Exelon Generation

RS-18-002 Order No. EA-12-049

January 5, 2018

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

Peach Bottom Atomic Power Station, Unit 3
Renewed Facility Operating License No. DPR-56
NRC Docket No. 50-278

Subject: Report of Full Compliance with 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)

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
2. NRC Interim Staff Guidance JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," Revision 0, dated August 29, 2012
3. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 0, dated August 2012
4. Exelon Generation Company, LLC's Initial Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated October 25, 2012
5. Exelon Generation Company, LLC Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 28, 2013 (RS-13-024)
6. Exelon Generation Company, LLC First Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 28, 2013 (RS-13-127)
7. Exelon Generation Company, LLC 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 28, 2014 (RS-14-014)

8. Exelon Generation Company, LLC 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 28, 2014 (RS-14-212)
9. Exelon Generation Company, LLC 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 27, 2015 (RS-15-023)
10. Exelon Generation Company, LLC 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 28, 2015 (RS-15-214)
11. Exelon Generation Company, LLC 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 26, 2016 (RS-16-026)
12. Exelon Generation Company, LLC Seventh 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 26, 2016 (RS-16-149)
13. Exelon Generation Company, LLC Eighth 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 28, 2017 (RS-17-021)
14. Exelon Generation Company, LLC Ninth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 28, 2017 (RS-17-096)
15. NRC letter to Exelon Generation Company, LLC, Peach Bottom Atomic Power Station, Units 2 and 3 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049, (Mitigation Strategies) (TAC Nos. MF0845 and MF0846), dated November 22, 2013
16. NRC Letter, Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 12, 2012
17. Exelon Generation Company, LLC letter to USNRC, Response to March 12, 2012, Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, Enclosure 5, Recommendation 9.3, Emergency Preparedness – Staffing, Requested Information Items 1, 2, and 6 - Phase 2 Staffing Assessment, dated May 8, 2015 (RS-15-114)
18. NRC letter to Exelon Generation Company, LLC, Peach Bottom Atomic Power Station, Units 2 and 3 – Report for the Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049 and EA-12-051 (TAC Nos. MF0845, MF0846, MF0849, MF0850), dated September 23, 2015

On March 12, 2012, the Nuclear Regulatory Commission ("NRC" or "Commission") issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements For Mitigation Strategies For Beyond-Design-Basis External Events," (Reference 1) to Exelon Generation Company, LLC (EGC). Reference 1 was immediately effective and directed EGC 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 initial status report 60 days following issuance of the final interim staff guidance (Reference 2) and an Overall Integrated Plan (OIP) pursuant to Section IV, Condition C. Reference 2 endorsed industry guidance document NEI 12-06, Revision 0 (Reference 3) with clarifications and exceptions identified in Reference 2. Reference 4 provided the EGC initial status report regarding mitigation strategies. Reference 5 provided the Peach Bottom Atomic Power Station, Unit 3 OIP.

Reference 1 required submission of a status report at six-month intervals following submittal of the OIP. References 6, 7, 8, 9, 10, 11, 12, 13, and 14 provided the first, second, third, fourth, fifth, sixth, seventh, eighth, and ninth six-month status reports, respectively, pursuant to Section IV, Condition C.2, of Reference 1 for Peach Bottom Atomic Power Station, Unit 3.

The purpose of this letter is to provide the report of full compliance with the 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) (Reference 1) pursuant to Section IV, Condition C.3 of the Order for Peach Bottom Atomic Power Station, Unit 3.

Peach Bottom Atomic Power Station, Unit 3 has developed, implemented, and will maintain the 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 in response to Order EA-12-049. The information provided herein documents full compliance for Peach Bottom Atomic Power Station, Unit 3 with Reference 1.

OIP open items have been addressed and closed as documented in References 10 and 11 and are considered complete pending NRC closure. EGC's response to the NRC Interim Staff Evaluation (ISE) open and confirmatory items identified in Reference 15 have been addressed and closed as documented in References 10, 11, and 13 and are considered closed as documented in Reference 18. EGC's response to the NRC ISE confirmatory items identified as open in Reference 18 are addressed in Reference 13 and are considered complete pending NRC closure. EGC's response to the NRC audit questions and additional audit open items have been addressed and closed as documented in Reference 13 and are considered complete pending NRC closure. The following tables provide completion references for each OIP open item and NRC ISE open or confirmatory item, and NRC Audit Report open items.

Overall Integrated Plan Open Items

Section Reference	Overall Integrated Plan Open Item	Completion Response Reference
Multiple Sections	Item 1) Transportation routes will be developed from the equipment storage area to the FLEX staging areas. An administrative program will be developed to ensure pathways remain clear or compensatory actions will be implemented to ensure all strategies can be deployed during all modes of operation. The location of the storage areas, identification of the travel paths and creation of the administrative program are open items.	Reference 11
Programmatic Controls (p. 7)	Item 2) An administrative program for FLEX to establish responsibilities, testing and maintenance requirements will be implemented.	Reference 11
Describe Training Plan (p. 8)	Item 3) Training materials for FLEX will be developed for all station staff involved in implementing FLEX strategies.	Reference 10
Maintain Spent Fuel Pool Cooling (p. 30)	Item 4) Complete an evaluation of the spent fuel pool area for steam and condensation to determine vent path strategy requirements.	Reference 10
Safety Function Support (p. 38)	Item 5) RCIC room temperature analysis is still in progress.	Reference 11
Safety Function Support (p.38)	Item 6) Evaluate the habitability of the Main Control Room and develop a strategy to maintain habitability.	Reference 10
Safety Function Support (p. 38)	Item 7) Develop a procedure to prop open battery room doors and utilize portable fans or utilize installed room supply and exhaust fans upon energizing the battery chargers to prevent a buildup of hydrogen in the battery rooms.	Reference 10
Sequence of Events (p. 4)	Item 8) Timeline walk through will be completed for the FLEX generator installations when the detailed design and site strategy is finalized. The final timeline will be validated once the detailed designs are developed.	Reference 11
Sequence of Events (p. 4)	Item 9) Timeline walk through will be completed for the FLEX pump installations when the detailed design and site strategy is finalized. The final timeline will be validated once the detailed designs are developed. The results will be provided in a future 6-month update.	Reference 10

Section Reference	Overall Integrated Plan Open Item	Completion Response Reference
Sequence of Events (p. 5)	Item 10) Additional analysis will be performed during detailed design development to ensure Suppression Pool temperature will support RCIC operation, in accordance with approved BWROG analysis, throughout the event.	Reference 11
Sequence of Events (p. 5)	Item 11) Analysis of deviations between Exelon's engineering analyses and the analyses contained in BWROG Document NEDC-33771P, "GEH Evaluation of FLEX Implementation Guidelines and documentation of results on Att. 1B, "NSSS Significant Reference Analysis Deviation Table." Planned to be completed and submitted with August 2013 Six Month Update.	Reference 10
Safety Function Support (p. 38)	Item 12) Evaluate the effect of additional load shed on the battery coping time.	Reference 11

Interim Staff Evaluation Open Items

Open Item	Completion Response Reference
Item No. 3.2.3.A	Reference 10
Item No. 3.2.4.3.A	Reference 10
Item No. 3.2.4.4.A	Reference 10
Item No. 3.2.4.5.A	Reference 10

Interim Staff Evaluation Confirmatory Items

Confirmatory Item	Completion Response Reference
Item No. 3.1.1.1.A	Reference 13
Item No. 3.1.1.2.A	Reference 11
Item No. 3.1.1.2.C	Reference 10
Item No. 3.1.1.3.A	Reference 10
Item No. 3.1.1.3.B	Reference 10
Item No. 3.1.1.4.A	Reference 11
Item No. 3.1.2.A	Reference 13
Item No. 3.1.2.1.A	Reference 11
Item No. 3.1.2.2.A	Reference 10
Item No. 3.1.3.2.A	Reference 10
Item No. 3.1.4.2.A	Reference 11
Item No. 3.2.1.1.A	Reference 10

Confirmatory Item	Completion Response Reference
Item No. 3.2.1.1.B	Reference 10
Item No. 3.2.1.1.C	Reference 10
Item No. 3.2.1.1.D	Reference 10
Item No. 3.2.1.1.E	Reference 10
Item No. 3.2.1.2.A	Reference 10
Item No. 3.2.1.4.A	Reference 13
Item No. 3.2.1.4.B	Reference 11
Item No. 3.2.1.4.C	Reference 11
Item No. 3.2.1.4.D	Reference 10
Item No. 3.2.2.A	Reference 10
Item No. 3.2.4.2.A	Reference 11
Item No. 3.2.4.2.B	Reference 10
Item No. 3.2.4.4.B	Reference 13
Item No. 3.2.4.6.A	Reference 11
Item No. 3.2.4.7.A	Reference 10
Item No. 3.2.4.8.A	Reference 10
Item No. 3.2.4.9.A	Reference 10
Item No. 3.4.A	Reference 10
Item No. 3.4.B	Reference 10

NRC Audit Report Open Items

Audit Open Item	Completion Response Reference
ISE CI 3.1.2.A	Reference 13
ISE CI 3.1.1.1.A	Reference 13
ISE CI 3.2.1.4.A	Reference 13
ISE CI 3.2.4.4.B	Reference 13
AQ 40	Reference 13
OIP.9	Reference 13
OIP.11	Reference 13
SE.10	Reference 13
SE.12	Reference 13

MILESTONE SCHEDULE – ITEMS COMPLETE

Milestone	Completion Date
Submit 60 Day Status Report	October 25, 2012
Submit Overall Integrated Plan	February 28, 2013
Contract with National SAFER Response Center	February 14, 2013
Submit 6 Month Updates:	
Update 1	August 28, 2013
Update 2	February 28, 2014
Update 3	August 28, 2014
Update 4	February 27, 2015
Update 5	August 28, 2015
Update 6	February 26, 2016
Update 7	August 26, 2016
Update 8	February 28, 2017
Update 9	August 28, 2017
Modification Development:	
Phases 1 and 2 modifications	November 11, 2016
National SAFER Response Center Operational	September 30, 2014
Procedure Development:	
Strategy procedures	October 21, 2016
Validate Procedures (NEI 12-06, Sect. 11.4.3)	October 30, 2016
Maintenance procedures	October 21, 2016
Staffing analysis	May 8, 2015
Modification Implementation	
Phases 1 and 2 modifications	November 11, 2016
Storage plan and construction	October 21, 2015
FLEX equipment acquisition	October 21 2015
Training completion	October 14, 2015
Unit 3 implementation date	November 6, 2017

ORDER EA-12-049 COMPLIANCE ELEMENTS SUMMARY

The elements identified below for Peach Bottom Atomic Power Station, Unit 3 as well as the site OIP response submittal (Reference 5), the 6-Month Status Reports (References 6, 7, 8, 9, 10, 11, 12, 13, and 14), and any additional docketed correspondence, demonstrate compliance with Order EA-12-049.

Strategies - Complete

Peach Bottom Atomic Power Station, Unit 3 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. The Peach Bottom Atomic Power Station, Units 2 and 3 Final Integrated Plan for mitigating strategies is provided in the enclosure to this letter.

Modifications - Complete

The modifications required to support the FLEX strategies for Peach Bottom Atomic Power Station, Unit 3 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 Peach Bottom Atomic Power Station, Unit 3 has been procured in accordance with NEI 12-06, Sections 11.1 and 11.2, and has been received at Peach Bottom Atomic Power Station, Unit 3; and initially tested/performance verified as identified in NEI 12-06, Section 11.5, and is available for use.

Periodic maintenance and testing will be conducted through the use of the Peach Bottom Atomic Power Station, Unit 3 Preventative Maintenance program such that equipment reliability is achieved.

Protected Storage – Complete

The storage facilities required to implement the FLEX strategies for Peach Bottom Atomic Power Station, Unit 3 have been completed and provide protection from the applicable site hazards. The equipment required to implement the FLEX strategies for Peach Bottom Atomic Power Station, Unit 3 is stored in its protected configuration.

Procedures – Complete

FLEX Support Guidelines (FSGs) for Peach Bottom Atomic Power Station, Unit 3 have been developed and integrated with existing procedures. The FSGs and affected existing procedures have been verified and are available for use in accordance with the site procedure control program.

Training – Complete

Training for Peach Bottom Atomic Power Station, Unit 3 has been completed in accordance with an accepted training process as recommended in NEI 12-06, Section 11.6.

Staffing – Complete

The Phase 2 staffing study for Peach Bottom Atomic Power Station, Unit 3 has been completed in accordance with 10CFR50.54(f), "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," Recommendation 9.3, dated March 12, 2012 (Reference 16), as documented in Reference 17.

National SAFER Response Center – Complete

EGC 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 Peach Bottom Atomic Power Station, Unit 3 with Phase 3 equipment stored in the National SAFER Response Centers in accordance with the site specific SAFER Response Plan.

Validation – Complete

EGC has completed the 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) for Order EA-12-049.

FLEX Program Document - Established

The Peach Bottom Atomic Power Station, Unit 3 FLEX Program Document has been developed in accordance with the requirements of NEI 12-06.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact David J. Distel at 610-765-5517.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 5th day of January 2018.

Respectfully submitted,

James Barstow
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosure: Peach Bottom Atomic Power Station Units 2 and 3 Final Integrated Plan Document – Mitigation Strategies for a Beyond-Design-Basis Event (NRC Order EA-12-049)

cc: Director, Office of Nuclear Reactor Regulation
NRC Regional Administrator - Region I
NRC Senior Resident Inspector – Peach Bottom Atomic Power Station
NRC Project Manager, NRR – Peach Bottom Atomic Power Station
Mr. Peter J. Bamford, NRR/JLD/JOMB, NRC
Director, Bureau of Radiation Protection – Pennsylvania Department of Environmental Resources
S. T. Gray, State of Maryland
R. R. Janati, Chief, Division of Nuclear Safety, Pennsylvania Department of Environmental Protection, Bureau of Radiation Protection

Enclosure

Peach Bottom Atomic Power Station Units 2 and 3

Final Integrated Plan Document – Mitigation Strategies for a Beyond-Design-Basis External Event (NRC Order EA-12-049)

(72 pages)

Exelon Generation

PEACH BOTTOM ATOMIC POWER STATION UNIT 2 & UNIT 3

FINAL INTEGRATED PLAN DOCUMENT

MITIGATING STRATEGIES NRC ORDER EA-12-049

January 2018

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1. Background

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

The US Nuclear Regulatory Commission (NRC) assembled a Near-Term Task Force (NTTF) to advise the Commission on actions the US nuclear industry should take to preclude core damage and a release of radioactive material after a natural disaster such as that seen at Fukushima. The NTTF report 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 (BDBEEs).

Based on NTTF Recommendation 4.2, the NRC issued Order EA-12-049 (Reference 1) on March 12, 2012 to implement mitigation strategies for BDBEEs. The Order provided the following requirements for strategies to mitigate BDBEEs:

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

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

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

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

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

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

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

NRC Order EA-12-049 (Reference 1) required licensees of operating reactors to submit an overall integrated plan, including a description of how compliance with these requirements would be achieved by February 28, 2013. The Order also required licensees to complete implementation of the requirements no later than two refueling cycles after submittal of the overall integrated plan or December 31, 2016, whichever comes first.

The Nuclear Energy Institute (NEI) developed NEI 12-06 (Reference 2), which provides guidelines for nuclear stations to assess extreme external event hazards and implement the mitigation strategies specified in NRC Order EA-12-049. The NRC issued Interim Staff Guidance JLD-ISG-2012-01 (Reference 3), dated August 29, 2012, which endorsed NEI 12-06 with clarifications on determining baseline coping capability and equipment quality.

NRC Order EA-12-051 (Reference 4) required licensees to install reliable SFP instrumentation with specific design features for monitoring SFP water level.

NEI 12-02 (Reference 5) 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 6), conformance with the guidance in NEI 12-02 is an acceptable method for satisfying the requirements in Order EA-12-051.

NRC Order EA-13-109 (Reference 8) required licensees to install a severe accident capable hardened containment vent system for the Primary Containment wetwell to remove decay heat, vent the containment atmosphere, and control containment pressure to within acceptable limits.

NEI 13-02 (Reference 51) provided guidance to assist licensees with compliance with Order EA-13-109. The NRC issued Interim Staff Guidance JLD-ISG-2013-02

(Reference 52), dated November 14, 2013, which endorsed NEI 13-02 with exceptions and clarifications for installing a reliable hardened wetwell vent on Mark 1 and Mark 2 containment venting systems.

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

2.1 General Elements - Assumptions

The assumptions used for the evaluations of a Peach Bottom Atomic Power Station (PBAPS) ELAP/LUHS event and the development of FLEX strategies are stated below.

Boundary conditions consistent with NEI 12-06 Section 3.2.1, *General Criteria and Baseline Assumptions,* are established to support development of FLEX strategies, as follows:

- The BDB external event occurs impacting both units at the site.
- Both reactors are initially operating at 100 percent rated thermal power for at least 100 days or has just been shut down from such a power history as required by plant procedures in advance of the impending event.
- Each reactor is successfully shut down when required (i.e., all control rods inserted, no ATWS). Systems designed for decay heat removal upon shutdown function normally, and reactor coolant system (RCS) overpressure protection valves respond normally, if required by plant conditions, and reseat. The emergency cooling system initiates and operates normally, providing decay heat removal, thus obviating the need for further overpressure protection valve operation.
- On-site staff is at site administrative minimum shift staffing levels.
- No independent, concurrent events, e.g., no active security threat.
- All personnel on-site are available to support site response.
- The reactor and supporting plant equipment are either operating within normal ranges for pressure, temperature and water level, or available to operate, at the time of the event consistent with the design and licensing basis.

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

- No specific initiating event is used. The initial condition is assumed to be a loss of off-site power (LOOP) with installed sources of emergency on-site AC power and station blackout (SBO) alternate AC power sources unavailable with no prospect for recovery.
- Cooling and make-up water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds and associated missiles are available. Permanent plant equipment that is contained in structures with designs that are robust with respect to seismic events, floods, and high winds and associated missiles, are available. The portions of the fire protection system that are robust with respect to seismic events, floods, and high winds and associated missiles are available as a water source.
- Normal access to the ultimate heat sink is lost, but the water inventory in the ultimate heat sink (UHS) remains available and robust piping connecting the UHS to plant systems remains intact. The motive force for UHS flow, i.e., pumps, is assumed to be lost with no prospect for recovery.
- Fuel for FLEX equipment stored in structures with designs that are robust with respect to seismic events, floods and high winds and associated missiles, remains available.
- Installed Class 1E electrical distribution systems, including inverters and battery chargers, remain available since they are protected.
- No additional accidents, events, or failures are assumed to occur immediately prior to or during the event, including security events.
- RCS inventory loss modeled in MAAP is 42 gpm (18 gpm from recirculation pump seals per pump, 5 gpm unidentified leakage, and 1 gpm identified leakage). The model shows decreasing leakage rate as the RPV is depressurized. Although RCS leakage may initiate after transient initiation, this is a reasonable representation of actual seal leakage.
- For the spent fuel pool, the heat load is assumed to be the maximum design basis heat load. In addition, inventory loss from sloshing during a seismic event does not preclude access to the pool area.

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

- Exceptions for the site security plan or other requirements of 10CFR may be required.
- Site access is impeded for the first 6 hours, consistent with NEI 12-01 (Reference 7). Additional resources are assumed to begin arriving at hour 6 with limited site access up to 24 hours. By 24 hours and beyond, near-normal site access is restored allowing augmented resources to deliver supplies and personnel to the site.
- This plan defines strategies capable of mitigating a simultaneous loss of all alternating current (AC) power and loss of normal access to the ultimate heat sink resulting from a BDB event by providing adequate capability to maintain or restore core cooling, containment integrity, and SFP cooling capabilities. Though specific strategies have been developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions. These pre-planned strategies developed to protect the public health and safety have been incorporated into the unit emergency operating procedures (EOP) in accordance with established EOP change processes.
- The plant Technical Specifications contain the limiting conditions for normal unit operations to ensure that design safety features are available to respond to a design basis accident and direct the required actions to be taken when the limiting conditions are not met. The result of the BDB event may place the plant in a condition where it cannot comply with certain Technical Specifications and/or with its Security Plan, and, as such, may warrant invocation of 10 CFR 50.54(x) and/or 10 CFR 73.55(p). This position is consistent with the previously documented Task Interface Agreement (TIA) 2004-04, "Acceptability of Proceduralized Departures from Technical Specification (TSs) Requirements at the Surry Power Station", (TAC Nos. MC42331 and MC4332), dated September 12, 2006 (Reference 9).

2.2 Strategies

The objective of the FLEX Strategies is to establish an indefinite coping capability in order to 1) prevent damage to the fuel in the reactor, 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 indefinite coping capability will address an ELAP/LOOP, emergency diesel generators (EDGs), and the station blackout Line (SBO Line) – with a simultaneous LUHS and loss of motive force for UHS pumps, but the water in the UHS remains available. This condition could arise following external events that are within the existing design basis with additional failures and conditions that could arise from a Beyond-Design-Basis external event.

The plant indefinite coping capability is attained through the implementation of pre-determined strategies (FLEX strategies) that are focused on maintaining or restoring key plant safety functions. The FLEX strategies are not tied to any specific damage state or mechanistic assessment of external events. Rather, the strategies are developed to maintain the key plant safety functions based on the evaluation of plant response to the coincident ELAP/LUHS event. A safety function-based approach provides consistency with, and allows coordination of, existing plant emergency operating procedures (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 involve a three-phase approach:

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

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

The FLEX strategies described below are capable of mitigating an ELAP/LUHS resulting from a BDB external event by providing adequate capability to maintain or restore core cooling, containment integrity, and SFP cooling capabilities at PBAPS. Though specific strategies have been developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions. These pre-planned strategies which have been developed to protect the public health and safety are incorporated into the Peach Bottom EOPs.

The FLEX strategies are implemented by FSGs in conjunction with other site emergency procedures (TRIP, SAMP, SE-11). SE-11 Sheet 6 (Reference 33) provides a Flowchart of actions to be performed under ELAP for all FLEX events. The entry condition for SE-11 Sheet 6 is Loss of Off-Site Power with no EDGs available and the expectation that power will not be restored to any 4 KV bus within one hour.

2.3 Reactor Core Cooling Strategy

The FLEX strategy for reactor core cooling and decay heat removal is to utilize Reactor Core Isolation Cooling System (RCIC) injection into the Reactor Pressure Vessel (RPV) and cycle Safety Relief Valves (SRV). Decay heat rejected to the Primary Containment via the SRV discharge and RCIC exhaust to the Suppression Pool will be released to outside the Reactor Building using the Hardened Containment Vent System (HCVS).

DC bus load shedding will ensure battery life is extended (to 7.25 hours for Division I, Reference 21). Portable generators will re-power instrumentation prior to battery depletion. DC load shed of all non-essential loads would begin when it is recognized that the station is in a SBO condition and completed within 90 minutes.

RPV makeup provided by a portable diesel driven pump, hereinafter called the FLEX Pump, will be available to be initiated by 12 hours from event onset, as a backup to RCIC, to ensure that reactor water level will remain above the Top of Active Fuel (TAF).

2.3.1 Phase 1 Strategy

At the initiation of the event, the operators enter the TRIPs (Transient Response Implementation Plan procedures which are the Peach Bottom-specific EOPs) and SE-11, "Loss of Offsite Power". Site specific FSGs are entered, as directed by SE-11, when there has been a loss of offsite power, including the Conowingo Tie Line (SBO Line) and the Emergency Diesel Generators, with confirmation of no imminent return of any of these power sources to service. To extend the 125 VDC battery and 250 VDC battery coping times, load shedding actions are taken during Phase 1 (SE-11 Att T and FSG-044-2/3) and completed within 90 minutes. In addition, the operators will line up a backup, safety grade pneumatic nitrogen supply to the ADS SRVs (FSG-044-2/3) to enable remote operation of the safety relief valves for a period of 72 hours (Reference 12). A gradual cool down of the RPV with SRVs will be performed.

The FLEX strategy utilizes the RCIC system for initial RPV water level control. The RCIC pump can take suction from the condensate storage tank (CST) or from the Torus. The CSTs are qualified for all events with the exception of seismic and tornado / high winds. If the CST is unavailable, suction is transferred to the Torus. Only water from the Torus is credited in the FLEX strategy. The RCIC System operates independent of AC power. It is expected that RCIC would remain a viable source of injection as long as 125 VDC control power is available for system control and 250 VDC is available for the control of valves. Procedural guidance exists in SE-13.1-2(3) to operate RCIC without DC power. This strategy is available but not required for the ELAP event. RCIC trips and isolations are defeated (FSG-043-2/3) to prevent a spurious signal from removing RCIC from service. A natural ventilation path will be established through the RCIC and HPCI rooms (SE-11 Att U). Doors are opened in the RCIC and HPCI rooms to allow for long term operation of the RCIC system.

Boiling Water Reactor Owners Group (BWROG) study BWROG-TP-14-018 evaluated RCIC performance at elevated temperatures. This study concluded that there is no loss of RCIC functionality below Torus suction temperatures of 250°F. RCIC will continue to be operated as long as possible before transitioning to portable FLEX equipment. Anticipatory venting of the containment will be initiated such that peak Suppression Pool temperature remains below 250° F.

Following stabilization of the plant after the event, a reactor cooldown is commenced at a rate not exceeding the 100°F/hour Technical Specification limit. Reactor pressure is maintained in the 200 to 300 psi range to preserve the steam supply to the RCIC turbine until RCIC operation is no longer viable. When RCIC operation is no longer viable, reactor pressure is further lowered so that the FLEX Pump can inject.

Deployment of the portable FLEX Pumps is initiated, using one of three FSGs depending on conditions (FSG-039-2/3, FSG-040-2/3, or FSG-041-2/3). Deployment of the portable FLEX Generators is initiated, using one of two FSGs depending on conditions (FSG-010-2/3 or FSG-011-2/3). The 480 VAC electrical system is aligned for repowering essential equipment during the event (FSG-013-2/3). Steps to provide RPV injection, Torus makeup, and Fuel Pool makeup and/or spray using a FLEX Pump are initiated (FSG-042-2/3).

2.3.2 Phase 2 Strategy

Within 7 hours of event initiation (reference Section 2.17, "Sequence of Events"), a portable FLEX Generator is providing power to the Unit's Division I Safety Related

480 VAC System (FSG-010-2/3 or FSG-011-2/3, refer to Figures 9, 10, 11, and 12). The FLEX Generator for each Unit can be located in one of two locations depending on conditions. The preferred location for each Unit is outside of the Unit's Reactor Building outer railroad door. An alternate location for each Unit is west of the Unit's Reactor Building. Temporary cables will be routed from the FLEX Generator to a connection panel that supplies two emergency 480 VAC load centers. After power is supplied to selected emergency buses, power is available to the Division I battery chargers. Selected valves in one loop of RHR for each Unit are powered to assist with RHR injection and Torus makeup. Power is also available for other essential loads such as ventilation for the Main Control Room and battery rooms.

Within 12 hours of event initiation, a portable FLEX Pump is available to supply makeup to the RPV, Torus, and SFP (FSG-042-2/3 in conjunction with either FSG-039-2/3, FSG-040-2/3, or FSG-041-2/3). The FLEX Pump for each Unit can be located in one of three locations depending on conditions. There are four different lineups available to support makeup water to the RPV, Torus and SFP as described below.

2.3.2.1 ECT Suction with Preferred Discharge to 2B(3A) RHR Loop (FSG-040-2/3)

Refer to Figures 1, 2, and 3. The FLEX coping strategies utilize portable, diesel powered pumps to provide the motive force supplying make-up water. A tie-in FLEX Pump connection has been added to the Emergency Cooling Tower (ECT) Reservoir letdown line for the source of make-up water to the diesel powered pumps. This modification consists of 6 inch tie in piping connecting to the 24 inch letdown line between valves MO-3-48-3804A and MO-3-48-3804B. The piping penetrates the south wall of the ECT Building and ends at a 6 inch connection. The entire length of hard pipe, including the wall penetration, is Seismic Class I.

The discharge of the FLEX Pump connects to the 2B(3A) RHR Loop system between gate valves HV-2(3)-10-57 and HV-2(3)-10-66 via a new 4" pipe connection. Gate valves HV-2(3)-10-57 and HV-2(3)-10-66 are double isolation valves connecting the 24" RHR loop "B"("A") header to the Radwaste system. The configuration also contains an isolation gate valve and an additional globe valve for throttling. The new piping and associated fittings are designed per seismic Class I criteria and are only utilized for FLEX coping strategies. From this RHR injection point,

make-up water can be supplied to the RPV, Torus, or SFP (backup for SFP makeup). The discharge from the FLEX Pump splits into one line discharging to the 2B/3A RHR Loop and another line discharging to the SFP.

2.3.2.2 ECT Suction with Alternate Discharge to 2A(3B) RHR Loop (FSG-040-2/3)

Refer to Figures 4, 5, and 6. The FLEX Pump ECT suction when discharging to the 2A(3B) RHR Loop is identical to the suction as described in the above section. The discharge from the FLEX Pump splits into one line discharging to the RHR system at gate valve HV-2(3)-10-2(3)1596 via a 3" pipe connection for make-up to the RPV or Torus and another line discharging to the SFP. The RHR piping and associated fittings are designed per seismic Class I criteria and are utilized for B.5.b and FLEX coping strategies. The discharge to the SFP also connects to the SBLC system at globe valve HV-2(3)-11-37 via a 3/4" pipe connection for make-up to the RPV.

2.3.2.3 ECT Suction with Alternate Discharge to 2B(3A) HPSW Loop (FSG-039-2/3)

Refer to Figures 7, 2, and 3. The FLEX Pump ECT suction when discharging to the 2B(3A) HPSW Loop is identical to the suction as described above. The discharge of the FLEX Pump connects to the HPSW system at globe valve HV-2-32-23446(HV-3-32-33445) and then into the RHR System through MO-2(3)-10-174 and MO-2(3)-10-176 (HPSW to RHR Cross-Tie valves). From the RHR System, make-up water can be supplied to the RPV, Torus, or SFP.

2.3.2.4 Alternate Pump Structure Suction with Discharge to 2B(3A) HPSW Loop (FSG-041-2/3)

Refer to Figures 8, 2, and 3. The FLEX Pump is capable of using the plant intake (i.e., UHS) at various locations as a source of make-up water. This water source requires no physical modification. A strainer on the end of hardened suction hose is submerged below the water surface at a plant intake accessible pathway.

The discharge of the FLEX Pump connects to the HPSW system at globe valve HV-2-32-23446(HV-3-32-33445) and then into the RHR System through MO-2(3)-10-174 and MO-2(3)-10-176 (HPSW to RHR

Cross-Tie valves). From the RHR System, make-up water can be supplied to the RPV, Torus, or SFP.

Arrangements can be made for obtaining water makeup to the ECT via the Emergency Response Organization or the Nuclear Duty Officer (NDO). Makeup water can be obtained through contact with the National SAFER Response Centers (NSRC).

2.3.3 Phase 3 Strategy

Phase 3 will utilize Phase 2 connections and NSRC equipment as spares. PBAPS relies on equipment stored off-site for Phase 3 of the FLEX mitigation strategy. Equipment may be provided from NSRCs. Another nuclear plant may also provide Phase 3 equipment, if response would be faster than from the NSRCs.

Temporary staging areas have been identified and details for their use in supporting Phase 3 equipment receipt, inspection, and deployment to operating areas are provided in CC-PB-118-1001, "SAFER Response Plan for PBAPS" (Reference 18).

2.3.4 Structures, Systems, Components

2.3.4.1 Reactor Core Isolation Cooling (RCIC)

The RCIC system consists of a steam-driven turbine-pump unit and associated valves and piping capable of delivering makeup water to the reactor vessel. The steam supply to the turbine comes from the "C" main steam line between the reactor and inboard MSIV and exhausts to the suppression pool. The pump can take suction from the condensate storage tank or from the suppression pool. The makeup water is delivered into the reactor vessel through a connection to the "B" feedwater line and is distributed within the reactor vessel through the feedwater spargers. Cooling water for the RCIC system turbine lube oil cooler and barometric condenser is supplied from the discharge of the pump.

All components necessary for initiating operation of the RCIC system are completely independent of auxiliary AC power, plant service air, and external cooling water systems, requiring only DC power from the station battery. The power source for the turbine-pump unit is the steam generated in the reactor pressure vessel by the decay heat in the core. Calculation PM-1159 (Reference 14) was performed to determine the temperature of the RCIC Pump Room during an ELAP given that supplemental actions to supply cool air to the room are taken, which

include opening room doors and placing portable cooling in service. Operation of the RCIC system provides make-up to the RPV to maintain water level during operation until RPV pressure is insufficient for system operation, at which time the FLEX Pump will be used for RPV level control.

2.3.4.2 Batteries

The safety-related Class 1E batteries and associated DC distribution systems are located within safety-related structures and will provide power to support operation of RCIC, SRVs, and key instrumentation. Load shedding of non-essential equipment has been conservatively calculated to provide a coping time of 7.25 hours of operations for the Division I batteries.

2.3.4.3 RHR System

Each Unit's RHR system consists of two independent loops ("A" and "B"). Each loop is provided with two motor-driven pumps, two heat exchangers, piping, suction strainers, valves, instrumentation, and controls. The two RHR loops can be connected by opening a cross-tie valve. Each loop is capable of providing water makeup to the RPV or to the Suppression Pool. The Unit 2 "B" and Unit 3 "A" RHR loops can provide SFP makeup, although in most cases SFP makeup is via hoses connected directly to the FLEX Pump. The specific use of the RHR system depends on the FLEX Pump lineup chosen (FSG-039-2/3, FSG-040-2/3, or FSG-041-2/3).

2.3.5 Key Parameters

The following key parameter instrumentation is provided to support the reactor core cooling and decay heat removal strategy with indication available in the PBAPS Main Control Room (MCR):

RPV Level:

- LI-2(3)-02-3-085A
- LI-2(3)-02-3-091
- LI-2(3)-02-3-113

RPV Pressure:

- PI-2(3)-06-090A, B, C
- PR/LR-2-06-096 (Unit 2) / XR-91446 (Unit 3)
- PI-2(3)-23-111 (HPCI Steam Inlet Pressure, only available until Division II batteries are depleted)
- PI-2(3)-13-094 (RCIC Steam Inlet Pressure)

The above instrumentation is available prior to and after DC load shedding of the DC buses during ELAP response procedure implementation for up to 7.25 hours (Reference 21). Availability after 7.25 hours is dependent on actions to restore and maintain the Division I Battery Chargers with the portable FLEX Generator.

In the unlikely event that key parameter instrumentation is unavailable, alternate methods for obtaining the critical parameters locally are provided in procedure FSG-045-2(3), "Obtaining Transmitter Instrument Readings".

2.3.6 Thermal Hydraulic Analyses

At the initiation of the loss of all AC power event, the main steam isolation valves (MSIVs) will automatically close, feedwater is lost, and SRVs automatically cycle to control pressure. The inventory passing through the SRVs causes reactor water level to decrease. When reactor water level reaches -48.0 inches, RCIC automatically starts with suction from the Condensate Storage Tanks (CSTs) (Reference 12 & Technical Specification (TS) 3.3.5.2 Reference 11) and operates to inject makeup water to the reactor vessel (note that the CSTs are not seismically qualified and if damaged, RCIC will automatically transfer suction to the Suppression Pool). This injection is sufficient to maintain reactor water level above TAF and to recover the reactor level to the normal band. MAAP4 computer code was used to simulate the ELAP event for PBAPS and is an acceptable method for establishing a timeline which meets the intent of NRC Order EA-12-049 (Reference 1). The specific MAAP4 analysis case that was used to validate the timing of mitigating strategies is documented in PBAPS document PB-MISC-010 (Reference 13). Case 20B evaluates the plant response during the ELAP when RCIC is taking suction from the Suppression pool.

The PBAPS FLEX strategy is to depressurize/cool down to approximately 500 psig for the first hour, approximately 500 psig to 300 psig for the second hour, and approximately 300 psig to 200 psig in the third hour and beyond. The representative Case 20B of MAAP analysis PB-MISC-010 demonstrates that the cooldown rate will not exceed 100 °F/hour and that the RPV water level remains above TAF for the duration of the analysis.

2.3.7 FLEX Pumps and Water Supply

2.3.7.1 Flex Pumps

Consistent with NEI 12-06, Appendix C, RPV injection capability is provided using FLEX Pumps via a primary or alternate connection. The FLEX Pump is a Godwin Dri-Prime HL130M, trailer-mounted, diesel engine driven centrifugal pump that is stored in the robust FLEX Building.

Calculations PM-1173 (Reference 17) and PM-1184 (Reference 20) were performed to verify the capability of the FLEX Pumps and piping/hose system to adequately deliver the required amount of water makeup for each FLEX Pump configuration.

2.3.7.2 Water Supplies

Emergency Cooling Tower (ECT)

The ECT consists of a fireproof, multicell, mechanical, induced-draft cooling tower, constructed as a seismic Class I structure, with an integral onsite 3.55 million gallons water storage reservoir (Reference 12). The equipment, valves, and piping in the emergency heat sink system are designed in accordance with seismic Class I criteria. During an ELAP, the ECT remains available as a source for inventory makeup to mitigate the consequences of external hazard events including seismic, severe storms with high winds, extreme cold/hot temperatures, and flooding. The ECT basin level can drop to minimum level of 17 feet (elevation 147.75 feet) which accounts for the available makeup water of 3.55 million gallons (Reference 11).

The ECT is the preferred suction for the FLEX Pumps supplying make-up water to the RPV, Torus, and SFP (FSG-039-2/3 or FSG-040-2/3) and is the required source for flood conditions.

While a layer of ice may form in the ECT during freezing conditions, the hose connections for drawing suction from the ECT are below this level where the water is expected to remain liquid.

Ultimate Heat Sink

Depending on conditions, the FLEX Pumps may take suction from the Conowingo Pond (Susquehanna River) via the Circulating Water Pump Bay or Intake Canal (FSG-041-2/3).

2.3.8 Electrical Analysis

Class 1E batteries and associated DC distribution systems are located within safety-related structures and provide power to required key instrumentation and applicable DC components. The critical instruments fed from the battery system include reactor water level, reactor pressure, drywell pressure, drywell temperature, suppression pool temperature, and suppression pool level. The Class 1E battery duty cycles for PBAPS were calculated in calculation PE-0140 (Reference 21) resulting in 7.25 hours for Division I batteries. PBAPS has two (2) Division I Class 1E batteries per Unit that are utilized as part of the Phase 2 FLEX strategies. The FLEX strategies ensure the Division I Safety Related battery chargers are energized before the battery coping time is exceeded. The expected deployment time for the portable FLEX Generators (one for each Unit) to supply the battery chargers is seven (7) hours.

For FLEX Phase 2, the strategy to maintain the station's safety-related DC buses and other essential loads requires the use of one portable diesel FLEX Generator for each Unit to re-power two of the Unit's Safety Related 480 VAC load centers using portable cables that are connected to one of two FLEX 480 VAC connection panels installed on each Unit. The connection panel used depends on the location chosen for the FLEX Generator. The FLEX diesel generators are trailer-mounted units rated at 500 kW/625 kVA, 480 VAC, 3 phase, 60Hz, with an integral 500 gallon fuel tank. Each Unit has a trailer for the portable cables to be used with the Unit's FLEX Generator. Three FLEX Generators and the two cable trailers are located within the robust FLEX Building. The third FLEX Generator satisfies the N+1 requirement. Per EC 555794 (Unit 2, Reference 22) and EC 555714 (Unit 3, Reference 23) the FLEX Generators are capable of supplying FLEX Phase 2 required electrical loads.

Since continuous loading of the FLEX Generators will be below 30% rated load (References 22 and 23), load banks are utilized to regulate the generator's power output and eliminate the detrimental effects of unloaded or lightly loaded operation of the diesel engine. The load banks are rated for a minimum of 187.5 kW (approximately 30% of generator rated output, References 22 and 23) and are capable of adding the required amount of load to the generator in order to achieve the minimum loading requirement. There is one load bank for each Unit, mounted on the Unit's cable trailer.

2.4 Containment Integrity

An ELAP causes a loss of containment cooling. In addition, leakage from the recirculation pump seals, SRV discharge to the Suppression Pool, and RCIC turbine exhaust to the Suppression Pool will add heat to the containment. The loss

of cooling and heat addition will cause containment temperature and pressure to increase.

RPV pressure will be reduced to 200 to 300 psig with SRVs and maintained in that band to support RCIC operation. It is expected that RCIC would remain a viable source of injection as long as 125 VDC power is available for system control, 250 VDC is available for valve operation, RPV pressure is above 150 psig, and Suppression Pool temperature is maintained below the range of 250°F to 300°F. Boiling Water Reactor Owners Group (BWROG) study BWROG-TP-14-018 evaluated RCIC performance at elevated temperatures. This study concluded that there is no loss of RCIC functionality below Suppression Pool suction temperatures of 250°F. RCIC will continue to be operated as long as possible before transitioning to portable FLEX equipment. Anticipatory venting of the containment will be initiated to remove decay heat and prevent Suppression Pool temperature from exceeding 250°F. A FLEX Pump will be available within 12 hours of the event to provide makeup to the Suppression Pool.

2.4.1 Phase 1

During Phase 1, Primary Containment integrity is maintained by normal design features of the containment, such as the containment isolation valves. In accordance with NEI 12-06, the containment is assumed to be isolated following the event. PBAPS TRIP Procedures T-200, "Primary Containment Venting" and T-200J, "Containment Venting via the Torus Hardened Vent" are used to maintain containment pressure within design limits. SRVs cycle automatically or manually to control reactor pressure until RCIC is placed into service. RCIC may automatically start and inject to the RPV on low-low RPV level following the ELAP event onset. RCIC will remove some decay heat energy from the RPV and pump water to the RPV with RCIC turbine exhaust returning to the Suppression Pool. The energy deposited to the containment is from radiative heat transfer of the RPV and connected piping, leakage from the reactor recirculation pump seals, SRV discharge to the Suppression Pool, RCIC turbine exhaust to the Suppression Pool, and identified containment leakage. RCIC will continue to operate to maintain RPV level above TAF while the containment continues to heat up and pressurize. The Torus is vented via the Hardened Containment Vent System (HCVS) to remove decay heat from the containment and to prevent Suppression Pool temperature from exceeding 250°F. Based on MAAP analysis (Reference 13), the HCVS will be opened when containment pressure reaches 2 psig (approximately 1 hour into the event) and remain open to control containment pressure and temperature to support continued operation of RCIC for core cooling. Suppression Pool water level will be maintained as directed by Emergency Operating Procedures (EOP's) using the FLEX Pump. The FLEX Pumps will be ready for Suppression Pool makeup via the Residual Heat Removal System within 12 hours from event onset.

2.4.2 Phase 2

In Phase 2, containment integrity is maintained by normal design features of the containment and by venting the Torus using the HCVS. Suppression pool temperature will be limited by controlling Torus pressure. Containment venting will prevent approaching Containment pressure limits as indicated by MAAP analysis (Reference 13). Monitoring of containment pressure and temperature will be available in the Control Room via installed plant instrumentation powered by the safety related batteries and safety related uninterruptable power supplies (UPS). These batteries, and subsequently the UPSs, are maintained in Phase 2 by deployment of FLEX Generators.

With HCVS venting of the Torus, Suppression Pool temperature slowly rises and reaches a peak temperature of 238°F. Therefore, RCIC survivability is not threatened. FLEX Pumps will be ready for injection to the RPV via the RHR system and for Suppression Pool makeup at 12 hours from event onset. The various FLEX Pump lineups are discussed in Section 2.3.2.

2.4.3 Phase 3

Necessary actions to reduce Containment temperature and pressure and to ensure continued functionality of the key parameters will utilize existing plant systems and those restored by off-site equipment and resources. During Phase 3, RPV make-up will continue to be provided by Phase 2 portable equipment and backed up by NSRC equipment. Monitoring of Containment parameters will continue.

2.4.4 Structures, Systems, Components

2.4.4.1 Hardened Containment Vent System

The Hardened Containment Vent System (HCVS) is designed (References 51 and 52) and installed to meet the operational requirements of NRC Order EA-13-109 (Reference 8). The HCVS Argon system is placed in service locally on Radwaste 135' elevation at the Remote Operating Station (ROS) by opening the argon bottle valves and isolation valves. The HCVS rupture disc PSD-8(9)0293 is burst using argon. A dedicated nitrogen supply can be used to operate containment isolation valves to initiate containment venting via the hardened vent line. The HCVS system can be operated from either the Main Control Room on Panels 2(3)0C003-3 and 00C767 or from the ROS. Pneumatic supply to valves and DC power for instrumentation and controls are provided by nitrogen bottles and a HCVS battery located in the Radwaste Building. Both are capable of supporting system operation for at least 24 hours.

2.4.4.2 RHR System

The RHR System is utilized to provide Suppression Pool makeup when a FLEX Pump is in operation. The RHR System is discussed in Section 2.3.4.3.

2.4.5 Key Parameters

Instrumentation providing the following key parameters is credited for all phases of the containment integrity strategy with the indication available in the PBAPS MCR (except as noted):

Drywell Pressure:

- PR/TR-4(5)805

Drywell Temperature:

- PR/TR-4(5)805

Suppression Pool Temperature:

- TRS-2(3)-10-131
- TI-8(9)457 (located on Alternate Shutdown Panel, only available until Division II batteries are depleted)

Suppression Pool Level:

- LI-8(9)027 (narrow range)
- LR/TR-8(9)123A (wide range, will not be available until the FLEX Generator is in service)
- LI-8(9)456 (located on Alternate Shutdown Panel, only available until Division II batteries are depleted)

The above instrumentation is available prior to and after DC load shedding of the DC buses during ELAP response procedure implementation for up to 7.25 hours. Availability after 7.25 hours is dependent on actions to restore and maintain the Division I Battery Chargers with the portable FLEX Generator.

In the unlikely event that key parameter instrumentation becomes unavailable in the MCR, alternate methods for obtaining the critical parameters locally are provided in procedure FSG-045-2(3), "Obtaining Transmitter Instrument Readings".

2.4.6 Thermal-Hydraulic Analyses

MAAP4 computer code evaluations were used to simulate ELAP conditions for PBAPS (Reference 13). Several MAAP cases were run to analyze methods of containment heat removal, including containment venting strategies, to control containment heatup and pressurization. Using the FLEX strategies developed, the

MAAP cases have shown that Primary Containment temperature and pressure will remain below containment design limits.

Critical inputs to the analysis are as follows:

- RCIC automatically starts on low reactor water level immediately at the ELAP onset and injects to the RPV from the Suppression Pool suction at 600 gpm to recover RPV water level to approximately 195 inches above TAF.
- Safety Relief Valves (SRV) are operated consistent with EOP guidance to reduce RPV pressure to a band of 200 – 300 psig while RCIC is in service.
- Containment venting using the HCVS system occurs prior to reaching the Primary Containment Pressure Limit (PCPL)
- The reactor coolant leakage is no more than 42 gpm at normal operating conditions.

Drywell pressure rises and the HCVS is operated when containment pressure reaches 2 psig.

Additional MAAP analysis identified that operating the HCVS at 2 psig containment pressure reduces the challenges to RCIC operation caused by elevated Suppression Pool temperatures. With the Suppression Pool and Chamber at saturated conditions lowering pressure will provide for lower Suppression Pool temperature. It also extends RCIC operation. Venting of the containment at 2 psig is only for the period of time that RCIC is in service for core cooling. Once transition to the FLEX Pump occurs containment pressure is controlled to maintain pressure less than the PCPL in accordance with EOPs.

2.4.7 FLEX Pump and Water Supplies

The FLEX Pump and water supplies for Containment Integrity is described in Section 2.3.7 for Reactor Core Cooling.

2.4.8 Electrical Analysis

The electrical analysis for Containment Integrity is covered in Section 2.3.8 for Reactor Core Cooling. The same methodology and strategy applies to Containment Integrity.

2.5 SFP Cooling/Inventory

The PBAPS SFP is a wet spent-fuel storage facility located on the refueling floor in the Secondary Containment (Reactor Building). Each Unit has its own spent fuel pool. PBAPS SFPs are designed to withstand the anticipated earthquake loadings as a Class I structure (Reference 12). The SFP provides specially designed underwater storage space for the reactor spent fuel assemblies which

require shielding and cooling during storage and handling. The basic FLEX strategy for maintaining SFP safe level is to monitor SFP level and provide sufficient make-up to the SFPs to maintain a safe level.

2.5.1 Phase 1 Strategy

The loss of all AC Power Sources causes a loss of forced circulation and heat removal for the SFP. At initial conditions, the spent fuel pool is assumed to be at 22 feet above the top of active fuel which is the minimum level per Technical Specifications (Reference 11). Calculation PM-1173 (Reference 17) incorporates a review of Spent Fuel Pool response to an ELAP.

For the SFP makeup analysis, an ELAP is assumed to occur simultaneously with a full core offload 5 days after shutdown. Loss of SFP cooling with this heat load and an initial SFP temperature of 150°F results in a boil time to uncover the spent fuel as approximately 35 hours. Therefore, completing the equipment line-up for initiating SFP makeup at 12 hours into the event ensures adequate cooling of the spent fuel is maintained by keeping the fuel covered.

2.5.2 Phase 2 Strategy

SFP makeup will be established in Phase 2 utilizing a portable FLEX Pump to makeup to the SFP keeping the spent fuel covered with water. The various FLEX Pump lineups are discussed in Section 2.3.2. Additionally, FSG-042-2(3) sets up equipment on the refuel floor in advance of high dose rates or temperatures on the refuel floor precluding access. Equipment set up on the refuel floor will be completed 5.5 hours after onset of the ELAP/LUHS event. Phase 2 actions to have the pump connected and available for makeup will be completed 12 hours from onset of the ELAP/LUHS event. FLEX Pump makeup to the SFP will prevent SFP level from lowering below 10 feet above the fuel. Makeup to the SFP is by hoses supplying water to the SFP or by spray cooling of the spent fuel pool (if required) utilizing Blitzfire monitors connected to hoses. Some of the equipment required for SFP makeup and spray is located in storage lockers in a stairwell outside the refuel floor area.

2.5.3 Phase 3 Strategy

Phase 3 Strategy is to continue with the Phase 2 methodologies using the FLEX Pumps. Additional high capacity pumps will be available from the NSRC as a backup to the on-site FLEX Pumps.

2.5.4 Structures, Systems, and Components

2.5.4.1 SFP and SFP Cooling and Cleanup System

The SFP is designed to seismic Class I criteria and lined with stainless steel. Provisions are made for level detection to ensure the fuel in the spent fuel storage is covered with sufficient water for radiation shielding. Leakage detection instrumentation is also provided to ensure an adequate fuel pool water level is maintained. The design of the spent fuel pool structure is such as to prevent inadvertent draining of the pool. The general arrangement of the spent fuel racks in the pool permit the storage of approximately 3,819 fuel assemblies (Reference 12).

The design function of the SFP cooling portion of the system is to remove decay heat from spent fuel bundles after removal from the reactor, maintaining the SFP water temperature below a maximum design temperature of 150°F under all other conditions. SFP level is maintained by providing demineralized water from the Condensate Storage Tanks to maintain level 23 feet above the spent fuel storage racks as required.

2.5.4.2 RHR System

The RHR System may provide SFP makeup depending on the FLEX Pump alignment. SFP makeup is primarily from hoses directed directly to the FLEX Pump. The RHR System is discussed in Section 2.3.4.3.

2.5.4.3 Ventilation

During an ELAP/LUHS event, normal and emergency Reactor Building ventilation will be non-functional. In addition to the spent fuel pool, the Reactor Building will have heat addition from RCIC operation and seal leakage. Since FLEX manual actions are performed on the Reactor Building elevation 234' (spent fuel pool elevation) following an ELAP event, temperatures on Reactor Building elevation 234' were evaluated in calculation PM-1174 (Reference 29).

Deployment of FLEX equipment on 234' elevation is commenced in accordance with FSG-042-2(3) within 4 hours of event onset and completed before 5.5 hours.

In addition, actions are taken to initiate passive ventilation in the Reactor Building by opening specified doors in the Reactor Building at grade level and at the Reactor Building roof to allow natural convective cooling.

2.5.5 Key Parameters

Spent Fuel Pool Level Instrumentation (SFPLI) was installed per NEI 12-02 (Reference 5) by EC 555715 (Reference 24). Each spent fuel pool has two level transmitters. Each transmitter has a display in the Radwaste 165' elevation Fan Room.

The following instrumentation providing the key parameter of Spent Fuel Pool level is credited for all phases of the Spent Fuel Pool cooling strategy:

- LI-2(3)-19-001A, "SFP Primary Level Indicator"
- LI-2(3)-19-001B, "SFP Backup Level Indicator"

The primary and backup SFPLI instrument channels will be normally powered from 120 VAC. LI-2(3)-19-001A is powered by 20Y035-05 and LI-2(3)-19-001B is powered by 30Y035-05. Upon loss of normal AC power, individual batteries installed in each channel's electronics/UPS enclosure will automatically maintain continuous channel operation for at least (72) hours (Reference 24). The enclosure for the Unit 2 primary indicator is 20C860, the enclosure for Unit 2 backup indicator is 20C861. The enclosure for the Unit 3 primary indicator is 30C860, the enclosure for Unit 3 backup indicator is 30C861. The power cables are routed so that spatial and physical separation is maintained between the primary and backup channels. 20Y035 is backed up by the Unit 2 FLEX Generator on E324-R-B (3882). 30Y035 is backed up by the Unit 3 FLEX Generator on E334-R-B (3882). Therefore, the SFPLI systems will not lose power during an ELAP.

2.5.6 Thermal-Hydraulic Analysis

The minimum normal SFP water level at the event initiation is approximately 22' feet over the top of the spent fuel seated in the storage racks. Maintaining the SFP full of water at all times during the ELAP/ LUHS event is not required; the requirement is to maintain adequate water level to protect the stored spent fuel and limit exposure to personnel on-site and off-site. For the purposes of this strategy, the objective is to maintain the SFP level at least 10 feet above the spent fuel seated in the spent fuel racks. This is conservatively identified as Level 2 in NEI 12-02, Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation" and is specified as at least 10 feet above the fuel seated in the spent fuel racks.

Per calculation PM-1173 (Reference 17), the SFP water inventory will heat up from 150°F to 212°F during the first 2.46 hours. The maximum SFP boil off rate is 122

gpm. Conservatively, 122 gpm is used as the required makeup rate to maintain the SFP filled during the ELAP/ LUHS event. There are approximately 10,470 gallons per foot of level in the SFP above the spent fuel storage racks. Using the maximum boil off rate identified above, the SFP water level will lower approximately 0.7 feet every hour with no makeup. At the assumed SFP level of 22 feet above the top of the spent fuel storage racks, it will take approximately 17 hours to reach a level of 10 feet above the spent fuel (the level below which is assumed to prohibit access to the refuel floor from a radiological perspective). Thus, the transition from Phase 1 to Phase 2 for SFP cooling function is conservatively established to occur in Phase 2 within 12 hours of the onset of the ELAP/LUHS event.

SFP cooling will be established in Phase 2 utilizing a FLEX Pump to makeup to the SFP keeping the spent fuel covered. Phase 2 actions to have the pump connected and available for SFP makeup will complete within 12 hours of event onset. In accordance with calculation PM-1173 (Reference 17), PBAPS has the capability to provide the required flow for spent fuel pool makeup of 122 gpm using direct injection or 250 gpm using spray per Unit.

2.5.7 FLEX Pump and Water Supplies

The FLEX Pump and water supplies for Spent Fuel Pool Cooling/Inventory is described in Section 2.3.7 for Reactor Core Cooling.

2.5.8 Electrical Analysis

The SFP will be monitored by instrumentation installed in response to Order EA-12-051 (Reference 4). The power for this equipment has backup battery capacity for 72 hours (Reference 24). Alternative power will be provided within 72 hours using onsite portable FLEX Generators.

Further electrical analysis for Spent Fuel Pool Cooling/Inventory is covered in Section 2.3.8 for Core Cooling. This same methodology and strategy applies to Spent Fuel Pool Cooling/Inventory.

2.6 Characterization of External Hazards

2.6.1 Seismic

The list of Peach Bottom Seismic Class I structures includes: the Reactor Building, Main Control Room Complex, Pump Structure (containing critical service water pumps), Emergency Diesel Building, Radwaste Building, and Emergency Heat Sink Facility including cooling tower. All Class I structures were seismically

analyzed. The design earthquake considers a maximum horizontal ground acceleration of 0.05g, and the Maximum Credible Earthquake considers a horizontal ground acceleration of 0.12g. A remote possibility exists that a seismic event could affect availability of the Ultimate Heat Sink (Conowingo Pond) due to reliance on a non-seismically robust downstream dam.

PBAPS submitted the complete and final Seismic Hazard Evaluation and Screening Report on March 31, 2014 (Reference 53). The evaluation determined PBAPS does not meet all the requirements of EPRI Report 1025287, "Screening, Prioritization and Implementation Details" (SPID). As a result, PBAPS screens in, requiring a Risk Evaluation and SFP evaluation to be performed as determined by NRC prioritization following submittal of all nuclear power plant Seismic Hazard Re-evaluations. The Risk Evaluation is scheduled to be complete by March 31, 2018. The SFP evaluation was submitted December 15, 2017 (Reference 59). Additionally, PBAPS prepared and submitted an Expedited Seismic Evaluation Process (ESEP) Report (Reference 62) in accordance with EPRI Technical Report 3002000704 (Reference 48).

With the exception of two RCIC relays (one per Unit) identified in the report, all other equipment evaluated for the PBAPS ESEP was found to have adequate capacity for the required seismic demand as defined by the EPRI Seismic Evaluation Guidance. The Unit 3 relay was replaced in the fall of 2017 by EC 556378 (Reference 54). PBAPS has committed to replace the Unit 2 relay under EC 556379 (Reference 55) in the fall of 2018.

For FLEX strategies, the earthquake is assumed to occur without warning and result in damage to non-seismically designed structures and equipment. The FLEX Strategy provides guidance to use installed and portable equipment to maintain or restore core cooling, containment, and SFP cooling capabilities. Non-seismic structures and equipment may fail in a manner that would hinder accomplishment of FLEX-related activities (normal access to plant equipment, functionality of non-seismic plant equipment, deployment of BDB equipment, restoration of normal plant services, etc.). The diverse nature of the FLEX strategies has been discussed. The ability to clear haul routes from seismic debris to facilitate the deployment of the BDB Phase 2 equipment is addressed in Section 2.8.

2.6.2 External Flooding

PBAPS is located on the west bank of the Conowingo Pond on the Susquehanna River. The Conowingo Pond is formed by the backwater of Conowingo Dam on

the Susquehanna River, the dam is located about 9 miles downstream. Holtwood Dam, located about 6 miles upsteam from PBAPS, forms the upper limit of Conwingo Pond. The finished grade at the plant is 116 feet mean sea level (MSL). Normal elevation of the Conowingo Pond is between 104 and 109.25 feet.

External Flooding is applicable with regional precipitation, probable maximum flood (PMF) as the Design Basis flood hazard. Critical equipment, systems, and structures essential to a safe shutdown of the reactor are flood protected to elevation 135 feet against the most severe combination of the PMF, failure of the upstream dam, and wind-generated waves. During the flooding event, it is assumed that a long lead time exists before flood levels will reach plant grade elevation.

The Flood Hazard Reevaluation Report (Reference 31) reevaluated the flooding hazards at PBAPS against present-day regulatory guidance and methodologies. The report determined that the "Max Still Water Elevation" is 127.49 feet, which is below the Current Licensing Basis level of 131.87 feet (reference report Table 4.0.3). The report also determined that the "Max Wave Runup Elevation" is 130.24 feet, which is below the Current Licensing Basis level of 136.77 feet. Therefore, both of these flood parameters are bounded by the current design basis flood.

Table 3.10.3.13.2 of the Flood Hazard Reevaluation Report indicates that the time to rise from the normal 109 feet elevation river level to the Probable Maximum Flood (PMF) level of 127.49 feet is approximately 49.5 hours. This time does not consider advance warning time from the NOAA's National Weather Service forecasts, therefore time for the station to prepare for a flood of this magnitude would exceed 49.5 hours.

The PBAPS Mitigating Strategies Assessments for Flooding (Reference 32) determined that Local Intense Precipitation (LIP) is a short term event and not a significant issue for FLEX implementation at PBAPS. The NRC reviewed and agreed with this assessment (Reference 56).

2.6.3 Severe Storms with High Wind

PBAPS is located at 39°45'34" north latitude and 76°16'8" west longitude. Per Figure 7-1 of NEI 12-06, PBAPS is susceptible to hurricanes due to location. Per Figure 7-1, peak wind gusts at PBAPS will be between 130 and 140 mph. Per Figure 7-2 of NEI 12-06, peak tornado winds at PBAPS will be 165 mph.

The general wind flow in the site area is moderate. Per PBAPS UFSAR Section 2.3.4.3, observational data of the Philadelphia area indicate peaks in excess of 75

mph are quite rare. These modest peak winds are to be expected, since the site is not affected by the full force of any hurricane. The plant is not usually influenced by any other phenomena producing exceptional wind speeds.

Features of the plant important to continuity of core cooling are either designed to withstand tornados having 300 mph winds, or are contained in a structure which is designed to the same criteria (UFSAR 1.6.1.1.10c, Reference 12). The robust FLEX Building design is contained in EC 555825 (Reference 30). The Design Criteria states it meets the requirements of NEI-12-06, and is therefore designed to resist tornado wind, differential pressure, and missiles, along with other sustained loads. The RHR and HPSW connections are inside Safety Related buildings, as are one of the FLEX electrical connections on each unit. The FLEX Pump suction connection on the ECT was installed by EC 555716 (Reference 25). The hose connection is outside the building but is protected by a Tornado Missile Barrier installed by the EC. Calculation PS-1117 (Reference 61) qualified the tornado missile barrier.

Based on the above, PBAPS storage of FLEX equipment is qualified for severe storms with high wind hazards, including tornado missiles.

2.6.4 Ice, Snow and Extreme Cold

Per NEI 12-06 Section 8 Figures, PBAPS is subject to Snow and Ice. PBAPS UFSAR Sections 2.3.4.1 and 2.3.4.4 characterize the site. There is a high probability of severe ice storms in the PBAPS area and there have been instances in which disruption of power, communications, and transportation has occurred. One severe ice storm can be expected every 3 years.

Freeze protection for the FLEX Pumps and suction hoses is provided by maintaining flow in the pump/suction hose through the use of a recirculation flow line. Structures to provide protection of FLEX equipment are constructed to meet the requirements of NEI 12-06 Section II, therefore FLEX equipment is qualified for snow, ice, and extreme cold. Diesel fuel for FLEX equipment is treated with a fuel additive during cold weather conditions to prevent gelling.

Clearing of FLEX deployment pathways has been incorporated into MA-PB-1003, "Winter Readiness and Storm Response Guidelines for the Peach Bottom Facility" (Reference 38). The FLEX F-750 truck can be equipped with a snow plow. The FLEX tractors can be equipped with a snow plow or loader bucket. These vehicles can be used for snow removal of FLEX deployment pathways. The FLEX F-750

truck, tractors, generators, and pumps are housed in the FLEX Building which is temperature controlled.

2.6.5 High Temperatures

The issues related to high temperatures are similar to those for cold and ice in that FLEX equipment must be sufficiently protected from high temperatures so that it functions when necessary. The FLEX equipment high temperature operating capability exceeds the plant's design basis for (high temperature) environmental conditions. PBAPS UFSAR Section 2.3.4.1 states there are occasional readings above 90° F in the summer. The FLEX Pump Engine manufacturer provides no limitations for Hot Weather Operation. The FLEX Generator manufacturer documents the radiator design is based on a 104° F ambient temperature, which bounds Peach Bottom conditions.

2.7 Protection of FLEX Equipment

PBAPS has constructed a single hardened FLEX storage structure of approximately 8,400 square feet that will meet the requirements for the external events identified in NEI 12-06, such as earthquakes, storms (high winds, and tornado missiles), extreme snow, ice, extreme heat, and cold temperature conditions (Reference 2). The flood scenario at Peach Bottom allows for deployment of FLEX equipment before water levels affect the FLEX Building. EC 555825 (Reference 30) contains the design information for the robust FLEX Building. The robust FLEX Building is located outside the Protected Area (PA) fence north of the PBAPS warehouse complex and east of the Low Level Radwaste Storage Building.

The robust FLEX Building is designated as a seismic Category I and QA Category III structure (Non-Safety Related). The top of the slab (floor elevation) is 118.5 feet which is below the evaluated flood hazard maximum probable flood elevation of 127.49 feet in that area of the site. The robust FLEX Building was designed and constructed to prevent water intrusion and built to protect the housed FLEX equipment from other hazards identified in Section 2.6 above. The robust FLEX Building has its own heating and ventilation, and fire suppression system.

Large FLEX portable equipment such as pumps, generators, fuel trailers, hose trailers, tractors, and trucks are secured with tie-down straps to floor anchors inside the robust FLEX Building to protect them during a seismic event. The robust FLEX Building anchors are integrated into the floor slab.

Debris removal equipment such as the FLEX tractor are stored inside the robust FLEX Building in order to be reasonably protected from external events such that the equipment will remain functional and deployable to clear obstructions from the pathway between the robust FLEX Building and its deployment location(s).

Deployments of the FLEX debris removal equipment from the robust FLEX Building are not dependent on off-site power. All actions required to access and deploy debris removal equipment and BDB/FLEX equipment can be accomplished manually.

As required by NEI 12-06, all equipment credited for implementation of the FLEX strategies at PBAPS is either stored in the robust FLEX Building or in a plant structure that meets the station's design bases for Safe Shutdown Earthquake (SSE), specifically the PBAPS Reactor Buildings and Radwaste Building.

2.8 Planned Deployment of FLEX Equipment

2.8.1 Haul Paths and Accessibility

Pre-determined haul paths have been identified and documented in procedure FSG-001. Figure 13 shows the haul paths from the FLEX Storage Building to the various deployment locations. These haul paths are checked for possible obstructions in procedure FSG-002. Debris removal equipment is stored inside the robust FLEX Building to be protected from external hazards such that the equipment remains functional and deployable to clear obstructions from the pathway between the robust FLEX Building and the deployment location(s). Debris removal equipment includes the FLEX Tractors and FLEX F-750 Truck. FLEX debris removal hand tools such as tow chains, chainsaws, demolition saw, axe, sledgehammer, and bolt cutters are also available. Equipment deployment from the robust FLEX Building may require minimal debris removal at the buildings. The FLEX Building incorporates multiple access doors for equipment deployment. The equipment is stored in a manner to facilitate the deployment sequence. Deployment paths and staging areas are contained in the snow removal plan. These areas are maintained as a priority after site safety concerns are addressed.

The potential impairments to required access include security fencing (including razor wire), Patriot Gates, high voltage transmissions lines, Warehouse Building debris, light poles, and vehicles (personnel, delivery, etc.).

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

remain open. This departure from normal administrative controls is acknowledged and is acceptable during the implementation of FLEX coping strategies.

The ability to open doors for ingress and egress, ventilation, or temporary cables/hoses routing is necessary to implement the FLEX coping strategies. With the declaration of an ELAP, security keys are issued by procedure to Operations personnel to enable access to appropriate areas and Security is contacted support Protected Area access.

Phase 3 of the FLEX strategies involves the receipt of equipment from offsite sources including the NSRC with various commodities such as fuel and supplies. Transportation of these deliveries will be through airlift or via ground transportation utilizing the SAFER Response Plan for Peach Bottom Atomic Power Station (Reference 18). Debris removal for the pathway between Staging Areas 'A' and the NSRC receiving location Staging Area 'B' and from the various plant access routes may be required based on conditions present.

2.9 Deployment of Strategies

Direction to implement most FLEX Strategy Guidelines (FSGs) stems from SE-11 Sheet 6 (Reference 33). FSG-001, "FLEX Equipment Deployment Location Assessment" and FSG-002, "Debris Removal" are performed on a priority basis for an ELAP event. Performance of FSG-003, "Pre-Staging FLEX Equipment", is directed by SE-4 (Reference 34) for a predicted flood event or pre-emptively by Shift Management if an ELAP event is probable for any reason.

FLEX Pump deployment, discussed below, is based on event conditions. There are several deployment options using either the ECT or Conowingo Pond as the suction source and discharge options using the HPSW and/or RHR systems along with hoses going directly to the SFP.

FLEX Generator deployment, discussed below, is also based on event conditions with two staging areas available for each Unit.

2.9.1 FLEX Pump Deployment

2.9.1.1 ECT Suction with Preferred Discharge to 2B(3A) RHR Loop (FSG-040-2/3)

As stated on SE-11 Sheet 6, FSG-040-2(3) with injection via the 4 inch RHR connection on the Unit 2 2B and Unit 3 3A RHR Loops is the preferred FLEX Pump alignment (the alternate injection point is a 2 inch connection). The FLEX Pumps for both Units are transported from the

FLEX Building to the area between the Plant Services Building and the Unit 3 Startup Switchgear Building, which is just south of the ECT that is the suction source for the pumps. This location is preferred because it is above the PMF level and provides protection against dose. A gated wye valve is attached to the discharge of each pump in order to supply two discharge hoses. One discharge hose from each pump is routed west of the Reactor Buildings to the Unit's RBCCW room where the hose is attached to the Unit 2 2B RHR loop and the Unit 3 3A RHR loop 4 inch FLEX connection. The Unit's RHR loop provides RPV and Suppression Pool makeup. The second discharge hose from each pump is routed west of the Reactor Buildings to the Unit 2 southwest stairwell and Unit 3 northwest stairwell up to approximately elevation 165'. FSG-042-2(3) completes the hose alignment to the SFP, which splits into one hose providing makeup and the other spray. These lineups are completed within 12 hours of the event before dose and habitability concerns become an issue.

2.9.1.2 <u>ECT Suction with Alternate Discharge to 2A(3B) RHR Loop (FSG-040-2/3)</u>

FSG-040-2(3) provides an alternate injection point via the 2 inch B.5.b connection on the Unit 2 2A and Unit 3 3B RHR Loops in the event the preferred connection point is not usable. The FLEX Pumps for both Units are located in the same location as described in the paragraph above. A gated wye valve is attached to the discharge of each pump in order to supply two discharge hoses. One discharge hose from each pump is routed west of the Reactor Buildings to the Unit's RBCCW room where the hose is attached to the Unit 2 2A RHR loop and the Unit 3 3B RHR loop 2 inch B.5.b connection. The Unit's RHR loop provides RPV and Suppression Pool makeup. The second discharge hose from each pump is routed west of the Reactor Buildings to the Unit 2 southwest stairwell and Unit 3 northwest stairwell up to approximately elevation 165'. FSG-042-2(3) completes the hose alignment to the SFP, which splits into one hose providing makeup and the other spray. In addition, FSG-042-2(3) attaches a hose coming off of the SFP hose that attaches to a ¾ inch SBLC connection. This connection supplements RPV makeup from the RHR loop. These lineups are completed within 12 hours of the event before dose and habitability concerns become an issue.

2.9.1.3 ECT Suction with Alternate Discharge to 2B(3A) HPSW Loop (FSG-039-2/3)

FSG-040-2(3) provides a lineup with the FLEX Pumps for each Unit taking suction from the ECT, however the pumps in this case are transported from the FLEX Building to just north of the Administration Building at approximately 116' elevation. Each FLEX Pump has one discharge hose that is routed to the Unit's HPSW room located in the Circulating Water Pump Structure. The discharge hoses are connected to a Unit 2 2B HPSW loop 4 inch connection that will supply the 2B RHR loop and the Unit 3 3A HPSW loop 4 inch connection that will supply the 3A RHR loop. RPV and Suppression Pool makeup is supplied via the RHR loop. SFP make and spray is supplied via hard pipe RHR makeup lines to the SFP or by hose run from a 165' elevation RHR connection to the SFP. These lineups are completed within 12 hours of the event.

2.9.1.4 Alternate Pump Structure Suction with Discharge to 2B(3A) HPSW Loop (FSG-041-2/3)

FSG-041-2(3) provides a lineup with the FLEX Pumps for each Unit taking suction from the plant intake with various options as a source of make-up water. This water source requires no physical modification. A strainer on the end of hardened suction hose is submerged below the water surface at a plant intake accessible pathway. The pumps in this case are transported from the FLEX Building to just north of the Circulating Water Pump Structure at approximately 116' elevation. This option may be used in the event the ECT is not available as a suction source. The discharge lineup is the same as described in the paragraph above. These lineups are completed within 12 hours of the event.

2.9.2 FLEX Generator Deployment

One FLEX Generator for each Unit is transported from the FLEX Building to one of two locations by a FLEX tractor or FLEX F-750 truck. In addition to the generator, one cable trailer for each Unit is also transported from the FLEX Building to the location chosen. The cable trailers contain the electrical cables used to supply vital plant loads and to attach the generator to a load bank that is also located on the cable trailer (refer to Section 2.3.8). The preferred location for each Unit is just outside the Unit's Reactor Building 135' elevation outer railroad door. FSG-010-2(3) is the procedure used in this case. This location is preferred due to dose concerns. This lineup utilizes Panel 2(3)AS1061, "FLEX 480 VAC

Connection Panel" which is located inside the Reactor Building (both the outer and inner railroad doors are opened to access the panel). The panels are equipped with quick connect fittings. The alternate location is west of the Unit's Reactor Building in the vicinity of Panel 2(3)AS1062, "FLEX 480 VAC Connection Panel". FSG-011-2(3) is the procedure used in this case. These panels are mounted on the exterior west wall of the Unit's Reactor Building at elevation 135' and are also equipped with quick connect fittings.

Deployment of the FLEX Generators commences at approximately 1 hour into the event. While the deployment is being performed, the Unit's 480 VAC emergency electrical distribution system is aligned using FSG-013-2(3). The alignment involves shedding unnecessary loads and closing breakers for vital loads necessary to cope with the event. The alignment will be complete when the FLEX Generators are placed in service.

Color coded cables are obtained from the Unit's cable trailer and utilized to connect the generator to the appropriate connection panel and to the load bank. Color coded cables are also utilized to connect the Unit 2 FLEX Generator to MCC 2PS4-F-B for to supply power to 00P174, "FLEX Fuel Oil Transfer Pump".

Once the cables are installed for the 480 VAC connection panel and load bank, the generator is started and a disconnect switch located inside the Reactor Building on elevation 165' to provide power to the Unit 2 Load Centers E124 and E324 and Unit 3 MCCs E134 and E334 is closed. The FLEX Generators will be available to supply vital plant loads in 7 hours.

2.9.3 Electrical Strategy

The strategy uses a portable 500 kW diesel FLEX Generator to power two existing safety related 480 VAC Load Centers for each Unit. This enables 480 VAC power restoration to key FLEX related loads and 480 VAC/125 VDC Battery Chargers in Division I in order to maintain vital DC loads necessary to support FLEX strategy implementation. These Unit Load Centers are the normal 480 VAC power supplies to the battery chargers. The FLEX Generators, temporary cables, and connection panels have been evaluated for the powering the required and optional loads for support of the Phase 2 FLEX strategy implementation per EC 555794 (Reference 22) and EC 555714 (Reference 23).

2.9.4 Refueling of Equipment

EC 555585 (Reference 35) and Calculation PM-1171 (Reference 36) address FLEX equipment diesel fuel oil supply.

There are four Emergency Diesel Generator (EDG) main fuel oil storage tanks. Each has a Technical Specification minimum volume of 33,000 gallons (Reference 11). FSG-050 has been developed to provide two options for providing diesel fuel oil to FLEX equipment during a beyond design basis event. One option is to transfer diesel fuel oil from any of the four EDG fuel oil storage tanks to the F-750 truck using a portable diesel oil transfer pump. The F-750 truck has two diesel fuel oil tanks that hold a total of approximately 200 gallons. The second option is to transfer diesel fuel oil from 0AT038, "Diesel Fuel Oil Storage Tank" and 0BT038, "Diesel Fuel Oil Storage Tank" to the F-750 truck using 00P174, "FLEX Fuel Oil Transfer Pump." EC 555585 states that 0AT038 and 0BT038 will supply the FLEX Generators and FLEX Pumps for a minimum of 22 days. Within this time off-site support would be available to obtain additional fuel as stated in CC-PB-118 (Reference 19).

2.10 Offsite Resources

2.10.1 National SAFER Response Center

To meet the requirements of Phase 3, the Strategic Alliance for FLEX Emergency Response (SAFER) team, an alliance between AREVA and Pooled Equipment Inventory Corporation (PEICo), was established. The SAFER team is contracted by the nuclear industry through PEICo to establish National SAFER Response Centers (NSRC) operated by Pooled Inventory Management (PIM) and in collaboration with AREVA to purchase, store, and deliver emergency response equipment in the case of a major nuclear accident or BDBEE in the U.S. The equipment will mitigate events that cause an extended loss of electrical power or motive force, and a loss of access to a site's ultimate heat sink.

The industry has established two (2) National SAFER Response Centers (NSRCs) to support utilities during BDB events. Onsite BDB equipment hose and cable end fittings are standardized with the equipment supplied from the NSRC.

In the event of a BDB external event and subsequent ELAP/LUHS condition, equipment will be moved from an NSRC to a local assembly area (Staging Area C) established by the Strategic Alliance for FLEX Emergency Response (SAFER) team. For PBAPS, Staging Area C is the Coatesville EOP Parking Lot. From

there, equipment can be taken to the PBAPS site and staged at the SAFER onsite Staging Area B (onsite blast area east of the warehouse). Communications will be established between the PBAPS plant site and the SAFER team via satellite phones and required equipment moved to the site as needed. First arriving equipment will be delivered to the site within 24 hours from the initial request.

Primary and alternate deployment routes for Phase 3 portable FLEX equipment are described in CC-PB-118-1001, SAFER Response Plan for Peach Bottom Atomic Power Station (Reference 18).

See Figure 14 for SAFER and Site Responsibilities and Figure 15 for a generic Phase 3 timeline.

2.10.2 Equipment List

PBAPS can cope indefinitely with the BDBEE/ELAP/LUHS event with the Phase 2 equipment already onsite, however, some of the NSRC equipment is used as spares or backups to this equipment. The equipment stored and maintained at the NSRC for transportation to the PBAPS Staging Area B to support the response to a BDB external event at PBAPS is listed in Table 1. Table 1 identifies the equipment that is specifically credited in the FLEX strategies for PBAPS but also lists the equipment that will be available for backup/replacement should on-site equipment break down. Since all the equipment will be located at the PBAPS Staging Area B, the time needed for the replacement of a failed component will be minimal.

Table 1 – NSRC Equipment

Equipment	Performance Characteristics	
Medium Voltage Generator	4160 VAC	1 MW
Low Voltage Generator	480 VAC	1000 KW
Cable / Electrical	Various	
High Pressure Injection Pump	2000 PSI	60 GPM
SG/RPV Make-up Pump	500 PSI	500 GPM
Low Pressure / Medium Flow Pump	300 PSI	2500 GPM
Low Pressure / High Flow Pump	150 PSI	5000 GPM

Hose / Mechanical Connections	Various	
Lighting Towers	440,000 lumens	(minimum)
Diesel Fuel Transfer	500 gallon air-lift container	
Diesel Fuel Transfer Tank	264 gallon tank, with mounted AC/DC pumps	
Portable Fuel Transfer Pump	60 GPM after filtration	
Electrical Distribution System	4160 VAC, 1200 A	

2.11 Equipment Operating Conditions

2.11.1 Ventilation

FSG-030, "Establishing Control Room Ventilation and Lighting", FSG-031, "Establishing Battery Room and Switchgear Room Ventilation", FSG-032-2(3), "Establishing HPCI/RCIC/Sump Room Ventilation, Lighting and Water Removal" and FSG-033-2(3), "Establishing Natural Circulation of the Secondary Containment Atmosphere" provide guidance for establishing ventilation in areas supporting the FLEX strategies.

2.11.1.1 Main Control Room (MCR)

FSG-030 implements MCR ventilation by using permanent plant equipment or portable equipment when permanent equipment is not available. With the FLEX Generator is in service, MCR ventilation is provided by MCR emergency ventilation supply fan 0AV030. The FLEX Generator will be in service within 7 hours of the event. Otherwise, doors are opened and small portable fans attached to flexible ventilation ducts are powered by a 120V/240V 5.5 kW portable generator. The portable generator is obtained from the FLEX Equipment Trailer. The remaining portable equipment is located in a FLEX equipment cabinet on Radwaste Building 165' elevation.

2.11.1.2 Battery Room and Switchgear Room

FSG-031 establishes ventilation in the Battery Rooms and E13/E33 Switchgear Room. With the FLEX Generator is in service, Battery Room ventilation is provided by Battery Room emergency ventilation supply fan 0AV034 and exhaust fan 0AV036. The FLEX Generator will be in service

within 7 hours of the event. Otherwise, doors are opened and small portable fans attached to flexible ventilation ducts are powered by a 120V/240V 5.5 kW portable generator. The portable generator is obtained from the FLEX Equipment Trailer. The remaining portable equipment is located in a FLEX equipment cabinet on Radwaste Building 165' elevation.

2.11.1.3 RCIC

SE-11 Attachment U directs opening of RCIC and HPCI room doors in order to limit heat up of the RCIC Room. In addition to lighting and water removal, FSG-032-2(3) establishes portable ventilation to prevent the RCIC Room temperature from rising above 150°F. Equipment necessary to provide ventilation is stored in the RCIC Room FLEX cabinet or on the FLEX Equipment Trailer that is stored in the FLEX Building.

According to Calculation PM-1159 (Reference 14), RCIC Room temperature will remain below 130°F for 72 hours and will not exceed 150°F throughout the event.

2.11.1.4 Refuel Floor

The Spent Fuel Pool area is ventilated by opening the inner and outer railroad doors on Reactor Building 135' elevation to allow air to flow into the Reactor Building and out through the Reactor Building fuel floor roof hatch utilizing natural circulation. Refer to FSG-033-2(3).

2.12 Habitability

While it is anticipated that certain areas of the plant critical for the success of the FLEX Shutdown Mitigation Strategy will exceed 120°F, operating personnel working in these areas will be protected through the application of heat stress control measures such as the use of cooling garments, stay times, and personnel rotation. Exelon procedure SA-AA-111, "Heat Stress Control", (Reference 40) defines a Very High Temperature area as one in which the dry bulb temperature is between 145°F and 160°F (Section 2.25). Section 4.7 of the procedure provides direction for the use of cooling garments to extend stay times in areas with elevated temperatures. Sections 4,7.5.1.B.1 and 4,7.5.2.B.3 allow for personnel working in cooling garments to work for 60 minutes in areas with elevated temperatures. The FLEX Shutdown Mitigation Strategy will employ use of cooling garments stored in the robust FLEX Building. Based on the use of cooling garments and other heat stress controls such as working in pairs and rotating personnel it is reasonable to

assume the Operator actions required to implement the FLEX strategies can be accomplished.

2.13 Lighting

There are areas at Peach Bottom that must be accessed to implement FLEX strategies if a beyond design basis event occurs. Some AC power is restored when the Unit 2 and Unit 3 FLEX Generators are in operation to provide lighting in areas of the Main Control Room (MCR), Cable Spread Room (CSR), Radwaste Building, Turbine Building, and Unit 3 Circulating Water Pump Structure. All FSG series procedures have guidance for use of flashlights or head lamps if needed. Additional lighting is provided by use of smaller portable generators and lighting towers.

2.14 Communication

If radio communications fail, FSG-020 provides direction to place an alternate repeater in service to allow use of Operations Channel 1. The repeater is located in a seismically mounted cabinet, 00C1049, in Unit 3 Reactor Building elevation. 135'-0" near the railroad bay doors. The repeater can be powered by batteries installed in the cabinet or its normal power supply, Panel 2(3)0Y035, which will be powered by a FLEX Generator. The FLEX communication system is addressed in EC 556041 (Reference 37).

Offsite communications will utilize voice/IP phones in the MCR and TSC, which are connected to a satellite antenna installed on the Radwaste Building roof. In case the installed satellite antenna is unavailable, a portable satellite antenna, which is stored in the FLEX Building can be placed in service. In addition, hand-held satellite phones are staged in the Control Room (Reference 57).

2.15 Water Sources

For Phase 1, PBAPS uses the Suppression Pool for RPV injection. PBABS uses the ECT as the primary water source and the UHS as its' backup for RPV level, containment cooling, and SFP make-up throughout the Phase 2 and Phase 3 ELAP/LUHS event.

2.15.1 Suppression Pool

The suppression pool offers a relatively clean source of make-up water to the RPV using RCIC until such time as suppression pool makeup is provided by the FLEX Pump. At the beginning of the event, the suppresion pool is near reactor quality water. Reactor coolant leakage into the drywell and Phase 1 usage of suppression

pool inventory require water addition from the ECT or UHS to maintain suppression pool level. This will degrade suppression pool water quality.

2.15.2 Emergency Cooling Tower (ECT)

The PBAPS primary water source throughout the ELAP/LUHS event is the Emergency Cooling Tower (ECT). This allows the FLEX strategy to position the FLEX Pumps at one of two locations for a water source containing 3.55 million gallons that can provide make-up water to the RPV, Primary Containment, and Spent Fuel Pool. The ECT is also discussed in Section 2.3.7.2. EC 555716 (Reference 25) addresses use of the ECT as part of the FLEX strategy.

2.15.3 Ultimate Heat Sink (UHS)

The PBAPS Ultimate Heat Sink (UHS) is the Conowingo Pond which is used as the alternate water source for the ELAP/LUHS event. The FLEX strategy positions the FLEX Pumps at one location, but with several options for pump suction, at a source that can provide unlimited make-up water to the RPV, Primary Containment, and Spent Fuel Pool. The UHS is also discussed in Section 2.3.7.2.

2.15.4 SFP

At PBAPS, any water source available is acceptable for use as make-up to the SFP, however, the primary source would be from the ECT or Conowingo Pond via the FLEX Pump. Water quality is not a significant concern for make-up to the SFP.

2.16 Shutdown and Refueling Modes Analysis

PBAPS will abide by the Nuclear Energy Institute position paper entitled "Shutdown/Refueling Modes" (Reference 46) addressing mitigating strategies in shutdown and refueling modes. This position paper is dated September 18, 2013, and has been endorsed by the NRC staff (Reference 47). These mitigating strategies are defined below.

Using the NEI position paper to further develop and clarify the guidance provided in NEI 12-06 (Reference 2) related to industry's ability to meet the intent of Order EA-12-049, (Reference 1) Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events, during shutdown and refueling modes of operation, the following Exelon fleet strategy objectives are established:

1. A defense in depth approach will be used to support FLEX strategies during shutdown/refueling modes. The defense in depth approach is selected over development of mode specific FSGs and supporting analysis for the following reasons:

- Outage conditions are highly diverse and will be a significant challenge to developing modifications, procedures and supporting analysis that will be valid under all shutdown/refueling conditions.
- The time duration of shutdown/refueling conditions is small compared to the time at operating conditions such that the risk of external initiating events concurrent with shutdown/refueling conditions is very small. Additionally, due to the large and diverse scope of activities and configurations for any given nuclear plant outage (planned or forced), a systematic approach to shutdown safety risk identification and planning, such as that currently required to meet §50.65(a)(4) along with the availability of the FLEX equipment, is the most effective way of enhancing safety during shutdown.
- Resource availability is much greater and more diverse during outages, particularly during high risk evolutions such as shutdown and refueling mode operations and reduced inventory conditions (e.g., RPV water level below the vessel flange with irradiated fuel seated in the reactor vessel (BWR), mid-loop operation with fuel seated in the reactor vessel or reactor vessel head installed with Reactor Coolant System loops isolated (PWR)). This includes command and control structures to support event mitigation and recovery.
- Shutdown Safety Management Program procedures require availability of a greater number of systems than required by plant Technical Specifications to ensure capability of key safety functions. Contingency plans are developed as required when the defense in depth is reduced below a specified minimum value. A defense in depth strategy is recognized by previous NRC and industry initiatives to improve shutdown safety.

2. No modifications, analyses, or engineering evaluations need to be performed to support shutdown/refueling FLEX strategy implementation. This approach is fully consistent with the NEI position paper on shutdown/refueling modes and the NRC endorsement letter of the NEI position paper.

2.17 Sequence of Events

The following presents a Sequence of Events (SOE) Timeline for an ELAP/LUHS event at PBAPS. Validation of FLEX time constraint actions has been completed in accordance with NEI 12-06 guidance and includes consideration for staffing. Time to clear debris to allow equipment deployment is assumed to be up to 2 hours. This time is considered to be reasonable based on site reviews of the deployment paths and the location of the FLEX Building. Debris removal equipment is stored in the FLEX Building.

Action Item	Elapsed Time	Action	Time Constraint Y/N	Remarks/ Applicability
	0	Event Starts.	NA	Plant @ 100% power
1	0	SBO, Reactor Scram.	NA	Automatic Action
2	.5 min	HPCI and RCIC start automatically on – 48 inch signal.	N	This is an approximation – depending on how the event is initiated, RCIC could start automatically or be manually started by the operator.
3	5 min	Operators shut down HPCI.	N	As long as RCIC is in service, HPCI operation is not required. This is not time critical because HPCI could remain in operation if the CST is available, and could be used for makeup if the operator chooses to use it. The operator will secure HPCI if it is not needed for RPV makeup or if CST is not available for use in the CST– CST mode of operation (RPV pressure control).
4	15 min	DC Load Shed commenced.	N	Prolong safety related battery life. Completion of load shed is time critical. SE-11 Att. T
5	20 min	Commence cooldown of RPV. Reduce pressure to 500 psig then 100F per hour to 200 psig to 300 psig.	N	Peach Bottom procedures direct RPV depressurization. This is not time critical and is currently part of the PB strategy for coping with an SBO condition. The RPV could remain pressurized to preserve steam driven injection systems required for RPV makeup.
6	30 min	Commence opening RCIC/HPCI Room doors.	N	Limit heat up of RCIC Room. SE-11 Att. U
7	60 min	Operators enter ELAP procedure.	Y	Time is reasonable approximation based on operating crew assessment of plant conditions.

Action Item	Elapsed Time	Action	Time Constraint Y/N	Remarks/ Applicability
8	60 min	Commence Deep DC Load Shed.	N	Prolong safety related battery life. Completion of load shed is time sensitive. FSG-012 ELAP DC Load Shed
9	60 min	Commence aligning Nitrogen Bottles to ADS SRVs by bypassing around SV-8(9)130A&B.	N	Not time sensitive due to sufficient accumulator volume for prolonged SRV operation cycles. Prevent exhausting the ADS SRV accumulators by providing a long term supply of nitrogen. FSG -044
10	60 min	Equipment Operators dispatched to the FLEX building to commence debris removal and deploy FLEX equipment.	N	Debris removal to allow transfer of FLEX equipment to required areas. FSG-002
11	60 min	Commence defeat of RCIC trips and isolations.	N	Not time sensitive – Action only defeats trips and isolations to prevent a spurious signal from removing RCIC from service. FSG-043
12	60 min	Commence antenna deployment and opening hatches and doors.	N	The FLEX repeater is a contingency if the plant radio system fails. The opening of the doors and hatches limits the temperature rise on the refuel floor. FSG-020; FSG-033.
13	60 min	Commence containment venting with Drywell pressure greater than 2 psi as required.	Y	Limit Torus temperature rise.

Action Item	Elapsed Time	Action	Time Constraint Y/N	Remarks/ Applicability
14	90 min	Complete DC Load Shed.	Y	FSG-012 ELAP DC Load Shed and SE-11 Att. T
15	4 hr	Commence installation of SFP hoses on refuel floor.	N	Completion of this step is time sensitive. FSG-042
16	5.5 hr	Complete installation of SFP hoses on refuel floor.	Y	Preparation for inventory boil-off. FSG-042
17	5 hr 45 min	Commence Control Room ventilation.	N	Actions will improve habitability. FSG-030
18	6 hr	Commence Battery Room ventilation.	Y	Maintain atmospheric conditions in the battery room. FSG-031
19	6 hr	Commence deployment of FLEX pump.	N	Allow makeup to RPV, Torus and SFP.
20	7 hr	Complete deployment of portable fans to supply cooling air flow to the RCIC Rooms.	N	Prevent RCIC Room temperature from rising above 150°F. FSG-032
21	7 hr	Portable generator is providing power to Safety Related 480VAC. System	Y	Provide power to safety related battery chargers. FSG 010/011/013
22	12 hr	Commence makeup to SFP from FLEX Pump (based on lowering SFP level).	Y	Provide makeup to the SFP due to inventory loss from boiling. Makeup to the RPV and Torus is also available. FSG-042
23	24 hrs	Initial equipment from Regional Response Center becomes available.	NA	PBAPS Strategy does not rely on SAFER Equipment

Action Item	Elapsed Time	Action	Time Constraint Y/N	Remarks/ Applicability
24	24 -72 hrs	Continue to maintain critical functions of core cooling (via RCIC), containment (via hardened vent opening and FLEX pump injection to Torus), and SFP cooling (FLEX pump injection to SFP).	NA	
25	30 hr	Commence injection into Torus.	N	Provide makeup to Torus due to inventory loss from venting. FSG-042

2.18 Programmatic Elements

2.18.1 Overall Program Document

PBAPS procedure CC-PB-118 (Reference 19) provides a description of the Diverse and Flexible Coping Strategies (FLEX) Program for PBAPS. This procedure implements Exelon fleet program document CC-AA-118 (Reference 39) which contains governing criteria and detailed requirements. The key elements of the program include:

- Summary of the PBAPS FLEX strategies
- Maintenance of the FSGs including any impacts on the interfacing procedures (TRIPs, SAMPs, SEs, etc.)
- Maintenance and testing of FLEX equipment (i.e., SFP level instrumentation, emergency communications equipment, portable FLEX equipment, FLEX support equipment, and FLEX support vehicles)
- Portable equipment deployment routes, staging areas, and connections to existing mechanical and electrical systems
- Validation of time critical operator actions
- The robust FLEX Building and the Regional Response Center
- Supporting evaluations, calculations, and FLEX drawings
- Tracking of commitments and FLEX equipment unavailability
- Staffing and Training
- Configuration Management
- Program Maintenance

The instructions required to implement the various elements of the FLEX Program at PBAPS and ensure readiness in the event of a BDBEE are contained in Exelon fleet program document CC-AA-118.

Design control procedure CC-AA-102 (Reference 41) has 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.

Design control procedure CC-AA-309-101, "Engineering Technical Evaluations" (Reference 42) has been revised to ensure technical evaluations are performed when new information is received that potenetially challenges the conservatism of current external event design assumptions.

Future changes to the FLEX strategies may be made without prior NRC approval provided:

1) Revised FLEX strategies meet the requirements of NEI 12-06 (Reference 2) or a previously approved alternate approach,

And

2) An engineering basis is documented that ensures that the change in FLEX strategies continues to ensure the key safety functions (core and SFP cooling, containment integrity) are met.

2.18.2 Procedural Guidance

The inability to predict actual plant conditions that require the use of BDB 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 will ensure that FLEX strategies are used only as directed for BDB external event conditions, and are not used inappropriately in lieu of existing procedures. When FLEX equipment is needed to accomplish FLEX strategies or supplement EOPs, the SE-11 Sheet 6 flowchart, TRIPs, or Severe Accident Mitigation Guidelines (SAMGs) will direct the entry into and exit from the appropriate FSG procedure.

FLEX strategy support guidelines have been developed in accordance with BWROG guidelines. FLEX Support Guidelines provide available, pre-planned FLEX strategies for accomplishing specific tasks. FSGs will be used to supplement (not replace) the existing procedure structure that establishes command and control for the event. See Figure 16 for a listing of PBAPS FSGs.

Procedural interfaces have been incorporated into SE-11 Sheet 6 flowchart to the extent necessary to include appropriate reference to FSGs and provide command and control for the ELAP.

Changes to FSGs are controlled by OP-PB-114-101, Transient Response Implementation Plan (TRIP), Severe Accident Management Plan (SAMP), and FLEX Support Guideline (FSG) Procedures Program (Reference 43). FSG

changes will be reviewed and validated by the involved groups to the extent necessary to ensure the strategy remains feasible. Validation for applicable FSG strategies has been accomplished in accordance with the guidelines provided in NEI 12-06.

2.18.3 Staffing

Using the methodology of NEI 12-01, Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities (Reference 7), an assessment of the capability of PBAPS on-shift staff and augmented Emergency Response Organization (ERO) to respond to a BDBEE was performed (Reference 49).

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

1) an extended loss of AC power (ELAP)
2) an extended loss of access to ultimate heat sink (UHS)
3) impact on units (the unit is in operation at the time of the event)
4) impeded access to the unit by off-site responders as follows:
    - 0 to 6 Hours Post Event – No site access.
    - 6 to 24 Hours Post Event – Limited site access. Individuals may access the site by walking, personal vehicle or via alternate transportation capabilities (e.g., private resource providers or public sector support).
    - 24+ Hours Post Event – Improved site access. Site access is restored to a near-normal status and/or augmented transportation resources are available to deliver equipment, supplies and large numbers of personnel.

PBAPS Operations personnel conducted a table-top review of the on-shift response to the postulated BDBEE and extended loss of AC power for the Initial and Transition Phases using the FLEX mitigating strategies. Resources needed to perform initial event response actions were identified from the Emergency Operating Procedures (EOPs) and SE-11, "Loss of Off-Site Power". The sequence, timing, and duration of required actions were included in this review.

This Phase 2 Staffing Assessment (Reference 49) concluded that the current minimum on-shift staffing as defined in the Emergency Response Plan for PBAPS, as augmented by site auxiliary personnel, is sufficient to support the implementation of the FLEX strategies, as well as the required Emergency Plan actions, with no unacceptable collateral duties.

2.18.4 Training

PBAPS's Nuclear Training Program has been revised to assure personnel proficiency in the mitigation of BDB external events is adequate and maintained. These programs and controls were developed and have been implemented in accordance with the Systematic Approach to Training (SAT) Process.

Using the SAT process, Job and Task analyses were completed for the new tasks identified applicable to the FLEX Mitigation Strategies. Based on the analysis, training for Operations was designed, developed and implemented for Operations continuing training. ANSI/ANS 3.5, "Nuclear Power Plant Simulators for use in Operator Training" (Reference 50) certification of simulator fidelity is considered to be sufficient for the initial stages of the BDB external event scenario training. The simulator has been modified to allow for operator training to be conducted for re-powering Division I 480VAC load centers (from the FLEX Generator), RPV makeup from the FLEX Pump, and operation of the HCVS. Upon SAFER equipment deployment and connection in an event, turnover and familiarization training on each piece of SAFER equipment will be provided to station operators by the SAFER deployment/operating staff.

Initial and periodic training has been instituted for site emergency response leaders on BDB emergency response strategies and implementing guidelines. Continuing training including FLEX drills has been incorporated into EP-AA-122, Drills and Exercise Program (Reference 44). Personnel assigned to direct the execution of mitigation strategies for BDB external events have received the necessary training to ensure familiarity with the associated tasks, considering available job aids, instructions, and mitigating strategy time constraints.

Where appropriate, integrated FLEX drills will be conducted periodically; with all time-sensitive actions evaluated over a period of not more than eight years. It is not required to connect/operate temporary/permanently installed equipment during these drills. PBAPS has incorporated FLEX drills into the Drill and Exercise program per EP-AA-122.

2.18.5 Equipment List

The equipment stored and maintained in the robust FLEX Building and various pre-staged locations at PBAPS necessary for the implementation of the FLEX strategies in response to a BDB external event are listed in CC-PB-118 Attachment 2 (Reference 19). Attachment 2 identifies the quantity and applicable strategy for the major BDB/FLEX equipment components only. Details regarding fittings, tools, hose lengths, consumable supplies, etc., are not in Attachment 2 but are detailed in RT-0-100-591-2, "Diverse and Flexible Coping Strategies (FLEX) Tool and Material Inventory" (Reference 58). Major FLEX Equipment is contained in Table 2 below.

Table 2 – Major FLEX Equipment

Phase	Description of Equipment	Strategy
2	Three (3) 500 KW 480V AC diesel generators, distribution panel for primary and alternate strategies (00G310, 00G311, 00G312)	Core, Containment, SFP, Restoration of Battery Chargers, Instrumentation, Accessibility
2	Two (2) cable trailers** (4/0 cables for diesel generators)	Core, Containment, SFP, Restoration of Battery Chargers, Instrumentation, Accessibility
2	Three (3) Godwin HL130M Self Priming Pumps (00P434, 00P440, 00P441)	Core, Containment, SFP
2	One (1) hose trailer** (6" suction and 4" discharge hoses with required fittings)	Core, Containment, SFP
2	Six (6) Portable 5500 watt diesel generators	Ventilation, Lighting, Instrumentation, Accessibility
2	F-750 with plow and fuel oil storage tanks	Debris Removal, Equipment Deployment, Refueling FLEX Equipment
2	Two (2) John Deere 6125M Tractors w/Grab Rakes	Debris Removal, Equipment Deployment

2.18.6 N + 1 Equipment Requirement

NEI 12-06 (Reference 2) invokes an N+1 requirement for the major BDB FLEX equipment that directly performs a FLEX mitigation strategy for core cooling, containment, or SFP cooling in order to assure reliability and availability of the FLEX equipment required to meet the FLEX strategies. PBAPS meets this requirement.

In the case of hoses and cables associated with FLEX equipment required for FLEX strategies, an alternate approach to meet the N+1 capability has been selected. These hoses and cables are passive components being stored in a protected facility. It is postulated the most probable cause for degradation/damage of these components would occur during deployment of the equipment. Therefore the +1 capability is accomplished by having sufficient hoses and cables to satisfy the N capability + 10% spares or at least 1 length of hose and cable. This 10% margin capability ensures that failure of any one of these passive components would not prevent the successful deployment of a FLEX strategy.

The N+1 requirement does not apply to the BDB FLEX support equipment, vehicles, and tools. However, these items are covered by an administrative procedure and are subject to inventory checks, unavailability requirements, and any maintenance and testing that are needed to ensure they can perform their required functions.

2.18.7 Equipment Maintenance and Testing

Periodic testing and preventative maintenance of the BDB/FLEX equipment conforms to the guidance provided in INPO AP-913 (Reference 15). A fleet procedure has been developed to address Preventative Maintenance (PM) using EPRI templates or manufacturer provided information/recommendations, equipment testing, and the unavailability of equipment.

EPRI has completed and has issued "Preventive Maintenance Basis for FLEX Equipment – Project Overview Report" (Reference 16). Preventative Maintenance Templates for the major FLEX equipment including the portable diesel pumps and generators have also been issued.

The PM Templates include activities such as:

- Periodic Static Inspections
- Fluid analysis
- Periodic operational verifications
- Periodic functional verifications with performance tests

The EPRI PM Templates for FLEX equipment conform to the guidance of NEI 12-06 (Reference 2) providing assurance that stored or pre-staged FLEX equipment are being properly maintained and tested. EPRI Templates are used for equipment where applicable. However, in those cases where EPRI templates were not available, Preventative Maintenance (PM) actions were developed based on manufacturer provided information/recommendations and Exelon fleet

procedure ER-AA-200, Preventive Maintenance Program (Reference 45). Refer to Table 3 for an overview. Detailed information on FLEX and FLEX support equipment PM's is contained in FLEX program document CC-PB-118 (Reference 19).

Table 3 – Maintenance Procedures for FLEX Equipment

Document No.	Title
RT-O-100-591-2	Diverse and Flexible Coping Strategies (FLEX) Tool and Material Inventory
SO 19.8.A-2(3)	Fuel Pool Cooling System Routine Inspection
SO 39.8.A	FLEX Equipment Routine Inspection
Various Equipment Operator (EO) Rounds	Night Shift Turbine Building, Night Shift Reactor Building EO Rounds
312017-02	00G310: FLEX DG Inspection and Functional Test
312017-03	FLEX Portable Diesel Generator 00G310 3yr PM
312018-02	00G311: FLEX DG Inspection and Functional Test
312018-03	FLEX Portable Diesel Generator 00G311 3yr PM
312019-02	00G312: FLEX DG Inspection and Functional Test
312019-03	FLEX Portable Diesel Generator 00G312 3yr PM
235249-01	00P440: FLEX Pump 6 Month Inspection
235249-02	00P440: FLEX Pump Operational Insp/G
235250-01	00P441: FLEX Pump 6 Month Inspection
235250-02	00P441: FLEX Pump Operational Insp/G
235247-01	OOP434: FLEX Pump 6 Month Inspection
235247-02	OOP434: FLEX Pump Operational Insp/G
IC-11-00660	Calibration of ABB KTEK MT5000 Series Spent Fuel Pool Level Instrumentation System

The unavailability of FLEX equipment and applicable connections that perform a FLEX mitigation strategy for core, containment, and SFP is controlled and managed per PBAPS procedure CC-PB-118 (Reference 19) Attachment 7, "Unavailability Requirements for FLEX Direct, Support, SFPI Equipment, and HCVS", such that risk to mitigating strategy capability is minimized. The guidance in this procedure conforms to the guidance of NEI 12-06 (Reference 2) and CC-AA-118 (Reference 39) for FLEX direct equipment as follows:

- Portable FLEX equipment may be unavailable for 90 days provided that the site FLEX capability (N) is available
- If portable equipment becomes unavailable such that the site FLEX capability (N) is not maintained, initiate actions within 24 hours to restore the site FLEX capability (N) and implement compensatory measures (e.g., use of alternate suitable equipment or supplemental personnel) within 72 hours

FLEX support equipment is defined as equipment not required to directly support maintenance of the key safety functions. There are no requirements specified in NEI 12-06 for unavailability time for any of the FLEX support equipment. This equipment is important to the successful Implementation of the PBAPS FLEX strategy and Exelon Generation Company (EGC) requires establishment of an unavailability time (Reference 39).

- One or more pieces of FLEX support equipment available but not in its evaluated configuration for protection restore protection within 90 days
- One or more pieces of FLEX support equipment is unavailable, restore the equipment to available within 90 days AND implement compensatory measures for the lost function within 14 days.

When FLEX equipment deficiencies are identified the following action will be taken:

1. Identified equipment deficiencies shall be entered into the Corrective Action Program (CAP).
2. Equipment deficiencies that would prevent FLEX equipment from performing the intended function shall be worked under the station priority list in accordance with the work management process.
3. Equipment that cannot perform its intended functions shall be declared unavailable. Unavailability is tracked per CC-PB-118 in eSOMS and a Potential Technical Specification Action (PTSA) entry shall be made.

3. References

1 NRC Order EA-12-049, Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, March 12, 2012

2 NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, August 2012.

3 NRC 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

4 NRC Order EA-12-051, Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, March 12, 2012

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

6 NRC JLD-ISG-2012-03, Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation, Revision 0, August 29, 2012

7 NEI 12-01, Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities, Revision 0, April 2012

8 NRC Order 13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions, June 6, 2013

9 Task Interface Agreement (TIA) 2004-04, "Acceptability of Proceduralized Departures from Technical Specification (TSs) Requirements at the Surry Power Station"

10 Not used.

11 Peach Bottom Atomic Power Station Units 2 and 3 Technical Specifications

12 Peach Bottom Atomic Power Station Updated Final Safety Analysis Report (UFSAR), Revision 26.

13 PB-MISC-010 Rev. 6, Peach Bottom MAAP Analysis to Support FLEX Initial Strategy

14 Calculation PM-1159, Revision 1A, RCIC Room Heat Up Analysis for Extended Loss of AC Power (ELAP) / Extended SBO

15 INPO AP-913, Periodic Testing and Preventative Maintenance of the BDB/FLEX Equipment

16 Preventive Maintenance Basis for FLEX Equipment – Project Overview Report (EPRI Report TR-3002000623), September 2013.

17 Calculation PM-1173, Revision 5, PBAPS FLEX Makeup Analysis in Response to NRC ORDER EA-12-049

18 CC-PB-118-1001, "SAFER Response Plan for Peach Bottom Atomic Power Station", Rev 0

19 CC-PB-118, Peach Bottom Implementation of Diverse and Flexible Coping Strategies (FLEX) and Spent Fuel Pool Instrumentation Program, Rev 5
20 Calculation PM-1184, Revision 2, Evaluation of FLEX Makeup to RPV and SFP via ECT
21 Calculation PE-0140, Revision 13, Class 1E 125/250 V DC System "What If" Cases
22 EC 555794, Revision 1, Fukushima Mod – U2 FLEX – Electrical Connections to E-LC's
23 EC 555714, Revision 1, Fukushima Mod – U3 FLEX – Electrical Connections to E-LC's
24 EC 555715, Revision 2, Fukushima Modification – Spent Fuel Pool Level Instrument
25 EC 555716, Revision 4, Portable Pump Water Supply – Fukushima Mech. Mod Common Unit
26 EC 555717, Revision 5, RHR and HPSW Tie-In Points – Fukushima Mech. Mod Unit3
27 EC 556049, Revision 4, Fukushima Modification – U2 Hardened Containment Vent System
28 EC 556318, Revision 4, Fukushima Modification – U3 Hardened Containment Vent System
29 Calculation PM-1174, Revision 0, SFP Air Space Transient Temperature Profile Following ELAP
30 EC 555825, Revision 0, Design and Construction Support of the FLEX Storage Bldg
31 Flood Hazard Reevalution Report, Revision 0, July 10, 2015 (RS-15-163)
32 Mitigating Strategies Flood Hazard Assessment (MSFHA) Submittal, June 30, 2016 (RS-16-103)
33 SE-11, Loss of Off-Site Power, Revision 17
34 SE-4, Flood, Revision 42
35 EC 555585, Revision 1, Diesel Fuel Oil Supply - Fukushima Mech. Mod Common Unit
36 PM-1171, Revision 0, PBAPS Mechanical FLEX Analysis in Response to NRC Order EA-12-049 – Diesel Fuel Oil Supply
37 EC 556041, Revision 1, Fukushima – Common Unit FLEX Mod – Internal Communications
38 MA-PB-1003, Winter Readiness and Storm Response Guidelines for the Peach Bottom Facility, Revision 11
39 CC-AA-118, Diverse and Flexible Coping Strategies (FLEX) and Spent Fuel Pool Instrumentation Program Document, Rev 2

40 SA-AA-111—Heat Stress Control, Rev 16
41 CC-AA-102, Design Input and Configuration Change Impact Screening, Rev 30
42 CC-AA-309-101, Engineering Technical Evaluations, Rev 15
43 OP-PB-114-101, Transient Response Implementation Plan (TRIP), Severe Accident Management Plan (SAMP), and FLEX Support Guideline (FSG) Procedures Program, Rev 3
44 EP-AA-122, Drills and Exercise Program, Rev 18
45 ER-AA-200, Preventative Maintenance Program, Rev 3
46 NEI Position Paper: "Shutdown/ Refueling Modes," dated September 18, 2013
47 Letter to Mr. J.E. Pollock (NEI) from Mr. J. R. Davis (NRC) dated September 30, 2013 endorsing NEI Shutdown/Refueling Modes Position Paper
48 Electric Power Research Institute (EPRI) Report 3002000704 (Dated May 2013), Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic.
49 PBAPS Station NEI 12-01 Phase 2 Staffing Assessment, May 8, 2015 (RS-15-114)
50 ANSI/ANS 3.5-2009, Nuclear Power Plant Simulators for use in Operator Training
51 NEI 13-02, Industry Guidance for Compliance with NRC Order EA-13-109, BWR Mark I & II Reliable Hardened Vents Capable of Operation Under Severe Accident Conditions, Revision 1, April 2015
52 NRC Interim Staff Guidance JLD-ISG-2013-02, Revision 0, Compliance with Order EA-13-109 Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions, November 14, 2013
53 Seismic Hazard and Screening Report, March 31, 2014 (RS-14-071/ML14090A247)
54 EC 556378, Revision 0, Relocation of Relay 3-13A-K033
55 EC 556379, Revision 0, Relocation of Relay 2-13A-K033
56 NRC Letter to Mr. Bryan C. Hanson (Exelon Generation Company, LLC), Peach Bottom Atomic Power Station, Units 2 and 3 -Flood Hazard Mitigation Strategies Assessment (CAC Nos. MF7958 and MF7959), January 11, 2017 (ML16362A208)
57 Passport 1362747-52, Regulatory Commitments Associated with FUKUSHIMA DAI-ICHI
58 RT-0-100-591-2, Diverse and Flexible Coping Strategies (FLEX) Tool and Material Inventory, Rev 5
59 Spent Fuel Pool Evaluation Supplemental Report, December 15, 2017 (RS-17-149)

60 EC 555793, Revision 3, Fukushima Mod – U2 FLEX – Mechanical East Side to HPSW
61 Calculation PS-1117, Revision 0, Tornado Missile Barrier for the FLEX Make-Up Water Line at the ECT
62 Expedited Seismic Evaluation Process Report, December 19, 2014 (RS-14-300)

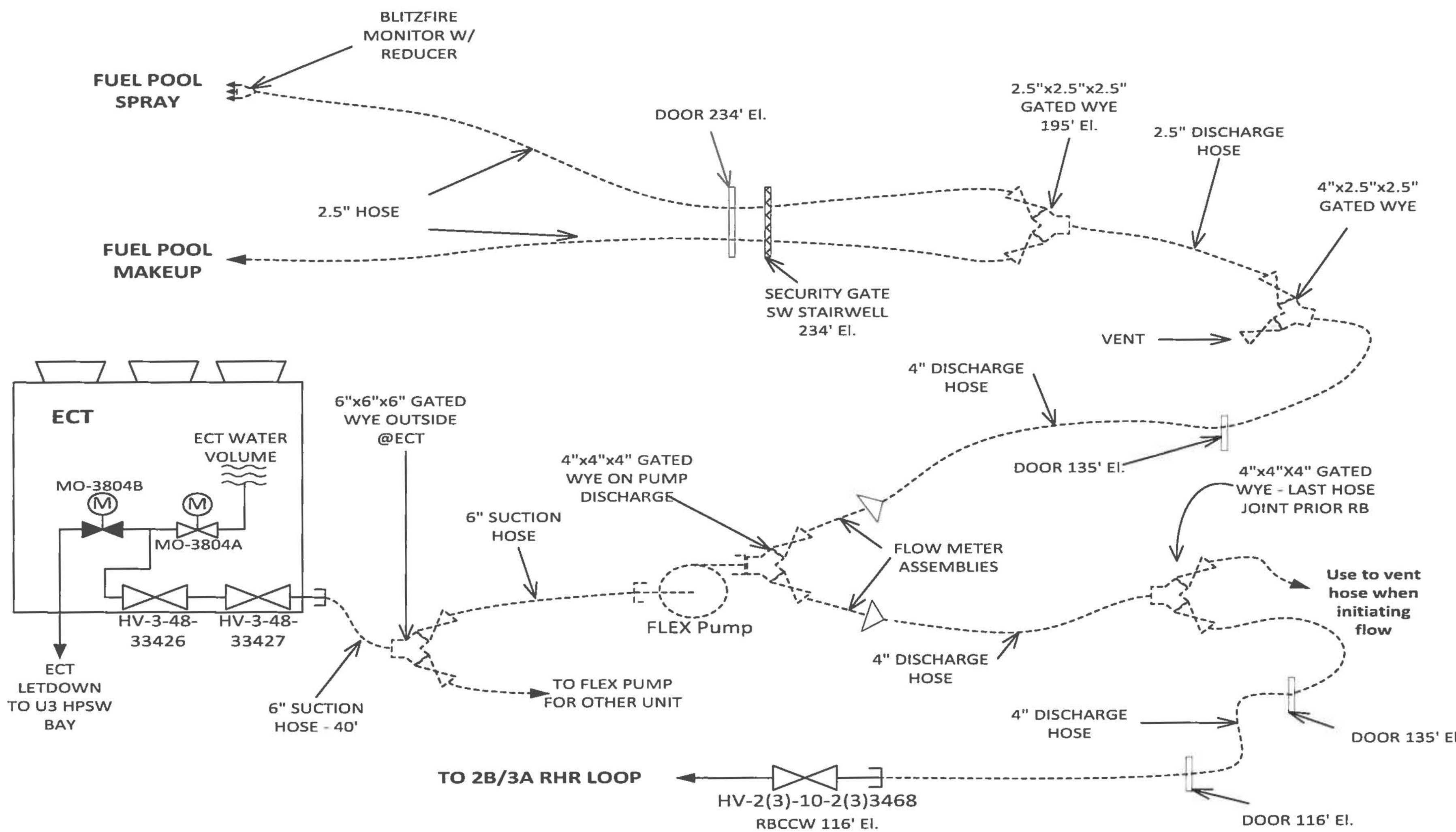

Figure 1: FSG-040-2/3 ECT Suction with Preferred Discharge to 2B(3A) RHR Loop

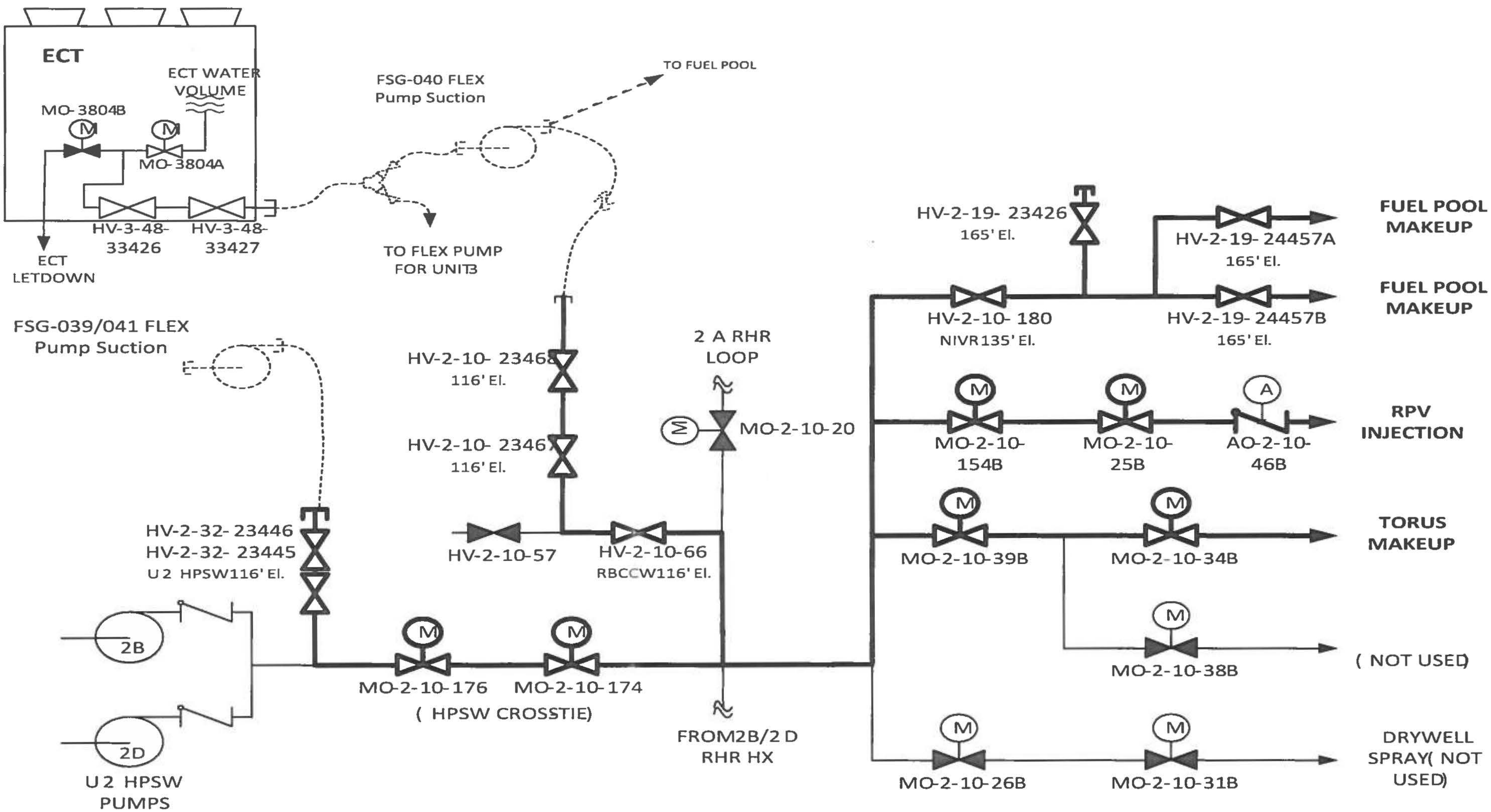

Figure 2: FSG-039/040/041-2 with Discharge to 2B RHR Loop

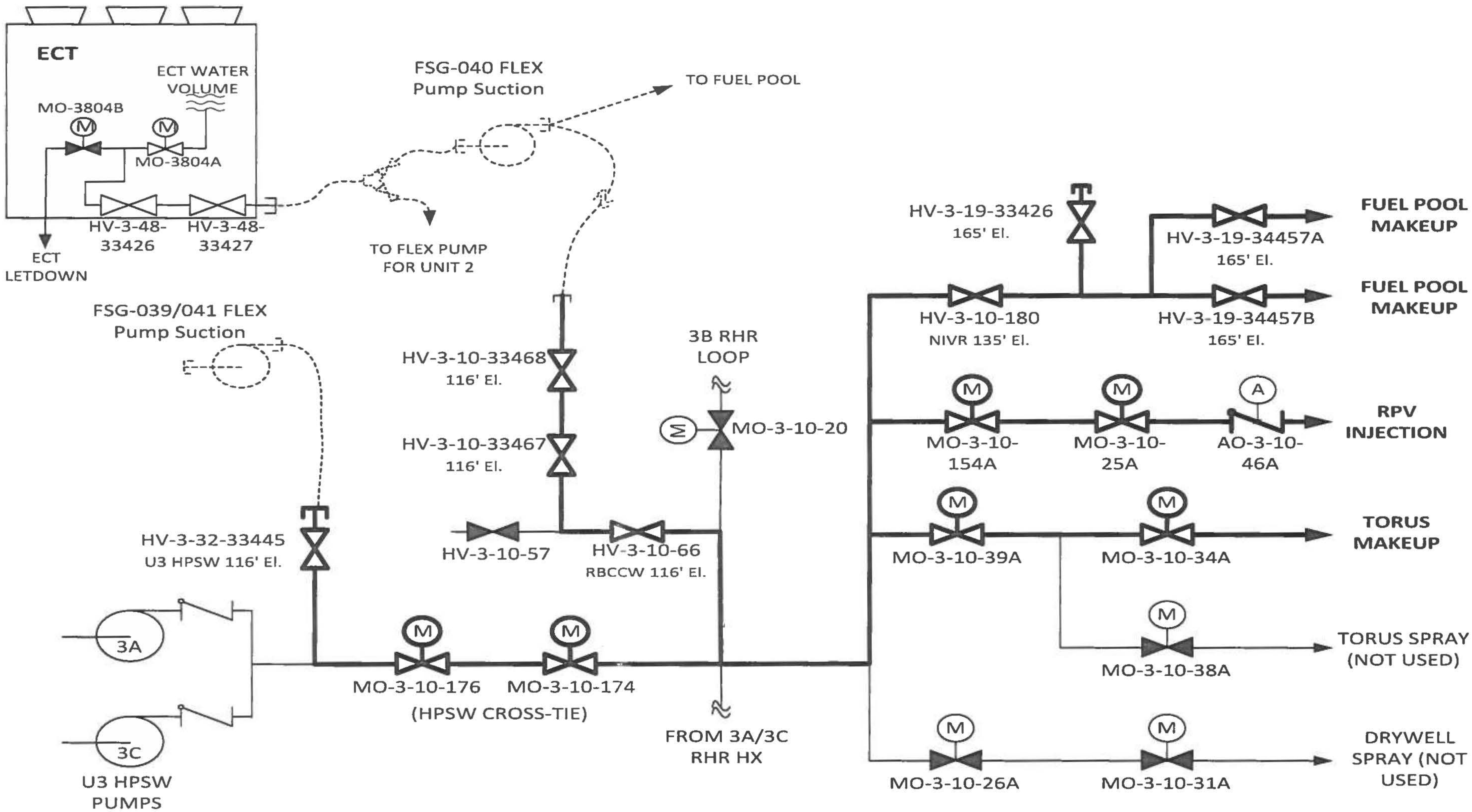

Figure 3: FSG-040-3 ECT Suction with Preferred Discharge to 3A RHR Loop

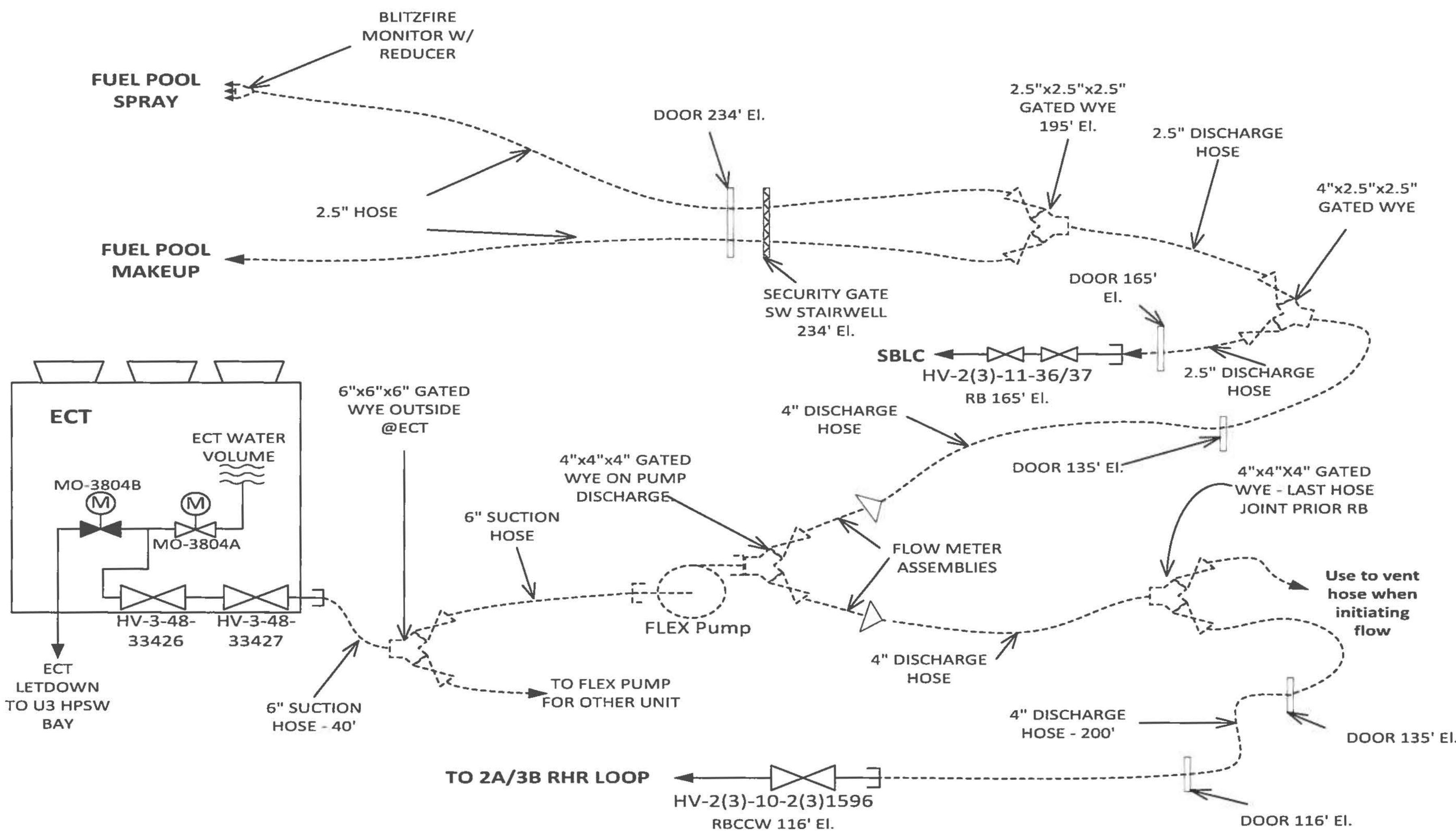

Figure 4: FSG-040-2/3 ECT Suction with Alternate Discharge to 2A(3B) RHR Loop

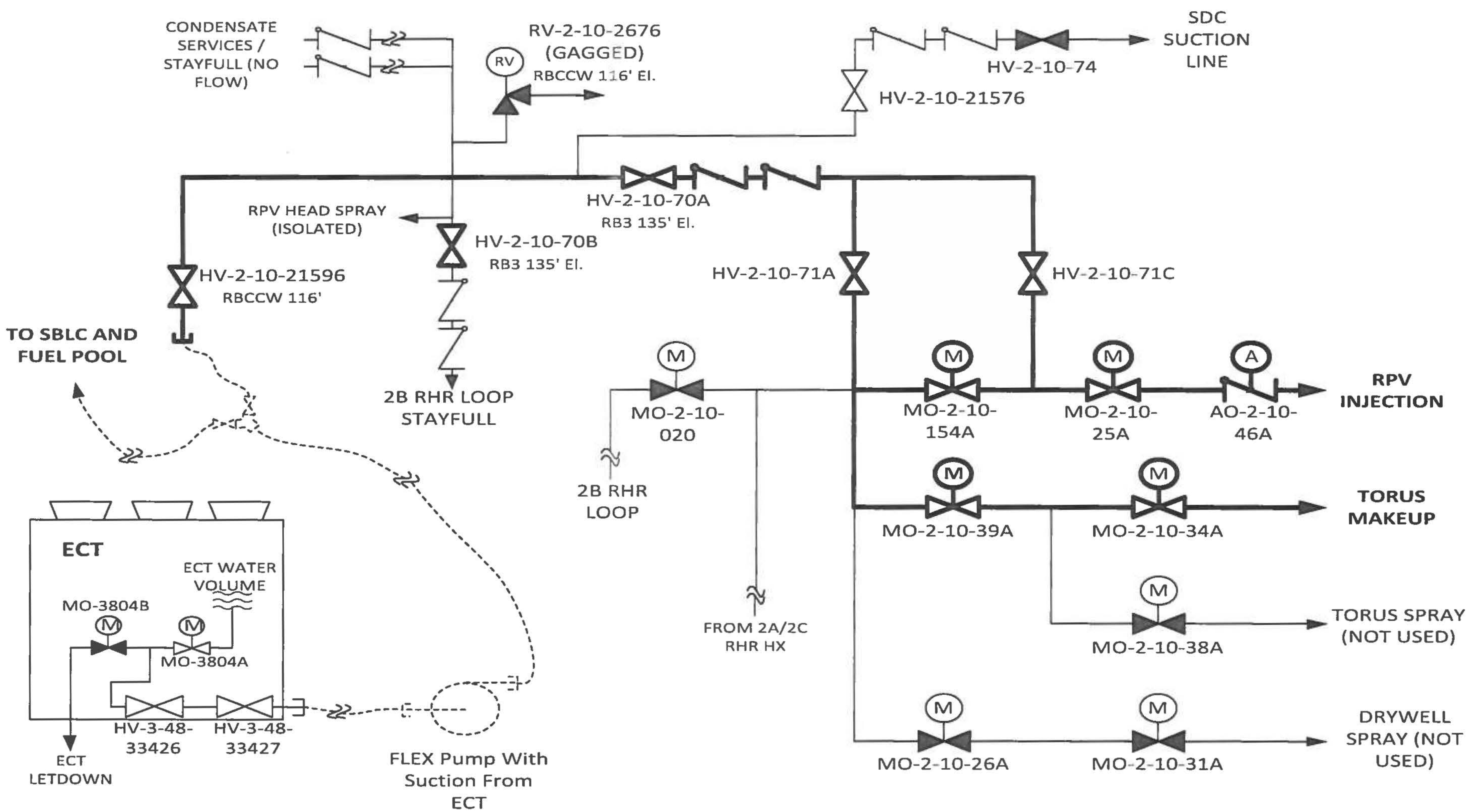

Figure 5: FSG-040-2 with Alternate Discharge to 2A RHR Loop

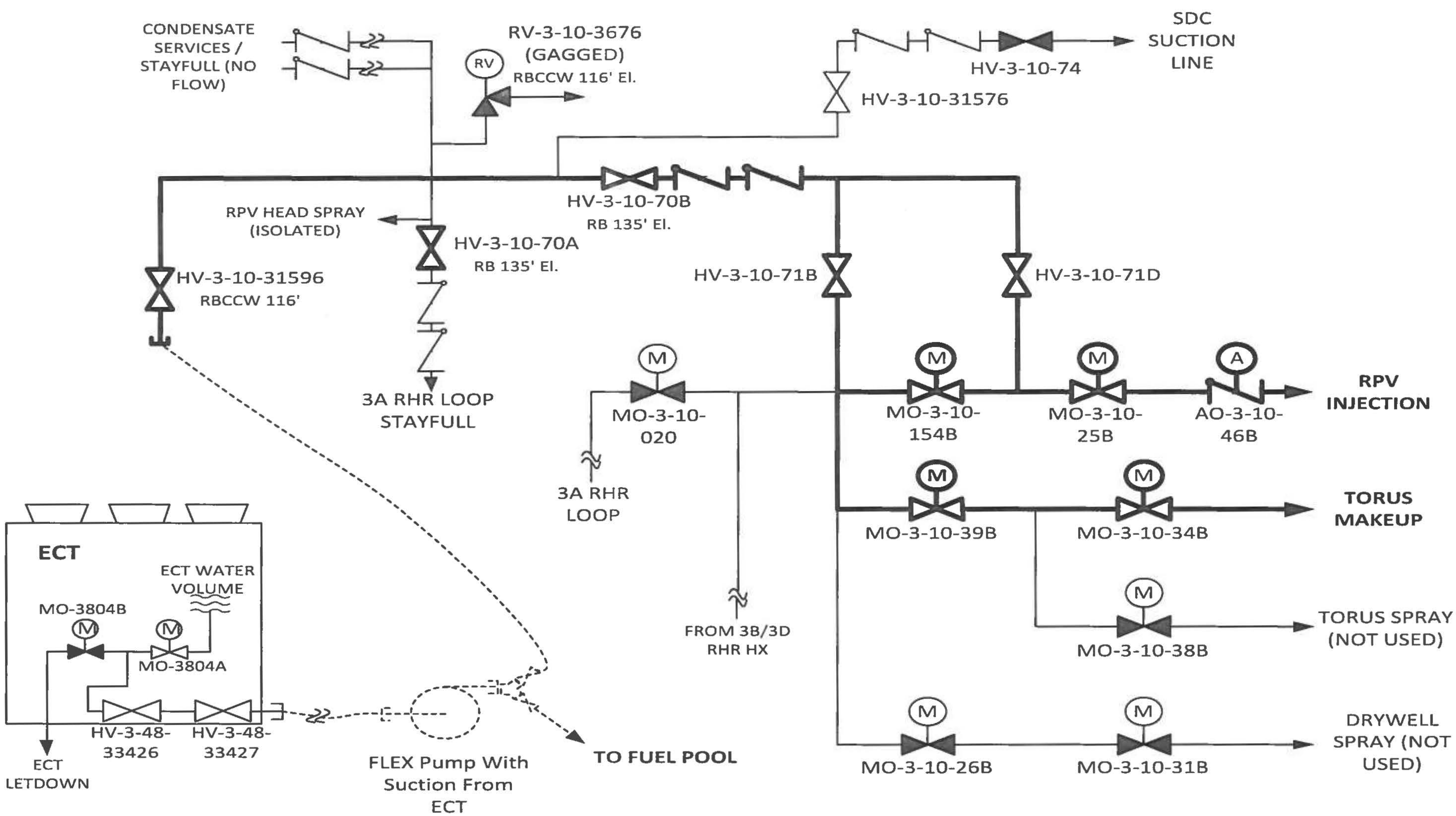

Figure 6: FSG-040-2 with Alternate Discharge to 3B RHR Loop

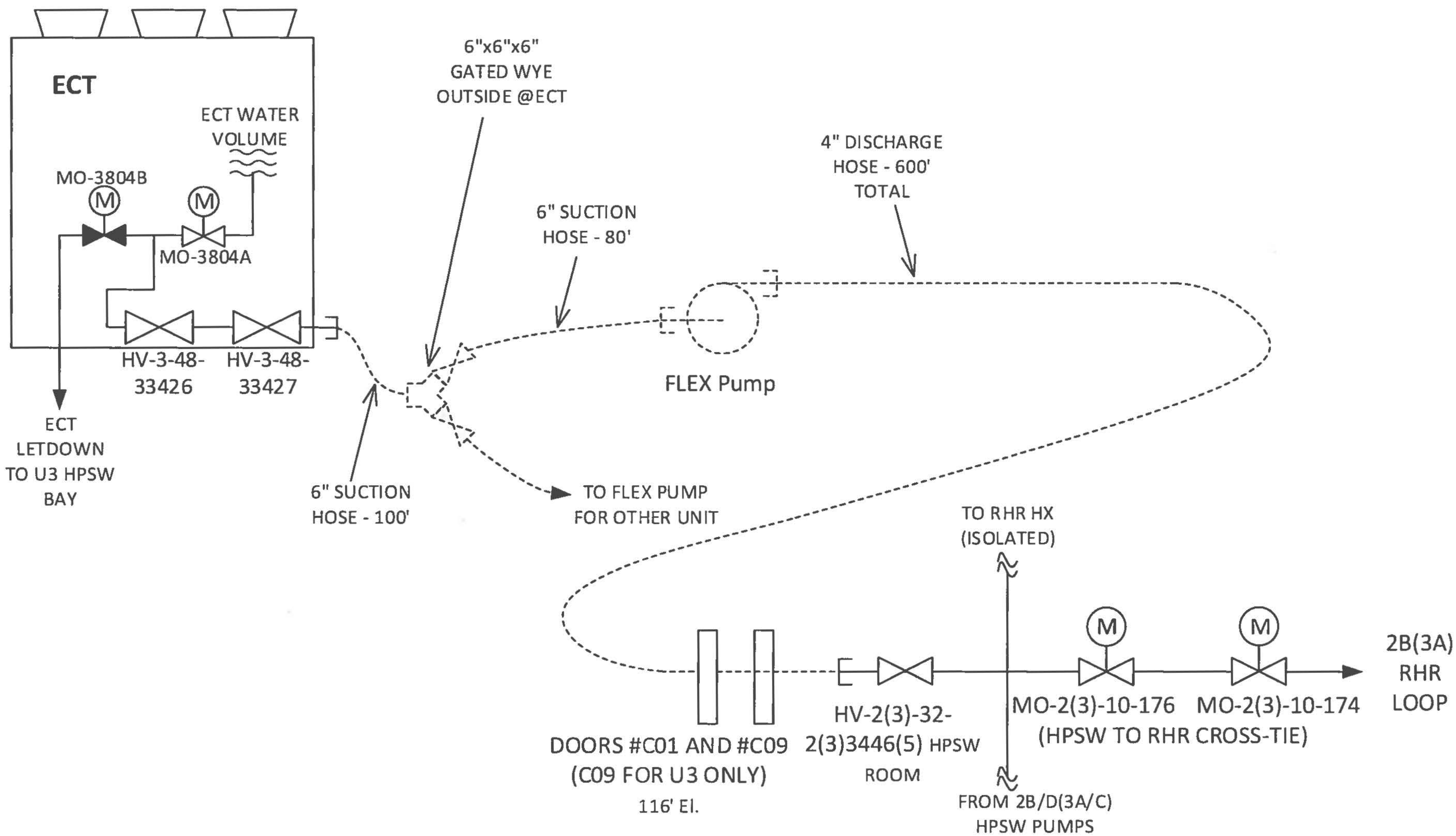

Figure 7: FSG-039-2/3 ECT Suction with Discharge to 2B(3A) HPSW Loop

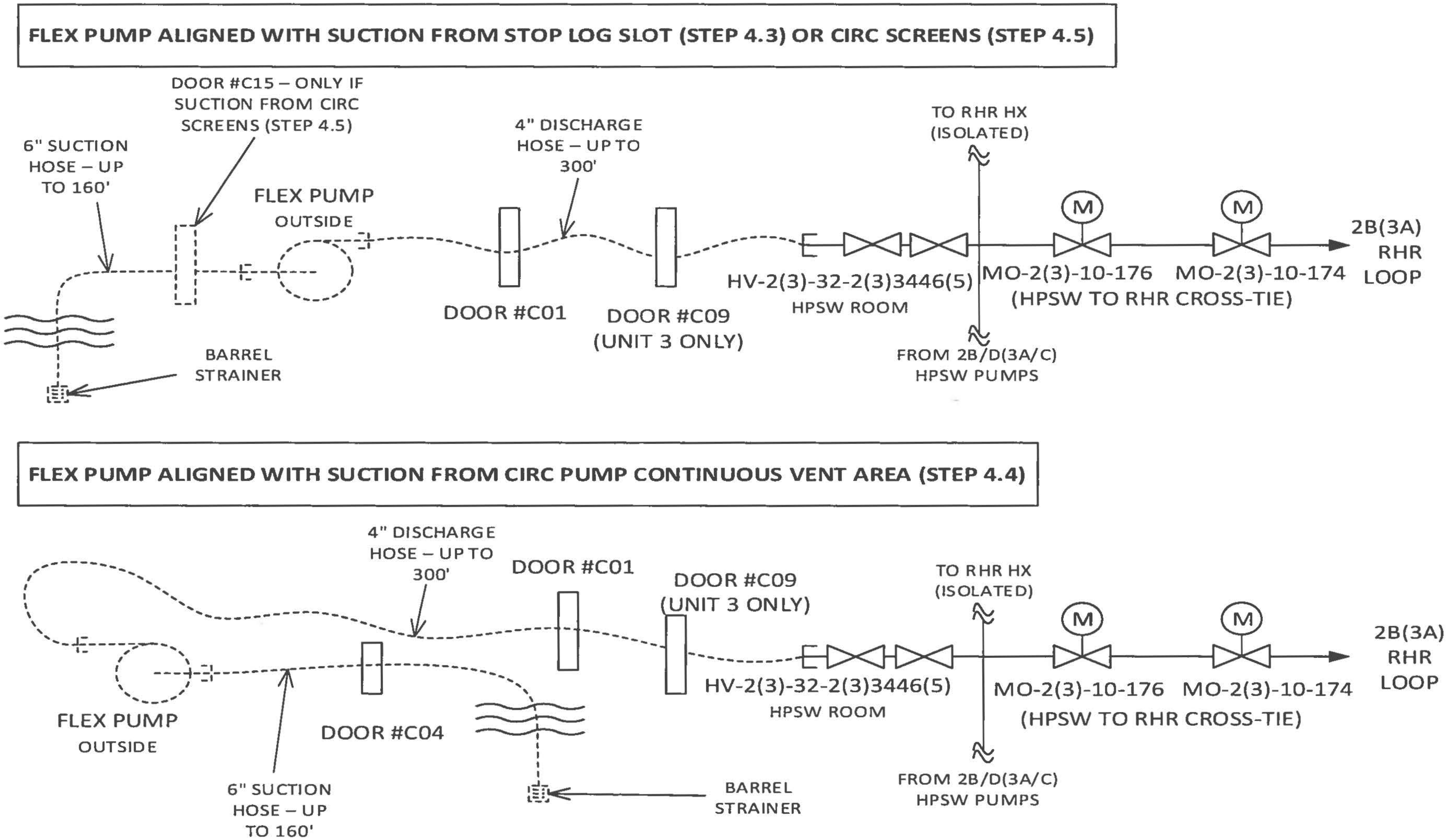

Figure 8: FSG-041-2/3 Pump Bay Suction with Discharge to 2B(3A) HPSW Loop

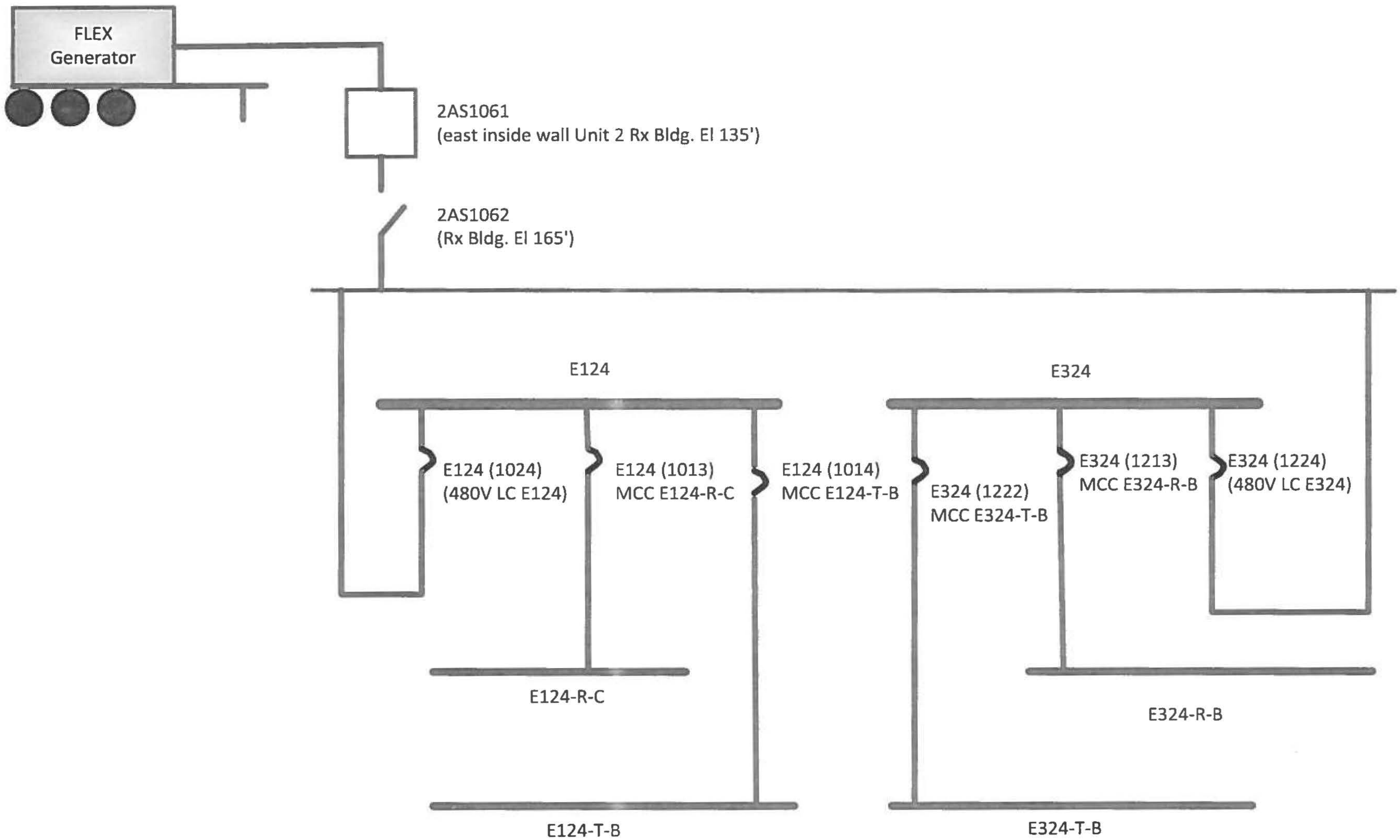

Figure 9: FSG-010-2 FLEX Generator Preferred Power Distribution to E124 and E324

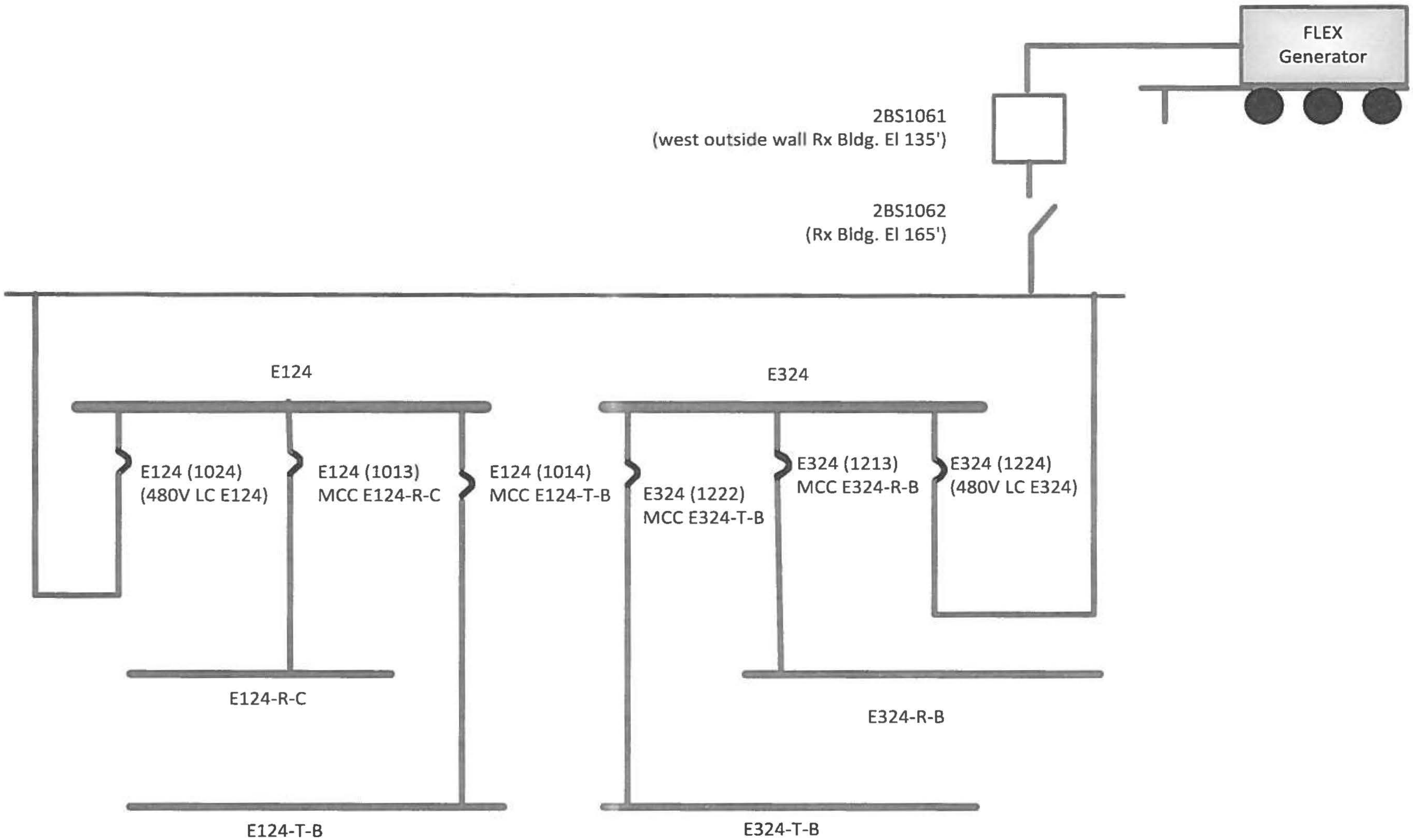

Figure 10: FSG-011-2 FLEX Generator Alternate Power Distribution to E124 and E324

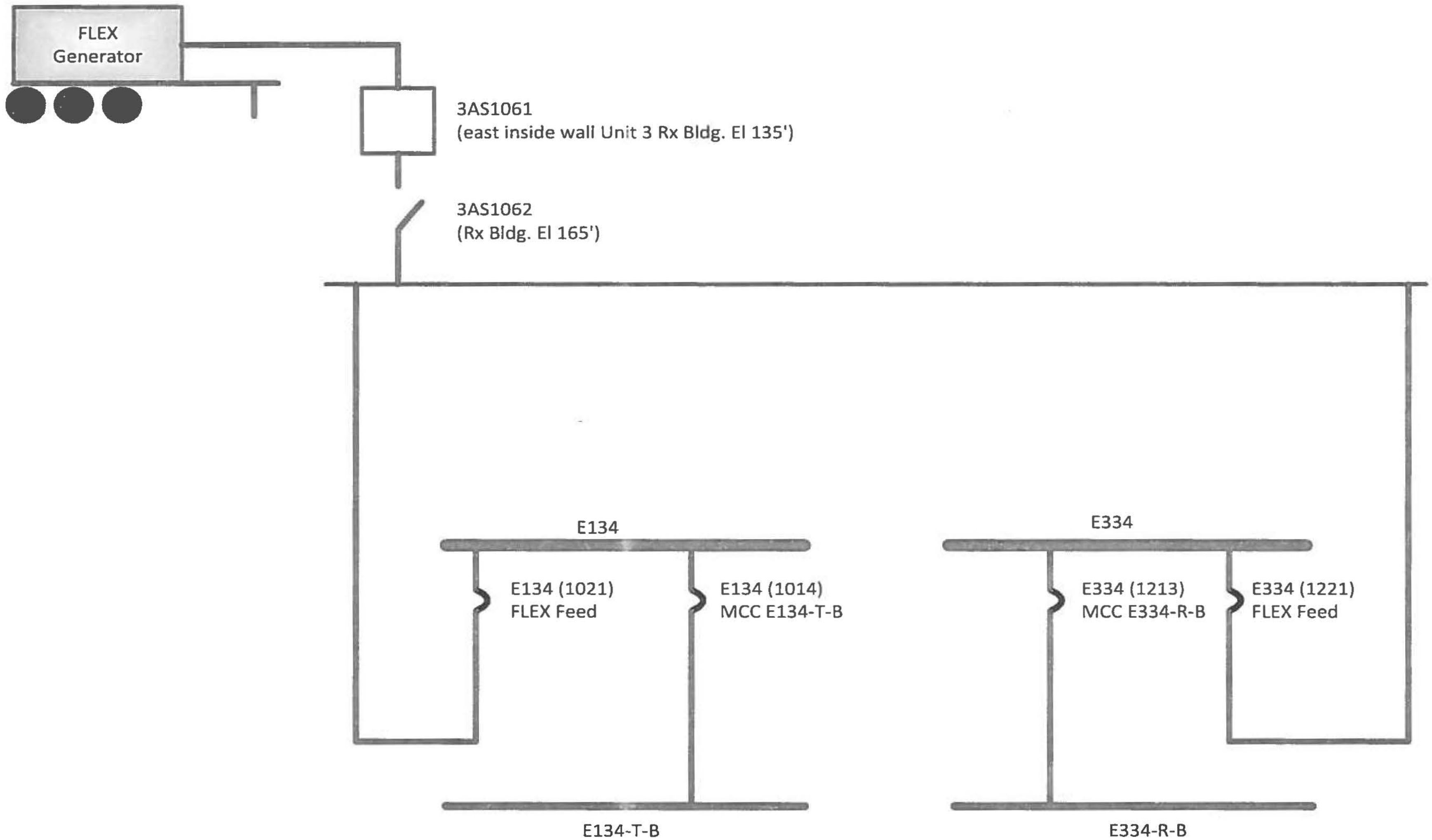

Figure 11: FSG-010-3 FLEX Generator Preferred Power Distribution to E134 and E334

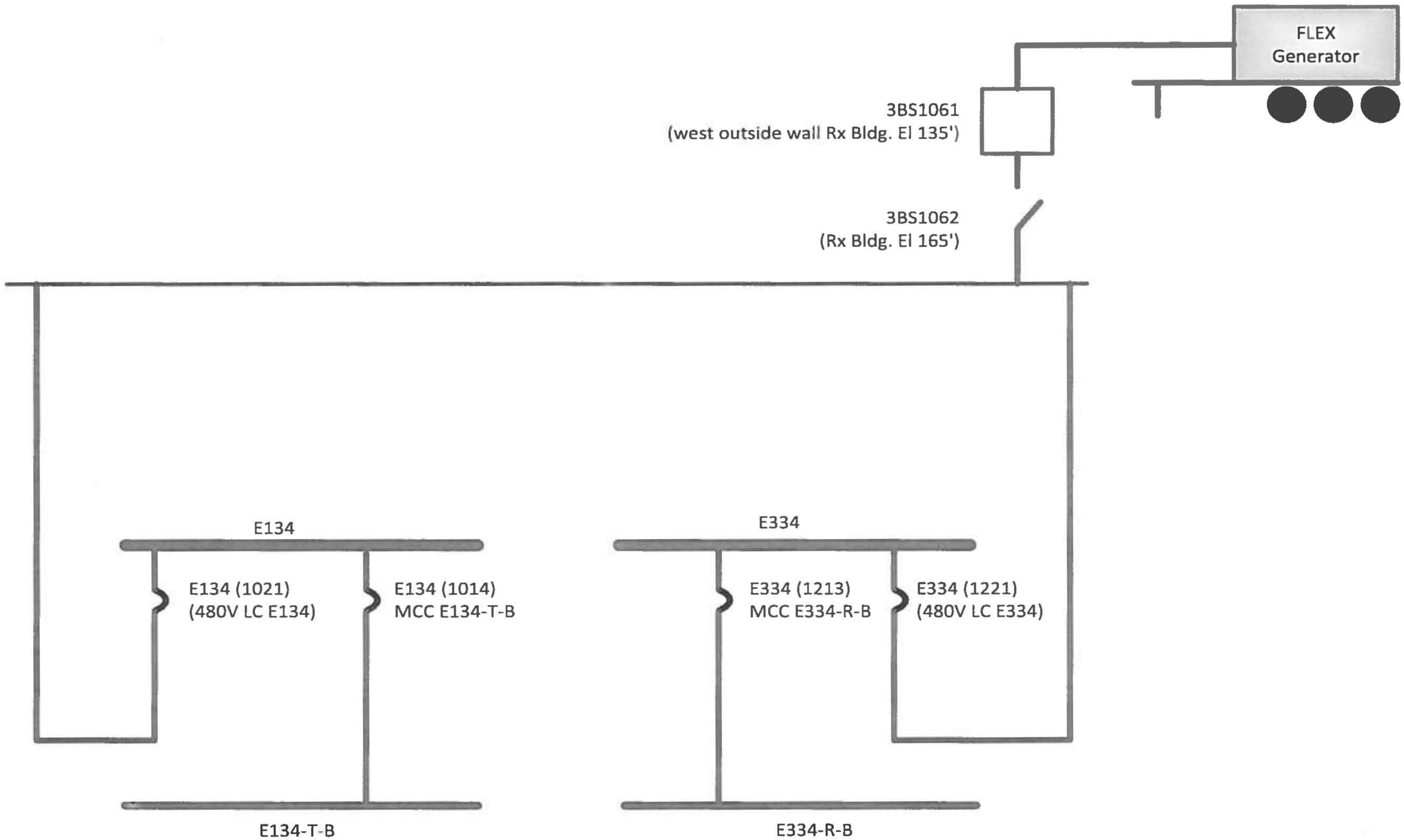

Figure 12: FSG-011-3 FLEX Generator Alternate Power Distribution to E134 and E334

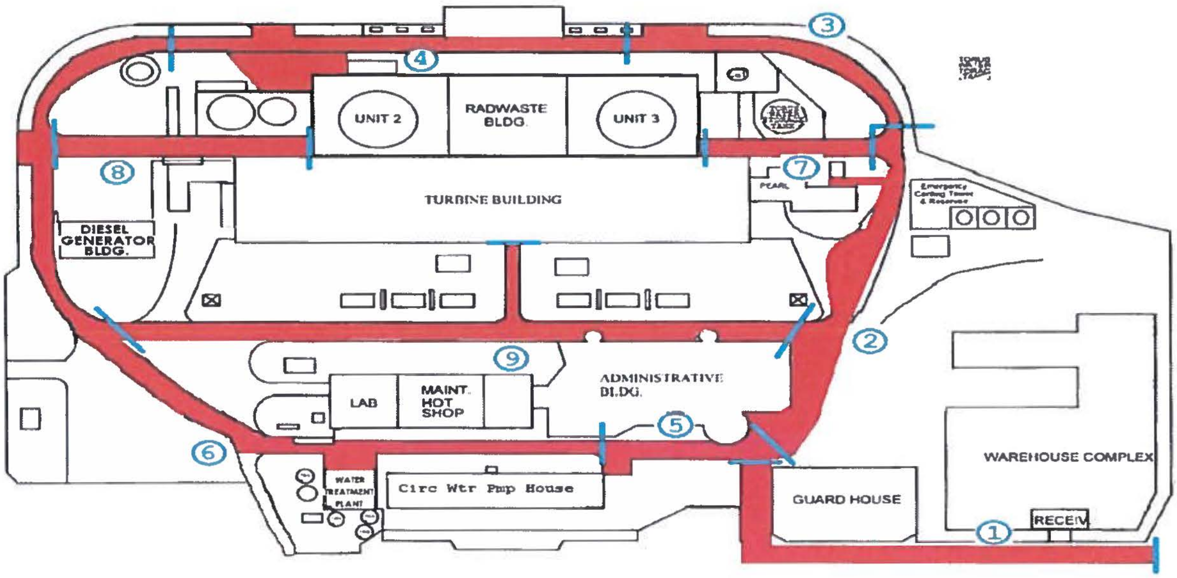

Figure 13: Deployment Haul Paths

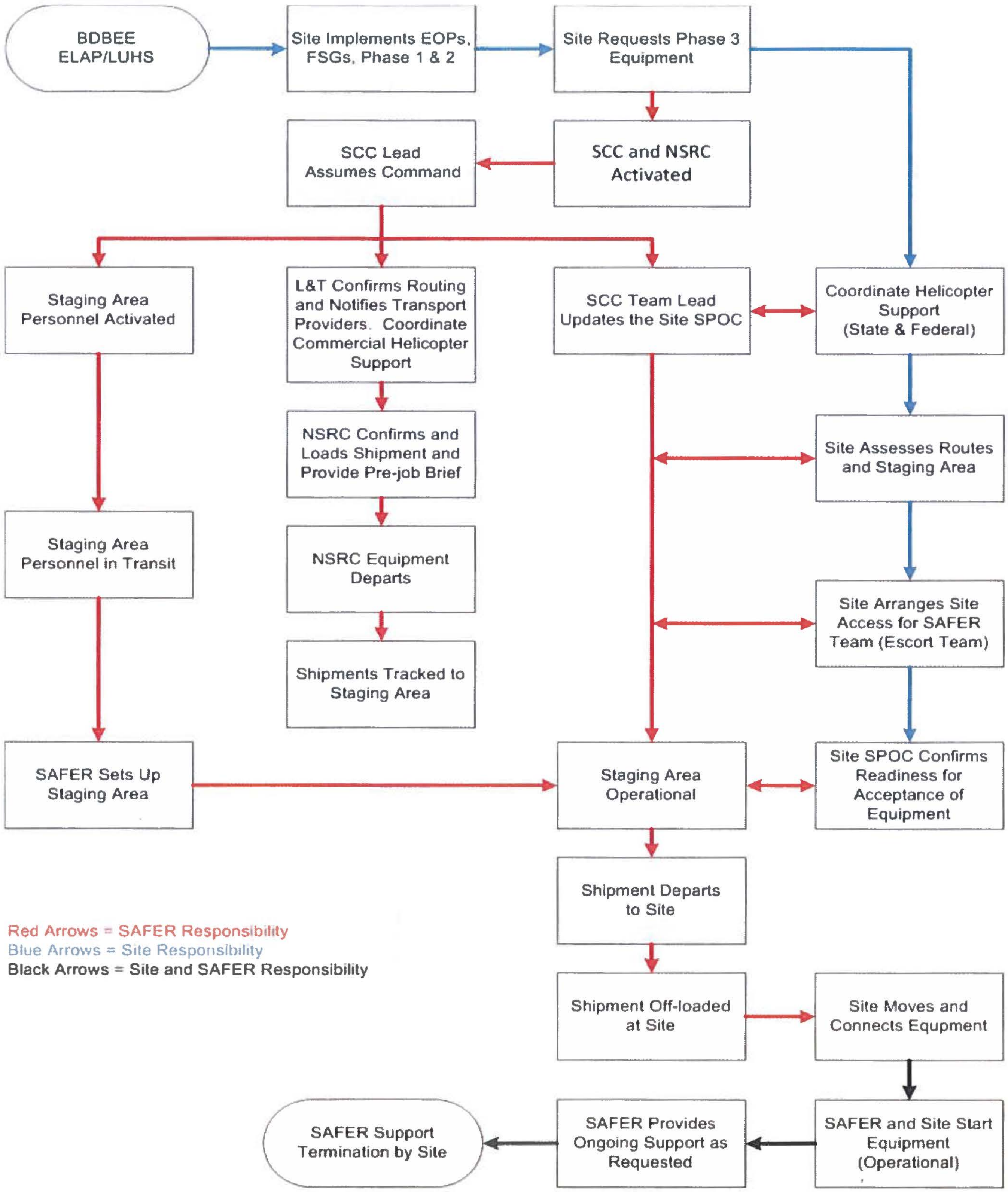

Figure 14: SAFER and Site Responsibilities Flowchart

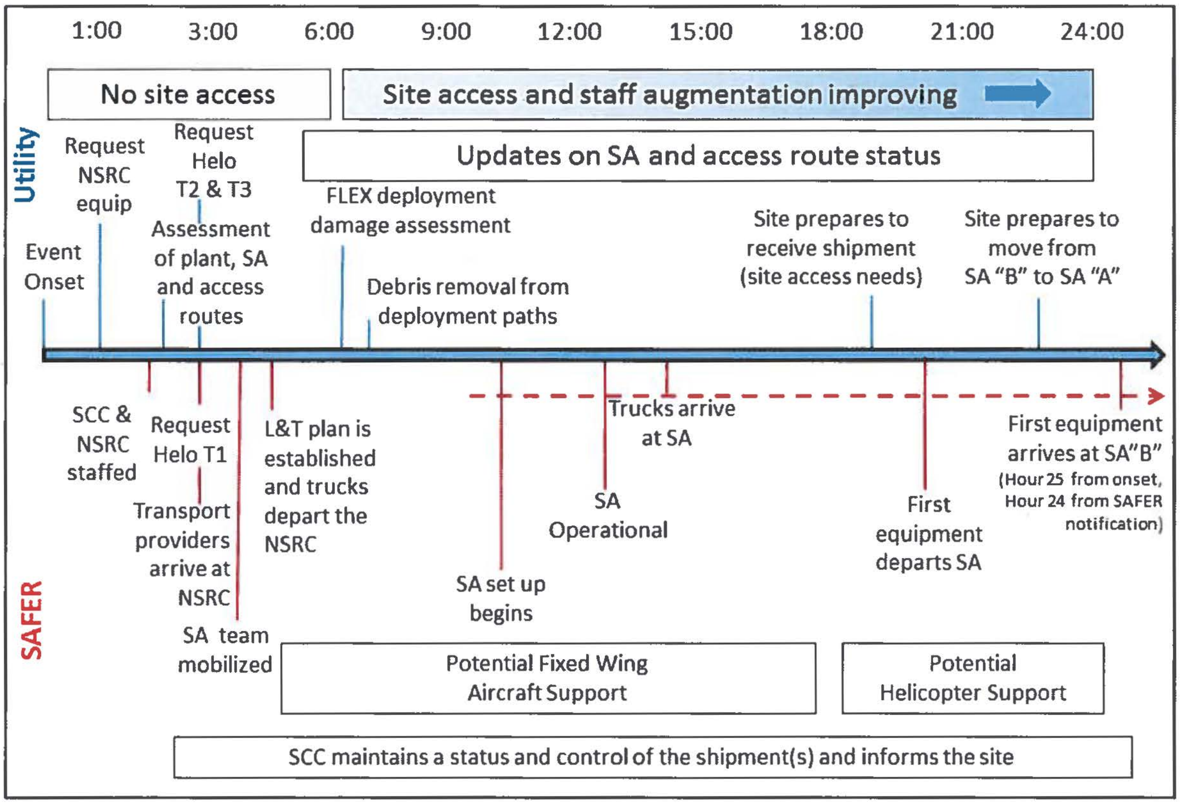

Figure 15: Generic SAFER and Site FLEX Phase 3 Timeline

Procedure	Title
FSG-001	FLEX Equipment Deployment Location Assessment
FSG-002	Debris Removal
FSG-003	Pre-staging FLEX Equipment
FSG-010-2	Aligning FLEX Generator To Panel 2AS1061 and for Fuel Oil Transfer
FSG-010-3	Aligning FLEX Generator To Panel 3AS1061
FSG-011-2	Aligning FLEX Generator To Panel 2BS1061 and for Fuel Oil Transfer
FSG-011-3	Aligning FLEX Generator To Panel 3BS1061
FSG-012-2	ELAP DC Load Shed
FSG-012-3	ELAP DC Load Shed
FSG-013-2	ELAP AC Load Alignment
FSG-013-3	ELAP AC Load Alignment
FSG-020	Deploying Alternate Radio Communications Antenna
FSG-030	Establishing Control Room Ventilation and Lighting
FSG-031	Establishing Battery Room Ventilation
FSG-032-2	Establishing HPCI/RCIC/Sump Room Ventilation, Lighting and Water Removal
FSG-032-3	Establishing HPCI/RCIC/Sump Room Ventilation, Lighting and Water Removal
FSG-033-2	Establishing Natural Circulation of the Secondary Containment Atmosphere
FSG-033-3	Establishing Natural Circulation of the Secondary Containment Atmosphere
FSG-039-2	Aligning the FLEX Pump from the ECT to 2B HPSW
FSG-039-3	Aligning the FLEX Pump from the ECT to 3A HPSW
FSG-040-2	Aligning the FLEX Pump from the ECT to RHR
FSG-040-3	Aligning the FLEX Pump from the ECT to RHR
FSG-041-2	Aligning the FLEX Pump from Pump Bay to HPSW
FSG-041-3	Aligning the FLEX Pump from Pump Bay to HPSW
FSG-042-2	RPV, Torus, and Fuel Pool Makeup Using the FLEX Pump
FSG-042-3	RPV, Torus, and Fuel Pool Makeup Using the FLEX Pump
FSG-043-2	Defeating RCIC Interlocks
FSG-043-3	Defeating RCIC Interlocks
FSG-044-2	Bypassing Backup Instrument Nitrogen SV-8130A and SV-8130B
FSG-044-3	Bypassing Backup Instrument Nitrogen SV-9130A and SV-9130B
FSG-045-2	Obtaining Instrument Readings
FSG-045-3	Obtaining Instrument Readings
FSG-050	FLEX Equipment Fuel Oil Supply
FSG-060	Transitioning from FLEX Equipment to National SAFER Response Center (NSRC) Equipment

Figure 16: FSG Procedure List