FPL

June 20, 2016
L-2016-068
10 CFR 2.202

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
Florida Power & Light Company's Turkey Point Units 3 and 4, Status of Required Actions for EA-12-049 Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, and Submittal of the Turkey Point Site FLEX Final Integrated Plan

References:

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

2. NRC Japan Lessons-Learned Directorate (JLD) Interim Staff Guidance (ISG), JLD-ISG-2012-01, Compliance with Order EA 12 049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, Revision 0, dated August 29, 2012, ADAMS Accession No. ML12229A174.

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

4. FPL Letter L-2012-137, Turkey Point Nuclear Generating Station's Superseding Answer to March 12, 2012 Commission Order Modifying License with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated March 30, 2012.

5. FPL Letter L-2013-061, Florida Power and Light Company's Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 26, 2013, ADAMS Accession No. ML13072A038.

6. FPL Letter L-2013-249, Florida Power and Light Company's Turkey Point Units 3 and 4, First Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 21, 2013, ADAMS Accession No. ML13248A311.

A151
NRR

Florida Power & Light Company
9760 S.W. 344th Street Homestead, FL 33035

7. FPL Letter L-2014-041, Florida Power and Light Company's Turkey Point Units 3 and 4, Second Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 26, 2014, ADAMS Accession No. ML14073A454.

8. FPL Letter L-2014-243, Florida Power and Light Company's Turkey Point Units 3 and 4, Third Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 27, 2014, ADAMS Accession No. ML14253A162.

9. FPL Letter L-2015-017, Florida Power and Light Company's Turkey Point Units 3 and 4, Fourth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 26, 2015, ADAMS Accession No. ML15076A195.

10. FPL Letter 2015-193, Florida Power and Light Company's Turkey Point Units 3 and 4, Fifth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 11, 2015, ADAMS Accession No. ML15233A417.

11. FPL Letter 2016-016, Florida Power and Light Company's Turkey Point Units 3 and 4, Sixth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 18, 2016, ADAMS Accession No. ML16109A160.

12. FPL Letter L-2014-362, Florida Power and Light Company's Turkey Point Unit 3, Request for Schedule Relaxation from NRC Order EA-12-049, "Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events dated December 19, 2014, ADAMS Accession No. ML15014A228.

13. NRC Letter dated March 13, 2015,, Turkey Point Nuclear Generating, Unit 3 – Relaxation of the Schedule Requirements for Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (TAC No. MF 0982), ADAMS Accession No. ML15013A498.

14. NRC Letter dated February 6, 2014, Turkey Point Units 3 and 4 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049 (Mitigation Strategies) (TAC Nos. MF0982 and MF0983), ADAMS Accession No. ML14002A151.

15. NRC Letter dated November 12, 2015, Turkey Point Nuclear Generating, Units 3 and 4 – Report for the Onsite Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049 and EA-12-051 (TAC NOS. MF0982, MF0983, MF0988, MF0980), ADAMS Accession No. ML15307A314.

16. NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 2, dated December 2015, ADAMS Accession No. ML16005A625.

On March 12, 2012, the Nuclear Regulatory Commission ("NRC" or "Commission") issued an order, Reference 1 to Florida Power & Light Company (FPL). Reference 1 was immediately effective and directed FPL's Turkey Point 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. Specific requirements are outlined in Attachment 2 of Reference 1.

Reference 1 required submission of an Overall Integrated Plan (OIP) by February 28, 2013. The NRC Interim Staff Guidance (ISG), Reference 2, was issued on August 29, 2012, which endorsed industry guidance document NEI 12-06, Revision 0, Reference 3, with clarifications and exceptions identified in Reference 2. Reference 3 provides direction regarding the content of the OIP.

Reference 4 provided FPL's Turkey Point initial response regarding mitigation strategies, as required by Reference 1. Reference 5 provided FPL's Turkey Point OIP pursuant to Section IV, Condition C.1, of Reference 1. References 6-11 are the reports for the Six-month updates for the development and implementation of the order that were also required by the order. Reference 12 submitted the request for relaxation of compliance with the order for Unit 3 only. NRC's approval of the relaxation request is provided in Reference 13.

The original OIP and subsequent updates followed the guidance of NEI 12-06 Revision 0, Reference 3. The Final Integrated Plan (FIP) has been reconciled to the guidance of NEI 12-06 Revision 2, Reference 16.

The purpose of this letter is to provide notification to NRC that FPL's Turkey Point Units 3 and 4 have completed the requirements of EA-12-049 and are in full compliance with the subject Order.

The following attachments contain: 1) Turkey Point Units 3 and 4, Order EA-12-049 Compliance Requirements Summary 2) Turkey Point Audit Open Item Closure Summary 3) Turkey Point Units 3 and 4 FLEX Final Integrated Plan.

This letter contains no new regulatory commitments.

If there are any questions regarding this submittal, please contact Mitch Guth, Turkey Point Licensing Manager, at (305) 246-6698.

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

Executed on June 20, 2016.

Sincerely,

Thomas Summers
Vice President
Turkey Point Nuclear Plant

cc: USNRC Regional Administrator, Region II
USNRC Senior Resident Inspector, Turkey Point Units 3 and 4

Attachments

1. Turkey Point, Unit 3 and 4 Order EA-12-049 Compliance Requirements Summary
2. Turkey Point Units 3 and 4 FLEX Audit Open Item Closure Summary
3. Turkey Point FLEX Final Integrated Plan (Engineering Evaluation PTN-ENG-SEMS-16-003, Attachment 1)

Attachment 1

Turkey Point Units 3 and 4, Order EA-12-049 Compliance Requirements Summary

STRATEGIES - COMPLETE

Turkey Point Units 3 and 4 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 requiring action by FPL. Attachment 2 of this correspondence provides the closure methods for all of the Turkey Point Units 3 and 4 Audit open items discussed in the NRC Letter dated November 12, 2015, Turkey Point Nuclear Generating, Units 3 and 4 – Report for the Onsite Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049 and EA-12-051 (TAC NOS. MF0982, MF0983, MF0988, MF0980), ADAMS Accession No. ML15307A314.

MODIFICATIONS - COMPLETE

The modifications supporting the FLEX strategies for Turkey Point Units 3 and 4 have been fully implemented in accordance with the station design control process.

EQUIPMENT – PROCURED AND MAINTENANCE & TESTING - COMPLETE

The equipment required to implement the FLEX strategies for Turkey Point Units 3 and 4 has been procured and designed in accordance with NEI 12-06, Section 11.1 and 11.2, received at the site, initially tested/performance verified as identified in NEI 12-06, Section 11.5, and is available for use.

Subsequent maintenance and surveillance testing will be conducted through the use of the Turkey Point surveillance and preventative maintenance programs such that equipment reliability is maintained.

PROTECTED STORAGE - COMPLETE

The storage facility required to support the FLEX strategies for Turkey Point Units 3 and 4 has been completed and provides protection from the applicable site hazards. All the N and +1 equipment required to implement the FLEX strategies for Turkey Point Units 3 and 4 are stored in this building or in seismic category 1 buildings for time critical actions.

PROCEDURES - COMPLETE

FLEX Support Guidelines (FSGs), for Turkey Point Units 3 and 4 have been developed, and integrated with existing procedures. The FSGs and affected existing procedures have been implemented in accordance with the site procedure control program.

TRAINING - COMPLETE

Training for Turkey Point Units 3 and 4 has been completed. Training was developed and implemented in accordance with the systematic approach to training as recommended in NEI 12-06, Section 11.6.

STAFFING - COMPLETE

The staffing study for Turkey Point has been completed in accordance with 10 CFR 50.54(f), "Request for Information Pursuant to Title 10 of the Code of Federal Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," Recommendation 9.3, dated March 12, 2012, as documented in FPL letter L-2014-345 dated November 20, 2014, "FPL/Turkey Point Plant Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 9.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident, Emergency Preparedness – Phase 2 Staffing Assessment." As stated below, the strategies were successfully validated using the site's minimum staffing, therefore no changes to the submitted study are necessary.

NATIONAL SAFER RESPONSE CENTERS - COMPLETE

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

VALIDATION - COMPLETE

Turkey Point has completed performance of 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 Overall Integrated Plan (OIP) / Final Integrated Plan (FIP) for Order EA-12-049.

FLEX PROGRAM DOCUMENT - ESTABLISHED

The NextEra Fleet and Turkey Point Units 3 and 4 FLEX Program Documents have been developed in accordance with the requirements of NEI 12-06.

Attachment 2

Turkey Point Audit Open Item Closure Summary

Audit Item Reference	Subject	NRC Request	Required Action	Tracking Document Response to NRC
ISE OI 3.2.1.9.A	RCS Injection	The staff reviewed Turkey Point's RCS inventory coping strategy, which involves an alternate approach to NEI 12-06. During the onsite audit, the licensee indicated that Turkey Point's strategy solely relies on repowering one of three installed charging pumps. The staff questioned if diversity is present in the licensee's RCS strategy, since it relies on charging pumps only and no portable pumps supplying RCS makeup among the equipment available in phase 2, nor among the equipment requested from the National SAFER Response Centers (NSRC's) for phase 3.	After conclusion of the onsite audit, the licensee indicated that they are revising their strategy to have the capability to inject into the RCS using a NSRC high pressure pump and are in the process of completing a hydraulic analysis of the pump. The staff requested that the licensee make available details of the revised strategy (connection points, flow path, etc.) and the hydraulic analysis.	The FLEX Support Guidelines were updated to provide the connection points, instructions to connect and use the pump, and the flow path. The hydraulic analysis supporting the strategy was provided to NRC and is referenced in the FIP. This open item is considered satisfied.
ISE CI 3.2.1.B	ELAP Modelling	Turkey Point is one of a small number of sites using RETRAN-3D to model an ELAP event. During the exit meeting, the staff indicated that they have no additional questions regarding FPL's use of RETRAN-3D. However, the staff is tracking this item to ensure sufficient time to complete the review of the adequacy of the RETRAN-3D code modeling.	None	The staff completed the review of the RETRAN-3D model and the NRC Project Manager closed the open item with no further questions. See next item for additional information.

Audit Item Reference	Subject	NRC Request	Required Action	Tracking Document Response to NRC
ISE CI 3.2.1.2.A, AQ 52-c	RCP Seals	Due to a number of plants using Flowserve low leakage seals, Flowserve submitted a white paper on the generic use of the seals that plants can reference. The staff is currently reviewing the generic use of the Flowserve low leakage seals.	None	The staff completed the review of the Flowserve low leakage seals white paper and found it to be acceptable with some caveats that were submitted in letter from the NRC to NEI. The caveats were reviewed and a response was provided on how those were met. After review of the response, some additional information was requested. Specifically, a clarification of how the performance of the new Flowserve NX seal was modelled with respect to leakage rates and the fluid density used in the RETRAN model as compared to the white paper parameters. After the additional information was provided, the open action was closed by the Project Manager. A discussion of the reconciliation of the RETRAN model and Flowserve NX seal performance is provided in the FIP.

Turkey Point Units 3 and 4

FLEX

Final Integrated Plan

(Engineering Evaluation PTN-ENG-SEMS-16-003, Attachment 1)

Following 106 pages

FINAL
OVERALL
INTEGRATED
PLAN
DOCUMENT

Turkey Point Nuclear Station
Units 3 & 4
June 2016

Table of Contents

1. Introduction

In March of 2011, an earthquake-induced tsunami that was Beyond-Design-Basis (BDB) flooded the Fukushima Dai-ichi Nuclear Power Station in Japan. The flooding caused the emergency power supplies and electrical distribution systems to become inoperable, resulting in an Extended Loss of Alternating Current (AC) power (ELAP) on the site. The ELAP led to (1) the loss of core cooling, (2) loss of spent fuel pool (SFP) cooling capabilities, and (3) a significant challenge to maintaining containment integrity. Fuel elements were damaged 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 5.1) 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. The NRC issued two Orders, EA-12-049 and EA-12-051, to enhance safety at pressurized water reactors.

The orders were EA-12-049 (Reference 5.2) to implement mitigation strategies for Beyond-Design-Basis External Events (BDBEEs) and EA-12-051 (Reference 5.5) to install reliable SFP instrumentation for monitoring SFP water level.

All of the basis documents, analysis and reference documents are captured in an engineering document referred to as the Fukushima FLEX Strategy Implementation Umbrella Modification (Reference 5.33). A document was created to describe how the program is implemented and managed (Reference 5.34). This is referred to as the FLEX Program Document.

2. Regulatory Evaluation

2.1 Order EA-12-049

NRC Order EA-12-049 required licensees of operating reactors to submit an overall integrated plan, including a description of how compliance with these requirements would be achieved by February 28, 2013 and the for six month progress updates to be provided to the commission. The overall integrated plan and 6 months updates were provided in references 5.24, 5.25, 5.26, 5.27, 5.28, 5.31 and 5.32. 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. Compliance with Order EA-12-049 for both Units 3 and 4 was declared on April 22, 2016.

The Nuclear Energy Institute (NEI) developed NEI 12-06 Revision 2 (Reference 5.3), which provides guidelines for nuclear stations to assess extreme external event hazards and implement the mitigation strategies specified in NRC Order EA-12-049. The NRC issued Interim Staff Guidance JLD-ISG-2012-01 Revision 1 (Reference 5.4), dated February 22, 2016, which endorsed NEI 12-06 with clarifications for determining baseline coping capability and equipment quality. The Turkey Point Station Final Integrated Plan conforms to NEI 12-06 Revision 2 and JLD-ISG-2012-01 Revision 1 with the exception of attachments not related to the Order but to be used for future submittals such as the Mitigating Strategies Assessment for Seismic and Flooding.

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

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

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

4. Licensees must be capable of implementing the strategies in all modes.

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

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

- Phase 1 - The initial phase requires the use of installed equipment and resources to maintain or restore core cooling, containment and SFP cooling capabilities.
- Phase 2 - The transition phase requires providing sufficient, portable, on-site 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 off-site resources to sustain those functions indefinitely.

2.2 Order EA-12-051

NRC Order EA-12-051 (Reference 5.5) 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.

NEI 12-02 (Reference 5.6) 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 5.7), conformance with the guidance in NEI 12-02 is an acceptable method for satisfying the requirements in Order EA-12-051.

Other recommendations by the NTTF resulted in requests for information that were used to inform the FLEX strategies (Reference 5.17).

3. Technical Evaluation of Order EA-12-049

3.1 Summary of Mitigation Strategies

The objective of the FLEX strategies is to establish capability in order to 1) prevent damage to the fuel in the reactors, 2) maintain the containment function and 3) maintain cooling and prevent damage to fuel in the SFP using installed equipment, on-site portable equipment, and pre-staged off-site resources. This coping capability will address an extended loss of AC power – loss of off-site power and emergency diesel generators, but not the loss of AC power to buses fed by station batteries through inverters – with a simultaneous loss of access to the ultimate heat sink. This condition could arise following a BDBEE which results in failures and conditions that exceed the design basis of the plant, and its duration is indefinite.

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

The strategies for coping with the plant conditions that result from an ELAP/LUHS event are implemented at PTN as follows:

- Phase 1 – Initially cope by relying on installed plant equipment. During the initial coping period, only installed plant equipment and the minimum station operating staff are used to maintain the essential functions of core cooling, containment integrity, and SFP cooling. The duration of Phase 1 at PTN is expected to be less than 8 hours. The 8 hours accounts for the longest expected time for debris removal (approximately 2 hours) and deployment and placing into operation the first piece of Phase 2 FLEX equipment.

- Phase 2 – Transition from installed plant equipment to on-site FLEX equipment. During the transition phase, on-site FLEX equipment is deployed by the on-site minimum station staff augmented with emergency personnel responding from off-site to maintain essential functions. Phase 2 durations begin once the Phase 2 equipment is deployed and operating to meet plant needs. Phase 1 equipment may continue to be used in Phase 2. Phase 2 equipment and strategies will continue to be used until no longer required. This could be in as little time as 24 hours (earliest availability of Phase 3 equipment from off-site per NEI 12-06) or the Phase 2 equipment could be used indefinitely.

- Phase 3 – Obtain additional capability and redundancy from off-site equipment and resources until normal power, water, and coolant injection systems are restored. For the long term (indefinite) phase, off-site FLEX equipment from the National SAFER Response Center (NSRC) is deployed to maintain essential functions. Phase 3 durations begin once off-site equipment is deployed and operating to meet plant needs. Phase 3 equipment is assumed to be available as early as 24 hours after the BDBEE but no later than 72 hours after the BDBEE.

The specific duration of each phase is established based on prudent and realistic response times for the station staff to mobilize and implement applicable strategies in a manner that does not inhibit the emergency response. These times ensure that substantial margin exists in maintaining or restoring core cooling, containment, and spent fuel pool cooling to accommodate the many unknowns associated with a BDBEE.

The strategies described 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 Turkey Point Units 3 & 4. 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.

A simplified description of the Turkey Point Integrated Plan to mitigate the postulated ELAP event is as follows:

<u>In Modes 1-4 and Mode 5 with steam generators available</u>

The PTN strategy for the plant initially at 100% power removes the core decay heat by maintaining feedwater flow to the steam generators (SGs) and releasing steam from the SGs through the Main Steam Safety valves (MSSV) or the Steam Dump to Atmosphere valves (SDTA), if available. The flow will initially be added by one of three redundant turbine-driven auxiliary feedwater (TDAFW) pumps taking suction from a condensate storage tank (CST). A portable diesel-driven pump, FLEX Well Pump, is used to refill the CST from an artesian well, designated as the FLEX well, for the duration of the TDAFW pump operation. When the TDAFW pumps can no longer be operated reliably, the FLEX Well pump supplied from the FLEX well will be used to add water to the SGs directly.

When CST makeup is available from the FLEX well or alternate sources the reactor coolant system (RCS) will be cooled down and depressurized utilizing the SGs. Upon RCS depressurization, the safety injection accumulators will partially inject into the RCS assisting with inventory and reactivity control.

For each unit, a FLEX diesel generator (DG) will be used to reenergize vital 480 volt AC load centers. This will provide power to the installed battery chargers to keep the necessary direct current (DC) loads energized. The FLEX DG will also power one of three redundant charging pumps per unit and a boric acid transfer pump to enable borated water injection from the Boric Acid Storage Tank (BAST) for additional RCS makeup and reactivity control. In addition, a high pressure pump is provided by the NSRC and can be used as a backup means of providing RCS makeup.

This strategy is applicable whenever SG cooling is available or recoverable. The timing may vary due to RCS temperature, decay heat level, RCS boration status; however, in all other cases, the time line for the plant being initially at 100% power remains bounding.

The sequence of events for Turkey Point Unit 3 and 4 during an ELAP event occurring with both units at 100% power with Steam Generators available is provided in Table 2. This table lists the critical activities and timing in response to ELAP/LUHS and rational for validation of time sensitive tasks.

<u>In Mode 6 and Mode 5 without steam generators available</u>

With the steam generators unavailable in Mode 5 and Mode 6, the source of makeup to the RCS for core cooling is the borated water in the Refueling Water Storage Tanks (RWST). Makeup to the RCS would begin early in Phase 1 by gravity draining into the RCS. In Phase 2, makeup can be supplied from the RWST through a repowered charging pump. As the RWST is depleted, borated RCS makeup can be made utilizing water supplied from the FLEX well mixed with borated water from the boric acid storage tanks or batching tank. In the long-term, additional equipment, such as 4160 volt AC generators and high flow pumps will be delivered from the NSRC to repower the residual heat removal system and provide an alternate method of using the component cooling water (CCW) system as the heat sink.

<u>Spent Fuel Pool Cooling</u>

During an ELAP event, normal cooling to the SFP will be lost and the SFP water may reach the boiling point. In the worst case using very conservative heat loads, it would take 33 hours to boil down to the top of the fuel assemblies. A portable pump (SFP FLEX Pump) will be used to add water via hoses to the SFP. A hose will be connected to inject or spray water directly into the pool or the hose can be hooked up to the hardened discharge piping of the SFP cooling pumps in an adjacent room. This injection capability will ensure that a sufficient volume of water remains above the top of the stored fuel assemblies in the SFP at all times. The SFP FLEX pump will take suction from the intake canal or a non-robust but better quality source such as the raw water tanks if available.

3.2 Reactor Core Cooling and Heat Removal Strategy

A coping strategy has been developed to prevent damage to the fuel due to an ELAP and LUHS event. The systems, structures and components (SSCs) of Units 3 and 4 associated with reactor core cooling following an ELAP and LUHS event, including the modification that were made to implement FLEX, are essentially identical and, therefore, the three phase strategy developed is the same for both units.

Reactor core cooling also requires baseline capabilities for several safety functions. These safety functions include reactor core cooling and heat removal (with the steam generators available), RCS inventory and long-term sub-criticality, and core cooling and heat removal for Mode 6 and Mode 5 (with steam generators not available to remove decay heat). This is covered in Section 3.11.

3.2.1 Phase 1

Immediately following the event, reactor core cooling is accomplished by natural circulation of the RCS through the steam generators (SGs) following the guidance of the Emergency Operating Procedures (EOPs). The steam generators are supplied by the AFW system and steam pressure is controlled either by the Main Steam Safety Valves (MSSV's) or the Steam Dump to Atmosphere valves (SDTA) if they are available (i.e. control power and air survive). The main active components associated with this strategy are the Auxiliary Feedwater (AFW) pumps. All three turbine-driven pumps have DC powered flow control valves and controls that are automatically actuated on a loss of AC power to provide feedwater for the removal of reactor core decay heat.

AFW pumps can supply feedwater flow to both units through individual air-operated flow control valves (FCVs). Control of the FCVs from the control room would utilize the safety related and seismically mounted nitrogen supply bottles in the scenario. Supply lasts for a minimum of 2 hours per AFW train. Additional installed nitrogen capacity (available by "valving-in" normally isolated nitrogen bottles) extends FCV control from the main control room. After the nitrogen bottles are exhausted, replacement of the nitrogen bottles can be replaced or the FCVs can be operated using hand-wheels.

In addition, two of the AFW turbine steam admission valves will remain open (one on each train) even if power is lost to their DC motors should power to the station batteries' chargers be delayed. The third steam admission valve is aligned to train 2 and will remain closed as it requires 480V AC power to operate. This operation of the AFW system maintains SG level to maintain the steam generators as the heat sink.

Suction to the AFW pumps is from either Unit's Seismic Class I Condensate Storage Tanks (CSTs). Each CST has a nominal available inventory of 233,075 gallons. For tornado events, only one CST at minimum inventory is assumed to survive. Also, for hurricane (Category 4 or 5) events, only one CST at maximum inventory, 250,000 gallons, is assumed to survive. For seismic and other non-missile events, both CSTs are assumed available with this nominal inventory available in each. Note that plant procedures for severe weather preparations require that the plant be placed in Mode 5 prior to the arrival on-site of Category 4 or 5 hurricane force winds. Therefore, for the Modes 1 through 4, the tornado event is the most limiting BDBEE with respect to time constraints for the core cooling function.

A decay heat calculation was performed to analyze the length of time a single CST can supply flow to the steam generators for both units assuming each unit is at 100% power for 100 days prior to the event (Reference 5.39). The calculation shows that the volume of water required to cool down the plant (i.e., remove sensible heat as well as decay heat) is significantly greater than that required to maintain plant temperatures (i.e., only remove decay heat). By only removing decay heat (i.e., no cooldown), the minimum CST volume is capable of providing approximately 12 hours of feedwater with one CSTs inventory split between both units.

To preserve the CST inventory if one CST is lost, plant cooldown will be delayed until a CST makeup supply has been established At this point, cooldown may proceed without the risk of drying out the steam generators because the CST(s) is being replenished at a rate greater than the demand. The cool down is performed under the guidance of procedures 3/4-FSG-09 (Reference 5.55). At approximately 9 hours after the event, the FLEX Well pump will be in place and capable of operation to provide makeup to the CST. The FLEX Well pump is capable of supplying flow for decay heat removal and sensible heat removal for both units.

Delaying the plant cooldown until Phase 2 for the worst-case scenario supports the FLEX coping strategies in three ways: (1) extends the time in which initial CST inventory is available, thereby allowing more time to establish CST makeup; (2) allows more time for establishing supplemental FLEX equipment for plant cooldown using Steam Dump to Atmosphere (SDTAs); and (3) allows additional time for establishing 480V AC availability to close the Safety Injection (SI) Accumulator isolation valves to prevent injecting nitrogen as the RCS depressurizes.

The SDTAs at PTN are air-operated valves supported by a non-safety related, non-robust backup nitrogen system. If available, the backup nitrogen system is capable of supplying nitrogen to the SDTAs for both units for a minimum of 2 hours. If operation of the SDTAs are unavailable as a result of the BDBEE, then RCS pressure and temperature is maintained by the main steam safety valves (MSSVs). The use of the MSSVs is the credited strategy for maintaining RCS pressure and temperature during Phase 1. The MSSVs will maintain RCS temperature and pressure slightly above normal no-load values, thus not challenging the pressurizer PORVs or RCS safety relief valves. Plant cool down may commence when a CST makeup supply is established and nitrogen bottles are in place to permit local SDTA operation. Calculations were performed to size the bottles needed for this operations (Reference 5.41).

Pressurized Water Reactor Owner's Group (PWROG) guidance given in WCAP-17601-P (Reference 5.13) recommends cooling down the plant approximately 6 hours after the ELAP and LUHS event has occurred. This would be done if both CSTs are available. However, if CST inventory limitations exist such as with the loss of one tank, a delayed cooldown is preferable. One of the primary drivers in the WCAP for cooling down this early is to minimize RCS inventory loss due to RCP seal leakage. This issue is a larger concern for plants with older RCP seal packages subject to significant leakage without seal injection present. PTN has installed low leakage seals that will reduce RCP seal leakage at normal operating pressure and temperature to near zero gpm per RCP when the controlled bleed-off (CBO) isolation valves are closed. This is done early in the event and maintained for several hours thereafter until the RCS is depressurized. Because of this, RCP seal failure or RCS inventory losses are not as critical, and the cooldown can be delayed until the capability to refill the surviving CST is established.

Extended coping times are achievable by maintaining sufficient RCS inventory to provide natural circulation without having to provide makeup to the RCS. The RCS inventory, and thus the time when natural circulation is available are maximized by reducing or eliminating RCS leakage. The newly installed low leakage RCP seals significantly reduce leakage thereby allowing for natural circulation for an extended period of time. Section 3.2.4.10.2 provides the results of the RCS analysis using the RCP seals leakage values. In summary, this analysis determined that reactor coolant makeup is not required until Phase 2.

Injection for reactivity control is not required during Phase 1 (Section 3.2.4.10.4).

Hurricane Scenario - PTN has substantial defense-in-depth preparation plans for the hazards posed by hurricanes and tropical storms due to the plant's geographic location and operating experience. PTN has procedural guidance to mitigate potential impacts due to such storms. Current severe weather plant procedures require the units to be shut down before hurricane force winds arrive at the site. For severe hurricanes (e.g. Category 4 or 5), the units are cooled down to Mode 5 at least 2 hours prior to the arrival of hurricane force winds on-site, as well as pre-staging small gas/diesel generators, gas/diesel powered dewatering pumps, and topping off major water tanks. Therefore, actions taken in response to hurricane events will be different from other events due to the state of the plant, the volume of water available, additional available staff and limited access to plant areas due to high winds. For this reason, the strategy developed to cope with an ELAP and LUHS event initiated by a hurricane has a different timeline and initial conditions than all other initiating events.

For a severe hurricane event, only one CST is assumed to survive (Reference 5.19, App. 5E) with the surviving CST topped off to the maximum capacity per plant severe weather preparation procedures. With the plants cooled down to Mode 5 in preparation for the hurricane, decay heat calculations show that the inventory from a single, topped off CST will last for approximately 24 hours when providing the SG makeup needs of both units (Reference 5.39). The initial coping strategy for this scenario is to allow the RCS to heat up from Mode 5 to Mode 4 and to establish natural circulation using the steam generators. This is the strategy for all ELAP BDBEEs that occur while the plant is in Mode 5 with SGs available.

In a tornado event, only one CST is assumed to survive, however, the event is much shorter in duration so the hurricane event bounds this event with respect to deployment of equipment for the strategies.

Electrical/Instrumentation – The 125V DC power supplied from plant batteries remains available and 120V Vital AC powered from the DC buses through inverters remains available. All required permanent electrical distribution equipment and circuits including batteries and battery chargers are designed to Class 1E requirements and are located in Class 1 structures thus protected from external hazards. The 125V DC and 120V AC distribution remains available as long as battery capacity is available. An extended load shed strategy has been developed and involves opening breakers in 5 rooms (all located in the control building). The load shedding strategy is directed by procedure 0-FSG-04 (Reference 5.50). This extended load shed strategy will de-energize the DC backed Main Control Room (MCR) lighting, which will be supplemented by portable lanterns (permanently located in the MCR) prior to the load shed.

Two cases have been evaluated (Reference 5.45); the first case assumes a deep load shed occurs within 90 minutes to conserve battery power and credits use of the spare battery. The second case involves an ELAP event combined with a severe hurricane. This second case assumes a deep load shed occurs within 90 minutes, but in this case, the 120V Vital AC buses are powered by pre-deployed and protected portable 6 kW generators. The inverter loads are removed from the battery in this scenario. This provides for decreased load on the batteries extending their life until it is safe to deploy the 480V AC FLEX Diesel Generators.

For Case 1, using a deep load shed and the spare battery, 125V DC and 120V Vital AC buses are available for 21 hours. Based on projected durations for damage assessment, debris removal, and deployment of the FLEX Diesel Generators, the expected return of battery charging capability is within 8 hours of the ELAP. This is well within the time that the first DC bus would require switching to the spare battery at 10.9 hours.

For Case 2 (ELAP event combined with a severe hurricane), using a deep load shed, powering the 120V Vital AC buses using portable 6 kW generators (one per unit), unloading the static inverters, and using the spare battery 125V DC and 120V Vital AC power is available for over 49 hours. Based on projected durations for damage assessment, debris removal, and deployment of the FLEX Diesel Generators, the expected return of battery charging capability is well within this time frame.

3.2.2 Phase 2

Several actions are required during Phase 2 following the event for reactor core cooling. The main strategy is dependent upon the continual operation of the AFW pumps, which are only capable of feeding the steam generators as long as there is sufficient steam pressure to drive the AFW pump turbines. The Phase 2 FLEX Well pump is used to refill the surviving CST(s) from the FLEX well (artesian well) for the duration of AFW pump operation. The FLEX Well pump will be capable of supplying in excess of 600 gpm to ensure that the inventory requirements in Phase 2 will be met based on WCAP-17601-P (Reference 5.13).

Additionally, per guidance of NEI 12-06, Phase 2 will include the ability to use portable pumps to directly provide SG makeup. The FLEX Well pump is used to provide water/makeup to the SGs directly in the event that the AFW pumps fail or when sufficient steam pressure is no longer available to drive the AFW pump turbines. The method to implement this capability is to depressurize the steam generators to allow for makeup from the FLEX Well pump (previously used to refill the CST(s)) and to realign flow from the CSTs to the AFW piping that supplies the steam generators. These strategies are directed by procedures 0-FSG-03 and 3/4-FSG-09 (References 5.49 and 5.55)

To achieve the capability of providing a backup supply to the CSTs before initiating plant cooldown, the FLEX Well pump will be in place and capable of operation at approximately 9 hours after the event. The FLEX Well pump is capable of supplying the required flow for decay heat removal and sensible heat removal to initiate a cooldown. The cooldown rate is variable based on AFW and FLEX Well pump flow rates and the remaining inventory in the CST(s).

A single CST is capable of providing a minimum of 12 hours of water for steam generator injection using a single AFW pump injecting to both units for decay heat removal. Prior to depletion, the CSTs will be provided makeup from the FLEX well. The FLEX well is the ultimate water source for maintaining inventory for SG injection including Phase 3. This source of non-nuclear grade water was evaluated to ensure the effects of the well water chemistry, over the time it would be used. The results of this evaluation determined that the use of this well water would not significantly reduce the SG heat transfer capability through a period of at least 120 hours (Reference 5.35)

At 12 hours following the event, the decay heat calculation shows that the flow rate required to remove decay heat is equal to 96 gpm per Unit (Reference 5.39). To remove sensible heat from the RCS using a 75°F per hour cooldown rate requires approximately 325 gpm of feedwater per Unit. This cooldown will not be started until makeup to the CST is available; nitrogen bottles are available for SDTA operation, and one auxiliary feedwater pump for each unit are available. Depressurization of the steam generators may require deploying nuclear plant operators (NPOs) to locally complete this activity if manual loaders are utilized. If the nitrogen bottles are connected to the nitrogen header on the main steam platform, and SDTAs are intact, they may be controlled from the control room. The steam generators will be depressurized via the SDTAs to a pressure of approximately 220 psig. At some point in Phase 2, the FLEX Well pump can be placed in operation with suction from the FLEX well and injection directly into the steam generators using the connection points installed downstream of the AFW pumps.

For RCS inventory control and long term sub-criticality during Phase 2, the credited action is to cool down and depressurize the RCS for injection of boron and coolant inventory from the boric acid storage tanks. Depressurizing the RCS to inject the accumulators occurs when the steam generators are depressurized per emergency operating procedures. The best estimate analysis using the RETRAN computer code determined that for RCS makeup, some of the accumulator liquid inventory is injected into the RCS before the accumulators are isolated (Reference 5.47). This volume is credited for inventory control but conservatively not credited for reactivity control.

The heat removed by depressurizing the steam generators also cools and depressurizes the RCS. The initial method for accomplishing RCS makeup in Phase 2 is the use of the charging pumps to make up for losses from the RCP seals and for contraction of the primary coolant due to cool down. Following injection of the accumulators, additional makeup is from the Boric Acid Storage Tanks (BAST) injected through the installed boric acid transfer pumps and the charging pumps. Flow to the RCS can be accomplished via the normal charging path or alternatively through the reactor coolant pump seal injection lines. The charging and boric acid transfer pumps are powered from the FLEX Diesel Generator. Cooling water is required for operation of the charging pump and it supplied by the FLEX Well pump. The strategy for RCS inventory control is directed by procedures 3/4-FSG-01 and 3/4-FSG-08 (Reference 5.48 and 5.54).

The methods for injecting borated water into the RCS provides sufficient negative reactivity to ensure that shutdown margin is maintained following cooldown and xenon decay. Injection for reactivity control is required at 13 hours to ensure adequate boric acid concentration is provided to the RCS (Reference 5.61).

Prior to injection of nitrogen from the accumulators, RCS pressure is reduced and stabilized by reducing steam generator pressure to 220 psig. This reduces RCS temperature and pressure. Prior to additional RCS cooldown and depressurization, the accumulator isolation valves are closed. This isolation is done by repowering and closing the 480V AC accumulator isolation valves using the FLEX Diesel Generator. Figure 1 provides an overview of Phases 1 and 2 water movement lineups.

The electrical portion of the Phase 2 coping strategy following the ELAP and LUHS events is to stage and connect a 480-VAC diesel generator to power selected loads. The loads which may be powered by the Phase 2 FLEX Diesel Generator (DG) include the battery chargers that supply the Class 1E 125V DC Switchgear. When power from the FLEX DG is restored to the Class 1E Load Centers, all interlocks and protective features for the loads are re-enabled.

Additional guidance has been added to stage 6 kW portable generators and associated cabling prior to the arrival of hurricane force winds from Category 4 or 5 hurricanes. During a prolonged hurricane event the generators are dedicated to supply power to vital AC panels until the FLEX DG is operational. The generators are within the turbine building mezzanine level where they are protected from the effects of wind and wind-driven missiles.

Figures 6 and 7 provide the FLEX Electrical Lineups. The portable 480-VAC FLEX DGs, the 6kW portable generators, and the required power cables are stored in the FLEX Equipment Storage Building and will be transported from this location to their staged positions (Figure 8).

3.2.3 Phase 3

The Phase 2 strategy for core cooling and decay heat removal strategy can be utilized for an extended period of time until it is desired to transition to a Phase 3 recovery configuration wherein offsite equipment is used to restore normal functions to cool the reactor, containment building, and spent fuel pools.

As determined by the Emergency Response Organization (ERO), an NSRC pump capable of removing heat from the reactor core in addition to supporting other loads including the SFP may be utilized. The ideal flow path for decay heat removal is to utilize piping in the Intake Cooling Water (ICW) system. The Residual Heat Removal (RHR) system would require re-powering the RHR pump via an off-site turbine generator to establish recirculation in the RCS. Heat removal would be through the RHR heat exchangers which are cooled by establishing flow through the CCW system. The CCW pumps are also powered by the off-site turbine generator. The CCW heat exchangers would transfer the heat from this and other loads to canal water which is supplied by a pump provided by the NSRC through the ICW piping.

The CCW system provides cooling to the RHR heat exchangers as well as to the SFP heat exchangers, the RHR pump seal coolers, and the Emergency Containment Coolers (ECCs). The diesel-driven NSRC Cooling Water pump is sized to provide the flow required to remove all decay heat from the irradiated fuel located in the unit's reactor core and SFPs as well as the heat that has been rejected to the containment atmosphere. The NSRC Cooling Water pump (one per unit) will be connected to an existing ICW basket strainer utilizing a manifold stored in the FLEX Equipment Storage Building. Valves in the ICW system will be aligned to maximize pump flow to the operating CCW, RHR, and SFP heat exchangers (Figure 9).

The RHR pumps, CCW pumps, ECCs and SFP pump, and associated equipment will be powered through the electrical distribution system in Phase 3 by NSRC 4kV Turbine Generators.

For RCS injection in Phase 3, the boric acid batch tank is available to produce borated water to supplement the BAST and RWST, utilizing water supplied by the FLEX well. When available from off-site, demineralized water will be utilized for makeup to the boric acid batch tank.

Connections have been identified and a strategy has been developed to utilize an NSRC high pressure pump as a backup to the charging pumps for RCS inventory control.

3.2.4 Reactor Core Cooling Strategies Evaluation

3.2.4.1 Auxiliary Feedwater System

The Auxiliary Feedwater (AFW) System supplies feedwater to the steam generators at times when the normal feedwater system is not available. Two CSTs provide a source of water to the AFW pumps. Three steam-turbine-driven auxiliary feedwater pumps are installed for Turkey Point Units 3 and 4. The three pumps are installed such that each supplies auxiliary feedwater to either Unit 3 or 4, with any single pump supplying the total decay heat feedwater requirement to both units. Normal water supply to the auxiliary feedwater pumps is from two 250,000 gallon CSTs, through locked open gate valves and check valves. The Auxiliary Feedwater Cage houses the AFW pumps and turbine drivers used to supply the SGs with the required feedwater. The pumps are protected from high winds and external missiles by their location in the Turbine Building. The CSTs protection with respect to BDBEE is discussed in Section 3.2.4.4.

3.2.4.2 Steam Generator Steam Dump to Atmosphere Valves (SDTAs)

The functions of the Main Steam System (MSS) are maintained following the ELAP. The Steam Dump to Atmosphere (SDTA) valves are used to remove heat from the RCS by providing a variable operator selected steam load. These valves are well protected from wind driven hazards by their elevation and location behind substantial structures including the containment buildings to the east and structural steel enclosure to the north, south and west.

The required SDTA heat removal rate for a 25°F/hr cooldown under natural circulation conditions is calculated. The calculation shows the maximum possible heat transfer across the SG tubes under natural circulation conditions and the maximum possible SDTA heat transfer capacity at a given steam generator pressure. The maximum possible SDTA and steam generator heat removal rate is greater than three times the 25°F/hr cooldown rate. Therefore, the SDTA and SG can achieve a 75°F/hr cooldown rate under natural circulation conditions.

The credited method for operation of the SDTA for FLEX is to use bottled nitrogen and hand loader to locally operate each of the SDTAs. An additional method is available that allows remote operation of the SDTAs from the Main Control Room (MCR). To utilize this method, verification is required that control power remains available to the SDTAs and additional nitrogen bottles, regulators, and air hose are connected to the nitrogen header on the main steam platform and replace the non-robust instrument air supply. The nitrogen bottles, regulators and hand loaders are located in a protected location on the turbine deck.

3.2.4.3 Batteries

Batteries 3A, 3B, 4A and 4B are located within robust structures designed to meet applicable design basis (see Section 3.5) external hazards and will be used to power required key instrumentation and applicable DC components. Each of the four 125V DC station batteries has two dedicated safety related battery chargers powered by separate power supplies. The spare battery is normally not aligned to a DC Bus and is available as a backup for any of the four normal batteries.

3.2.4.4 Condensate Storage Tank

Both CSTs are rugged structures designed to withstand the design basis seismic and wind events. They are partially surrounded by a security barrier that is constructed of structural steel and steel grating. Although the security barriers are not designed to withstand the design basis missiles and therefore not considered "robust" as defined in NEI

12-06, they would absorb substantial energy from wind driven missiles such that impacts to the CST's would be largely attenuated for a large portion of their height.

Nevertheless, the current licensing basis considers one tank to be lost due to impact by a tornado missile with the other surviving since they are at opposite ends on the east side of the Turbine Building, separated by several hundred feet and intervening structures. The FLEX strategy is consistent with the licensing basis in that it assumes that one tank is lost and that the other is supplying the water inventory for steam generator cooling water makeup for both units. Per UFSAR Chapter 5 Appendix 5E, redundancy and spacing of the condensate storage tanks provide the required system capability in the event of damage to one component by a tornado missile. Therefore, if the CST of one unit is lost during a missile event with a coincidental loss of power, the CST of the opposite unit will be available to feed the SGs for a period of time since the tanks are cross-tied. The cross-tie includes check valves which prevent draining of the surviving CST.

3.2.4.5 Chemical and Volume Control System

The Chemical and Volume Control System (CVCS) is used to maintain a continuous feed and bleed on the RCS during normal plant operation. The bleed flow from the RCS is referred to as "letdown' and the return or feed flow, is through the "charging" path. The CVCS system components are part of the reactor coolant pressure boundary and provide the capability to shut down the reactor and maintain the safe shutdown condition through injection from the charging pumps. RCS makeup is supplied by re-energizing a charging pump from either train of electrical power in each unit. The charging pumps are located in the Class 1 Auxiliary Building, which is designed for seismic, wind and wind-driven missile impact loads. The charging pumps are located within the flooding protection barriers. Therefore, they are not susceptible to an external flooding event.

In conclusion, the charging pumps are protected against all BDBEEs. The charging pumps are energized from the FLEX Diesel Generator in Phase 2 to restore RCS makeup and reactivity control capability. Load Centers from each train are located in the same room, and will be electrically tied together such that all four in each unit are powered.

The Load Centers are located in a robust structure. In addition, the raceways to the pump motors and the pump motors themselves are also robust.

To provide additional defense-in-depth for the RCS inventory strategy, connections to the CVCS system have been identified in procedures such that a high pressure pump from SAFER can be utilized to perform the makeup and boration function as backup to the charging pumps.

3.2.4.6 Boric Acid Storage Tanks

The Boric Acid Storage Tanks (BASTs), boric acid batching tank, and system piping and valves remain available following the ELAP. The Batching Tank Mixer will be re-powered to mix the solution prior to transferring to the BAST. Any of the Unit 3 or Unit 4 Boric Acid Transfer Pumps can be aligned to either transfer from the Batching Tank to the BAST or transfer to the Blender since the system is cross tied via manual valves. The boric acid transfer pumps will be powered from the FLEX Diesel Generator.

3.2.4.7 Refueling Water Storage Tank (RWST)

For the Modes 1 through 4 ELAP, RCS inventory is maintained by the use of low-leakage RCP seals, injection of the accumulators, and makeup from the BASTs which provide sufficient volume until the recovery phase 72 hours after the initiation of the ELAP event. Therefore, the RWSTs are not needed during Modes 1 through 4 and mode 5 with steam generators available.

The following discussion describes that there is reasonable assurance that at least one tank would survive as backup to the primary strategy for RCS makeup in Modes 1-4 and in Mode 5 with SG's available as well as in shutdown modes without SG's available.

The Refueling Water Storage Tanks meet the requirements in NEI 12-06 for protection from seismic, high winds, and flooding events. The RWSTs are susceptible to tornado missile strikes.

The current UFSAR Chapter 5E indicates that the RWSTs are not required to achieve safe shutdown. However, Chapter 5E of the original Final Safety Analysis Report, which was reviewed and approved by the NRC as part of the initial operating license, identified that the RWSTs have adequate separation and redundancy to ensure one RWST would remain available following a design basis tornado missile event. Later versions of the UFSAR eliminated the need for the RWSTs as a boration source to maintain hot standby conditions and changed Chapter 5E accordingly.

The tanks have nearby structures on the west, north and south directions that provide full height shielding. On the east side, there are several structures that provide protection to the lower half of the tanks, and the Cask Crane and support structure that provides partial protection for the full height of both tanks. The structures surrounding the RWSTs would be expected to provide substantial protection for both tanks from the wind driven design basis tornado missiles.

NEI 12-06 Section 7.3.1(c) allows use of separation as a method for ensuring at least "N" FLEX equipment is available during tornado conditions provided the axis of separation considers the predominant path of tornados. Since adequate separation was found acceptable for the Turkey Point design basis tornado missile in the original plant licensing basis, the RWSTs are considered to have sufficient separation such that at least one tank or portions of both tanks will be available as a water source following a high wind event to support ELAP strategies for shutdown conditions in Modes 5 and 6. Nevertheless, if an RWST for a unit is not available, then blended borated water from the BAST utilizing the FLEX Well pump and batched boric acid can be used for makeup when SGs are not available.

3.2.4.8 FLEX Modifications

3.2.4.8.1 FLEX Well Pump Discharge Connections

The FLEX Well pump discharge connections for SG injection allow direct injection path to the Unit 3 and Unit 4 SG via the FLEX Well pump. Per NEI 12-06, the portable fluid connections for core cooling functions are expected to have a primary and an alternate connection or delivery point. In order to comply with NEI 12-06, two flanged hose connections in the AFW "A" & "B" pump discharge lines have been installed downstream of the pumps. These connections are used to attach temporary flanged hose adapters after a BDBEE and are angled to provide ease of connecting the flanged hose adapter and the hose. Each of these connections are capable of passing a 600 gpm volumetric flow rate. Both connections are located in the AFW cage where the AFW pumps and turbine drivers are located. The connections are located above grade level and within the flood protected boundary therefore protected from external flooding.

The AFW pumps and turbine drivers are provided with missile protection by their location in the turbine building which protects them in all directions. The associated piping is also protected by its location and physical separation between units 3 and 4 piping. The AFW valve stations (i.e. FCVs) and associated nitrogen back-up stations are protected from tornado missiles by their location as well as redundancy and separation.

The hose routing and personnel access is through the Turbine Building which has been evaluated for design basis seismic loading which far exceeds the reevaluated seismic hazard.

The new connections provide the flexibility to supply make-up water to the Steam Generators using Train 1 or Train 2 via valve manipulation. These connections are suitable for both the on-site FLEX equipment and the NSRC equipment. These flanged hose connections are designed to meet all the external hazards requirements including flooding. Protection from flooding is provided by flood barriers (stop logs, concrete blocks, etc.) around the perimeter of the turbine building.

3.2.4.8.2 CST Connections

As part of the Phase 2 coping strategy, refilling the Condensate Storage Tanks (CST) provides the inventory required to provide water flow to the Steam Generators. This is a time sensitive activity within the FLEX Strategies; therefore, making the connection to fill the CST time sensitive. Connection capability on each CST is required to allow fill capability utilizing the diesel driven FLEX Well pump which takes suction from the FLEX well. The strategy to deploy the FLEX pump is directed by 0-FSG-06 (Reference 5.52). Two connections have been installed to provide the ability to refill the CST. The primary connection is located on an abandoned-in-place level transmitter line for each CST. This connection consists of an isolation valve and a permanent hose connection. The alternate connection is located in the CST Roof Manhole Cover in each CST. For this connection, the CST manhole cover has been modified to include an elbow and a permanent hose connection angled downwards.

The primary CST connection (level transmitter line) will be located inside the Condensate Storage Tank Cage while the alternate CST connection will be located on the Roof Manhole Cover. Per UFSAR Chapter 5 Appendix 5E, redundancy and spacing of the Condensate Storage Tanks provide the required system capability in the event of damage to one component by a tornado missile. If one tank is lost due to missile impact with a coincidental loss of power, an adequate supply of water is available from the remaining tank to achieve hot standby for a period of time since the tanks are cross-tied. Based on the above, the new connections do not require protection from wind driven missiles. The connections were designed to meet the NEI 12-06 requirements (flooding, and loads from seismic and high wind events).

3.2.4.8.3 Boric Acid Batching Tank Injection

The Boric Acid Batching Tank is utilized in the coping strategy to batch the required borated water source to fill the Boric Acid Storage Tanks. The method of supplying water to the Batching Tank will be by opening the tank lid and routing the hose directly inside the tank. There are no physical modifications in order to utilize the Batching Tank. The water source is the FLEX well. The three Boric Acid Tanks are shared between both units with sufficient boric acid inventory to conduct an orderly shutdown and cool down of both units to cold shutdown conditions. Because the three tanks are located close to one another, missile protection is provided by concrete walls and ceilings of the Auxiliary Building. The boric acid pumps, filters and blender (batch tank), which are located adjacent to the tanks, are also missile protected by the concrete barriers. The boric acid used for batching is stowed and protected in the FLEX Equipment Storage Building.

3.2.4.8.4 Charging Pump Hydraulic Drive Cooler

As part of the Phase 2 coping strategy, the charging pumps are required to deliver inventory make-up to the RCS. To accomplish this strategy, the pumps require cooling water to the hydraulic drive cooler in order to operate for an extended period of time. The strategy uses the existing emergency service water "quick connect" connections to provide well water via the FLEX Well pump to the Oil Cooler Heat Exchanger. No physical modifications are required to utilize the existing connection. The charging pump hydraulic coupling cooler heat exchangers are located in the charging pump room adjacent to the charging pumps. The charging pumps are located in the Class I Auxiliary Building, which is designed for seismic, wind and missiles. Additional missile protection is not required.

3.2.4.8.5 Primary Makeup Water Line to Boric Acid Blender Connection

A modification was performed to install an isolation valve and 2 flanged connections on the existing Primary Makeup Water line where it can supply the Boric Acid Blender. These connections allow for normal boron mixing using well water supplied by a hose from the FLEX Well pump and boric acid from the BAST utilizing the boric acid transfer pumps. Discharge from the boric acid blender goes directly to the charging pump suction line for makeup to the RCS through either the normal charging or reactor coolant pump seal injection lines. The connections to the Primary Makeup Water line to the Boric Acid Blender are located in the

Auxiliary Building within the Charging Pump Room. The Auxiliary Building is a Class I structure designed for seismic, wind and missiles. Additional missile protection is not required.

3.2.4.8.6 FLEX Water Well

An artesian well that taps into the Floridan Aquifer has been constructed. This well provides an unlimited makeup source of water during a FLEX BDBEE to refill the CST or directly to the steam generators. Well water is also used to makeup to the RCS and cooling of the Charging pumps. Artesian wells take their water from an underground aquifer which is under positive pressure from a body of water at an elevation above the elevation from which the water is needed. The well head, piping and connections are located within concrete bunkers protecting them from wind and wind borne missiles. The well, well head, piping and connections have been designed for a seismic event, and as the well is buried, it is protected from the other extreme events specified in NEI 12-06.

3.2.4.8.7 Electrical Connections

For Phase 2, the modifications for Unit 3 installed a circuit breaker in spares cubicles of 480V Load Centers 3B and 3D, respectively. For Unit 4, the modification installed a circuit breaker in spare cubicles of 480V Load Centers 4B and 4D, respectively. In Load Centers 3A/3C and 4A/4C spare cubicles, circuit breaker/insert assemblies were installed to interface with the portable generator. Two terminal boxes in each unit are mounted above the 18' Elevation on the north side of the 3A and 4A Switchgear Room wall. A third terminal box, one for each unit, has been installed near the 3C/4C station service transformer at Elevation 31'. For Unit 3, permanent raceway and cable have been installed between one of the terminal boxes and the new circuit breakers installed at each B and D Train load center. The other terminal box is connected via permanent raceway and cable to a terminal box inside the load center. From there, connections are made using portable cables to the inserts installed in the A and C load centers. Unit 4 has a similar configuration.

The terminal boxes will be fed from a 480V portable diesel generator that is stored and maintained on site in FLEX Equipment Storage Building. The equipment is protected from seismic, hurricane, tornado, and wind generated missiles to ensure their availability.

In addition, cables and connectors are available to make a contingency connection directly from the FLEX 480 V DG to the breaker cubicle inserts on the A and C train load center of each unit. Procedural guidance has been provided in the FSGs for making this contingency connection. This is provided as backup to the primary and alternate connection boxes at the 18' elevation for both units.

The modifications described were reviewed for impacts due to the reevaluated flood hazards within the Flooding Hazard Reevaluation Report (Reference 5.20). The Unit 3 electrical connection boxes are installed outside the flood protection boundary on the North wall of PTN3 Switchgear Room. The electrical boxes are not completely above the maximum flooding elevation for their location, but the lowest elevation terminal is located above the maximum flood elevation and will not be energized until after flood waters recede. In addition, the boxes are NEMA-4X rated and are designed to provide a degree of protection with respect to water ingress. The PTN4 electrical connection boxes installed within the flood protection boundary and are above the flood hazard levels analyzed within the IAR.

To provide additional defense-in-depth, cabling is available to directly power the load centers from the portable diesel generators bypassing the connection buses should they be damaged.

Phase 3 does not require significant modifications to 4 kV Switchgear 3A/4A and 3B/4B in order to provide a temporary connection. The incoming circuit breakers from the C Bus are used as the incoming feeders for the temporary 4 kV turbine generator. The power for Phase 3 is provided by 4160V portable turbine generators that will be provided by the NSRC. The NSRC will be able to provide the generator and interconnecting cables to the site within 72 hours of the event. Once on site, the station will route the cables from the portable generator location to either the 3B/4B (Primary) or 3A/4A (Secondary) 4160V Switchgear. The cables will come equipped with the stress cones and lugs installed. Therefore, the existing feeders from the C Bus will be disconnected and the new temporary cables connected onto the breaker load-side terminals thus repowering the 4kV bus when the breaker is closed.

3.2.4.8.8 Reactor Coolant Pump Seals Upgrade

The existing Areva/Westinghouse Reactor Coolant Pump (RCP) seals were replaced with Flowserve N seals (specifically model NX seals). The RCP seals replacement is a three-stage configuration plus an abeyance seal designed to be installed on Westinghouse RCPs. To provide additional RCS inventory control during Phase 1 following a FLEX BDBEE, an accumulator for instrument air has been added to the controls for the Control Bleed Off (CBO) valve at each RCP to allow the valve to be held closed following a loss of offsite power and instrument air while RCS is still at or near normal operating pressures. FLEX strategies for subsequent phases following a BDBEE provide makeup to the RCS allowing for cool down and depressurization of the RCS, thereby lowering the potential seal leakage rate significantly.

The Flowserve NX shaft sealing system design consists of three mechanical face-type sealing stages arranged for assembly as a single piece cartridge unit for installation in the RCP. Since each of the three sealing stages is identical, additional redundancy in maintaining the RCS pressure boundary at the shaft seal is achieved resulting in improved seal reliability. Additionally, normal and maximum seal leakage rates are lower than those of the existing seal, thereby reducing charging flow from the Chemical and Volume Control System (CVCS) and reducing RCS inventory loss during plant transients. The Flowserve NX seal package has been tested and demonstrated that the leakage from the seals when injection is lost is very low (initially zero and approximately up to 1.7 gpm at 8 hours after injection is lost). In addition the seal package includes an abeyance, or shutdown, seal that activates on failure of all three stages when seal leakage past the third seal exceeds 4.25 gpm steam equivalent.

3.2.4.8.9 Intake Cooling Water Tie-ins

The Low Pressure/High Flow NSRC pumps will be connected to the existing Intake Cooling Water (ICW) Basket Strainers (BS) via a modified cover flange which acts as a manifold. In support of the Phase 3 UHS restore strategy, temporary basket strainer covers, each with six (6) integral 5" STORZ hose connections, will be available in the FESB. These covers allow injection of canal water into the Component Cooling Water (CCW) heat exchangers and serve as the final connection point required to allow UHS restore. The strainers are stored in the FLEX equipment storage building protected from all external hazards or supplied by the NSRC.

3.2.4.9 Key Reactor Parameters

Essential instrumentation and control functions are maintained by the 125V DC Class 1E batteries that are designed to power the safety related instrumentation. The extended load shedding performed within 90 minutes of the event provides monitoring function for one channel of the following essential parameters until the FLEX DG is available to supply all channels of required instrument loads:

- Steam generator water level
- Steam generator pressure
- Reactor coolant system pressure
- Reactor coolant system pressurizer level
- Reactor coolant system hot and cold leg temperatures

- Containment pressure
- Core exit thermocouples
- Reactor vessel level
- Neutron flux
- DC bus voltage
- CST level
- RWST level

All instrumentation was reviewed for environmental effects and determined to be adequate such that reliable indication will be available. Additionally, strategies are provided to take local readings of these key parameters should DC power be lost.

Portable FLEX equipment is supplied with the local instrumentation needed to operate the equipment. The use of these instruments is directed by procedure 0-FSG-07 (Reference 5.53).

3.2.4.10 Thermal Hydraulic Analyses

3.2.4.10.1 Secondary Analysis

A decay heat calculation was performed to determine the inventory required to maintain steam generator levels and times associated with the volumes. The results of this analysis showed that a single CST is capable of providing a minimum of 12 hours of water for steam generator injection using AFW pump injection to both units. Prior to depletion, the CSTs will be provided makeup from the FLEX well. At 12 hours following the event, the decay heat calculation shows that the flow rate required to remove decay heat is 96 gpm per unit. To remove sensible heat from the RCS using a 75°F per hour cooldown rate requires approximately 325 gpm per Unit during the four hour cool down period. This cool down will not be started until makeup to the CST is available from the FLEX well and nitrogen bottles are available for SDTA operation.

3.2.4.10.2 RCS Analysis

An RCS analysis was performed using the RETRAN code (Reference 5.47). The RETRAN analysis was completed for an upper bounding core uncovery case and a more realistic core uncover case assuming seals do not fail and that the CBO isolation valves close and remain closed for 8 hours.

The upper bounding core uncovery case utilizes the following case-specific assumptions:

1) Controlled bleed-off (CBO) line will remain open for the first 30 minutes after the reactor trip at a nominal flow rate of 2.5 gpm/RCP.

2) After 30 minutes, RCP seal leakage increases to 4.25 gpm/RCP for the rest of the transient. A constant 3 gpm of additional leakage is assumed throughout the transient to account for unidentified RCS losses. This is to include the Technical Specification requirement of an RCS unidentified leakage to be less or equal to 1 gpm.

The more realistic seal leakage case assuming elastomer failure degradation but no complete seal failures utilizes the following case-specific assumptions:

1) Controlled bleed-off (CBO) line will remain open and maintain 2.5 gpm/RCP for the first 30 minutes.

2) CBO valves are closed and RCP seal leakage is 0.04 gpm/RCP after 30 minutes.

3) RCP seal leakage increases and remains at 1.7 gpm/RCP after 8 hours.

4) No extra leakage is assumed.

The results of the upper bounding core uncover case demonstrate that reflux cooling does not occur for the ELAP scenario prior to 36 hours after the event. Although some voiding begins to develop during the transient, the one-hour running average flowing quality at the top of the steam generator tubes remains far below the 10% limit which would be indicative that reflux cooling is possible. The results of the more realistic seal leakage case also demonstrates that reflux cooling does not occur for the ELAP scenario prior to 36 hours. This is expected considering the upper bounding core uncovery case result. The more realistic seal leakage case is much milder than the upper bounding core uncovery case with respect to inventory loss but more limiting with respect to the volume that can be injected for reactivity control.

The RCS inventory calculation was reviewed against a summary paper provided by Flowserve and endorsed by the NRC regarding seal performance in an SBO and ELAP event (Reference 5.23). It was determined that the caveats discussed in the NRC endorsement are met and that there is substantial margin between the time that RCS makeup is provided to the onset of the reflux cooling regime. Note that the remaining RCS inventory for the upper bounding case is 305,000 lbm over the 36 hour period whereas the mass using the Flowserve leakage rate of 1.7 gpm at 8 hours assuming a constant density of 62 lb/ft3 is 310,000 lbm. Therefore, the upper bounding case bounds the caveats for the Flowserve endorsement. In summary, there is significant margin between the onset of reflux cooling at 36 hours after the event and when RCS injection commences at 13 hours.

3.2.4.10.3 Reactor Coolant Pump Seals

As previously noted, the existing Areva/Westinghouse Reactor Coolant Pump (RCP) seals were replaced with Flowserve N seals. The NX seal package, in addition to being a low leakage seal in operation is also provided with a shutdown seal (abeyance seal) that mechanically closes onto the RCP shaft if it is subjected to sufficient flow and temperature from the upper (third stage) seal leakage. The RETRAN analysis shows that makeup to RCS inventory is provided well within the time that the onset of reflux cooling would occur. The analysis bounds both the leakage rate of 1.7 gpm from the Flowserve paper and a complete failure of the seals where the abeyance feature would actuate.

3.2.4.10.4 Shutdown Margin Analysis

PTN will provide sufficient negative reactivity by injecting borated water into the RCS using the charging pumps, the boric acid transfer pumps and the boric acid storage tanks (BASTs). If required, RCS letdown will be established through the reactor vessel head vents. No design value was identified for the Turkey Point reactor head vent flow rate; however, back-fitting a hydraulic model of the reactor vessel head vent orifice and valves/piping, calculation determined a flowrate of 54 gpm at normal operating temperature and pressure. This flow rate is consistent with the UFSAR statement that losses through a failed open reactor vessel head vent valve would be less than the capacity of one charging pump (boric acid transfer pump credited capacity to the charging pumps is 69 gpm). Calculations determined the RCS flow through the reactor vessel head to be 12 gpm at 192 psig (Reference 5.62)

A reactivity calculation determined that boration was required to ensure Keff remains below 0.99, at a steam generator pressure of 220 psig. This calculation determined that RCS boration is required at 13 hours (Reference 5.61).

Concerning the boron mixing model, the NRC requested plants to justify adequate boron mixing during natural circulation conditions in the RCS. Westinghouse prepared a generic industry response (Reference 5.11) that shows adequate flow exists within the RCS for mixing. The NRC has accepted this position (Reference 5.12) provided the one hour running average flowing void fraction at the top of the steam generator tubes remains below the 10% limit which is indicative of the onset of reflux cooling.

Injection of the accumulators will occur during the RCS cooldown and depressurization; however, this calculation does not credit negative reactivity resulting from accumulator injection. As discussed above in Section 3.2.4.10.2, the RETRAN analysis has verified that PTN remains in natural circulation cooling beyond 36 hours. Therefore the RCS will be in natural circulation at 13 hours when the boration commences. The calculation credits a 1.6 hour margin, which exceeds the 1 hour boron mixing requirement by the Boron Mixing Model accepted by the NRC.

If the plant is initially in Modes 5 or 6, the RCS is already sufficiently borated and the Phase 2 RCS makeup strategy has the ability to add borated water to prevent localized low boron areas with the RCS vented and boiling.

3.2.4.11 Flex Pumps and Water Supplies

3.2.4.11.1 FLEX Well Pump

The FLEX Well pump is sized to provide makeup water supply to refill the CST or to provide makeup water directly to the hose connections on the discharge lines of the train 1 and train 2 for both units, using suction from the FLEX well. This alternate SG makeup strategy is directed by procedure 0-FSG-03 (Reference 5.49) Hydraulic analysis of the flowpath from the FLEX well source to the CST or the hose connections on the discharge of the A and B TDAFW pumps has confirmed that applicable performance requirements are met. In addition, the FLEX well pump provides makeup water supply to the charging pump oil cooler, to the Boric Acid Batching Tank and to the Boric Acid Blender.

One (1) FLEX Well pump is capable of providing the flow rate required to refill the CST, or to provide makeup water directly to the hose connections on the train1 and train 2 discharge lines of the A and B TDAFW pumps for both units. The "N+1" criteria outlined by Section 3.2.2 of NEI 12-06 which states that "It is also acceptable to have a single resource that is sized to support the required functions for multiple units at a site". Based on these criteria, there are two diesel-driven FLEX Well Pumps available for the PTN site. These pumps are stored in the FLEX Equipment Storage Building.

3.2.4.11.2 AFW Water Supplies

Condensate Storage Tank

The Condensate Storage Tanks (CST) provide an AFW water source at the initial onset of the event. The Condensate Storage Tanks meet the requirements in NEI 12-06 for protection from seismic, extreme heat, extreme cold, and flooding events. Each CST has a maximum capacity of 250,000 gallons. Each CST has a nominal 233,075 gallons available for use by the auxiliary feedwater pumps. For tornado events, only one CST, at minimum inventory, is assumed to survive. For hurricane events, only one CST, at the maximum capacity of 250,000 gallons, is assumed to survive. For seismic and other non-missile events, both CSTs are assumed available with the nominal inventory available in each.

FLEX Well

The FLEX well is the ultimate source to refill the surviving CST for the duration of the TDAFW pump operation. The FLEX well is also the ultimate source for maintaining inventory for SG injection. In Phase 3, equipment is available to cool down the RCS using the normal decay heat removal flowpaths and equipment. This source of non-nuclear grade water was evaluated to ensure the effects of the well water chemistry, over the time it would be used, would support the required heat transfer.

3.2.4.11.3 Borated Water Supplies

The following sources of borated water have been evaluated for use during a Beyond-Design-Basis event and they are discussed below.

Accumulators

For RCS inventory control and long-term sub-criticality in Phase 2, the credited action will be to cool down and depressurize the RCS. A method for accomplishing RCS makeup during cool down is the use of the accumulators to make up for losses from the RCP seals and for contraction of the primary coolant due to cool down. Depressurizing the RCS to inject the accumulators occurs when the steam generators are depressurized per emergency operation procedures. Prior to injection of nitrogen from the accumulators, RCS pressure is stabilized by maintaining a steam generator pressure of 220 psig. Prior to continued RCS cooldown and depressurization, the accumulator isolation valves are closed. The strategy for isolation of the accumulators is directed by procedure 3/4-FSG-10 (Reference 5.56). Accumulators are protected from all BDBEE.

Boric Acid Storage Tank (BAST)

Following injection of the accumulators, RCS inventory control and long-term sub-criticality in Phase 2 is achieved by additional makeup from the Boric Acid Storage Tank (BAST). Borated water is injected through installed charging and boric acid transfer pumps. The Boric Acid Storage Tanks (BASTs) are located inside a Class I structure therefore they are protected from the effects of a tornado event, flooding and extreme temperatures. They are seismically qualified to the current licensing basis events. Therefore they meet the NEI guidance for robust SSCs.

Refueling Water Storage Tank (RWST)

Each unit is equipped with one RWST. The tanks are carbon steel, epoxy lined tanks located in the yard east of the Auxiliary Building. Both RWSTs are rugged structures designed to withstand the design basis seismic and wind events but not tornado-generated missiles. As part of the initial operating license, the NRC identified that the RWSTs have adequate separation and redundancy to ensure one RWST would survive a design basis tornado missile event. Therefore, an RWST is the credited borated water source to support the ELAP strategies for Modes 5 and 6 (Section 3.11). The FLEX well and batched acid would be used to provide makeup as backup to the RWST's. Calculations were performed to determine boric acid solubility through the event (Reference 5.44).

3.2.4.12 Electrical Analysis

The Class 1E battery duty cycle of 21 hours for PTN 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.

Calculations show that with stripping of electrical loads from the installed plant batteries, 125V DC and 120V Vital AC power will remain available until the battery chargers are repowered from the FLEX Diesel Generator. Two cases are evaluated; the first case assumes a deep load shed occurs within 90 minutes to conserve battery power and credits use of the spare battery. The second case involves an ELAP event combined with a severe hurricane. This second case assumes a deep load shed occurs within 90 minutes, the 120V Vital AC buses are powered by portable 6 kW generators within 90 minutes, the static uninterruptible power supplies (SUPSs) are de-energized, and credits use of the spare battery. During a severe hurricane, essential monitoring instrumentation is the only equipment that requires AC power to remain functional. An alternate power source would be staged in order to remove the 120V AC vital instrument inverters from the batteries. Two (2) 6 kW portable diesel generators, one per unit will be staged in a protected staging area along with interconnecting cables. The portable generators will be connected to the constant voltage transformers (CVT) secondary windings and will allow the 6 kW generators to power the reduced load vital instrument power panels. This arrangement will allow the DC feed to the inverters to be opened during the deep load shedding in order to extend the availability of the 125V DC System.

For Case 1, using a deep load shed and the spare battery, the 125V DC and 120V Vital AC buses remain available for 21 hours. Based on projected durations for damage assessment, debris removal, and deployment of the FLEX Diesel Generators, the expected return of battery charging capability is within this time frame (8 hours for deployment).

For Case 2, powering the 120V Vital AC buses using portable 6 kW generators and de-energizing the SUPSs; and using a deep load shed and the spare battery for the 125V DC buses, the 125V DC/120V Vital AC buses remain available for over 49 hours. During a hurricane event, site access could be limited due to winds above 60 mph for 18 hours. Based on projected durations for damage assessment, debris removal, and deployment of the FLEX Diesel Generators, the expected return of battery charging capability is well within this time frame.

The spare battery is normally not aligned to a DC Bus and is available as a backup for any of the four normal batteries. A Kirk Key interlock is provided to ensure the spare battery is only aligned to one DC electrical train at a time. With the reduced loads on the DC Buses following the completion of deep load shed, the spare battery has the capability to safely power all four DC electrical trains simultaneously. To accomplish this, four additional Kirk Keys are available to allow connecting all four DC electrical trains to the spare battery during an ELAP event.

The FLEX DG has a prime rating of 550 kW with a standby rating of 611 kW. Three FLEX DGs are available for the site and are stored in the FLEX Equipment Storage Building.

3.3 Spent Fuel Pool Cooling/Inventory

Turkey Point has two independent Spent Fuel Pools (SFP). The pools for both units are similar in design and are not interconnected in any way. The basic FLEX strategy for maintaining SFP cooling is to monitor SFP level and provide makeup water to the SFP sufficient to maintain the fuel covered and makeup for boil-off.

3.3.1 Phase 1

The initial coping strategy for spent fuel pool cooling is to monitor spent fuel pool level using instrumentation installed as required by NRC Order EA-12-051. If the BDBEE occurs following a full core offload (applicable during refueling outages and/or emergency off-load), on-site personnel actions would need to be taken prior to boiling in the pool (i.e. before 2.7 hours after the event). On-site personnel actions include propping open doors to the spent fuel pool room and running hoses for portable makeup from the SFP FLEX pump staging area. Propping open these doors provides a ventilation pathway to maintain room habitability by venting steam created by pool boil-off in addition to providing a pathway for laying hoses. SFP makeup and hoses would be connected and run outside of the refueling building through the propped open door. This would preclude the need to re-enter the refueling floor after boiling has occurred, when environmental conditions may prevent access. Remaining hose runs from the SFP hose pumps to the refuel floor door may be connected later as resources become available. In the event that access to the refuel floor is not available, makeup to the SFP can be established using the alternate means (hose connection to SFP system in the SFP pump room).

Using the design basis heat load and worst-case fuel offload timing, the pool will start boiling at 2.7 hours after cooling is lost (Reference 5.39). The 2.7 hours occurs only for the case of an emergency core off-load, in which case core cooling and containment integrity should not be required functions for that unit. A 99 gpm makeup will be required for the makeup strategy at approximately 20 hours. Borated water is not required to maintain sub-criticality.

It is recognized that following an emergency core off-load, that there would be some FLEX actions of higher priority for that unit than restoring cooling/makeup to the SFP. However, given that fuel in the SFP would not become uncovered until 33 hours after the event, and the availability to provide makeup to the SFP without entering the SFP deck, actions to provide ventilation and makeup to the SFP through hoses on the refueling floor may be postponed such that resources can be focused on the other unit and its time sensitive actions. On-site staff is augmented prior to a hurricane reaching the site such that additional resources are available once conditions permit.

To facilitate the implementation of the SFP makeup strategy for a severe hurricane scenario, hoses and nozzles would be pre-deployed with the connections just inside the building for use when conditions permit. Should access to the connections not be possible, the alternate makeup strategy via the SFP system would remain available to maintain level in the SFP.

3.3.2 Phase 2

The Phase 2 baseline capabilities required for SFP cooling are: makeup via hoses on the fuel floor, makeup via connection to SFP cooling piping, vent pathway for steam from the SFP. Capabilities to spray from the refueling floor onto the fuel are included in this strategy. The SFP makeup strategy is directed by procedures 3/4-FSG-11 (Reference 5.57).

The vent pathway for steam is discussed above. The recommended strategy is opening the personnel doors and providing makeup via the portable SFP FLEX pump. As stated above, early deployment of hoses with makeup connections will prevent personnel from having to access the SFP area in the event of extensive loss of pool level. Note that, even after the plant has undergone an emergency core off-load, all actions for SFP cooling should be done on a not-to-interfere with other, higher priority FLEX strategies and actions (Section 3.3.1).

Makeup to the SFP without accessing the refueling floor will be accomplished by using the existing SFP cooling piping which discharges into the pool. A small section of piping just upstream of the Emergency SFP Cooling Water pump was modified to install an isolation valve and a hose connection. Modifications were performed to add a flange with hose connection and isolation valve to SFP cooling piping in order to supply makeup to the SFP without accessing the refueling floor. The pumps are located at the 18' elevation in the SFP Pump and Heat Exchanger room in a robust structure that protects them from external hazards. Portable hoses from the FLEX storage facility will be connected from the SFP FLEX pump to the hose connections to provide the required makeup without accessing the refueling floor. Suction to the SFP FLEX pumps will be from the intake canal or better quality water from the non-robust raw water tanks if available.

Opening the SFP doors to provide ventilation early after the ELAP and LUHS event may not be possible during a hurricane event due to the high winds. However, the winds and drop in temperature associated with a hurricane would be expected to assist in mitigating the temperatures and steam above the pools through transfer of heat and quenching of steam through the ventilation plenum. Once conditions are safe, the doors can be opened to provide ventilation and for connection of the hoses that have been pre-deployed.

3.3.3 Phase 3

The Phase 2 strategy can be maintained indefinitely. As determined by the Emergency Response Organization (ERO), Phase 3 equipment may be placed in service as options are identified / evaluated and guidance identified / developed based on plant conditions at the time. Options include moving from makeup/boil-off to making use of the flow through the SFP heat exchanger after the CCW system has been reestablished. The SFP cooling pump will be powered to provide the motive force for the water through the SFP Heat Exchanger and can be used to cool the SFP indefinitely.

3.3.4 Spent Fuel Pool Strategies Evaluation

3.3.4.1 Emergency Cooling Pump Suction Line Connection

Part of the Phase 2 Coping Strategy for SFP cooling requires portable, on-site equipment, to provide alternate injection paths to the Spent Fuel Pool. The connection points allow makeup for SFP water inventory loss, due to boiling, via a SFP FLEX pump. Per NEI 12-06, portable fluid connections for SFP cooling functions are expected to have a primary and an alternate connection or delivery point. Also, the NEI 12-06 (Revision 0) requires sites where the SFP can be drained to provide spray capability via portable monitor nozzles from the refueling floor. In order to comply with NEI 12-06 (Revision 0), the primary delivery point is to run hoses and install nozzles capable of spray coverage over the edge of the SFP. The alternate delivery points are flanged hose connections in the Emergency SFP Cooling Pump suction line of each unit. A flanged connection has been installed in the Emergency SFP pump suction line, and it is located in the SFP Heat Exchanger Room for each unit. The flanged connection has a permanent hose adapter angled downwards. The hose connection is threaded for ease in installing the hoses to reduce installation times.

3.3.4.2 Ventilation

Ventilation requirements to prevent excessive steam accumulation in the Spent Fuel Building include propping open doors to the spent fuel pool room. Propping open these doors provides a ventilation pathway to maintain room habitability by venting steam created by pool boil off in addition to a pathway for laying hoses. Ventilation of the SFP is provided by opening the SFP West Side door by the Emergency Escape Hatch door on 58' elevation, by opening the SFP Normal Access door East Side door on 58' elevation, and the SFP access door on the East side at 71' elevation. In a hurricane, it is expected that the lower temperatures and wind will create sufficient heat transfer through the ventilation plenum until the doors can be opened once conditions are safe to do so.

3.3.4.3 Key Parameters

The key parameter for the SFP makeup 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 and located in the Auxiliary Building. Temperature can also be monitored via local instrumentation and remote video display. The remote video display is not considered essential to the strategy, and hence not robust, but would be used to trend the SFP temperature if available.

3.3.4.4 Thermal-Hydraulic Analyses

An analysis was performed that determined that with the maximum expected SFP heat load immediately following a full core off-load (applicable during refueling outages), the SFP will reach a bulk boiling temperature of 212°F in approximately 2.7 hours and boil off to the top of the active fuel in ~ 33 hours unless additional water is supplied to the SFP (Reference 5.39). The analysis determined that the boil-off rate for full core off-load is 99 gpm. Supply makeup to the SFP is established within 20 hours after the event. SFP FLEX pump will provide for adequate makeup to restore the SFP level for both units and maintain an acceptable level of water for shielding purposes.

3.3.4.5 Flex Pump and Water Supplies

The SFP FLEX Pump is a Godwin Model HL130M pump. This pump includes an air ejector priming system. The pump will self-prime and operate at 1200 rpm to provide a flow of 600 gpm. Since the maximum flow rate required by the SFP FLEX strategies is 500 gpm (250 gpm to each Unit's SFP) this pump provides the required flow. The pump is a diesel driven pump that is stored in the FLEX Equipment Storage Building. The pump is deployed by towing the trailer to the designated staging locations. Since one pump is capable of supplying both units, there are two SFP FLEX Pumps available for the site, therefore complying with the N+ 1 requirement established in NEI 12-06. Hoses downstream of the pumps are provided with splitters to supply flow to each unit and then to each fill/spray nozzle.

3.3.4.6 Electrical Analysis

The Spent Fuel Pool will be monitored by instrumentation installed by Order EA-12-051. The power for this equipment has a backup battery; the total time duration the battery at full charge will last is 101 hours which satisfies the 72 hour minimum requirement for continuous level monitoring upon loss of power to the system. The system will automatically switch to battery backup upon loss of normal AC power. A diesel powered generator is available to power the system once the batteries run down. The generator and a spare are located in the FLEX Equipment Storage Building and would be deployed to the connection points for backup power.

3.4 Containment Integrity Strategy

With an ELAP initiated while either PTN unit is in Modes 1-4, containment cooling for that unit is lost for an extended period of time. Containment temperature and pressure will slowly increase. Structural integrity of the reactor containment building due to increasing containment pressure will not be challenged. With no cooling in the reactor containment building, temperature and pressure in the Containment are expected to rise, but will remain below design limits.

Since design limits are not exceeded, key instrumentation is expected to remain available.

3.4.1 Phase 1

The containment design pressure is 55 psig (69.7 psia) and the design temperature limit for the containment atmosphere is 283°F. For Modes 1-4, an analysis was performed to determine the long term containment response following a postulated ELAP and LUHS event 5.37). The results determined that the containment function is maintained for at least 120 hours following event initiation using the FlowServe Abeyance RCP seal design.

There are no coping strategies required for maintaining containment integrity during Phase 1 in Modes 1-4 and Mode 5 with steam generators available. The only action necessary is to monitor containment pressure and temperature. These parameters will be available via normal plant instrumentation

For Modes 5 and 6, without the steam generators available for decay heat removal, the containment pressure and temperature would increase due to the discharge of the core decay heat during "feed and bleed" cooling and direct heat transfer from the RCS. Heat loss from the containment would be negligible without containment venting or the operation of a cooling system. Analysis has demonstrated that pressurization will challenge containment integrity and therefore, a vent path utilizing an open airlock or the containment equipment hatch will be provided prior to RCS starting to boil. With the airlock open or the containment equipment hatch open, no significant containment pressurization occurs.

3.4.2 Phase 2

The Modes 1-4 containment analysis for PTN with the FlowServe low leakage RCP seals determined containment temperature and pressure are not challenged during Phase 2 FLEX timeline so long as decay heat removal is maintained. As such, the primary strategy for containment integrity in Phase 2 is to monitor containment temperature and pressure and maintain decay heat removal using steam generators to exhaust RCS heat out to the atmosphere using the MSSVs or the SDTAs.

For Mode 5 and 6 without steam generator heat removal available, containment temperature and pressure will not be challenged with both doors on any airlock or the containment equipment hatch open.

3.4.3 Phase 3

The Phase 2 strategy can be maintained indefinitely. As determined by the Emergency Response Organization, Phase 3 equipment may be placed in service as options are identified / evaluated and guidance identified / developed based on plant conditions at the time. Additional containment cooling may be provided by repowering the emergency containment cooling (ECC) fans from the NSRC 4160 VAC generators and restoring component cooling water (CCW) flow to the ECC coolers. Cooling water flow through the containment coolers will be provided by re-powering the CCW pumps from the NSRC 4160 VAC turbine generator. Heat will be removed from the CCW system by a NSRC Cooling Water pump connected to the ICW strainers.

Timing of these actions is not critical as containment parameters are increasing gradually and at 120 hours (approximately 4.3 psig, 190°F remain well below containment design criteria (69.7 psia / 283°F).

In Modes 5-6, containment temperature and pressure increase is mitigated by maintaining a containment vent path open until RHR cooling is recovered and RCS boiling is halted.

3.4.4 Containment Strategies Evaluation

3.4.4.1 Containment Strategies

The active safety-related functions of the CCW System are not available during the ELAP due to the loss of 4160V/480V AC power. The system passive components remain available following the ELAP and the CCW System may be re-powered by a NSRC 4160V turbine generator in Phase 3.

The active safety-related functions of the ICW System are not available during the ELAP due to the loss of 4160V/480V AC power. The motive force for the system, i.e., pumps, is assumed to be non-recoverable. The system passive components remain available following the ELAP and the ICW System may be utilized to provide a flow path for cooling a CCW heat exchanger with flow from a diesel driven NSRC Cooling Water pump in Phase 3.

The active functions of the ECC System are not available during the ELAP due to the loss of 4160V/480V AC power. The system piping and fan coolers remains available following the ELAP BDBEE, and the ECC System may be powered by a portable turbine generator later in Phase 3.

During Phase 3, a low pressure / high flow pump from the NSRC will be connected to the connections in the ICW strainer cover to supply flow through the ICW piping. One pump is required per unit.

3.4.4.2 Key Containment Parameters

Key parameters are monitored to ensure that Containment Integrity is properly maintained. The extended load shed extends the battery powered monitoring function for one train of the essential parameters until the FLEX DG is available to supply required instrument loads. Containment pressure monitoring is available via normal plant instrumentation throughout the event. Containment temperature will be available following load shed in Phase 1 when the containment temperature recorder is connected to a vital ac a source. Since Containment pressures will not increase significantly, this is not time sensitive and the delay is acceptable.

3.4.4.3 Thermal-Hydraulic Analyses

For modes with steam generators available, a calculation was performed using the Modular Accident Analysis Program (MAAP - Reference 5.36 and 5.42). This analysis concluded that the containment pressure will reach a maximum of 18.8 psia within the evaluated 120 hours timeframe or an increase of 4.1 psi. The containment design pressure is 55 psia. Based on the results of this evaluation, no actions are required to ensure maintenance of containment integrity through Phases 1 and 2 for an event which occurs when the SGs are available (Modes 1- 5 with SG available).

For Modes 5 and 6 without steam generator cooling available, the core decay heat is released to the containment atmosphere during feed and bleed. The analysis using MAAP determined that following an ELAP BDBEE without steam generator cooling available, using one of the containment airlocks, or the containment equipment hatch, is adequate to provide a vent path. The time to containment pressurizing such that opening the airlock is prevented is dependent on many factors including operating history, time since shutdown, inventory in RCS, etc. To address this concern, both doors in at least one airlock will remain open during Mode 5 and 6 operations without steam generators available. In Mode 6 the airlocks will be closed if fuel is being moved before 72 hours after reactor shutdown. If an event occurs during this period, an airlock or equipment hatch would be opened prior to reactor cavity boiling. These guidelines are included in the outage risk assessment procedure

3.4.4.4 Flex Pump and Water Supplies

The NSRC will provide low pressure/high flow pumps which will be used if required to provide cooling during Phase 3. Water supply will be provided by the cooling canal system, and the NSRC pumps would provide flow through the ICW/CCW heat exchanger. The CCW and ECC systems would be repowered allowing forced cooling of the containment buildings.

3.4.4.5 Electrical Analysis

3.4.4.6 The Phase 3 coping strategy required for maintaining containment integrity involves either venting containment (Modes 5 and 6) or using containment coolers (Modes 1-4) for indefinite containment cooling. For Modes 1-4, the strategy for containment integrity during Phase 3 is to repower an emergency containment cooling (ECC) fan from the NSRC 4160 VAC generators and restore component cooling water flow to the ECC fans.

3.5 Characterization of External Hazards

3.5.1 Seismic

Per NEI 12-06, all sites must consider the seismic hazard. The design criteria for PTN accounts for two design basis earthquake spectra, Maximum Potential Earthquake (MPE) also known as Operating Basis Earthquake and Design Earthquake (DE) also known as Safe Shutdown Earthquake (SSE). Structures, systems, and components (SSCs) important to safety are designed to withstand loads developed from these spectra. This includes qualification of installed equipment credited for the event and effects of the event on the FLEX strategies. Seismic design of Turkey Point safety related SSCs is discussed in the UFSAR (Reference 5.19), Chapter 2, Section 2.11, Earthquake Design Basis. A re-evaluation of recent seismic data was requested by the NRC as a result of the Fukushima event (Reference 5.17). FPL re-evaluated more recent seismic data and found that when realistic soil characteristics are employed the revised ground response is lower in intensity than the current Turkey Point UFSAR values. The NRC agreed with FPL's re-evaluation of seismic hazards in Reference 5.18.

Therefore, the FLEX strategies developed using the seismic design bases were not affected by the seismic re-evaluation.

In summary, the seismic hazard applies to PTN. As a result, the credited FLEX equipment has been assessed based on the current PTN seismic licensing basis to ensure that the equipment remains accessible and available after a BDBEE. The FLEX strategies developed for the Turkey Point site include documentation ensuring that the FLEX Equipment Storage Building (FESB) and primary deployment routes meet the FLEX seismic criteria. The assessment included a review of the potential for liquefaction. Also, a debris assessment for the site was performed, including debris generated by seismic events, to determine debris removal tool requirements; see Section 3.7.1 for a discussion of debris removal capability. Finally, walk downs were conducted to ensure that the deployment paths within the power block would be available following a seismic event.

3.5.2 External Flooding

External flooding design for Turkey Point safety related structures is discussed in UFSAR, Section 2.7, Hydrology (Surface Water). Flood protection criteria applied to plant structures, systems and components is listed in UFSAR Section 5G.5. (Reference 5.19)

Per section 2.7 of the UFSAR, plant grade is at elevation +18', for both Units 3 and 4, with surrounding land gradually sloping from the coastal ridge (about 5-10 ft above MSL at Homestead) southeast toward the site. Manmade drainage and flood control canals direct some surface flow away from the site (Reference 5.19).

The plant is located at approximately 25° north latitude, 80° west longitude on the shore of Biscayne Bay. The site is situated approximately 25 miles south of Miami. The plant is originally situated above the highest possible water levels attainable except for wave run-up resulting from probable maximum hurricane (PMH) considerations. Based upon the high water level due to the probable maximum hurricane wave run-up level and plant elevation (+18') flood protection is provided to +20 ft. mean low water using stop logs at entrances to the North, South, and West sides of the facility. Additional wave run-up protection is provided at +22 ft. mean low water on the eastside of the facility. The ICW Pump Motors are protected to +22.5 ft. mean low water.

Per administrative procedures, preparations begin 72 hours prior to the projected arrival of tropical storm force winds. The severe weather preparations procedure instructs the operators to cool down the plant to Mode 4 or Mode 5 at least 2 hours prior to the projected onset of hurricane force winds. The actual mode is dependent on the category of the projected hurricane and determinations by plant personnel. Current severe weather preparation and administrative procedures also direct operators to top off major water tanks, pre-stage small diesel generators and diesel powered pumps, as well as increase plant staffing and supplies. Therefore, prior to the arrival of hurricane induced flooding and high winds, the plant is shut down and well prepared to cope with the event. The strategy for maintaining the baseline capabilities following the event utilizes these procedures prior to and during Phase 1 and Phase 2.

During a hurricane induced flooding event, access to areas in the plant, as well as access to the FLEX Equipment Storage Building (FESB), could be restricted due to flood waters and high winds. The strategy to maintain core cooling was developed such that access to Phase 2 FLEX equipment and access to environmentally harsh areas would not be required until the flood waters have receded and high winds have subsided.

The limiting sources for external flooding for the Florida coastal area are from regional precipitation and hurricane storm surges. In the event of an external flooding event, the FESB finished floor is above flood stage elevation, requiring construction well above the surrounding ground level. Ramps have been installed at each equipment door for ingress and egress of the stored equipment. Personnel and equipment doors are above the flood plain determined in the flood hazard reevaluation and water resistant to minimize infiltration due to wave run-up and driving rain. The equipment doors are redundant and face to the west such that debris from storm surge would be less likely to accumulate adjacent to them. Therefore, FLEX equipment stored in the FESB is protected from a BDBEE external flooding event.

An outdoor area near the FESB has been provided for equipment testing/maintenance and tractor trailer parking.

Travel paths and staging areas have been selected such that flooding from surges or precipitation will not impede deployment of the equipment.

The reevaluated PMSS event has a bounding duration of site inundation of 8 hours. Therefore, flooding above site grade is not expected during Phase 2 and will not inhibit the implementation of the FLEX strategy. Flooding from a LIP or Tsunami is of a much shorter duration and will not inhibit the implementation of FLEX Phase 2 strategies.

Finally, ruptures of tanks that are not robust would not impact the strategies. These tanks are located in outdoor areas where the flows from them, if they were to fail, would be away from the power block and FLEX tie-ins. In addition, deployment of the equipment would occur well after the water level around the tanks has subsided.

3.5.3 Severe Storms with High Wind

NEI 12-06 requires an evaluation of external hazards that are considered credible for a specific site. This includes evaluating storms (e.g., hurricanes, high winds, and tornadoes) for the protection and deployment of FLEX equipment and off-site resources. NEI 12-06, Section 3.2.1.3 also provides the following guidance:

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

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

The definition of "robust" provided in NEI 12-06 is, "The design of an SSC either meets the current plant design basis for the applicable external hazards or has been shown by analysis or test to meet or exceed the current design basis." Therefore, equipment and components that meet the current design basis could be assumed to be available post BDBEE and credited in the FLEX Coping Strategies.

Florida is susceptible to hurricane and/or tornado events per review of NEI 12-06 Figures 7-1 and 7-2. In the event of a BDBEE, extreme winds and missiles from tornadoes and hurricanes are possible. The FESB has been designed in accordance with the requirements of the current licensing basis (UFSAR) for wind and tornado driven missile conditions.

Per FSAR Chapter 5, Appendix 5E (Reference 5.19), all Class I structures are designed to withstand the stresses of a tornado with wind velocity of 225 mph (and its associated missiles) and with a differential pressure of 1.5 psi without exceeding elastic limits of the structure. No loss of function will occur for structures which experience tornado winds of up to 337 mph and with a differential pressure of 2.25 psi.

Protection of FLEX equipment is ensured since the characteristics of the FESB meet the requirements in NEI 12-06. At PTN, the FESB is located at the south east corner of the Protected Area (PA). The FESB at PTN has been designed to withstand high winds and tornado/hurricane generated missiles. This robust pre-cast concrete panel FLEX storage structure provides reasonable protection and deployment of FLEX equipment following a BDBEE high winds event.

FLEX equipment remains deployable for high wind hazards such as a tornado or hurricane. Debris could potentially have an impact on the time it takes to deploy FLEX equipment. Debris removal capabilities are provided by the on-site FLEX equipment located inside the FESB. Positioning of equipment in the FESB will aid in the deployment of FLEX equipment against lack of significant notice from a BDBEE tornado event. The tow-vehicles for the FLEX equipment are also stored with the FLEX equipment.

In Phase 3, off-site resources may be delayed. However, PTN has enough on-site capabilities to cope past 72 hours. The regional impacts of hurricanes and tornados can impact the ability to receive off-site FLEX equipment. In the case of a hurricane, the site still can be accessed from by land, sea, or air (by helicopter).

3.5.4 Ice, Snow and Extreme Cold

The guidelines provided in NEI 12-06 Section 8.2.1, exclude the need to consider extreme snowfall at plant sites in the southeastern U.S. below the 35th parallel. The PTN plant site is located at approximately 25° north latitude (Reference 5.19, Section 2.1.1) and thus the capability to address impedances caused by extreme snowfall with snow removal equipment need not be provided. Based on historical records, the average snowfall is only a trace amount (Reference 5.19, Table 2.3-3).

The storage of FLEX equipment must consider the minimum temperature specified by the manufacturers. 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 must consider the possibility of freezing when conditions warrant action. Actions to protect idle portable pumps and hoses can consider periodic starting and running to prevent freezing of the lines. The FESB is designed with thick concrete walls that provide insulation to protect the FLEX equipment stored inside from freezing with minimal effort due to the long time it will take the mass of the structure to release its stored heat. 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 relative to the short duration of low temperatures at the site.

3.5.5 High Temperatures

Per NEI 12-06 (Reference 5.3), all sites will address extreme high temperatures.

The climate at the site is typical of that in Southern Florida, being hot and humid in the summer and mild in the winter. Because PTN is situated on the coast, more moderate maximum temperatures are experienced, owing to the heat transfer with the adjacent ocean waters.

In the event of an extreme high temperature BDBEE, deployment of FLEX equipment from the FESB is not impacted. The FESB has an air-conditioned environment to aid in the relief of increasing temperatures that might develop within the storage building prior to an extreme heat BDBEE causing a loss of AC power. The storage building roof and walls will shade and protect the longevity of stored FLEX equipment from direct sun rays. The FLEX equipment has been specified to operate in temperatures in excess of the expected maximum temperatures at the plant. 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. In addition, the validation of the strategies was conducted under typical hot conditions experienced at the plant in the summer.

Although NEI 12-06 note that many states have experienced temperatures in excess of 120°F, historically Miami, Florida, has recorded one day where temperatures reached 100°F dating back to 1895. Temperatures in the hot summers months are typically in the mid-90's.

3.6 Protection of Flex Equipment

FLEX equipment is stored in a single tornado-missile protected structure that meets the plant's design basis for the Safe Shutdown Earthquake (SSE), wind loads and tornado driven missiles. The FLEX Equipment Storage Building (FESB) is a pre-cast concrete panel building of approximately 9,000 sq. ft. located at the south east corner of the Protected Area. The finished floor of the FESB was designed to be above the flood stage elevation determined in the flood hazard reevaluation and built to protect the equipment from other hazards identified in Section 3.5 above.

FLEX equipment in the FESB is protected from seismic events and evaluated to ensure that seismic interactions that could damage equipment will not occur. Due to the low seismic accelerations for the site, tie down of the equipment is not required.

Debris removal equipment is also stored inside the FESB in order to be reasonably protected from the applicable external events such that the equipment is likely to remain functional and deployable to clear obstructions from the pathway between the FLEX equipment's storage location and its deployment location(s). This includes mobile equipment such as a compact track loader, tug, and utility vehicle that are stored inside the FESB. The strategy for initial damage assessment and debris removal is directed by procedure 0-FSG-05 (Reference 5.51).

Deployments of the FLEX and debris removal equipment from the FESB are not dependent on off-site power. All actions are accomplished manually.

3.7 Planned Deployment of Flex Equipment

3.7.1 Haul Paths and Accessibility

Pre-determined, preferred haul paths have been identified and documented in the FLEX Support Guidelines. Figure 8 shows the haul paths from the FESB to the various deployment locations. These haul paths have been reviewed for potential soil liquefaction and it has been determined that soil liquefaction will not preclude FLEX strategy implementation. Additionally, the preferred haul paths avoid areas with trees, power lines, and narrow passages. The deployment of on-site FLEX equipment to implement coping strategies beyond the initial plant capabilities (Phase 1) requires that pathways between the FESB and various deployment locations be clear of debris resulting from beyond design basis (BDB) seismic, high wind (tornado), or flooding events. Debris removal equipment is stored inside the FESB, protected from the severe storm and high wind hazards such that the equipment remains functional and deployable to clear obstructions from the pathway between the FESB and its deployment location(s). The FESB is sized and designed to accommodate arrangement of FLEX equipment for prioritized deployment, personnel ingress and egress, and quick access to equipment. In order to address conditions where access to equipment may be blocked immediately after a BDBEE event, FLEX equipment is arranged in a redundant fashion for deployment from either end of the storage facility.

Phase 3 of the FLEX strategies involves the receipt of equipment from off-site sources including the NSRC and various commodities such as fuel and supplies. Transportation of these deliveries can be through via ground transportation or airlift via helicopter. Debris removal for the pathway between the site and the NSRC receiving location and from the various plant access routes may be required. The same debris removal equipment used for on-site pathways can be used to support debris removal to facilitate road access to the site.

3.7.2 Deployment of Strategies

3.7.2.1 AFW Makeup Strategy

The Phase 2 FLEX Well pump will refill the CST from the FLEX well for the duration of the Phase 2 coping time using hose connections. The FLEX well supplied by the Floridan aquifer is the credited backup water supply following exhaustion of the surviving CST(s). The FLEX Well pump is supplied by this well and discharges to the CST(s) if the AFW pumps are still in use, or discharges directly to the steam generators via connections installed in the AFW system if the steam generators have been depressurized. Hoses will be used for these supply and discharge connections. Prior to using the well water supply, the Demineralized Water Storage Tank (DWST) is used if available. The DWST is not credited because of the potential for wind missiles affecting the tank although it is fitted with a connections that can be used for the Well pump hoses.

The CST connections are qualified to Seismic Class 1 requirements. The FLEX SG Makeup Pump discharge connections are located inside the AFW cage which is protected from all external hazards. The hose runs will be through the Turbine Building that has been evaluated for seismic loads.

The FLEX Well pumps and hoses are stored in the FESB and they are protected from the BDBEE hazards identified in Section 3.5.

3.7.2.2 RCS Strategy

The FLEX RCS strategy relies on the utilization of the Charging Pumps for RCS makeup for all Modes of operation. For Modes 1-4 the credited method for accomplishing RCS makeup in Phase 2 is the use of the charging pumps to make up for losses from the RCP seals and for contraction of the primary coolant due to cool down. Makeup from the Boric Acid Storage Tank (BAST) is injected through installed boric acid transfer pumps and charging pumps. The charging and boric acid transfer pumps are powered from the FLEX Diesel Generator. The primary injection path to the RCS is through the charging lines and an alternate path through reactor coolant pumps seal injection lines is available.

For Modes 5 and 6 without steam generators available, if the RCS is sufficiently vented such that the RCS does not re-pressurize following the loss of RHR cooling, then gravity drain flow from the RWST is available to replenish the RCS inventory (Ref 5.43). If sufficient RCS venting or the RWST is not available then pump makeup using the charging pumps is required. The RWST will be utilized if available or the FLEX well pump will be utilized to produce additional borated water by mixing with water from the boric acid batch tank. Considering the relatively short duration and low RCS temperatures when borated well water is added to the RCS, degradation of fuel cladding and the ability to maintain a coolable geometry is not expected to be affected.

As backup to the charging pumps, connection points are identified in procedures to allow for connection of an NSRC high pressure pump. Suction can be taken from either an RWST or BAST and injected through the normal charging lines or the RCP injection lines.

3.7.2.3 Electrical strategy

The Phase 2 coping strategy following an ELAP and LUHS event is to stage and connect a 480V portable diesel generator to power select loads. The loads which may be powered by the Phase 2 FLEX Diesel Generator include the battery chargers that supply the Class 1E 125V DC Switchgear. Additional guidance has been added to station portable 6kW portable generators prior to the arrival of hurricane force winds from severe hurricanes. When power from the FLEX DG is restored to the Class 1E Load Centers, all interlocks and protective features for the loads are re-enabled.

The FLEX 480V diesel generators will be stored in the FLEX Equipment Storage Building and they are protected from the BDBEE hazards identified in Section 3.5.

3.7.2.4 Fueling of Equipment

The FLEX strategies for maintenance and/or support of safety functions involve several elements including the supply of fuel to necessary diesel powered generators, pumps, hauling vehicles, etc. The strategy for fuel starts with all of the equipment used for FLEX being fully fueled in in its stowed location.

Subsequently, the FLEX strategy calls for the use of a Diesel Fuel Oil Refueling Trailer to transfer fuel from the PTN Unit 4 Diesel Oil Storage Tank to various equipment, including the FLEX Well Pump, the FLEX SFP Pump, the FLEX 480 V Diesel Generators, and the FLEX 20 kW and 6 kW Diesel Generators. The Unit 4 EDG building is Seismic Class 1 and therefore designed to withstand design basis seismic, wind and wind driven missile loads. A Transfueler 1000 gallon diesel fuel oil tank on a trailer was evaluated to transfer the fuel between the various plant locations as required. The trailer footprint was qualified for use on the plant roads and gates such that the refueling tank could be credited for use in the post-event response.

Table 1 below provides a summary of all the required portable equipment requiring diesel fuel along with their expected fuel consumption. Based on the expected fuel consumption rate for each device and their internal fuel tank capacity, a minimum refueling duration has been determined for each device. Given the total fuel storage capacity of all portable equipment and their consumption rate, a 1,000 gallon portable re-fueling tank was selected. The minimum refuel time for any device is 10 hours except for the portable 6 kW generators which is 6 hours. A portable 5 gallon fuel can will be provided for each 6 kW generator to extend the refuel cycle time to 12 hours.

Diesel fuel in the Unit 4 Fuel Oil Storage Tanks is routinely sampled and tested to assure fuel oil quality is maintained to ASTM standards. This sampling and testing surveillance program also assures the fuel oil quality is maintained for operation of the station Emergency Diesel Generators. All equipment was verified to be capable of using this fuel. Procedures have been created to test and condition the fuel that is maintained in the equipment.

The diesel fuel consumption information does not include fuel requirements for the equipment to be received from the NSRC which include the High Pressure RCS Injection Pump, Low Pressure / High Flow Dewatering Pump the 480V Turbine Generator and additional fuel tanks. Fuel for this equipment will be provided by local or regional providers that have contracts with NextEra.

Table 1: Diesel Refueling Equipment List

EQUIPMENT	MODEL/PART #	QTY	FUEL STORAGE (GALS/SKID)	FUEL CONSUMPTION (GPH)	COMMENTS
480V Diesel Generator	Volvo Penta Genset Engine TWD1643GE	2	400 Gals (800 Gals Total)	40 GPH @ Full Load (80 GPH Total)	10 hrs/tank @ 80% Load per PTN Specs under EC
Spent Fuel Pit Diesel Makeup Pump	Godwin HL130M	1	172 Gals	13 GPH @ Full Load	13 hrs/tank @ 100 % Load per Godwin Vendor Specs
Artesian Well Diesel Makeup Pump (RCS, SG, and CST Makeup)	Godwin 3393	1	212 Gals	13.8 GPH @ Full Load	15.33 hrs/tank @ 100 % Load per Godwin Vendor Specs
20 kW TSC Diesel Generator	Baldor TG25T	1	50 Gals	2.12 GPH @ Full Load	23.6 hrs/tank @ 50 % load as per Baldor Vendor Specs
20 kW Nuclear Administrative Bldg Phone/Data Backup Generator	Baldor TG25T	1	50 Gals	2.12 GPH @ Full Load	23.6 hrs/tank @ 50 % load as per Baldor Vendor Specs
5kW/6kW Diesel Generators (Communications, Inverters, Lights, etc)	Baldor DG6E or Equivalent	10	4.6 Gals (46 Gals Total)	7.7 GPH @ 50% Load	6 hrs/tank @ 50 % load as per Baldor Vendor Specs
	Totals	13	1330 Gals	118.7 GPH	

Based solely on fuel consumption and refueling tank capacity yields the following: 1000 gals/118.7 GPH =8.4 hrs.

The refueling schedule includes the following:

- 1 hour/circuit transit time (estimated by 3 mph driving speed and vehicle entry/exit)
- 2 circuits/ refuel cycle (one for both 480V Generators at 800 gals total, and one for all other pumps/gens)
- 133 min for fuel load/offload (1330 gals/20 gpm refueling pump capacity X 2)

Total of 4.2 hrs per refueling cycle

3.8 Off-Site Resources

3.8.1 National SAFER Response Center

The industry has established two (2) National SAFER Response Centers (NSRCs) to support utilities during BDBEEs. NextEra has established contracts with the Pooled Equipment Inventory Company (PIMS) 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 BDB 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 delivered from the NSRC to the Miami International Airport (MIA). Technical information for the equipment from NSRC is contained in the National SAFER Response Center Equipment Technical Requirements document (Reference 5.14).

From MIA, equipment can be hauled to the site if roadways are clear or to the Homestead Air Reserve Base. Once at the Air Reserve Base, it can be helicoptered to the site. In either case, the equipment will be located at staging area B at the site as defined in the NSRC Response Plan, 5.33, Attachment 3).

Communications will be established between the PTN plant site and the SAFER team via satellite phones and required equipment moved to the site as needed. The order and which equipment is needed is identified in the Turkey Point's "NSRC Response Plan". Procedures are in place with contact information and protocols to be used with the NSCR.

The equipment stored and maintained at the NSRC for transportation to the Staging Area B to support the response to a BDBEE at PTN is listed in the FLEX Program Document. A listing of the major equipment is provided in Table 4.

3.9 Habitability and Operations

3.9.1 Equipment Operating Conditions

Following a BDBEE and subsequent ELAP event at PTN, ventilation providing cooling to occupied areas and areas containing FLEX strategy equipment will be lost. Per the guidance given in NEI 12-06, FLEX strategies must be capable of execution under the adverse conditions (unavailability of installed plant lighting, ventilation, etc.) expected following a BDBEE resulting in an ELAP/LUHS. The primary concern with regard to ventilation is the heat buildup which occurs with the loss of forced ventilation in areas that continue to have heat loads. Loss of ventilation analyses were performed to quantify the maximum steady state temperatures expected in specific areas related to FLEX implementation to ensure the environmental conditions remain acceptable for personnel habitability and within equipment qualification limits (Reference 5.38).

The key areas identified for all phases of execution of the FLEX strategy activities are the SFP area, the Main Control Room (MCR) and the DC Equipment Rooms. These areas have been evaluated to determine the temperature profiles following an ELAP/LUHS event.

Ventilation of the SFP will be provided by opening the SFP West Side door located near the Containment Emergency Escape Hatch door on 58' elevation, by opening the SFP Normal Access door East Side door on 58' elevation, and by opening the SFP access door on the East side at 71' elevation.

An evaluation of the temperature inside the DC Equipment Rooms concluded that the temperature remains below the equipment temperature limit of 135°F for 12 hours without cooling. After this period of time normal cooling will be restored using the FLEX diesel generator.

The calculations also performed a loss of ventilation scenario for the main control room (MCR Reference 5.38). The results show that without opening any doors, the maximum temperatures remain below 110°F for 12 hours. The analysis used normal heat loads and an outside temperature of 95°F that are conservative for the ELAP event. Under ELAP conditions all non-vital control room electrical AC loads will be de-energized and at least 50% of the 120V AC Vital Instrument (battery backed) / 125V DC loads and vital 120V AC loads will be de-energized due to load shedding within the first 90 minutes of the event. Consequently, during an ELAP event the MCR will see at least a 50% reduction in the electrical heat loads assumed in the calculation. Therefore, portable fans are not expected to be required and only opening doors should be adequate to maintain the control room environment below 110°F for the 8 hour period without air conditioning. Door blocks and rope will be stored in the FLEX Equipment Storage Building to assist in maintain the required doors. Nevertheless, portable fans are available in FLEX Equipment Storage Building along with portable diesel generators to power them if needed.

Control room operators are dressed in conventional office clothing and would be performing less than light work since they would be monitoring indications. As indicated in NUMARC 87-00 at least 4 hour periods are tolerable in this environment. Pressurized Water Reactors Owners Group (PWROG) FSG-5, Initial Assessment and FLEX Equipment Staging, contains guidance on heat stress reduction techniques to extend stay times such as fluid replenishment, outside air directed ventilation and rotating outside breaks. In addition, the FSG procedures consider accessibility of equipment, tooling, connection points, plant components and human performance aids applicable to FLEX strategies.

Outside the control room, conditions should be normal for operators to perform necessary actions. In addition, adverse weather preparations ensure water inventories for fluid replenishment are staged. Operations personnel are routinely exposed to high temperature environments since most plant equipment is located outside or in buildings without air conditioning.

An additional ventilation concern applicable to Phase 2 is the potential buildup of hydrogen in the battery rooms. Off-gassing of hydrogen from batteries is only a concern when the batteries are charging. The installed battery room ventilation will be re-powered by the portable 480V FLEX diesel generator prior to 12 hours following the ELAP initiation. At that time, the batteries will begin charging and the battery room HVAC system will be in operation. Hydrogen accumulation during recharging will be removed by the HVAC system. The exhaust path that will be used is part of the battery room HVAC system.

3.9.2 Heat Tracing

The minimum temperature for BAST solubility is 63°F when at the maximum concentration of 7,000 ppm. PTN typically maintains the BAST concentration below 6500 ppm. South Florida temperatures rarely stay below 40 degrees for more than a day or two. Due to the thermal inertia of the auxiliary building, there is no normal heating capability installed in the building. During an ELAP event, the normal Auxiliary Building exhaust fans will not be running but the charging pumps will be running. The PTN 4 pumps are in the room adjacent to the BAST tanks with a door between them that can be opened to allow reject heat from the charging pumps to heat the BAST room. Given the size of the charging pump motors, this is judged more than adequate to compensate for any cold periods. Therefore, heat tracing is not required.

3.9.3 Lighting

Appendix R emergency battery pack lights have an expected life of 8 hours. Since the ELAP event extends beyond 8 hours, alternate portable lighting is provided. Normal lighting and emergency lighting units are non-safety-related therefore, portable lighting is provided for deployment of FLEX strategies.

Pump and generator skids are supplied with self-powered lighting mounted on and powered by the portable equipment to provide illumination of controls for operating portable equipment. For illumination of personnel routes within and around buildings, as well as the continuously manned control room, portable lighting is provided. The FLEX temporary lights have up to 24 hour life and are stored in the control room and FESB. Generators are provided to recharge batteries. EOPs and FSGs address the use of temporary and portable lighting.

3.9.4 Communications

Turkey Point Units 3 and 4 have communication capabilities with off-site response organizations, the NRC, between emergency response facilities, with field and off-site monitoring teams, and with in-plant and off-site emergency response organization staff. An assessment of communications assuming a large-scale natural event, which would lead to an extended loss of all AC power was performed (Reference 5.22). As part of this assessment, PTN identified enhancements/changes to maintain communications capabilities for responding to emergency events.

The Turkey Point Nuclear Plant Communications Assessment during an Extended Loss of AC Power included the following improvements:

- designates and stores adequate backup radios, satellite phones, and batteries, that are reasonably protected from flooding, seismic, and wind hazards;
- acquired portable generators to charge primary and backup radio and satellite phone batteries, and store them such that they are reasonably protected from flooding seismic, and wind hazards; and provide instructions for use;
- designed, fabricated, and staged stop logs to protect the Nuclear Administration Building Commercial Phone rooms from flooding as well as the development of applicable procedural guidance;
- radios, satellite phones, and batteries are staged at the Turkey Point Emergency Response Facilities (ERFs) as deemed necessary; and
- relocated the currently installed external power connector for the Technical Support Center to an external wall above the flood plain to facilitate the use of an appropriately sized external/portable generator and provide instructions for use.

These improvements have been implemented. In addition, the validation process confirmed that the enhanced communications are adequate to deploy and manage the FLEX strategies. Therefore, Turkey Point communications' capabilities are considered robust and diverse to support the strategies.

3.10 Water sources

3.10.1 Secondary Water Sources

Section 3.2.4.11 provides the potential water sources that may be used to provide cooling water to the SGs and/or to refill the CSTs. An assessment of availability following the applicable hazards is provided in this section. The CSTs meet the requirements in NEI 12-06 for protection from seismic, extreme heat, extreme cold, and flooding events. However these tanks are susceptible to wind-borne missile strikes.

Both CSTs are rugged structures designed to withstand the design basis seismic and wind events. They are partially surrounded by a security barrier that is constructed of structural steel and steel grating. Although the security barriers are not designed to withstand the design basis missiles and therefore not considered "robust" as defined in NEI 12-06, they would absorb substantial energy from wind driven missiles such that impacts to the CST's would be largely attenuated.

Nevertheless, the current licensing basis considers one tank to be lost due to impact by a tornado missile with the other surviving since they are at opposite ends on the east side of the Turbine Building, separated by several hundred feet. Per UFSAR Chapter 5 Appendix 5E, redundancy and spacing of the condensate storage tanks provide the required system capability in the event of damage to one component by a tornado missile. The assumption used in the FLEX integrated plan assessment is consistent with the licensing basis in that it assumes that one tank is lost and that the other is supplying the water inventory for steam generator cooling water makeup.

An evaluation was performed to determine if the amount of water contained in these tanks is adequate to provide cooling water to the SGs (Reference 5.39). The results show that the water reserves in one tank provide an adequate supply of water for at least a period of 12 hours, for both units after the event.

Therefore, if the CST of one unit was impacted by a tornado missile, the CST from the opposite unit would be available to provide water to the TDAFW until the FLEX Well Pump can be used to supply a source of water to refill the surviving CST or for use in feeding the SGs.

3.11 Shutdown and Refueling Analysis

PTN abides by the Nuclear Energy Institute position paper entitled "Shutdown/Refueling Modes" addressing mitigating strategies in shutdown and refueling modes. This position paper is dated September 18, 2013 (Reference 5.9) and has been endorsed by the NRC staff (Reference 5.10). These mitigating strategies are defined below.

The guidance of the position paper is to size the FLEX equipment and connections to be capable of the required shutdown and refueling modes flow rates, and to utilize such equipment within the shutdown risk process and procedures. This guidance has been implemented in the outage risk procedures, off normal procedures and procedure 0-FSG-14 (Reference 5.59). This includes:

- How FLEX equipment is deployed or pre-deployed/pre-staged to support maintaining or restoring key safety functions in the event of a loss of shutdown cooling;
- In cases where FLEX equipment needs to be deployed in locations that would become inaccessible before the time it would take to deploy the equipment as a result of a loss of decay heat removal from an ELAP event, pre-staging of that equipment is considered.

Based on the Shutdown/Refueling modes industry position paper, the FLEX strategy for core cooling with SGs unavailable is described below.

Phase 1 consists only of boiling the existing water inventory within the RCS/reactor cavity. Pressure is maintained below the design limit of containment via adequate containment venting that is established prior to entering this condition. Calculations were performed to ensure that boric acid solubility is maintained for this scenario (Reference 5.44)

- The Phase 2 strategy utilizes RWST gravity drain or the charging pump taking suction from the RWST and providing discharge to the RCS. The FLEX Diesel Generator is utilized to provide power to the charging pump via the Class 1E switchgear.
- Phase 2 strategy may be continued indefinitely. However, the ERO may direct that the station enter a recovery phase to utilize installed equipment. As such, during Phase 3 ICW flow provided by a NSRC

pump and the CCW and RHR systems should be available within 120 hours and may be used, if desired.

Figure 1 Phases 1 and 2 FLEX Water Movement General Arrangement

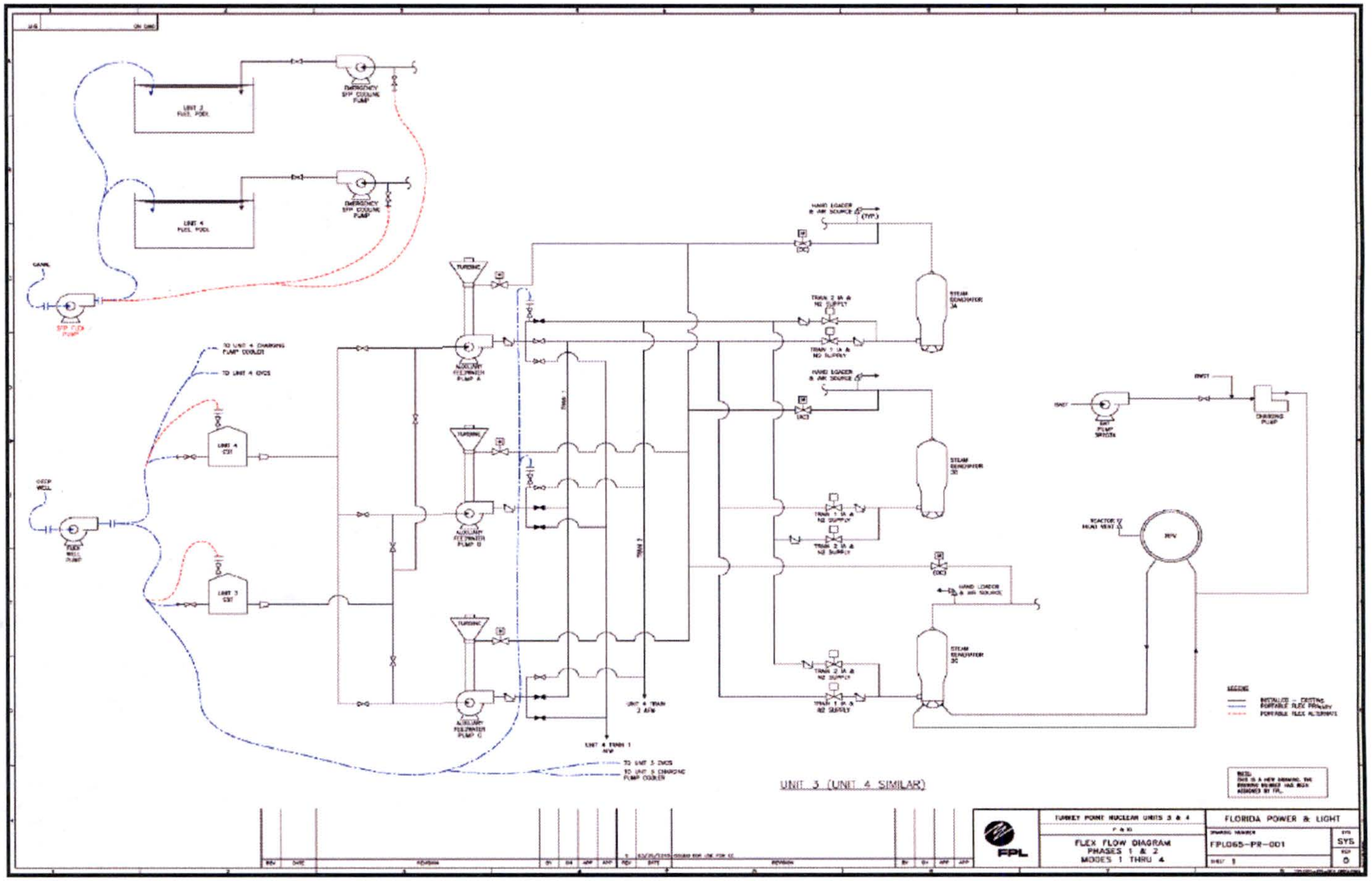


Figure 2 FLEX WELL PUMP HOSE ROUTING (Unit 3 CST Survives)

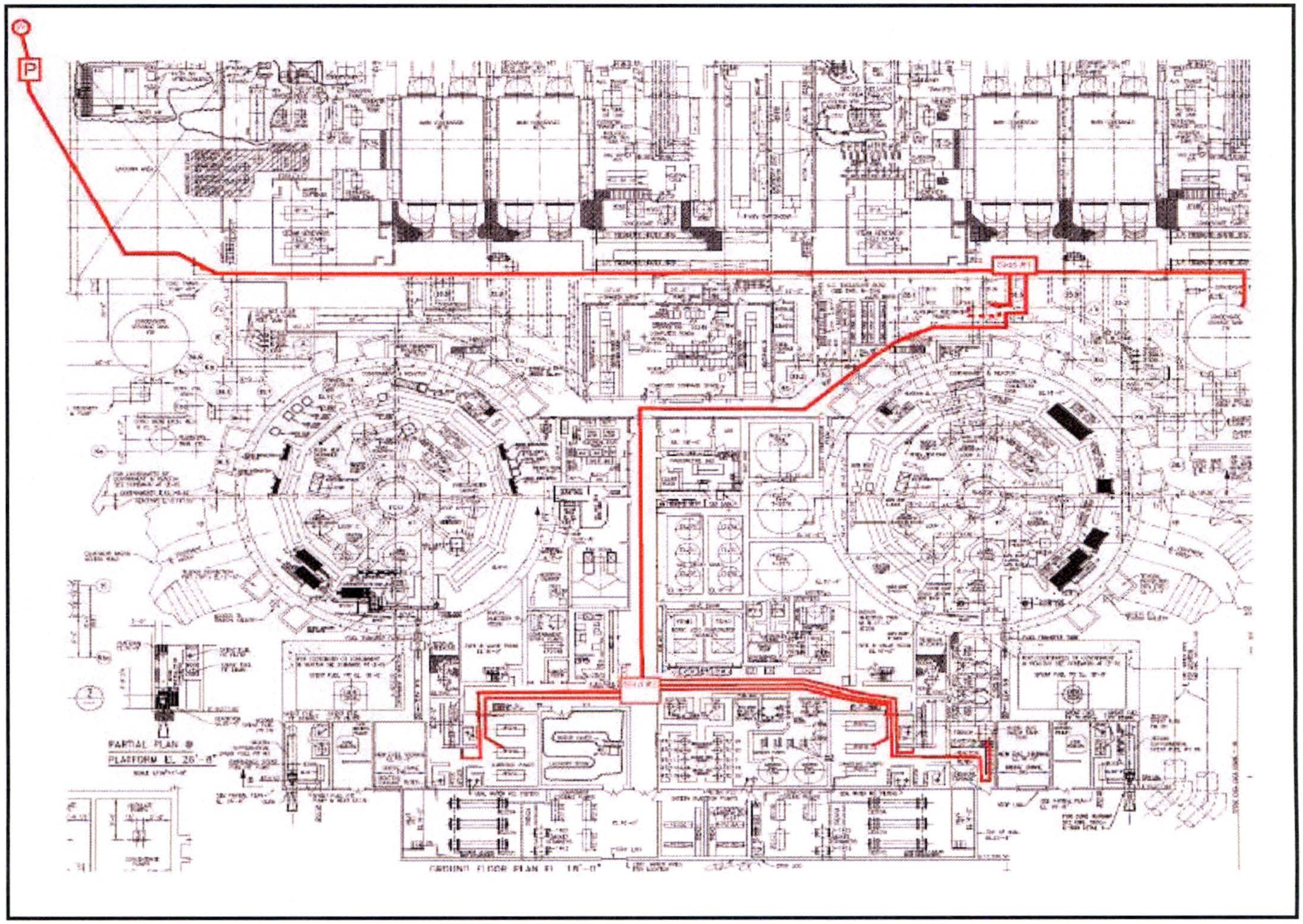


Figure 3 FLEX WELL PUMP HOSE ROUTING (Unit 4 CST Survives)

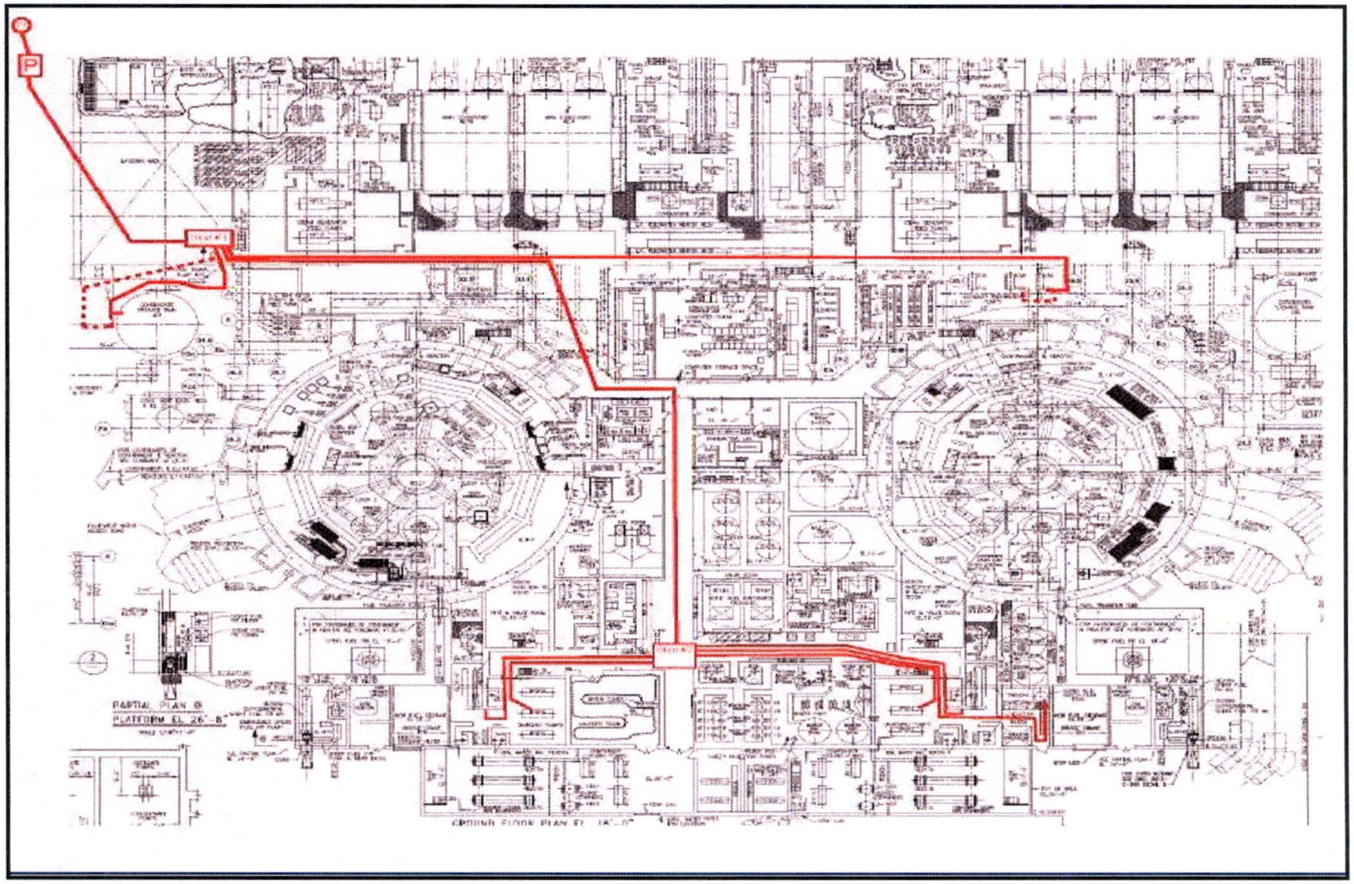


Figure 5 Spent Fuel Pool Hose Routing

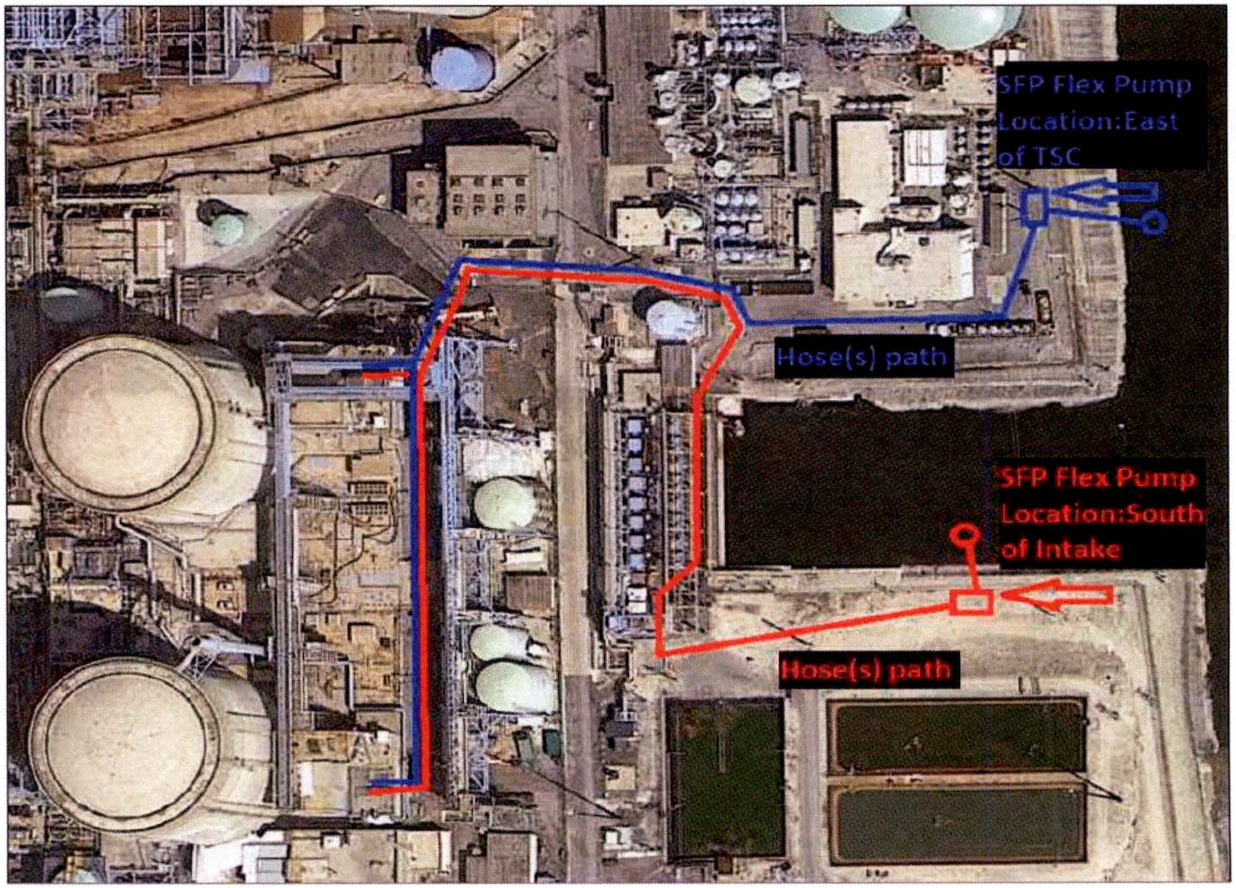


Figure 6 Unit 3 FLEX Electrical Lineups

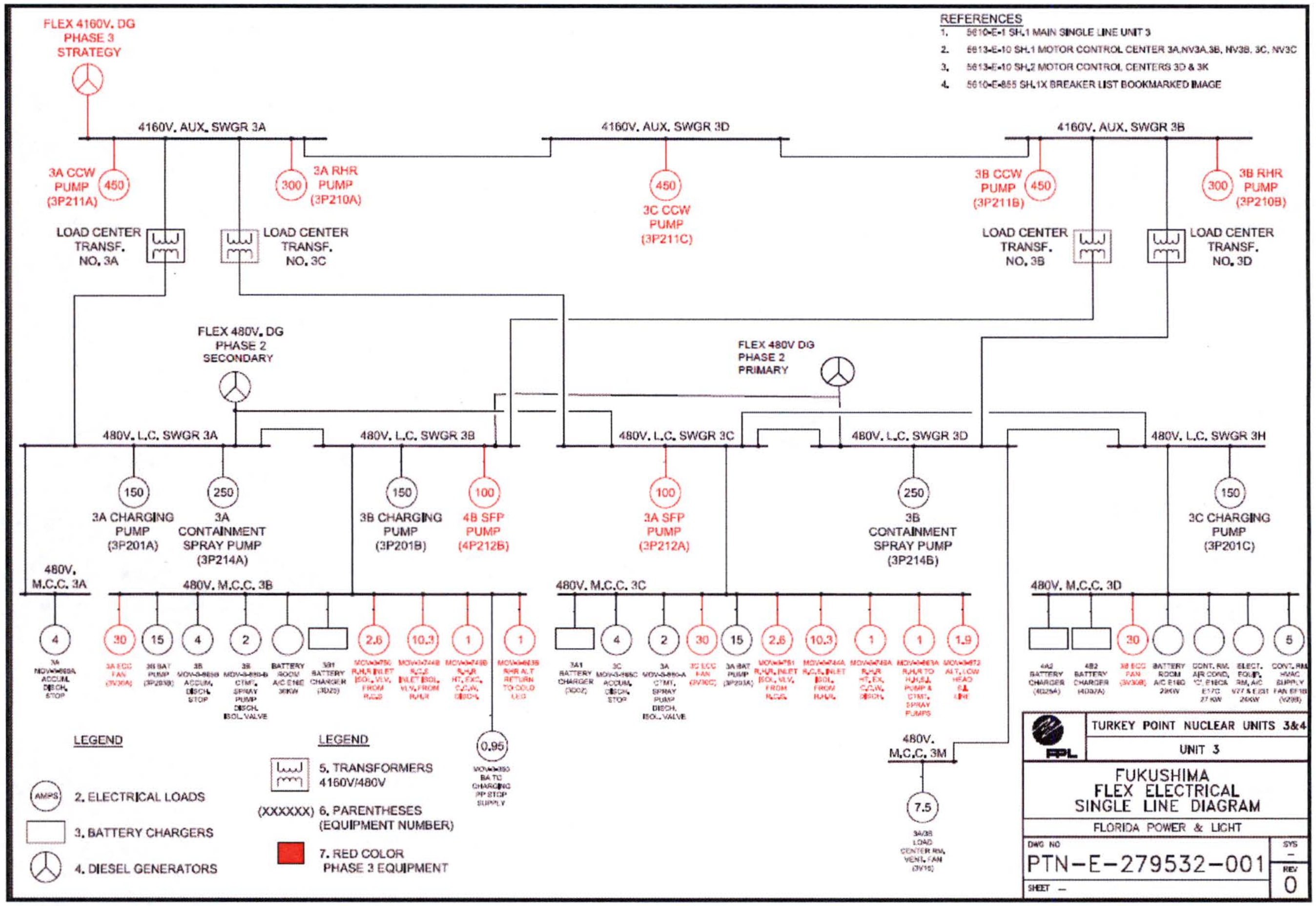

FLEX 4160V. DG
PHASE 3
STRATEGY
REFERENCES
1. 5610-E-1 SH.1 MAIN SINGLE LINE UNIT 3
2. 5613-E-10 SH.1 MOTOR CONTROL CENTER 3A,NV3A,3B, NV3B, 3C, NV3C
3. 5613-E-10 SH.2 MOTOR CONTROL CENTERS 3D & 3K
4. 5610-E-855 SH.1X BREAKER LIST BOOKMARKED IMAGE
4160V. AUX. SWGR 3A
4160V. AUX. SWGR 3D
4160V. AUX. SWGR 3B
3A CCW PUMP (3P211A)
450
300
3A RHR PUMP (3P210A)
450
3C CCW PUMP (3P211C)
3B CCW PUMP (3P211B)
450
300
3B RHR PUMP (3P210B)
LOAD CENTER TRANSF. NO. 3A
LOAD CENTER TRANSF. NO. 3C
LOAD CENTER TRANSF. NO. 3B
LOAD CENTER TRANSF. NO. 3D
FLEX 480V. DG
PHASE 2
SECONDARY
FLEX 480V DG
PHASE 2
PRIMARY
480V. L.C. SWGR 3A
480V. L.C. SWGR 3B
480V. L.C. SWGR 3C
480V. L.C. SWGR 3D
480V. L.C. SWGR 3H
150
3A CHARGING PUMP (3P201A)
250
3A CONTAINMENT SPRAY PUMP (3P214A)
150
3B CHARGING PUMP (3P201B)
100
4B SFP PUMP (4P212B)
100
3A SFP PUMP (3P212A)
250
3B CONTAINMENT SPRAY PUMP (3P214B)
150
3C CHARGING PUMP (3P201C)
480V. M.C.C. 3A
480V. M.C.C. 3B
480V. M.C.C. 3C
480V. M.C.C. 3D
480V. M.C.C. 3M
0.95
7.5
LEGEND
2. ELECTRICAL LOADS
3. BATTERY CHARGERS
4. DIESEL GENERATORS
LEGEND
5. TRANSFORMERS 4160V/480V
(XXXXXX) 6. PARENTHESES (EQUIPMENT NUMBER)
7. RED COLOR PHASE 3 EQUIPMENT
TURKEY POINT NUCLEAR UNITS 3&4
FPL
UNIT 3
FUKUSHIMA
FLEX ELECTRICAL
SINGLE LINE DIAGRAM
FLORIDA POWER & LIGHT
DWG NO
PTN-E-279532-001
SYS
REV
0
SHEET

Figure 7 Unit 4 FLEX Electrical Lineups

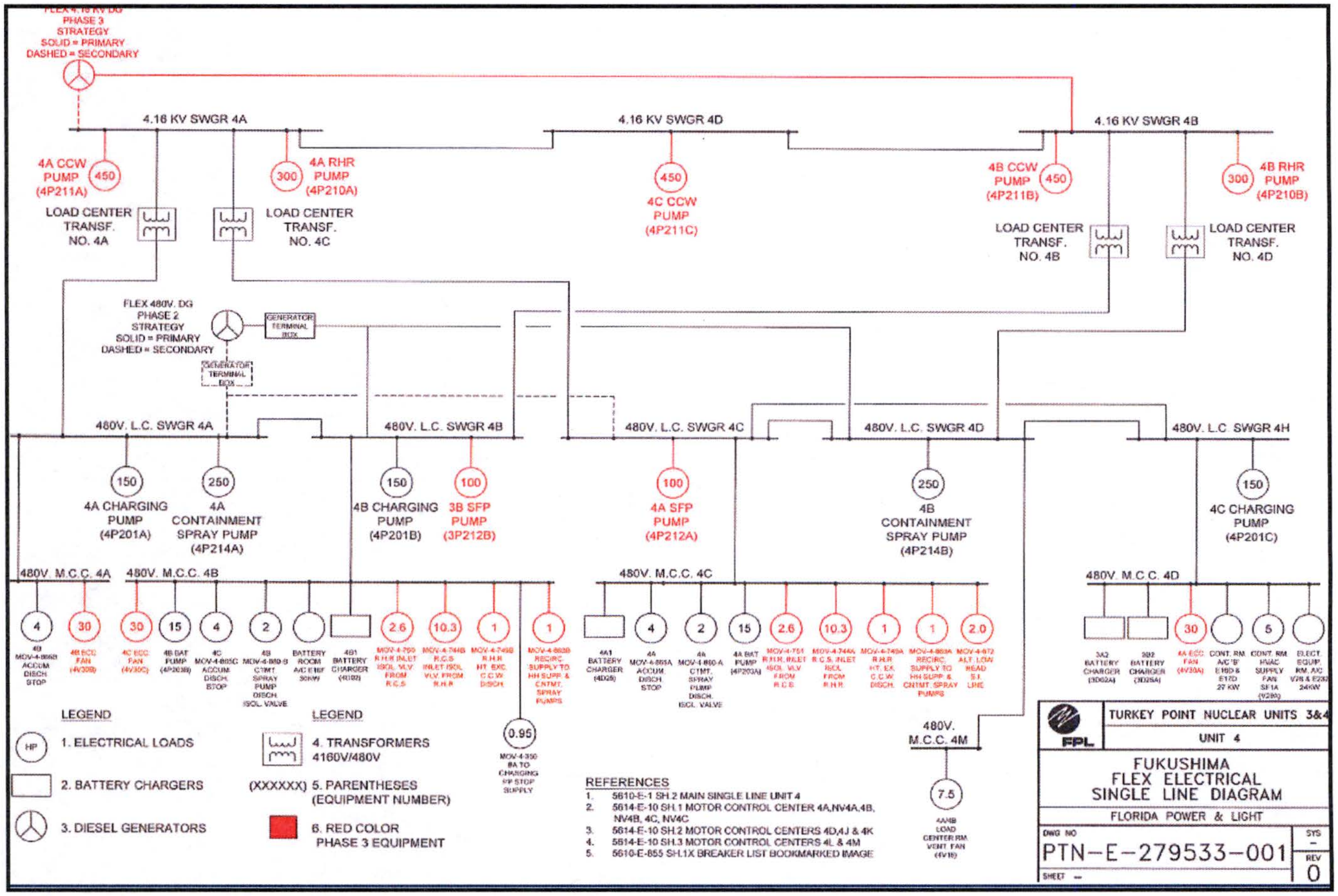


Figure 8 Site Map and Haul Routes from the FLEX Equipment Storage Building

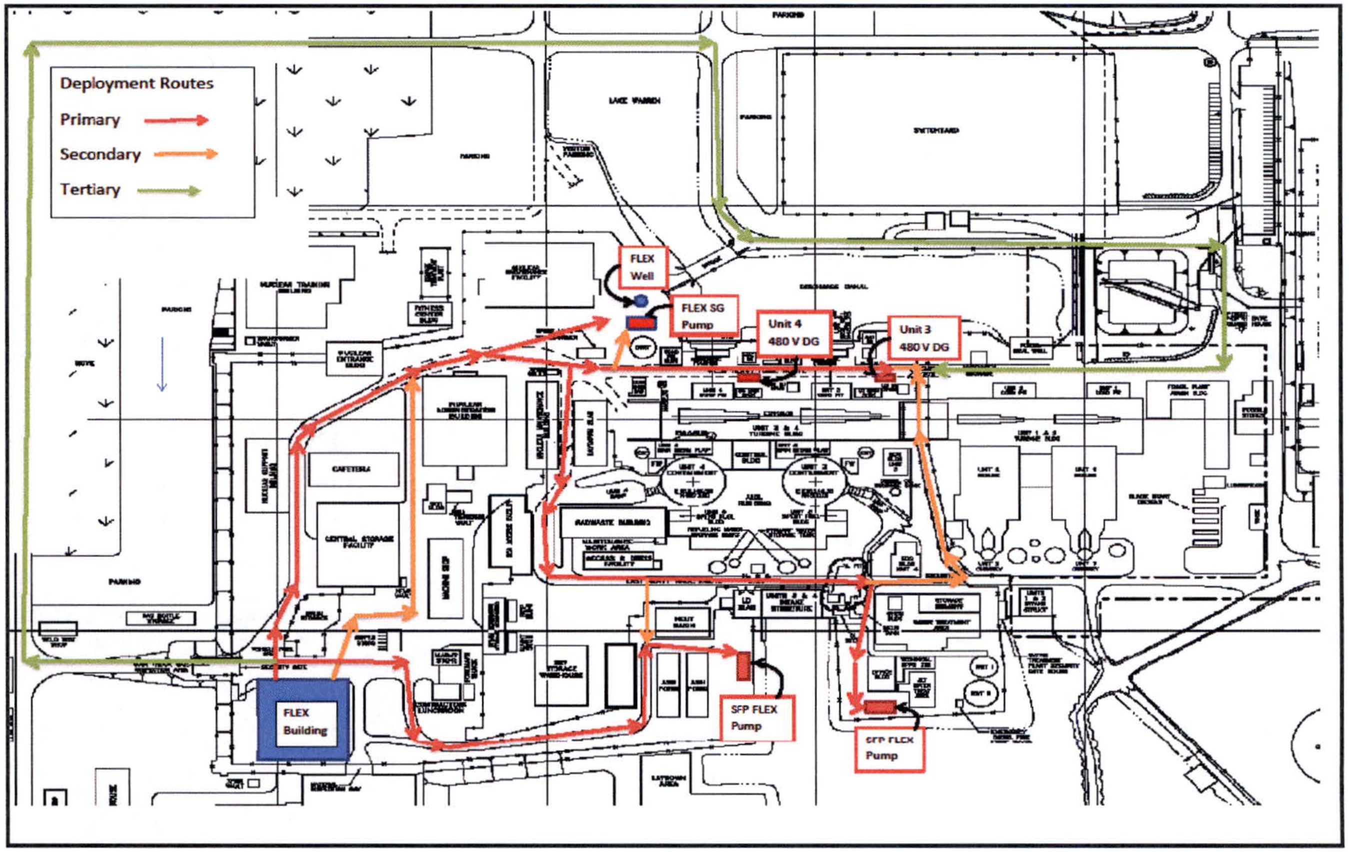
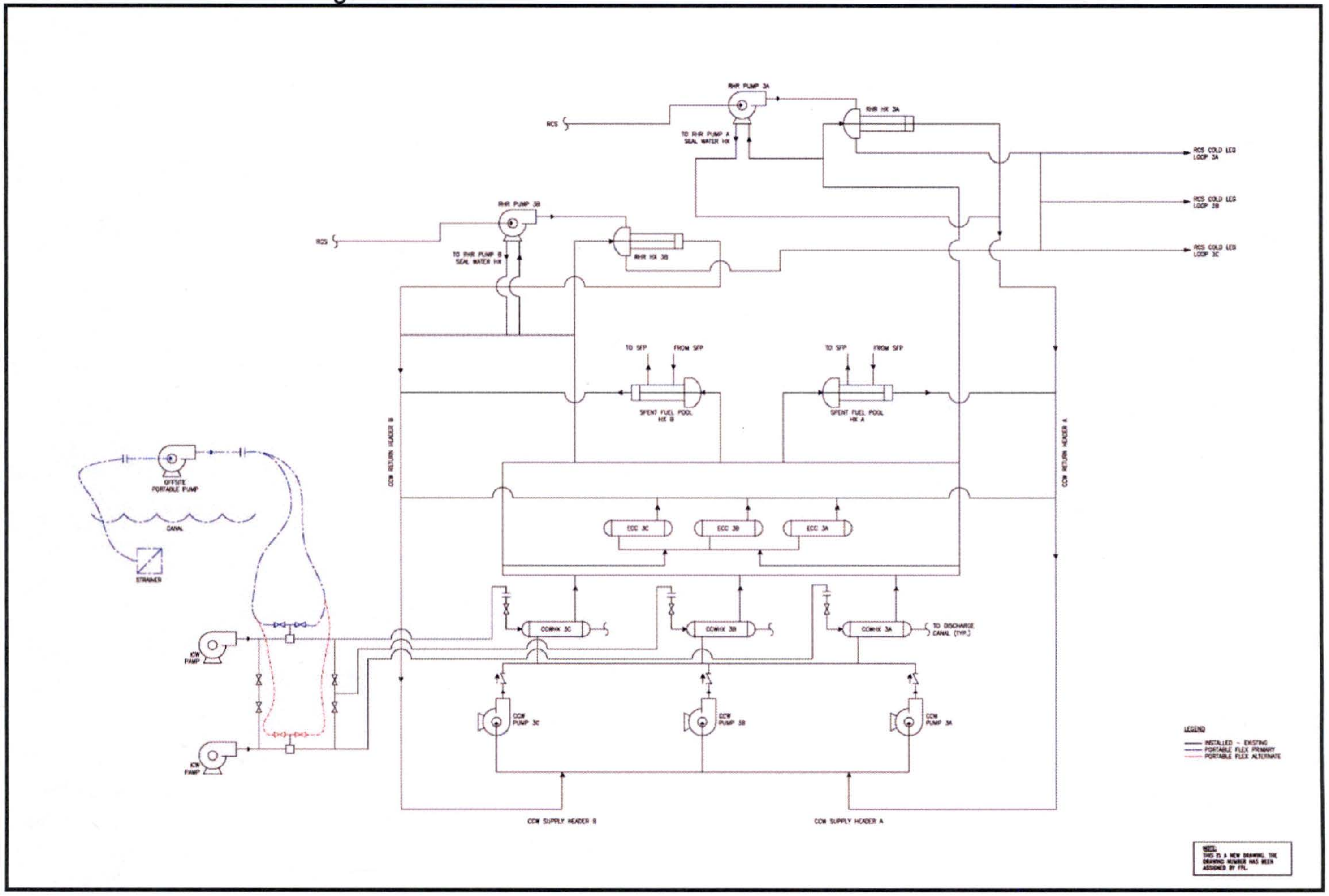


Figure 9 Phase 3 FLEX Water Movement



Sequence of Events

Table 2 below presents a Sequence of Events (SOE) Timeline for an ELAP/LUHS event at PTN. Validation of each of the FLEX time sensitive actions has been completed in accordance the FLEX Validation Process document issued by NEI and includes consideration for staffing. Times are from the time the ELAP event occurs.

Table 2

Action	Start Time	Finish Time	
ELAP BDBEE occurs	0	NA	Reactor Trip. **No operator action** All AC power except for battery backed 120V AC power and normal access to the UHS is lost. **No operator action** Event initiated with plant at 100% power after 100 days of FP operation. **No operator action**
Maintain SG Level	0	NA	AFW pumps starts and flow begins to SGs at full flow. **No operator action** Operate AFW FCVs to maintain SG level from the main control room. Existing main control room operator action in 3/4-ONOP-075 . **No validation performed.** RCS temperature/pressure control provided automatically by the MSSVs as SDTAs are not credited since there is not robust air/nitrogen to the SDTAs. **No operator action is required as the MSSVs operate strictly on RCS pressure without external control.**
Electrical Power	0	NA	EDGs fail to start. No operator action; however, operators are dispatched to investigate diesel generator failure, EOP-ECA-0.0. **No validation required.**
Operating crew enters EOP-ECA-0.0	0.1	NA	Existing main control room operator action that has been demonstrated in training. **No validation required.**

Table 2			
RCP Seal CBO	0.5	0.5	Close RCP CBO isolation valves. Main control room operator action in EOP-ECA-0.0. **Simulator validation documented per 0-ADM-110.**
ELAP Deep Load Shed	0.5-0.75	1.5	Operating crew completes deep load shedding on 125 VDC and battery backed 120 VAC buses. **Action added to maintain battery life. Action is time sensitive at 90 minutes and requires demonstration that action will be completed within 90 minutes of ELAP event. Validation per PTN-0-V1.**
Debris removal initiated	1	3	To be completed to support FLEX Well pump and FLEX DG operation. Debris removal evaluated and timeline determined for the various BDBEEs, i.e., seismic, hurricane, etc., for primary and alternate routes. An evaluation was performed (via walk-though) using engineering judgment for anticipated debris creation and subsequent removal timeline using FLEX debris removal equipment. **The evaluation provides an adequate timeline evaluation and no further validation is required.**
Response to AFW pump trip	1+	NA	One AFW pump is capable of removing decay heat from both units. Because of minimum recirculation limitations, other two AFW pumps are stopped. If running AFW pump subsequently trips, manual action is necessary to restart another AFW pump and manually align discharge valves. Deep load reduction on DC buses requires the manual discharge valve realignment. **Validation is performed by PTN-0-V8.**

Table 2			
AFW Flow Control	2	NA	Post trip operation of AFW is an existing operator action in EOP-ECA-0.0 that has been demonstrated in training. **No validation required.**
SFP doorways opened and hoses staged	1	2	Timing is dependent on worst-case emergency full core offload just being completed. Validation assumes conditions as noted in NEI 12-02, Rev 1, Section 3.4 and unit at power operation with minimum staffing on site. Initial action to setup nozzles and associated hoses in SFP room prior to becoming inaccessible. **Action applies to both units concurrently. Validation per PTN-4-V9.**
Initiate deployment and setup of the FLEX Well pump	3	9	To be completed to support FLEX Well pump operation. **Included in the validation of FLEX Well pump aligned and supplying the CST. Supplying the CST is the first required task of the FLEX Well pump. Validation per PTN-0-V5.**
Initiate deployment and setup of the FLEX DG	2	7	To be completed to support FLEX DG operation. Included in the Validation is the stripping of AC buses and the FLEX DG aligned and powering load centers and battery chargers. **Validation per PTN-4-V4.**
Locally operate AFW FCVs	7	-	AFW N_2 supply exhausted and local operation is an existing operator action in 3/4-ONOP-075 that has been demonstrated in training. **Validation per PTN-0-V8 to demonstrate swapping AFW pumps.**
FLEX DGs in place and powering load centers and battery chargers	7	8	**Validation per PTN-3-V3 and PTN-3-V4.**

Table 2			
FLEX Well pump and hoses installed to supply CST	8	9	With one CST available following a tornado missile at minimum CST level, CST makeup is required before 12 hours (time sensitive) and prior to initiation of plant cooldown. Included in the validation of FLEX Well pump aligned and supplying the CST. **Supplying the CST is the first required task of the FLEX Well pump. Validation per PTN-0-V5.**
Begin depressurizing SGs using the SDTAs to 220 psig following staging of CST makeup	9	12	Pressure target to inject accumulators and allow FLEX Well pump to feed the SGs directly. To depressurize the steam generators, motive power (air/nitrogen pressure) is restored to the STDAs. Since local actions are required to restore functionality of the SDTAs and control plant cooldown and depressurization validation is required. **Validation performed by PTN-3-V2.**
Establish cooling water flow to the charging pumps from the FLEX Well Pump.	9	13	Ensure operation of charging pump. **FLEX Well pump flow to the CST was established earlier per Validation PTN-0-V5. Starting from this configuration well water flow to the selected charging pump is aligned to maintain charging pump functionality. Validation performed by PTN-3-V6.**
Repower boric acid transfer pumps and charging pumps for RCS inventory and reactivity management.	9	13	RCS boration and inventory control. The FLEX DG is in operation as previously validated. Starting from this configuration the boric acid transfer pump, charging pump (after cooling water is established), and the Emergency Boration Valve are energized and operated to establish boration flow. **Validation performed by PTN-4-V4 and PTN-0-V6.**

Table 2			
Stabilize SGs at 220 psig using the SDTAs	13	NA	Stabilizing pressure prevents possible nitrogen injection. Action in EOP-ECA-0.0 (setpoint revised to 220 psig) and capability to operate the SDTAs was validated in PTN-3-V2 previously. **No additional validation required.** FLEX Well pump capable of directly feeding the SGs when steam pressure is too low for AFW pumps to operate. FLEX Well pump flow to the CST was established in PTN-0-V5 and starting from this configuration, flow is established directly from the FLEX Well pump to the AFW lines feeding the steam generators. **This action is NOT time critical and no validation is required.**
Close accumulators' isolation valves	13+	NA	Required closed prior to further RCS cooldown/ depressurization. Staging and operating the FLEX DG to supply the 480 VAC buses was validated previously in PTN-3-V3 and PTN-3-V4, power and control power are available to the accumulator isolation valves. **Closing the accumulator isolation valves is a normal shutdown activity performed by the main control room operator; therefore, no validation is required.**
Portable FLEX equipment refueling	16	-	Required to maintain portable equipment operable. Capability to refuel Phase 2 portable equipment is a new required action required to support FLEX. **Validation is performed by PTN-0-V7.**
FLEX SFP Diesel Pump makeup to SFP	20+	-	Spent fuel uncovery for design basis full core off-load occurs at ~33 hours. For non-defueled conditions, the time requirement for this task is delayed beyond 33 hours. Based on the complexity and timing of the task, a walkdown was performed to validate this task could be implemented. **No validation is required.**

Table 2			
Phase 3 entered	120	NA	NSRC DG powering 4 kV buses RHR, CCW, SFP, and ECC in service. **Based on the actions being performed for Phase 3, no validation is required.** NSRC Cooling Water pump in service. **Based on the actions being performed for Phase 3, no validation is required.**

3.12 Procedures and Training

3.12.1 Overall Program Document

The Turkey Point Program Document (Reference 5.34) provides a description of the Diverse and Flexible Coping Strategies (FLEX) Program for Turkey Point Nuclear Plant. The key program elements provided in the Program Document include:

- Description of the FLEX strategies and basis
- Provisions for documentation of the historical record of previous strategies and the basis for changes
- The basis for the ongoing maintenance and testing programs chosen for the FLEX equipment
- Designation of the minimum set of parameters necessary to support strategy implementation

In addition, the program description includes a list of the FLEX basis documents that will be kept up to date for facility and procedure changes.

Existing design control procedures have been revised to ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies.

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

3.12.2 Procedural Guidance

The inability to predict actual plant conditions that require the use of FLEX equipment makes it impossible to provide specific procedural guidance. As such, the FSGs will provide guidance that can be employed for a variety of conditions. Clear criteria for entry into FSGs ensures that FLEX strategies are used only as directed for BDBEE conditions, and are not used inappropriately in lieu of existing procedures. When FLEX equipment is needed to supplement EOPs or Off-Normal Operating Procedures (ONOPs) strategies, the EOPs, ONOPs, will direct the entry into and exit from the appropriate FSG procedure.

Procedural Interfaces have been incorporated into 3/4-ECA-0.0, "Loss of All AC Power" and Off ONOPs to the extent necessary to include appropriate reference to FSGs and provide command and control for the ELAP.

FLEX Support Guidelines have been developed in accordance with PWROG guidelines. FLEX Support Guidelines provide available, pre-planned FLEX strategies for accomplishing specific tasks in the EOPs or ONOPs. FSGs are used to supplement (not replace) the existing procedure structure that establishes command and control for the event. In general, the FSG's follow the structure of the PWROG with regard to overall strategy with procedure 0-FSG-099 (Reference 5.60) providing the details for use of the equipment. Procedure 0-FSG-13 (Reference 5.58) provides for the transition from FLEX equipment to installed plant equipment as it is restored.

FSGs maintenance is performed by the Operations department as delineated in the FLEX Overall Program Document

FSGs have been reviewed and validated by the involved groups to the extent necessary to ensure the strategy is feasible. Validation may be accomplished via walk-throughs or drills of the guidelines.

3.12.3 <u>Staffing</u>

The assumptions for the NEI 12-01 (Reference 5.8) Phase 2 scenario postulate that the BDBEE involves a large-scale external event that results in:

- an extended loss of AC power (ELAP)
- an extended loss of access to ultimate heat sink (UHS)
- impact on units (all units are in operation at the time of the event)
- impeded access to the units by off-site responders as follows:

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

Using the methodology of (Nuclear Energy Institute) NEI 12-01, an assessment of the capability of the Turkey Point on-shift staff and augmented Emergency Response Organization (ERO) to respond to a Beyond Design Basis External Event (BDBEE) was performed. The results of the staffing assessment determined that FLEX could be implemented with minimum staffing required by the Technical Specifications, the Emergency Response Plan, and Fire Brigade as augmented by the Security staff to assist in debris removal and equipment transport (Reference 5.29 and 5.30).

3.12.4 Training

PTN's Nuclear Training Programs have been revised to assure personnel proficiency in the mitigation of BDBEEs is adequate and maintained. These programs and controls were developed and have been implemented in accordance with the Systematic Approach to Training (SAT) Process.

- Training curriculum for all programs is documented in the Umbrella EC (Reference 5.33).
- Personnel assigned to direct the execution of mitigation strategies for beyond-design basis events have received necessary training to ensure familiarity with the associated tasks, considering available job aids, instructions, and mitigating strategy time constraints.

- Periodic training will be provided to site emergency response leaders (on beyond design- basis emergency response strategies and implementing guidelines. Emergency response leaders are those utility emergency response personnel assigned leadership roles, as defined by the Emergency Plan, for managing emergency response to design basis and beyond-design-basis plant emergencies.)
- Operator training for BDBEE mitigation has received the appropriate emphasis in comparison with other training requirements. The testing/evaluation of operator knowledge and skills in this area have been similarly weighted.
- "ANSI/ANS 3.5, Nuclear Power Plant Simulators for use in Operator Training" certification of simulator fidelity is considered to be sufficient for the initial stages of the BDBEE scenario until the current capability of the simulator model is exceeded. Full scope simulator models have not been upgraded to accommodate FLEX training or drills.
- FLEX drills will be organized on a team or crew basis and conducted periodically; with all time-sensitive actions to be evaluated over a period of not more than eight years.

3.12.5 Equipment List

The equipment stored and maintained in the FLEX Equipment Storage Building necessary for the implementation of the FLEX strategies in response to a BDBEE at PTN is listed in the Overall Program Document. Table 3 provides a summary of the major equipment and their uses in the strategies as well as denotes what equipment meets the N+ 1 requirement.

3.13 Equipment Maintenance and Testing

Portable equipment that directly performs a FLEX mitigation strategy for the core, containment, or SFP is subject to the maintenance and testing guidance provided in INPO AP 913, Equipment Reliability Process, to verify proper function. PTN utilized EPRI Report 3002000623 entitled "Nuclear Maintenance Applications Center: Preventive Maintenance Basis for FLEX Equipment," and the NextEra Energy Fleet Program to determine appropriate PMs and their frequencies. The maintenance program ensures that the FLEX equipment reliability is being achieved. Preventative maintenance procedures will incorporate the following guidance.

- Periodic testing and frequency was determined based on equipment type and expected use. Testing is done to verify design requirements and/or basis. The basis is documented and deviations from vendor recommendations and applicable standards are justified and documented. Several surveillance procedures were created to carry out this testing regime.
- Preventive maintenance is based on equipment type and expected use. The basis is documented and any deviations from vendor recommendations and applicable standards are justified and documented. The PM program follows the standard program for installed plant equipment with respect to procedures developed, evaluation of frequencies, and documentation.
- Existing work control processes are used to control maintenance and testing.

Table 3: Major Equipment Stored in the FESB or Field Boxes

Description	Quantity	Notes/ References
Eagle Tug XL-40 or engineering approved equivalent 30,000 lbs. Drawbar Pull, 300,000 lb. towing capacity	1	Used to move heavy items out of the deployment path. Backup for transport.
Compact Track Loader Caterpillar 299D HXP	1	Used to move smaller debris from the deployment path. Backup for transport.
Transport Truck Ford F550	1	Used for transport of portable equipment
Refueling Trailer w/ 1000 gal Tank, Superior Storage Tank 1000DW Double Walled Tank w/ Trailer or engineering approved equivalent	1	Used to refuel portable equipment
480V, 550 kW Portable Diesel Generator (N+1)	3	Use in repowering the 480 V load centers, battery chargers, charging pumps, boric acid transfer pumps, and ventilation.
Cables for 480V, 600 KW Portable Diesel Generator connections (N+1)	Various	Used to connect the portable diesel generators to the load centers
Godwin 3393 Portable Diesel Pump, 625 gpm at 500 psig (N+1)	2	FLEX WELL Pump used to makeup to the CST's and directly inject into the SG's
Hoses and fittings for FLEX WELL Pump (N+1)	Various	Used to distribute flow from the pumps to skids that supply the CST's, SG's directly and Aux Building equipment
Godwin HL130M Portable Diesel Pump, 600 gpm at 190 psig (N+1)	2	FLEX SFP Pump used to makeup to the spent fuel pools
Hoses and fittings for SFP FLEX Pump (N+1_	Various	Used to distribute flow from pumps to SFP's primary and alternate connections
Hose Trailers	4	Used to transport hoses to pump and connection locations for phases 2 and 3

Description	Quantity	Notes/ References
FLEX Skid A* (N+1)	2	Used to distribute water from the FLEX well to the CST's, direct SG injection and to Skid b
FLEX Skid B** (N+1)	2	Used to distribute water for charging pump cooling, blender station, and BAST mixer.
Hoses for FLEX Skid A and B (N+1)	Various	Used to connect Skids A to Skid B which provides flow to the charging pumps for cooling, blender station, and boric acid storage tank mixer.
UHS manifold for Phase 3 high flow pumps (N+1)	4	Used to distribute flow for high flow SAFER pumps to ICW/CCW Heat Exchangers
Hoses for UHS (N+1)	Various	Used to distribute flow for high flow SAFER pumps to ICW/CCW Heat Exchangers
Trailer Mounted Portable Diesel Generator, 20 kW, Single phase 240/120V, 3-phase 208/120V, 3 phase 480/277V, Generac MMG25 and associated cable.	2	Used for communications equipment
120 VAC , 6 **kW** Portable Diesel Generator (Isolated Neutral) (N+1)	3	CVT Secondary Connect, 0-ONOP-103.3
Portable Diesel Generator, 5 or 6 kW, Single phase 240/120V, Baldor Model DG6E, or equivalent (N+1 for SFP instruments)	7	Used for SFP level, general lighting, fans, and charging radios
Portable lighting	Various	
Radios and Satellite Phones	Various	
Extension Cords and light strings	Various	
Hand tools and hardware	Various	Used for debris removal, mechanical connections, etc.

Description	Quantity	Notes/ References
Equipment Backpack (to hold instrument monitor kit)*** (N+1)	3	1 for Unit 3, 1 for Unit 4, and 1 Spare **Each backpack contains 1/3 of the above SL-012798 Items. Backpacks are stored in field boxes for prompt access.*
Fluke 726 Precision Multifunction Process Calibrator assemblies (N+1)	3	Used on 0-FSG-07 to take direct readings of critical parameters. Stored in backpacks
Goal Zero Yeti 1250W UPS (N+1)	3	Used to power heated junction thermocouples for measurement of critical parameters.
Consumables	Various	Coolant, oil, DEF fluid, gasoline, batteries
Personnel support items	Various	Food, water, hygiene products

* one skid stored in Control Building Elevator Vestibule
** one skid stored in Aux Building Fan Room
*** 2 backpacks stored in Computer Room, and 1 in Control Room

Table 4: Phase 3 Portable Equipment from the NSRC

Component	Description	Unit 3	Unit 4
Medium Voltage Generator	Performance	4160 VAC	4160 VAC
		1 MW	1 MW
	Priority	72 hrs	72 hrs
	Quantity	2	2
	Fuel Consumption	103 gph	103 gph
		12 hrs	12 hrs
	Fuel Tank Capacity	1247 gal	1247 gal
Medium Voltage Generator Cables	Total Feet of Cable (350 ft. of cable per reel)	2450 feet (7 reels on a single cable trailer, 2 per phase and a neutral)	2450 feet (7 reels on a single cable trailer, 2 per phase and a neutral)
	Cable Type	Single conductor type SH, 8kV	Single conductor type SH, 8kV
	Cable Size	4/0 AWG	4/0 AWG
	Cable Connectors	Two hole connector	Two hole connector
	Quantity	2	2
Low Voltage Three-Phase Generator	Performance	480 VAC	480 VAC
		1000 kW	1000 kW
	Priority	72 hrs	72 hrs
	Quantity	1	1
	Fuel Consumption	103 gph	103 gph
		12 hrs	12 hrs
	Fuel Tank Capacity	1247 gal	1247 gal
	Rating Plug	1250A max – 312A min	1250A max – 312A min
Low Voltage Three-Phase Generator Cables	Total Feet of Cable (100 ft. of cable per reel)	2000 feet (20 reels on a single cable trailer, 6 per phase and a 2 neutral)	2000 feet (20 reels on a single cable trailer, 6 per phase and a 2 neutral)
	Cable Type	600 VAC, Type W	600 VAC, Type W
	Cable Size	4/0 AWG	4/0 AWG
	Cable Connectors	Locking connector	Locking connector
	Quantity	1	1
Component	**Description**	**Unit 3**	**Unit 4**

Component	Description	Unit 3	Unit 4
High Pressure Injection Pump	Performance	2000 psi	2000 psi
		60 gpm	60 gpm
	Priority	24 hrs	24 hrs
	Quantity	1	1
	Fuel Consumption	5.75 gph	5.75 gph
		12 hrs	12 hrs
	Fuel Tank Capacity	90 gal	90 gal
High Pressure Injection Pump Suction Hose	Number of Hoses	2 X 100 feet	2 X 100 feet
	Hose Length	200 feet total	200 feet total
	Performance	150 psi	150 psi
	Connection Type	2 – 1/2 inch NPT	2 – 1/2 inch NPT
	Number of Header Connections	1	1
	Quantity	2	2
High Pressure Injection Pump Discharge Hose	Number of Hoses	4 X 50 feet/ 4 X 100 feet	4 X 50 feet/ 4 X 100 feet
	Hose Length	600 feet total	600 feet total
	Performance	2500 psi	2500 psi
	Connection Type	1 – 1/2 inch NPT	1 – 1/2 inch NPT
	Number of Header Connections	1	1
	Quantity	8	8
SG/RPV Makeup Pump	Performance	500 psi	500 psi
		500 gpm	500 gpm
		12 feet lift	12 feet lift
		140°F	140°F
	Priority	72 hrs	72 hrs
	Quantity	1	1
	Fuel Consumption	13 gph	13 gph
		12 hrs	12 hrs
	Fuel Tank Capacity	400 gal	400 gal
SG/RPV Pump Suction Hose	Number of Hoses	4 X 10 feet	4 X 10 feet
	Hose Length	20 feet total	20 feet total
	Performance	150 psi	150 psi
	Connection Type	6 inch NH	6 inch NH
	Number of Header Connections	2	2
	Quantity	4	4

Component	Description	Unit 3	Unit 4
SG/RPV Pump Discharge Hose	Number of Hoses	9 X 100 feet	9 X 100 feet
	Hose Length	300 feet total	300 feet total
	Performance	500 psi	500 psi
	Connection Type	2 – 1/2 inch NH	2 – 1/2 inch NH
	Number of Header Connections	3	3
	Quantity	9	9
Low Pressure / Medium Flow Pump	Performance	300 psi	300 psi
		2500 gpm	2500 gpm
		12 feet lift	12 feet lift
		130°F	130°F
	Priority	72 hrs	72 hrs
	Quantity	1	1
	Fuel Consumption	26 gph	26 gph
		12 hrs	12 hrs
	Fuel Tank Capacity	400 gal	400 gal
Low Pressure / Medium Flow Pump Suction Hose	Number of Hoses	8 X 10 feet	8 X 10 feet
	Hose Length	20 feet total	20 feet total
	Performance	150 psi	150 psi
	Connection Type	6 inch NH	6 inch NH
	Number of Header Connections	4	4
	Quantity	8	8
Low Pressure / Medium Flow Pump Discharge Hose	Number of Hoses	18 X 50 feet	18 X 50 feet
	Hose Length	300 feet total	300 feet total
	Performance	300 psi	300 psi
	Connection Type	5 inch STORZ	5 inch STORZ
	Number of Header Connections	3	3
	Quantity	18	18
Low Pressure / High Flow (Dewatering) Pump	Performance	150 psi	150 psi
		5000 gpm	5000 gpm
		12 feet lift	12 feet lift
		140°F	140°F
	Priority	72 hrs	72 hrs
	Quantity	1	1
	Fuel Consumption	26 gph	26 gph
		12 hrs	12 hrs
	Fuel Tank Capacity	400 gal	400 gal
Low Pressure / High Flow (Dewatering) Pump Suction Hose	Number of Hoses	12 X 10 feet	12 X 10 feet
	Hose Length	20 feet total	20 feet total
	Performance	150 psi	150 psi
	Connection Type	6 inch NH	6 inch NH
	Number of Header Connections	6	6
	Quantity	12	12

Component	Description	Unit 3	Unit 4
Low Pressure / High Flow (Dewatering) Pump Discharge Hose	Number of Hoses	30 X 50 feet	30 X 50 feet
	Hose Length	300 feet total	300 feet total
	Performance	300 psi	300 psi
	Connection Type	5 inch STORZ	5 inch STORZ
	Number of Header Connections	5	5
	Quantity	30	30
Mobile Lighting Tower	Number of Towers	1	1
	Performance	440,000 Lumens	440,000 Lumens
		30 feet height	30 feet height
	Priority	72 hrs.	72 hrs.
	Quantity	3	3
	Fuel Consumption	1 gph	1 gph
		30 hrs.	30 hrs.
	Fuel Tank Capacity	30 gal	30 gal
Diesel Fuel Transfer	Performance	264 gal	264 gal
		30 gpm AC pump	30 gpm AC pump
		25 gpm DC pump	25 gpm DC pump
	Priority	72 hrs.	72 hrs.
	Quantity	1	1
Fuel Air-Lift Containers	Number of Containers	1	1
	Capacity	500 gal	500 gal
	Connection	2 inch Cam-Lock	2 inch Cam-Lock
On-Site Diesel Transfer	Number of Pumps Delivered per Unit	1	1
	Capacity	60 gpm	60 gpm
	Performance	1/2 Micron Filter	1/2 Micron Filter
		25 feet ground strap	25 feet ground strap
	Fuel Consumption	1.32 gal	1.32 gal
		1 hr.	1 hr.
	Fuel Tank Capacity	1.3 gal	1.3 gal
	Connections	Cam-Lock	Cam-Lock
	Suction Hose	10 feet	10 feet
		2 inch	2 inch
	Discharge Hose	25 feet	25 feet
		1 – 1/2 inch	1 – 1/2 inch

Component	Description	Unit 3	Unit 4
Portable Diesel Fuel Tank and Attached Pumps	Number of pumps delivered	1	1
	Capacity	25 gpm DC/35 gpm AC	25 gpm DC/35 gpm AC
	Performance	264 gal	264 gal
		25 gpm DC pump	25 gpm DC pump
	Connections	2 inch NPT	2 inch NPT
	Quantity		
4160 VAC Distribution System	Components	4160 VAC	4160 VAC
		1200 Amp	1200 Amp
	Priority	72 hrs.	72 hrs.

4. Technical Evaluation of Order EA-12-051

4.1 Levels of Required Monitoring

Three Spent Fuel Pool levels were identified in the requirements for reliable instrumentation [Reference 5.5 and 5.6]. These consist of the level required for normal Spent Fuel Pool cooling function, the level required to provide approximately 10 ft. of water shielding above the fuel and the level where the fuel remains covered.

4.2 Design Features

4.2.1 Instruments

The SFPLI consists of two independent channels of guided wave radar probes that are permanently installed to detect the water level inferred from the reflection of the electromagnetic energy. Instrument design and installation adopts requirements provided in NRC and NEI guidance.

4.2.2 Arrangement

The SFPLI level instruments are installed at opposite corners of the north wall of the SFP in Unit 3 and south wall of the SFP in Unit 4 to provide separation of the channels.
Power supplies and transmitter electronics are located remotely to maximize radiation shielding provided by the SFP, Fuel Handling Building and Auxiliary Building structures.

4.2.3 Mounting

The SFPLI detector and associated components are designed and installed as Seismic Class I components.

4.2.4 Qualification

The SFPLI instrumentation quality and expected reliability has been demonstrated by design, analysis, operating experience and testing with operating and environmental conditions applicable or bounding to the PTN fuel handling buildings following an extended loss of all AC power with concurrent loss of SFP cooling and ventilation.

4.2.5 Independence

The SFPLI primary channel components have been constructed and arranged to be redundant and independent of the backup channel through separation and isolation of sensors, power supplies and cabling.

4.2.6 Power Supplies

The SFPLI channels are powered by separate local battery chargers fed from separate sources of 120VAC power. Separate batteries provide at least 72 hours of backup power with the provision for replacement. Provision of 120 VAC power plug for a 6 KW portable generator is also included.

4.2.7 Accuracy

The SFPLI accuracy is +/- 3" (~2%). Operating Procedures establish the SFP levels with 46" of margin for normal fuel pool cooling operation and FLEX Support Guidelines establish the SFP levels with 9" of margin to the minimum shielding elevation (10 ft above fuel) where SFP spray would be initiated.

4.2.8 Testing

Factory Acceptance Testing and On-site Modification Acceptance Testing were performed for function and calibration of the new SFPLI's. Connections and test kits are provided for periodic functional and calibration surveillance procedures that have been established and scheduled.

4.2.9 Display

The SFPLI displays are located in the fully protected structure of the Auxiliary Building at an elevation and location separated from the SFP and in an area that assures accessibility in conditions following a BDBEE.

4.3 Programmatic Controls

4.3.1 Training

Training impact resulting from the installation of the SFPLI was reviewed for operations, maintenance, engineering and simulator. Training lesson plans, class scheduling and sessions were completed to implement the results of these reviews.

4.3.2 Procedures

Operating, maintenance and testing procedures have been developed for SFPLI utilization and reliability. FLEX support guideline have been issued to instruct operators on the use of the SFPLI indication following a BDBEE.

4.3.3 Testing and Calibration

Testing and calibration has been established in instrumentation functional and calibration procedures issued for each channel of each Unit's SFPLI.

All of these requirements have been met for the installations at PTN (Reference 5.21)

5. References

Regulatory, Industry and Docketed

5.1 SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," (ADAMS Accession No. ML 11186A950).

5.2 NRC Order EA-12-049, "Order to Modify Licenses With Regard to Requirements for Mitigation Strategies For Beyond-Design-Basis External Events," dated March 12, 2012, (ADAMS Accession No. ML 12056A045).

5.3 Nuclear Energy Institute (NEI) 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 2, dated December 2015 (ADAMS Accession No. ML 15348A015)

5.4 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 1, dated February 22, 2016(ADAMS Accession No. ML15357A163).

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

5.6 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)

5.7 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)

5.8 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)

5.9 Nuclear Energy Institute, Position Paper: Shutdown/Refueling Modes, dated September 18, 2013 (ADAMS Accession No. ML13273A514)

5.10 NRC letter dated September 30, 2013 (ADAMS Accession No. ML13267A382)

5.11 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.

5.12 NRC Letter, Boron Mixing Endorsement Letter in Regards to Mitigation Strategies Order EA-12-049, dated January 8, 2014 (ADAMS Accession No. ML13276A183)

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

5.14 51-9199717-013, National SAFER Response Center Equipment Technical Requirements

5.15 Not used

5.16 Not used

5.17 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, ADAMS Accession No. ML12053A340

5.18 NRC Letter, Screening And Prioritization Results Regarding Information Pursuant To Title 10 Of The Code Of Federal Regulations 50.54(F) Regarding Seismic Hazard Re-Evaluations For Recommendation 2.1 Of The Near-Term Task Force Review, Of Insights From The Fukushima Dai-Ichi Accident, Adams Accession No. ML 14111A147

5.19 Updated Final Safety Analysis Report (UFSAR), Turkey Point Units 3 & 4, UFSAR_427_a, 04/17/2013

5.20 FPL062-PR-001, Rev. 0, NTTF Recommendation 2.1 (Hazard Reevaluations): Flooding, Florida Power and Light – PTN, March 2013

5.21 FPL Letter L-2016-002, Florida Power and Light Company's, Turkey Point Units 3 and 4, Final Compliance Letter in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), January 6, 2016.

5.22 FPL Letter L-2012-388, Response to NRC 10 CFR 50.54(f) Request for Information Regarding Near-Term Task Force Recommendation 9.3, Emergency Preparedness, 10/25/2012, ML12300A425

5.23 U.S. Nuclear Regulatory Commission letter to Mr. Jack Stringfellow, Chairman PWR Owners Group, dated November 12, 2015 (ML15310A094)

5.24 FPL Letter L-2013-061, Florida Power and Light Company's Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 26, 2013.

5.25 FPL Letter L-2013-249 to NRC, Florida Power and Light Company's Turkey Point Units 3 and 4, First Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 21, 2013.

5.26 FPL Letter L-2014-041 to NRC, Florida Power and Light Company's Turkey Point Units 3 and 4, Second Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 26, 2014.

5.27 FPL Letter L-2014-243 to NRC, Florida Power and Light Company's Turkey Point Units 3 and 4, Third Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 27, 2014.

5.28 FPL Letter L-2015-017 Florida Power and Light Company's Turkey Point Units 3 and 4, Fourth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 26, 2015.

5.29 FPL Letter 2015-254 and 256 (SGI), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation of the Near Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, Emergency Preparedness Phase 3 Staffing Assessment, dated September 28, 2015.

5.30 FPL Letter 2016-013 (SGI), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation of the Near Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, Emergency Preparedness Phase 3 Staffing Assessment with Clarifications, dated January 20, 2016.

5.31 FPL Letter 2015-193 Florida Power and Light Company's Turkey Point Units 3 and 4, Fifth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 11, 2015.

5.32 FPL Letter 2016-016 Florida Power and Light Company's Turkey Point Units 3 and 4, Sixth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 18, 2016.

Supporting Documents (Not Docketed)

5.33 EC 280301, Unit 3 and 4 Fukushima FLEX Strategy Implementation Umbrella Modification.

5.34 Procedure 0-ADM-566, Rev. 1, FLEX Program

5.35 Calculation FPL077-CALC-001 Rev. 0, Well Water Qualification

5.36 Calculation FPL077-CALC-002 Rev. 0, MAAP Steam Generator Analysis

5.37 Calculation FPL077-CALC-003 Rev. 1, MAAP Containment Analysis Calculation FPL077-CALC-004 Rev. 0, Reactivity Balance

5.38 Calculation FPL077-CALC-005 Rev. 0, Control Building Heatup

5.39 Calculation FPL077-CALC-006 Rev. 0, Decay Heat and Makeup Requirements

5.40 Calculation FPL077-CALC-007 Rev. 0, SI Accumulator Volume Injected

5.41 Calculation FPL077-CALC-008 Rev. 0, Nitrogen Usage for Steam Dump to Atmosphere Valves

5.42 Calculation FPL065-CALC-010 Rev. 0, MAAP Analysis

5.43 Calculation FPL065-CALC-005 Rev. 0, Refueling Water Storage Tanks Gravity Drain

5.44 Calculation FPL065-CALC-007 Rev. 0, Boric Acid Solubility

5.45 Calculation FPL065-CALC-009 Rev. 1, Battery Capacity

5.46 Calculation FPL062-CALC-016 Rev. 0, Probable Maximum Storm

5.47 Calculation FPL-CP-018, Turkey Point RETRAN-3D Best Estimate ELAP Analysis.

5.48 3/4-FSG-01, Long Term RCS Inventory Control.

5.49 0-FSG-03, Alternate Low Pressure Feedwater.

5.50 0-FSG-04, ELAP DC Load Shed / Management.

5.51 0-FSG-05, Initial Assessment and Equipment Deployment.

5.52 0-FSG-06, Alternate CST Makeup.

5.53 0-FSG-07, Rev. 0, Loss of Vital Instrumentation or Control Power.

5.54 3/4-FSG-08, Alternate RCS Boration.

5.55 3/4-FSG-09, Low Decay Heat Temperature Control.

5.56 3/4-FSG-10, Passive RCS Injection Isolation.

5.57 3/4-FSG-11, Alternate SFP Makeup and Cooling.

5.58 0-FSG-13, Transition from FLEX Equipment.

5.59 0-FSG-14, RCS Makeup While Shutdown.

5.60 0-FSG-99, Attachments.

5.61 Calculation PTN-BOSI-15-003 Rev. 0, Turkey Point EOP/FSG Setpoints

5.62 Calculation NEE-076-CALC-004 Rev. 0, Turkey Point Reactor Head Vent Hydraulic Calculation