAP resulting from a BDBEE.

A 600V FLEX terminal box for each unit is mounted on an inside wall of each auxiliary building. Missile-shield protected penetrations allow access to the terminal boxes, which are connected to the referenced load centers via the transfer switches. The terminal box provides the color coded connections for the 600V FLEX DG to be plugged into the system. The primary staging area for the FLEX DG is near the Unit 2 auxiliary building. The 600V FLEX terminal box at that location will power the A Train equipment on both units (load centers 1D and 2D). The alternate location, near the Unit 1 auxiliary building, will power the B Train equipment on both units (load centers 1E and 2E). Only one FLEX DG is necessary to support coping strategies for both units. See Figure 2 and Figure 4.

2.3.5.2 480V FLEX Electrical Connections

A wall-mounted receptacle is located near the RCS makeup FLEX pump staging area on each unit. Permanent power cable from each receptacle is routed to the hot machine shop to a termination box at plant grade elevation. This box, when connected by temporary cabling to the 480V FLEX DG outside the east missile shield door, will power the pumps on both units from either the primary location (Unit 2) or the alternate location (Unit 1). As an alternate, a 480V FLEX terminal box, along with receptacles, is mounted on a portable cart that can be used to connect the 480V FLEX DG to the pumps. See Figure 2 and Figure 4.

2.3.6 Electrical Analysis

Battery calculations demonstrate that the limiting train of battery capacity is sufficient to provide critical loads for 8.5 hours following a load shed (Reference 3.15). The Class 1E battery duty cycle of 8.5 hours for FNP was calculated in accordance with the IEEE-485 methodology using manufacturer discharge test data applicable to the licensee's FLEX strategy as outlined in the NEI white paper on Extended Battery Duty Cycles (Reference 3.39) as endorsed by the NRC (Reference 3.40). According to Table 4, the minimum time margin between the limiting calculated battery duration for the FLEX strategy and the maximum deployment time for FLEX equipment to supply the dc loads is approximately 0.5 hours for FNP; however, validation and verification has shown a time margin of greater than one hour. Assuming use of the least limiting train of batteries, which is protected from all screened in hazards, the time margin is greater than 2 hours.

2.3.7 600V and 480V FLEX Generators

The selected FLEX DGs have sufficient capacity to supply the Phase 2 loads as determined by the Phase 2 600V and 480V Alternate Power Diesel Generator sizing calculation (Reference 3.9).

2.4 Reactor Core Cooling and Heat Removal Strategy MODES 1-4 and MODE 5 with Steam Generators Available

Initially, core decay heat is removed by adding water to the steam generators (SGs) and releasing steam from the SGs from the main steam safety valves to the atmosphere. Water will initially be added by the turbine-driven auxiliary feedwater (TDAFW) pump, taking suction from the condensate storage tank (CST).

At or before 10 hours after the start of the event (time sensitive at greater than 15 hours), depressurization of the SGs is initiated via local operation of atmospheric relief valves (ARVs). RCS cooldown occurs at the same time as the SGs are depressurized. This enables boration via accumulators and the boron injection FLEX Pump to maintain sub-criticality margin. In the analysis, no credit is taken for boron added from the SI accumulators.

As soon as resources are available (at or before 10 hours after the start of the event), a diesel driven SG FLEX pump (taking suction from either the CST or the RMWST) will be deployed and available for operation. This action provides defense in depth when adequate steam pressure is no longer available to drive the TDAFW pump's turbine.

If the initial CST water supply is depleted, the RMWST can supply makeup water to the CST via the diesel driven SG FLEX pump, at or before 11 hours after the start of the event (time sensitive at greater than 12 hours). The RWST serves as the alternate supply of makeup water to the CST using the RCS makeup FLEX pump. Use of the RWST would not compromise system integrity or equipment performance that would preclude maintaining the plant in a safe condition (Reference 3.19).

At or before 14 hours after the start of the event (time sensitive at 19 hours), the portable boron injection FLEX pump is available to initiate supplemental boration (with letdown via the head vents as necessary) transferring water from the BATs to the RCS to ensure adequate boration and maintain sub-criticality following RCS cooldown.

2.4.1 Phase 1 Strategy

Core Cooling and Heat Removal

Immediately following the ELAP event, reactor core cooling (decay heat removal) will be accomplished by natural circulation of the reactor coolant system (RCS) through the steam generators. The heatsink (SG) is maintained by operation of the turbine-driven auxiliary feedwater (TDAFW) pump supplying water to all three (3) steam generators (see Figure 1). Heat removal is accomplished by steam release from the Main Steam Safety Valves (MSSVs). Operation of the TDAFW pump will be automatically actuated within 1 minute of a loss of ac power (Reference 3.11).

The TDAFW pump supplies flow to all three steam generators through individual air-operated flow control valves (FCV) that fail open on loss of compressed air or modulate on a loss of dc control power. Since the compressed air system is non-seismic, local, manual operation of the FCVs is assumed to be required throughout the ELAP. Control of the valves, if compressed air is available, and manual speed control for the TDAFW pump, is provided in the MCR.

Suction to the TDAFW pump will be from the seismically qualified CST (see Figure 1). Each CST is nominally a 500,000 gallon tank; however, only the bottom, approximately 164,000 gallons, is missile protected and credited for injection to the steam generators for high wind hazards. Based on the minimum volume of water available in the CST, along with core decay heat and RCS sensible heat removal requirements for cool down to 350°F, the protected inventory of the CST is available to provide flow to the steam generators for approximately 12 hours (Table 3, Reference 3.14).

The initial phase of reactor core cooling will be heavily dependent upon the operation of the TDAFW pump to remove the decay heat from the reactor core. The TDAFW uninterruptable power supply (UPS) provides for two hours of automatic operation of the TDAFW pump. In addition, the turbine steam admission valves will remain open for two hours utilizing compressed air from the associated air accumulator. To ensure uninterrupted operation of the TDAFW pump, operator action is required within two hours after the start of the event to manually open the steam admission valves and then manually control TDAFW turbine speed by throttling the TDAFW trip and throttle valve to control turbine speed and pump discharge pressure (Reference 3.11).

RCS Inventory Control and Reactivity Control

Farley has installed safe shutdown/low leakage reactor coolant pump (RCP) seals (Westinghouse SHIELD® Passive Shutdown Seal) for the reactor coolant pumps (RCP). Proper operation of the shutdown seals is assumed. While not required for compliance, proper operation will be verified using pressurizer level readings for defense in depth.

No Phase 1 actions are required for inventory control. With RCP shutdown seals and the injection of accumulator inventory, analyses demonstrate that natural circulation in the RCS can be maintained for approximately 29 hours without reliance upon FLEX RCS injection (Reference 3.19).

The Phase 1 action for RCS long term sub-criticality will be to cool down and initiate depressurization of the RCS within 10 hours after the event. This allows for injection of the safety injection (SI) accumulators which adds boron and coolant inventory to the RCS. Prior to injecting the entire contents of the SI accumulators, they will be isolated to avoid nitrogen injection into the RCS (introduction of nitrogen has the potential to inhibit natural circulation). Procedural guidance for stopping RCS cooldown and depressurization prior to nitrogen injection is provided in the appropriate emergency operating procedure. See Section 2.4.8 for a discussion on reactor coolant pump (RCP) seals. No credit is taken for the boron addition from the SI accumulators.

2.4.2 Phase 2 Strategy

Primary Strategy Core Cooling and Heat Removal

The primary strategy for maintaining reactor core cooling in Phase 2 remains the same as Phase 1 and is dependent upon the continued operation of the TDAFW pump. The TDAFW pump is capable of feeding the steam generators provided there is adequate steam pressure available (nominally 150 psig) to drive the turbine and an adequate supply of water in the CST.

Prior to depletion, the CST can be provided makeup from the RMWST (primary) or RWST (alternate) (see Figure 1). Both the RMWST and the RWST are protected (i.e., seismically qualified and missile protected) sources of water. The preferred source of makeup for SG injection is the RMWST; this makeup will occur prior to exhausting the initial inventory of the CST. The RMWST also contains de-mineralized water with a minimum inventory of 160,000 gallons (see Section 2.4.4.7) that is capable of providing at least 19 additional hours of makeup after depletion of the CST (see Table 3 and Reference 3.14).

Makeup from the RMWST requires the use of on-site equipment including a portable pump (SG FLEX pump) and hoses. The SG FLEX pump suction will be aligned to the RMWST with discharge to the CST or directly to the AFW or alternate feedwater injection connections (see Figure 1).

When the RMWST inventory is depleted as a CST makeup source, then the RCS makeup FLEX pump will be used to supply makeup from the RWST. The discharge from the RCS makeup FLEX pump will be connected by hose to any of the available CST or RMWST fill connections (See Figure 1).

Alternate Strategy Core Cooling and Heat Removal

In the event that adequate steam pressure is no longer available to drive the TDAFW pump's turbine, the Phase 2 alternate coping strategy for reactor core cooling requires connecting a diesel driven SG FLEX pump for injection of water into the steam generators (see Figure 1).

If not already complete, implementing this capability requires depressurizing the steam generators. To complete this activity, operations personnel will be dispatched to the main steam valve rooms to manually reposition the atmospheric relief valves (ARVs) and reduce pressure in the steam generators to approximately 230 psig. Manual operation of these valves is moderate work of short durations. Continuous standby in the area is not required and operators can cycle in and out of the room as necessary to make minor adjustments directed by the MCR operator. Thus the impact of heat stress on the operators is minimized.

The SG FLEX pump is sized based on the decay heat removal requirements at one hour after reactor shutdown in accordance with the Pressurized Water Reactor Owners Group (PWROG) position for alternate low pressure feedwater pump requirements (Reference 3.18). Thus, the SG FLEX pumps are capable of delivering 300 gpm at a discharge pressure equal to the steam generator injection pressure of 300 psig (at the SG feed ring) in addition to all head losses (e.g., hoses, piping, connections, and elevation of the feed injection point) from the discharge of the SG FLEX pump to the steam generator.

Throughout Phase 2, either the TDAFW pump with suction from the CST, or the SG FLEX pump, with suction from either the CST or the RMWST, will be in operation and aligned to discharge to the SGs. For injection using the SG FLEX pump, the pump will be deployed at a location near the CST (see Figure 4).

The discharge of the SG FLEX pump will be directed to all three steam generators via connection to the auxiliary feedwater (AFW) pump discharge header. The strategy at FNP provides primary and alternate diverse injection point connections externally accessible from ground level (155' elevation). FLEX hoses from these connection points to the discharge piping of the AFW pumps inside the auxiliary building are stored in the vicinity of this connection point.

As an alternate, the SG FLEX pump can be directed to all three steam generators via piping connections on the main feedwater system (currently used for B.5.b strategies). The option of using the alternate connection for injection into the SGs provides additional redundancy. The flow path provides the capability to provide balanced flow to all three steam generators.

RCS Inventory and Reactivity Control

No additional action is required for RCS inventory control during Phase 2. With the assumed RCS leakage (refer to Section 2.4.8) no additional makeup beyond the SI accumulator volume added in Phase 1 will be required to maintain RCS inventory until Phase 3.

The reactivity control evaluation for FNP (Reference 3.19) indicates that it will be necessary to initiate supplemental boron injection (with letdown via head vents as necessary) to maintain sub-criticality margin. Therefore, following injection of the SI accumulators and prior to xenon decaying back below the 100% equilibrium value, a means for injecting additional borated water into the RCS is available as needed for reactivity control as discussed in the following paragraphs.

The addition of borated water is accomplished by a boron injection FLEX pump. The BI FLEX pump is deployed and available for operation approximately 14 hours into the event. This pump is powered by a 480V FLEX DG (one 480V FLEX DG supplies both units) and provides sufficient borated water at the RCS injection point to meet the makeup needs associated with both primary inventory control and subcriticality requirements. Diverse connections (primary and alternate) for discharge of the BI FLEX pump are located downstream of the charging pumps in the charging and cold leg injection headers (see Figure 1).

The BAT is the primary suction source for the BI FLEX pump. The BAT (2 per unit) has a Technical Specification minimum capacity of 11,336 gallons (see Section 2.4.4.9). The BI FLEX pump has a capacity of 20 gpm. The RWST is also available as a source of borated water for boron injection if needed. The RWST has a Technical Specification minimum volume of 471,000 gallons (see Section 2.4.4.8).

The RCS makeup evaluation for FNP (Reference 3.19) determined that single phase natural circulation is maintained until approximately 29 hours after the event. This analysis also determined that sufficient shutdown margin is achieved in less than 22.3 hours using the BAT as the RCS makeup source. The FNP ELAP analysis uses a uniform boron mixing model which requires a mixing delay period of 60 minutes following the addition of the targeted quantity of boric acid to the reactor coolant system. The FNP strategy begins RCS injection at hour 14 (under single phase natural circulation) at a rate of 20 gpm from the BAT. At this rate of injection, the required amount of boric acid injected into the RCS will be completed in sufficient time to ensure mixing of injected borated water throughout the RCS. Although borated water will be injected via the SI accumulators, this volume is not credited for the FLEX response. Therefore, FNP abides by the position expressed by the NRC staff in the letter dated January 8, 2014 regarding the boron mixing issue for pressurized water reactors (PWRs) (Reference 3.22).

2.4.3 Phase 3 Strategy

Primary Strategy

The primary coping strategy is to extend the Phase 2 strategy for reactor cooling to 72 hours after the start of the event and beyond with no immediate reliance on equipment from the NSRC until after 72 hours. This requires long-term reliance on SGs for core cooling via the TDAFW or the SG FLEX pump. Expected long-term plant conditions utilizing TDAFW include:

- Maintaining SGs at 150 psig, which is adequate to maintain TDAFW pump operation (Reference 3.23), and
- Maintaining RCS cold leg temperature at 350°F which is below the value for maintaining integrity of the RCP seals (Reference 3.18).

NSRC equipment is utilized to backup the Phase 2 equipment and to transition to Phase 3 coping. For example, for RCS injection beyond 72 hours after the start of the event, boron mixing equipment (delivered from the NSRC) can be employed to restore the RWST inventory (the RWST has the capacity to supply borated water to the RCS after the BAT is depleted, see Table 3).

See Table 2 for a list of equipment that will be delivered to the site by the NSRC; refer to Section 2.11 for a discussion on NSRC supplied equipment.

Since no time sensitive Phase 3 actions have been identified, instructions for connection and utilization of NSRC equipment for long term coping or recovery will be provided by TSC personnel who will have assessed the condition of the plant and infrastructure, plant accessibility, and additional available offsite resources (both equipment and personnel) following the BDBEE.

2.4.4 Systems, Structures, Components

2.4.4.1 Turbine Driven Auxiliary Feedwater (TDAFW) Pump

The TDAFW pump is utilized to maintain the heatsink for decay heat removal following an ELAP event, by supplying water to all three SGs through individual air-operated FCVs that fail open on loss of compressed air or modulate on a loss of dc control power.

The TDAFW pump is a safety related, seismically qualified component which is located in the auxiliary building, a seismically qualified structure, and therefore protected from BDBEE hazards (Reference 3.24, Section 3.5).

2.4.4.2 TDAFW Pump Discharge Flow Control Valves

The TDAFW pump supplies flow to all three steam generators through individual air-operated FCVs. Since the compressed air system is non-seismic, manual operation of the FCVs is required throughout the ELAP. Control of the FCVs, if compressed air is available, and manual speed control for the TDAFW pump, is provided in the MCR. The TDAFW UPS and batteries provide for two hours of automatic operation of TDAFW. In addition, the turbine steam admission valves will remain open for two hours utilizing compressed air from the associated air accumulator. Within two hours, local operator action is required to manually open the steam admission valves and then manually control TDAFW turbine speed by throttling the TDAFW trip and throttle valve to control turbine speed and pump discharge pressure per existing procedural guidance.

The TDAFW pump discharge flow control valves are safety-related, seismically qualified components which are located in the auxiliary building, and therefore protected from BDBEE hazards (Reference 3.24, Section 3.5).

2.4.4.3 Main Steam Safety Valves (MSSVs)

During the initial stages of the event, heat generated by the reactor is dissipated by steam release by the spring-loaded MSSVs. Refer to FNP FSAR (Reference 3.24) Section 10.3 for a description of the MSSVs.

The MSSVs are seismically qualified components which are also protected from BDBEE hazards (Reference 3.24, Section 3.5).

2.4.4.4 Atmospheric Relief Valves (ARVs)

During a BDBEE, the ARVs are manually operated locally to cooldown and depressurize the SGs to allow SG makeup via the SG FLEX pump and to allow boration via the SI accumulators (not credited) and the BI FLEX Pump (RCS cooldown occurs at the same time the secondary side depressurizes). Refer to FNP FSAR (Reference 3.24) Section 10.3 for a description of the ARVs.

The ARVs are seismically qualified components which are also protected from BDBEE hazards (Reference 3.24, Section 3.5).

2.4.4.5 Reactor Vessel Head Vent System (RVHVS)

A safety-grade letdown path is provided by the RVHVS. The RVHVS provides a head vent letdown path, if needed, to inject a sufficient volume of borated water. The RVHVS valves are dc powered solenoid valves and are operated manually from the MCR. DC power is maintained throughout the event, initially by the safety-related station batteries and subsequently by the battery chargers once the onsite 600V FLEX DG is operating. Refer to FNP FSAR (Reference 3.24) Section 5.5.15 for a description of the RVHVS.

The RVHVS piping and valves are seismically qualified components located in Containment, and therefore protected from BDBEE hazards (Reference 3.24, Section 5.5.15).

2.4.4.6 Condensate Storage Tank

Suction to the TDAFW pump will be from the seismically qualified CST, which is also protected from tornado missiles and BDBEE hazards (Reference 3.24 Table 3.2-1). Each unit has one (1) CST with a credited inventory of 164,000 gallons of de-mineralized water (Reference 3.13, Bases 3.7.6). Based on the minimum volume of water available, the credited volume in the CST can support core cooling and heat removal requirements in MODES 1 through 4 for approximately 12 hours (see Table 3 and Reference 3.14). Refer to FNP FSAR (Reference 3.24) Sections 3.8.4.1.H and 9.2.6 for a description of the CST.

In order to ensure the 164,000-gallon reserve required by Technical Specifications, the lower 12 feet of the tanks are designed to withstand ruptures caused by missiles generated by tornadoes. (Reference 3.24, Table 3.2-1, Section 3.8.4.1.H).

2.4.4.7 Reactor Makeup Water Storage Tank (RMWST)

If the CST is depleted, the RMWST can supply makeup water to the CST via the SG FLEX pump. The RMWST contains de-mineralized water with a minimum inventory of 160,000 gallons (Reference 3.14). Refer to FNP FSAR (Reference 3.24) Section 9.2.7 for a description of the RMWST.

The seismically qualified RMWST is designed to withstand the effects due to the design basis tornado and BDBEE hazards. The RMWST volume credited for FLEX is protected against externally generated missiles (Reference 3.24, Section 3.5.4, Section 3.8.4.1.H, 3.8.5.1.G, and Table 3.2-1).

2.4.4.8 Refueling Water Storage Tank (RWST)

The borated water inventory in the RWST is available as a backup source for SG injection during MODES 1 through 4 and MODE 5 with SGs available (i.e., backup to CST and RMWST for core cooling). During MODE 6 and MODE 5 without SGs available, makeup to the RCS from the RWST can be provided. The RWST contains a minimum of 471,000 gallons (Reference 3.13, SR 3.5.4.2). The boron concentration of the RWST is maintained ≥ 2300 ppm and ≤ 2500 ppm (Reference 3.13, SR 3.5.4.3). Refer to FNP FSAR (Reference 3.24) Section 6.2.2.2.1 for a description of the RWST.

The RWST is a seismically qualified structure which is also designed to withstand the effects due to the design basis tornado (Reference 3.24, Table 3.2-1, Sections 3.5.4, 3.8.5.1.G). The RWST is protected against externally generated missiles and BDBEE hazards (Reference 3.24, Table 3.2-1).

2.4.4.9 Boric Acid Tank (BAT)

The Boric Acid Tank (BAT) is the primary source for boron addition using the portable boron injection FLEX pump. The BAT (2 per unit) has a capacity of 21,000 gallons (Reference 3.24, Table 9.3-6). The two BATs per unit have a minimum required volume of 11,336 gallons and boron concentration between 7000 and 7700 ppm (Reference 3.25 Technical Requirements Surveillance (TRS) TRS 13.1.7.3 and 13.1.7.4). Refer to FNP FSAR (Reference 3.24) Section 9.3.4 for a description of the BAT.

The BAT is seismically qualified and located in the auxiliary building. The BAT is protected against externally generated missiles and BDBEE hazards by the auxiliary building (Reference 3.24, Table 3.2-1). In addition, the location of the tanks in the auxiliary building precludes boron precipitation concerns due to cold temperatures.

2.4.4.10 Service Water (SW) Pond

The SW pond is the preferred source of makeup to the SFP during all MODES. Additionally, the SW pond can be used to provide makeup to the CST/RMWST prior to their depletion. The capacity of the storage pond is approximately 439,899,429 gallons of water (Reference 3.14). Refer to FNP FSAR (Reference 3.24) Section 2.4.8.1 for a description of the SW pond.

The SW pond is a seismically qualified structure which is designed to withstand the effects due to BDBEE hazards (Reference 3.24, Sections 3.2.1.2, 3.5.4).

2.4.5 FLEX Connections

2.4.5.1 Primary SG FLEX Pump Discharge Connection

The discharge of the SG FLEX pump will be directed to the steam generators via hose and adapters connected to either of two diverse, seismically qualified, missile protected injection points (primary and alternate) located in the auxiliary building at plant grade level. Permanent piping is run in an equipment hatch from these connection points down to the 100' elevation of the auxiliary building. Hoses will connect this piping to a seismically qualified, missile protected connection on the AFW discharge header which feeds all 3 steam generators. Hose to provide the final connection to the AFW piping is stored in the vicinity of this connection point.

2.4.5.2 Alternate SG FLEX Pump Discharge Connection

In the event that the primary AFW Pump discharge connection is not available, an alternate connection location is provided. The alternate connection point is located on the main feedwater line (B.5.b/50.54(hh) connection, see Figure 1). This alternate injection point also allows for injection to all three SGs.

2.4.5.3 CST Connection

Easily accessible, diverse, seismically qualified, missile protected connection points are available on the CST to support AFW injection and/or CST makeup using the SG FLEX pump. Hoses will be used for these supply and discharge connections (See Figure 1).

2.4.5.4 Primary and Alternate RCS Connection

The addition of borated water is accomplished by a BI FLEX pump. This pump will be powered by a 480V FLEX DG and is sized to provide sufficient borated water at the RCS injection point to meet the makeup needs associated with both primary inventory control and subcriticality requirements. Diverse, seismically qualified, missile protected connections (primary and alternate) for discharge of the BI/RCS makeup FLEX pump are located downstream of the charging pumps in the charging and cold leg injection headers (See Figure 1).

2.4.5.5 RMWST Suction Connection

The preferred source of makeup to the CST for SG injection prior to exhausting the inventory of the CST is the RMWST. Diverse, seismically qualified, missile protected connection points are available on the RMWST. Makeup from the RMWST requires the use of the SG FLEX pump. The SG

FLEX pump discharges to the CST via diverse, seismically qualified, missile protected fill connection points. Hoses will be used for both the supply and discharge connections (See Figure 1).

Additionally, the RMSWT can be directly aligned to the AFW injection piping for SG injection utilizing the SG FLEX pump.

2.4.5.6 RWST Suction Connection

An alternate source of makeup to the CST for SG injection prior to exhausting the inventory of the CST is the RWST. Makeup from the RWST requires the use of the RCS makeup FLEX pump. The seismically qualified, missile protected RWST suction connection as well as the RCS makeup FLEX pump are located on the 100' elevation of the auxiliary building. Hoses will be used for both the supply and discharge connections (See Figure 1).

2.4.6 Key Reactor Parameters

The instruments monitoring the listed parameters in Table 1 for reactor core cooling and decay heat removal strategy remain available following specified load shed actions outlined in plant procedures. Analysis (Reference 3.15) indicates this strategy provides critical instrumentation relying on the Station Batteries until supplied by a 600V FLEX DG. Only a single channel of Table 1 instrumentation is needed for FLEX strategy implementation.

Table 1

Essential Monitored Parameters and Associated Instrumentation

Parameter	Available Channel*	Power Source
SG-1A(2A) Pressure	PI-474 PI-475 PI-476	A-Train Battery B-Train Battery B-Train Battery
SG-1B(2B) Pressure	PI-484 PI-485 PI-486	A-Train Battery B-Train Battery B-Train Battery
SG-1C(2C) Pressure	PI-494 PI-495 PI-496	A-Train Battery B-Train Battery B-Train Battery
SG-1A(2A) Level	LI-474 LI-475 LI-476	A-Train Battery A-Train Battery B-Train Battery
SG-1B(2B) Level	LI-484 LI-485 LI-486	A-Train Battery A-Train Battery B-Train Battery
SG-1C(2C) Level	LI-494 LI-495 LI-496	A-Train Battery A-Train Battery B-Train Battery
AFW Flow	FI-3229A FI-3229B FI-3229C	A-Train Battery A-Train Battery B-Train Battery
RCS Wide Range (WR) T-Cold	TI-410 TI-420 TI-430	A or B-Train Battery A or B-Train Battery A or B-Train Battery
RCS WR T-Hot	TI-413 TI-423 TI-433	A-Train Battery A-Train Battery B-Train Battery
RCS Wide Range Pressure	PI-402A PI-403A	A-Train Battery B-Train Battery
Pressurizer Level	LI-459A LI-460 LI-461	A-Train Battery A-Train Battery B-Train Battery

Table 1

Essential Monitored Parameters and Associated Instrumentation

Parameter	Available Channel*	Power Source
Source Range Neutron Flux	N31 N32	A-Train Battery B-Train Battery
Core Exit Thermocouples (CET)	TE-2301 through TE-2351 on Unit 1 and TE-2301 through TE-2349 on Unit 2 as available per Technical Specifications	A-Train Battery B-Train Battery
Containment Pressure	PI-950 PI-951 PI-952 PI-953	A-Train Battery A Train Battery B-Train Battery B-Train Battery
CST Level	LI-4132A LI-4132B	A-Train Battery B-Train Battery
SFP Level	LI-0007 LI-0008	On-board battery / 600V FLEX DG
Reactor Vessel Level Indication	ICC Monitor Panel	A-Train Battery B-Train Battery
DC Bus Voltage		125V dc power

*Note: Only a single channel of instrumentation is needed for FLEX strategy implementation.

Contingencies for alternate instrumentation monitoring are provided to the MCR team following a BDBEE via procedural guidance for establishing alternate indications for essential instrumentation. In addition, local indications will remain available and the Key Reactor Parameters can be determined from a local reading using standard I&C instruments.

Portable FLEX equipment is supplied with the local instrumentation needed to operate the equipment. The use of these instruments is detailed in the operating procedures for each piece of FLEX equipment.

2.4.7 Thermal Hydraulic Analyses

The FLEX strategies used to implement the coping capabilities are discussed in detail in the following sections. The strategies are based on the analysis presented in Calculation SM-SNC458207-004, Farley Extended Loss of ac power Decay Heat and Makeup Requirements

(Reference 3.14) and Evaluations to Support SNC FLEX strategies for FNP performed by Westinghouse (Reference 3.19).

These analyses demonstrate that the strategies provide the ability of FNP to successfully cope from the baseline conditions of the ELAP concurrent with LUHS resulting from a postulated BDBEE using diverse and redundant combinations of installed and portable equipment. The analyses also demonstrate that the overall coping capabilities provide sufficient margin during each of the coping durations described above so as to provide defense-in-depth against the many unknowns associated with BDBEEs. The coping strategy for each essential function is evaluated and described in detail in the following sections.

2.4.7.1 Secondary Analysis

Immediately following the ELAP event, reactor core cooling (decay heat removal) will be accomplished by natural circulation of the RCS through the steam generators. The heatsink is maintained by operation of the TDAFW pump supplying water to all three (3) steam generators. Suction to the TDAFW pump will be from the seismically qualified CST, which is also protected from tornado missiles (Reference 3.24, Table 3.2-1). Each unit has one (1) CST, each with a credited inventory equal to 164,000 gallons of de-mineralized water (Reference 3.13, Bases 3.7.6). Based on the minimum volume of water available, the credited volume in the CST can support core cooling and heat removal requirements in MODES 1 through 4 for a minimum of 12 hours (see Table 3 and Reference 3.14).

When adequate steam pressure is no longer available to drive the TDAFW pump's turbine, the alternate coping strategy for reactor core cooling requires depressurization of the steam generators and connecting a diesel driven SG FLEX pump for injection of water into the steam generators.

Implementing this capability requires depressurizing the steam generators. To complete this activity, operations personnel will be dispatched to the main steam valve rooms to manually reposition the ARVs and reduce pressure in the steam generators to approximately 230 psig. The normal supply for the SG FLEX pump will be from the CST (primary) and the alternate suction source will be from the RMWST (alternate). The RMWST contains de-mineralized water with a minimum inventory of 160,000 gallons (Reference 3.14) that is capable of providing at least 19 additional hours of makeup after depletion of the CSTs (see Table 3).

If circumstances dictate the need for an additional SG makeup source, inventory in the RWST will be available. Each RWST contains a minimum inventory of 471,000 gallons of borated water (Reference 3.13, SR 3.5.4.2). The inventory located in the RWST provides an additional ~76 hours for SG injection after exhausting the CSTs and RMWST (see Table 3 and Reference 3.14) for core cooling. The RCS makeup FLEX pump will be used to provide makeup to the CST and/or RMWST using hoses.

2.4.7.2 RCS Analysis

The use of the safe shutdown/low leakage seal design for the reactor coolant pumps will delay the need for RCS makeup to prevent core uncovery to well beyond 7 days following an ELAP event (Reference 3.23). The coping strategy credits use of the Westinghouse SHIELD® Passive Shutdown Seal as described in the vendor's technical report (Reference 3.27) subject to the limitations and conditions endorsed by the NRC (Reference 3.8). The Westinghouse RCS makeup evaluation for FNP (Reference 3.19) demonstrates that RCS makeup will be required at 29 hours to maintain single phase RCS core cooling using the steam generators. If credit is taken for two-phase RCS core cooling using the steam generators, RCS makeup would not be required until after 72 hours. Regardless, RCS makeup will be required for supplemental boron addition for reactivity control beginning approximately 14 hours following an ELAP event.

2.4.8 Reactor Coolant Pump Seal Leakage

The SHIELD® low leakage seals are credited in the FLEX strategies in accordance with the four conditions identified in the NRC's endorsement letter from J. Davis, NRC, to J. A. Gresham, Westinghouse Electric Company, LLC, dated May 28, 2014 (Reference 3.8). That NRC letter endorsed Westinghouse Technical Report TR-FSE-14-1-P (Reference 3.27) and supplemental information provided by Westinghouse letters dated March 19, 2014, and April 22, 2014 (References 3.28, 3.29). The

May 28, 2014 NRC letter documented the staff's conclusion that the Westinghouse Technical Report and supplemental information is acceptable for use in ELAP evaluations for NRC Order EA-12-049 subject to four limitations and conditions. Each of these four limitations and conditions is restated below followed by a description of FNP Unit 1 and Unit 2 compliance.

1) *Credit for the SHIELD® seals is only endorsed for Westinghouse RCP Models 93, 93A, and 93A-1. Additional information would be needed to justify use of SHIELD® seals in other RCP models.*

   FNP Unit 1 and 2 compliance: The FNP Unit 1 and 2 RCPs are Model 93A. Therefore, FNP Unit 1 and Unit 2 comply with this limitation/condition.

2) *The maximum steady-state reactor coolant system (RCS) cold-leg temperature is limited to 571°F during the ELAP (i.e., the applicable main steam safety valve setpoints result in an RCS cold-leg temperature of 571°F or less after a brief post-trip transient). Nuclear power plants that predict higher cold-leg temperatures shall demonstrate the following:*

   a. *The polymer ring and sleeve O-ring remain at or below the temperature to which they have been tested, as provided in TR-FSE-14-1-P, Revision 1; or,*

   b. *The polymer ring and sleeve O-ring shall be re-tested at the higher temperature.*

   FNP Units 1 and 2 compliance: The maximum steady-state RCP seal temperature during an ELAP response is expected to be the T_{cold} corresponding to the lowest SG safety relief valve setting of 1075 psig. This corresponds to a T_{cold} value of 553°F to 557°F. Therefore FNP Units 1 and 2 comply with this limitation/condition.

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.*

   FNP Units 1 and 2 compliance: Nominal RCS Unit 1 and Unit 2 operating pressure of 2250 psia is bounded by Figure 7.1-2 of

TR-FSE-14-1-P, Revision 1 (Ref. 3.27). Therefore, FNP Unit 1 and Unit 2 comply with this limitation/condition.

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.*

   FNP Unit 1 and 2 compliance: A constant Westinghouse SHIELD® RCP seal package leak rate of 1 gpm per RCP was assumed in the applicable analysis, Westinghouse letter LTR-FSE-12-25, Rev. 2 (Reference 3.19). As stated in Westinghouse letter LTR-FSE-14-29, Rev 0 (Reference 3.30): "*Although seal leakage may be higher than 1 gpm/pump before shutdown seal actuation, the total integrated inventory loss expected during that time period is negligible when compared to the total RCS mass because the time period before actuation is on the order of 10 minutes compared to the 168 hour duration of the ELAP event.*" Therefore, FNP Unit 1 and Unit 2 meet the intent of this limitation/condition.

2.4.9 Shutdown Activity Analysis

Farley will provide sufficient negative reactivity by injecting borated water into the RCS using the BI FLEX pump to ensure that shutdown margin (1%) is maintained following cooldown and xenon decay. To ensure adequate boric acid concentration is provided to the RCS, injection for reactivity control is provided at approximately 14 hours following the loss of power and a reactor trip from full power. The primary borated water source for reactivity control in Phase 2 is the BAT. As an alternate, injection will be from the RWST. The analysis determined that subcriticality would be maintained from either source. A head vent letdown path to accommodate the additional inventory (see Section 2.4.4.5 for a description of the head vent letdown path) can be established to allow for injection. Reference 3.19 shows that injection of approximately 5,000 gallons of borated water from the BAT (7000 ppm) or 9,247 gallons of borated water from the RWST (2400 ppm) will be adequate to meet shutdown reactivity requirements at limiting cycle conditions and the core inlet temperature as low as 425°F. Note that the BAT-credited volume will provide adequate shutdown margin. No credit is taken for boron addition from the SI accumulators.

With the boron injection FLEX pump capability of 20 gpm, commencing makeup by 14 hours after the start of the event will provide adequate shutdown margin.

The Westinghouse RCS makeup evaluation for FNP (Reference 3.19) determined that single phase natural circulation is maintained until approximately 29 hours after the event. The FNP ELAP analysis uses a uniform boron mixing model which requires a mixing delay period of 60 minutes following the addition of the targeted quantity of boric acid to the reactor coolant system. The FNP strategy begins RCS injection at hour 14 (under single phase natural circulation) at a rate of 20 gpm from the BAT. At this rate of injection, the required amount of boric acid injected into the RCS ensures sufficient time for complete mixing of injected borated water throughout the RCS. Therefore, FNP abides by the position expressed by the NRC staff in the letter dated January 8, 2014 regarding the boron mixing issue for PWRs (Reference 3.22).

2.4.10 FLEX Pumps and Water Supplies

2.4.10.1 SG FLEX Pumps

Throughout Phase 2, either the TDAFW pump with suction from the CST, or the diesel driven SG FLEX pump, with suction from either the CST or the RMWST, will be in operation and aligned to discharge to the SGs (see Figure 1 and Figure 4). The SG FLEX pump is deployed and ready for operation at approximately 10 hours into the event. The discharge of the SG FLEX pump will be directed to all three steam generators via hose and adapters connected to either primary or alternate connection points (see Sections 2.4.5.1 and 2.4.5.2). The SG FLEX pump is sized based on the decay heat removal requirements at one hour after reactor shutdown. This corresponds to a minimum flow rate of approximately 300 gpm at a discharge pressure sufficient to feed a SG at a pressure of 300 psig (Reference 3.31).

The bounding case used to size the SG FLEX pump is the SG FLEX pump taking suction from the RMWST. A minimum pump head of 949.8 ft is required to ensure a minimum flow rate of 300 gpm can be provided for Steam Generator injection when the SG FLEX pump is aligned to the RMWST. At this flow rate, the minimum Net Positive Suction Head

Available (NPSHa) is 13 ft which exceeds the NPSH required (NPSHr) of approximately 6 ft (References 3.31 and 3.78).

Prior to depletion, makeup to the CST will be provided from the RMWST by the SG FLEX pump. The SG FLEX pump suction will be aligned to the RMWST via one of two diverse RMWST connection points (see Section 2.4.5.5 2.4.5.5). The SG FLEX pump discharges to the CST via one of two diverse fill connection points. Hoses will be used for these supply and discharge connections (See Figure 1).

With the SG FLEX pump taking suction from the RMWST, air entraining vortices are prevented from forming by the RMWST diaphragm, and the entire water volume in the RMWST is available for CST make-up (Reference 3.31).

2.4.10.2 <u>RCS Makeup FLEX Pumps</u>

When the RMWST inventory is depleted as a CST makeup source, then the RCS makeup FLEX Pump stored in the auxiliary building will be used to supply makeup from the RWST. The discharge from the pump will be connected by hose to any of the available CST or RMWST fill connections (See Figure 1).

A minimum pump head of 99.7 ft is required to ensure a minimum flow rate of 100 gpm can be provided for RMWST or CST makeup at any RWST water level. At this flow rate, the minimum NPSHa is 41.7 ft, which exceeds the NPSHr of approximately 6 ft (References 3.34 and 3.36).

2.4.10.3 <u>Boron Injection FLEX Pumps</u>

Evaluation for FNP indicates that it will be necessary to initiate supplemental boron injection (with letdown as necessary) to maintain sub-criticality. The addition of borated water is accomplished by a boron injection FLEX pump. This pump will be powered by a 480V FLEX DG and is sized to provide sufficient borated water at the RCS injection point to meet the makeup needs associated with both primary inventory control and subcriticality requirements. Diverse connections (primary and alternate) for discharge of the BI FLEX pump are located downstream of the charging pumps in the charging and cold leg injection headers (see Section 2.4.5.4). The boric acid tank (BAT) is the primary suction source for the BI FLEX pump. The RWST is also available as a source of borated water for boron injection if needed (See Figure 1). All connections meet the current design basis qualifications.

The limiting minimum pump head of 1193.2 ft is required to ensure a flow rate of 20 gpm can be provided for boron injection with suction from the BAT or RWST for MODES 1-4. At this flow rate, the minimum NPSHa is 26.1 ft (Reference 3.35) which exceeds the NPSHr of 12 ft (Reference 3.36).

2.4.10.4 AFW Water Supplies

Condensate Storage Tanks

The lower portion of the seismically qualified CST is protected from tornado missiles (Reference 3.24, Table 3.2-1). Each unit has one CST, each with a credited inventory equal to 164,000 gallons of de-mineralized water (Reference 3.13, Bases 3.7.6). Based on the minimum volume of water available, the credited volume in the CST can support core cooling and heat removal requirements in MODES 1 through 4 for a minimum of 12 hours (see Table 3 and Reference 3.14) which is greater than the time required to have the portable FLEX pumps operational.

Reactor Makeup Water Storage Tank

The RMWST is a seismically qualified source of water. The preferred source of makeup to the CST for SG injection prior to exhausting the inventory of the CST is the RMWST. The RMWST contains de-mineralized water with a minimum inventory of 160,000 gallons that is capable of providing at least 19 additional hours of makeup after depletion of the initial inventory of the CSTs (see Table 3 and Reference 3.14).

Refueling Water Storage Tank

The source of makeup to the CST for SG injection following exhaustion of the RMWST inventory is the RWST. The Technical Specifications (Reference 3.13, SR 3.5.4.2) require a minimum inventory of at least 471,000 gallons of water in the RWST (see Table 3 and Reference 3.14) which will provide water for greater than 72 hours after the event.

The RCS makeup FLEX pump will be used to supply the inventory from the RWST.

Service Water Pond

Following exhaustion of the CST, RMWST, and RWST volumes, the SW pond may be used as a source of makeup water. See Section 2.4.3 for more information.

2.4.10.5 Borated Water Supplies

Boric Acid Tank

The boric acid tank (BAT) is the primary source for supplemental boron addition. The two BATs per unit have a combined Technical Specification minimum volume of 11,336 gallons (see Section 2.4.4.9) providing shutdown margin necessary to maintain the core in a subcritical state for greater than 72 hours post event.

RWST

The borated water inventory in the RWST will remain available (Technical Specifications minimum of 471,000 gallons) as a backup source for RCS injection.

2.5 Spent Fuel Pool Cooling/Inventory

In the postulated ELAP event, the SFPs will initially heat up due to the unavailability of the normal cooling system. The basic FLEX strategy for maintaining SFP cooling is to monitor SFP level utilizing the SFP level instrumentation and initiating SFP makeup as soon as resources are available; however, makeup will be initiated prior to the SFP level reaching 15 feet above the racks. No Phase 1 actions are required for Spent Fuel Pool Cooling/Inventory other than opening of doors for ventilation, directed by an FSG.

For Phase 2, the SFP FLEX pump drawing water from the Service Water pond will be aligned and used to add water to the SFPs of both units to maintain level. Three paths will be available for SFP makeup: hoses directly discharging into the pools, connections to the existing SFP cooling lines, and via hoses directed to portable spray monitors positioned around the SFPs (see Figure 1).

Deployment of hoses will begin prior to the time to boil to maintain a sufficient amount of water above the top of the fuel assemblies for cooling and shielding purposes. The time to boil is maintained in the MCR on a daily basis, so the time for deployment of the hoses to the SFP area is consistently known by the MCR staff. The long term strategy for SFP cooling is to continue the strategies described above. When supplemented by portable equipment delivered from off-site (NSRC), water from the Chattahoochee River can be used to replace depleted on-site seismically qualified water inventories. However, the associated actions for the long term strategy are not relied upon in the FLEX strategy during the first 72 hours following ELAP.

2.5.1 Phase 1 Strategy

The only Phase 1 action is to open the SFP room door, the roll up door between the SFP room door and the new fuel room, and the new fuel room missile door to ventilate the SFP room to mitigate the steam caused by SFP boiling on each unit.

2.5.2 Phase 2 Strategy

The spray monitor flow path is the bounding case for all FLEX SFP cooling baseline capabilities (i.e., the three methods described below). The SFP FLEX pump is sized with the capability to provide the minimum flow rate with enough discharge pressure to provide the appropriate pressure to the spray monitor nozzles and to overcome head losses associated with discharge hoses and any other discharge connections. Since the SFP is designed so that it does not require borated water to maintain subcritical conditions, the service water pond is the credited source of SFP makeup. The inventory of the service water pond (approximately 439,899,429 gallons) is capable of providing spray for both SFPs (500 gpm total flow) for well beyond 72 hours (see Table 3 and Reference 3.14).

Hoses will be staged prior to spent fuel pool makeup being required. This strategy consists of installing hoses for makeup and spray on each unit. A manifold is provided to connect three hoses: one that discharges directly into the SFP (Method 1), one that can provide makeup to the SFP cooling piping (Method 2), and one that can supply the monitor spray nozzles (Method 3).

Makeup Strategy Method 1 - Spent Fuel Pool makeup via hoses directly into the spent fuel pool

Direct makeup to the SFP would be accomplished by hoses deployed on the SFP floor. This makeup strategy employs hoses for each SFP. Since the SFP area may become inaccessible as Phase 2 progresses, hoses will be deployed as soon as possible to minimize the need for personnel access to the SFP area following degraded environmental conditions in the SFP area following the ELAP event.

Makeup Strategy Method 2 - Spent Fuel Pool makeup via a connection to SFP cooling piping

Hose would be used for connecting to a flange connection on the SFP cooling system (see Figure 1). The connection is located in the auxiliary building (a seismically qualified structure).

Makeup Strategy Method 3 - spray capability via portable monitor nozzles

A third method for spent fuel pool cooling is spray capability with portable monitors located on the floor adjacent to the SFP. The spray strategy consists of deploying a hose to a spray monitor located adjacent to each of the SFPs (see Figure 1).

2.5.3 Phase 3 Strategy

The long-term strategy for SFP cooling is to continue the Phase 2 strategy supplemented by portable equipment delivered from off-site. Water from the Chattahoochee River can be used to replace depleted on-site seismically qualified water inventories. See Table 2 for a list of equipment that will be delivered to the site by the NSRC; refer to Section 2.11 for a discussion on NSRC supplied equipment.

As resources become available, actions can be taken to transition away from extended Phase 2 coping strategies. Since no time sensitive Phase 3 actions have been identified, instructions for connection and utilization of NSRC equipment for long term coping or recovery will be provided by TSC personnel who will have assessed the condition of the plant and infrastructure, plant accessibility, and additional available offsite resources (both equipment and personnel) following the BDBEE.

2.5.4 Structures, Systems, and Components

2.5.4.1 Primary Connection

Makeup Strategy Method 1 (Hose)

Direct makeup from the SFP FLEX pump in the SW Pond to the SFP will be accomplished by laying out hoses on the SFP floor (ground level) to discharge into the SFP. Therefore, there are no connections associated with the Method 1 strategy; all equipment is portable and does not require any physical connections to permanent plant equipment (See Figure 1).

Makeup Strategy Method 2 (SFP cooling piping)

Hoses will be used for connecting to a flange connection located on the SFP cooling system. The connection is located in the auxiliary building and protected from BDBEE hazards (See Figure 1 and Figure 3).

Makeup Strategy Method 3 (Spray)

Spray makeup from the SFP FLEX pump to the SFP will be accomplished by hoses staged on the SFP floor connected to a portable spray monitor.

2.5.4.2 Alternate Connection

Due to the diverse makeup methods available, alternate connections in addition to those described in the Primary Connections are not required.

2.5.4.3 Ventilation

SFP bulk boiling will create adverse temperature, humidity, and condensation conditions in the SFP area which requires a ventilation vent pathway to exhaust the humid atmosphere from SFP area. The primary pathway will be established by manually opening the SFP room door, the roll up door between the SFP room door and the new fuel room, and the new fuel room missile door on each unit. An alternate ventilation path can be established by opening the missile doors on the east side of the plant. Either vent path will be sufficient for the initial coping efforts due to the relatively large openings provided. Establishing the vent path will occur prior to boiling in the SFP.

2.5.5 Key SFP Parameters

The key parameter for the SFP make-up strategy is the SFP water level. The SFP water level is monitored by instrumentation (N1/2G31LI-0007 and N1/2G31-LI0008) that was installed in response to Order EA-12-051, Reliable Spent Fuel Pool Instrumentation (Reference 3.5).

2.5.6 Thermal-Hydraulic Analyses

An analysis was performed that determined, with the maximum expected SFP heat load immediately following a full-core offload, the SFP will reach a bulk boiling temperature of 212°F in approximately 5.6 hours and boil off to a level 15 feet above the top of fuel in 23.9 hours unless additional water is supplied to the SFP. Total required flow for the most limiting case (full-core offload with full SFP) to make up for boil off is less than 125 gpm per pool (Reference 3.14).

The time to reach 200°F is conservative in regard to the time to reach 212°F. Since verification of the time to reach 200°F in the SFP is performed daily and reported on the morning report, the time to reach 200°F will be utilized to guide task performance in the SFP area. Additional conservatism has been included in the implementing procedures (FSGs) to begin these activities at approximately the 5-6 hour time frame.

Based upon Documentation of Engineering Judgment DOEJ-FRC111207401-M001, Evaluation of the Time for the SFP to Reach 200°F (Reference 3.85), 30 day, post refueling time to reach 200°F is approximately 18 hours.

2.5.7 FLEX Pump and Water Supplies

2.5.7.1 SFP FLEX Pump

Makeup to the SFP is supplied from the SW pond using the portable, diesel-driven SFP FLEX pump (consisting of both the submersible pump and submersible hydraulic pumping unit from Table 5). The pump is sized to provide required flow and pressure for all three makeup strategies discussed in Section 2.5.2 (Reference 3.43).

2.5.7.2 Ultimate Heat Sink

The inventory of the SW pond (UHS) is capable of providing spray for both SFPs (500 gpm total flow) for well beyond 72 hours (Reference 3.43)

2.5.8 Electrical Analysis

The SFP level will be monitored by instrumentation, N1/2G31LI-0007 and N1/2G31-LI0008, installed in response to Order EA-12-051 (Reference 3.5). The power for this equipment has a backup battery; a minimum battery life of 24 hours is provided to allow for power restoration from the 600V FLEX DG (References 3.45, 3.46).

2.6 Containment Integrity MODES 1-4 and MODE 5 with Steam Generators Available

FNP has a large dry containment building. During a BDBEE, containment integrity is maintained by normal design features of the containment. FNP utilizes low-leakage seals on the reactor coolant pumps. Utilizing the low leakage seals will limit the leakage inside the containment, resulting in containment pressure and temperature remaining within design limits without active containment cooling until well beyond 72 hours after the start of the event, at which time availability of the NSRC equipment will allow implementation of long-term strategies to control containment pressure and temperature. Containment parameters are monitored during ELAP using the guidance of the PWR owners group. This includes utilization of the Critical Safety Function Status Trees. Containment conditions are also checked periodically during implementation of the EOPs and FSGs.

2.6.1 Phase 1 Strategy

Following a BDBEE event, with the reactor tripped and containment isolated, containment pressure and temperature will slowly increase due to reactor coolant leakage and direct heat transfer from the RCS.

Analysis (Reference 3.47) demonstrates that containment response following a postulated ELAP event does not challenge containment design limits. As a result, no coping strategy is required for maintaining containment integrity during Phase 1 beyond monitoring containment pressure.

2.6.2 Phase 2 Strategy

Phase 2 coping strategies remain the same as Phase 1. No additional strategies are required for maintaining containment integrity. In Phase 2, the onsite 600V FLEX DG will be employed to charge station batteries which will maintain dc bus voltage for continued availability of instrumentation needed to monitor containment pressure.

2.6.3 Phase 3 Strategy

The primary coping strategy for Phase 3 is to extend the Phase 2 strategy. When decay heat can no longer support TDAFW pump operation (estimated to be 120 hours, Reference 3.23), additional mitigation activities will be implemented as directed by the TSC.

Calculations (Reference 3.47) determined that the MODES 1-4 containment pressure at 120 hours is 5.4 psig and the peak containment temperature at 120 hours is 223.3°F. It is expected that containment temperature and pressure will remain below the design basis limits beyond 120 hours because of the significant margin to the design basis limits. Operators will continue to monitor containment parameters to inform the Emergency Director/TSC staff when additional actions may be required. These include transition to the SG FLEX pump for SG makeup, additional SG depressurization, or use of the NSRC-supplied equipment. Should use of the NSRC equipment become necessary, the only modification required would be the installation of special adapter flanges on the SW discharge header. These adapters have been designed for this function, purchased, and stored in the FLEX storage building. NSRC-supplied high volume low pressure pumps and hoses would be utilized to take a suction on the SW pond and discharge into the SW header. Based upon the expected containment temperature and pressure response, adequate time is available to perform these activities to support the containment integrity function.

As resources become available, actions can be taken to transition away from Phase 2 coping strategies. Since no time sensitive Phase 3 actions have been identified, instructions for connection and utilization of NSRC equipment for long term coping or recovery will be provided by TSC personnel, who will have assessed the condition of the plant and infrastructure, plant accessibility, and additional available offsite resources (both equipment and personnel) following the BDBEE. General guidance for this activity is provided in the TSC procedure for

ELAP and in A181109, "FLEX Engineering Judgment Review – FLEX Actions Beyond 72 Hours" (Reference 3.84).

2.6.4 Structures, Systems, Components

2.6.4.1 Containment

During the BDBEE which results in an ELAP concurrent with LUHS, containment integrity is maintained by normal design features of the containment. The containment design pressure is +54 psig and the containment atmospheric design temperature is 280°F (Reference 3.24, Table 6.2-1). Refer to FNP FSAR (Reference 3.24) Section 6.2.1 for a description and discussion of design capabilities of the containment.

2.6.4.2 Containment Coolers

No time sensitive actions have been identified for maintaining containment integrity; however, containment coolers, when supplemented by portable equipment (i.e., pumps for cooling water and DG for powering the fans) delivered from off-site (NSRC), can be aligned to support maintaining containment integrity long term. Refer to FNP FSAR (Reference 3.24) Section 6.2.2.1.2 for a description and discussion of design capabilities of the containment coolers.

The Containment Coolers are seismically qualified components which are also protected from the effects due to the design basis tornado and BDBEE hazards (Reference 3.24, Table 3.2-1, Section 6.2.2.3.2).

2.6.5 Key Containment Parameters

The instruments monitoring containment pressure remain available following specified load shed actions outlined in plant procedures. Analysis (Reference 3.15) indicates this strategy provides critical instrumentation relying on the Station Batteries until supplied by a 600V FLEX DG. Only a single channel is needed for FLEX strategy implementation.

The containment pressure instrumentation credited in the strategy are:

CTMT Pressure	PI-950	A-Train Battery
	PI-951	A-Train Battery

	PI-952	B-Train Battery
	PI-953	B-Train Battery

Contingencies for alternate instrumentation monitoring are provided to the MCR team following a BDBEE. Procedural guidance is provided for establishing alternate indications for essential instrumentation.

2.6.6 Thermal-Hydraulic Analyses

Analysis (Reference 3.47) demonstrates that containment response following a postulated ELAP event does not challenge design limits until well after availability of off-site equipment and implementation of strategies to control pressure and temperature. Modular Accident Analysis Program (MAAP) PWR Version 4.0.5 analysis software was utilized for the containment analysis (Reference 3.26). The MAAP PWR Version 4.0.5 analysis software was employed to analyze the specified FLEX scenarios during a LUHS and ELAP. MAAP4 is an EPRI sponsored computer code that simulates the response of light water nuclear power plants during severe accident sequences, including actions taken as part of the severe accidents. MAAP4 can predict the progression of hypothetical accident sequences from a set of initiating events to either a safe, stable, coolable state or to an impaired containment and depressurization. The guidance provided in the position paper entitled "Use of Modular Accident Analysis Program (MAAP) in Support of Post-Fukushima Applications" (Reference 3.48) as endorsed by the NRC (Reference 3.49) was used to support the performance of ELAP containment analyses.

2.6.7 FLEX Pump and Water Supplies

Additional equipment is not specifically required for maintaining the containment integrity function. Containment integrity is maintained by providing for reactor core cooling. See the reactor core cooling strategy sections (Sections 2.4.1, 2.4.2, and 2.4.3) for further discussion of the FLEX pumps and water supplies.

2.6.8 Electrical Analysis

Power requirements for the containment critical instrumentation is provided by the station batteries. 600V FLEX portable DGs are used to repower station battery chargers and to repower ac powered instrumentation. Phase 3 DGs provided by the NSRC may be used to power additional equipment, as desired. See additional discussion in Sections 2.3.2 and 2.3.3.

2.7 Characterization of External Hazards

In accordance with NEI 12-06, Sections 4 through 9, the applicable extreme external hazards at FNP Unit 1 and 2 are seismic, high wind, extreme cold with ice and high temperature (Reference 3.79). These hazards are bounded by the current design basis hazards as described in the FSAR (Reference 3.24) unless otherwise stated.

2.7.1 Seismic

Per the Farley Unit 1 and 2 Final Safety Analysis Report (FSAR), the seismic criteria for FNP include two design basis earthquake spectra: Operating Basis Earthquake (OBE) and the Safe Shutdown Earthquake (SSE). The OBE and the SSE are 0.05g and 0.10g, respectively; these values constitute the design basis of FNP (Reference 3.24, Section 3.10.1).

For Diverse and Flexible Coping Strategies (FLEX), the earthquake is assumed to occur without warning and result in damage to non-seismically designed structures and equipment. A debris assessment for the site was performed, including debris generated by seismic events, to determine debris removal tool requirements; see Section 2.9.1 for a discussion of debris removal capability.

2.7.2 External Flooding

FNP is built above the design basis flood level. The probable maximum flood (PMF) stage is 144.2 ft. mean sea level (MSL) without wave runup. With wave runup, the water may reach as high as 153.3 ft MSL (Reference 3.24, Section 2.4.2.2). Grade elevation of the FNP auxiliary building, containment buildings, diesel generator buildings, and all safety-related structures is approximately 155 ft MSL. The site is not adjacent to a large, enclosed, or partially enclosed body of water (Reference 3.24, Section 2.4.5). Therefore, in accordance with the NEI guidance (Reference 3.3, Section 6.2.1), FNP is considered a dry site, and would not be adversely affected by external flooding.

2.7.3 Severe Storms with High Wind

Current plant design bases address the storm hazards of hurricanes, high winds and tornados.

FNP is located at approximately 31°13′ N latitude and 85°06′ W longitude (Reference 3.24, Section 2.1.1). The location of FNP is situated between the 150 mph and 160 mph contours shown in Figure 7-1 of NEI 12-06 (Reference 3.3); therefore hurricanes are applicable to FNP. Per Figure 7-2 of NEI 12-06, the recommended tornado design wind speed for the 10^{-6}/yr probability level for the 2 latitude/longitude block where FNP is located is 182 mph. Therefore, tornado hazards are applicable to FNP.

For hurricanes, the FNP FSAR (Reference 3.24, Sections 1.2.1.8 and 2.3.1.2) indicates that the site is located approximately 80 miles inland from the Florida coast; so the effects from hurricanes or tropical depressions are reduced.

For strong winds, the FNP FSAR (Reference 3.24, Section 2.3.1.3) indicates the frequency of strong winds, 50 knots or greater, has been analyzed for 2° and 1° squares for a 13-year period, 1955 to 1967. For this area, the frequency is 50 per year per 2° square and 16 for the 1° square over the 13 year period.

Protection of FLEX equipment is provided by ensuring that the characteristics of the storage locations meet the requirements in NEI 12-06. At FNP the storage location is in the Owner Controlled Area (OCA). By providing a storage building designed to withstand hurricane and tornado high wind hazards, sufficient FLEX equipment to supply both units will be protected from all high wind hazards including high wind missiles.

FLEX equipment will remain deployable for high wind hazards such as a tornado or hurricane. Potentially downed trees and other debris will have an impact on the time it takes to deploy FLEX equipment; however, debris removal capabilities are provided for by the onsite FLEX equipment (*e.g.*, wheeled loader). The tow vehicles for the FLEX equipment are also protected by storage in the FLEX Storage Building; see Section 2.9.1 for additional discussion of debris removal capability.

2.7.4 Ice, Snow and Extreme Cold

Per NEI 12-06 Section 8.2.1 guidance, extreme snowfall is not a concern for FNP which is located in the southeastern U.S. Snow is infrequent in the site region and heavy snow is very rare. Based on historical records, the average snowfall is only a trace amount (Reference 3.24, Table 2.3-3). Thus, even in the unlikely scenario of an ELAP coincident with a maximum probable snowfall, snow removal could be easily accomplished with the normal debris removal equipment (*e.g.*, wheeled loader).

The FNP site is located within the region characterized by EPRI as ice severity level 4 (NEI 12-06, Figure 8-2, Reference 3.3). As such, the FNP site is subject to severe icing conditions that could also cause catastrophic destruction to electrical transmission lines. While freezing rain resulting in heavy ice loading in the FNP site region is considered rare (Reference 3.24, Section 2.3.1.3), NEI guidelines still dictate that the storage and deployment of FNP FLEX equipment must consider the impact of severe icing due to the EPRI study. Thus, the storage of FLEX equipment, including transport equipment, has been designed to protect it from extreme weather. The design criteria for the storage buildings meet the site design basis weather effects in accordance with the requirements of ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures* (Reference 3.70). Debris removal equipment is stored in the FLEX Storage Building; see Section 2.9.1 for additional discussion of debris removal capability. Because advance warning of freezing weather would be available, actions will be taken per procedural guidance in advance to prepare for adverse conditions (including personnel actions).

The normal daily minimum temperature ranges from 41°F at Dothan to 40°F at Blakely in December and January (Reference 3.24, Section 2.3.2.2). An extreme minimum temperature of -1°F was recorded at Blakely in February 1899. Based on historical records, the temperature remains below freezing on less than 1 day in 2 years. About 22 days per year have minimum temperatures below freezing (Reference 3.24, Table 2.3-5).

There is no record of the Chattahoochee River icing over in the vicinity of FNP (Reference 3.24, Section 2.4.7). Per Reference 3.24, Section 2.4.11.5, temperature records indicate that icing of ponds and rivers is not a factor to be considered. Therefore, there is no risk of ice blockage of the Chattahoochee River, frazil ice, or freezing of the UHS water source in the SW pond.

The storage of FLEX equipment considers the minimum temperature specified by the manufacturers. The FLEX pumps and generators have additional operating requirements when temperatures fall below 32°F, which are freeze protection of idle but primed portable pumps and hoses when conditions warrant action. It should not be necessary to thaw the relatively short connections at the outdoor water tanks due to the large thermal mass of water in the tank and the limited period of time before utilization.

2.7.5 High Temperatures

The FNP site normal daily maximum temperature ranges from 63°F in January to 92°F in June through August. An extreme maximum of 107°F was recorded in Blakely and 104°F in Dothan. The maximum temperature exceeds 90°F on about 100 days a year at Dothan and 89 days a year at Blakely (Reference 3.24, Section 2.3.2.2).

The FLEX pumps can operate in hot weather, including the 107°F extreme as documented in the vendor manuals. Similarly, the FLEX portable DGs can operate in ambient air up to 113°F based on information from the equipment vendor.

Extreme high temperatures are not expected to impact the ability of personnel to implement the required FLEX strategies. Site industrial safety procedures currently address activities with a potential for heat stress to prevent adverse impacts on personnel (refer to Section 2.13 for more detail).

2.8 Protection of FLEX Equipment

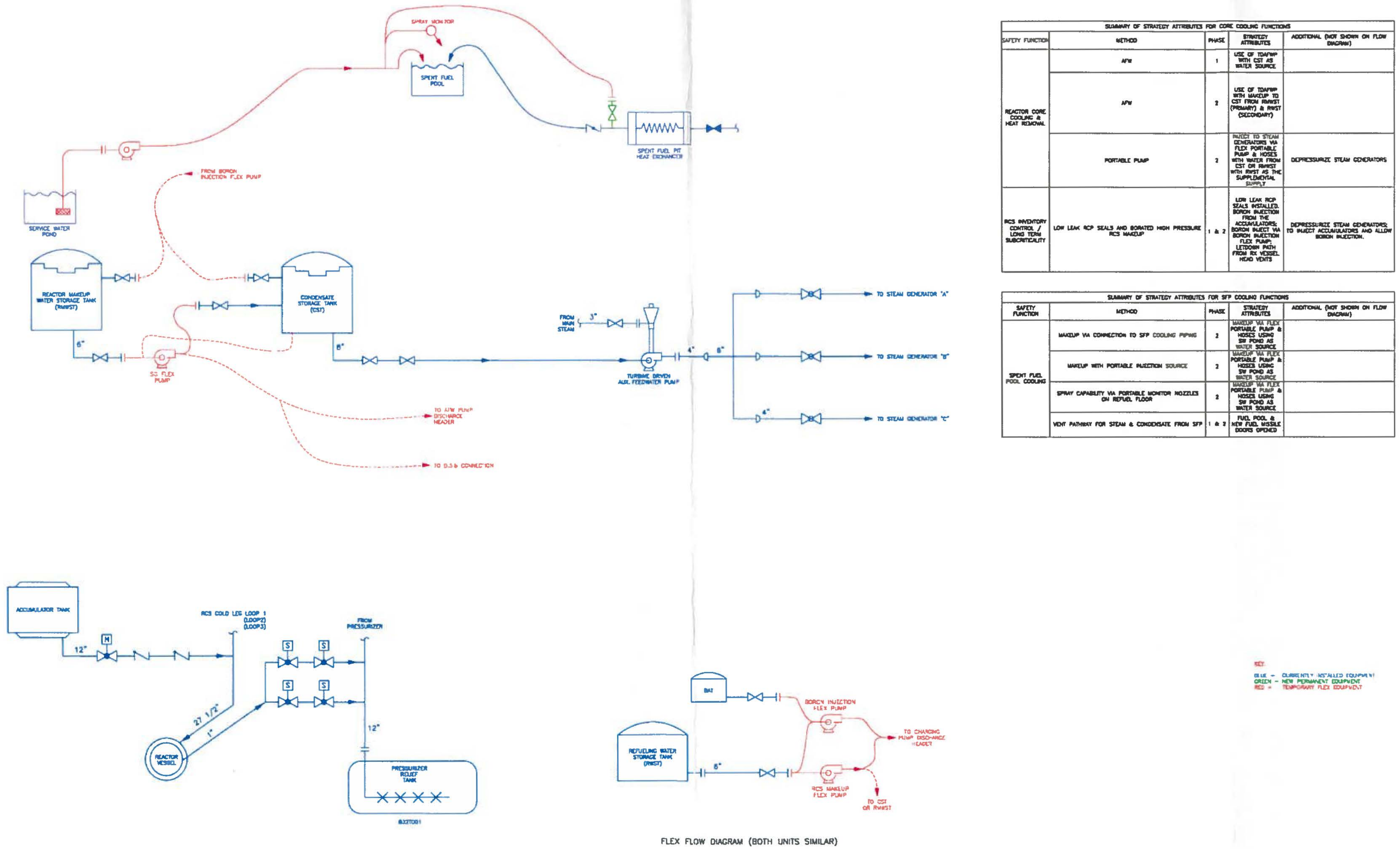
FLEX equipment is stored in a single 12,000 ft^2 concrete, tornado-missile protected structure that meets the plant's design basis for the Safe Shutdown Earthquake (SSE) (Reference 3.52). Additionally, it has a 5,200 ft^2 (4750 ft^2 usable) mezzanine. The FNP FLEX Storage Building is located outside of the Protected Area but within the Owner Controlled Area (see Figure 3). This location is significantly above the upper-bound flood stage elevation. The FLEX Storage Building was designed and constructed to prevent water intrusion and built to protect the equipment from the BDBEE hazards identified in Section 2.7.

Large portable FLEX equipment such as pumps and power supplies are secured, as required, inside the FLEX Storage Building to protect them during a seismic event. The FLEX Storage Building has tie downs integrated into the floor slab for this purpose. These tie downs are used to secure any equipment that is not considered stable to ensure the stored FLEX equipment remains protected from damage during a seismic event. Additionally, fire piping and HVAC were designed and installed to meet the FLEX Storage Building specifications (seismic, wind, etc.). The lighting, conduits, electrical, and fire detection components were not seismically installed because they are considered insignificant and not able to damage FLEX equipment and only required functional before the event.

Debris removal equipment is also stored inside the FLEX Storage Building in order to reasonably protect it from the applicable external events such that the equipment remains functional and deployable to clear obstructions from the pathway between the FLEX equipment's storage location and its deployment location(s). See Section 2.9.1 for additional discussion of debris removal capability.

Deployments of the FLEX and debris removal equipment from the FLEX Storage Building are not dependent on off-site power. All actions are accomplished by either batteries, on-site emergency ac power (backup generator tied to the building), or manually.

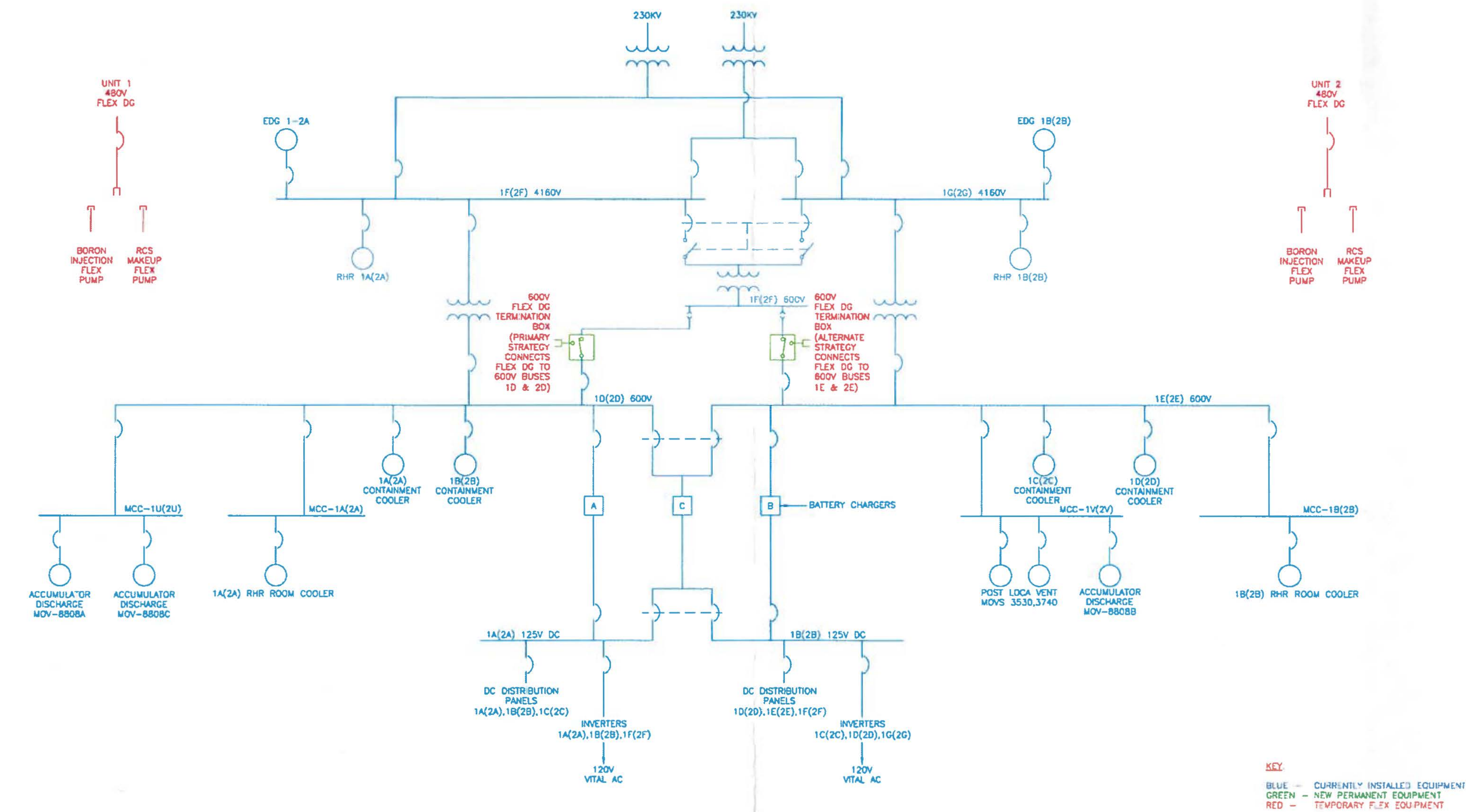
The logistics of equipment removal after a BDBEE was considered in the design of the building. Two equipment doors are provided and located 180° around the perimeter of the building from each other. The door opening size provides a minimum clearance for equipment of 14 ft in height and 16 ft in width. The design also includes two personnel entry/exit doors. The doors are designed for design basis tornado and wind loading, and to be operational after tornado wind pressure loads and tornado-missile loads. Equipment access and personnel access doors have the ability to be operated manually in the case of a loss of power. The HVAC systems are designed to maintain the following indoor conditions: Heating: minimum indoor temperature of 50°F; Cooling: maximum indoor temperature of 100°F.



SUMMARY OF STRATEGY ATTRIBUTES FOR CORE COOLING FUNCTIONS				
SAFETY FUNCTION	METHOD	PHASE	STRATEGY ATTRIBUTES	ADDITIONAL (NOT SHOWN ON FLOW DIAGRAM)
REACTOR CORE COOLING & HEAT REMOVAL	AFW	1	USE OF TDAFWP WITH CST AS WATER SOURCE	
	AFW	2	USE OF TDAFWP WITH MAKEUP TO CST FROM RMWST (PRIMARY) & RWST (SECONDARY)	
	PORTABLE PUMP	2	INJECT TO STEAM GENERATORS VIA FLEX PORTABLE PUMP & HOSES WITH WATER FROM CST OR RMWST WITH RWST AS THE SUPPLEMENTAL SUPPLY	DEPRESSURIZE STEAM GENERATORS
RCS INVENTORY CONTROL / LONG TERM SUBCRITICALITY	LOW LEAK RCP SEALS AND BORATED HIGH PRESSURE RCS MAKEUP	1 & 2	LOW LEAK RCP SEALS INSTALLED. BORON INJECTION FROM THE ACCUMULATORS; BORON INJECT VIA BORON INJECTION FLEX PUMP; LETDOWN PATH FROM RX VESSEL HEAD VENTS	DEPRESSURIZE STEAM GENERATORS; TO INJECT ACCUMULATORS AND ALLOW BORON INJECTION.

SUMMARY OF STRATEGY ATTRIBUTES FOR SFP COOLING FUNCTIONS				
SAFETY FUNCTION	METHOD	PHASE	STRATEGY ATTRIBUTES	ADDITIONAL (NOT SHOWN ON FLOW DIAGRAM)
SPENT FUEL POOL COOLING	MAKEUP VIA CONNECTION TO SFP COOLING PIPING	2	MAKEUP VIA FLEX PORTABLE PUMP & HOSES USING SW POND AS WATER SOURCE	
	MAKEUP WITH PORTABLE INJECTION SOURCE	2	MAKEUP VIA FLEX PORTABLE PUMP & HOSES USING SW POND AS WATER SOURCE	
	SPRAY CAPABILITY VIA PORTABLE MONITOR NOZZLES ON REFUEL FLOOR	2	MAKEUP VIA FLEX PORTABLE PUMP & HOSES USING SW POND AS WATER SOURCE	
	VENT PATHWAY FOR STEAM & CONDENSATE FROM SFP	1 & 2	FUEL POOL & NEW FUEL MISSILE DOORS OPENED	

Figure 1 – Flow Diagram for FLEX Strategies



	125V DC		120V AC BUS		600V AC BUS	
	STRATEGY	METHOD	STRATEGY	METHOD	STRATEGY	METHOD
PHASE I	125V DC POWER AVAILABLE	125V DC BUSES SUPPLIED BY STATION BATTERIES	120V VITAL AC POWER AVAILABLE	VITAL AC SUPPLIED BY INVERTERS	600V AC POWER NOT AVAILABLE	N/A
PHASE II	125V DC POWER AVAILABLE CHARGE 125V DC BATTERIES CRITICAL INSTRUMENTS CR EMERGENCY LIGHTING MISCELLANEOUS LOADS	POWER BATTERY CHARGERS FROM ONSITE FLEX DG	120V VITAL AC POWER AVAILABLE	VITAL AC SUPPLIED BY INVERTERS	POWER 600V BUS D OR E POWER BATTERY CHARGERS POWER 600V MCCS	POWER 600V BUS D OR E FROM ONSITE FLEX DG

Figure 2 – Electrical Diagram for FLEX Strategies

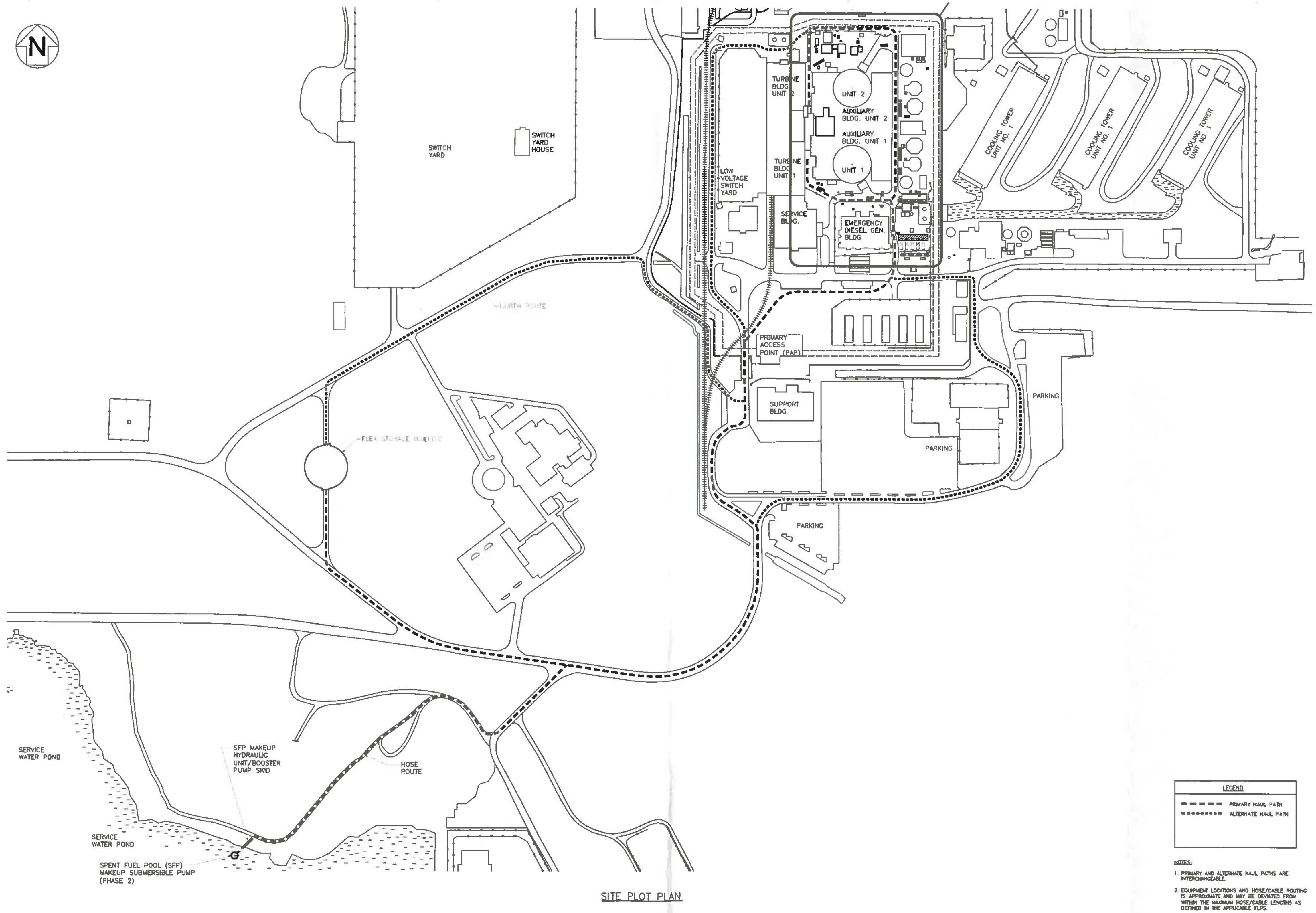


Figure 3 – FNP Overall Site Plan (derived from A-181115)

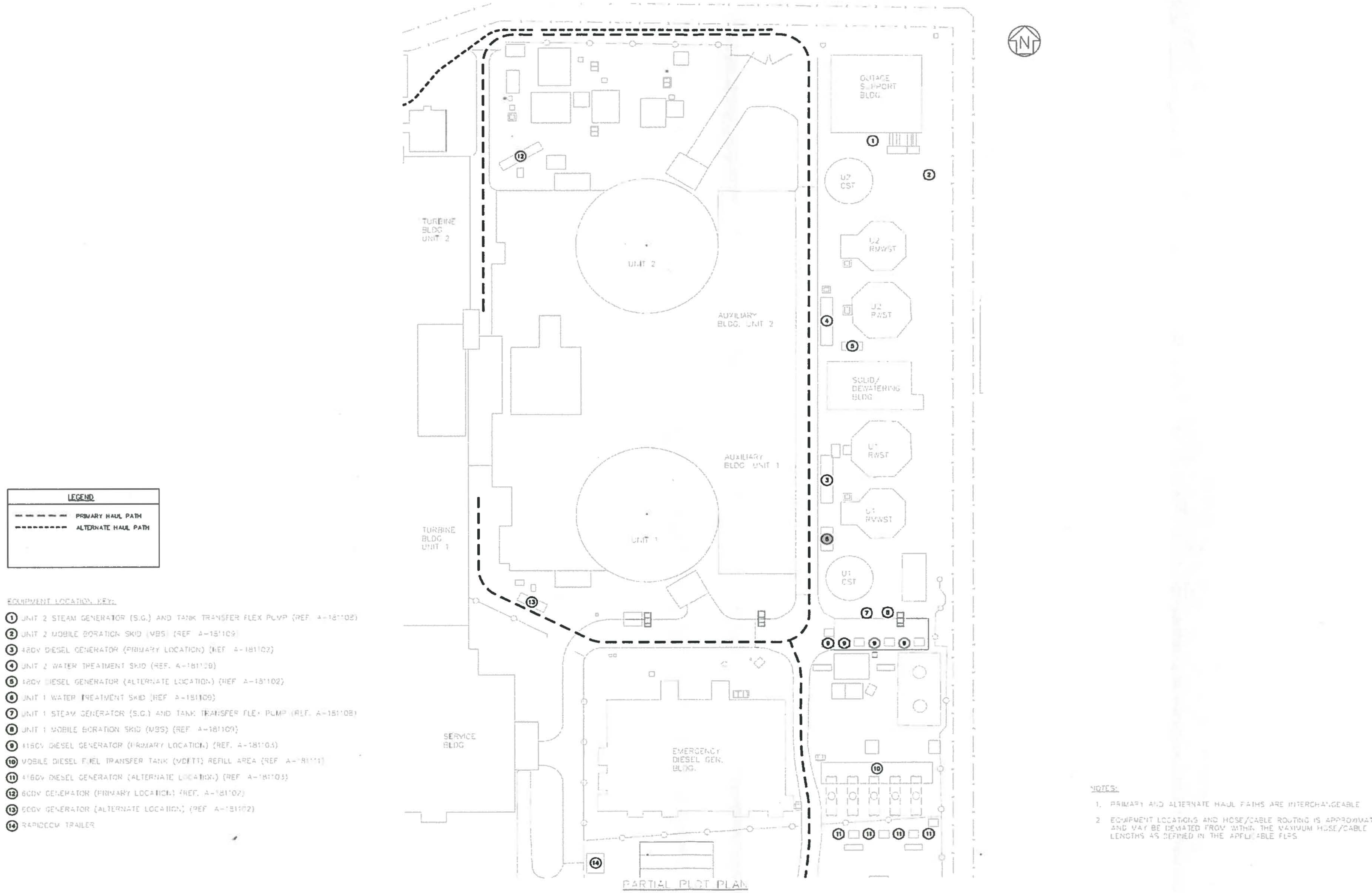


Figure 4 – FNP Partial Site Plan (derived from A-181115)

2.9 Deployment of FLEX Equipment

2.9.1 Haul Paths and Accessibility

Multiple haul routes are available from the FLEX Storage Building to any staging area. The appropriate haul routes have been evaluated for access per NEI 12-06, Section 5.3.2 (including liquefaction).

The equipment being transported for Phase 2 strategies will be towed by a heavy duty pickup truck or a small semi-tractor. The wheeled loader can also be used to tow equipment. The tires for these vehicles and trailers are designed to withstand small debris punctures and razor wire cuts/penetration (i.e., large commercial/military grade tires). Debris clearing equipment is stored in the FLEX Storage Building. This provides the equipment with direct access to the critical travel paths providing timely debris removal. All transmission lines that are brought down by an external hazard are assumed to be electrically charged until verified otherwise. Equipment (such as v-watch proximity meters, di-electric shoes, high voltage stick/meter, etc.) is available to address downed power lines.

It was determined through walk downs that all haul paths can support a minimum of two lanes of normal vehicular traffic. This will decrease the likelihood of a path being completely blocked, as well as reduce the time it will take to clear any debris adequately to deploy the FLEX equipment. The possibility exists to move off of the roadway to avoid debris along a majority of the deployment route paths. Alternative routes into the power block area exist on the south and east sides of the plant that could be utilized.

Based on the results of a liquefaction potential assessment, the overall liquefaction potential at the FLEX Storage Building and across the designated travel paths is deemed low for the postulated seismic ground motions. The risk of surface displacement due to faulting or lateral spreading is also deemed low (Reference 3.53).

A debris assessment for the site was performed to determine debris removal equipment requirements. It was determined that the debris removal equipment should be capable of moving large debris such as automobiles, trees, pieces of buildings, switchyard structures, and concrete barriers, in addition to general assorted small debris such as limbs. Based on this assessment, it was determined that a medium wheeled loader with the appropriate blade and horsepower can move the postulated debris in a single maneuver which simplifies and speeds the debris removal effort.

2.10 Fueling of Equipment

The five underground diesel fuel oil storage tanks (DFOSTs) at FNP are seismically qualified, protected from missiles, and have a nominal capacity of 40,000 gallons each. The FNP Technical Specifications (Reference 3.13, SR 3.8.3.1) require that each DFOST (except the tank associated with Diesel 2C, which is procedurally controlled above 25,000 gallons) contain at least 25,000 gallons of fuel. The stored quantity of fuel in any one selected DFOST will meet the fuel demand for all of the diesel driven FLEX equipment well past 72 hours (References 3.56, 3.57). The Phase 2 support strategy includes repowering an existing diesel fuel oil transfer pump to refill a FLEX Fuel Tanker from the chosen DFOST. Hoses are connected to a flanged connection in the transfer pump discharge piping. Breaker alignments will supply power from a 600V FLEX DG to the selected transfer pump motor. A FLEX Fuel Tanker will be towed to each diesel-driven FLEX component that needs refueling. An on board dc powered pump will dispense fuel oil from the tanker. The haul routes for transporting fuel are the same haul routes for deployment of the FLEX equipment, which are evaluated for accessibility following screened in external hazards.

The Farley management of diesel fuel oil storage tanks (DFOST) is adequate to provide sufficient fuel for ultra-low sulfur diesel use. The debris removal equipment and tow vehicles are the only FLEX equipment that require ultra-low sulfur diesel. FLEX procedures direct the operators to utilize the available DFOST that has the lowest sulfur content.

2.11 Offsite Resources

2.11.1 National SAFER Response Centers

The industry established two (2) National SAFER Response Centers (NSRCs) to support utilities during BDBEEs. SNC has established contracts with the Pooled Equipment Inventory Company (PEICo) to participate in the process for support of the NSRCs as required. Each NSRC holds five (5) sets of equipment, four (4) of which will be available for deployment when requested, the fifth set will have equipment in a maintenance cycle. In addition, on-site FLEX equipment hose, cable, and fittings are standardized with the equipment supplied from the NSRC. In the event of a BDBEE and subsequent ELAP concurrent with LUHS condition, equipment will be moved from an NSRC to a local staging area established by the Strategic Alliance for FLEX Emergency Response (SAFER) team. FLEX strategy requests to the NSRC are directed by FLEX Procedures. SNC also utilizes the BI and RCS makeup FLEX pumps at Vogtle Electric Generating Plant (VEGP) as back-ups because of the unique design of these components. These Phase 3 pumps can be provided within the 72 hours of event initiation because they are located at another SNC site.

For FNP, the local Staging Area "C" is the Abbeville Municipal Airport, Abbeville, Alabama. From there, equipment can be delivered to the Farley site by helicopter if ground transportation routes are not available. Communications will be established between the FNP 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 FNP "SAFER Response Plan."

NSRC personnel will commence delivery of a pre-selected equipment set from the NSRC upon notification. Plans are to deliver equipment from offsite sources via truck or air lift. Typically, deliveries will go by truck using preselected routes and with any necessary escort capabilities to ensure timely arrival at the plant site staging area "B" or to staging area "C" approximately 25 miles from the site. The delivery of equipment from the intermediate staging area will use the same methodology. The "B" staging area is an approximately 100 ft x 100 ft paved lot with surrounding hard packed grassy area of several acres. Helicopter landing considerations were accounted for in selection of the areas. These areas are designed to accommodate the equipment being delivered from the NSRC.

Depending on time constraints, equipment can be flown commercially to a major airport near the plant site and trucked or air lifted from there to the staging areas. The use of helicopter delivery is typically considered when routes to the plant are impassable and time considerations for delivery will not be met with ground transportation. Multiple pre-selected routes are one method to circumvent the effects of seismic events, floods, etc. and these routes take into account potentially impassible areas such as bridges, rivers, heavily wooded areas and towns. The drivers will have the routes marked and will be in communication with the NSRC to ensure that the equipment arrives on time.

2.11.2 Equipment List

The equipment stored and maintained at the NSRC for transportation to the local assembly area to support the response to a BDBEE at FNP is listed in Table 2.

See Reference 3.55 for descriptions and capabilities of equipment maintained by the NSRC.

Table 2

PWR Portable Equipment From NSRC

Use and (Potential / Flexibility) Diverse Uses									Performance Criteria		Notes
List Portable Equipment	**Qty Req'd / Unit**	**Qty Provided / Unit**	**Power**	**Core Cool-ing**	**Cont. Cooling/ Integrity**	**Access**	**Instrumen -tation**	**RCS Inventory**			
Mobile Boration Skid and Boric Acid	1	1	Diesel					X		1000 gal	1
Water Treatment Systems	1	1	Diesel	X				X		250 gpm	1
Water Treatment Generators	1	1	Diesel						480V	150 kW	1
480/600V Step Up Transformer & cable	1	1	N/A	X			X	X	480V to 600V	1375 kVA	1
Ventilation Fans	0	1	120 V			X				3000 cfm	1
Portable Air Compressor	0	1	Diesel						150 psi	300 scfm	1
Suction Lift Booster Pumps	1	1	Diesel	X				X	26 ft lift	5000 gpm	1
Medium Voltage Generator	1	2	Turbine	X	X		X		4160 V	2 MW	2,3
Low Voltage Generator	1	1	Turbine	X			X	X	480V	1000 kW	2
Cable / Electrical	0	Various	N/A	X	X		X	X	4160 V 600V 480V		2
High Pressure Injection Pump	0	1	Diesel					X	2000 psi	60 gpm	2
SG/RPV Makeup Pump	0	1	Diesel	X				X	500 psi	500 gpm	2

Table 2

PWR Portable Equipment From NSRC

Use and (Potential / Flexibility) Diverse Uses									Performance Criteria		Notes
List Portable Equipment	**Qty Req'd / Unit**	**Qty Provided / Unit**	**Power**	**Core Cool-ing**	**Cont. Cooling/ Integrity**	**Access**	**Instrumen-tation**	**RCS Inventory**			
Low Pressure / Medium Flow Pump	1	1	Diesel	X					300 psi	2500 gpm	2
Low Pressure / High Flow Pump	0	1	Diesel		X				150 psi	5000 gpm	2
Hose / Mechanical Connections	0	Various	N/A	X	X			X	Various	Various	2
Lighting Towers	0	3	Diesel			X			440,000 lumens	(minimum)	2
Diesel Fuel Transfer	0	1	N/A	X	X		X	X	500 gallon air-lift container		2
Diesel Fuel Transfer Tank	0	1	Motor	X	X		X	X	264 gallon tank, with mounted ac/dc pumps		2
Portable Fuel Transfer Pump	0	1	Diesel	X	X		X	X	60 gpm after filtration		2
Electrical Distribution System	0	1	N/A	X	X		X		4160 V	250 MVA, 1200 A	2

Note 1 - NSRC Non-Generic Equipment –Provided as Defense-in-Depth (Reference 3.55, Table 9-1).

Note 2 - NSRC Generic Equipment –Provided as Defense-in-Depth (Reference 3.55, Table 7-1).

Note 3 - 1 MW is the individual generator output, and 2 MW is the total standard output to be supplied by the Phase 3 MV generators to satisfy identified load demands. The total output may be created by connection of several smaller generators in parallel (Reference 3.55, Table 7-1).

2.12 Habitability and Operations

2.12.1 Equipment Operating Conditions

Following a BDBEE and subsequent ELAP event at FNP, ventilation providing cooling to occupied areas and areas containing FLEX strategy equipment could 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.) possible following a BDBEE resulting in an ELAP concurrent with 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 steady state temperatures expected in specific areas related to FLEX implementation to ensure the environmental conditions remain acceptable for personnel habitability or accessibility and within equipment limits.

The key areas identified for all phases of execution of the FLEX strategy activities are the MCR, TDAFW pump room, battery and dc equipment rooms, the auxiliary building 100' elevation, and the SFP area.

2.12.1.1 Main Control Room

Accessibility in the MCR must be maintained for the duration of the extended loss of all ac power (ELAP). During the ELAP, some MCR vital electronics, instrumentation and emergency lighting remain energized from emergency dc power sources. At one hour, extended load shedding is complete and some instrumentation and the MCR emergency lights are de-energized. Prior to the extended load shed removing power from the MCR emergency lighting, portable battery powered lighting will be established in the MCR. The portable lights are stored in the auxiliary building near the MCR. MCR lighting will be reestablished once the 600V FLEX DG is operational.

Under ELAP conditions with no mitigating actions taken, it is reasonable to assume that there is sufficient sensible heat and heat from personnel and the limited electrical loads still active during Phase 1 of an ELAP to increase the MCR temperature above the 110°F value assumed for the maximum temperature for efficient human performance as described in NUMARC 87-00 (Reference 3.10). Based on calculation SM-SNC458207-001 (Reference 3.58), the Phase 1 FLEX strategy is to block open the MCR access doors within the first 2 hours post-BDBEE (which open to the building exterior at plant grade level), followed by the addition of a 6000 cubic feet per minute (cfm) fan within 14 hours. This strategy will provide enough ventilation to equalize the MCR temperature to approximately that of the outside air. The Phase 1 strategy for maintaining MCR ventilation can be extended indefinitely. Per NUMARC 87-00, the equipment in the MCR can be exposed to thermal environments of 120°F (Reference 3.10). Since the temperature in the MCR will be maintained less than 110°F the electrical equipment is expected to remain operable.

During cold weather, the ventilation flow can be limited to keep the MCR at a habitable temperature. If the outside temperature is above 98°F, then the MCR doors will not be opened until the MCR temperature is in excess of the outside temperature. Note that on the infrequent days when the peak daily outside temperature is above 98°F, this temperature is normally only exceeded for a limited time during the early afternoon hours. In addition, there is on average a 22.7°F difference between the daily high and low temperatures (Reference 3.24, Table 2.3-4).

2.12.1.2 TDAFW Pump Room

During operation, there will be a considerable heat load within the room from the steam turbine and associated piping. Operation of TDAFW without forced ventilation was evaluated for the ELAP concurrent with LUHS condition (Reference 3.59). This conservative calculation determined that with no supplemental ventilation, the room would heat up to 123°F during the first hour of the SBO coping period but remain below 125°F during the initial 24 hours.

Per NUMARC 87-00, the TDAFW pump room equipment can be exposed to thermal environments of 150° to 300°F (Reference 3.10). A temperature of 125°F is deemed acceptable for infrequent occupancy to allow local operation of the turbine and pump as required. The acceptance criteria for personal habitability for short intervals of exposure is

150°F, which is derived from an aero medical laboratory report titled "Human Tolerance for Short Exposures to Heat" (Serial No. TSEAL-3-695-49A) (Reference 3.77).

Continuous habitability would not be required in the TDAFW pump room. If personnel entry is required into the TDAFW pump room then personal protective measures will be taken. Site industrial safety procedures currently address activities with a potential for heat stress to prevent adverse impacts on personnel.

2.12.1.3 Battery and Switchgear Rooms

During the ELAP event, the 125V dc and inverter-fed 120V ac electrical distributions are energized and maintain power to instrumentation and controls for core cooling, containment, and SFP cooling functions.

Analysis (Reference 3.60) determined that opening seven doors per unit at one hour is adequate to maintain the battery and dc equipment room temperatures for the first eight hours following ELAP (time to deploy the three fans per unit described below). The doors will be opened by the operators performing the dc bus load shed.

During battery charging operations in Phases 2 and 3 in support of maintaining power to instrumentation and controls for core cooling, containment, and SFP cooling functions, ventilation is required in the battery rooms and associated dc equipment rooms for cooling the rooms and venting hydrogen released from the batteries during charging. Analysis determined that opening seven doors at one hour and installing three fans per unit, one with a trunk from the floor above, at 8 hours after the start of the event was adequate to maintain the room temperatures below 122°F to support continued operation of the equipment for FLEX coping (Reference 3.60). NUMARC 87-00 indicates that certain classes of electrical equipment (such as those in the dc equipment rooms at FNP) will likely remain operable in thermal environments of 150°F to 300°F for up to 8 hours (Reference 3.10).

The Phase 2 strategy includes connecting a 600V FLEX DG to supply the electrical distribution for the Class 1E battery chargers. During subsequent battery charging operations, hydrogen will be released into the battery rooms. Analysis (Reference 3.61) determined that the same strategy as used to mitigate room heatup also successfully mitigates hydrogen accumulation. Smaller fans placed in the battery room doorways will ensure air in the battery rooms is sufficiently mixed to prevent an unacceptable buildup of hydrogen (Reference 3.63).

2.12.1.4 Auxiliary Building 100' Elevation

The boron injection and RCS makeup FLEX pumps are stored/located on the auxiliary building 100' elevation. Analysis determined that temperatures in this area will remain below 125° F so as to not impact accessibility or equipment operation (Reference 3.62).

2.12.1.5 Containment

A limited number of instruments in containment are required to remain operable for post-accident monitoring as specified in Technical Specification 3.3.3, Post Accident Monitoring Instrumentation (Reference 3.13). These instruments meet Regulatory Guide 1.97 Category I design and qualification requirements for seismic and environmental qualification, single failure criterion, utilization of emergency standby power, immediately accessible display, continuous readout, and recording of display (Reference 3.72). Additionally refer to NTTF tier 3 item closure plan for Instrument Enhancements for BDB Events (white paper, Joint steering committee presentation 10/20/2015, and SECY-15-0187, Notation Vote Request on Tier 2 & 3 Plans).The accumulator isolation valves, reactor vessel head vents, and pressurizer power operated relief valves may be required within the first 24 hours following the BDBEE for RCS inventory and/or boration control. Either the head vent valves or the PORVs will be operated as required to allow for any additional RCS makeup or boration. The environmental qualification reports for these components demonstrate that the temperature test criteria applied to each component exceeds the expected containment conditions for ELAP event (References 3.47, 3.73, 3.74, 3.75, and 3.76). Test conditions for the equipment expected to be operated inside containment after 24 hours exceeds the expected post ELAP containment temperature conditions based on the calculation at the 5 day point. Operators will continue to monitor containment parameters to inform the Emergency Director/TSC staff when additional actions may be required to reduce containment temperature and pressure. These include transition to the SG FLEX pump for SG makeup, additional SG depressurization, or use of the NSRC-supplied equipment. TSC procedures contain guidance for the use of NSRC equipment to establish containment cooling. Therefore, it is expected that equipment in containment required to respond to an ELAP event will remain functional for the extended coping period required for the event.

Containment entry is not required following an ELAP; therefore, personnel habitability/accessibility is not applicable.

The Phase 3 strategy for containment protection is to continue the Phase 2 strategy supplemented by portable equipment delivered from off-site. See Table 2 for a list of equipment that will be delivered to the site by the NSRC after notification by the plant; refer to Section 2.11 for a discussion on NSRC-supplied equipment.

As resources become available, actions can be taken to transition away from extended Phase 2 coping strategies. Since no time sensitive Phase 3 actions have been identified, instructions for connection and utilization of NSRC equipment will be provided by Technical Support Center (TSC) personnel who will have assessed the condition of the plant and infrastructure, plant accessibility, and additional available offsite resources (both equipment and personnel) following the BDBEE.

2.12.1.6 SFP Area

Actions required in the vicinity of the SFP will be completed prior to the time when boiling in the SFP causes the area to become uninhabitable. A ventilation path will be established as discussed in Section 2.5.4.3 to mitigate buildup of temperature and humidity.

2.12.2 Heat Tracing

For the FNP site, the normal daily minimum temperature ranges from 41°F at Dothan to 40°F at Blakely in December and January (Reference 3.24, Section 2.3.2.2). An extreme minimum temperature of -1°F was recorded at Blakely in February 1899. Based on historical records, the temperature remains below freezing on less than 1 day in 2 years. About 22 days per year have minimum temperatures below freezing (Reference 3.24, Section 2.3-5). Therefore, extreme cold is not considered to be a significant concern for the site.

During normal plant operation, the RMWST tank nozzles and level instrument piping are maintained above freezing temperature by heat tracing. During a BDBEE, the RMWST can supply makeup water to the CST when it is depleted via the SG FLEX pump. The CST will be the initial source of water and in continuous use so there is no need for heat tracing. The need for a backup supply is not anticipated prior to 31 hours into the BDBEE due to the capacity of the CST and RMWST (see Table 3). Additionally, the RWST serves as an alternate supply of makeup water to the CST/RMWST. When heat tracing is lost during cold weather events, it should not be necessary to thaw the relatively short connections at the outdoor water tanks due to the large thermal mass of water in the tank. Because of the length of time available to address freezing concerns and the availability of alternate water sources such as the RWST (connection in the auxiliary building which is not susceptible to freezing) as backup to the RMWST, heat tracing is not required to be maintained following a BDBEE.

During normal plant operation, the RWST lines and appurtenances to the RWST are heat traced as necessary to prevent freezing. During a BDBEE, the RWST is a secondary source of borated water for boron injection to maintain sub-criticality (the BAT is the primary source). When heat tracing is lost during cold weather events, it should not be necessary to thaw the relatively short connections at the outdoor water tanks due to the large thermal mass of water in the tank. Because of the length of time available to address freezing concerns (i.e., greater than 24 hours), heat tracing is not required to be maintained following a BDBEE. Additionally, during MODE 6 and MODE 5 without SGs available, makeup to the RCS via gravity feed from the RWST is credited. Because advance warning of freezing weather would be available, actions will be taken per procedural guidance in advance to mitigate a loss of heating to the RWST. In addition, the RWST connections utilized for FLEX are located on the 100 ft elevation of the auxiliary building and are not susceptible to freezing.

The storage of FLEX equipment considers the minimum temperature specified by the manufacturers (see Section 2.8). The FLEX pumps and generators have special operating requirements (contained in the FSGs) when temperatures fall below 32°F. Freeze protection of idle but primed portable pumps and hoses considers the possibility of freezing.

2.13 Personnel Habitability

Operators are trained on recognizing the symptoms of heat stress and on proper hydration methods to combat heat stress. Guidance derived from current site industrial safety procedures and passive cooling technologies already used by response personnel will be applied as deemed necessary to minimize impacts of heat stress. Continued accessibility will be assured by evaluation of room environments, application of heat stress countermeasures, and rotation of personnel to the extent feasible.

Personnel habitability was evaluated in Section 2.12.1 and determined to be acceptable.

2.14 Lighting

Flashlights are the primary means of lighting to accomplish FLEX actions. All operators are required to have flashlights. In addition, the MCR and Maintenance Shop include a stock of flashlights and batteries to further assist the staff responding to a BDBEE event during low light conditions.

The majority of areas for ingress/egress and deployment of FLEX strategies contain emergency lighting fixtures (Appendix "R" lighting) consisting of a battery, battery charger and associated light fixtures. These emergency lights are designed and periodically tested to insure the battery pack will provide a minimum of eight (8) hours of lighting with no external ac power sources. Therefore, these currently installed emergency lighting fixtures provide lighting to pathways for 8 hours. Prior to the depletion of the Appendix "R" lighting, portable battery powered lighting could be deployed to support the FLEX strategy tasks, but are not required for compliance.

There are no emergency lighting fixtures in the yard outside of the protected area to provide lighting in those areas where portable FLEX equipment is to be deployed. Therefore, the FLEX pumps and diesel generators are outfitted with light plants that are powered from either their respective diesel generators or batteries in order to support connection and operation. In addition to the lights installed on the FLEX equipment, portable light plants are available to be deployed from the FLEX Storage Building as needed to support night time operations.

Emergency lighting in the MCR will be de-energized as part of the dc extended load shed. Portable, battery-powered lighting will be established prior to the dc extended load shed. MCR emergency lighting will be re-established once the 600V FLEX DG has been staged and connected.

2.15 Communications

The plant Public Address (PA) system will assist with initial notifications and directions to on-site personnel, the on-shift Emergency Response Organization (ERO) personnel, and in-plant response personnel. Battery operated handheld satellite phones will assist with initial notifications and directions to off-site Emergency Response Organization (ERO) personnel and other personnel.

As discussed in the FNP communications assessment (Reference 3.65), provisions have been made for battery backup for the plant public address system to perform in plant notification functions. A rapidly deployable communications kit (RAPIDCASE) and a mobile communications system (RAPIDCOM) will be utilized to support satellite communications for the ERO. The RAPIDCOM is self-powered via a generator located on board and it can support radio communications for operations and security personnel. The RAPIDCASE is maintained in a charged condition and requires a backup source of power before the batteries are depleted. The backup power source is a propane generator stored with the RAPIDCASE. The fuel source is staged outside near the storage location.

The FLEX communications equipment is stored in the FLEX storage building and security diesel generator building which are seismically robust structures.

2.16 Water sources

2.16.1 Secondary Water Sources

Table 3 provides an expanded list of onsite water sources considered for core cooling and SFP cooling coping strategies. This table considers each source's design robustness with respect to seismic events, high winds, and associated missiles. The Condensate Storage Tank (CST), Reactor Makeup Water Storage Tank (RMWST), Refueling Water

Storage Tank (RWST), and Service Water Pond (SWP) meet the qualification guidelines of NEI 12-06 for an injection source that can be credited for the ELAP concurrent with LUHS event. Other tanks and basins are included in the table to provide a comprehensive list of site water sources. These non-creditable water sources may be available for injection, depending on the cause of the event, and although these are not credited, they will be considered for use during an actual event.

Table 3
Water Sources

Water Sources	Usable Volume (Gallons)	Qualified for Applicable Hazard?					SG Makeup		RCS Makeup			SFP Makeup		
		Seismic	Flooding	High Winds	Low Temp	High Temp	Time Based on Decay Heat	Cumulative Time Based on Decay Heat	MODES1-4	MODE 5	MODE 6	MODES1-4	MODE 5	MODE 6
Water sources and associated piping that fully meet ALL BDB external hazards, i.e., are FLEX qualified (See Reference 3.14 Attachment A for Calculated Times)														
CST (Ref. 3.133, SR 3.7.6.1)	164,000 (one per unit)	Y	Y	Y	Y	Y	12 hrs	12 hrs	--	--	--	--	--	--
RMWST (Ref. 3.14)	160,000 (one per unit)	Y	Y	Y	Y	Y	19 hrs	31 hrs	--	--	--	--	--	--
RWST (Ref. 3.13, SR 3.5.4.2)	471,000 (one per unit - ~71,000 for boron injection requirements in MODES1-4 / remaining ~400,000 for SG makeup in MODES 1-4)	Y	Y	Y	Y	Y	76 hrs	107 hrs	>2.5 days	>3.2 days	>3.2 days (Note 2)	--	--	--
SW Pond (Ref. 3.14; Ref. 3.13, SR 3.7.9.1)	439,899,429 (common between units)	Y	Y	Y	Y	Y	>1 year	>1 year	>1 year	>1 year	>1 year	>1 year	>1 year	>1 year
Chattahoochee River	Continuous Source	Y	Y	Y	Y	Y	Indefinite	Indefinite	Indefinite	Indefinite	Indefinite	Indefinite	Indefinite	Indefinite
						Totals	--	> 1 year (Indefinite)	> 1 year (Indefinite)	>1 year (Indefinite)	>1 year (Indefinite)	>1 year (Indefinite)	>1 year (Indefinite)	>1 year (Indefinite)
Water sources not credited in FLEX strategy (No analysis performed for the non-qualified water sources)														
Condenser Hotwell	Note 1	N	--	--	--	--	--	--	--	--	--	--	--	--
Demin. Water Storage Tank (Ref. 3.14)	200,000	N	--	--	--	--	--	--	--	--	--	--	--	--
Fire Protection Tanks (Ref. 3.14)	300,000	N	--	--	--	--	--	--	--	--	--	--	--	--
Filtered Water Storage Tank (Ref. 3.14)	200,000	N	--	--	--	--	--	--	--	--	--	--	--	--
Circulating Water Canal	Note 1	N	--	--	--	--	--	--	--	--	--	--	--	--

Note 1 - as these water sources are not credited following a BDBEE, no attempt was made to quantify the volumes for these sources

Note 2 – The majority of the contents of the RWST would already be in the refueling cavity in MODE 6; MODE 5 bounds MODE 6 requirements.

2.17 Shutdown and Refueling Analysis

FNP abides by the Nuclear Energy Institute position paper entitled "Shutdown/Refueling MODES" (Reference 3.66) addressing mitigating strategies in shutdown and refueling MODES. This paper has been endorsed by the NRC Staff (Reference 3.67).

FNP has site-specific procedures based on owners group guidance for implementation of FLEX in shutdown MODES. The applicable procedure addresses all plant configurations expected in MODES 5 & 6. No pre-deployment of FLEX equipment is required.

FLEX mitigating strategies available during shutdown and refueling MODES are summarized below.

2.17.1 RCS Inventory and Reactivity Control MODE 5 without Steam Generators Available

2.17.1.1 Phase 1

In Phase 1 without the steam generators available, makeup to the RCS is provided via gravity feed from the Refueling Water Storage Tank (RWST). Prior to filling the reactor cavity, the volume of water in the RWST is sufficient to provide gravity feed until a pressure of 30 psig is reached in the RCS. Establishing the gravity feed alignment will be accomplished via manual valve operation.

The gravity feed path will be from the RWST via the Residual Heat Removal (RHR) system flow path to the RCS hot legs. Additional gravity feed paths from the RWST to the RCS are also available using the RHR flow path to the RCS cold legs.

The required makeup flow rate to the RCS following a loss of RHR cooling is 100 gpm (Reference 3.19). Depending on the rate at which containment pressure rises and RWST level decreases, gravity feeding may not maintain the required flow rate necessary to makeup to the RCS; however, it is still a credited action that will mitigate core uncovery. The initial response of gravity feeding from the RWST will extend the required Phase 2 response time to prevent or mitigate the consequences of the event.

2.17.1.2 Phase 2 and 3

The primary strategy for inventory and reactivity control will be to utilize an electric motor driven RCS makeup FLEX pump, powered by a 480V FLEX DG, taking suction on the RWST with its discharge aligned to a connection in the charging/high head safety injection (HHSI) system.

The RCS makeup evaluation (Reference 3.19) indicates that a flow rate of 100 gpm is sufficient to remove the decay heat for MODES 5 events that occur beyond 48 hours after plant shutdown. The suction connection is from the RWST at a location upstream of the hydro test pump. Diverse connections for discharge of the pump are located on or downstream of the charging pump discharge header (the same connections are also utilized for the Modes 1-4 strategy). No venting of the RCS will be required since a pressurizer safety valve is removed from the pressurizer during the limiting shutdown condition (i.e., in MODE 5 with the reactor vessel head installed).

A minimum RCS makeup FLEX pump head of 471 ft is required to ensure a minimum flow rate of 100 gpm can be provided for inventory control with suction from the RWST for MODES 5-6. At this flow rate, the minimum NPSHa is 42 ft (Reference 3.35) which exceeds the NPSHr of approximately 9 ft (Reference 3.36).

2.17.2 RCS Inventory and Reactivity Control MODE 6

2.17.2.1 Phase 1

In MODE 6, when the RWST inventory is available in the reactor refueling cavity no Phase 1 actions will be required. Otherwise, makeup to the RCS will be provided via gravity feed from the RWST as discussed in Section 2.17.1.1.

2.17.2.2 Phase 2 and 3

The primary strategy for inventory and reactivity control will be to utilize an electric motor driven RCS makeup FLEX pump, powered by a 480V FLEX DG, taking a suction on the RWST with its discharge aligned to a connection in the charging/HHSI system.

The Westinghouse RCS makeup evaluation (Reference 3.19) indicates that a flow rate of 100 gpm is sufficient to remove the decay heat for MODE 6 events that occur beyond 48 hours after plant shutdown. No venting of the RCS will be required since the reactor vessel head is de-tensioned or removed in MODE 6. See Section 2.17.1.2 for a discussion of the RCS makeup FLEX pump performance requirements.

2.17.3 Spent Fuel Pool Cooling/Inventory

For SFP cooling considerations, refer to Section 2.5.

2.17.4 Containment Integrity, MODES 5 & 6

Except for the specific containment closure requirements of Technical Specifications, equipment hatches and airlocks are often opened during outages. Each breach of containment integrity is administratively controlled. While the containment may not initially be isolated in operating MODES 5 and 6, plant operating procedures require that containment be manually isolated following the ELAP event. To maintain containment parameters within design limits, local manual actions are required to establish a vent flow path through one of the two installed lines provided for Integrated Leak Rate Testing (ILRT) (Reference 3.47). The coping strategy for maintaining containment integrity includes monitoring containment pressure.

2.17.4.1 Thermal-Hydraulic Analyses

Analysis (Reference 3.47) demonstrates that containment response following a postulated ELAP event does not challenge design limits as long as an adequate vent is established. Either ILRT penetration provides an adequate containment vent path.

Modular Accident Analysis Program (MAAP) PWR Version 4.0.5 analysis software was utilized for the containment analysis (Reference 3.26). See Section 2.6.6 for additional discussion on the utilization of the MAAP4 analysis software.

2.18 Sequence of Events

Table 4 below presents a sequence of events timeline for an ELAP concurrent with LUHS event at FNP. Validation of each of the FLEX time constraint actions has been completed in accordance with the FLEX Validation Process document issued by NEI (Reference 3.16) and includes consideration for staffing (References 3.37 and 3.38). Time to clear debris to allow equipment deployment is assumed to be up to 4 hours (Reference 3.38). This time is considered to be conservative based on site reviews and the location of the FLEX Storage Building. Debris removal equipment is stored in the FLEX Storage Building.

Additional technical basis details regarding the identified time sensitive actions (i.e., Actions which have a "Y" in the ELAP Time Constraint column in Table 4) follow the table.

Table 4

Sequence of Events Timeline

Action Number	Elapsed Time	Action	ELAP Time Constraint Y/N[1]	Remarks
	0	Event Initiation	N/A	
1	60 sec	TDAFW Pump Starts	N	Unit Operator (RO) verifies initiation of TDAFW and that SG levels are increasing
2	~5 min	Attempt to establish DG emergency power and local diesel start	N	RO attempts to start EDG from MCR and dispatches System Operator (SO) to start locally.
3	~5 min	Evaluate off-site power with off-site Power Coordination Center	N	Shift Manager determines availability of off-site power
4	22 min	Attempts to start EDGs have been unsuccessful. Enter ELAP Procedure.	Y	Time sensitive at 40 minutes. Entry into ELAP provides guidance to operators to perform ELAP actions.
5	25 min	Stage MCR portable lighting	Y	Time sensitive at 45 minutes. Stage portable battery powered lighting for use in MCR following extended load shed. Elapsed time assumes the action will be initiated 22 minutes after the event.

Table 4

Sequence of Events Timeline

Action Number	Elapsed Time	Action	ELAP Time Constraint Y/N[1]	Remarks
6	34 min	dc extended load shed complete	Y	Time sensitive at one hour. Action to minimize battery load to extend operation of the dc and vital ac buses. Dc buses are readily available for operator access and breakers/control switches at the dc switchgear will be appropriately identified (labeled) to show which are required to be opened. Elapsed time assumes the action will be initiated 22 minutes after the event.
6A	54 min	Open seven doors to provide ventilation for the battery and dc equipment rooms	Y	The 125V dc and inverter-fed 120V ac electrical distributions remain energized and generate heat in these rooms. With doors opened, natural mixing of air in these rooms with large adjacent spaces will maintain adequate temperatures prior to availability of forced ventilation. Elapsed time assumes the action will be initiated 40 minutes after the event.
7	1 hour 46 min	Manually control TDAFWP	Y	Time sensitive at 2 hours. Reactor operator dispatches a system operator to take manual control of TDAFW pump following TDAFW UPS depletion. Elapsed time assumes the action will be initiated 90 minutes after the event.
7A	25 min	Block open the MCR access doors that provide an open pathway to the building exterior at plant grade level	Y	Time sensitive at 2 hours. Analysis has shown this strategy will provide sufficient ventilation to equalize the MCR temperature to approximately that of the outside air. During cold weather, the ventilation flow can be limited to keep the

Table 4

Sequence of Events Timeline

Action Number	Elapsed Time	Action	ELAP Time Constraint Y/N[1]	Remarks
				MCR at a habitable temperature. If the outside temperature is above 98°F, then the MCR doors will not be opened until the MCR temperature is in excess of the outside temperature. Elapsed time assumes the action will be initiated 22 minutes after the event.
8	6 hours 46 min	Stage and connect on-site 600 FLEX DG to dc bus battery chargers	Y	Time sensitive at 8.5 hours. On-site 600V FLEX diesel generator will be utilized to power the battery chargers and to recharge the batteries. Elapsed time assumes the action will be initiated 4 hours after the event.
8A	8 hours 13 min	Establish forced ventilation for switchgear rooms	Y	Time sensitive after battery chargers are energized, i.e., at 8.5 hours, to control temperature and hydrogen concentration levels. Deploying portable fans to circulate air between these rooms and the large adjacent spaces will maintain adequate temperatures. Elapsed time assumes the action will be initiated 7 hours after the event.
9	10 hours	Stage and connect portable SG FLEX pump as alternate to TDAFW pump.	N	SG FLEX pump will be staged as personnel become available.
10	13 hours 12 min	Initiate depressurization of the steam generators to achieve the RCS cooldown and depressurization.	Y	Time sensitive at 15 hours. Depressurizing the SG enables the ability to borate the RCS prior to net xenon decay (i.e., within 24 hours) and also to utilize the SG FLEX pump as an alternate to the TDAFW pump. Elapsed time assumes the

Table 4

Sequence of Events Timeline

Action Number	Elapsed Time	Action	ELAP Time Constraint Y/N[1]	Remarks
				action will be initiated 10 hours after the event.
11	10 hours 49 min	Begin makeup to the CST from the RMWST using the SG FLEX pump	Y	Time sensitive at 12 hours. Operator starts the transfer of water from the RMWST to the CST before the initial CST inventory will be exhausted. Elapsed time assumes the action will be initiated 10 hours after the event.
11A	7 hours 25 min	Install portable ventilation fan to maintain an acceptable MCR temperature	Y	Analysis determined that a portable ventilation fan will be required in order to maintain an acceptable MCR temperature following energizing the MCR emergency lights and additional instrumentation when the battery charger is powered from the on-site FLEX diesel generator. Elapsed time assumes the action will be initiated 7 hours after the event.
12	15 hours 35 min	Initiate boration of the RCS to ensure maintenance of the subcritical reactor state. Stage and connect on-site 480V FLEX DG to boron injection RCS makeup FLEX pump	Y	Time sensitive at 19 hours. Operator starts the transfer of water from the BATs to the RCS to ensure adequate boration and sub-criticality. Elapsed time assumes the action will be initiated 14 hours after the event.
13	20 hours	Begin makeup to SFP as necessary to maintain adequate level in the SFP. (Under design basis conditions with full core offload, boiling begins at ~5.6 hours; without makeup, SFP level falls to 15 feet above the active fuel in ~23 hours.) Vent the spent fuel pool area by opening doors to minimize condensation during pool boiling	N	SFP area venting and hose deployment will begin at approximately 5-6 hour time frame. Boil-off rate is slow with a large volume of water in the SFP. Times shown assume worst case emergency full-core off load heat load in both units' SFPs.

Table 4

Sequence of Events Timeline

Action Number	Elapsed Time	Action	ELAP Time Constraint Y/N[1]	Remarks
14	30 hours	Begin makeup to the CST or RMWST from the RWST prior to depletion of the initial CST inventory and supplemental RMWST inventory.	Y	Time sensitive at a time greater than 31 hours. Prior to depletion of the initial CST inventory and supplemental RMWST inventory, the CST or RMWST will require makeup from the RWST sufficient to continue decay heat removal from the steam generators. The RCS makeup FLEX pump will be utilized to perform this task.

Discussion of time constraints identified in Table 4 with actual times taken from the validation & verification (Reference 3.87) activities:

- Table 4 Item 4: 22 minutes, Entry into ELAP – time sensitive at a time greater than 40 minutes. To ensure that safety-related station batteries can maintain dc bus voltages above minimum required voltage for a minimum of 8.5 hours following a loss of ac power, dc extended load shed is required to be completed by one hour after loss of ac power. The dc buses are located in switchgear rooms in the auxiliary building and are readily accessible to the operator. Load stripping consists of opening 11 breakers in Unit 1 and 10 breakers in Unit 2 dc switchgears. As an operator aid, the breakers/control switches are appropriately identified (labeled) to show which are required to be opened to facilitate an extended load shed.

- Table 4 Item 5: 25 minutes, Stage portable MCR Lighting – Time sensitive at a time greater than 45 minutes. Time period of 5 minutes past ELAP entry is selected to ensure that MCR portable lighting is established prior to the ELAP load shed de-energizing the emergency MCR lighting.

- Table 4 Item 6: 34 minutes, dc extended load shed complete – Time sensitive at a time greater than one hour. Time period of 20 minutes past ELAP entry is selected to ensure that dc buses are available from battery sources.

- Table 4 Item 6A: 54 minutes, Open doors to battery rooms and associated dc equipment rooms – Analysis has determined that opening seven doors per unit at one hour is sufficient ventilation and cooling prior to commencing to charge the batteries from the on-site 600V FLEX DG.

- Table 4 Item 7: 1 hour 46 minutes, Manually control TDAFWP – After two hours, operator action is required to manually open the steam admission valves and then manually control TDAFW pump turbine speed by throttling the TDAFW trip and throttle valve to control turbine speed and pump discharge pressure per existing procedural guidance.

- Table 4 Item 7A: 25 minutes, Open access doors on the Main Control Room (MCR) – This strategy will provide sufficient ventilation to equalize the MCR temperature to approximately that of the outside air. During cold weather, the ventilation flow can be limited to keep the MCR at a habitable temperature. If the outside temperature is above 98°F, then the MCR doors will not be opened until the MCR temperature is in excess of the outside temperature.

- Table 4 Item 8: 6 hours 46 minutes, Stage and connect on-site FLEX 600V DG to dc bus battery chargers – Time sensitive at 8.5 hours. Battery durations are calculated to be greater than 8.5 hours. The on-site FLEX 600V DG will be deployed during the 6-8 hour time frame to power the battery chargers by eight hours. The on-site FLEX DGs will be maintained in the on-site FLEX storage structure. The on-site FLEX DGs will be deployed and staged via haul routes and staging areas evaluated for impact from external hazards.

- Table 4 Item 8A: 8 hours 13 minutes, Establish forced ventilation for switchgear rooms – Time sensitive at a time greater than 8.5 hours. Ventilation is required in the battery rooms and associated dc equipment rooms for cooling the rooms and venting hydrogen released from the batteries during charging. Analysis determined that in addition to the seven doors per unit opened at one hour, installing three fans per unit, one per unit with a trunk from the floor above, at 8 hours was adequate to maintain the room temperatures. Smaller fans placed in the battery room doorways will ensure air in the battery rooms is sufficiently mixed to prevent an unacceptable buildup of hydrogen while the batteries are charging.

- Table 4 Item 10: 13 hours 12 minutes, Initiate depressurization of the steam generators to achieve the RCS cooldown and depressurization –

Time sensitive at 15 hours. Initiating cooldown before the specified time allows for RCS depressurization (estimate four hours) prior to when borated makeup must be started for maintaining sub-criticality at the most limiting core conditions.

- Table 4 Item 11: 10 hours 49 minutes, Begin makeup to the CST from the RMWST using the SG FLEX pump – Time sensitive at a time greater than 12 hours. Prior to depletion, the CST will be provided with makeup from the RMWST, which is seismically qualified and missile protected, using the SG FLEX pump. The RMWST contains demineralized water with a minimum inventory of 160,000 gallons that is capable of providing an additional 19 hours to the 12 hours of available inventory in the CST (Reference 3.14).
- Table 4 Item 11A: 7 hours 25 minutes, Establish forced ventilation for the MCR – Forced ventilation from the MCR establishes a flow path through the MCR to the outdoor atmosphere. Deploying a portable fan at 14 hours will keep MCR temperatures at an acceptable level.
- Table 4 Item 12: 15 hours 35 minutes, Initiate boration of the RCS to ensure maintenance of the subcritical reactor state – Time sensitive at a time greater than 19 hours. The Westinghouse RCS makeup evaluation for FNP (Reference 3.19) determined that injecting approximately 5,000 gallons from the Boric Acid Tanks (BATs) provides sufficient shutdown margin for the worst case boration requirements (i.e., end-of-life). Initiating makeup from the BATs at 19 hours ensures adequate boration (with 1 hour for mixing) to maintain long-term sub-criticality is accomplished within 24 hours with injection rate limited by letdown through the head vent flow path.
- Table 4 Item 14: 30 hours, Makeup to CST or RMWST from RWST – Time sensitive at approximately 31 hours. Prior to depletion of the initial CST inventory and supplemental RMWST inventory, the CST or RMWST will require makeup from the RWST sufficient to continue decay heat removal from the steam generators. The RCS makeup FLEX pump will be utilized to perform this task.

2.19 Programmatic Elements

2.19.1 Overall Program Document

Southern Nuclear Operating Company's (SNC) program for Diverse and Flexible Coping Strategies (FLEX) in response to a BDBEE is described in two documents; the program description – for common elements applicable to all SNC sites (NMP-GM-038, Reference 3.69), and a program document specific for each of the SNC sites (NMP-GM-038-001 for FNP, Reference 3.64). Together, the two documents describe the FLEX program for FNP.

Key elements of the FNP FLEX program include:

- A summary of FLEX strategies including validation methods
- A description of FLEX equipment including:
    - Quality attributes
    - Maintenance and testing
    - Availability tracking
    - Storage
    - Requirements for deployment
- A description of SNC's FLEX procedure development including:
    - The interface between design basis and beyond design basis procedures
    - Procedure maintenance
    - Application of procedures during emergencies
- Plant Configuration Control:
    - Changes to FLEX strategies
    - Configuration Management
    - Activities that Potentially Affect FLEX strategies
    - Plant Configuration Control Processes during Emergencies
- A summary of personnel related items including staffing and training

2.19.2 Procedural Guidance

The overall plant response to an ELAP concurrent with LUHS is accomplished through normal plant command and control procedures and practices. The inability to predict plant conditions following an extreme external event has prompted the creation of a new set of procedures. These procedures, FLEX Support Guidelines (FSGs), provide guidance for deployment of FLEX equipment. FSGs are written such that they can be implemented during a variety of post event conditions. When the use of FLEX equipment is required for response to a FLEX stylized BDBEE, EOPs or AOPs will direct the entry into and exit from the appropriate FSG. This procedure approach conforms to NEI 12-06, Section 11.4 guidance for the relationship between FLEX procedures and other relevant plant procedures.

FSGs were developed from the PWROG procedure guidelines to provide pre-planned strategies for accomplishing specific tasks associated with implementation of FLEX strategies. Strategy Implementation Guides (SIGs) were developed to have operator actions in the field included in a separate "operator friendly" procedure format. The FSGs and SIGs together are equivalent to the PWROG generic FSGs.

Procedural Interfaces have been incorporated into ECP-0.0, "Loss of All AC Power" (References 3.50 and 3.12) to the extent necessary to include appropriate reference to FSGs and provide command and control for the ELAP. Additionally, procedural interfaces have been incorporated into the AOPs for MODES 5 & 6 to include appropriate reference to FSGs.

Changes to plant procedures including FSGs and SIGs are screened using existing procedural guidance which incorporates the aspects of NEI 96-07, Revision 1 (Reference 3.68), and NEI 97-04, Revision 1 (Reference 3.44).

2.19.3 Staffing

Using the methodology of NEI 12-01, Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities (Reference 3.42), assessments of the capability of the FNP 1 & 2 on-shift staff and ERO to respond to a BDBEE were performed for Phase 1 and for Phase 2 staffing studies (References 3.37 and 3.38).

2.19.4 Training

Training has been developed and delivered to the target populations (operations, maintenance, engineering, security, and ERO staff) using the systematic approach to training (SAT) process. The training conducted by SNC satisfies the applicable requirements of NEI 12-06, Section 11.6.

The SNC general population is trained using NANTeL courses provided by the Emergency Response Training Development (ERTD) Working Group (INPO facilitated). The ERTD conducted a job analysis to identify common training topics and coordinated the design and development of common training materials.

SNC staff responsible for the implementation of the FSGs also complete additional NANTeL training provided by the ERTD working group.

ERO Decision Makers receive additional training on directing actions and implementing strategies following a BDBEE.

The guidance for drill performance and the evaluation of time sensitive actions necessary to meet NEI 12-06 requirements is described in the following procedures:

- NMP-EP-303, Drill and Exercise Standards (Reference 3.82)
- NMP-OS-014, Time Critical Operator Action Program (Reference 3.83)

2.19.5 FLEX Equipment List

The equipment necessary for the implementation of the FLEX strategies in response to a BDBEE at FNP is listed in Table 5. The table includes the quantity, applicable strategy, and equipment performance criteria for the required FLEX equipment. FLEX equipment is primarily stored in the FLEX Storage Building (FSB). Some equipment (boron injection FLEX pumps, dc switchgear room fans, FLEX ventilation fans, and RCS makeup FLEX pumps) are stored near their staging areas in the auxiliary building. In addition, some FLEX communications equipment is stored in the security diesel generator building.

2.19.6 N+1 Equipment Requirement

NEI 12-06 invokes an N+1 requirement for the FLEX equipment that directly performs a FLEX mitigation strategy for core cooling, containment, or SFP cooling in order to assure reliability and availability of the FLEX equipment required to meet the FLEX strategies. Sufficient equipment is available to address all functions at all units on-site, plus one additional spare, i.e., an N+1 capability, where "N" is the number of equipment required by FLEX strategies for all units on-site. Where a single resource is sized to support the required function of both units a second resource is available to meet the +1 capability. In addition, where multiple strategies to accomplish a function have been developed, the equipment associated with each strategy does not require N+1 capability. Plant Farley provided additional hose or cable equivalent to 10% of the total length of each type/size of hose or cable necessary for the “N” capability as described in NEI 12-06, Revision 2, Section 3.2.2 to establish the quantities of N+1 hose and cable. Plant unavailability tracking guideline provides the quantity details for each type of hose and cable.

The N+1 requirement does not apply to the FLEX support equipment, vehicles, and tools. However, these items are subject to inventory checks, requirements, and associated maintenance and testing.

Table 5
PWR Portable Equipment Stored On-Site

Use and (Potential / Flexibility) Diverse Uses							Performance Criteria
List Portable Equipment	Qty	Core	Containment	SFP	Instrumentation	Accessibility	
Medium Wheeled Loader	1	X	X	X	X	X	Debris Removal
Tow Vehicles - 1 large, 1 small	2	X	X	X	X	X	Towing Pumps and Diesel Generators
600V FLEX Diesel Generator (trailer mounted)	2				X		Provide 600V ac power to battery chargers
SG FLEX Pump (trailer mounted, diesel driven, centrifugal)	3	X					Provides injection into the SGs to remove decay heat from the core.
SFP FLEX pump (trailer mounted, diesel driven with hydraulic driven submersible package, centrifugal)	2	X		X			Pump submersible unit placed in the SW Pond for SFP makeup and potential core cooling makeup water.
Sets of Monitor Spray Nozzles for SFP Spray and required hoses	3			X			Provides 250 gpm of spray water for each unit
Boron Injection FLEX Pump (skid mounted, electrical motor driven, centrifugal)	3	X					Provides Borated Water from the BAT or RWST for injection to the RCS in MODES with SGs available for decay heat removal
RCS Makeup FLEX Pump (skid mounted, electrical motor driven, centrifugal)	3	X					Provides borated water from the RWST for injection to the RCS during MODES with SGs not available for decay heat removal. Can also be used to transfer water from the RWST to RMWST or CST for core cooling makeup water.
FLEX Fuel Tanker (trailer mounted)	2	X	X	X	X		Provide fuel to diesel powered FLEX equipment.

Table 5
PWR Portable Equipment Stored On-Site

Use and (Potential / Flexibility) Diverse Uses							Performance Criteria
List Portable Equipment	Qty	Core	Containment	SFP	Instrumentation	Accessibility	
20 kW FLEX Diesel Generator	3						Not credited in FLEX strategies
480V FLEX Diesel Generator (trailer mounted)	2	X					Provides power for boron injection and RCS makeup FLEX Pumps
FLEX dc Equipment Room Fan	4	X	X	X	X	X	Portable ventilation for equipment operability
FLEX Ventilation Fan	2	X	X	X	X	X	Portable ventilation for equipment operability
Battery Room FLEX Fan	4	X	X	X	X	X	Battery room H2 control
MCR FLEX Ventilation Fan	2	X	X	X	X	X	For MCR Ventilation
Diesel Powered Lights	4	X	X	X	X	X	Misc. lighting. Not credited in FLEX strategies
Air Compressor	1	X	X	X	X	X	Air as needed. Not credited in FLEX strategies
Rapidly Deployable Communications devices	2	X	X	X	X	X	Does not rely on the availability of either on-site or off-site infrastructure other than satellites. Devices are not identical.

2.19.7 Equipment Maintenance and Testing

FLEX equipment (including support equipment) is subjected to initial acceptance testing and to periodic maintenance and testing utilizing the guidance provided in INPO AP 913, Equipment Reliability Process (Reference 3.71), to verify proper function.

The standard EPRI industry PM process (similar to the Preventive Maintenance Basis Database) is used to establish the maintenance and testing actions for FLEX equipment. This provides assurance that stored or pre-staged FLEX equipment is being properly maintained and tested.

EPRI FLEX maintenance templates (where provided) were used to develop the specific maintenance and testing guidance for the associated FLEX equipment. In the absence of an EPRI FLEX template, existing maintenance templates (where available) were used to develop the specific maintenance and testing guidance. For all other equipment not covered by a maintenance template, manufacturer OEM or industry standards were used to determine the recommended maintenance and testing.

The PM Templates include activities such as:

- Functional Test and Inspection
- Fluid Filter Replacement
- Fluid Analysis
- Generator Load Test
- Component Operational Inspection
- Standby Walkdown

2.19.8 FLEX Equipment Unavailability Tracking

The unavailability of FLEX equipment and applicable connections that directly perform a FLEX mitigation strategy for core, containment, and SFP are managed such that risk to mitigating strategy capability is minimized. Maintenance/risk guidance conforms to the guidance of NEI 12-06.

The unavailability of FLEX equipment, connections, and SFP level indication is controlled using the tracking application in the Shift

Operations Management System (eSOMS) per NMP-OS-019-013, Beyond Design Basis Equipment Unavailability Tracking (Reference 3.33).

FLEX equipment and connections will not normally be used for purposes other than emergency response. It is permissible, however, to pre stage and/or use FLEX equipment and connections provided the following requirements are met:

- Permission is received from the Shift Manager or Emergency Director.
- The proper action to restore the equipment to an available status is determined and the status of the affected equipment and/or connection is tracked per NMP-OS-019-013.

FLEX equipment and resources may be allocated when requested to support a beyond design basis emergency event at another nuclear site provided the following requirements are met:

- Permission is received from the Shift Manager per NMP-OS-007, Conduct of Operations (Reference 3.86)
- The status of the allocated equipment is tracked and unavailability actions implemented per NMP-OS-019-013.

3. References

3.1 SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated July 12, 2012 (ADAMS Accession No. ML11186A950)

3.2 NRC Order Number EA-12-049, Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for BDBEEs, dated March 12, 2012 (ADAMS Accession No. ML12056A045)

3.3 Nuclear Energy Institute (NEI) 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 2, dated December 2015 (ADAMS Accession No. ML15348A015)

3.4 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 BDBEEs, Revision 0, dated August 29, 2012 (ADAMS Accession No. ML12229A174)

3.5 NRC Order Number, EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, dated March 12, 2012 (ADAMS Accession No. ML12054A682)

3.6 Nuclear Energy Institute (NEI) 12-02, Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable SFP Instrumentation, Revision 1, dated August 2012 (ADAMS Accession No. ML12240A307)

3.7 NRC Interim Staff Guidance JLD-ISG-2012-03, Compliance with Order EA-12-051, Reliable SFP Instrumentation, Revision 0, dated August 29, 2012 (ADAMS Accession No. ML12221A339)

3.8 United States NRC Endorsement Letter for Westinghouse Electric Company Technical Report TR-FSE-14-1-P, Revision 1 and TR-FSE-14-1-NP, Revision 1 "Use of Westinghouse Shield Passive Shutdown Seal for FLEX Strategies," May 28, 2014 (ADAMS Accession Number ML14132A128)

3.9 A181126, Ver. 2.0, FLEX Portable System Phase 2 480V and 600V Alternate Power Diesel Generator Sizing

3.10 NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Revision 1

3.11 A181010, Ver. 36.0, Functional System Description Auxiliary Feedwater System

3.12 FNP-2-ECP-0.0, 29.0, Loss of All AC Power

3.13 Farley Units 1 and 2 Technical Specifications and Bases, Amendment No. 198 (Unit 1) and Amendment No. 194 (Unit 2)

3.14 SM-SNC458207-004, Ver. 1.0, Farley Extended Loss of ac power Decay Heat and Makeup Requirements

3.15 SE-SNC458207-001, Ver. 2.0, Auxiliary Building Battery LOSP Extended Coping Time Study, dated May 15, 2014

3.16 Nuclear Energy Institute letter to Administrative Points of Contact (APC 14-17), Validation Document for FLEX Strategies, dated July 18, 2014.

3.17 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 BDBEEs, Revision 1, dated January 22, 2016, (ADAMS Accession No. ML15357A163)

3.18 Westinghouse Letter LTR-PSCA-12-78, PA-PSC-0965 Core Team PWROG Core Cooling Management Interim Position Paper, Revision 0, November 2012

3.19 LTR-FSE-12-25 Revision 2, "Evaluations to Support SNC FLEX Strategies for Farley Nuclear Plant," March 4, 2013

3.20 NRC Letter from J. Davis, NRC, to J. A. Gresham, Westinghouse Electric Company, LLC, dated May 28, 2014 (ML14132A128).

3.21 NRC Letter "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 (ML12053A340)

3.22 United States NRC Endorsement Letter for Boron Mixing in Regards to Mitigation Strategies Order EA-12-049, January 8, 2014 (ADAMS Accession Number ML13276A183)

3.23 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, dated January 2013

3.24 Farley Nuclear Plant Final Safety Analysis Report Update, Rev 27

3.25 Farley Nuclear Plant Technical Requirements Manual, Rev 33

3.26 MAAP4 Application Guidance, Desktop Reference for Using MAAP4 Software, Revision 2" (Electric Power Research Institute Report 1020236), July 2010

3.27 Westinghouse White Paper TR-FSE-14-1-P, Use of Westinghouse SHIELD® Passive Shutdown Seal for FLEX Strategies, Rev. 1, March 2014

3.28 Westinghouse Letter LTR-NRC- 14-16, Submittal of TR-FSE-14-1-P, Revision 1 and TR-FSE-14-1-NP, Revision 1, "Use of Westinghouse SHIELD® Passive Shutdown Seal for FLEX Strategies" (Proprietary/Non-Proprietary), dated March 19, 2014 (ADAMS Accession No. ML 14084A497)

3.29 Westinghouse Letter LTR-NRC- 14-24, Submittal of LTR-FSE-1 4-29, Revision 0, "Acceptance Criteria and Applicability of the Westinghouse SHEILD® Passive Shutdown Seal for FLEX Strategies" (Non-Proprietary), dated April 22, 2014 (ADAMS Accession No ML 14129A353)

3.30 Westinghouse Letter LTR-FSE-14-29, Acceptance Criteria and Applicability of the Westinghouse SHEILD® Passive Shutdown Seal for FLEX Strategies, Rev. 0, April 22, 2014

3.31 A181154, Ver. 2.0, FLEX Portable System, Steam Generator Injection FLEX Pump Sizing Criteria

3.32 NMP-GM-036, Ver. 1.1, Duty Manager

3.33 NMP-OS-019-013, Ver. 1.0, Beyond Design Basis Equipment Unavailability Tracking

3.34 A181146, Ver. 1.0, FLEX Phase 2 Core Cooling Subsystem Sizing Criteria for the RWST to CST or RMWST Pump

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3.37 SNC Letter NL 13-0763, Joseph M Farley Nuclear Plant Units 1 & 2 Emergency Preparedness Information Requested By NRC Letter 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-Tem Task Force Review Of Insights From The Fukushima Daiichi Accident, letter dated April 30, 2013 [FNP Phase 1 Staffing Assessment], Version 1.0

3.38 SNC letter NL 14-0586, Farley Nuclear Plant Response To Request For Information , letter dated June 6, 2014 [FNP Phase 2 Staffing Assessment], Version 1.0

3.39 Nuclear Energy Institute (NEI) White Paper entitled "Battery Life Issue," dated August 27, 2013 (ADAMS Accession No. ML13241A186)

3.40 United States NRC Endorsement Letter of the Nuclear Energy Institute (NEI) White Paper entitled "Battery Life Issue," dated September 16, 2013 (ADAMS Accession No. ML13241A188)

3.41 A181102, Ver. 2.0, Phase 2 480V and 600V Alternate Power Subsystem

3.42 Nuclear Energy Institute (NEI) 12-01, Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities, Revision 0, dated May 3, 2012 (ADAMS Accession No. ML12125A410)

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3.44 Nuclear Energy Institute (NEI) 97-04, Revision 1, Design Bases Program Guidelines, dated February 2001

3.45 SNC Letter NL-15-0699, Joseph M. Farley Nuclear Plant Unit 1 Completion of Required Action by NRC Order EA-12-051 Reliable Spent Fuel Pool Level Instrumentation, dated June 26, 2015 (ADAMS Accession Number ML15182A175)

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3.47 SM-SNC458207-002, Ver. 1.0, Containment Analysis of FLEX Strategies

3.48 EPRI Report 3002001785, Use of Modular Accident Analysis Program (MAAP) in Support of Post-Fukushima Applications, June 2013 (ADAMS Accession Number ML13190A201)

3.49 United States NRC Endorsement Letter for Use of Modular Accident Analysis Program (MAAP) in Support of Post-Fukushima Applications, October 3, 2013 (ADAMS Accession Number ML13275A318)

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3.53 U735759, Ver. 1.0, Report of Liquefaction Potential Assessment FLEX Dome Storage Building and Travel Paths

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3.57 A181153, Ver. 2.0, FLEX Portable System Evaluation of On-Site Diesel Fuel Consumption

3.58 SM-SNC458207-001, Ver. 2.0, Farley Main Control Room Heat up Evaluation during an Extended Loss of all ac Power

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3.69 NMP-GM-038, Ver. 1.1, Diverse and Flexible Coping Strategies (FLEX) Program

3.70 ASCE 7-10, Minimum Design Loads for Buildings and Other Structures

3.71 INPO AP 913, Equipment Reliability Process

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3.77 TSEAL-3-695-49A, Human Tolerance for Short Exposures to Heat

3.78 A181163, Ver. 1.0, FLEX Portable System Steam Generator FLEX Pump Vendor Manual

3.79 Nuclear Energy Institute (NEI) 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, dated August 2012. (ADAMS Accession No. ML12242A378)

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3.85 DOEJ-FRC111207401-M001, Ver. 1.0, Evaluation of the Time for the SFP to Reach 200°F

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