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

Vogtle Electric Generating 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 Vogtle Electric Generating Plant - Units 1 and 2 (VEGP) 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 VEGP Units 1 and 2 on March 27, 2016 as Unit 2 completed refueling outage U2R18. SNC previously notified the NRC of the Unit 1 compliance with the Order on November 20, 2015.

Enclosure 1 summarizes VEGP Units 1 and 2's compliance with Order EA-12-049. Enclosure 2 contains the VEGP 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 VEGP 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 VEGP 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.

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NRR

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 23rd *day of* May*, 2016.*

Notary Public

My commission expires: 1/2/2018

Enclosures: 1. Compliance with Order EA-12-049
2. Vogtle Electric Generating Plant Final Integrated Plan

cc: Southern Nuclear Operating Company
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Vogtle Electric Generating 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 Vogtle Electric Generating Plant (VEGP) - 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 VEGP 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 - VEGP Units 1 and 2 has no open or pending items
- Licensee Identified Open Items - VEGP Units 1 and 2 has no open or pending licensee identified open items
- Audit Questions/Audit Report Open Items - VEGP Units 1 and 2 FLEX has no open or pending items

Milestone Schedule - Items Complete

VEGP Unit 1 & 2 Milestone	Completion Date
Submit 20 Day Letter Acknowledging Receipt of Order	March 2012
Submit Overall Integrated Plan	February 2013
1st 6 Month Update	August 2013
2nd 6 Month Update	February 2014
Unit 1 - 1st Refueling Outage	April 2014
3rd 6 Month Update	August 2014
Unit 2 - 1st Refueling Outage	October 2014
4th 6 Month Update	February 2015
Develop Modifications	March 2015
Develop Training Material	June 2015
Develop Strategies (Vogtle Response Plan) with National SAFER Response Center	June 2015
5th 6 Month Update	August 2015
Develop Operational Procedure Changes	October 2015
Unit 1 Walk-throughs or Demonstrations	October 2015

VEGP Unit 1 & 2 Milestone	Completion Date
Implement Training	October 2015
Unit 1 - 2nd Refueling Outage / Implementation Complete	**October 2015**
Phase 2 Equipment Procurement Complete	December 2015
6th 6 Month Update	February 2016
Develop FSGs	February 2016
Issue FSGs	February 2016
Unit 2 Walk-throughs or Demonstrations	February 2016
Unit 2 - 2nd Refueling Outage / Implementation Complete	March 27, 2016

Order EA-12-049 Compliance Elements Summary

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

Strategies - Complete

VEGP 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 supporting the FLEX strategies for VEGP Unit 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 VEGP Unit 1 and 2 has been procured, received at VEGP, initially 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 VEGP 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 before their due date.

Protected Storage - Complete

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

Procedures - Complete

FLEX Support Guidelines (FSGs) for VEGP Unit 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 VEGP Unit 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 VEGP Phase 2 staffing study for VEGP (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 Vogtle 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

VEGP 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 VEGP 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 VEGP 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. Vogtle Electric Generating 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. Vogtle Electric Generating 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. Vogtle Electric Generating 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, Vogtle Electric Generating Plant, Units 1 and 2 - Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049 (Mitigation Strategies) (TAC NOS. MF0714 and MFO715), dated January 16, 2014.
8. Vogtle Electric Generating 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. Vogtle Electric Generating Plant – Unit 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. Vogtle Electric Generating 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 – Vogtle Units 1&2 Mitigation Strategies (FLEX) Overall Integrated Implementation Plan (OIP), Revision 4.
12. Vogtle Electric Generating 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, Vogtle Electric Generating 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 August 25, 2015.
14. Vogtle Electric Generating 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. Vogtle Electric Generating 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 May 16, 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. Vogtle Electric Generating Plant Notification of Commitment Completion - NTTF Recommendation 9.3, dated October 15, 2015.
19. Vogtle Electric Generating Plant - Unit 1, Completion of Required Action for NRC Orders EA-12-049 & EA-12-051, Mitigation Strategies for Beyond-Design-Basis External Events and Reliable Spent Fuel Pool Level Instrumentation, dated November 20, 2015.
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.

Vogtle Electric Generating Plant – Units 1 and 2
Notification of Full Compliance of for NRC Orders EA-12-049
<u>Mitigation Strategies for Beyond-Design-Basis External Events</u>

Enclosure 2

Vogtle Electric Generating Plant
Final Integrated Plan

(93 pages)

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

VOGTLE ELECTRIC GENERATING PLANT
Units 1 & 2

May 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. 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 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, Rev. 0, 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 on January 22, 2016 (Reference 3.81).

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 VEGP 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 VEGP 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 VEGP without exception.
- Additional staff resources are expected to begin arriving at 6 hours and the site will be fully staffed 24 hours after the event (References 3.74 and 3.75).
- Temperature is not expected to impact the utilization of off-site resources or the ability of personnel to implement the required FLEX strategies.
- Vogtle has installed low leakage Reactor Coolant Pump (RCP) seals (Westinghouse SHIELD® Passive Shutdown Seal). 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/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/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.

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 tanks (CSTs). 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 FLEX pump (also taking suction from the CSTs) will be used to add water to the SGs. If the CSTs are depleted, the Reactor Makeup Water Storage Tank (RMWST) can supply makeup water to the CSTs via another FLEX pump. The Nuclear Service Cooling Water basins serve as alternate supplies of makeup water to the CSTs. 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 FLEX pump, powered by a FLEX generator, taking suction from the Boric Acid Storage Tank (BAST) or Refueling Water Storage Tank (RWST).

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. Vogtle will utilize the industry National SAFER Response Centers (NSRCs) for supplies of Phase 3 equipment, with the intent of reenergizing certain plant safety buses and establishing long-term cooling from the ultimate heat sink (UHS), as necessary.

In the postulated ELAP event, the SFPs will initially heat up due to the unavailability of the normal cooling system. Gravity feed from the RWST will be established as needed for SFP makeup during the initial phase of an ELAP. A FLEX pump will be aligned and used to add water to the SFPs of both units to maintain level as the pools boil. Three paths will be available for SFP makeup; via hoses directly discharging into the pools; via connections to the existing SFP makeup lines; or 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 Savannah River can be used to replace depleted on-site Seismic Category 1 water inventories. However, the associated actions are not relied upon in the FLEX strategy during the first 72 hours following ELAP.

Vogtle has a large dry containment building. Vogtle 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. 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 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/LUHS resulting from a BDBEE by providing adequate capability to maintain or restore core cooling, containment, and SFP cooling capabilities at VEGP. 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 VEGP emergency operating procedures in accordance with established EOP 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 would maintain Control Room Instrumentation and required control features with power supplied from the Train A, B & C station batteries. Critical 125V DC loads would also be 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 45 minutes after the start of the event, thus ensuring the station batteries are available for a minimum of 12 hours (Reference 3.15).

Control Room lighting is initially supplied with power from battery ballasts included in each light fixture which provide 90 minutes of lighting. Prior to depleting the battery ballasts, control room lighting can be transferred to the Train D station batteries. All loads are shed from the D train batteries allowing one train of control room lighting to be powered by the D train batteries via a transfer switch. (Reference 3.15)

Following an ELAP, inverters would maintain the plant Public Address (PA) system with power supplied from the N-Train TSC batteries. In order to extend battery life, operators are directed to take steps to minimize the load on the TSC batteries by shedding unnecessary loads in accordance with station procedures. The PA system equipment and the power supplies are located in the Control Building.

2.3.2 Phase 2 Strategy

A 480V FLEX DG per unit will be deployed to power an installed 480V FLEX Switchboard (Reference 3.41). The FLEX Switchboard distributes power to one battery charger for each of the four Class 1E 125V DC Switchgear (providing continuity of power for critical instrumentation, remote TDAFW pump operation, lighting in the "horseshoe" area of the Main Control Room), and one portable FLEX pump (Boron Injection or RCS Makeup, as needed). Installed FLEX transfer switches transfer power from the normal 1E source to the 480V FLEX Switchboard for each of the battery chargers. In addition to the 480V FLEX Switchboard, the 480V FLEX DG supplies power to a fuel oil transfer pump, SFP level indication system, and the plant public address system. Diverse connection points for the 480V FLEX DG are provided outside and inside the Control Building (primary and alternate, respectively); see Section 2.3.5 for additional details.

Ventilation fans for the battery and DC switchgear rooms are power by receptacles available on the 480V FLEX Switchboard; see Section 2.12.1.3 for additional details.

2.3.3 Phase 3 Strategy

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 can 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. Loads that can be supported by the turbine generators include, Containment Coolers, RHR pumps, CCW pumps and SFP pumps.

2.3.4 Systems, Structures, Components

2.3.4.1 Installed DC Electrical Power

There are four safety-related 125-V-dc systems (identified A, B, C, and D) per unit. These four dc systems are credited in the Phase 1 coping strategies to maintain critical loads including: critical instrumentation; remote TDAFW pump operation: and lighting in the "horseshoe" area of the Main Control Room for at least 12 hours. Refer to VEGP FSAR (Reference 3.24) Section 8.3.2 for a description of the 125-V-dc system.

The Class 1E 125-V-dc systems are Safety Class 1, Seismic Category 1 components which are also protected from the effects due to the design basis tornado (Reference 3.24, Table 3.2.2-1, Section 3.5.1.4).

2.3.4.2 480V FLEX Electrical Connections

Permanent nonsafety-related, non-Class 1E, seismically qualified 480V FLEX switchboards installed on Level B of the Control Building are used to support FLEX strategies for coping with an ELAP resulting from a BDBEE. The switchboards, via permanently installed cables, are connected to one of the two Class 1E battery chargers per train via safety-related, Class 1E, seismically qualified transfer switches. In addition, a safety-related seismically qualified transfer switch is used to align the D train battery to Control Room lighting. A nonsafety-related, non-Class 1E, seismically qualified receptacle on level C of the Auxiliary Building is also provided to allow powering portable RCS and Boron Injection FLEX Pumps. The FLEX switchboards have the capability to be crosstied.

Permanently installed nonsafety-related, seismically qualified connection boxes are provided for connection of the portable 480V FLEX DGs to the 480V FLEX switchboards. The primary 480V FLEX DG connection boxes are installed on the north wall outside the Control Building. The alternate 480V FLEX DG connection boxes are installed in the Train "A" vertical chases at grade level inside the Control Building.

A connection box and transfer switch are installed in the TSC of the Control Building to power the PA system directly from the 480V FLEX diesel generator following a BDBEE.

2.3.5 FLEX Connections

2.3.5.1 Primary Electrical Connection

The primary connection point for the 480V FLEX DGs is installed outside the Control Building at grade level. The primary connection point is designed to withstand applicable seismic loads but do not have missile protection. See Section 2.3.4.2, Figure 2 and Figure 3.

2.3.5.2 Secondary Electrical Connection

The secondary connection point for the 480V FLEX DG — located inside the Control Building — is designed and installed to withstand all applicable hazards. The Control Building is a Category 1 safety-related structure which meets design requirements for all site hazards including missile protection. (See Section 2.3.4.2, Figure 2 and Figure 3)

2.3.6 Electrical Analysis

Battery calculations demonstrate that battery capacity is sufficient to provide three trains (A, B & C) of critical loads for greater than 12 hours (Reference 3.15). Battery capacity 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).

Battery calculations demonstrate D train battery capacity is sufficient to provide MCR lighting for greater than 14 hours (Reference3.15) and that the TSC battery capacity is sufficient to provide power to the PA system at full load (emergency sirens on) for greater than 10 hours (Reference 3.16). Battery capacity 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).

2.3.7 480V FLEX Generator

The selected diesel generator has sufficient capacity to supply the Phase 2 loads as determined by the 480V FLEX 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 safeties to the atmosphere. The water will initially be added by the turbine-driven auxiliary feedwater (TDAFW) pump, taking suction from the condensate storage tanks (CSTs).

At 8 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 Boron Injection FLEX Pump to maintain sub-criticality margin. No credit is taken for boron added from the SI accumulators.

As soon as resources are available, but no later than 12 hours after the start of the event, a diesel driven SG FLEX Pump (taking suction from either the CSTs or the RMWST) will be deployed and available for operation. This action provides defense in depth for when adequate steam pressure is no longer available to drive the TDAFW pump's turbine.

At approximately 12 hours, the portable Boron Injection FLEX Pump is available to initiate supplemental boration (with letdown as necessary) transferring water from the BASTs to the RCS to ensure adequate boration and maintain sub-criticality following RCS cooldown.

If the initial CSTs' water supply are depleted, the RMWST can supply makeup water to the CSTs via the diesel driven Makeup FLEX Pump. The Nuclear

Service Cooling Water basins serve as alternate supplies of makeup water to the CSTs using the FLEX Submersible Pump.

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 is maintained by operation of the Turbine-Driven Auxiliary Feedwater (TDAFW) pump supplying feedwater to all four (4) 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 is designed to supply the feedwater flow required for removal of 200 percent of the decay heat from the reactor. The TDAFW pump supplies flow to all four steam generators through individual dc motor-operated control valves. Control of the valves, as well as manual or automatic speed control for the TDAFW pump, is provided in the control room and at the local control panels located in the AFW pump house. Operating status of the TDAFW pump is indicated locally and in the control room.

Suction to the TDAFW pump will be from the Seismic Category 1 CSTs (see Figure 1), which are also protected from tornado missiles (Reference 3.12). All Category 1 structures are designed for SSE and OBE conditions (Reference 3.24 Section 3.7.B). Each unit has two (2) CSTs, each with a credited inventory equal to 340,000 gallons of de-mineralized water (see Section 2.4.4.6). Based on the minimum volume of water available, the credited volume in the CSTs can support core cooling and heat removal requirements in MODES 1 through 4 for a minimum 89 hours (see Table 3 and 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. Operation of the TDAFW pump from the MCR is reliant upon an available battery powered source. In the event that battery power is unavailable, local manual operation of the TDAFW pump can be performed without reliance on battery power per procedural guidance.

RCS Inventory Control and Reactivity Control

Vogtle has installed safe shutdown/low leakage Reactor Coolant Pump (RCP) seals (Westinghouse SHIELD® Passive Shutdown Seal) for the Reactor Coolant Pumps (RCP).

No Phase 1 actions are required for inventory control. With RCP shutdown seals and the injection of accumulator inventory, analyses demonstrates that natural circulation in the RCS can be maintained for at least 70 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 depressurize the RCS at 8 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 vented 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. 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 to drive the turbine and an adequate supply of water in the CSTs.

Alternate Strategy Core Cooling and Heat Removal

In the event that the TDAFW pump fails or when 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 depressurization of the steam generators, if needed and 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 300 psig. Manual operation of these valves is relatively light work of short duration. Maximum normal temperature in these spaces is 115°F; abnormal temperature is 126°F (Reference 3.17). The manual operating station is located near openings in the vertical walls that communicate with the ambient outdoor environment via security grating. 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 specified steam generator injection pressure of 300 psig (at the SG feedring) 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, it is expected that either the TDAFW pump with suction from the CST, or the SG FLEX Pump, with suction from either the CSTs 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 AFW pump house (see Figure 3).

The discharge of the SG FLEX Pump will be directed to all four steam generators via hose and adapters connected to either of two injection points (primary and alternate) located in the AFW pump house. The two injection points are from diverse locations: one located in the Train C AFW Pump room on the TDAFW pump discharge header; the other located in the Train A AFW Pump room on the motor-driven AFW (MDAFW) pump discharge header cross-tie line (see Figure 1). The two rooms housing the connection points are accessed through grade level doors on opposite sides of the AFW Pump House (a Class I structure).

Following depressurization of the steam generators via the ARVs, these injection points are used as the alternate injection pathway for the SG FLEX Pump core cooling strategy. Each of the connections serves a discharge header that feeds all four SGs. When the injection point downstream of the TDAFW pump (primary) is used, symmetric cooldown of all four SGs will be controlled by the associated dc-powered MOVs. If the injection point downstream of the MDAFW pumps (alternate) is used, plant personnel will manually align the Train A and Train B ac-powered MOVs (located on Level A—outside of the Radiation Controlled Area—in the Auxiliary Building and Control Building, respectively) to control feeding all four SGs simultaneously effectively providing symmetric cool down of all four SGs.

Prior to depletion, the CSTs can be provided makeup from the RMWST (primary) or one of the Nuclear Service Cooling Water (NSCW) basins (alternate) (see Figure 1). Both the RMWST and the NSCW basins are protected (i.e., Seismic Category 1) 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 CSTs. The RMWST also contains de-mineralized water with a minimum inventory of 148,000 gallons (see Section 2.4.4.7) that is capable of providing at least 30 additional hours of makeup after depletion of the CSTs (see Table 3 and Reference 3.14).

Makeup from the RMWST requires the use of on-site equipment including a portable pump (Makeup FLEX Pump). The diesel driven Makeup FLEX Pump suction will be aligned to the RMWST via a connection located in the moat adjacent to the RMWST valve gallery (see Figure 1 and Figure 3). The isolation valve for this suction source is located in the RMWST valve gallery. The Makeup FLEX Pump discharges to either of the CSTs (two per unit) via diverse fill connection points and/or the cross-tie (see Figure 1). Hoses will be used for these supply and discharge connections.

When the RMWST inventory is depleted as a CST makeup source, then the self-powered portable FLEX Submersible Pump will be used to supply makeup from one of the NSCW Basins. The discharge from the portable FLEX Submersible Pump will be connected by hose to any of the available CST fill connections. (See Figure 1 and Figure 3)

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) it is not anticipated that any 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 VEGP (Reference 3.19) indicates that it will be necessary to initiate supplemental boron injection (with letdown as necessary) to maintain sub-criticality margin. Therefore, following injection of the SI accumulators (at approximately 12 hours following shutdown) and prior to the peak reactivity addition resulting from xenon decay, a means for injecting additional borated water into the RCS as needed for reactivity control will be made available as discussed in the following paragraphs.

The addition of borated water is accomplished by a Boron Injection FLEX Pump. The Boron Injection FLEX Pump is deployed and available for operation approximately 12 hours into the event. 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 Boron Injection FLEX Pump are located downstream of each RHR pump on the piping that discharges to the RCS cold legs (see Figure 1).

The BAST is the primary suction source for the Boron Injection FLEX Pump. The BAST has a usable capacity of 46,000 gallons (see Section 2.4.4.9). The Boron Injection 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 usable capacity of 686,000 gallons (see Section 2.4.4.8).

Depending on the source of borated water, venting of the RCS may be necessary. The RCS can be vented using 125V DC powered Reactor Head Vent valves operated from the MCR.

Sufficient shutdown margin is achieved in less than 23 hours using the BAST as RCS makeup source (Reference 3.20). The 23 hours includes a mixing delay period of 60 minutes following the addition of the targeted quantity of boric acid to the reactor coolant system. The time sensitive action for reactivity control must be completed by 24 hours after the event. The Vogtle strategy begins RCS injection at hour 12 at a rate of 10 gpm from the BAST. In addition, initiating RCS makeup flow prior to losing natural circulations prevents reflux cooling from occurring. At this rate of injection the required amount of boric acid injected into the RCS will be completed by hour 22, which ensures sufficient time for complete mixing of injected borated water throughout the RCS. The Boron Injection FLEX Pumps are capable of delivering a flowrate of 20 gpm from the BAST, however a 10 gpm flowrate is assumed based on the evaluations performed to support FLEX strategies (Reference 3.19).

With RCP shutdown seals, the injection of accumulator inventory, and injection of borated water to maintain sub-criticality, natural circulation in the RCS can be maintained for greater than 72 hours.

2.4.3 <u>Phase 3 Strategy</u>

<u>Primary Strategy</u>

The primary coping strategy is to extend the Phase 2 strategy for reactor cooling to 72 hours 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 include:

- Maintaining SGs at 120 psig, which is adequate to maintain TDAFW operation (Reference 3.23), and
- Maintaining RCS cold leg temperature maintained 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, 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 for 47 days after the BAST is depleted, see Table 3).

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.

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 feedwater to all four SGs. The TDAFW pump is operated from the MCR if dc power is available or it can be manually operated locally if dc power is not available. DC power is maintained throughout the event, initially by the safety-related station batteries and subsequently by the battery chargers once the onsite 480V FLEX DG is operating, which ensures control power will be available for the TDAFW pump. Refer to VEGP FSAR (Reference 3.24) Section 10.4.9 for a description and discussion of capabilities of the TDAFW pump.

The TDAFW Pump Turbine and the TDAFW Pump are both Seismic Category 1 components which are also protected from the effects due to the design basis tornado (Reference 3.24, Table 3.2.2-1, Section 3.5.1.4).

2.4.4.2 TDAFW Pump Discharge Isolation/Flow Control Valves

The TDAFW pump discharge motor-operated isolation/flow control valves are used to modulate the auxiliary feedwater flow to maintain the required steam generator water level. The valves can be controlled from either the MCR or local panels. Additionally, the valves can be operated locally by the handwheel if dc power is lost. DC power is maintained throughout the event, initially by the safety-related station batteries and subsequently by the battery chargers once the onsite 480V FLEX DG is operating, which ensures power will be available for the valves. Refer to VEGP FSAR (Reference 3.24) Section 10.4.9 for a description of the isolation/flow control valves.

The TDAFW Pump discharge motor-operated isolation/flow control valves and their motors are both Seismic Category 1 components which are also protected from the effects due to the design basis tornado (Reference 3.24, Table 3.2.2-1, Section 3.5.1.4).

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 VEGP FSAR (Reference 3.24) Section 10.3 for a description of the MSSVs.

The MSSVs are Seismic Category 1 components which are also protected from the effects due to the design basis tornado (Reference 3.24, Table 3.2.2-1, Section 3.5.1.4).

2.4.4.4 Atmospheric Relief Valves (ARVs)

During a BDBEE, the ARVs are manually operated locally to cooldown and depressurize the RCS to allow SG makeup via the SG FLEX Pump and also to allow boration via the SI accumulators (not credited) and the Boron Injection FLEX Pump. Refer to VEGP FSAR (Reference 3.24) Section 10.3 for a description of the ARVs.

The ARVs are Seismic Category 1 components which are also protected from the effects due to the design basis tornado (Reference 3.24, Table 3.2.2-1, Section 3.5.1.4).

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 Main Control Room. DC power is maintained throughout the event, initially by the safety-related station batteries and subsequently by the battery chargers once the onsite 480V FLEX DG is operating. Refer to VEGP FSAR (Reference 3.24) Section 5.4.15 for a description of the RVHVS.

The RVHVS piping and valves are located in Containment are Seismic Category 1 components which are also protected from the effects due to the design basis tornado (Reference 3.24, Section 3.5.1.4).

2.4.4.6 Condensate Storage Tank

Suction to the TDAFW pump will be from the Seismic Category 1 CSTs, which are also protected from tornado missiles (Reference 3.12). Each unit has two (2) CSTs, each with a credited inventory equal to 340,000 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 CSTs can support core cooling and heat removal requirements in MODES 1 through 4 for more than 72 hours (see Table 3 and Reference 3.14). Refer to VEGP FSAR (Reference 3.24) Sections 3.8.4.1.8, 9.2.6.1.1.C, 9.2.6.3.2 and 10.4.9.2.2.4 for a description of the CSTs.

The Seismic Category 1 CSTs are designed to withstand the effects due to the design basis tornado (Reference 3.24, Table 3.2.2-1, Section 3.3.2). The CSTs are protected against externally generated missiles (Reference 3.24, Section 3.5.1.4 and Table 3.5.1-7).

2.4.4.7 Reactor Makeup Water Storage Tank (RMWST)

If the CSTs' initial inventories are depleted, the RMWST can supply makeup water to the CSTs via the diesel driven Makeup FLEX Pump. The RMWST can also be used as the alternate connection point for the SG FLEX pump. The RMWST contains de-mineralized water with a minimum inventory of 148,000 gallons (Reference 3.14). Refer to VEGP FSAR (Reference 3.24) Sections 9.2.7.2.2 and 9.2.7.3 for a description of the RMWST.

The Seismic Category 1 RMWST is designed to withstand the effects due to the design basis tornado (Reference 3.24, Table 3.2.2-1, Section 3.3.2). The RMWST is protected against externally generated missiles (Reference 3.24, Section 3.5.1.4 and Table 3.5.1-7).

2.4.4.8 Refueling Water Storage Tank (RWST)

The borated water inventory in the RWST is available as a backup source for RCS injection during MODES 1 through 4 and MODE 5 with SGs available and as a backup source for SFP cooling (i.e., backup to CSTs, RMWST, and NSCW basins). 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 686,000 gallons (Reference 3.13, Tech Specs and Bases SR 3.5.4.2). The boron concentration of the RWST is maintained ≥ 2400 ppm and ≤ 2600 ppm (Reference 3.13, SR 3.5.4.3). Refer to VEGP FSAR (Reference 3.24) Section 6.2.2.2.2.3.1 for a description of the RWST.

The RWST is a Seismic Category 1 structure which is also designed to withstand the effects due to the design basis tornado (Reference 3.24, Table 3.2.2-1, Sections 3.3.2, 3.8.5.1.9). The RMWST is protected against externally generated missiles (Reference 3.24, Section 3.5.1.4 and Table 3.5.1-7).

2.4.4.9 Boric Acid Storage Tank (BAST)

The Boric Acid Storage Tank (BAST) is the primary source for boron addition using the portable Boron Injection FLEX Pump. The BAST has a usable capacity of 46,000 gallons (Reference 3.24, Table 9.3.4-2). The BAST has a minimum required volume of 36,674 gallons (Reference 3.25 TRS 13.1.7.4). Refer to VEGP FSAR (Reference 3.24) Section 9.3.4.1.2.5.12 for a description of the BAST.

The BAST is Seismic Category 1 (Reference 3.24, Table 3.2.2-1, Sections 3.3.2, Table 9.3.2-4). The BAST is protected against externally generated missiles by the Auxiliary Building (Reference 3.24, Section 3.5.1.4 and Table 3.5.1-7).

2.4.4.10 Nuclear Service Cooling Water (NSCW) Basin

The NSCW basins can be used to provide makeup to the CSTs. Additionally, the NSCW basins are the preferred source of makeup to the SFP during all MODES. The minimum capacity of each basin is 3.65 x 10^6 gal (30.1 x 10^6

lbs) of water (Reference 3.24, Section 9.2.5.2.2). Refer to VEGP FSAR (Reference 3.24) Section 9.2.5 for a description of the NSCW basins.

The NSCW cooling towers are Seismic Category 1 structures which are designed to withstand the effects due to the design basis tornado (Reference 3.24, Table 3.2.2-1, Sections 3.3.2, 3.8.5.1.8). The NSCW basins are located below grade and protected against externally generated missiles (Reference 3.24, Sections 3.5.1.4, 9.2.5.2.3).

2.4.5 FLEX Connections

2.4.5.1 Primary SG FLEX Pump Discharge Connection

The discharge of the SG FLEX Pump can be directed to all four steam generators via hose and adapters connected to the primary connection point in the Train C AFW Pump room on the TDAFW pump discharge header (see Figure 1) located in the AFW pump house. The AFW Pump House is a Seismic Category 1 structure.

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 in the Train A AFW Pump room on the motor-driven AFW (MDAFW) pump discharge header cross-tie line (see Figure 1). If the injection point downstream of the MDAFW pumps (alternate) is used, plant personnel will manually align the Train A and Train B ac-powered MOVs (located on Level A—outside of the Radiation Controlled Area—in the Auxiliary Building and Control Building, respectively) to control feeding all four SGs simultaneously.

2.4.5.3 Primary SG FLEX Pump Suction Connection

The primary suction connection point for the SG FLEX pump is located in the CST Valve gallery on the TDAFW suction line from CST #1 (see Figure 1). The CST Valve gallery is a Seismic Category 1 Structure (Reference 3.24 Section 3.8.4.1.8 and Reference 3.12).

2.4.5.4 Alternate SG FLEX Pump Suction Connection

The alternate SG FLEX pump suction connection is the RMWST Suction connection. See section 2.4.5.8.

2.4.5.5 Primary CST Makeup Connection

Each CST has a fill connection available to allow makeup to the CST's from any available source, including the RMWST and the NSCW basins. These fill connections are seismically qualified. (See Figure 1)

2.4.5.6 Alternate CST Makeup Connection

In the event that both of the CST fill connections are not available, makeup to the CSTs can be accomplished by connecting to either or both CST drain lines. The drains lines are seismically qualified and are located at opposite ends of the CSTs. (See Figure 1)

2.4.5.7 Primary and Alternate RCS Connection

Diverse connections (primary and alternate) for discharge of the Boron Injection FLEX Pump are located downstream of each RHR pump on the piping that discharges to the RCS cold legs. The connection points are located in the Auxiliary Building which is a Seismic Category 1 Structure. (See Figure 1)

2.4.5.8 RMWST Suction Connection

The RMWST suction connection is the RMWST drain line located in the moat adjacent to the RMWST valve gallery. The isolation valve for the drain line is located in the RMWST valve gallery. The drain line is seismically qualified. (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 a minimum of two channels of instrumentation for a minimum of 12 hours while relying on the Station Batteries, which allows for the installation of the

480V FLEX DGs by 10 hours after the start of the event. Only a single channel is needed for FLEX strategy implementation.

In addition, local indications such as CST tank level will remain available and the Key Reactor Parameters can be determined from a local reading using standard I&C instruments.

Table 1

Essential Monitored Parameters and Associated Instrumentation

Parameter	Available Channel	Power Source
SG-1 Pressure	PI-514A PI-515A	A-Train Battery B-Train Battery
SG-2 Pressure	PI-524A PI-525A	A-Train Battery B-Train Battery
SG-3 Pressure	PI-534A PI-535A	A-Train Battery B-Train Battery
SG-4 Pressure	PI-544A PI-545A	A-Train Battery B-Train Battery
SG-1 Narrow Range Level	LI-551 LI-519	A-Train Battery B-Train Battery
SG-2 Narrow Range Level	LI-529 LI-552	A-Train Battery B-Train Battery
SG-3 Narrow Range Level	LI-539 LI-553	A-Train Battery B-Train Battery
SG-4 Narrow Range Level	LI-554 LI-549	A-Train Battery B-Train Battery
CST Level	LI-5100 LI-5115	N/A
TDAFW Pump Flow to SG-1	FI-5152A	A-Train Battery
TDAFW Pump Flow to SG-2	FI-5151A	B-Train Battery
TDAFW Pump Flow to SG-4	FI-5150A	A-Train Battery
TDAFW Pump Flow to SG-3	FI-5153A	B-Train Battery
RCS WR T-Cold	TI-413B LP1 CL TI-423B LP2 CL TI-433B LP3 CL TI-443B LP4 CL	B-Train Battery B-Train Battery B-Train Battery B-Train Battery

Table 1

Essential Monitored Parameters and Associated Instrumentation

Parameter	Available Channel	Power Source
RCS WR T-Hot	TI-413A LP1 HL TI-423A LP2 HL TI-433A LP3 HL TI-443A LP4 HL	A-Train Battery A-Train Battery A-Train Battery A-Train Battery
RCS Pressure	PI-405 LP4 HL WR PI-428 LP4 HL WR PI-438 LP1 HL WR PI-403 LP1 HL WR	A-Train Battery B-Train Battery A-Train Battery B-Train Battery
Source & Intermediate Range Neutron Flux	N31/35 N32/36	A-Train Battery B-Train Battery
CETs	Plant Safety Monitoring System (PSMS)	A-Train Battery B-Train Battery
RVLIS	Plant Safety Monitoring System (PSMS)	A-Train Battery B-Train Battery

Contingencies for alternate instrumentation monitoring are provided to the control room team following a BDBEE via procedural guidance for establishing alternate indications for essential instrumentation.

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 X4CPS0173, Required Makeup Flows and Water Availability for a Beyond Design Basis External Event at Vogtle Electric Generating Plant (Reference 3.14) and Evaluations to Support SNC FLEX Strategies for Vogtle Electric Generating Plant performed by Westinghouse (Reference 3.19).

These analyses demonstrate that the strategies provide the ability of Vogtle to successfully cope from the baseline conditions of the ELAP and 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 feedwater to all four (4) steam generators. Suction to the TDAFW pump will be from the Seismic Category 1 CSTs, which are also protected from tornado missiles (Reference 3.12). Each unit has two (2) CSTs, each with a credited inventory equal to 340,000 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 CSTs can support core cooling and heat removal requirements in MODES 1 through 4 for a minimum of 89 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 300 psig. The normal supply for the SG FLEX Pump will be from the CSTs (primary) and the alternate suction source will be from the RMWST (alternate). The RMWST contains de-mineralized water with a minimum inventory of 148,000 gallons (Reference 3.14) that is capable of providing at least 30 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 NSCW basins will be available. Each NSCW basin contains a nominal inventory of 3,670,000 gallons of water (Reference 3.24, Section 3.8.4.1.7). The inventory located in one (1) NSCW basin provides a minimum of 728 hours (30 days) for SG injection after exhausting the CSTs and RMWST (see Table 3 and Reference 3.14) for core cooling. Since the NSCW basin is over 80 ft deep, a portable submersible pump (FLEX Submersible Pump) will be used to supply the inventory from the NSCW basin.

2.4.7.2 RCS Analysis

The use of the new 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 VEGP (Reference 3.19) demonstrates that RCS makeup at 10 gpm will be required at 46 hours to maintain single phase RCS core cooling using the steam generators with no credit taken for boration. If credit is taken for two-phase RCS core cooling using the steam generators, RCS makeup would not be required until after 72 hours with no credit taken for boration. The Boron Injection FLEX pump will be available for RCS makeup as needed (but well in advance of 46 hours) with suction available from either the BAST or the RWST.

2.4.8 Recirculation 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 VEGP 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.*

   VEGP Unit 1 and 2 compliance: The VEGP Unit 1 and 2 RCPs are Model 93A-1. Therefore, VEGP 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.*

   VEGP Unit 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 1185 psig. This corresponds to a T_{cold} value of 567°F to 569°F. Therefore VEGP Unit 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.*

VEGP Unit 1 and 2 compliance: Nominal Unit 1 and 2 operating pressure is 2250 psia. Therefore, VEGP 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.*

   VEGP 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-12-26, 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, VEGP Unit 1 and Unit 2 meet the intent of this limitation/condition.

2.4.9 Shutdown Activity Analysis

Vogtle will provide sufficient negative reactivity by injecting borated water into the RCS using the Boron Injection 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 12 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 BAST. As an alternate, injection will be from the RWST. The analysis determined that subcriticality would be maintained from either source, however a head vent letdown path may need to be established to allow for injection if the source of the borated water is the RWST to accommodate the additional inventory due its lower concentration (See Section 2.4.4.5 for a description of the head vent letdown path). Reference 3.19 shows that injection of approximately 5,000 gallons of borated water from the BAST (7000 ppm) or 13,800 gallons of borated water from the RWST (2400 ppm) will be adequate to meet shutdown reactivity requirements at limiting cycle conditions and the RCS average temperature as low as 425°F. Note that the BAST volume required will provide adequate shutdown margin. No credit is taken for boron addition from the SI accumulators.

With a 10 gpm boron injection flowrate from the BAST, commencing makeup by 12 hours will provide adequate shutdown margin by the time at which xenon is no longer maintaining greater than 1000 pcm (1% or K_{eff}<0.99) shutdown margin (approximately 24 hours).

Sufficient shutdown margin is achieved in less than 23 hours using the BAST as RCS makeup source (Reference 3.20). The Boron Injection FLEX Pumps are capable of delivering a flowrate of 20 gpm from the BAST, however a 10 gpm flowrate is assumed based on the evaluations performed to support FLEX strategies (Reference 3.19). The 23 hours includes a mixing delay period of 60 minutes following the addition of the targeted quantity of boric acid to the reactor coolant system. The time sensitive action for reactivity control must be completed by 24 hours after the event. The Vogtle strategy begins RCS injection at hour 12 at a rate of 10 gpm from the BAST. At this rate of injection the required amount of boric acid injected into the RCS will be completed by hour 22, which ensures sufficient time for complete mixing of injected borated water throughout the RCS. Therefore, Vogtle complies with the August 15, 2013 Westinghouse position paper on boric acid mixing, including the conditions imposed in the NRC staff's corresponding endorsement letter (References 3.21 and 3.22).

2.4.10 FLEX Pumps and Water Supplies

2.4.10.1 SG FLEX Pumps

Throughout Phase 2, it is expected that 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 3). The diesel driven 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 four steam generators via hose and adapters connected to either of two injection points (primary and alternate) located in the AFW pump house (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 864.0 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 24.6 ft which exceeds the NPSH required (NPSHr) of 10 ft. At the minimum RMWST water level, the NPSHa is 17.5 ft at a flow rate of approximately 218 gpm which exceeds the NPSHr of 10 ft. With the SG FLEX Pump suction aligned to the CST at minimum CST water level, the NPSHa is 19.8 ft at a flow rate of approximately 300 gpm which exceeds the NPSHr of 10 ft. (Reference 3.31)

2.4.10.2 Makeup FLEX Pumps

Prior to depletion, makeup to the CSTs can be provided from the RMWST (primary) or one of the Nuclear Service Cooling Water (NSCW) basins (alternate). Makeup from the RMWST requires the use of on-site equipment including a portable pump (diesel driven Makeup FLEX Pump). The diesel driven Makeup FLEX Pump suction will be aligned to the RMWST via a connection located in the moat adjacent to the RMWST valve gallery. The diesel driven Makeup FLEX Pump discharges to either of the CSTs (two per unit) via diverse fill connection points or the cross-tie which is connected to the CST drain lines. Hoses will be used for these supply and discharge connections. (See Figure 1 and Figure 3)

A minimum pump head of 171.3 ft is required to ensure a minimum flow rate of 130 gpm can be provided for CST makeup at any RMWST water level, which is higher than the minimum required of 120 gpm (120 gpm exceeds the flowrate necessary to maintain CST at the time makeup would be required (References 3.14, 3.32)). At this flow rate, the minimum NPSHa is 15.7 ft (Reference 3.32) which exceeds the NPSHr of 10 ft (Reference 3.33). With the diesel driven Makeup 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 3.32)

2.4.10.3 FLEX Submersible Pumps

When the RMWST inventory is depleted as a CST makeup source, then the portable self-powered FLEX Submersible Pump will be used to supply makeup from one of the NSCW Basins. The discharge from the pump will be connected by hose to any of the available CST fill connections. (See Figure 1 and Figure 3)

A minimum pump head of 145.8 ft is required to ensure a minimum flow rate of 130 gpm can be provided for CST makeup at any NSCW water level which is higher than the minimum required of 120 gpm (120 gpm exceeds the flowrate necessary to maintain CST at the time makeup would be required (References 3.14, 3.34).

2.4.10.4 Boron Injection FLEX Pumps

Evaluation for VEGP indicates that it will be necessary to initiate supplemental boron injection (with letdown as necessary) to maintain sub-criticality margin. 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 Boron Injection FLEX Pump are located downstream of each RHR pump on the piping that discharges to the RCS cold legs. The Boric Acid Storage Tank (BAST) is the primary suction source for the Boron Injection FLEX Pump. The RWST is also available as a source of borated water for boron injection if needed. (See Figure 1)

The limiting minimum pump head of 1213.9 ft is required to ensure a flow rate of 20 gpm can be provided for boron injection with suction from the BAST or RWST for MODES 1-4. At this flow rate, the minimum NPSHa is 25.5 ft (Reference 3.35) which exceeds the NPSHr of 14 ft (Reference 3.36).

2.4.10.5 AFW Water Supplies

Condensate Storage Tanks

The Seismic Category 1 CSTs, are also protected from tornado missiles (Reference 3.12). Each unit has two (2) CSTs, each with a credited inventory equal to 340,000 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 CSTs can support core cooling and heat removal requirements in MODES 1 through 4 for a minimum of 72 hours (see Table 3 and Reference 3.14).

Reactor Makeup Water Storage Tank

The RMWST is a Seismic Category 1 source of water. The preferred source of makeup to the CSTs for SG injection prior to exhausting the inventory of the CSTs is the RMWST. The RMWST contains de-mineralized water with a minimum inventory of 148,000 gallons that is capable of providing at least 30 additional hours of makeup after depletion of the initial inventory of the CSTs (see Table 3 and Reference 3.14).

Nuclear Service Cooling Water Basins

If circumstances dictate the need for an alternative SG makeup source, inventory in the NSCW basins will be available. Each NSCW basin contains a nominal inventory of 3,670,000 gallons of water (Reference 3.24, Section 3.8.4.1.7). The NSCW basins are concrete structures, deeply embedded, and are identical. The water inventory is located within the basin, which is a large cylindrical shell that extends 81 ft below the grade elevation. The Technical Specifications (Reference 3.13, SR 3.7.9.1) require a minimum inventory of at least 80.25 ft of water. The inventory located in one (1) NSCW basin provides a minimum of 728 hours (30 days) for SG injection after exhausting the CSTs and RMWST for core cooling (see Table 3). Since the NSCW basin is over 80 ft deep, the portable FLEX Submersible Pump will be used to supply the inventory from the NSCW basin.

Savannah River

The ultimate source of water for VEGP is the Savannah River, which is located approximately 3,600 ft from the Unit 1 reactor and 3,900 ft from the Unit 2 reactor (Reference 3.37). When supplemented by portable equipment delivered from off-site, water from the Savannah River can be used to replace depleted on-site Seismic Category 1 water inventories. 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. In addition, the plant is on high ground with entrance to the power block structures at grade El 220 ft, approximately 140 ft above the minimum Savannah River level (Reference 3.38).

2.4.10.6 Borated Water Supplies

Boric Acid Storage Tank

The Boric Acid Storage Tank (BAST) is the primary source for supplemental boron addition. The BAST has a minimum required volume of 36,674 gallons (Reference 3.25 TRS 13.1.7.4) providing shutdown margin necessary to maintain the core in a subcritical state.

RWST

The borated water inventory in the RWST will remain available (Technical Specifications minimum of 686,000 gallons) as a backup source for RCS injection. This availability is due to the preferred use of other sources of water inventory (BAST, CSTs, RMWST, and NSCW basins) during Phases 1 and 2 for core reactivity and SFP cooling strategies.

2.5 Spent Fuel Pool Cooling/Inventory

In an ELAP event, the SFPs will initially heat up due to the unavailability of the normal cooling system. Unit 1 SFP heat loads and temperatures are bounded by Unit 2 values due to the larger capacity for fuel assembly storage in the Unit 2 SFP. 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 but prior to adequate shielding being lost. Deployment of hoses and equipment inside the Fuel Handling Building (FHB) will begin no later than 6 hours prior to the SFP reaching 200°F. The Control Room Staff maintains the time to 200°F at all times.

Gravity feed to the SFPs from the RWST in MODES 1-5 will be available and can be established immediately following an ELAP event using existing plant procedures (see Figure 1). The makeup flow rate using the RWST will be approximately 75 gpm if the RWST is near its Technical Specifications minimum volume of 686,000 gallons (Reference 3.13, SR 3.5.4.2). In MODE 6, gravity feed may not be available if the contents of the RWST have been transferred to the Refueling Cavity. As such, the RWST isn't credited for SFP makeup during Phase 1 during MODE 6 but is included as an option in plant procedures.

For Phase 2, the FLEX Submersible Pump drawing water from the NSCW basins 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; via hoses directly discharging into the pools; via connections to the existing SFP makeup lines; or via hoses directed to portable spray monitors positioned around the SFPs (see Figure 1). Deployment of hoses inside the FHB will begin no later than 6 hours prior to the SFP reaching 200°F. This will maintain a sufficient amount of water above the top of the fuel assemblies for cooling and shielding purposes. 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 Savannah River can be used to replace depleted on-site Seismic Category 1 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

No specific operator actions are required in Phase 1.

Requirements for SFP makeup (which are not required by the strategy until SFP water level reaches 15 feet above the top of the spent fuel racks) are based on the design basis heat loads applicable to specific operating MODES as described below.

MODES 1 through 5

For an ELAP event initiated during MODES 1-5, the SFP makeup flow rate is based on the maximum normal design basis heat load limit for power operation immediately following startup from a refueling outage. On a loss of cooling, water in the SFP (normally less than 100°F) would reach 212°F in 14 hours. Without makeup, the time to reach 15 feet above the top of irradiated fuel is greater than 50 hours. Total required flow to make up for losses due to boil off is less than 62 gpm per pool (Reference 3.14).

MODE 6

For an ELAP event initiated during MODE 6, the SFP makeup flow rate is based on the SFP cooling system design basis heat load for the emergency condition in which all fuel has been transferred from the reactor to the SFP shortly after shutdown (i.e., full-core offload). The time to 212°F is approximately 7 hours. Without makeup, time to reach 15 feet above the top of irradiated fuel is approximately 27 hours. Total required flow to make up for boil off is less than 125 gpm per pool (Reference 3.14).

2.5.2 Phase 2 Strategy

This spray capability flow rate is bounding for all SFP cooling baseline capabilities (i.e., the three methods described below). Based on needs identified for Phase 2, makeup or spray may be chosen by alignment of the appropriate hose to the discharge of a pump capable of providing the minimum flow rate with enough discharge pressure to provide the appropriate spray pressure from the 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 NSCW basins are the credited sources of makeup in this scenario. The RMWST and the CSTs are available as backup sources. The inventory of each NSCW basin (approximately 3,600,000 gallons based on the Technical Specifications minimum level of 80.25 ft, Reference 3.13 SR 3.7.9.1) is capable of providing spray for both SFPs (500 gpm total flow) for approximately 112 hours (Reference 3.43). Since the NSCW basin is over 80 ft deep, the FLEX Submersible Pump will be used to provide the required lift so the inventory from the NSCW basin may be accessed. Separate sets of hoses and the necessary makeup equipment (tools, spray monitor nozzles, wyes, etc.) for hose spray and makeup will be stored in both the SFP area and in the FLEX Storage Building. (See Figure 1 and Figure 3)

Prior to the spent fuel pool reaching 200°F, staging hoses for makeup inside the FHB will be accomplished. Hoses outside the FHB will be staged prior to 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 from the Reactor Makeup Water (RMW) system that does not require access to the SFP (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 will be accomplished by hoses staged on the refuel floor. This makeup strategy employs hoses for each SFP. Since the SFP area (Level 1 of the Fuel Handling and Auxiliary Buildings) may become inaccessible as Phase 2 progresses, hoses inside the FHB will be deployed prior to the SFP reaching 200°F 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

An adapter will be used for connecting to an existing valve located on the SFP makeup line from the RMW system (see Figure 1). The isolation valves for makeup are located in the Auxiliary Building (a Seismic Category 1 structure) with accessibility from the yard (i.e., personnel access to the SFP area will not be required). This injection source requires operator action to isolate other valves (all located in the Auxiliary Building) in the RMW system and other interfacing systems.

Makeup Strategy Method 3 - spray capability via portable monitor nozzles

To assure spent fuel cooling in the event that methods described above prove insufficient, spray capability with portable monitor nozzles from the refueling floor will be provided. The monitor nozzles are deployed prior to the SFP reaching 200°F to minimize the need for personnel access to the SFP area following degraded environmental conditions in the SFP area following the ELAP event. The spray strategy consists of deploying a hose to a pre-determined location in the SFP area, splitting flow into two separate hoses for each SFP which connect to spray monitors located in the two most accessible corners of each SFP (see Figure 1).

2.5.3 Phase 3 Strategy

The long-term strategy for SFP cooling is to continue the Phase 2 strategy. When supplemented by portable equipment delivered from off-site, water from the Savannah River can be used to replace depleted on-site Seismic Category 1 water inventories. 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 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 FLEX Submersible Pump in the NSCW basin to the SFP will be accomplished by hoses staged on the refuel floor. 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)

An adapter will be used for connection to an existing valve located on the SFP makeup line from the RMW system. The isolation valve is 1-1228-U4-039 for Unit 1 and 2-1228-U4-039 for Unit 2 (References 3.42 and 3.44). These valves are located in the Auxiliary Building (a Seismic Category 1 structure) with accessibility from the yard (i.e., personnel access to the SFP area is not required). (See Figure 1)

Makeup Strategy Method 3 (Spray)

Direct makeup from the FLEX Submersible Pump in the NSCW basin to the SFP will be accomplished by hoses staged on the refuel floor. All equipment is portable and does not require any physical connections to permanent plant equipment. Therefore, there are no connections associated with the Method 3 strategy. (See Figure 1)

2.5.4.2 Alternate Connection

As an alternate to the NSCW basins as a source of makeup to the SFP, the RMWST, RWST and the CSTs are available. 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 personnel door on the south wall of the Auxiliary Building. An alternate ventilation path can be established by opening doors that allow steam to escape through the hot machine shop and adjacent corridor and passage to outdoors. Either vent path will be sufficient for the initial coping efforts due to the relatively large openings provided. Establishing the vent path will occur no later than 6 hours prior to boiling in the SFP.

2.5.5 Key Reactor Parameters

The key parameter for the SFP make-up strategy is the SFP water level. The SFP water level is monitored by the instrumentation that was installed in response to Order EA-12-051, Reliable Spent Fuel Pool level 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 7 hours and boil off to a level 15 feet above the top of fuel in 27 hours unless additional water is supplied to the SFP. Total required flow for the most limiting case (full-core offload) to make up for boil off is less than 125 gpm per pool (Reference 3.14).

2.5.7 FLEX Pump and Water Supplies

2.5.7.1 FLEX Submersible Pump

Makeup to the SFP is supplied by either gravity feed from the RWST or from the NSCW basin using the portable self-powered FLEX Submersible Pump. Since the NSCW basin is over 80 ft deep, the self-powered FLEX Submersible Pump will be used to provide the required lift so the inventory from the NSCW basin may be accessed. 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 each NSCW basin (minimum of 3,600,000 gallons based on Technical Specifications minimum level) is capable of providing spray for both SFPs (500 gpm total flow) for approximately 112 hours (Reference 3.43)

2.5.8 Electrical Analysis

The SFP level will be monitored by instrumentation installed by Order EA-12-051. 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 480V FLEX DG. (References 3.45, 3.46)

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

Vogtle has a large dry containment building. During a BDBEE, containment integrity is maintained by normal design features of the containment. Vogtle 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 limit without active containment cooling until well beyond 72 hours; at which time availability of the NSRC equipment will allow implementation of long-term strategies to control containment pressure and temperature.

2.6.1 Phase I

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

Phase 2 coping strategies remain the same as Phase 1. No additional strategies are required for maintaining containment integrity. In Phase 2, the onsite 480V 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

Calculations (Reference 3.47) determined that the MODES 1-4 containment pressure at 120 hours is 5.7 psig and the peak containment temperature at 120 hours is 213.2°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. Since the containment design limits are not exceeded, then the equipment in containment is expected to remain operable. Containment coolers, when supplemented by portable equipment delivered from off-site, can be aligned to maintain containment integrity. 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 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.

2.6.4 Structures, Systems, Components

2.6.4.1 Containment

During the BDBEE which results in an ELAP and LUHS, containment integrity is maintained by normal design features of the containment. The containment design pressure is +52 psig/-3 psig and the containment atmospheric design temperature is 381°F (Reference 3.24, Table 6.2.1-1). Refer to VEGP 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 4kV generator for powering the fans) delivered from off-site (NSRC), can be aligned to maintain containment integrity long term. Refer to VEGP FSAR (Reference 3.24) Section 6.2.2 for a description and discussion of design capabilities of the containment coolers.

The Containment Coolers are Seismic Category 1 components which are also protected from the effects due to the design basis tornado (Reference 3.24, Table 3.2.2-1, Section 3.5.1.4).

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 a minimum of two channels of instrumentation for a minimum of 12 hours from Station batteries, which allows for the installation of the 480V FLEX DGs by 10 hours after the start of the event. Only a single channel is needed for FLEX strategy.

The containment pressure instrumentation credited in the strategy are:

CTMT Pressure	PI-937	A-Train Battery
	PI-936	B-Train Battery

Contingencies for alternate instrumentation monitoring are provided to the control room 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. Two methodologies were used in the analysis. The first is use of the Modular Accident Analysis Program (MAAP) PWR Version 4.0.5 analysis software for the containment analysis (Reference 3.78). 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. The second was the use of the modified Darcy equation for compressible flow to determine the pressure drop in the containment vent line for MODES 5 & 6 with SGs not Available.

2.6.7 FLEX Pump and Water Supplies

No FLEX pump or water supplies are credited for containment integrity coping strategies.

2.6.8 Electrical Analysis

Power requirements for the containment critical instrumentation is provided by the station batteries. 480V FLEX portable DGs are used to repower station battery chargers and to repower ac powered instrumentation. See additional discussion in Section 2.3.2.

2.7 Characterization of External Hazards

In accordance with NEI 12-06 sections 4 through 9, the applicable extreme external hazards at Vogtle Unit 1 and 2 are seismic, high wind, extreme cold with ice and high temperature.

2.7.1 Seismic

Per the Vogtle Unit 1 and 2 Final Safety Analysis Report (FSAR), the seismic criteria for VEGP include two design basis earthquake spectra: Operating Basis Earthquake (OBE) and the Safe Shutdown Earthquake (SSE). The OBE and the SSE are 0.12g and 0.20g, respectively; these values constitute the design basis of VEGP (Reference 3.24 Sections 2.5.2.7 and 2.5.2.6).

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

Vogtle is built above the design basis flood level. The limiting design basis flood causing mechanism for Plant Vogtle is dam failures. As stated in the Vogtle Updated Final Safety Analysis Report (UFSAR) Chapter 2 (Section 2.4.2), the flood elevation for dam failures is 168 ft msl while the elevation of the VEGP control building, containment buildings, diesel generator buildings, and all safety-related structures is approximately 220 ft msl.

Contours and grading in the Units 3 and 4 construction area are controlled to prevent impact on flooding analysis. The site is not adjacent to a large, enclosed, or partially enclosed body of water (Reference 3.24, Chapter 2). In accordance with NEI 12-06 (Section 6.2.1) Vogtle is considered a dry site and would not be adversely affected by external flooding (Reference 3.3).

2.7.3 Severe Storms with High Wind

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

VEGP is located at approximately 33°09′ N latitude and 81°46′ W longitude (Reference 3.24, Section 2.1.1.1). The location of Vogtle is situated between the 160 mph and 170 mph contours shown in Figure 7-1 of NEI 12-06 (Reference 3.3); therefore hurricanes are applicable to Vogtle. 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 Vogtle is located is 172 mph. Therefore, tornado hazards are applicable to Vogtle.

For hurricanes, the VEGP UFSAR (Reference 3.24, Section 2.3.1.2.5) indicates that the site is located approximately 100 miles inland from the Atlantic coast; so the effects from hurricanes or tropical depressions are considerably diminished.

The design basis tornado has a probability of occurrence of about 10^{-7} per year. For the site region, the 10^{-7} probable tornado would have a maximum wind speed of about 360 mph, which is considered 290 mph rotational and 70 mph translational (Regulatory Guide 1.76, 1974, Reference 3.51). Safety-related systems and components are protected by missile barriers.

Protection of FLEX equipment is ensured by ensuring that the characteristics of the storage locations meet the requirements in NEI 12-06. At Vogtle 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 flooded roads will have an impact on the time it takes to deploy FLEX equipment. Debris removal capabilities are provided for by the onsite FLEX equipment (*e.g.*, wheeled loader). The tow vehicles for the FLEX equipment are also stored 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 VEGP which is located in the southeastern U.S. Snow is infrequent in the site region and heavy snow is very rare. The highest 24 hour snowfall on record was 13.7 inches in February of 1973 (Reference 3.24, Section 2.3.1.2.3). The average annual snowfall is only about 1 inch and the maximum probable winter precipitation is 19 inches over a 48 hour period. 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 Vogtle site is located within the region characterized by EPRI as ice severity level 5 (NEI 12-06, Figure 8-2, Reference 3.3). As such, the Vogtle 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 Vogtle site region is considered rare (Reference 3.24, Section 2.3.1.2.4), NEI guidelines still dictate that the storage and deployment of Vogtle 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*. 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 can be taken in advance to prepare for adverse conditions (including personnel actions).

The normal daily minimum temperature ranges from 34°F in December and January to 70°F in July (Reference 3.24, Section 2.3.2.1.2). An extreme minimum temperature of 3°F was recorded in February 1899. Based on historical records, the temperature remains below freezing all day on the average of only 1 day each January. About one-half of the days in December, January, and February have minimum temperatures below freezing.

Icing does not occur on the lower reaches of the Savannah River based on records of minimum temperature from 1961 to 1980 (Reference 3.24, Section 2.4.7) Therefore, there is no risk of ice blockage of the Savannah River, frazil ice, or freezing of the below-grade UHS water source in the NSCW basins.

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. Freeze protection of idle but primed portable pumps and hoses considers the possibility of freezing 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.

2.7.5 High Temperatures

The Vogtle site normal daily maximum temperature ranges from 58°F in January to 91°F in July. An extreme maximum of 106°F was recorded in July 1952. Based on a 14-year record, the average number of days in a year on which temperatures of 90°F and above occur is 62, ranging to approximately two-thirds of the days in July (Reference 3.24, Section 2.3.2.1.2).

The FLEX pumps can operate in hot weather well in excess of 100°F. Similarly, the 480V FLEX portable DGs can operate in ambient air up to 113°F based on information from the equipment vendor. The FLEX Storage Building is ventilated to maintain equipment functional. Active cooling systems are not required as normal room ventilation will be utilized.

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.

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 which is seismically robust (Reference 3.53). The VEGP

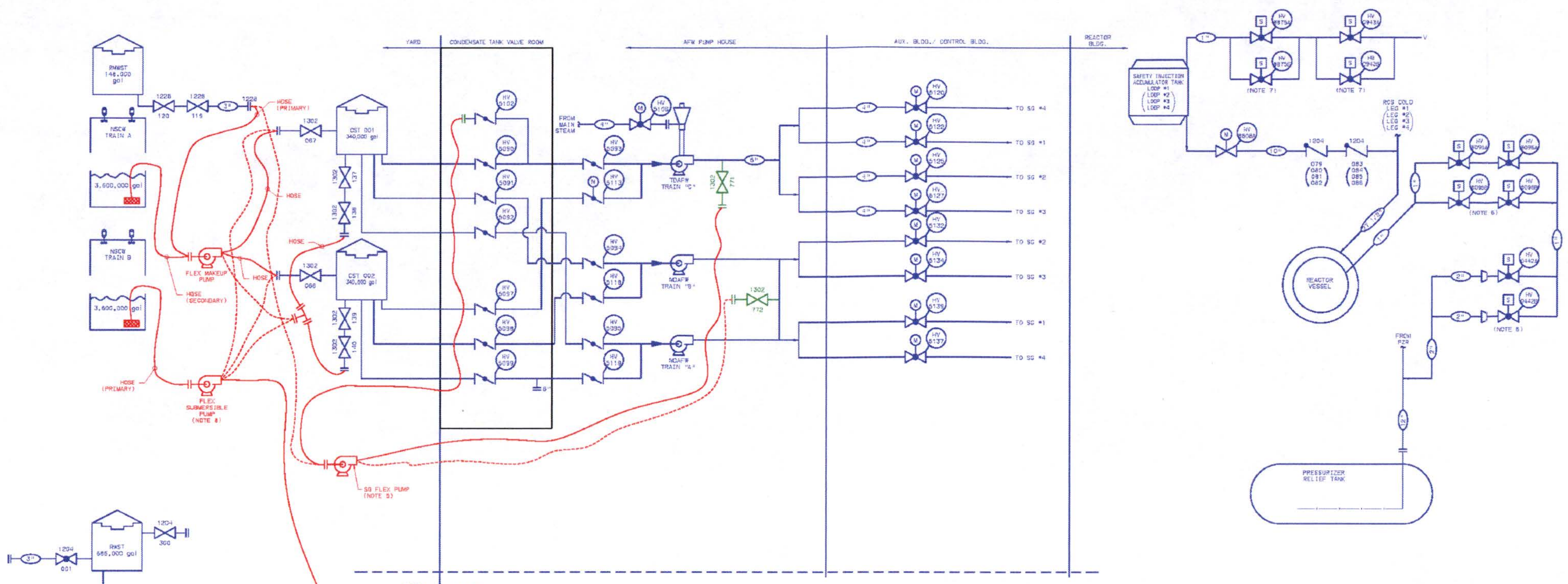
FLEX Storage Building is located outside of the Protected Area but within the Owner Controlled Area (see Figure 3). This location is significantly above the upper-bound flood stage elevation. The FLEX Storage Building was designed and constructed to prevent water intrusion and built to protect the equipment from other hazards identified in Section 2.7.

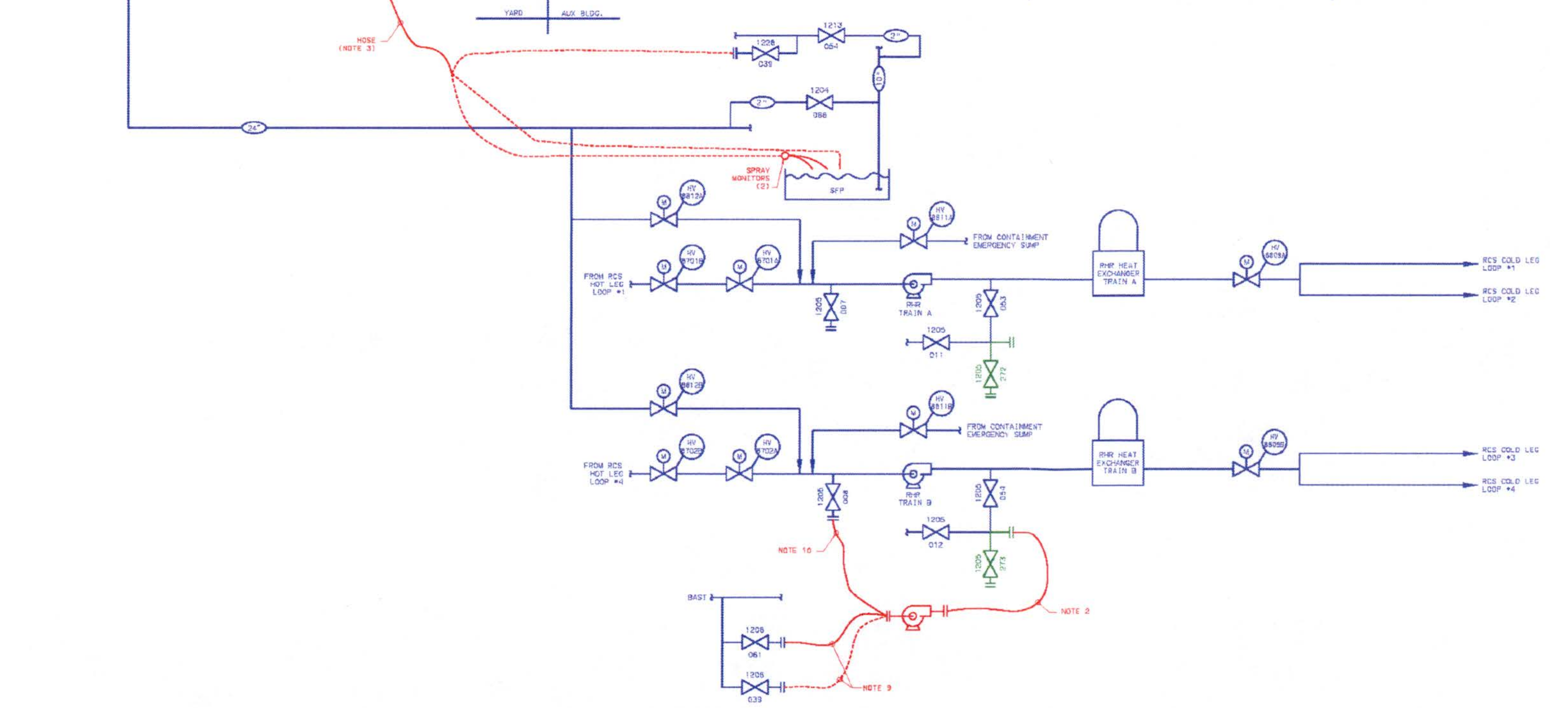
Large portable FLEX equipment such as pumps and power supplies are secured, as required, inside the FLEX Storage Building to protect them during a seismic event. The FLEX Storage Building has tie downs integrated into the floor slab for this purpose. These tie downs are used to secure any equipment that 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.

The logistics of equipment removal for maintenance and after a BDBEE was considered in the design of the building. Two tornado missile-resistant 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 tornado-resistant doors are designed to resist, and be operational during and after tornado wind pressure loads and tornado-missile loads. All tornado missile-resistant 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 PHASE 1 & 2 FUNCTIONS			
SAFETY FUNCTION	METHOD	PHASE	STRATEGY ATTRIBUTES
CORE COOLING	AFW	1	USE OF TDAFWP WITH SUCTION FROM CST.
	AFW	2	USE OF TDAFWP WITH SUCTION FROM CST. MAKEUP TO CSTS WITH FLEX MAKEUP PUMP VIA RMWST (PRIMARY) OR FLEX SUBMERSIBLE PUMP VIA NSCW BASIN.
	PORTABLE PUMP	2	MANUALLY DEPRESSURIZE STEAM GENERATORS. INJECT TO STEAM GENERATORS VIA SG FLEX PUMP & HOSES WITH SUCTION FROM CSTS OR RMWST.
RCS INVENTORY CONTROL / LONG TERM SUBCRITICALITY	LOW LEAK RCP SEALS AND BORATED HIGH PRESSURE RCS MAKEUP REQUIRED	1 & 2	LOW LEAK RCP SEALS INSTALLED. BORON INJECTION FROM SI ACCUMULATORS AND/OR FLEX INJECTION PUMP. LETDOWN PATH FROM RX VESSEL TO PZR RELIEF TANK ESTABLISHED.
SFP COOLING	MAKEUP VIA CONNECTION TO SFP COOLING PIPING	1	GRAVITY FEED FROM RWST TO SFP ESTABLISHED VIA SFP COOLING PIPING.
	MAKEUP WITH PORTABLE INJECTION SOURCE TO SFP COOLING PIPING	2	MAKEUP VIA FLEX SUBMERSIBLE PUMP & HOSES TO SFP COOLING PIPING WITH MAKEUP FROM NSCW BASIN
	MAKEUP WITH PORTABLE INJECTION SOURCE TO HOSES ON REFUEL FLOOR	2	MAKEUP VIA FLEX SUBMERSIBLE PUMP & HOSES DIRECTLY THOUGH OPENED FUEL HANDLING BLDG DOORS TO SFP.
	SPRAY CAPABILITY VIA PORTABLE MONITOR NOZZLES FROM REFUEL FLOOR	2	FLEX SUBMERSIBLE PUMP TO (2) SPRAY MONITORS WITH MAKEUP FROM NSCW BASIN.

NOTES:

1. FLEX MAKEUP STRATEGIES SHOWN ARE TYPICAL FOR VEGP UNITS 1 & 2.
2. MAY ALSO BE CONNECTED TO TRAIN "A".
3. HOSE SUPPLY SHOWN FOR SFP MAKEUP, SPRAY AND HARDENED CONNECTION OPTIONS. ONLY ONE SFP HOSE SUPPLY OPTION IS TO BE USED AT A TIME.
4. NOT USED.
6. NOT USED.
6. NOT USED.
7. ACCUMULATORS WILL BE VENTED AFTER PARTIAL INJECTION TO AVOID NITROGEN INJECTION.
8. TWO FLEX SUBMERSIBLE PUMPS ARE DRIVEN BY A SINGLE HYDRAULIC POWER UNIT.
9. HOSES (TWO PRIMARY CONNECTION OPTIONS) FOR USE WITH BORON INJECTION FLEX PUMP (PHASE 2 INVENTORY CONTROL FOR MODES 1 THROUGH 4, AND MODE 5 WITH STEAM GENERATORS AVAILABLE).
10. HOSE (PRIMARY CONNECTION OPTION) FOR USE WITH RCS MAKEUP FLEX PUMP (PHASE 2 INVENTORY CONTROL FOR MODE 6 AND MODE 5 WITHOUT STEAM GENERATORS AVAILABLE).

= CURRENTLY INSTALLED EQUIP
= NEW PERMANENT FLEX EQUIP
= TEMPORARY FLEX EQUIP

INFORMATION
SNCV065-SK-001 1.0

Figure 1 – Flow Diagram for FLEX Strategies

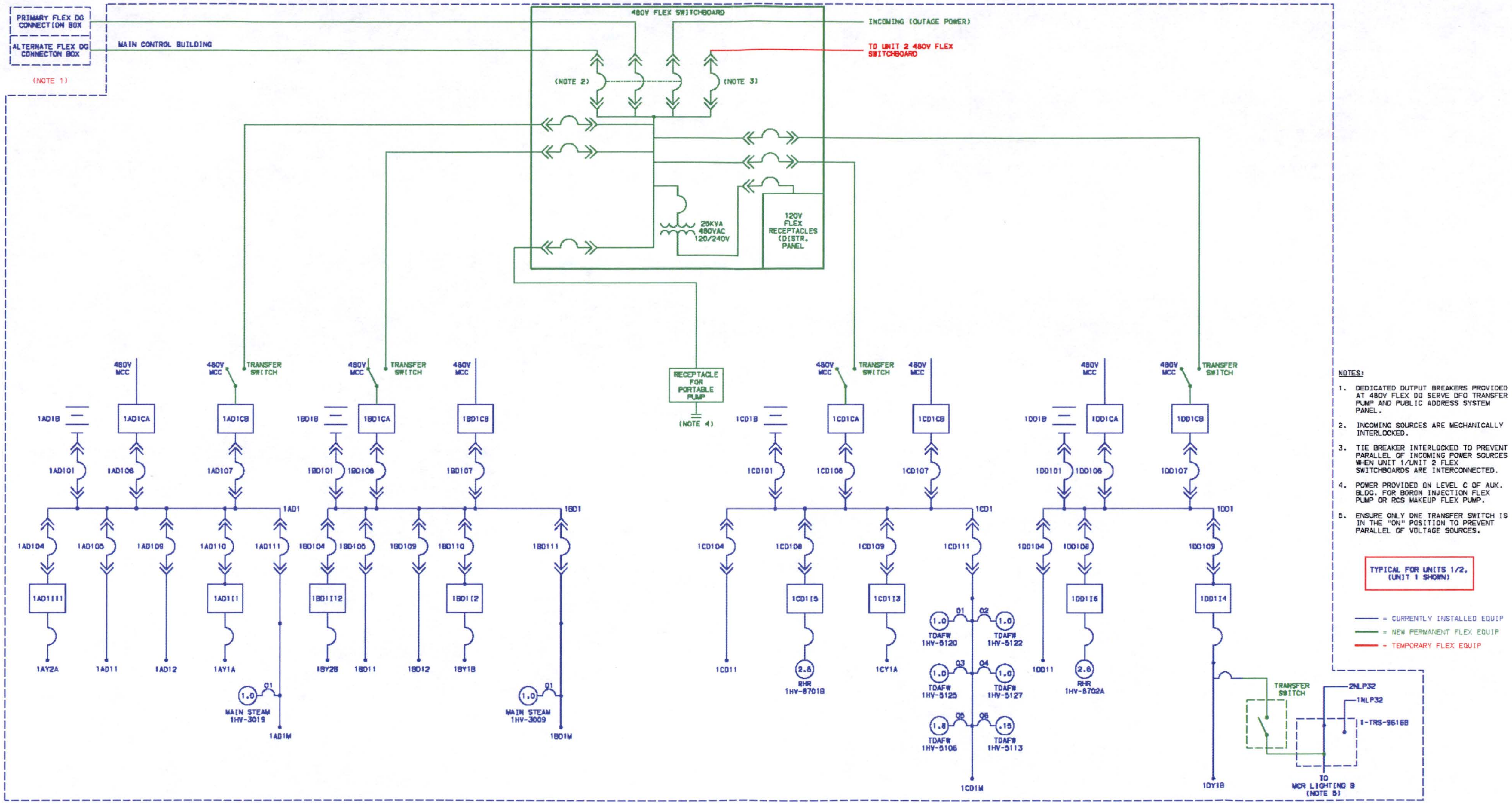


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Figure 2 – Electrical Diagram for FLEX Strategies

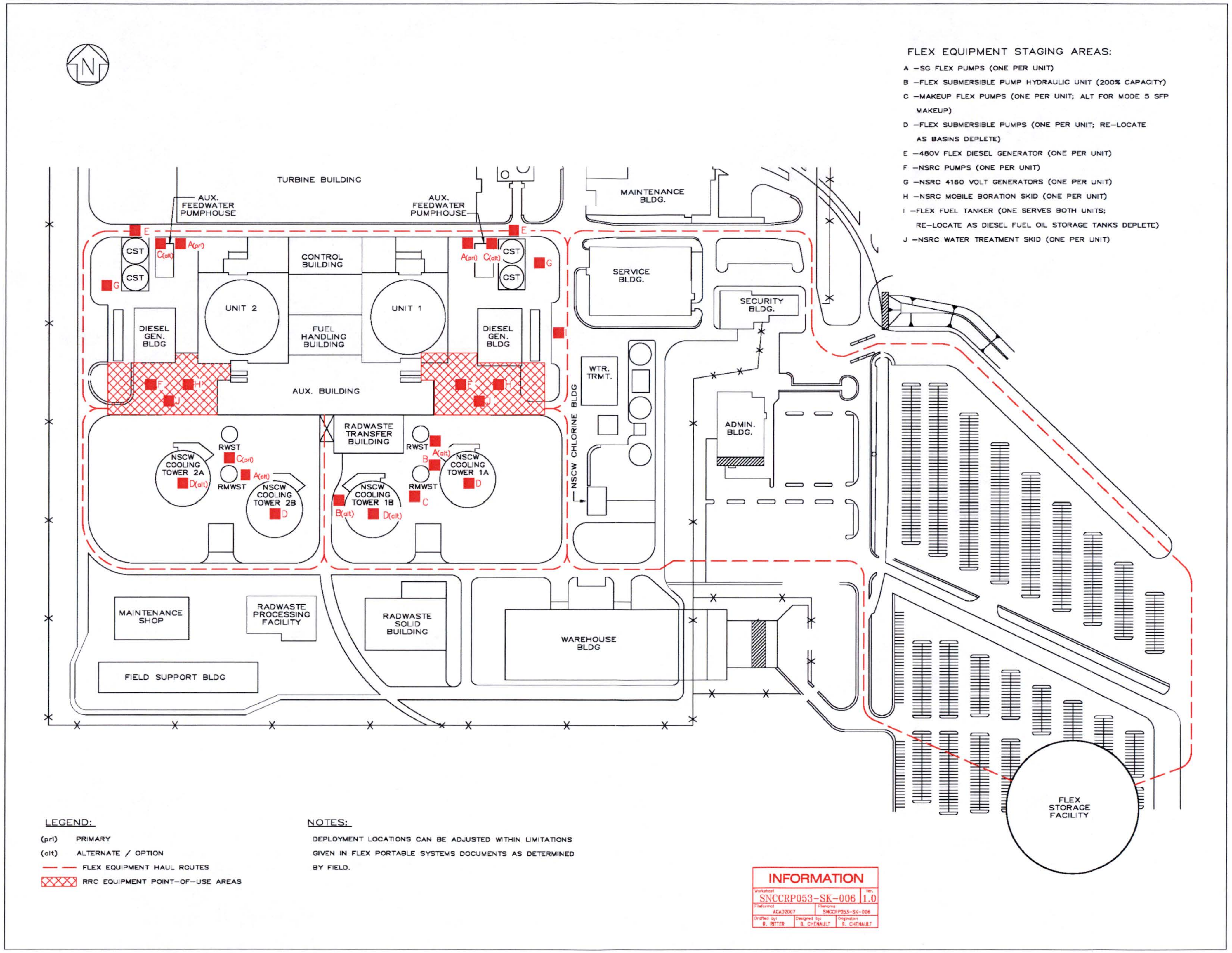

Figure 3 – VEGP Overall Site Plan

2.9 Deployment of FLEX Equipment

2.9.1 Haul Paths and Accessibility

Multiple haul routes will be 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 and 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, run-flat, non-pneumatic 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.

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. 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 north and west sides of the plant that could be utilized.

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 perhaps 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. This is because of its articulated steering and the capability of using a variety of tools which can be specific to the task. Multiple functions afforded the wheeled loader because of its various tools make this machine: a fork lift; a hoist; a modified version of a bulldozer; or a bucket lift. All tools are stored in the FLEX Storage Building.

For the travel paths, analyses indicate that there are potentially liquefiable soils below the design groundwater level, and that some settlement may occur along the travel paths following an earthquake.

The magnitude of the settlement expected to occur is not anticipated to make the road impassable for the selected haul vehicles and wheeled loader (Reference 3.54).

2.10 Fueling of Equipment

The four underground diesel fuel oil storage tanks (DFOSTs) at Vogtle are seismically qualified and have a nominal capacity of 80,000 gallons each. The VEGP Technical Specifications (Reference 3.13, SR 3.8.3.1) require that each DFOST contains at least 68,000 gallons of fuel. The stored quantity of fuel in any 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 vent connections in the existing pump discharge piping. Temporary FLEX cables with quick connect terminations will supply power from a 480V FLEX DG to the existing pump motor cables. 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.

All four Diesel Fuel Oil Storage Tanks (DFOST) have been sampled to determine sulfur content and all were found to be in excess of 200 ppm. At the current usage rate of fuel oil it will be years before the sulfur content in the DFOSTs reaches 15 ppm (Ultra Low Sulfur Diesel fuel). The debris removal equipment, tow vehicles and diesel lights are the only FLEX equipment that require ultra-low sulfur diesel. Because of how long it will take to reduce the sulfur content in the DFOST's a sufficient quantity of ultra-low sulfur fuel oil will be maintained to operate the equipment listed above for a minimum of 72 hours.

A fixed fuel tanker, that is stored in the FLEX Storage Building, is used to keep the equipment requiring ultra-low sulfur fueled. The 500 gallon capacity fuel tanker is sufficient to keep the FLEX equipment requiring ultra-low sulfur fueled for at least 72 hours.

2.11 Offsite Resources

2.11.1 National SAFER Response Centers

The industry has 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 able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle. In addition, on-site FLEX equipment hose and cable end fittings are standardized with the equipment supplied from the NSRC. In the event of a BDBEE and subsequent ELAP/LUHS condition, equipment will be moved from an NSRC to a local assembly area established by the Strategic Alliance for FLEX Emergency Response (SAFER) team. FLEX Strategy requests to the NSRC will be directed by FLEX Procedures.

For Vogtle, the local assembly area (Staging Area "C") is the Barnwell Regional Airport, South Carolina. From there, equipment can be delivered to the Vogtle site by helicopter if ground transportation routes are not available. Communications will be established between the Vogtle plant site and the SAFER team via satellite phones and required equipment moved to the site as needed. First arriving equipment will be delivered to the site within 24 hours from the initial request. The order at which equipment is delivered is identified in the Vogtle "Site Response Plan."

NSRC personnel will commence delivery of a pre-selected equipment set from the NSRC upon notification by the plant site. 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 or to an intermediate staging area approximately 25 miles from the site. The delivery of equipment from the intermediate staging area will use the same methodology. 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 will 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 VEGP 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											
List Portable Equipment	**Qty Req'd / Unit**	**Qty Provided / Unit**	**Power**	**Core Cool-ing**	**Cont. Cooling/ Integrity**	**Access**	**Instrumen -tation**	**RCS Inventory**	**Performance Criteria**		**Notes**
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
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	3
Low Voltage Generator	0	1	Turbine	X			X	X	480V	1000 kW	2
Cable / Electrical	0	Various	N/A	X	X		X	X	4160 V 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
Low Pressure / Medium Flow Pump	1	1	Diesel	X					300 psi	2500 gpm	2
Low Pressure / High	0	1	Diesel		X				150 psi	5000 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			
Flow Pump											
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 – Not required for FLEX Strategy – Provided as Defense-in-Depth (Reference 3.55, Table 9-1).

Note 2 - NSRC Generic Equipment – Not required for FLEX Strategy – 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 is 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 VEGP, 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/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. A loss of ventilation analyses was 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, and Battery and Switchgear Rooms.

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 control room vital electronics, instrumentation and emergency lighting remain energized from emergency DC power sources. An ELAP event disables all trains of control room HVAC for both units simultaneously.

Under ELAP conditions with no mitigating actions taken, analysis (Reference 3.58) projects the control room temperature to surpass 110°F (the assumed maximum temperature for efficient human performance as described in NUMARC 87-00 (Reference 3.10)) in less than 4 hours. The Phase 1 FLEX strategy will be to block open the MCR access doors on the Unit 2 side within 3 hours. This strategy will open the MCR to the structure exterior at plant grade level and provide enough ventilation to keep MCR temperature below 110°F until power can be provided for a portable fan. By 15 hours, actions to deploy portable ventilation and block open additional doors on the Unit 1 side of the MCR (to complete a flow path for outdoor through the MCR) are complete. 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 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 afternoon hours. In addition, there is on average a 20°F difference between the daily high and low temperatures. (Reference 3.24, Section 2.3.2.1.2 and Table 2.3.2-1)

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/LUHS condition (Reference 3.59). This conservative calculation determined that with no supplemental ventilation, the room would heat up to a maximum of 116°F during the first 72 hours of operation.

The temperature rise in this room is mitigated by natural circulation. A fail open installed damper provides air flow via heat-induced natural circulation. It is sufficient to maintain accessibility of the room for manual operation if required and to maintain equipment temperatures within operating limits. A temperature of 116°F is deemed acceptable for infrequent occupancy to allow local operation of pumps 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 3.63).

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 the maximum temperature in the switchgear and battery rooms over a period of 7 days from the start of the BDBEE is 108°F and 95°F respectfully. This requires that the doors to the switchgear and battery rooms be propped open within 1 hour from the start of the event. Although not required for equipment protection, fans are available to allow for additional mixing of air from the switchgear and battery rooms with the large volume of the adjacent non-train switchgear room on Level "B" in the Control Building. Operators are procedurally directed to open the switchgear and battery room doors within 1 hour and to stage and start room fans as part of the FLEX Switchgear energization. An evaluation of equipment in the switchgear and battery rooms determined that this equipment will operate with no perceptual change in life expectancy when operating at the maximum temperatures for up to 7 days.

Since temperatures in and around the switchgear and battery rooms will remain less than 110°F, no specific action is needed to address habitability. Since continuous occupation is not needed for operation of this equipment, operators can withdraw to a cooler area between equipment checks.

During subsequent battery charging operations, hydrogen will be released into the battery rooms. With no mitigating action taken, the limiting time to 2% hydrogen concentration in the battery rooms is 86 hours from the start of the event (Reference 3.61). Propping the battery room doors open at 1 hour ensures that the time to 2% hydrogen concentration in the battery rooms is well beyond 30 days (Reference 3.61).

2.12.1.4 Aux. Bldg. "D" Level Corridor

The Phase 2 strategy includes supplying the electrical distribution for RCS inventory strategies that rely on the portable Boron Injection and RCS Makeup FLEX Pumps located in the Aux. Bldg. "D" Level corridor from the 480V FLEX DG. Analysis (Reference 3.62) confirms that by propping open a door between corridors by 10 hours, temperature in these areas will remain low enough (i.e., less than 104°F for the first 72 hours of operation) so as to not impact accessibility or equipment operation given the heat load and building size. The Boron Injection and RCS Makeup FLEX pumps can provided design flow rates at a maximum ambient temperature of 104°F (Reference 3.62).

Since temperatures around the pumps will remain less than 110°F, no specific action is needed to address habitability. Since continuous occupation is not needed for operation of this equipment, operators can withdraw to a cooler area between equipment checks.

2.12.1.5 Containment

Analysis (Reference 3.47) determined that the MODES 1-4 containment pressure at 120 hours is 5.7 psig and the peak containment temperature at 120 hours is 213.2°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. An additional analysis (Reference 3.64) determined that the instrumentation in containment needed in Modes 1-4 would be available throughout a BDBEE for the first 120 hours.

Analysis (Reference 3.47) demonstrates that containment response in MODES 5 & 6 following a postulated ELAP event does not challenge design limits. 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). Either ILRT penetration provides an adequate containment vent path. An additional analysis (Reference 3.64) determined that the instrumentation in containment needed in Modes 5 & 6 would be available throughout a BDBEE for the first 120 hours.

2.12.1.6 FLEX Switchgear

During the ELAP event, the FLEX Switchboard distributes power to one battery charger for each 125V DC Switchgear and other critical loads (See Section 2.3.2). The FLEX Switchboards are located on Level "B" of the Control Building immediately outside the 125V DC Switchgear and Battery rooms. Analysis (Reference 3.60) determined that the maximum temperature in the FLEX switchgear rooms over a period of 7 days from the start of the BDBEE is 96°F. The FLEX Switchboards are designed to operate up 104°F.

Since temperatures around the FLEX Switchboards will remain less than 110°F, no specific action is needed to address habitability. Since continuous occupation is not needed for operation of this equipment, operators can withdraw to a cooler area between equipment checks.

2.12.2 Heat Tracing

For the VEGP site, the normal daily minimum temperature ranges from 34°F in December and January to 70°F in July (Reference 3.24, Section 2.3.2.1.2). An extreme minimum temperature of 3°F was recorded in February 1899. Based on historical records, the temperature remains below freezing all day on the average of only 1 day each January. About one-half of the days in December, January, and February have minimum temperatures below freezing. 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 CSTs when their initial inventories are depleted via the FLEX Makeup 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 89 hours into the BDBEE due to the capacity of the CSTs (see Table 3). Additionally, the NSCW basins serve as alternate supplies of makeup water to the CSTs. 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., 89 hours) and the availability of the NSCW basins (which are 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 BAST 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) and the availability of the NSCW basins (which are not susceptible to freezing) as backup to the RMWST, heat tracing is not required to be maintained following a BDBEE.

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 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

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

2.14 Lighting

In order to validate the adequacy of supplemental lighting and the adequacy and practicality of using portable lighting to perform FLEX strategy actions it was confirmed that 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 light 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.

There are no emergency lighting fixtures in the yard outside of the protected area to provide necessary lighting in those areas where portable FLEX equipment is to be deployed. Therefore, the large 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.

Installed ballasts on MCR light fixtures provide reduced illumination for 90 minutes. The strategy calls for operator action to align MCR lighting in the "Horseshoe" area to the associated unit's D Battery. Analysis indicates that execution of specified load shed actions directed in plant procedures ensures a continued reliable source of illumination for a minimum of 14 hours until the 480V FLEX DG will be available to repower the battery charger that supplies the D Battery which powers the MCR lighting (Reference 3.15). To align MCR lighting in the “Horseshoe” area to the associated Unit's D battery, operators manipulate breakers on a single 120V Instrument ac panel and position two control switches at readily accessible locations in the Control Building.

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 VEGP communications assessment (Reference 3.65), provisions have been made for battery backup for the plant public address system to allow for extended operation following a loss of power, as necessary, to support plant operations until AC power is restored or alternative communications are available. 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. The RAPIDCASE is maintained in a charged condition and requires a backup source of power before the batteries are depleted.

The RAPIDCASE is stored in the Equipment Building which is a seismically qualified structure and the RAPIDCOM is stored in the FLEX Storage Building.

The electrical strategy for Phase 2 includes the capability to enhance the Phase 2 onsite communications by repowering the Public Address system.

2.16 Water sources

2.16.1 Secondary Water Sources

Table 3 provides a comprehensive 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. Only the Condensate Storage Tank (CST), Reactor Makeup Water Storage Tank (RMWST), Refueling Water Storage Tank (RWST), Nuclear Service Cooling Water (NSCW), and Savannah River meet the qualification guidelines of NEI 12-06 for an injection source that can be credited for the ELAP/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 and associated piping that fully meet ALL BDB external hazards, i.e., are FLEX qualified (See Reference 3.14 Attachment A for Calculated Times)													
Water Sources	Usable Volume (Gallons)	Qualified for Applicable Hazard?				SG Makeup		RCS Makeup			SFP Makeup		
		Seismic	High Winds	Low Temp	High Temp	Time Based on Decay Heat	Cumulative Time Based on Decay Heat	MODES 1-4 (SGs)	MODE 5 (No SGs)	MODE 6	MODES 1-4 (SGs Available)	MODE 5 (No SGs)	MODE 6 (Full-Core Offload)
CST 1 (Ref. 3.13, SR 3.7.6.1)	340,000 (one per unit)	Y	Y	Y	Y	29 hrs	29 hrs	--		47 hrs	--	--	45 hrs makeup >22 hrs spray
CST 2 (Ref. 3.13, SR 3.7.6.1)	340,000 (one per unit)	Y	Y	Y	Y	60 hrs	89 hrs	--		47 hrs	--	--	45 hrs makeup >22 hrs spray
RMWST (Ref. 3.14)	148,000 (one per unit)	Y	Y	Y	Y	31 hrs	120 hrs	--		>20 hrs	--	--	19 hrs makeup >9 hrs spray
NSCW Basin A (Ref. 3.14; Ref. 3.13, SR 3.7.9.1) (Note 2)	3,361,500 (one per unit)	Y	Y	Y	Y	30 days	>35 days	--	--	--	--	19 days makeup 112 hrs spray	9 days makeup 112 hrs spray
NSCW Basin B (Ref. 3.14; Ref. 3.13, SR 3.7.9.1) (Note 2)	3,361,500 (one per unit)	Y	Y	Y	Y	--	--	--	--	--	19 days Makeup 112 hrs Spray	19 days makeup 112 hrs spray	9 days makeup 112 hrs spray
RWST (Ref. 3.13, SR 3.5.4.2)	686,000 (one per unit)	Y	Y	Y	Y	--	--	>47 days	95 hrs	95 hrs (Note 3)	--	--	--
Savannah River	Continuous Source	Y	Y	Y	Y	Indefinite	Indefinite						
Totals						--	>35 days (Indefinite)	>47 days	>3.9 days	115 hours	>19 days makeup >4.5 days spray	>38 days makeup >9 days spray	>23 days makeup >11 days spray
Water sources not credited in FLEX strategy (No analysis performed for the non-qualified water sources)													
Condenser Hotwell (Note 1)	156,534 (one per unit)	N	--	--	--	--	--	--	--	--	--	--	--
Demin. Water Storage Tank (Ref. 3.24, Table 2.4.12-2)	250,000	N	--	--	--	--	--	--	--	--	--	--	--
Fire Water Storage Tanks (Ref. 3.24, Table 2.4.12-2)	600,000	N	--	--	--	--	--	--	--	--	--	--	--
Makeup Well Water Storage Tank (Ref. 3.24, Table 2.4.12-2)	300,000	N	--	--	--	--	--	--	--	--	--	--	--
Potable Water Storage Tank (Ref. 3.24, Table 2.4.12-2)	25,000	N	--	--	--	--	--	--	--	--	--	--	--
Cooling Tower Basins (Ref. 3.24, Section 10.4.5.2.2)	6,000,000 (one per unit)	N	--	--	--	--	--	--	--	--	--	--	--

Note 1 - The condenser hotwell level was determined by multiplying the maximum water level in the condenser (which is 7.3 feet from the bottom) by volume of water per one foot rise in the condenser (which is calculated to be 21,443 gallons per foot). (Ref. 3.26)

Note 2 – SFP makeup and spray are based on submergence considerations for the submersible pump (Reference 3.43). Makeup values are conservatively based on submergence requirements for flow path through flexible hoses and permanent plant piping (Reference 3.43). The required SFP flow rates are doubled because a single basin is used for both units.

Note 3 – 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

VEGP 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).

Vogtle has site-specific procedures for implementation of FLEX in shutdown MODES. The applicable procedure addresses all expected plant configurations expected in MODES 5 & 6. No pre-deployment of FLEX is required. Some FLEX equipment used for MODES 5 & 6 strategies is stored near containment inside protected structures such as the Equipment Building.

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 35 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 Safety Injection (SI) system flow path to the RCS cold legs. Additional gravity feed paths from the RWST to the RCS are also available using the SI flow path to the RCS hot legs and flow paths in the Residual Heat Removal (RHR) System and the Chemical Volume and Control System (CVCS).

The required makeup flow rate to the RCS following a loss of RHR cooling is 120 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, 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 a suction on the RWST with its discharge aligned to a connection in the RHR system.

The Westinghouse RCS makeup evaluation (Reference 3.19) indicates that a flow rate of 120 gpm is sufficient to remove the decay heat for MODES 5 events that occur beyond 48 hours after plant shutdown. Diverse connections (primary and alternate) for suction from the RWST are provided upstream of each RHR pump. Diverse connections for discharge of the pump are located downstream of each RHR pump on the piping that discharges to the RCS cold legs. No venting of the RCS will be required since the Pressurizer Safety Valves are 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 449.6 ft is required to ensure a minimum flow rate of 120 gpm can be provided for boron injection with suction from the RWST for MODES 5-6. At this flow rate, the minimum NPSHa is 86.8 ft (Reference 3.35) which exceeds the NPSHr of 8 ft (Reference 3.36).

2.17.2 RCS Inventory and Reactivity Control MODE 6

2.17.2.1 Phase 1

In MODE 6, the RWST inventory is available in the reactor refueling cavity and no Phase 1 actions will be required.

2.17.2.2 Phase 2 and 3

The Westinghouse RCS makeup evaluation (Reference 3.19) indicates that a flow rate of 120 gpm is sufficient to remove the decay heat for MODES 6 events that occur beyond 48 hours after plant shutdown. The strategy for inventory control for MODE 6 will be established by using the SG FLEX Pump to make up demineralized water, from any available makeup source (i.e., CST or RMWST) to the top of the refueling cavity (Reference 3.19). Makeup to the refueling cavity is through one of two available containment penetrations.

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

To maintain containment parameters within design limits, local manual actions are required (Reference 3.47) to establish a vent flow path through one of the two installed lines provided for Integrated Leak Rate Testing (ILRT). 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.

Two methodologies were used in the analysis. The first is use of the Modular Accident Analysis Program (MAAP) PWR Version 4.0.5 analysis software for the containment analysis (Reference 3.78). The second was the use of the modified Darcy equation for compressible flow to determine the pressure drop in the containment vent line for MODES 5 & 6, SGs not Available, and mid loop conditions. 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 (SOE) Timeline for an ELAP/LUHS event at VEGP. Validation of each of the FLEX time constraint actions has been completed in accordance the FLEX Validation Process document issued by NEI (Reference 3.82) and includes consideration for staffing (References 3.74 and 3.75). Time to clear debris to allow equipment deployment is assumed to be up to 6 hours from the start of the event (Reference 3.75). 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	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	10 min	Attempt to establish DG emergency power from MCR and attempt local diesel start	N	RO attempts to start EDG from MCR and dispatches System Operator (SO) to start locally.
3	15 min	Evaluate off site power with off- site PSCC and attempt Plant Black Start.	N	Shift Manager determines availability of off-site power
4	30 min	DC load shed complete	Y	Time sensitive at a time greater than 45 minutes. DC buses are readily available for operator access and breakers/control switches at the DC switchgear are appropriately identified (labeled) to show which are required to be opened.
5	30 min	Attempts to start EDGs have been unsuccessful. Enter ELAP procedure	Y	Time sensitive at a time greater than1 hour. Entry into ELAP provides guidance to operators to perform ELAP actions.

Table 4

Sequence of Events Timeline

Action Number	Elapsed Time	Action	ELAP Time Constraint	Remarks
6	1 hour	Transfer MCR lighting to the associated unit's D battery	N	Installed ballasts on emergency MCR light fixtures provide reduced illumination for 90 minutes. To align MCR lighting in the "Horseshoe" to the associated Unit's D battery, operators manipulate 12 breakers on a single 120V Instrument AC panel and position two control switches at readily accessible locations in the Control Building.
6A	1 hour	Open doors to the main battery rooms and adjacent switchgear rooms	Y	A time constraint of 60 minutes was established for this action. Opening the doors is procedurally performed during the battery load shed. 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.
6B	3 hours	Open access doors on Unit 2 side of the MCR	Y	Time sensitive at a time greater than 3 hours. Command and control functions require continued personnel accessibility to the MCR. With these doors opened, natural mixing of air in the MCR with the outdoor environment will maintain adequate temperatures prior to availability of forced ventilation.
7	8 hours	Initiate depressurization of the SGs via local operation of the ARVs	Y	Time sensitive at a time greater than 16 hours. RCS cooldown occurs at the same time as the secondary side depressurizes. This enables boration via accumulators and Boron Injection FLEX pump prior to net xenon decay (i.e.,

Table 4

Sequence of Events Timeline

Action Number	Elapsed Time	Action	ELAP Time Constraint	Remarks
				within 24 hours).
8	10 hours	Stage and connect the 480V FLEX DG to battery chargers and Boron Injection FLEX Pump	Y	Time sensitive after 12 hours
8A	10 hours	Establish forced ventilation for battery and switchgear rooms	N	Battery charging operations generate additional heat in these spaces and release hydrogen into the battery rooms. Forced ventilation is not required for maintaining acceptable room temperatures and battery room hydrogen concentration levels. Deploying portable fans to circulate air between these rooms and the large adjacent spaces will provide additional operating margin.
9	12 hours	Stage and connect portable SG FLEX Pump in the event the TDAFW Pump fails	N	The SG FLEX Pump will be staged beginning at approximately 8-10 hours
10	12 hours	Initiate supplemental boration (with letdown as necessary) using portable Boron Injection FLEX Pump	Y	Time sensitive after at a time greater than 12 hours. Operator starts the transfer of water from the BASTs to the RCS to ensure adequate boration and maintain sub-criticality
10A	15 hours	Open access doors on the Unit 1 side of the MCR and establish forced ventilation	Y	Time sensitive at a time greater than approximately 18 hours. During the ELAP event, command and control functions require continued personnel accessibility to the MCR. Deploying a portable fan to ventilation provide forced ventilation through the MCR will maintain acceptable temperatures for at least 72 hours.
11	20 hours	Begin makeup to SFP as necessary to maintain adequate level in the SFP. (Under	N	SFP area venting and hose deployment will begin at approximately 5-6 hour time frame. Boil-off rate is slow

Table 4

Sequence of Events Timeline

Action Number	Elapsed Time	Action	ELAP Time Constraint	Remarks
		design basis conditions, boiling begins at ~7 hours; without makeup, SFP level falls to 15 feet above the active fuel in ~27 hours.) Vent the spent fuel pool area by opening doors to minimize condensation during pool boiling		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.
12	24 hours	Align second CST for SG Makeup and install CST crosstie.	Y	Time sensitive at a time greater than 29 hours. To transfer source of water to the second CST before the first CST inventory will be exhausted (initial selection of CST 1 assumed)
13	17 hours	Power DFOST pump from 480V FLEX DG and fill Trans Cube.	N	Action added because it requires significant coordination. An elapsed time was developed based placing the SG FLEX pump in operation at 6 hrs. The SG FLEX pump has a refueling time of 11 hrs.

Discussion of time constraints identified in Table 4.

- 30 minutes, dc extended load shed complete (Table 4 item 4) - Time sensitive at a time greater than 45 minutes. To ensure that all safety-related station batteries can maintain dc bus voltages above minimum required voltage for a minimum of 12 hours following a loss of AC power, dc load shed is required to be completed by 45 minutes after loss of AC power. Station procedures will require a dc load shed following a loss of all AC power even if an ELAP has not been declared at about 15 minutes after the start of the event. The Verification & Validation (V&V) performed determined that the load shed can be performed in 16 minutes. Battery chargers are assumed to be operating no later than 10 hours via the 480FLEX DG after the start of the event (Table 4 item 8); therefore, there is sufficient conservatism in the life of the dc power source. The ac & dc distribution panels are primarily located in Switchgear Rooms on the B level of the control building and are readily accessible to the operator. One distribution panel is located on level 1 of the Auxiliary Building. It too is readily accessible to the operator. As an operator aid, the breakers are appropriately identified (labeled) to show which are required to be opened to facilitate an extended load shed.

- 30 minutes, Entry into Extended Loss of ac Power (Table 4 item 5) - Time sensitive at a time greater than1 hour. Time period of 1 hour is selected conservatively to ensure that ELAP entry conditions can be verified by control room staff and it is validated that emergency diesel generators (EDG) are not available. 1 hour is a reasonable assumption for system operators to perform initial evaluation of the EDGs. Entry into ELAP provides guidance to operators to perform ELAP actions.

- 1 hour, Open doors to main battery rooms and associated switchgear rooms (Table 4 item 6A). Analysis (Reference 3.60) indicates that this action allows mixing of air from the main battery rooms and associated switchgear rooms with the large volume of the adjacent non-train switchgear room on Level "B" in the Control Building. Opening the doors to these spaces during the first hour following ELAP—which operators will be doing to accomplish credited load shedding actions—will provide enough natural mixing to keep temperatures below 108°F in the switchgear rooms and 94°F in the battery rooms.

- 3 hours, Open access doors on Unit 2 side of the Main Control Room (MCR) (Table 4 item 6B) - Time sensitive at a time greater than 3 hours. Opening the MCR to the structure exterior at plant grade level within 3 hours provides enough ventilation to keep MCR temperature below 110°F until power can be provided for a portable fan (Reference 3.58). 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 doors will not be opened until the MCR temperature is in excess of the outside temperature.

- 8 hours, Depressurize steam generators (SGs) via local operation of Atmospheric Relief Valves (ARVs) (Table 4 item 7) - Time sensitive at 16 hours. Initiating cooldown at 16 hours allows sufficient time for RCS cooldown and depressurization (estimate 4 hours) prior to when borated makeup must be started (Table 4 item 10) for maintaining sub-criticality at the most limiting core conditions (Reference 3.19).

- 10 hours, Energize 480V FLEX switchboard (Table 4 item 8) - Time sensitive at a time greater than 12 hours. Current battery calculations demonstrate that battery capacity is sufficient to provide three trains of critical loads for greater than 12 hours (Reference 3.15). The 480V FLEX DG will be available for service no later than 10 hours after the start of the event. Thus, the 480V FLEX DGs will be available to restore power to one battery charger on each Class 1E 125V dc distribution bus and a portable FLEX pump (Boron Injection or RCS Makeup as needed—dependent on ELAP initial conditions). The 480V FLEX DGs will be maintained in the on-site FLEX Storage Building. The 480V FLEX DG will be transferred and staged via haul routes and staging areas evaluated for impact from external hazards. Diverse connection points for the 480V FLEX DG are provided outside and inside the Control Building (primary and alternate, respectively) to facilitate the connections and operational actions required to supply the battery chargers and portable FLEX pumps from the 480V FLEX DG.

- 12 hours, Begin supplemental boron injection from the Boric Acid Storage Tank (BAST) using portable Boron Injection FLEX pump (Table 4 item 10) - Time sensitive after at a time greater than 24 hours. The Westinghouse RCS makeup evaluation for VEGP (Reference 3.19) determined that injecting from the BAST provides sufficient shutdown margin for the worst case boration requirements. Initiating makeup from the BAST at 12 hours ensures adequate boration (with one hour for mixing) to maintain long-term sub-criticality is accomplished within 24 hours with injection rate limited by letdown through the upper head vent flowpath (Reference 3.19).

- 15 hours, Open access doors on Unit 1 side of the MCR and establish forced ventilation (Table 4 item 10A) - Time sensitive at a time greater than approximately 18 hours. Opening additional doors on the Unit 1 side of the MCR establishes a flow path through the MCR to the outdoor atmosphere. Deploying a portable fan at 15 hours will keep MCR temperatures below 110°F for at least 72 hours (Reference 3.58).

- 24 hours, Align second CST for SG injection and install CST crosstie (Table 4 item 12) – Aligning to the second CST is time sensitive at a time greater than 29 hours. The inventory of one CST is capable of removing decay heat and RCS stored energy for a minimum of 29 hours (see Table 3 and Reference 3.14). Prior to depletion of the first CST, the TDAFW pump (or SG FLEX Pump, as applicable) will require makeup from the second CST. Cross tying the CSTs is not time sensitive. The CSTs have the capability to be cross-tied removing the need to realign to the second CST for injection and to add an alternate flowpath for CST makeup. V&V of the cross-tie was added because it requires significant coordination.

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-038-003 for VEGP, Reference 3.70). Together, the two documents describe the FLEX program for VEGP.

Key elements of the VEGP 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

  - o Activities that Potentially Affect FLEX Strategies
  - o 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 and 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. The FSGs satisfy the criteria specified in Section 11.4 of NEI 12-06.

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 ECA-0.0, "Loss of All AC Power" (Reference 3.71) 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.

FSGs and SIGs are reviewed, approved, and maintained in accordance with existing procedure control procedures.

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 3.72).

2.19.3 Staffing

Using the methodology of NEI 12-01, Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities (Reference 3.73), assessments of the capability of the Vogtle 1 & 2 on-shift staff and ERO to respond to a BDBEE were performed for Phase 1 and for Phase 2. (References 3.74 and 3.75)

2.19.4 Training

Training has been developed and delivered to the target populations (Operations, Maintenance, 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.

2.19.5 FLEX Equipment List

The equipment necessary for the implementation of the FLEX strategies in response to a BDBEE at VEGP 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, and RCS Makeup FLEX Pumps) are stored near their staging areas in the Auxiliary 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.

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 any 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 – Can also be used as a tow vehicle	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
480V FLEX Diesel Generator	3	X			X		Provide 480V AC power to FLEX Switchboard
SG FLEX Pump	3	X					Provides injection into the SGs to remove decay heat from the core.
Makeup FLEX Pump	2	X					Provide CST Makeup - Godwin HL110M
Makeup FLEX Pump	1	X					Provide CST Makeup - Godwin HL-4M
SFP FLEX Submersible Pump Hydraulic Unit	2	X		X			Provides the hydraulic motive force to drive the submersible pump
SFP FLEX Pump Submersible Pumps	4	X		X			Pump unit placed in the NSCW Basin for access to entire water volume
Sets of Monitor Spray Nozzles for SFP Spray and required hoses	6			X			Provides 250 gpm of spray water for each unit
Boron Injection FLEX Pump	3	X					Provides Borated Water from the BAST or RWST for injection to the RCS in MODES with SGs available for decay heat removal
RCS Makeup FLEX Pump	3	X					Provides borated water from the RWST for injection to the RCS during MODES with SGs not available for decay heat removal
FLEX Fuel Tanker	3	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
DC Equipment Room FLEX Fan	10	X	X	X	X	X	Not credited in FLEX strategies. Portable ventilation for equipment operability.
Battery Room FLEX Fan	10						Not credited in FLEX strategies. Portable ventilation fans available for long term cooling.
FLEX Ventilation Fan	2	X	X	X	X	X	For MCR Ventilation
Diesel Powered Lights	4						Misc. lighting. Not credited in FLEX strategies
Air Compressors	2						Air as needed. Not credited in FLEX strategies
Rapidly Deployable Communications Kit	2	X	X	X	X	X	Does not rely on the availability of either on-site or off-site infrastructure other than satellites

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, 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 is 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 and connections 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 3.76).

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 Site Duty Manager per NMP-GM-036, Duty Manager (Reference 3.77)
- 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 2016 (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 AX3DT120, FLEX Portable System, Units 1 & 2 480V Diesel Generator Sizing Calculation, Version 1.0

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

3.11 VEGP Design Criteria DC-1302, Auxiliary Feedwater System, Version 15.0

3.12 VEGP Design Criteria DC-2130, Condensate Storage Tanks and Valve Houses, Revision 5

3.13 Vogtle Units 1 and 2 Technical Specifications and Bases, Amendment No. 177 (Unit 1) and Amendment No. 158 (Unit 2)

3.14 X4CPS0173, Required Makeup Flows and Water Availability for a Beyond Design Basis External Event at Vogtle Electric Generating Plant, Version 2.0

3.15 X3CF14, Class 1E Battery Station Blackout Extended Coping Time Study, Version 2.0, dated May 27, 2015

3.16 X3CF15, TSC Battery capability evaluation after Beyond Design Basis External Event (BDBEE), Version 1.0

3.17 VEGP Design Criteria DC-1007, Environment - Interdiscipline, Version 34.0

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 Westinghouse Letter LTR-FSE-12-26 Revision 2, "Evaluations to Support SNC FLEX Strategies for Vogtle Electric Generating Plant," March 4, 2013

3.20 CN-PCSA-14-6, Westinghouse Calculation, Vogtle Unit 1 and Unit 2 EOP Setpoints for ELAP, Revision 0

3.21 Westinghouse Letter LTR-FSE-13-46, Rev. 0, Westinghouse Response to NRC Generic Request for Additional Information (RAI) on Boron Mixing in Support of the Pressurized Water Reactor Owners Group (PWROG), dated August 15, 2013.

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 Vogtle Electric Generating Plant Final Safety Analysis Reports Update, Rev 20

3.25 Vogtle Electric Generating Plant Technical Requirements Manual, Rev 42

3.26 X4C1305S28, Condenser Water Level, Version 2.0

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

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3.32 AX4DT112, FLEX Portable System, CST Makeup Sizing Criteria for the Makeup FLEX Pump, Version 1.0

3.33 AX4DT011, FLEX Portable System Tank Makeup Subsystem Phase 2, Version 1.0

3.34 AX4DT113, FLEX Portable System, CST Makeup Sizing Criteria for the NSCW Sump Pump, Version 2.0

3.35 AX4DT100, FLEX Portable System, Boron Injection Pump Sizing Calculation, Version 2.0

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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)

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3.43 AX4DT009, FLEX Portable System, Spent Fuel Pool Subsystem, Version 1.0.

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3.46 SNC Letter NL-14-1745, Vogtle Electric Generating Plant -Unit 2 Completion of Required Action by NRC Order EA-12-051 Reliable Spent Fuel Pool level instrumentation, dated December 1, 2014 (ADAMS Accession No. ML14336A587)

3.47 X4CPS0175, Containment Integrity Analysis for FLEX Coping Strategies, Version 2

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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3.52 FHC-S-13-001 / X1AR50 Procurement Specification for FLEX Equipment Storage Building, Version 2.0

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3.60 X4C1533V02, Vogtle DC Equipment Rooms Heat Up after an Extended Loss of All AC Power, Version 2.0

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3.71 19100-C,ECA-0.0, Loss of All AC Power, Version 39

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

3.73 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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