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Dominion®

June 23, 2015

10 CFR 2.202
EA-12-049

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

Serial No.:	14-393D
NLOS/DEA:	R0
Docket No.:	50-423
License No.:	NPF-49

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 3
COMPLIANCE LETTER AND FINAL INTEGRATED PLAN IN RESPONSE TO THE MARCH 12, 2012 COMMISSION ORDER MODIFYING LICENSES WITH REGARD TO REQUIREMENTS FOR MITIGATING STRATEGIES FOR BEYOND-DESIGN-BASIS EXTERNAL EVENTS (ORDER NUMBER EA-12-049)

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-049, "Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" [the Order]. The Order requires a three-phase approach for mitigating beyond-design-basis external events. The initial phase requires the use of installed equipment and resources to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities. The transition phase requires providing sufficient, portable, onsite equipment and consumables to maintain or restore functions until they can be accomplished with resources brought from offsite. The final phase requires obtaining sufficient offsite resources to sustain these functions indefinitely. Condition C.3 of the Order requires all Licensees to notify the Commission when full compliance with the requirements of the Order is achieved.

This letter provides notification that Dominion Nuclear Connecticut, Inc. (DNC) has completed the requirements of the Order and is in full compliance with the Order for Millstone Power Station Unit 3. The attachments to this letter provide: 1) a summary of how the requirements of the Order were met, and 2) the Final Integrated Plan (FIP) for Millstone Power Station Unit 3.

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NRR

If you have any questions, please contact Ms. Margaret Earle at (804) 273-2768.

Sincerely,

Mark D. Sartain
Vice President - Nuclear Engineering

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Mark D. Sartain who is Vice President - Nuclear Engineering of Dominion Nuclear Connecticut, Inc. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of the Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 23rd day of June, 2015.

My Commission Expires: 12/31/16.

(SEAL)

CRAIG D SLY
Reg. # 7518653
My Commission Expires December 31, 2016

Notary Public

Attachments:

1. Order EA-12-049 Compliance Requirements Summary
2. Final Integrated Plan (FIP) for Millstone Power Station Unit 3

Commitments contained in this letter: None

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NRC Senior Resident Inspector
Millstone Power Station

Attachment 1

Order EA-12-049 Compliance Requirements Summary

Dominion Nuclear Connecticut, Inc.
Millstone Power Station, Unit 3

Millstone Power Station Unit 3
Order EA-12-049 Compliance Requirements Summary

Dominion Nuclear Connecticut, Inc. (DNC) developed an Overall Integrated Plan (OIP) (Reference 1), documenting the diverse and flexible strategies (FLEX) for Millstone Power Station Unit 3 (MPS3), in response to NRC Order Number EA-12-049 (the Order) (Reference 2). The OIP for Millstone Power Station Unit 3 was submitted to the NRC on February 28, 2013 and was supplemented by Six-Month Status Reports (References 3, 4, 5 and 6), in accordance with Order EA-12-049, along with an additional supplemental letter that was submitted on April 30, 2013 (Reference 7).

A request to relax Condition A.2 of the Order to allow a delay to the full implementation date until April 30, 2015, in order to complete BDB operator training, was requested by letter dated May 16, 2014 (Reference 8). The NRC approved of the relaxation of the order implementation date by letter dated July 3, 2014 (Reference 9). Full compliance of Order EA-12-049 was completed on April 30, 2015.

Completion of the elements identified below, as well as References 1, 3, 4, 5, 6, and 7, document full compliance with Order EA-12-049 (Reference 2) for Millstone Power Station Unit 3.

NRC ISE AND AUDIT ITEMS COMPLETE

During the ongoing audit process (Reference 13), DNC provided responses for the following items for Millstone:

- Interim Staff Evaluation (ISE) Open and Confirmatory Items (Reference 15)
- Licensee Identified Open Items (Reference 1)
- Audit Questions
- Safety Evaluation Review Items

The NRC report, "Millstone Power Station, Units 2 and 3 – Report for the Onsite Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Instrumentation Related to Orders EA-12-049 and EA-12-051" (Reference 14) delineated the items reviewed during the Millstone Power Station onsite audit. The report also identified additional audit items, specified as Safety Evaluation Review Items, which were added during and following the audit and required supplemental information to address.

DNC's responses or references to the source document for responses, to the NRC's Interim Staff Evaluation (ISE) Open and Confirmatory Items have been provided in Reference 6.

Reference 6, Attachment 2 also provided the responses to Audit Questions, Safety Evaluation Review Items and Licensee Identified Open Items related to Order EA-12-049 that were not closed following the Millstone Power Station onsite audit performed on July 21-25, 2014 (Reference 14). It is DNC's position that no further actions related to any of the above items are required.

MILESTONE SCHEDULE – ITEMS COMPLETE

Unit 3 Milestone	Completion Date
Submit Integrated Plan	February 2013
Develop Strategies	April 2014
Develop Modifications	July 2014
Implement Modifications	November 2014
Develop Training Plan	April 2014
Implement Training	April 2015
Issue FSGs and Associated Procedure Revisions	October 2014
Develop Strategies/Contract with NSRC*	August 2014
Purchase Equipment	February 2014
Receive Equipment	August 2014
Validation Walk-throughs or Demonstrations of FLEX Strategies and Procedures	August 2014
Create Maintenance Procedures	August 2014
Outage Implementation	November 2014

* NSRC is the National SAFER Response Center

STRATEGIES - COMPLETE

Strategy related Interim Staff Evaluation (ISE) Open Items, Confirmatory Items, Audit Questions, Licensee Identified Open Items, and Safety Evaluation Review Items have been addressed as documented in Reference 6, Attachment 2. The Millstone Power Station, Unit 3 strategies are in compliance with Order EA-12-049.

MODIFICATIONS - COMPLETE

The plant modifications required to support the FLEX strategies for Millstone Power Station Unit 3 have been completed in accordance with the station design control process. The plant modification design changes (DCs) implemented in support of the FLEX strategies for Millstone Power Station Unit 3 are as follows:

- BDB FLEX Connection to ADV Air Supplies (MP3-14-01028)
- BDB FLEX Mechanical Connections to ECCS (RCS Injection) (MP3-12-01167)
- BDB FLEX Mechanical Connections to the Spent Fuel Pool Cooling System (MP3-12-01169)
- BDB FLEX Replacement of AFW Discharge Connection Hose Adapter (MP3-14-01033)
- BDB FLEX Storage Building Millstone Power Station Units 2, 3 (MPG-13-00010)
- BDB FLEX Strategy Support Modifications (MPG-13-01131)
- BDB Integrated FLEX Strategy – Electrical Connections (MP3-12-01171)
- BDB Satellite Communications Infrastructure (MPG-14-01080)
- Beyond Design Basis Event Emergency Equipment (MPG-12-01123)
- Beyond Design Basis Spent Fuel Pool Level Instrument Installation (MP3-13-01012)
- Turbine Driven Auxiliary Feedwater Pump FLEX Connections (MP3-12-01131)

Copies of these DCs have previously been provided to the NRC staff and are available for their review.

EQUIPMENT - PROCURED AND MAINTENANCE & TESTING – COMPLETE

The equipment required to implement the FLEX strategies for Millstone Power Station Unit 3 has been procured in accordance with NEI 12-06 (Reference 16), Sections 11.1 and 11.2, received onsite, initially tested, performance verified as identified in NEI 12-06, Section 11.5, and is available for use.

Maintenance and testing will be conducted through the use of the Millstone Power Station Preventative Maintenance program such that equipment reliability is maintained and is in compliance with EPRI guidelines where applicable to the FLEX equipment.

PROTECTED STORAGE - COMPLETE

The storage facility required to protect BDB equipment has been completed for Millstone Power Station. The BDB equipment is protected from the applicable site hazards and will remain deployable to assure implementation of the FLEX strategies for Millstone Power Station Unit 3.

PROCEDURES - COMPLETE

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

TRAINING - COMPLETE

Training of personnel responsible for the mitigation of Beyond-Design-Basis events at Millstone 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 staffing study for Millstone Power Station has been completed in accordance with "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," Enclosure 5 pertaining to Recommendation 9.3, dated March 12, 2012 (Reference 17). The staffing assessment was submitted by letter dated June 12, 2014, "Millstone Power Station Units 2 and 3, March 12, 2012 Information Request, Phase 2 Staffing Assessment Report" (Reference 11), and in the "Response to Request for Additional Information Regarding Phase 2 Staffing Assessment Report, Recommendation 9.3," dated September 22, 2014 (Reference 10). In the RAI response letter dated September 22, 2014, DNC notified the NRC that the final staffing assessment report would be submitted by July 30, 2015 based on the NRC approved relaxation to April 30, 2015 for completing final operator training using the FSG strategies. Operator training was completed by April 30, 2015 and no issues were identified that would affect the results documented in References 10 and 11. The FSG strategies can be successfully implemented using the current minimum on-shift staffing. Therefore, the conclusions reached by the NRC following their review of the Phase 2 Staffing Study remain valid (Reference 12).

NATIONAL SAFER RESPONSE CENTERS - COMPLETE

DNC 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 Millstone Power Station with Phase 3 equipment stored in the National SAFER Response Centers in accordance with the site specific SAFER Response Plan (Reference 18).

VALIDATION - COMPLETE

DNC has completed validation testing of the FLEX strategies for Millstone Power Station Unit 3 in accordance with industry developed guidance. The validations assure that required tasks, manual actions, and decisions for FLEX strategies may be executed within the constraints identified in the Overall Integrated Plan (OIP)/Final Integrated Plan (FIP) for Order EA-12-049. The FIP for Millstone Power Station Unit 3 is provided as Attachment 2 to this letter.

FLEX PROGRAM DOCUMENT - ESTABLISHED

The DNC FLEX Program Document has been developed in accordance with the requirements of NEI 12-06 and is in effect for Millstone Power Station Unit 3.

REFERENCES

The following references support the Millstone Power Station Unit 3 FLEX Compliance Summary:

1. DNC's Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 29, 2013 (Serial No. 12-161B).

2. NRC Order Number EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012.

3. DNC's 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 23, 2013 (Serial No. 12-161D).

4. DNC's 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 (Serial No. 12-161F).

5. DNC's 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 (Serial No. 14-393A).

6. DNC's 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, 2015 (Serial No. 14-393C).

7. Supplement to Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis Events (Order Number EA-12-049), dated April 30, 2013 (Serial No. 12-161C).

8. DNC Letter to NRC, "Millstone Power Station Unit 3 - Order Modifying License with Regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events Dated March 12, 2012 – Relaxation Request," dated May 16, 2014, (Serial No. 14-251).

9. NRC Letter to DNC, "Millstone Power Station, Unit 3 – Relaxation of Schedule Requirements for Order EA-12-049 'Issuance of Order to modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events'," dated July 3, 2014.

10. DNC Letter to NRC, "Millstone Power Station Units 2 and 3 – Response to Request for Additional Information Regarding Phase 2 Staffing Assessment Report, Recommendation 9.3," dated September 22, 2014 (Serial No. 14-443).

11. DNC Letter to NRC, "Millstone Power Station Units 2 and 3, March 12, 2012 Information Request, Phase 2 Staffing Assessment Report", dated June 12, 2014 (Serial No. 14-198).

12. NRC Letter to DNC, "Millstone Power Station, Units 2 and 3 – Response Regarding Phase 2 Staffing Submittals Associated With Near-Term Task Force Recommendation 9.3 Related to the Fukushima Dai-ichi Nuclear Power Plant Accident", dated December 15, 2014.

13. NRC letter from Jack R. Davis, Director Mitigating Strategies Directorate to All Operating Reactor Licensees and Holders of Construction Permits, "Nuclear Regulatory Commission Audits of Licensee Responses to Mitigating Strategies Order EA-12-049," dated August 28, 2013 (ML13234A503).

14. NRC letter from Stephen Monarque, Project Manager, JLD, Office of NRR, to David A. Heacock, President and Chief Nuclear Officer, Dominion Nuclear Connecticut, Inc., "Millstone Power Station, Units 2 and 3 – Report for the Onsite Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Instrumentation Related to Orders EA-12-049 and EA-12-051," dated November 17, 2014.

15. NRC Letter to DNC, "Millstone Power Station, Units 2 and 3 - Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049 (Mitigating Strategies)," dated January 31, 2014.

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

17. 10 CFR 50.54(f), "Request for Information Pursuant to Title 10 of the Code of Federal Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," Recommendation 9.3, dated March 12, 2012 (ML2073A348).

18. NRC letter from Jack Davis, JLD, Office of NRA, to Joseph E. Pollock, Vice President, Nuclear Operations, NEI, "Staff Assessment of National Safer Response Centers Established in Response to Order EA-12-049," September 26, 2014 (ML14265A107).

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Attachment 2

FINAL INTEGRATED PLAN

Beyond Design Basis
FLEX Mitigation Strategies

Dominion Nuclear Connecticut, Inc.
Millstone Power Station - Unit 3

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1. Background

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

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

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

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

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 BDB external events:

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

NRC Order EA-12-049 (Reference 2) required licensees of operating reactors to submit an overall integrated plan, including a description of how compliance with these requirements would be achieved by February 28, 2013. The Order also required licensees to complete implementation of the requirements no later than two refueling cycles after submittal of the overall integrated plan or December 31, 2016, whichever comes first.

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

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

NEI 12-02 (Reference 6) provided guidance for compliance with Order EA-12-051. The NRC determined that, with the exceptions and clarifications provided in JLD-ISG-2012-03 (Reference 7), conformance with the guidance in NEI 12-02 is an acceptable method for satisfying the requirements in Order EA-12-051.

2. NRC Order EA-12-049 – Diverse and Flexible Mitigation Capability (FLEX)

2.1 General Elements - Assumptions

The assumptions used for the evaluations of a Millstone Unit 3 ELAP/LUHS event and the development of FLEX strategies are stated below. The assumptions conservatively recognize that Millstone is a two (2) unit site and that the impact of resources must address both units.

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 full power, unless there are procedural requirements to shut down due to the impending event. The reactors have been operating at 100% power for the past 100 days.
- Each reactor is successfully shut down when required (i.e., all rods inserted, no ATWS). Steam release to maintain decay heat removal upon shutdown functions normally, and reactor coolant system (RCS) overpressure protection valves respond normally, if required by plant conditions, and reseat.
- Onsite staff is at site administrative minimum shift staffing levels.
- No independent, concurrent events, e.g., no active security threat.
- All personnel onsite 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*:

- No specific initiating event is used. The initial condition is assumed to be a loss of offsite power (LOOP) with installed sources of emergency onsite AC power and station blackout (SBO) alternate AC power sources unavailable with no prospect for recovery.
- Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds and associated missiles are available. Permanent plant equipment that is

contained in structures with designs that are robust with respect to seismic events, floods, and high winds and associated missiles, are available. The portion of the fire protection system that is robust with respect to seismic events, floods, and high winds and associated missiles is available as a water source.

- Normal access to the ultimate heat sink is lost, but the water inventory in the ultimate heat sink (UHS) remains available and robust piping connecting the UHS to plant systems remains intact. The motive force for UHS flow, i.e., pumps, is assumed to be lost with no prospect for recovery.

- Fuel for BDB 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.

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

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

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

- Exceptions for the site security plan or other requirements of 10 CFR may be required.

- Deployment resources are assumed to begin arriving at hour 6 and unlimited resources available after 24 hours.

- 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 external event by providing adequate capability to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities at all units on a site. Though specific strategies have been developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions to protect the public health and safety. Millstone Unit 3's Emergency Operating Procedures (EOPs) have been revised, in accordance with established EOP change processes, to clearly reference and identify appropriate entry and exit conditions for these pre-planned strategies. The EOPs retain overall command and control of the actions responding to a BDB external event. Also, the impact of these strategies on the design basis capabilities of the unit have been evaluated under 10 CFR 50.59.

- The plant Technical Specifications contain the limiting conditions for normal unit operations to ensure that design safety features are available to respond to a design basis accident and direct the required actions to be taken when the limiting conditions are not met. The result of the BDB event may place the plant in a condition where it cannot comply with certain Technical Specifications and/or with its Security Plan, and, as such, may warrant invocation of 10 CFR 50.54(x) and/or 10 CFR 73.55(p). This position is consistent with the previously documented Task Interface Agreement (TIA) 2004-04, *Acceptability of Proceduralized Departures from Technical Specifications (TSs) Requirements at the Surry Power Station*, (TAC Nos. MC4331 and MC4332), dated September 12, 2006 (Accession No. ML060590273).

2.2 Strategies

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

The plant indefinite coping capability is attained through the implementation of pre-determined strategies (FLEX strategies) that are focused on maintaining or restoring key plant safety functions. The FLEX strategies are not tied to any specific damage state or mechanistic assessment of external events. Rather, the strategies are developed to maintain the key plant safety functions based on the evaluation of plant response to the coincident ELAP/LUHS event. A safety function-based approach provides consistency with, and allows coordination with, existing plant EOPs. FLEX strategies are implemented in support of EOPs using FLEX Support 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 onsite resources.
- Phase 2 – Transition from installed plant equipment to onsite BDB equipment.
- Phase 3 – Obtain additional capability and redundancy from offsite equipment 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, and SFP cooling capabilities for Millstone Unit 3. Though specific strategies have been developed, due to the inability to anticipate all possible scenarios, the FLEX 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 Millstone Unit 3 EOPs in accordance with established EOP change processes, and their impact to the design basis capabilities of the unit evaluated under 10 CFR 50.59.

An overall diagram of the following FLEX strategies showing the staging locations of BDB equipment and general hose routing is provided in Figures 1 and 2. A schematic representation of the FLEX strategy connections is provided in Figure 3.

2.3 Reactor Core Cooling Strategy

Reactor core cooling involves the removal of decay heat through the secondary side of the Nuclear Steam Supply System (NSSS) and maintaining sufficient RCS inventory to ensure the continuation of natural circulation in the primary side of the NSSS. The FLEX strategy for reactor core cooling and decay heat removal is to release steam from the Steam Generators (SG) using the Atmospheric Dump Valves (ADVs) or the Atmospheric Dump Bypass Valves (ADBVs) and the addition of a corresponding amount of Auxiliary Feedwater (AFW) to the SGs via the turbine driven AFW (TDAFW) pump. The AFW system includes the Demineralized Water Storage Tank (DWST) as the initial water supply to the TDAFW pump. Operator actions to verify and throttle AFW flow are required by the EOPs following an ELAP/LUHS event to prevent SG dryout and/or overfill.

RCS cooldown will be initiated within the first 2 hours following a BDB external event that initiates an extended loss of AC power (ELAP)/loss of normal access to the ultimate heat sink (LUHS) event.

DC bus load stripping will be initiated within 45 minutes following a BDB external event to ensure battery life is extended to 14 hours. Portable generators will be used to repower instrumentation prior to battery depletion.

RCS makeup and boron addition will be initiated by 16 hours following a BDB external event to ensure natural circulation, reactivity control, and boron mixing is maintained in the RCS.

2.3.1 Phase 1 Strategy

Following the occurrence of an ELAP/LUHS event, the reactor will trip and the plant will initially stabilize at no-load RCS temperature and pressure conditions, with reactor decay heat removal via steam release to the atmosphere through the SG safety valves (SVs) and/or the ADVs. Natural circulation of the RCS will develop to provide core cooling and the TDAFW pump provides flow from the DWST to the SGs to make-up for steam release.

Operators will respond to the ELAP/LUHS event in accordance with EOPs to confirm RCS, secondary system, and containment conditions. A transition to EOP 35 ECA-0.0, *Loss of All AC Power*, will be made upon the diagnosis of the total loss of AC power. This procedure directs isolation of RCS letdown pathways, confirmation of natural circulation cooling, verification of containment isolation, reduction of DC loads on the station Class 1E batteries, and establishment of electrical equipment alignment in preparation for eventual power restoration. The operators establish manual control of the SG ADVs (or the SG ADBVs, if the ADVs are not available) and initiate a rapid cooldown of the RCS to minimize inventory loss through the Reactor Coolant Pump (RCP) seals (See Section 2.3.8 for discussion of RCP seals). EOP 35 ECA-0.0 directs local manual control of AFW flow to the SGs and manual control of the SG ADVs to control steam release to control the RCS cooldown rate, as necessary.

Secondary Side - The Phase 1 FLEX strategy for reactor core cooling and heat removal relies upon installed plant equipment and water sources for AFW supply to the SGs and steam release to the atmosphere. The TDAFW pump automatically starts on the loss of offsite power condition, and does not require either AC or DC electrical power to provide AFW to the SGs. In the event that the TDAFW pump does not start on demand or trips after start, the operator will locally reset the turbine and the pump will be restarted. Sufficient time (approximately 1.1 hours) will be available to restart the TDAFW pump to prevent SG dry-out (Reference 8). The AFW system is pre-aligned for flow to all SGs from the TDAFW pump. Therefore, no operator action is required to manually align flow to the SGs. Manual control of TDAFW pump flowrate to the SGs to establish and maintain proper water levels in the SGs will be performed locally in the Engineered Safety Features (ESF) Building at elevation 24' - 6" within the TDAFW pump cubicle.

Steam release from the SGs will be controlled locally from the Main Steam Valve Building (MSVB) using the air-operated SG ADVs. Since the ADVs fail closed upon a loss of air, the air supplies to these valves have been modified to allow operators to isolate the SOVs, and connect a pneumatic hose from remotely installed air tanks to a connector upstream of the SOV to allow remote operation of the ADVs. Local manual operation of the SG ADBVs, using an installed manual control handwheel, can also be performed in the Main Steam Valve Building (MSVB) in the event that compressed air supply for operation of the ADVs is expended, however, this alternate steam release method would be performed in a higher temperature region of the MSVB.

In accordance with the existing procedure for response to loss of all AC power, an RCS cooldown will be initiated at a maximum rate of 100°F/hr to a SG minimum pressure of 290 psig, which corresponds to an RCS core inlet temperature of approximately 419°F. The rapid RCS cooldown minimizes adverse effects of high temperature coolant on RCP shaft seal performance and reduces SG pressure to allow for eventual AFW injection from a portable pump in the event that the TDAFW pump becomes unavailable. The minimum SG pressure of 290 psig is established high enough to prevent nitrogen gas from the safety injection accumulator from entering the RCS.

Initially, AFW water supply is provided by the installed Demineralized Water Storage Tank (DWST). The tank has a minimum usable capacity of approximately 312,800 gallons based on plant Technical Specification minimum volume (Reference 9) and provides a suction source to the TDAFW pump for a minimum of 22.8 hours of RCS decay heat removal assuming an RCS cooldown at 100°F/hr to a minimum SG pressure of 290 psig (Reference 8). After depletion of the inventory in the DWST, the DWST level is replenished from various other onsite sources during Phase 2.

Primary Side (RCS) - The RCS will be cooled down and depressurized until SG pressure reaches 290 psig. RCS isolation is verified to have occurred automatically, and RCS leakage is assumed to be through the RCP seals (See Section 2.3.8). Natural circulation is maintained until approximately 24 hours (see Section 2.3.7.2) at which time reflux cooling begins. K_{eff} is calculated to be less than .99 at RCS conditions described for approximately 25 hours (See Section 2.3.9).

Electrical/Instrumentation - Load stripping of all non-essential loads would begin within 45 minutes after the occurrence of an ELAP/LUHS and completed within the next 30 minutes. With load stripping, the useable Class 1E station battery life for Millstone Unit 3 is calculated to be fourteen (14) hours (See Section 2.3.11).

2.3.2 Phase 2 Strategy

The Operations staff will monitor the DWST level in the control room or locally using level instruments. Once the DWST usable volume is depleted in 22.8 hours, an additional 6.8 hours is available to deploy another makeup source before the steam generators dry out. EOP 35 ECA-0.0 directs the transfer of the AFW pump suction to the Condensate Storage tank (CST), if available. The CST, however, is not fully protected from the BDB external events discussed in Section 2.6. Therefore, additional water sources as discussed in Section 2.15 have been included in the FLEX strategy procedures.

An AFW suction hose connection is installed in between the DWST and the TDAFW pump for use with the BDB FLEX strategies. Additionally, an alternate connection comprised of a fabricated adapter is available and can be installed on a flange in the DWST enclosure. Both connections provide a path to allow the DWST to be refilled using a portable transfer pump, if required. The DWST may be refilled from a variety of sources, including the onsite fire system, city water system, the onsite freshwater pond, and various onsite water storage tanks, if available.

Additionally, as required by NEI 12-06, SG water injection using a portable AFW pump is provided and is available through both primary and alternate connection locations (Figure 4).

RCS makeup is initiated within 16 hours of the ELAP/LUHS event using a portable pump to add borated water to the RCS for inventory control. A portable diesel driven BDB RCS Injection pump will be transported from the onsite BDB Storage Building and deployed for delivery of RCS inventory makeup and reactivity control from the Refueling Water Storage Tank (RWST) or from another borated suction source for the remainder of the event.

A suction hose will be connected to the RWST FLEX strategy connection to provide borated RWST water to the suction of the BDB RCS Injection pump. A high-pressure hose will be routed from the discharge of the BDB RCS Injection pump to the primary or the alternate RCS injection connection point in the ESF Building to provide RCS inventory makeup for the remainder of the ELAP event (Figure 5).

The Phase 2 FLEX strategy also includes re-powering of vital 120 VAC buses within 14 hours using a portable 120/240 VAC Diesel Generator (DG) stored onsite. Prior to depletion of the Class 1E 125 VDC batteries on Unit 3, vital 120 VAC circuits will be re-powered to provide key parameter monitoring instrumentation. A portable 480 VAC DG is available as an alternate to the 120/240 VAC DG.

Cables will be retrieved from the BDB Storage Building along with the 120/240 VAC DG. The portable 120/240 VAC DG will be deployed to an area north of the Millstone Unit 3 Control Building beside the Millstone Unit 3 Emergency Diesel Generator Building (Figure 6). The cables will be run through designated penetrations in the North Wall of the Millstone Unit 3 Control Building. The cables will then pass through the Cable Spreading Room and placed through designated penetrations in the floor to the East Switchgear Room below. The cables will then be connected to permanently installed receptacle boxes located on 120 VAC panels VIAC-1 and VIAC-3 (Figure 7). The connection boxes are hard wired to the 120 VAC Buses.

As an alternate connection point, modifications have been made to the 120 VAC Vital panels VIAC-2 and VIAC-4 to allow for connection of 120/240 VAC DG output cables in the same manner as VIAC-1 and VIAC-3.

Placing the 120/240 VAC DGs into service can be completed in approximately 4 hours after the activity is initiated (this includes an estimated 2 hour time allotment for debris removal). It is therefore, reasonable to expect the 120/240 VAC generators to be supplying power to the key instrumentation well within the 14 hours of battery life following a BDB external event which initiates an ELAP event even if deployment is not started until augmented staff arrives onsite at 6 hours following the BDB external event.

The alternate FLEX strategy for re-powering 120V vital bus circuits is the deployment of one 480 VAC DG connected to the 480V 32T bus. The portable 480 VAC DG and the required color coded power cables will be transported from the BDB Storage Building to its deployed position north of the Millstone Unit 3 Control Building beside the Millstone Unit 3 Emergency Diesel Generator Building (Figure 6). The connection cables will be routed through designated penetrations in the North Wall of the Millstone Unit 3 Control Building. The cables will then pass through the Cable Spreading Room and placed through designated penetrations in the floor to the East Switchgear Room below. A breaker has been installed in a spare breaker cubicle on the 32T bus. Connections will be made as directed to the spare breaker to power Bus 32T. Re-powering Bus 32T allows for the continued operation of the key parameter monitoring instrumentation, recharging of the Class 1E 125 VDC batteries, and the restoration of other selected AC loads.

Deployment of the 480 VAC DGs from the BDB Storage Building and placing the 480 VAC generators into service can be completed within 5 hours after deployment has been initiated. However, this time does not include the estimated 2 hour time allotment for debris removal, but does include additional time for transport from the BDB Storage Building due to the DG's larger size and the fact that a cable trailer must also be deployed to the staging location.

2.3.3 Phase 3 Strategy

The Phase 3 Strategy for core cooling and decay heat removal includes additional equipment available from the National SAFER Response Center (NSRC) to provide backup to the BDB High Capacity pumps as well as the BDB AFW pumps. Additionally, a Reverse Osmosis/Ion Exchanger water processing system will be provided from the NSRC to provide a method to remove impurities from alternate fresh water supplies to the TDAFW pump or the BDB AFW Pump.

Using the SGs for core cooling and decay heat removal is dependent on adequate reactor core decay heat generation if using the TDAFW pump, and the available supply of clean water from onsite sources or from water processing units provided from the NSRC.

The Phase 3 strategy for restoring RHR provides an alternate method for removing decay heat and/or cooling down the RCS to Cold Shutdown. Restoration of RHR requires the restoration of 4160 VAC power and portions of the Reactor Plant Component Cooling System (RPCCW), and Service Water System (SW).

1. The 4160 VAC Generators from the NSRC will be connected to the 34C Emergency Bus via a cross-tie to non-emergency bus 34A. Additionally, by restoring power to the 34C Emergency Bus, power can be restored to the 480 V buses via the 4160/480 VAC transformers to power selected 480 V loads (e.g., Motor Operated valves (MOVs)).
2. In order to meet the required 4160 VAC load requirements, two 1MW 4160 VAC generators will be connected to the non-emergency bus 34A via a distribution panel and necessary cables also provided from the NSRC. The 4160 VAC generators and distribution panel will be deployed to the area near the existing Millstone Unit 3 Emergency Diesel Generator Building (Figure 6).

2.3.4 Systems, Structures, Components

2.3.4.1 Turbine Driven Auxiliary Feedwater Pump

The TDAFW pump will automatically start and will deliver AFW flow to all four SGs following an ELAP/LUHS event. In the event the TDAFW pump fails to start, procedures direct the operators to manually reset and start the pump (which does not require electrical power for motive force or control). Approximately 1.1 hours are available to manually start the pump and initiate flow prior to steam generator dryout (Reference 8). The TDAFW pump is sized to provide more than the design basis AFW flow requirements and is located in a safety-related, Class I structure designed for protection for applicable design basis external events.

2.3.4.2 Steam Generator Atmospheric Dump Valves (ADVs)

During an ELAP/LUHS event with the loss of all AC power and instrument air, reactor core cooling and decay heat removal will be provided for an indefinite time period by manually throttling the air-operated SG ADVs. The air supply system has been modified to allow the connection of an installed bank of air bottles in a lower level of the MSVB so that the ADVs can be controlled in a more accessible area. Operation of the SG ADBVs is an alternative for SG control if the ADVs are unavailable. The SG ADVs and the ADBVs are safety-related, seismic Category I, and are missile protected inside of the MSVB.

The sections of the SG ADV and ADBV exhaust pipes that are located above the MSVB roof are not missile protected. However, there are four SG ADV flow pathways and four SG atmospheric dump bypass valve flow pathways. Therefore, flow pathway diversity ensures this functional capability during a tornado initiated ELAP. Both the SG ADVs and SG ADBVs are credited to be locally operated. If the SG atmospheric dump bypass valves are used due to SG ADV flow pathway missile damage, these valves are MOVs which have a hand wheel installed to facilitate manual operation.

2.3.4.3 Batteries

The safety-related Class 1E batteries and associated DC distribution systems are located within safety-related, Class I structures designed to meet applicable design basis external hazards and will be used to initially power required key instrumentation and applicable DC components. Load stripping of non-essential equipment has been calculated to conservatively provide 14 hours of operations.

2.3.4.4 Demineralized Water Storage Tank

The Demineralized Water Storage Tank (DWST) provides an AFW water source at the initial onset of the event. The tank is a safety-related tornado missile protected structure and is, therefore, designed to withstand applicable design basis external events. DWST volume is maintained per the Millstone Unit 3 Technical Specification (Reference 9) and is normally aligned to provide emergency makeup to the SGs. The minimum DWST usable volume is approximately 312,800 gallons.

2.3.5 FLEX Strategy Connections

2.3.5.1 Primary AFW Pump Discharge Connection

The BDB AFW pump discharge primary connection is via a 4-inch pipe on the TDAFW pump discharge piping. This connection location can feed all four SGs (Figure 4). The connection is located in the ESF Building at elevation 24' – 6" within the TDAFW pump cubicle. The connection is designed with an isolation valve to maintain the AFW system pressure boundary as ASME III Class 3. The hose connection piping up to the AFW system isolation valve is rated for at least 600-psig working pressure. A 2 1/2-inch diameter threaded fitting is used in the design to facilitate a rapid discharge hose connection to support rapid portable pump deployment.

2.3.5.2 Alternate AFW Pump Discharge Connection

In the event that the primary AFW Pump discharge connection is not available, an alternate connection location is provided. The alternate discharge connection is based upon using the SG Blowdown system (Figure 4). Specifically, a pre-fabricated connection fitting adapter facilitates a 2 1/2-inch diameter FLEX hose connection to one of two separate valves via bonnet removal (both 4-inch valves). These valves are located in the Main Steam Valve Building (MSVB) at Elevation 56'. This flow pathway relies upon piping that is classified as non-seismic, however, the Main Steam Valve Building is a seismic Category I structure and is missile protected.

To establish the credited flow pathways, two fail closed AOVs on each SG Blowdown line (total of 8 valves) must be opened manually. Four are opened using a handwheel and the other four require the use of a portable air bottle. Four of the AOVs are located in the MSVB at floor Elevation 41' and the other four AOVs (which are the outboard containment isolation valves) are located at the east end of the MSVB at Elevation 12'.

2.3.5.3 DWST Connection (AFW Pump Suction)

A connection to the DWST is installed to provide a suction source to portable equipment or to facilitate refill of the DWST. The BDB AFW pump suction connection is a 4-inch pipe connection on the TDAFW pump suction piping (Figure 4). The connection is located in the ESF Building at elevation 24' – 6" within the TDAFW pump cubicle. The ESF Building is a seismic Category I structure designed to withstand high wind and associated missiles. The connection is designed to maintain the AFW system pressure boundary as ASME III Class 3. The connection piping up to the AFW system isolation valve is rated for 150 psig working pressure. This connection also provides another means to replenish the DWST. A 5-inch diameter Storz fitting is used in the design to facilitate a rapid suction hose connection and to support rapid portable pump deployment.

Hydraulic analysis of the flowpath from the BDB DWST Refill connection to the primary and the alternate AFW Pump discharge connections has confirmed that the applicable performance requirement of 300 gpm is met.

2.3.5.4 Primary RCS Connection

The BDB RCS injection pump primary discharge connection is a 3-inch diameter stainless steel pipe connection that tees into the existing 4-inch diameter discharge line for the "A" safety injection pump (Figure 5). This FLEX connection has a 2235 psig design pressure and 140 °F design temperature. The BDB RCS injection pump discharge connection includes two manual isolation valves and a check valve. A 3-inch diameter lug nut union fitting is used to facilitate quick hose connection and to support rapid BDB RCS injection pump deployment.

The RCS injection FLEX fluid system connections are seismically designed in accordance with the plant design basis and are located inside the seismic Category I ESF Building, which provides high wind and associated missile protection.

2.3.5.5 Alternate RCS Connection

The alternate connection for RCS makeup is through a valve located in the "B" Safety Injection pump cubicle. The valve is in the 4-inch discharge line from Safety Injection pump (Figure 5). The valve bonnet shall be removed from the valve and a hose adapter and gasket, stored in the BDB Storage Building, will be used to provide an alternate flow path. The hose adapter quick connect fitting is the same as that used on the primary connection. The RCS alternate makeup pipe connection is seismically designed in accordance with the plant design basis and located inside the seismic Category I ESF Building, which provides high wind and associated missile protection.

2.3.5.6 RWST Suction Connection

The BDB RCS injection pump suction connection is a 4-inch pipe connection that tees into the existing 6-inch safety injection piping on the suction side of "A" Safety Injection pump (Figure 5). This connection is located within the ESF Building at elevation 21'- 6". The connection has a 150-psig design pressure and 140 °F design temperature (for the upstream piping). The connection includes two manual isolation valves. A 5-inch Storz fitting is used to facilitate quick hose connection and to support rapid BDB RCS Injection pump deployment. The RCS injection FLEX fluid system connections are seismically designed in accordance with the plant design basis and are located inside the seismic Category I ESF Building, which provides high wind and associated missile protection.

In the event that Millstone Unit 3's RWST is damaged and unavailable, the suction hose to the BDB RCS Injection pump can also be aligned to Millstone Unit 3's Boric Acid Storage Tanks (BASTs) through the existing 6-inch safety injection piping on the suction side of "A" Safety Injection pump (Figure 5). If the BASTs are not available then a connection to Millstone Unit 2's RWST can also provide a borated water source to the Millstone Unit 3 BDB RCS Injection pump through the portable Boric Acid Mixing Tanks. Alternately, if neither the RWSTs nor the Millstone Unit 3 BASTs are available, then the portable Boric Acid Mixing Tanks are available to batch non-borated water to provide borated water to the suction of the BDB RCS Injection pumps.

Hydraulic analysis of the flowpath from the various borated water sources to the BDB RCS Injection pump and to both the primary and alternate RCS Injection pump discharge connections has confirmed that applicable performance requirements are met.

2.3.5.7 Primary Electrical Connection

Cables will be retrieved from the BDB Storage Building along with the 120/240 VAC DG. The cables will be run through designated penetrations in the North Wall of the Millstone Unit 3 Control Building. The cables will then pass through the Cable Spreading Room and placed through designated penetrations through the floor to the East Switchgear Room below (Figure 6). The cables will then be connected to receptacle boxes located on 120V panels VIAC-1 and VIAC-3 (Figure 7). The connection boxes are hard wired to the 120V Buses.

As an alternate connection point, modifications have been made to 120V Vital panels VIAC-2 and VIAC-4 to allow for connection from the 120/240 VAC DG output cables in the same manner as VIAC-1 and VIAC-3 (Figure 7).

2.3.5.8 Alternate Electrical Connection

The portable 480 VAC DG and the required color coded power cables will be transported from the BDB Storage Building to its deployed position north of the Millstone Unit 3 Control Building beside the Millstone Unit 3 Emergency Diesel Generator Building (Figure 6). The connection cables will be routed through designated penetrations in the North Wall of the Millstone Unit 3 Control Building. The cables will then pass through the Cable Spreading Room and placed through designated penetrations in the floor to the East Switchgear Room below. A breaker has been installed in a spare breaker cubicle on the 32T bus. Connections will be made as directed to the spare breaker to power Bus 32T (Figure 8).

2.3.5.9 4160 VAC Electrical Connection

Two (2) 1-MW 4160 VAC generators will be provided from the NSRC along with a distribution panel and necessary connection cables. Cables will be connected to the output breakers of the 1MW 4160 VAC generators to the 4160V distribution panel. Color-coded cables will run from the distribution panel through the north wall of the Cable Spreading Room and through the floor to the East Switchgear Room (Figure 6). The cables will be directly connected to a breaker which allows power from the portable generators to supply Bus 34A and 34C via the cross-tie (Figure 9). The diesel will be started and when stabilized, the generator output breakers will be aligned to power the 34A Bus and, in turn, the 34C Bus.

2.3.6 Key Reactor Parameters

Instrumentation providing the following key parameters is credited for all phases of the reactor core cooling and decay heat removal strategy:

- FW Flowrate - AFW flowrate indication is available in the Main Control Room (MCR) and at the Auxiliary Shutdown Panel (ASP). AFW flowrate indication is available throughout the event.
- SG Water Level - SG wide range (WR) water level indication is available in the MCR and the ASP. SG narrow-range (NR) level indication is also available in the MCR and at the ASP Panel. SG NR level indication is available for all SGs throughout the event.
- SG Pressure - SG pressure indication is available in the MCR and at the ASP Panel. SG pressure indication is available for all SGs throughout the event.
- RCS Temperature - RCS hot-leg and cold-leg temperature indication is available in the MCR and at the ASP panel. RCS cold-leg temperature can be also inferred from SG pressure when only VIAC-1 and VIAC-3 are energized.
- RCS Pressure – RCS wide range pressure indication is available in the MCR and at the ASP panel. RCS pressure indication will be available throughout the event.
- Core Exit Thermocouple Temperature – Core Exit Thermocouple indications are available throughout the event at the Inadequate Core Cooling (ICC) cabinets located in the instrument rack room, adjacent to the MCR.
- DWST Level - DWST water level indication is available in the MCR, at the ASP, and locally at the tank throughout the event.

- Pressurizer Level: Pressurizer level indication is available in the MCR and at the ASP. Pressurizer level indication is available throughout the event.
- Reactor Vessel Level Monitoring System (RVLMS): RVLMS indication is available from the ICC cabinet. RVLMS is available throughout the event.
- Excore Nuclear Instruments: Indication of nuclear source range activity is available in the MCR and at the ASP. Indication is available throughout the event.

Portable BDB equipment is supplied with the necessary local instrumentation to operate the equipment. The use of these instruments is detailed in the associated FSGs for use of the equipment. These guidelines are based on inputs from the equipment suppliers, operating experience, and expected equipment function in an ELAP.

In the unlikely event that 125 VDC and 120 VAC Vital Bus infrastructure is damaged, alternate FLEX strategy guidelines for obtaining the critical parameters locally (e.g., at containment penetration, instrument racks, etc.) is provided in FSG-7, *Loss of Vital Instrumentation or Control Power.*

2.3.7 Thermal Hydraulic Analyses

2.3.7.1 Secondary Makeup Water Requirement

Calculations were performed to determine the inventory required to maintain steam generator levels and dryout times associated with the volumes of various onsite water sources. The conclusions from this analysis showed that the existing DWST usable volume of approximately 312,800 gallons would be depleted in approximately 22.8 hours at which time another source of water would be required. The additional sources at Millstone Unit 3 consist of the existing fire protection system, various storage tanks onsite, and a 3 million gallon freshwater pond. The additional 3 million gallons of water will be split between the two (2) Millstone units and is sufficient for several weeks of decay heat removal. Available water sources are identified in Section 2.3.10.4. Although water quality concerns make it the least preferable choice, Long Island Sound (LIS) could be used as an indefinite but last resort water supply, if required.

2.3.7.2 RCS Response

The model used for determination of RCS response was the same model used in the generic analysis in Section 5.2.1 of WCAP-17601 (Reference 10). Dominion performed a site specific applicability review of the analysis and confirmed applicability to Millstone Unit 3. Parameters used in the reference case model were compared to the Millstone Unit 3 plant and the overall results were confirmed to be bounded by the model and inputs used in the WCAP and associated analytical codes.

RCS inventory makeup will begin within 16 hours following the onset of the ELAP condition. Based on information from WCAP-17601 and WCAP-17792 (Reference 11), reflux cooling is conservatively assumed to occur at 17.0 hours with assumed leakage rates for Westinghouse OEM equivalent seals. Millstone Unit 3 has replaced the Westinghouse OEM seals on 2 of 4 RCPs with Flowserve N-seals. A comparative evaluation has demonstrated that the integrated RCS leakage, with at least 2 of 4 Westinghouse OEM seals replaced with Flowserve N-seals, is less than the value used in WCAP-17601 and the time to reflux cooling is increased to approximately 24 hours. Therefore, additional margin to reflux cooling of approximately 7 hours is available for Millstone Unit 3.

Since RCS inventory makeup at 45 gpm makeup capacity will begin within 16 hours following the onset of the ELAP condition and based on the conservative leakage evaluation with two Flowserve N-seals, the reflux cooling condition will be avoided.

2.3.8 Reactor Coolant Pump Seals

Millstone Unit 3 is a Westinghouse 4-Loop plant with Westinghouse Reactor Coolant Pumps (RCPs) and originally had Westinghouse OEM RCP seals. Millstone Unit 3 has replaced two of the four Westinghouse RCP seals with Flowserve N seals with the abeyance feature. Due to the installation of these two Flowserve N seals, the actual seal leakage for Millstone Unit 3 is reduced to a value less than the leakage assumed in the Westinghouse evaluations performed for the Millstone Unit 3 ELAP RCS response.

2.3.9 Shutdown Margin Analysis

A Shutdown Margin (SDM) Analysis was performed for a typical Millstone Unit 3 reactor core and determined that at least 1% SDM (Keff <0.99) is available up to 25 hours after a reactor trip from full power. However, due to xenon decay, additional core boron is needed after 25 hours in order to continue at the target SG pressure (290 psig). Calculations show that injection of approximately 6500 gallons of 2700 ppm borated water from the RWST will be adequate to meet shutdown reactivity requirements at the limiting End-of-Cycle condition and core inlet temperature of as low as 350°F. This additional boron requirement is met at less than 3 hours of RCS inventory makeup at 45 gpm. This makeup volume can easily be accommodated by RCS volume shrink without venting the RCS.

Since the RCS inventory makeup is initiated no later than 16 hours following an ELAP/LUHS event, the borated water injected into the RCS for inventory makeup bounds the boration requirements for maintaining core reactivity shutdown margin of 1% following an ELAP/LUHS.

DNC's Nuclear Analysis and Fuel Department performs checks for every reload core to verify that the FLEX inventory management and reactivity control strategy remains adequate to maintain k-eff < 0.99 throughout the ELAP event.

The SDM calculation assumes a uniform boron mixing model. Boron mixing was identified as a generic concern by the NRC and was addressed by the PWR Owner's Group (PWROG). The NRC endorsed the PWROG boron mixing position paper (Reference 12) with the clarification that a one hour mixing time was adequate provided that the flow in all loops is greater than or equal to the corresponding single-phase natural circulation flow rate (Reference 13). Westinghouse calculated the time for which the single-phase flow becomes less than the two-phase flow, if RCS makeup is not initiated, for the maximum RCS leakage case (Westinghouse seals leaking at an initial 21 gpm/seal). For 4-loop plants such as Millstone Unit 3, the time to reach this condition (two-phase natural circulation flow is less than single-phase natural circulation flow) is conservatively set at 17.0 hours. Since RCS makeup will be initiated within 16 hours, and the pump capacity of 45 gpm is greater than the maximum RCS leakage at 16 hours, the NRC clarification regarding single-phase flow has been addressed and a one hour mixing time is acceptable. Since additional boron is not required until 25 hours after the ELAP event, the SDM of at least 1% is maintained.

2.3.10 FLEX Pumps and Water Supplies

2.3.10.1 Beyond Design Basis (BDB) High Capacity Pump

The BDB High Capacity pump is a 150 psid at 1200 gpm pump that is shared between several functions. The pump is sized to provide AFW to both Millstone Unit 2 and Millstone Unit 3 and Spent Fuel Pool make-up to both Millstone Unit 2 and Millstone Unit 3, simultaneously. Hydraulic analysis of the flow path from each water source to the DWST, the Millstone Spent Fuel Pools, and to the BDB AFW Pump suction has confirmed that applicable performance requirements are met.

The BDB High Capacity Pump is a trailer-mounted, diesel driven centrifugal pump that is stored in the BDB Storage Building. The pump is deployed by towing the trailer to a designated draft location near the selected water source. Only one BDB High Capacity pump is required to implement the Phase 1 and Phase 2 reactor core cooling and heat removal strategy for both Millstone Unit 2 and Millstone Unit 3. Two BDB High Capacity pumps are available to satisfy the N+1 requirement.

2.3.10.2 BDB AFW Pump

Consistent with NEI 12-06, Appendix D, SG water injection capability is provided using a portable AFW pump through a primary and alternate connection. The BDB AFW pump is a 450 psid at 300 gpm pump. The BDB AFW Pump is a trailer-mounted, diesel engine driven centrifugal pump that is stored in the BDB Storage Building. The portable, diesel-driven BDB AFW Pump (Table 1) provides a back-up SG injection method in the event that the TDAFW pump can no longer perform its function due to insufficient turbine inlet steam flow from the SGs. Hydraulic analyses has confirmed that the BDB AFW pump is sized to provide the minimum required SG injection flowrate to support reactor core cooling and decay heat removal. Three BDB AFW pumps are available to satisfy the N+1 requirement.

2.3.10.3 BDB RCS Injection Pump

The PWROG Core Cooling Position Paper (issued in conjunction with WCAP 17601) recommends that the RCS Injection pump required delivery pressure be established at the saturation pressure of the reactor vessel head + 100 psi driving head to allow RCS injection. Following the formula in the position paper, the required delivery pressure for the RCS Injection pump for Millstone Unit 3 is approximately 1243 psia. Accordingly, the BDB RCS Injection pump is capable of delivering a minimum flow of 45 gpm at a discharge pressure of up to 2000 psig. Hydraulic analysis of the BDB RCS Injection pump with the associated hoses and installed piping systems confirm that the BDB RCS Injection pump minimum flow rate and head capabilities exceed the FLEX strategy requirements for maintaining RCS inventory.

Millstone Unit 3 relies on one BDB RCS Injection pump for RCS makeup. Millstone Unit 2 relies on a repowered Charging Pump for RCS makeup. Therefore, two RCS Injection pumps are available at Millstone to satisfy the N+1 requirement for RCS makeup.

2.3.10.4 AFW Water Supplies

– Demineralized Water Storage Tank

The DWST provides the AFW water source at the initial onset of the event. The tank is a safety-related, seismic Category I, tornado missile protected structure designed to withstand applicable design basis external events. DWST volume is maintained greater than or equal to 334,000 gallons per the Millstone Unit 3 Technical Specification (Reference 9) and aligned to provide emergency makeup to the SGs. The minimum usable volume is approximately 312,800 gallons.

The DWST may be refilled from a variety of sources (see the Table 3), including the onsite fire system, city water system, the onsite freshwater pond, and various other onsite water sources.

– Fire Protection/City Water Supply

If the fire water storage tanks are available after an ELAP/LUHS event, the TDAFW pump (or a BDB portable pump) suction can be aligned to take suction from the two fire water storage tanks. Each tank has a useable volume of 245,000 gallons. This is a non-seismic non-safety-related water supply. If needed, a fire hose adapter, stored in the DWST cubicle, can be connected to refill the DWST from fire water via a fire hydrant

The fire water storage tanks are filled through a domestic water line fed from the city water system.

If the fire water storage tanks are not available but the offsite city water supply is intact, the DWST will be replenished or the suction side of a portable pump will be connected to a fire hydrant that is connected to the city water supply. Refer to Section 2.15 for discussion of water quality.

- <u>Onsite Freshwater Pond</u>

  The onsite freshwater pond is an untreated water source and requires the use of a suction strainer. For every foot of depth there are approximately 1.06 million gallons in the pond. Even at the driest times the pond should maintain a 3' minimum depth. Therefore, it is assumed that approximately 3 million gallons of storage capacity would be available. Assuming that this water is evenly divided between Units 2 and 3, 1,500,000 gallons is available for use as an AFW water supply. Refer to Section 2.15 for discussion of water quality.

In event of an extreme storm surge there is a possibility that this water supply may become brackish due to the close proximity and limited elevation change to Long Island Sound. In this event, the onsite pond would be used only after any other clean onsite sources had been expended.

2.3.10.5 <u>Borated Water Supplies</u>

Three sources of borated water have been evaluated for use during a Beyond-Design-Basis event. Each borated water source is discussed below, in order of preference.

- **Refueling Water Storage Tank:** Each unit at Millstone is equipped with one RWST located at grade level. The tanks are stainless steel, safety-related, seismic Category I storage tanks, but are not protected from missiles. During "at power" operations, Millstone Unit 3's RWST borated volume is maintained greater than 1,166,000 gallons at a boron concentration approximately 2,700 ppm. The RWST is the preferred borated water source for the RCS Injection strategies.

- **Boric Acid Storage Tank (BAST):** Water with a higher boron concentration than the RWST may be available for RCS makeup from the Boric Acid Storage Tanks (BASTs). The two BAST tanks have a usable volume of 28,352 gallons at boron concentration of 6,600 to 7,175 ppm. The BAST tanks are located at Elevation 43 feet in the Auxiliary Building. Gravity drain lines are provided from the boric acid tanks to the Safety Injection pump suction header. Due to its high boric acid concentration, the BAST is heated. The BAST minimum temperature is 67 °F in order to prevent precipitation. Temperature can be monitored by a locally installed thermometer.

- **Portable Boric Acid Mixing Tank**: In the event that both RWSTs and the BASTs are unavailable or become depleted, portable Boric Acid Mixing Tanks are available to provide a suction source for the BDB RCS Injection pumps. These mixing tanks will be deployed, as needed, from the onsite BDB Storage Building to a position near the Millstone Unit 3 BDB RCS Injection pump. Dilution water will be added to the mixing tank by either a portable transfer pump, or from a branch line from the BDB High Capacity pump header taking suction from a clean water source. Bags of powdered boric acid will be mixed with dilution water to achieve the proper concentration for maintaining adequate shutdown margin while making up RCS inventory. The tank is equipped with an agitator to facilitate mixing of the boric acid, although complete dissolution of the powdered boric acid is not required since agitation will continue throughout the injection process. The maximum boron concentration that will be mixed in one of these mixing tanks is less than the concentration at which precipitation concerns occur, even at temperatures down to 32°F, however, a heater is also available to prevent tank freezing, if necessary.

2.3.11 Electrical

The Class 1E battery duty cycle of 14 hours for Millstone Unit 3 was calculated in accordance with the IEEE-485 methodology using manufacturer discharge test data applicable to the licensee's FLEX strategy as outlined in the NEI white paper on Extended Battery Duty Cycles (Reference 14). The time margin between the calculated battery duration for the FLEX strategy and the expected deployment time for FLEX equipment to supply the DC loads is approximately four (4) hours for Millstone Unit 3.

The strategy to re-power the stations vital AC/DC buses requires the use of diesel powered generators. Millstone Unit 3 requires one 120/240 VAC portable diesel generator or one 480 VAC portable diesel generator.

The 120/240 VAC DG is a 23.3 KW, single phase, 60Hz, generator that is trailer-mounted with a 100 gallon double-walled diesel fuel tank built into trailer.

The 480 VAC DG is a 500 KW, 3-phase generator that is trailer-mounted with a 500 gallon double-walled diesel fuel tank built into trailer.

Both 4160 VAC and additional 480 VAC generators are available from the National SAFER Response Center (NSRC) for the Phase 3 strategy. The specifications and ratings for this equipment are listed in Table 2.

2.4 Spent Fuel Pool Cooling/Inventory

The basic FLEX strategy for maintaining SFP cooling is to monitor SFP level and provide sufficient makeup water to the SFP to maintain the normal SFP level. Millstone Unit 3 has a single dedicated Spent Fuel Pool.

2.4.1 Phase 1 Strategy

An evaluation estimates that with no operator action following a loss of SFP cooling at the maximum design heat load, the Millstone Unit 3 SFP will reach 212 °F in approximately 10 hours and boil off to a level 10 feet above the top of fuel in 50 hours from initiation of the event. The Phase 1 coping strategy for spent fuel pool cooling is to monitor spent fuel pool level using instrumentation installed as required by NRC Order EA-12-051 (Reference 5).

2.4.2 Phase 2 Strategy

The Phase 2 strategy is to initiate SFP makeup within the first 24 hours by running a branch hose from the BDB High Capacity pump to the BDB SFP makeup connection inside the Millstone Unit 3 Fuel Building loading bay for the addition of makeup water to the SFP as it is needed to maintain the normal level (Figure 10). The connection piping is seismically designed in accordance with the plant design basis and is protected from missiles in all directions except the direction of the loading bay door opening. The BDB SFP makeup connection piping ties into an existing open ended line which will discharge directly into the SFP. Makeup water will be provided from either the RWST or from one branch of the Millstone Unit 3 distribution manifold being supplied from the BDB High Capacity pump. The BDB High Capacity pump is trailer mounted and will be towed to an available draft point by one of the BDB tow vehicles also located within the protected BDB Storage Building.

Required hose lengths and fittings are located in the BDB Storage Building, however, a 100 ft section of fire hose is pre-staged adjacent to the SFP connection. In the event of an ELAP, the pre-staged hose will be connected to the FLEX SFP connection and deployed out the east personnel door as part of the initial deployment of BDB equipment specified in FSG-5 to ensure the hose connection location is accessible. This deployment is anticipated to occur before pool boiling and well before any significant decrease in SFP pool level.

An alternate FLEX strategy consists of deploying a hose directly to the spent fuel pool area (Figure 10). Additionally, as required by NEI 12-06, spray monitors and sufficient hose length required for the SFP Spray Option are located in the BDB Storage Building.

2.4.3 Phase 3 Strategy

Additional Low Pressure / High Flow pumps will be available from the NSRC as a backup to the onsite BDB High Capacity pumps. Additionally, the NSRC will also provide two 4160 VAC generators which can be used to re-power SFP cooling systems if emergency buses are available or restored.

2.4.4 Structures, Systems, and Components

2.4.4.1 Primary Connection

The primary SFP hose connection is located inside of the Fuel Building on the south wall of the loading bay. The SFP pipe connection for the SFP ties into an existing open ended line which will discharge directly into the SFP. The primary SFP hose connection is sufficiently sized to restore SFP level long term with the loss of SFP cooling and a makeup rate of 250 gpm.

2.4.4.2 Alternate/Spray Option Connection

An additional alternate strategy utilizes either a direct hose option or a spray option to achieve SFP make-up. The 50.54(hh)(2) spray strategy (as required by NEI 12-06 Table D-3 for providing spray at 250 gpm) is to provide flow through portable spray monitors set up on the deck next to the SFP. A hose will be run from the BDB High Capacity pump, through the Fuel Building door, and up to the SFP operating deck. From there, the hose may be run directly over the side of the pool or to portable spray monitors. When deployed, the two spray monitors will be connected via a wye that splits the pump discharge. The two spray monitor hoses will be routed from the new fuel storage area to the SFP. These spray monitors will spray water into the SFP to maintain water level.

2.4.4.3 Fuel Building Ventilation

Ventilation to prevent excessive steam accumulation utilizes 5 doors (3 rollup and 2 personnel doors) in the Fuel Building. Two of the rollup doors are on the 24' – 6" level of the Fuel Building. The third door is also a rollup door which connects the east side of the Shipping Cask Area on the 52' elevation to the lower 24' – 6" elevation of the Fuel Building. Additionally, there is a personnel door from the north side of the SFP cask area on the 55' – 9" elevation into a stairwell and another door from the stairwell to the roof at the same elevation. The opening of these doors provide both a vent path for steam and allows for a flow path of cool air to enter the area from the rollup doors on the 24'- 6" level and exit through the Shipping Cask Area door on the 55' - 9" elevation of the Fuel Building. If needed, portable fans can also be positioned at the New Fuel Receiving area door to enhance the ventilation. BDB FLEX Support Guidelines (FSGs) implement this method of ventilation for the Fuel Building.

2.4.5 Key Reactor Parameters

The key parameter for the SFP makeup strategy is the SFP water level. The SFP water level is monitored by the instrumentation that was installed in response to Order EA-12-051, *Reliable Spent Fuel Pool Level Instrumentation* (Reference 5).

2.4.6 Thermal-Hydraulic Analyses

An analyses was performed that determined with the maximum expected SFP heat load immediately following a core offload, the SFP will reach a bulk boiling temperature of 212°F in approximately 10 hours and boil off to a level 10 feet above the top of fuel in 50 hours unless additional water is supplied to the SFP. A flow of approximately 90 gpm will replenish the water being lost due to boiling. Deployment of the SFP hose connection from the BDB High Capacity pump within 24 hours with a design flow of 250 gpm for the SFP provides adequate flow to operate the SFP spray monitors or to provide makeup the SFP level and maintain an acceptable level of water for shielding purposes.

2.4.7 FLEX Pump and Water Supplies

2.4.7.1 BDB High Capacity Pump (Refer to 2.3.10.1)

The BDB High Capacity pump is a 150 psid at 1200 gpm pump that is shared between several functions. The BDB High Capacity Pump is a trailer-mounted, diesel driven centrifugal pump that is stored in the BDB Storage Building. The pump is deployed by towing the trailer to a designated draft location near the selected water source. One BDB High Capacity pump is sized to provide 600 gpm (300 gpm to each unit) for AFW and 250 gpm makeup to either the Millstone Unit 2 or Millstone Unit 3 SFPs coincident with a 100 gpm makeup to the opposite unit's SFP to account for losses due to boiling.

2.4.7.2 Fire Protection/City Water Supply

If the fire water storage tanks are available after an ELAP/LUHS event, a BDB portable pump suction can be aligned to supply suction from these two tanks. Each of the two fire water storage tanks has a useable volume of 245,000 gallons. This is a non-seismic, non-safety-related water supply.

The fire water storage tanks are filled through a domestic water line fed from the city water system.

If the fire water storage tanks are not available but the offsite city water supply is intact, the suction side of a portable pump will be connected to a fire hydrant that is connected to the city water supply.

2.4.7.3 Onsite Freshwater Pond

This is an untreated water source and requires the use of a suction strainer. There is access to the pond from the west (plant side) side of the security barriers adjacent to the school house. For every foot of depth there are approximately 1.06 million gallons in the pond. Even at the driest times the pond should maintain a 3' minimum depth. In event of a storm surge there is a high probability that this water supply may become brackish due to the close proximity and limited elevation change to Long Island Sound.

2.4.7.4 Long Island Sound

The Long Island Sound is a salt-water source and is not a recommended source of makeup water for the SFP until all available freshwater sources have been depleted.

2.4.8 Electrical Analysis

The Spent Fuel Pool will be monitored by instrumentation installed in response to Order EA-12-051. The power for this equipment has backup battery capacity for 72 hours. Alternative power will be provided within 72 hours using onsite portable generators, if necessary, to provide power to the instrumentation and display panels and to recharge the backup battery.

2.5 Containment Integrity

With an ELAP initiated while Millstone Unit 3 is in Modes 1-4, containment cooling is also lost for an extended period of time. Therefore, containment temperature and pressure will slowly increase. Structural integrity of the containment due to increasing containment pressure will not be challenged. However, with no cooling in the containment, temperatures in the containment are expected to rise and could reach a point where continued reliable operation of key instrument transmitters might be challenged.

Conservative evaluations have concluded that containment temperature and pressure will remain below containment design limits and that key parameter instruments subject to the containment environment will remain functional for a minimum of seven days. Therefore, actions to reduce containment temperature and pressure and to ensure continued functionality of the key parameters will not be required immediately and will utilize offsite equipment during Phase 3 if onsite capability is not restored.

2.5.1 Phase I

The Phase 1 coping strategy for containment involves initiating and verifying Phase A containment isolation per EOP 35 ECA-0.0, *Loss of All AC Power.* These actions ensure containment isolation following an ELAP. Phase 1 also includes monitoring containment temperature and pressure from the MCR using installed instrumentation. Control room indication for containment pressure and containment temperature will be available for the duration of the ELAP.

2.5.2 Phase 2

Phase 2 coping strategy is to continue monitoring containment temperature and pressure using installed instrumentation. Phase 2 activities to repower key instrumentation (Section 2.9.3) are required to continue containment monitoring and also return the instrumentation necessary to monitor containment sump level.

The containment temperature will be procedurally monitored and, if necessary, the containment temperature will be reduced to ensure that key containment instruments will remain within analyzed limits for equipment qualification. (The choice of equipment qualification as a temperature limit is conservative with respect to the containment temperature design limit.) Containment temperature reduction will require the implementation of a containment cooling strategy utilizing equipment provided in Phase 3. The various containment cooling strategy options are discussed Section 2.5.3.

2.5.3 Phase 3

Necessary actions to reduce containment temperature and pressure and to ensure continued functionality of the key parameters will utilize existing plant systems powered by offsite equipment during Phase 3. The most significant need is to provide 4160 VAC power to operate the necessary station pumps. This capability will be provided by two 1 MW 4160 VAC portable generators per unit provided from the NSRC. The mobile 4160 VAC generators and a distribution panel for each unit will be brought in from the NSRC in order to supply power to one of the two Class 1E 4160 VAC buses. Additionally, by restoring the Class 1E 4160 VAC bus, power can be restored to the Class 1E 480 VAC via the 4160/480 VAC transformers to power selected 480 VAC loads.

If the SW pumps are not available, then Low Pressure/High Flow diesel driven pumps (up to 5,000 gpm) from the NSRC are available to provide flow to existing site heat exchangers in order to remove heat from the containment atmosphere.

Several options were evaluated to provide operators with the ability to reduce the containment temperature. Each of these options requires the restoration of multiple support systems to effectively remove heat from the containment thus reducing containment temperature and pressure.

Ventilation Cooling Option (Preferred)

The preferred means to reduce containment temperature is through use of the Containment Air Recirculation (CAR) fans. Once power is restored to the 4160 VAC and 480 VAC buses from temporary generators, a Service Water pump (SW), RPCCW pump and a CAR fan will be started, if available. The fans will circulate air through their heat exchangers transferring containment heat to the RPCCW System, which in turn will transfer the heat to the SW System and the ultimate heat sink. If a SW pump is unavailable, low pressure/high flow pumps from the NSRC will supply the SW header through hose connections to the "A" EDG Heat Exchanger SW inlet flange adapter (Figure 11).

Electrical System Requirements:

> The CAR fan motor is 480 VAC, 150KW and can be started on the 480 VAC generator deployed from the onsite BDB Storage Building. Various Motor Operated Valves (MOVs) necessary for the ventilation cooling option can also be opened once the BDB 480 VAC DG is deployed. A SW and an RPCCW pump, however, require the 4160 VAC generators from the NSRC to be available. The 4160 VAC generators from the NSRC are sized to support these loads in support of containment cooling.

Component Cooling System Requirements:

The RPCCW system is required to provide a heat sink for the CAR fan coolers. It then transfers the heat load through the SW system to the Ultimate Heat Sink (UHS). RPCCW flow will be manually controlled by throttling valves to the components being cooled. Power restoration to the MOVs mentioned in the Electrical System Requirements subsection will allow RPCCW to be supplied to the CAR fan coolers instead of their normal chilled water supply in order to provide containment cooling.

Service Water Cooling System Requirements:

It is assumed the SW pumps at the intake structure are NOT available to be restarted. Therefore, this strategy includes the use of a low pressure/high flow diesel driven pump from the NSRC. Water to the SW System components is established by connecting a low pressure/high flow pump from the NSRC to the SW supply header. A blind flange adapter for the "A" Emergency Diesel Generator (EDG) Heat Exchanger SW inlet end bell with multiple connection fittings to accommodate the NSRC low pressure/high flow pump has been fabricated (Figure 11). The low pressure/high flow diesel driven pump from the NSRC will be positioned to draw from Long Island Sound (LIS). The pump will discharge water via multiple fire hoses to the "A" EDG Heat Exchanger SW inlet end bell adapter. The seismic Category I EDG structure is designed to withstand missiles and high wind. The system connection points are located inside the EDG structure and are protected from extreme cold, ice and snow, and extreme high temperature. The credited SW piping is safety-related and seismically designed in accordance with the plant design basis.

SW valves are manually aligned to distribute SW to the RPCCW heat exchanger.

Once cooling water flow is established to a CAR fan coil unit, Operations will start the "A" CAR fan. This fan is powered from the station's emergency buses which will be repowered when the 480 VAC temporary generator is running. Hydraulic analysis has been performed to support this strategy option.

Spray Option

The use of the spray option involves 3 basic steps:

Step 1 - Flood containment sump

Step 2 - Provide cooling water to one of the Recirculation Spray System (RSS) heat exchangers

Step 3 - Start a RSS pump

In the event that the SW system is unavailable, 4160 VAC temporary power can be supplied to the installed Quench Spray System (QSS) pump to inject water into containment, from the RWST through the spray nozzles, to fill the containment sump. When adequate sump level is established, the QSS pump is stopped and the Containment Recirculation Spray pump is started on the 4160 VAC temporary power. The spray water is cooled by portable low pressure/high flow pumps tied into the "A" EDG heat exchanger Service Water adapter flange taking suction on LIS, supplying flow to the RSS heat exchanger Service Water side (Figure 12).

An alternate method to establish sufficient initial containment sump level will utilize installation of an adapter flange (in place of an expansion joint) on the inlet side of the "A" Containment Recirculation Cooler. The BDB High Capacity pump will be utilized to provide flow which, in this configuration, is a credited means to flood containment sump if the RWST is unavailable due to missile damage.

Electrical System Requirements:

The QSS pump motor is a 4160 VAC, 305 KW motor and is powered by the portable 4160 VAC diesel generators from the NSRC. One MOV will have to be opened manually or powered from the portable BDB 480 VAC DG from the BDB Storage Building. The RSS pump motor is 4160 VAC, 500 HP and will be started on the 4160 VAC generators from the NSRC.

Service Water Cooling System Requirements:

It is assumed the SW pumps at the intake structure are not available to be restarted, therefore, this strategy includes the use of a low pressure/high flow diesel driven pump from the NSRC. The connection of the low pressure / high flow pump is the same for the spray option as for the ventilation option previously discussed.

Service Water valves are manually aligned to distribute Service Water to the RSS heat exchanger.

2.5.4 Structures, Systems, Components

2.5.4.1 Ventilation Cooling Strategy

No mechanical equipment connections are required for the ventilation option if the SW pumps are available. If not, a Low Pressure / High Flow pump from the NSRC will be connected to a pre-fabricated flanged adapter to the "A" EDG Heat Exchanger SW inlet end bell with multiple connection fittings to accommodate the NSRC low pressure/high flow pump.

2.5.4.2 Spray Strategy

The existing site equipment required to implement the containment cooling options discussed above are components of safety-related systems and are protected from the site BDB hazards, with the exception of the RWST.

If the RWST is intact, the existing Quench Spray pump would be repowered to spray water into the containment. Once sufficient sump level is obtained, then the existing Recirculation Spray pump would be used to continue the spray strategy option.

If the RWST is not available, an adapter flange in place of an expansion joint on the inlet side of the "A" Containment Recirculation Cooler will be used to connect the BDB High Capacity pump to the containment spray system. In this case, the BDB High Capacity pump will be utilized to provide the driving force for spray flow.

The remaining equipment required to implement the containment cooling options discussed above is delivered to the site from the NSRC and is not subject to the site BDB hazards initiating the ELAP.

2.5.5 Key Containment Parameters

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

- Containment Pressure: Containment pressure indication is available in the main control room (MCR) and the Auxiliary Shutdown Panel (ASP) throughout the event.
- Containment Temperature: Containment temperature indication is available in the MCR throughout the event. Additionally, EOP 35 FSG-07 provides direction for taking containment temperature readings, by use of a portable meter applied to the instrumentation contacts for temperature of various detectors, in either the Instrumentation Racksets or the containment penetration instrument lead enclosures.

Instrumentation providing containment sump level indication is available in the MCR for Phases 2 and 3. Although this key parameter is available in Phase 2, it is only credited in Phase 3, specifically for the containment cooling spray option.

Also, instrumentation for use in Phase 3 containment cooling options, such as SW flow rate (either from plant equipment or portable pump), RPCCW flow rate, RPCCW temperature, RPCCW pressure, is available to the operators to monitor system performance once the instruments are repowered from temporary generators installed prior to implementing this strategy.

2.5.6 Thermal-Hydraulic Analyses

Conservative evaluations have concluded that containment temperature and pressure will remain below containment design limits and that key parameter instruments subject to the containment environment will remain functional for a minimum of seven days. The containment temperature will be procedurally monitored and, if necessary, the containment temperature will be reduced using the options available to ensure that key containment instruments will remain within their analyzed limits for equipment qualification.

2.5.7 FLEX Pump and Water Supplies

The NSRC is providing a Low Pressure / High Flow pump (nominal 5,000 gpm) which will be used if required to provide cooling flow to the SW system. A Low Pressure / Medium Flow (nominal 2,500 gpm) pump is also available from the NSRC, if needed. Water supplies are from Long Island Sound.

2.5.8 Electrical Analysis

The containment cooling options described above require the powering of the 4160 VAC bus. The 4160 VAC equipment being supplied from the NSRC provide adequate power to perform the Phase 3 containment cooling strategies. The necessary components to implement the various containment cooling options have been included in the load calculations to support the sizing of the 4160 VAC generators. Accordingly, two 1 MW 4160 VAC generators and a distribution panel are provided from the NSRC for Millstone Unit 3.

2.6 Characterization of External Hazards

2.6.1 Seismic

The Millstone Unit 3 seismic hazard is considered to be the earthquake magnitude associated with the design basis seismic event. Per the Millstone Unit 3 FSAR (Reference 15), Section 2.5.2, the safe shutdown earthquake (SSE) has been specified as 0.17g maximum horizontal ground motion and the operating basis earthquake has been specified as 0.09g maximum horizontal ground motion.

The site lies in an area of low seismic activity. Only 13 earthquakes of Intensity V, Modified Mercalli (MM) or greater have been recorded within a distance of 50 miles of the site in more than 300 years. The nearest significant earthquake was at East Haddam, Connecticut, in 1791. Its epicenter was approximately 25 miles north of the site. At the time, the earthquake was classified as having an intensity of VIII but later review indicates that the intensity was no higher than VI to VII MM. Per Section 2.5.1 of Reference 15, the maximum intensity of ground motion experienced at the site in approximately 300 years of recorded history has not exceeded intensity V MM, which would correspond to an acceleration of 0.02 to 0.03g.

In addition to the NEI 12-06 guidance, Near-Term Task Force (NTTF) Recommendation 2.1, Seismic, required that facilities re-evaluate the site's seismic hazard. Millstone Unit 3 subsequently re-evaluated the seismic hazard and developed a Ground Motion Response Spectra (GMRS) for the site based upon the most recent seismic data and methodologies. This reevaluated seismic hazard is being addressed in the industry initiative referred to as the Augmented Approach (EPRI Report 3002000704). The Augmented Approach provides guidance for plants to address the GMRS by performing the Expedited Seismic Evaluation Process (ESEP) as an interim measure while completing the long-term seismic risk evaluation, if required. A review of the re-evaluated hazard determined that seismic reviews performed for initial plant licensing, and further evaluated as part of the Individual Plant Examination for External Events (IPEEE), bounded the GMRS in the lower frequency range (1 to 10 Hz), and concluded that performance of an ESEP and risk evaluation was not required for Millstone Unit 3. NRC endorsement of use of the EPRI Augmented Approach guidance was provided in Reference 28.

For FLEX Strategies, the earthquake is assumed to occur without warning and result in damage to non-seismically designed structures and equipment. Non-seismic structures and equipment may fail in a manner that would prevent accomplishment of FLEX-related activities (normal access to plant equipment, functionality of non-seismic plant equipment, deployment of beyond-design-basis (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 debris, resulting from a seismic event, to facilitate the deployment of the BDB Phase 2 equipment is addressed in Section 2.8.

2.6.2 External Flooding

Millstone is located on the north shore of Long Island Sound. To the west of the site is Niantic Bay and to the east is Jordan Cove. Based on current licensing basis considerations, the only sources of flooding that could affect Millstone are direct rainfall and storm surge. There are no major rivers or streams in the vicinity of the station, nor are there any watercourses on the site. A number of small brooks flow into Jordan Cove, east of the site, and into the Niantic River and thence to Niantic Bay, west of the site. Any flooding of these brooks, even as a result of the probable maximum precipitation, would not significantly raise the water levels of any body of water in the vicinity of the site. Additionally, in each area, local topography precludes flooding of any portion of the site from the landward side. Since there are no major rivers or streams in the vicinity of the station, the effects of potential seismically-induced dam failures, are not applicable.

Since Millstone is located on a peninsula projecting into Long Island Sound, it is subjected to tidal flooding from severe storms. The highest such flooding has resulted from the passage of hurricanes. For a probable maximum hurricane, the maximum still water level was determined to be +19.7 feet msl with an associated wave runup elevation of +23.8 feet msl.

Most safety-related equipment is protected from flooding since the site grade elevation is +24 feet msl. The service water pumps and motors are located at elevation +14.5 feet msl inside watertight cubicles of the pumphouse. The front wall of the intake structure extends to elevation +43 feet msl and is designed to withstand the forces of a standing wave or clapotis with a crest elevation of +41.2 feet msl.

The effect of local intense precipitation has been evaluated onsite for existing structures containing safety-related equipment. It was determined that water accumulation from this precipitation would not have an adverse effect on safety-related equipment (Reference 15, Section 2.4.1).

The areas of the North American continent most susceptible to tsunamis are those bordering the Pacific Ocean and the Gulf of Mexico. Millstone is located on the North Atlantic coastline where there is an extremely low probability of tsunamis (Reference 15, Section 2.4.6). Therefore, in the original licensing and license renewal processes, tsunamis were not considered to be credible natural phenomena which might affect the safety of either unit at the Millstone site. Likewise, flooding due to ice jams was not considered a possibility since the site is not located on a river.

Since the original submittal of the Overall Integrated Plan, DNC has completed and submitted the Flood Hazard Reevaluation Report for Millstone requested by the 10 CFR 50.54(f) letter dated March 12, 2012. The reevaluation represents the most current flooding analysis for both Millstone Units 2 and 3. However, the impact of the flooding reevaluation on the execution and deployment of the FLEX strategies will be addressed through the Integrated Assessment process required by NTTF Recommendation 2.1: Flooding.

2.6.3 Severe Storms with High Wind

Strong winds, usually caused by intense low-pressure systems, tropical storms and hurricanes, or passages of strong winter frontal zones, occasionally affect the region. MPS is located on the north shore of the Long Island Sound. As such, it is exposed to tropical storms and hurricanes coming off the Atlantic Ocean. Storms of tropical origin occasionally affect the region during the summer and fall months. According to a statistical study by Simplon and Lawrence (1971), the 50-mile segment of coastline on which MPS is located, was crossed by five hurricanes during the 1886 to 1970 period. Based on observations from Montauk Point (located about 23 miles southeast of MPS on the eastern tip of Long Island), the maximum reported wind speed in the region was associated with the passage of a hurricane during which sustained winds of 115 mph, with short-term gusts up to 140 mph (Dunn and Miller 1960) were observed. For the period from 1961 through 1990, the "fastest-mile" wind speed recorded at Bridgeport was 74 mph occurring with a south wind in September 1985 (Reference 15, Section 2.3.1.2).

According to Reference 15, Section 2.3.1.2.4, a study of tornado occurrences during the period of 1955 through 1967 (augmented by 1968-1981 storm data reports), the mean tornado frequency in the one-degree (latitude-longitude) square where the MPS site is located is determined to be approximately 0.704 per year. The design basis tornado for MPS3 was developed from Regulatory Guide 1.76. The tornado model used for design purposes at MPS3 has a 290 mph rotational velocity and a 70 mph translational velocity (Reference 15, Section 2.3.2.3).

2.6.4 Ice, Snow and Extreme Cold

The climatology of the Millstone site may be reasonably described by the data collected by the National Weather Service at Bridgeport, CT.

Measurable snowfall has occurred in the months of November through April, although heavy snowfall occurrences are usually confined to the months of December through March. The mean annual snowfall at the present Bridgeport location is 25.3 inches, with totals (based on data from 1932 through 1990) ranging from 8.2 inches in the 1972-1973 season, to 71.3 inches in the 1933-1934 season. The maximum monthly snowfall, occurring in February 1934, was 47.0 inches. Since 1949, both the maximum measured snowfall in 24 hours (16.7 inches), and the greatest snowfall in one storm (17.7 inches) occurred during the same storm in February 1969. Per Reference 15, Section 2.3.1, the maximum measured snowfall in 24 hours (16.7 inches) was matched again in January 1978. For the time period following the reported values in Reference 15, the National Weather Service reported a maximum measured snowfall in 24 hours of 18.5 inches in February 2013.

Freezing rain and drizzle are occasionally observed during the months of December through March, and only rarely observed in November and April. An average of 18.5 hours of freezing rain and 8.5 hours of freezing drizzle occur annually in the region. Per Reference 15, Section 2.3.1, in the 32-year period between 1949-1980, all cases of freezing precipitation were reported as light (less than 0.10 inch per hour), except for 1 hour of moderate (0.10 to 0.30 inch per hour).

Winters are moderately cold, but seldom severe. Minimum daily temperatures during the winter months are usually below freezing, but subzero (°F) readings are observed, on the average, less than one day every two years. Per Reference 15, Section 2.3.1, below zero temperatures have been observed in each winter month, with an extreme minimum of -20 °F occurring in February 1934.

2.6.5 High Temperatures

Due to the proximity of Long Island Sound and the Atlantic Ocean, the heat of summer is moderated. Temperatures of 90 °F or greater occur an average of seven days per year at Bridgeport, while temperatures of 100 °F or greater have occurred only in July and August; with an extreme maximum of 104 °F occurring in July 1957 (Reference 15, Section 2.3.1).

2.7 Protection of FLEX Equipment

BDB equipment is stored in a single 10,000 sq.ft. concrete building that meets the plant's design-basis for tornado-missile and earthquake protection. The BDB Storage Building is located on the north-east side of the northern most overflow parking lot along the plant access road (Figure 13). This location is significantly above the upper-bound flood stage elevation for Millstone Unit 3. The BDB Storage Building was designed and constructed to prevent water intrusion and designed to protect the equipment from the other hazards identified in Section 2.6.

Analysis of components stored in the BDB Storage Building have been performed to determine appropriate measures to prevent seismic interaction. The fire protection and HVAC systems in the BDB Storage Building are seismically installed. The lighting, conduits, electrical, and fire detection components are not seismically installed, but are considered insignificant and not able to damage BDB equipment.

The debris removal equipment required to support the implementation of the FLEX strategies is also stored inside the BDB Storage Building in order to protect them from the applicable external hazards. Therefore, the equipment will remain functional and deployable to clear obstructions from the pathway between the BDB equipment's storage location and its deployment location(s). This debris removal equipment includes mobile equipment such as a front end loader and tow vehicles (tractors).

Deployment of the debris removal equipment and the Phase 2 BDB equipment from the BDB Storage Building is not dependent on offsite power. The building equipment doors are hydraulically operated with a battery backup and can also be opened manually.

2.8 Planned Deployment of FLEX Equipment

2.8.1 Haul Paths

Pre-determined, preferred haul paths have been evaluated and are identified in the FLEX Support Guidelines (FSGs). Figures 13 and 14 show the haul paths from the BDB Storage Building to the various deployment locations. These haul paths have been reviewed for potential soil liquefaction and have been determined to be stable following a seismic event. Additionally, the preferred haul paths minimize travel through areas with trees, power lines, narrow passages, etc. to the extent practical. However, high winds can cause debris from distant sources to interfere with planned haul paths. Debris removal equipment is stored inside the BDB Storage Building and is protected from the severe storm and high wind hazards such that the equipment remains functional and deployable to clear obstructions from the pathway between the BDB Storage Building and its deployment location(s).

The deployment of onsite BDB equipment in Phase 2 requires that pathways between the BDB Storage Building(s) and various deployment locations be clear of debris resulting from BDB seismic, high wind (tornado), or flooding events. The stored BDB debris removal equipment includes tow vehicles (tractors) equipped with front end buckets and rear tow connections in order to move or remove debris from the needed travel paths. A front end loader will also be available to deal with more significant debris conditions.

Phase 3 of the FLEX strategies involves the receipt of equipment from offsite sources including the NSRC and various commodities such as fuel and supplies. Delivery of this equipment can be through airlift or via ground transportation. Debris removal for the pathway between the site and the NSRC receiving “Staging Areas” locations and from the various plant access routes may be required. The same debris removal equipment used for onsite pathways may also be used to support debris removal to facilitate road access to the site once necessary haul routes and transport pathways onsite are clear.

2.8.2 Accessibility

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

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 High Energy Line Break (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. Security doors and gates that rely on electric power to operate opening and/or locking mechanisms are barriers of concern. The Security force will initiate an access contingency upon loss of the Security Diesel and all AC/DC power as part of the Security Plan. Access to the Owner Controlled Area, site Protected Area, and areas within the plant structures will be controlled under this access contingency as implemented by Security personnel. Access authorization lists are prepared daily and copies are protected from the various BDB external events for use post-ELAP event. The plant MCR contains a duplicate set of security keys for use by plant Operations personnel in implementing the FLEX strategies.

Primary vehicle access to the Protected Area is via the double gated sally-port at the Security Building located on the east side of the Millstone site (Figure 14). As part of the Security access contingency, the sally-port gates will be manually controlled to allow delivery of BDB equipment (e.g., generators, pumps) and other vehicles such as debris removal equipment into the Protected Area. An alternate haul route access area for BDB equipment delivery has been designated and would be available after removal of a portion of the security fence on the north side of the Millstone site (See Figure 13).

2.9 Deployment of Strategies

2.9.1 AFW Makeup Strategy

Make-up to the DWST for supply to the TDAFW pump or directly to the suction of the portable diesel driven BDB AFW pump may be from a variety of sources (Table 3), including the onsite fire system, city water system, the onsite freshwater pond, and various other onsite water sources.

The DWST can be replenished using the BDB High Capacity pump and network of temporary hoses that supplies city domestic water, onsite freshwater pond water, or seawater (as a last resort) to Millstone 3 for AFW supply. It can also provide SFP makeup, support boric acid batching evolution, and limited containment spray evolutions. The discharge of the BDB High Capacity pump will tie into a water distribution manifold located near the Millstone Unit 3 Refueling Water Storage Tank (RWST). The DWST replenishment is accomplished with a hose fitting in the portable pump suction line (i.e., water in excess of the TDAFW or portable AFW pump flow will refill the DWST).

The BDB High Capacity pump (150 psid at 1200 gpm capacity) will be positioned to take suction from city water / fire water, onsite freshwater pond, or Long Island Sound (as a last resort). For the onsite freshwater pond, a floating suction strainer is required to prevent debris from entering the suction hose during drafting operation of the pump. The hose network also contains inline strainers, in required locations, for finer particle removal.

Both the primary BDB AFW Pump discharge connection and the DWST Refill connection are located within the seismic Category I, tornado missile protected Engineered Safety Features (ESF) Building. The alternate BDB AFW Pump discharge connection is located within the seismic Category I, missile protected Main Steam Valve Building. The connections are protected from the external hazards described in Section 2.6

Figure 3 provides a diagram of the flowpath and equipment utilized to facilitate this FLEX strategy.

2.9.2 RCS Makeup Strategy

The RCS Injection pumps are stored in the BDB Storage Building and are protected against the external hazards described in Section 2.6.

Both the primary and alternate RCS Injection pump discharge connections are located inside of the ESF Building and provide a path to the RCS cold legs. Accordingly, these connections are protected against all BDB hazards.

The primary supply connections from the Millstone Unit 3 RWST (or the Boric Acid Storage Tanks) for the RCS Injection pump are located in the ESF Building and Auxiliary Building, respectively. Therefore, these connections are protected against all BDB hazards. Should the RWST and Boric Acid Storage Tanks become unavailable, an alternate supply of borated water is available from the portable Boric Acid Mixing Tanks stored in the BDB Storage Building.

Figure 3 provides a diagram of the flowpath and equipment utilized to facilitate this strategy.

2.9.3 Spent Fuel Pool Makeup Strategy

The SFP makeup strategy will initiate makeup using the BDB High Capacity pump deployed from the BDB Storage Building. The discharge of the BDB High Capacity pump will be connected to a hose connection inside the loading bay of the Fuel building. The SFP makeup hose connection is seismically designed in accordance with the plant design basis, and robustly missile protected. The SFP make-up connection is sufficiently sized to restore SFP level long term following the loss of SFP cooling with a makeup rate of 250 gpm for use of the spray monitors or 100 gpm to replenish losses due to boiling in the SFP.

Figure 3 provides a diagram of the flowpath and equipment utilized to facilitate this strategy.

2.9.4 Electrical Strategy

The 120/240 VAC generators and their connecting cables are stored in the BDB Storage Building and are, therefore, protected from the BDB external event hazards identified in Section 2.6.

One (1) 120/240 VAC DG will be deployed to the alleyway adjacent to the Millstone Unit 3 EDG Building. The 120/240 VAC DGs will have two output circuits. Each of the two output circuits on the 120/240 VAC DG include an adjustable output breaker, weatherproof receptacle, flexible and weatherproof cable with weatherproof connectors at both ends. The cables will be run through penetrations in the North Wall of the Millstone Unit 3 Control Building specifically designated for the 124/240 VAC cables. The cables will then pass through the Cable Spreading Room and be placed through similarly designated penetrations through the floor to the East Switchgear Room below. The cables will then be connected to receptacle boxes located on two 120 VAC panels. The connection boxes are hard wired to the 120 VAC buses.

The 480 VAC generators and their connecting cables are stored in the BDB Storage Building and are, therefore, protected from the BDB external event hazards identified in Section 2.6.

One (1) 480 VAC DG will be deployed to the alleyway adjacent to the Millstone Unit 3 Emergency Diesel Generator (EDG) Building near the location of the 120/240 VAC DG deployment. The 480 VAC DG has a set of color coded cables which connect from the deployed generators to the 480 VAC bus 32T. The cables will be run through penetrations in the North Wall of the Millstone Unit 3 Control Building specifically designated for the 480 VAC cables. The cables will then pass through the Cable Spreading Room and placed through similarly designated penetrations through the floor to the East Switchgear Room below.

2.9.5 Fueling of Equipment

FLEX equipment is stored in the fueled condition. Fuel tanks are typically sized to hold 24 hours of fuel. Once deployed during a BDB external event, a fuel transfer truck (F350) will refuel this equipment in the first 24 hours or sooner as required. The general coping strategy for supplying fuel oil to diesel driven portable equipment being utilized to cope with an ELAP / LUHS is to draw fuel oil out of any available existing diesel fuel oil tanks on the Millstone site. The following onsite fuel sources will be used to refuel the FLEX equipment via the fuel transfer truck (or portable containers) as required.

Fuel sources for the BDB portable pumps and generators used for the FLEX strategies during Phase 2 and Phase 3 of an ELAP event are provided from the following onsite fuel sources:

- Two 12,000 gallon (TS Minimum) seismic Category I, missile protected storage tanks located on the 38’-6” elevation in the Unit 2 Auxiliary

Building. These two "Day Tanks" are located well above the maximum postulated flood elevation so they can reasonably be expected to survive following a BDB external event.

- Two 32,760 gallon below-ground Fuel Oil (FO) storage tanks located outside the Millstone Unit 3 Emergency Diesel Generator facility. These tanks are seismic Category I, missile protected and located above the maximum postulated flood elevation. Therefore, the storage tanks can be reasonably expected to survive following a BDB external event.

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

Portable equipment powered by diesel fuel are designed to use the same low sulfur diesel fuel oil as the installed Emergency Diesel Generators (EDGs).

The above fuel oil sources will be used to fill the fuel transfer truck that is stored in the BDB Storage Building. The fuel transfer truck has a capacity of approximately 1,000 gallons and has a self-powered transfer pump. The fuel transfer truck will be deployed from the BDB Storage Building facility to refill the diesel fuel tanks of BDB equipment and to the various diesel fuel tank storage locations where it will be refueled by either gravity fill or pumped full.

Based on a fuel consumption study, a conservative combined fuel consumption rate for the Phase 2 BDB equipment was determined to be 120 gal/hr. The fuel transfer truck has sufficient capacity to support continuous operation of the major BDB equipment expected to be deployed and placed into service following a BDB external event. At this conservative fuel consumption rate, the Fuel Oil Storage Tanks which are protected from the BDB external hazards, have adequate capacity to provide the onsite BDB equipment with diesel fuel for >30 days. The NSRC will also be able to provide diesel fuel for diesel operated equipment, thus providing additional margin.

The diesel fuel consumption information above does not include diesel fuel requirements for the Phase 3 equipment received from the NSRC. Provisions for receipt of additional diesel fuel from offsite sources are in place to supply the diesel powered Phase 3 strategy equipment identified in Table 2.

The BDB external event response strategy includes a very limited number of small support equipment that is powered by gasoline engines (chain saws, chop saws, etc.). These components will be re-fueled using portable containers of fuel. Gasoline will be obtained from an aboveground gasoline fuel storage tank or, if necessary, from private vehicles on site. Oil for the 2-cycle engines is also available in the BDB Storage Building.

2.10 Offsite Resources

2.10.1 National SAFER Response Center

The industry has established two National SAFER Response Centers (NSRCs) to support utilities during BDB events. Dominion has established contracts with the Pooled Equipment Inventory Company (PEICo) to participate in the process for support of the NSRCs as required. Each NSRC will hold five (5) sets of equipment, four of which will be able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle. In addition, 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 established by the Strategic Alliance for FLEX Emergency Response (SAFER) team. From there, equipment can be taken to the Millstone site and staged at the SAFER onsite Staging Area "B" near the BDB Storage Building by helicopter if ground transportation is unavailable. Communications will be established between the Millstone plant site and the SAFER team via satellite phones and required equipment moved to the site as needed. First arriving equipment will be delivered to the site within 24 hours from the initial request. The order in which equipment is delivered is identified in the Millstone's *SAFER Response Plan* (Reference 16).

2.10.2 Equipment List

The equipment stored and maintained at the NSRC for transportation to the local assembly area to support the response to a BDB external event at Millstone Unit 3 is listed in Table 2. Table 2 identifies the equipment that is specifically credited in the FLEX strategies for the Millstone site, but also lists the equipment that will be available for backup/replacement should onsite equipment break down. Since all the equipment will be located at the local assembly area, the time needed for the replacement of a failed component will be minimal.

2.11 Equipment Operating Conditions

2.11.1 Ventilation

Following a BDB external event and subsequent ELAP/LUHS event at Millstone Unit 3, ventilation providing cooling to occupied areas and areas containing FLEX strategy equipment will be lost. Per the guidance given in NEI 12-06, FLEX strategies must be capable of execution under the adverse conditions (unavailability of installed plant lighting, ventilation, etc.) expected following a BDB external event resulting in an ELAP/LUHS. The primary concern with regard to ventilation is the heat buildup which occurs with the loss of forced ventilation in areas that continue to have heat loads. A loss of ventilation analysis was performed to quantify the steady state temperatures expected in specific areas related to FLEX implementation to ensure the environmental conditions remain acceptable for personnel habitability and equipment.

The key areas identified for all phases of implementation of the FLEX Mitigating Strategy activities are the Main Control Room (MCR), TDAFW Pump Room, Main Steam Valve Building (MSVB, location of the Atmospheric Dump Valves, ADVs), East & West DC Switchgear (SWGR) Rooms, East MCC Rod Drive Room, and the Auxiliary Building at elevation 43'-6". These areas have been evaluated to determine the temperature profiles following an ELAP/LUHS event. Results of the evaluations have concluded that for the identified areas, some actions are needed (either short term or long term actions) in order for temperatures to remain within acceptable limits following a BDB external event. The evaluations are based on conservative input heat load assumptions for all areas and with preemptive actions being taken, only when necessary, to reduce heat load or to establish either active or passive ventilation (e.g., portable fans, open doors, etc.)

The Phase 1 actions for ventilation involve existing plant structures, primarily doors. The Phase 1 (short term) actions for the MCR are those required by existing procedures for SBO and require certain instrument cabinets to be opened within 30 minutes. However, for an ELAP, additional cabinets will be opened since the SBO evaluation assumed these additional cabinets would receive power for cooling at 1 hour after the event. This is not the case for an ELAP. The Phase 1 actions for the MSVB and the DC SWGR Rooms (which include the station battery rooms) are to open various designated doors within 1 hour. The Phase 1 actions for the TDAFW Pump Room and the East MCC Rod Drive Room are to open various designated doors within 8 hours.

The temperatures expected in the MSVB for local operation of the SG ADVs (Section 2.3.1) are higher than those experienced during normal station operations, testing, and maintenance. Therefore, actions performed for FLEX activities will require the use of protective gear (turnout gear, ice vests or cool suits and SCBA gear) for this entry until the BDB 480 VAC diesel generator is in service at which time, ventilation will be restored to the MSVB.

The ventilation related actions that are taken in Phase 1 are expected to dissipate the minimal heat loads from the DC battery sources and residual heat loads in the de-energized equipment. However, Phase 2 introduces additional loads when the BDB 480 VAC diesel generator is placed into service. Evaluations have demonstrated that no additional actions, other than the doors opened in Phase 1, are necessary to maintain acceptable temperatures in the areas required to implement the Phase 2 FLEX Strategies.

Once the BDB 480 VAC diesel generators are available, charging of the station Class 1E batteries will begin. In order to prevent a buildup of hydrogen in the battery rooms, the battery room exhaust fans (supplied by the 480 VAC diesel Generators) will be energized. In addition, the open doors to the battery rooms are to be closed to ensure the effectiveness of the exhaust fans.

2.11.2 Heat Tracing

Major components for FLEX strategies are provided with cold weather packages and small electrical generators to protect the equipment from damage due to extreme cold weather and help assure equipment reliability as well as to power heat tape circuits, if necessary. Heat tape and portable heating equipment (BDB support equipment) are stored in the BDB Storage Building for additional low temperature mitigation, as needed.

2.12 Habitability

Personnel habitability was evaluated as discussed in Section 2.11.1 in conjunction with equipment operabilty and determined to be acceptable.

2.13 Lighting

In order to validate the adequacy of supplemental lighting and the adequacy and practicality of using portable lighting to perform FLEX strategy actions, a lighting study was completed. Tasks evaluated included traveling to/from the various areas necessary to implement the FLEX strategies, making required mechanical and electrical connections, performing instrumentation monitoring, equipment operation, and component manipulation.

The areas reviewed contain emergency lighting fixtures (Appendix "R" lighting) consisting of a battery, battery charger and associated light fixtures. These emergency lights are designed and periodically tested to insure the battery pack provides a minimum of eight (8) hours of lighting with no external AC power sources. Therefore, these currently installed emergency lighting fixtures provide adequate lighting to light pathways and implement the BDB strategies for Phase 1 mitigation strategy activities for 8 hours.

Prior to the depletion of the Appendix "R" lighting units, portable battery powered Remote Area Lighting System (RALS) would be deployed to support the FLEX strategy tasks. These RALSs are rechargeable LED lighting systems designed to power the LED lights for a minimum of 7 hours at 6000 Lumens or a maximum of 40 hours at 500 lumens.

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

In addition to installed Appendix "R" lighting, the RALS, and the portable light plants, the BDB Storage Building also includes a stock of flashlights and headband lights to further assist the staff responding to a BDB event during low light conditions.

2.14 Communications

In the event of a BDB external event and subsequent ELAP, communications systems functionality could be significantly limited. A standard set of assumptions for a BDB ELAP event is identified in NEI 12-01, Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities, May 2012.

Communications necessary to provide onsite command and control of the FLEX strategies and offsite notifications at Millstone can be effectively implemented with a combination of sound powered phones, satellite phones and hand-held radios.

Onsite:

Dedicated sets of sound-powered phone headsets and cords are available for the implementation of the FLEX strategies between the Main Control Room (MCR) and areas which implement the FLEX strategies (e.g., TDAFW pump, SG ADVs, etc.). The operation of this sound-powered phone subsystem is not dependent on the availability of the electric power system.

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

There are dedicated hand-held radios available for the implementation of onsite FLEX strategies. Sufficient batteries and chargers are also available. Use of the hand-held radios is somewhat limited (on a point to point basis); however, a portable repeater mounted on a communications trailer will enhance the effectiveness of the radios when the trailer is deployed.

Offsite:

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

NEI 12-01, Section 4.1 outlines the minimum communication pathways to the federal, state, and local authorities. Several portable (handheld) satellite phones are available for initial notifications. These handheld phones are distributed between the Main Control Room, the Technical Support Center, and the Emergency Operations Facility. Additionally, the local Offsite Response Organizations (OROs) that normally receive licensee notifications of an emergency declaration or a Protective Action Recommendation have or have been provided with a satellite phone if they are within a 25 mile radius of the Millstone site.

The MCR and TSC also have satellite phones that are permanently installed units (desk sets). The antennae setup for these installed desk sets is a deployable system with fiber optics cable from the inside desk sets to an outdoor, battery powered, portable dish antennae. This portion of the communications strategy is intended to function on batteries beyond the first 6 hours. If necessary, the portable dish antennae can be powered by a small portable electric generator available from the BDB Storage Building. Once augmented staff arrives on site a self-powered, mobile communications trailer designed to handle both satellite voice and data traffic, as well as to function as a radio repeater to enhance onsite communications, will be deployed from the BDB Storage Building.

Millstone Control Rooms:

MPS has two separate control rooms which present a unique challenge for onsite communications. Each unit's control room operates independent of the other and each enter their own unit-specific procedures in response to a loss of AC power event. Site procedures currently establish the Shift Manager in the Millstone Unit 3 Control Room as the Site Emergency Manager for matters that impact the entire site and for notifications to offsite federal, state, and local agencies.

However, in accordance with the Millstone Emergency Plan (E-Plan), each unit can declare an emergency situation to offsite agencies using the satellite phones available in each control room. In the event that Unit 2 is at minimum staffing when a BDB external event occurs, they may not have an available designated E-Plan communicator and would then rely on a "runner" to notify Millstone Unit 3 of the Unit 2 situation. In this case, Millstone Unit 3 would provide the required offsite notifications for both units.

To establish direct communications between the MCRs, Battery Operated Field Phones will be deployed. This deployment was validated to be complete within 45 minutes from the initiation of the event, which corresponds to the anticipated time at which each unit would be declaring that an ELAP has occurred. If communication between the Control Rooms has not been established at that time, necessary information would be communicated using a "runner."

2.15 Water Sources

2.15.1 Water Sources – Secondary Side

Table 3 provides a list of potential water sources that may be used to provide cooling water to the SGs, their capacities, and an assessment of availability following the applicable hazards identified in Section 2.6. Descriptions of the preferred water usage sources identified in Table 3 are provided below and are in sequence in which they would be utilized, based on their availability after an ELAP/LUHS event. As noted in Table 3, only one clean water source would survive all applicable hazards for Millstone and is credited for use in FLEX strategies. However, as shown in Table 3, other clean water sources are available depending on the applicable hazard initiating the ELAP event. No one hazard eliminates all of the additional clean water supplies. The largest of these clean water sources is the onsite freshwater pond. If the freshwater pond source is lost due to a BDB flooding event, the majority of the other clean water sources identified in Table 3 would still be available. The clean water sources identified in Table 3 would be used to refill the DWST to supply the TDAFW pump. The deployment of each strategy would be performed prior to the TDAFW pump losing suction per procedure.

The water sources have a wide range of associated chemical compositions. Therefore, extended periods of operation with the addition of these various water sources to the SGs have been evaluated for impact on long term SG performance and SG material (e.g., tube) degradation. This water quality analysis has provided guidance for times that the various onsite water sources can be used for the core cooling/decay heat removal, but do not define failure limits for BDB event response or for the SGs.

In addition to the various onsite tanks, the city water supply would be available as a clean water source for the SGs following all BDB hazards except a BDB seismic event. The analyses show that the city water could be used for approximately 301 hours after DWST depletion before the SG design corrosion limit would be expected to be reached, or if a conservative Total Suspended Solids (TSS) level of 500 ppm is assumed, for about 214 hours after DWST depletion before the limiting SG precipitation level would be expected to be reached. This evaluation also applies to the site fire systems since their water source is from the city water supply.

The onsite freshwater pond can be credited for all site hazards except for flooding from storm surges which would fill the pond with saltwater. The onsite freshwater pond could be used for approximately 97 hours after DWST depletion before the SG design corrosion limit is reached. The corrosion evaluation bounds the precipitation evaluation regarding the limiting time period. In the event of flooding, several onsite tanks containing clean water suitable for use in the SGs for extended periods of time are available.

Exceeding the expected time to reach the SG design corrosion limit would have an insignificant impact on the ability of the SGs to remove core decay heat from the RCS at its reduced temperature/pressure conditions. However, reaching the limiting SGs precipitation levels could potentially impact/reduce the SGs heat transfer capabilities.

The results of the water quality evaluation show that the credited, fully protected, onsite water sources provide an adequate AFW supply source for a much longer time than would be required for the delivery and deployment of the Phase 3 NSRC reverse osmosis (RO) / ion exchange equipment to remove impurities from the onsite natural water sources. The RO units have a capacity of up to 300 gpm. Once the reverse osmosis / ion exchange equipment is in operation, the onsite water sources provide for an indefinite supply of purified water.

The evaluation also determined that the RWST could be used as an emergency water source for approximately 60 hours after DWST depletion before the SG design corrosion limit is reached. Also, once the borated RWST is introduced into the SGs, the pH of the SG fluid is lowered, causing active corrosion. Thus, the SG corrosion rates resulting from the RWST introduction would not decrease until the concentration of boric acid is reduced by a method such as feed and bleed. Boric acid precipitation is not a concern based on the more limiting corrosion evaluation and elevated SG temperatures (the analyses were performed at a SG temperature of 420°F).

The evaluation shows that the Long Island Sound (LIS) seawater is not recommended for use in the SGs and would be used only as a last resort.

2.15.2 Water Sources- Primary Side

Three sources for borated water are available onsite: the RWSTs (one per unit), the Boric Acid Storage Tanks and the portable BDB Boric Acid Mixing

Tanks stored in the BDB Storage Building. These sources are discussed in Section 2.3.10.5.

Clean water sources for use in batching borated water in the BDB Boric Acid Mixing Tanks would be used in the same order of preference provided in Table 3 for the AFW sources and dependent on availability.

2.15.3 Spent Fuel Pool

For Millstone Unit 3, any water source available is acceptable for use as makeup to the SFP, however, the primary source would be from either Long Island Sound via the BDB High Capacity pump or from the city water supply through the fire protection system. Water quality is not a significant concern for makeup to the SFP. Likewise, boration is not a concern since boron is not being removed from the SFP when boiling.

2.16 Shutdown and Refueling Modes Analysis

Millstone Unit 3 is abiding by the Nuclear Energy Institute position paper entitled "Shutdown/Refueling Modes," dated September 18, 2013, addressing mitigating strategies in shutdown and refueling modes (Reference 17). This position paper has been endorsed by the NRC staff (Reference 18).

The reactor core cooling and heat removal strategies previously discussed in Section 2.3 are effective as long as the RCS is intact and the SGs are available for use. In this case, either the TDAFW pump or the BDB AFW pump can be used to remove decay heat through the SGs. The RCS is considered open and natural circulation is no longer considered a viable option once the reactor head bolts are detensioned (entry into Mode 6). A typical time for this transition is 100 hours.

Unit shutdown procedures require the pre-deployment of a BDB AFW pump with supply and discharge hoses to serve as a low pressure RCS injection pump which provides a means to establish forced feed of borated water to the RCS cold legs from the RWST during an ELAP event with a unit in either Modes 5 or 6.

Only a modest amount of RCS pressurization (approximately 15.4 psig) is required to lift the reactor head off the flange and create a vent path. Also, only a modest gap will adequately vent the RCS to allow the BDB pump to deliver flow. Once the head is unconstrained (stud nuts backed off) the RCS pressure would not increase above the backpressure created by the head, i.e. 15.4 psig.

Prior to detensioning the head bolts, the reactor vessel level is lowered and the upper plenum inventory is reduced. At 102 hours, the time to boil off the available inventory to the top of the core is calculated to be 3.75 hours. This is adequate time to initiate flow from the pre-deployed BDB AFW pump from the RWST to the RCS and provide feed and bleed through the head/flange interface.

The RWST is not protected from all hazards (i.e. tornado missiles). In the unlikely event that a tornado missile damages the RWST, procedures direct the operators to use the DWST. If the DWST is not available, the procedures will direct injection of available clean water sources in order as specified in Table 3. The flowrate will be reduced to match the boil-off rate of the RCS to minimize dilution of the RCS when adding unborated water. The water supply from the onsite freshwater pond would be available following a tornado event, thus providing a method for restoring core cooling for all hazards during Modes 5 and 6.

A containment vent path is established after the Unit enters Mode 5, "Cold Shutdown." The vent path uses an existing Integrated Leak Rate Test (ILRT) penetration. The isolation valve for this penetration inside containment is manually opened by use of the attached handwheel. Its position is administratively controlled by existing procedures for monitoring containment valve positions. Two additional valves in the flow path but external to the containment remain closed until needed for venting.

2.17 Sequence of Events

Table 4 presents a Sequence of Events (SOE) Timeline for an ELAP/LUHS event for Millstone Unit 3. Validation of each of the FLEX time sensitive actions has been completed in accordance the FLEX Validation Process document issued by NEI and includes consideration for staffing. Time to clear debris to allow equipment deployment is assumed to be 2 hours. This time is considered to be reasonable based on site reviews and the location of the BDB Storage Building. Debris removal equipment is stored inside the BDB Storage Building and is, therefore, protected from the external hazards described in Section 2.6.

2.18 Programmatic Elements

2.18.1 Overall Program Document

A Dominion nuclear fleet procedure provides a description of the Diverse and Flexible Coping Strategies (FLEX) Program for Surry, North Anna and Millstone Power Stations. The key elements of the program include:

- Maintenance of the FSGs including any impacts on the interfacing procedures (EOPs, AOPs, etc.)

- Maintenance and testing of BDB equipment (i.e., SFP level instrumentation, emergency communications equipment, portable BDB equipment, BDB support equipment, and BDB support vehicles)
- Portable equipment deployment routes, staging areas, and connections to existing mechanical and electrical systems
- Validation of time sensitive operator actions
- The BDB Storage Building and the National SAFER Response Center
- Hazards Considerations (Flooding, Seismic, High Winds, etc.)
- Supporting evaluations, calculations and BDB drawings
- Tracking of commitments and equipment unavailability
- Staffing, Training and Emergency Drills
- Configuration Management
- Program Maintenance

In addition, the program description includes (1) a list of the BDB FLEX basis documents that will be kept up to date for facility and procedure changes, (2) a historical record of previous strategies and their bases, and (3) the bases for ongoing maintenance and testing activities for the BDB equipment.

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

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

Future changes to the FLEX strategies may be made without prior NRC approval provided 1) the revised FLEX strategies meet the requirements of NEI 12-06, and 2) an engineering basis is documented that ensures that the change in FLEX strategies continue 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 FLEX Support Guidelines (FSGs) provide guidance that can be employed for a variety of conditions. Clear criteria for entry into FSGs ensures that FLEX strategies are used only as directed for BDB external event conditions, and are not used inappropriately in lieu of existing procedures. When BDB equipment is needed to supplement EOPs or Abnormal Operating Procedures (AOPs) strategies, the EOP or AOP directs the entry into and exit from the appropriate FSG procedure.

FLEX support guidelines have been developed in accordance with Pressurized Water Reactor Owner's Group (PWROG) guidelines. The FSGs provide instructions for implementing available, pre-planned FLEX strategies to accomplish specific tasks in the EOPs or AOPs. FSGs are used to supplement (not replace) the existing procedure structure that establishes command and control for the event.

Procedural Interfaces have been incorporated into EOP 35 ECA-0.0, *Loss of All AC Power*, to the extent necessary to include appropriate reference to FSGs and provide command and control for the ELAP. Additionally, procedural interfaces have been incorporated into the following procedures to include appropriate reference to FSGs:

- EOP 3501, *Loss of All AC Power (Mode 5, 6, and Zero)*
- EOP 3505A, *Loss of Spent Fuel Pool Cooling*

FSG maintenance is performed by the Station Procedures group via the Procedure Action Request in the Dominion nuclear fleet document AD-AA-100, *Technical Procedure Process Control*. In accordance with site administrative procedures, NEI 96-07, Revision 1 (Reference 19), and NEI 97-04, Revision 1 (Reference 20) are to be used to evaluate changes to current procedures, including the FSGs, to determine the need for prior NRC approval. However, per the guidance and examples provided in NEI 96-07, Rev. 1, changes to procedures (EOPs, AOPs, or FSGs) that perform actions in response events that exceed a site's design-basis should screen out. Therefore, procedure steps which recognize the BDB ELAP/LUHS has occurred and which direct FLEX strategy actions to ensure core cooling, containment, or SFP cooling should not require prior NRC approval.

FSGs have been reviewed and validated by the involved groups to the extent necessary to ensure that implementation of the associated FLEX strategy is feasible. Specific FSG validation was accomplished via table-top evaluation and walk-throughs of the guidelines when appropriate.

2.18.3 Staffing

Using the methodology of NEI 12-01, *Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities* (Reference 21), an assessment of the capability of the Millstone Power Station on-shift staff and augmented Emergency Response Organization (ERO) to respond to a BDB external event was performed. The results were provided to the NRC in a letter dated June 12, 2014 (Reference 22).

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

A. An extended loss of AC power (ELAP)

B. An extended loss of access to ultimate heat sink (LUHS)

C. Impact on units (all units at a site are in operation at the time of the event)

D. Impeded access to the units by offsite responders as follows:

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

A team of subject matter experts from Operations, Maintenance, Radiation Protection, Chemistry, Security, Emergency Preparedness and industry consultants performed tabletop exercises in December 2013 and January 2014 to conduct the on-shift portion of the assessment. The participants reviewed the assumptions and applied existing procedural guidance, including applicable FLEX Support Guidelines (FSGs) for coping with a BDB external event using minimum on-shift staffing. Particular attention was given to the sequence and timing of each procedural step, its duration, and the on-shift individual performing the step to account for both the task and time motion analyses of NEI 10-05, *Assessment of On-Shift Emergency Response Organization Staffing and Capabilities* (Reference 23).

The on-shift staffing analysis concluded that there were no task overlaps for the activities that were assigned to the on-shift personnel.

The expanded ERO analysis concluded that sufficient personnel resources exist in the current Millstone augmenting ERO to fill positions for the expanded ERO functions. Thus, the ERO resources and capabilities necessary to implement Transition Phase coping strategies performed after the end of the "no site access" 6-hour time exist in the current program.

The staffing assessments noted above were performed in conjunction with the development of procedures and guidelines that address NRC Order EA-12-049. Once the FSGs were developed, a validation assessment of the FSGs was performed using communication equipment determined available post-BDB external event and the staff deemed available per the staffing studies. The validation process was performed and documented in accordance with NEI Guidance (Reference 24).

2.18.4 Training

DNC's Nuclear Training Program has been revised to assure personnel proficiency in utilizing FSGs and associated BDB equipment for 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.

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

Care has been taken to not give undue weight (in comparison with other training requirements) to Operator training for BDB external event accident mitigation. The testing/evaluation of Operator knowledge and skills in this area has been similarly weighted.

In accordance with Section 11.6 of NEI 12-06, ANSI/ANS 3.5, *Nuclear Power Plant Simulators for use in Operator Training* (Reference 25), certification of simulator fidelity is considered to be sufficient for the initial stages of the BDB external event scenario until the current capability of the simulator model is exceeded. Full scope simulator models have not been upgraded to accommodate FLEX training or drills.

Integrated FLEX drills will be organized on a team or crew basis and conducted periodically such that all time-sensitive actions are evaluated over a period of not more than eight years. (It is not required to connect/operate permanently installed equipment during these drills.)

2.18.5 Equipment List

The equipment stored and maintained at the Millstone BDB Storage Building necessary for the implementation of the FLEX strategies in response to a BDB external event is listed in Table 1. Table 1 identifies the quantity, applicable strategy, and capacity/rating for the major BDB equipment components only, as well as various clarifying notes. Specific details regarding fittings, tools, hose lengths, consumable supplies, etc. are not provided in Table 1.

2.18.6 N+1 Equipment Requirement

NEI 12-06 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. Sufficient equipment has been purchased to address each function at all units on-site, plus one additional spare, i.e., an N+1 capability, where "N" is the number of equipment required by FLEX strategies considering both operating units on-site. Therefore, where a single resource is sized to support the required function of both operating units a second resource has been purchased to meet the +1 capability. In addition, where multiple strategies to accomplish a function have been developed, (e.g., two separate means to repower instrumentation) the equipment associated with each strategy does not require N+1 capability.

The N+1 capability applies to the portable FLEX equipment that directly supports maintenance of the key safety functions identified in Table 3-2 of NEI 12-06. FLEX support equipment that indirectly supports maintenance of the key safety function only requires N capability. FLEX support equipment includes equipment used for debris removal, towing of FLEX equipment, lighting, fuel transfer, alternate connection adapters, and communications in support of maintenance of the key safety functions.

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 additional length of each type of hose and cable. This 10% margin capability ensures that single 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 a fleet administrative procedure and are subject to inventory checks and any maintenance and testing that are needed to ensure they can perform their required functions.

2.18.7 Equipment Maintenance and Testing

Initial component level testing, consisting of Factory Acceptance Testing and Site Acceptance Testing, was conducted to ensure the portable FLEX equipment can perform its required FLEX strategy design functions. Factory Acceptance Testing verified that the portable equipment performance conformed to the manufacturers rating for the equipment as specified in the Purchase Order. Verification of the vendor test documentation was performed as part of the receipt inspection process for each of the affected pieces of equipment and included in the applicable Vendor Technical Manuals. Site Acceptance Testing confirmed Factory Acceptance Testing to ensure portable FLEX equipment delivered to the site performed in accordance with the FLEX strategy functional design requirements.

The portable BDB equipment that directly performs a FLEX mitigation strategy for the core cooling, containment, or SFP cooling is subject to periodic maintenance and testing in accordance with NEI 12-06 (Reference 3) and INPO AP 913, *Equipment Reliability Process*, (Reference 26), to verify proper function. Additional FLEX support equipment that requires maintenance and testing will have preventive maintenance to ensure it will perform its required functions during a BDB external event.

EPRI has completed and has issued *Preventive Maintenance Basis for FLEX Equipment – Project Overview Report* (Reference 27). Preventative Maintenance (PM) Templates for the major FLEX equipment including the portable diesel pumps and generators have also been issued.

The PM Templates include activities such as:

- Periodic Static Inspections – Monthly walkdown
- Fluid analysis (Yearly)
- Periodic operational verifications
- Periodic performance tests

Preventive maintenance (PM) procedures and test procedures are based on the templates contained within the EPRI Preventive Maintenance Basis Database, or from manufacturer provided information/recommendations when templates were not available from EPRI. The corresponding maintenance strategies were developed and documented. The performance of the PMs and test procedures are controlled through the site work order process. FLEX support equipment not falling under the scope of INPO AP 913 will be maintained as necessary to ensure continued reliability. Periodic testing of FLEX equipment is scheduled and performed as part of the PM process.

A fleet procedure was established to ensure the unavailability of equipment and applicable connections that directly perform a FLEX mitigation strategy for core cooling, containment, and SFP cooling will be managed such that risk to mitigation strategy capability is minimized. Maintenance/risk guidance conforms to the guidance of NEI 12-06 as follows:

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

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

3. References

1. "Recommendations for Enhancing Reactor Safety in the 21st Century, The Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident," dated July 12, 2011, (ML111861807).
2. NRC Order Number EA-12-049, *Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events*, dated March 12, 2012.
3. NEI 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide*, Revision 0, dated August 2012.
4. NRC Interim Staff Guidance JLD-ISG-2012-01, *Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events*, Revision 0, dated August 29, 2012.
5. NRC Order Number EA-12-051, *Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation*, dated March 12, 2012.
6. NEI 12-02, Revision 1, *Industry Guidance for Compliance with NRC Order EA-12-051, 'To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation'*, Nuclear Energy Institute, August 2012.
7. NRC Interim Staff Guidance JLD-ISG-2012-03, *Compliance with Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation*, Revision 0, dated August 29, 2012.
8. *Dominion Nuclear Connecticut's Supplement to 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 April 30, 2013 (Serial No. 12-161C).
9. Millstone Power Station, Unit 3, Technical Specifications.

10. WCAP-17601, Rev. 0, *Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering and Babcock & Wilcox NSSS Designs*, August 2012.

11. WCAP-17792-P, Revision 0, *Emergency Procedure Development Strategies for the Extended Loss of AC Power Event for all Domestic Pressurized Water Reactor Designs.*

12. "Westinghouse Response to NRC Generic Request for Additional Information (RAI) on Boron Mixing in Support of the Pressurized Water Reactor Owners Group (PWROG)," dated August 16, 2013 (ML13235A135).

13. Letter to Mr. J. Stringfellow (Westinghouse) from Mr. J. R. Davis (NRC) dated January 8, 2014 endorsing the Westinghouse Position Paper on Boron Mixing (ML13276A183).

14. Letter to Mr. J. E. Pollock (NEI) from Mr. J. R. Davis (NRC) dated September 16, 2013 endorsing NEI White Paper entitled "Battery Life Issue" (ML13241A182).

15. Millstone Power Station, Unit 3, Final Safety Analysis Report (FSAR). Rev. 16

16. *SAFER Response Plan for Millstone Power Station, Rev 003*, dated September 25, 2015 (Document NSRC-004).

17. NEI Position Paper: "Shutdown/ Refueling Modes," dated September 18, 2013 (ML13273A514).

18. Letter to Mr. J.E. Pollock (NEI) from Mr. J. R. Davis (NRC) dated September 30, 2013 endorsing NEI Shutdown/Refueling Modes Position Paper, (ML13267A382).

19. NEI Guideline 96-07, Revision 1, *Guidelines for 10CFR50.59 Implementation*, November 2000.

20. NEI Guideline 97-04, Revision 1, *Design Basis Program Guidelines*, February 2001.

21. NEI 12-01, *Guidelines for Assessing Beyond Design Basis Accident Response Staffing and Communications*, Rev.0.

22. Letter from D. A. Heacock to the USNRC transmitting *Millstone Power Station Phase 2 Staffing Report*, dated June 12, 2014, (Serial No. 14-198).

23. NEI 10-05, *Assessment of On-Shift Emergency Response Organization Staffing and Capabilities,* Rev. 0, June 2011.

24. NEI guidance document FLEX *(Beyond Design Basis) Validation Process.*

25. ANSI/ANS 3.5-2009, *Nuclear Power Plant Simulators for use in Operator Training.*

26. INPO AP 913, Revision 3, *Equipment Reliability Process Description*, Institute of Nuclear Power Operations, March 2011.

27. *Preventive Maintenance Basis for FLEX Equipment – Project Overview Report* (EPRI Report 3002000623), September 2013.

28. Letter to Mr. J. E. Pollock (NEI), *Electric Power Research Institute Final Draft Report XXXXXX, "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic," As An Acceptable Alternative to the March 12, 2012, Information Request for Seismic Reevaluations*, May 7, 2013, U.S. Nuclear Regulatory Commission (ML13114A949).

Table 1- PWR Portable Equipment Phase 2

List Portable Equipment	***Use** and (Potential / Flexibility) Diverse Uses*					**Performance Criteria**
	Core	***Containment***	***SFP***	***Instrumentation***	***Accessibility***	
BDB High Capacity diesel-driven pump (2) and assoc. hoses and fittings	X	X	X			150 psid @1200 gpm
BDB AFW pump (3) and assoc. hoses and fittings	X					450 psid at 300 gpm
BDB RCS Injection pump (2) and assoc. hoses and fittings	X					3000 psid at 45 gpm
120/240VAC generators (3) and associated cables, connectors and switchgear				X		23.3 kW
120/240VAC generators (8) and associated cables, connectors and switchgear (to power support equipment) [2]					X	5-6.5 kW

Table 1- PWR Portable Equipment Phase 2

List Portable Equipment	***Use and (Potential / Flexibility) Diverse Uses***					**Performance Criteria**
	Core	***Containment***	***SFP***	***Instrumentation***	***Accessibility***	
480VAC generators (3) and associated cables, connectors and switchgear (to re-power battery chargers, inverters, and Vital Buses)	X	X		X		500 kW
Portable boric acid batching tank (2)	X					1000 gal
Light plants (2)					X	
Front end loader (1) [2]					X	
Tow vehicles (2) [2]	X	X	X		X	
Hose trailer (2), cable trailer (1) and utility vehicle (1) [2]	X	X	X		X	
Fans / blowers (10) [2]					X	
Air compressors (6) [2]	X				X	

Table 1- PWR Portable Equipment Phase 2

List Portable Equipment	***Use** and **(Potential / Flexibility) Diverse Uses***					**Performance Criteria**
	Core	***Containment***	***SFP***	***Instrumentation***	***Accessibility***	
Fuel transfer truck (1) with 1,100 gal. tank and pumps	X	X	X	X	X	
Fuel carts (2) equipped with transfer pumps [2]	X	X	X	X	X	
Communications equipment [3]	X	X	X	X	X	
Misc. debris removal equipment [2]					X	
Misc. Support Equipment [2]					X	

Notes:

1. This table is based on one BDB Storage Building containing equipment for both MPS2 and MPS3.
2. Support equipment. Not required to meet N+1.
3. Quantities were identified in response to the results of the communications study performed for Recommendation 9.3 of the 10 CFR 50.54(f) letter dated March 12, 2012.

Table 2 – PWR Portable Equipment From NSRC[1]

List Portable Equipment	Quantity Req'd /Unit	Quantity Provided / Unit	Power	Use and (Potential / Flexibility) Diverse Uses					Performance Criteria		Notes
				Core Cooling	Cont. Cooling/ Integrity	Access	Instrumentation	RCS Inventory			
Medium Voltage Generators	2	2	Jet Turb.	X	X		X		4.16 kV	1 MW	(2)
Low Voltage Generators	0	1	Jet Turb		X		X	X	480VAC	1100 KW	(3)
High Pressure Injection Pump	0	1	Diesel					X	3000 psig	60 GPM	(3)
S/G RPV Makeup Pump	0	1	Diesel	X				X	500 psid	500 GPM	(3)
Low Pressure / Medium Flow Pump	0	1	Diesel		X	X			300 psid	2500 GPM	(3)
Low Pressure / High Flow Pump	1	1	Diesel	X	X				150 psid	5000 GPM	(4)
Lighting Towers	0	1	Diesel			X				40,000 Lu	(5)

Table 2 – PWR Portable Equipment From NSRC[1]

List Portable Equipment	Quantity Req'd /Unit	Quantity Provided / Unit	Power	Use and (Potential / Flexibility) Diverse Uses					Performance Criteria		Notes
				Core Cooling	Cont. Cooling/ Integrity	Access	Instrumentation	RCS Inventory			
Diesel Fuel Transfer	0	As Requested	N/A	X	X	X	X	X		265 Gal	(3)
Mobile Water Treatment	0	2	Diesel	X				X		150 GPM	(3) (6)
Mobile Boration Skid	0	1	N/A					X		1000 Gal	(3)

Notes:

1. Equipment quantities are specific to Millstone Unit 3 only.
2. NSRC 4160 VAC generator supplied in support of Phase 3 for Core Cooling, Containment Cooling, and Instrumentation FLEX Strategies.
3. NSRC Generic Equipment – Not required for FLEX Strategy – Provided as Defense-in-Depth.
4. NSRC Low Pressure / High Flow pump supplied in support of Phase 3 for Core Cooling and Containment Cooling FLEX Strategies. Includes booster pump to draft from Long Island Sound.
5. NSRC components provided for low light response plans.
6. Usage dependent on Westinghouse Water Quality Study results.

Table 3 – Water Sources

Water Sources	Usable Volume (Gallons)	Applicable Hazard					Time Based on Decay Heat[1]
		Seismic	Flooding	High Winds/ Tornado	Low Temp	High Temp	
Water Sources and Associated Piping that Fully Meet All BDB Hazards and Are Credited in FLEX Strategies							
Demineralized Water Storage Tank (DWST)	312,800	Y	Y	Y	Y	Y	22.8 hours
Long Island Sound (LIS) – Ultimate Heat Sink	Unlimited	Y	Y	Y	Y	Y	Indef. [4]
Water Sources that Partially Meet BDB Hazards and Are Not Credited in FLEX Strategies.							
Condensate Storage Tank (CST)	230,000	N	Y	N	Y	Y	31.3 hours
Primary Grade Storage Tank (PGST)	200,000[2]	N	Y	N	Y	Y	26.8 hours
Condenser Hotwell	81,000	N	Y	Y	Y	Y	10.1 hours
Site Fire Water System	490,000	N	Y	N	Y	Y	75.3 hours
City Domestic Water Supply	Unlimited	N	Y	Y	Y	Y	Unlimited
Onsite Freshwater Pond'[3]	3,000,000	Y	N	Y	Y	Y	167.6 hours

Table 3 – Water Sources

Water Sources	Usable Volume (Gallons)	Applicable Hazard					Time Based on Decay Heat[1]
		Seismic	Flooding	High Winds/ Tornado	Low Temp	High Temp	
Refueling Water Storage Tank (RWST)	1,116,000	Y	Y	N	Y	Y	234.5 hours

Notes:

1. The DWST is the initial source. The times shown for the additional sources are if they are deployed as the second source. If the source is used later, the available time would be longer. Includes cooldown to a SG pressure of 290 psig beginning at 2 hours.
2. Two Primary Grade Storage Tanks (PGSTs) with 100,000 gallons each.
3. Assumes Millstone Unit 3 uses ½ of the usable volume, i.e., 1,500,000 gallons.
4. Not a recommended source for AFW or RCS Makeup. Used only as a "last resort."

Table 4 - Sequence of Events Timeline

Action Item	Activity	Start	Duration	Time Constraint/ Sensitive Action Y/N	Personnel	Requirement
1	Event Starts	0 hr	-	N	-	Plant @ 100% power
2	SBO Procedures are entered	15 sec	-	N	-	
3	TDAFW pump starts. Flow verified	60 sec	-	N	-	Original design basis for SBO event, T=1.1 hour to SG dryout. (Reference Section 2.3.1)
4	Deploy TA-312 Battery Operated Field Phones	14 min	30 min	N	1 Chemistry Technician	No requirement, used for Communications between Millstone Unit 2 and Millstone Unit 3 Control Rooms.
5	Deploy Rapidcase for Off-Site Communications	26 min	90 min	N	2 Security Personnel	No requirement. This is a backup to the Iridium Phones for Off-site Communications. Equipment is stored in TSC.
6	SBO DG fails to start	43 min	-	N	-	
7	Identification of Loss of All Power	43 min	-	N	-	

Table 4 - Sequence of Events Timeline

Action Item	Activity	Start	Duration	Time Constraint/ Sensitive Action Y/N	Personnel	Requirement
8	Control SG atmospheric dump valves (ADVs)	<2 hours	On-Going	N	1 Plant Equipment Operator (PEO) 1 Fire Brigade	For Cooldown and decay heat removal. Initiation within T= 2 hours meets the requirements of generic ELAP analysis.
9	ELAP condition recognized	45 min	-	Y	-	
10	Throttle AFW flow to SGs	45 min	On-Going	Y	1 PEO	T=1.3 hrs to SG overfill.
11	Initiate Load Stripping from 120 VDC Buses	45 min	30 min	Y	1 PEO	T=75 min (will extend battery life of 14 hours) (Ref. Section 2.3.1)
12	Augmented Staff arrive onsite	6 hrs	-	N	-	T=6 hrs (Ref. NEI 12-01)
13	Repower 120 VAC Vital Buses	6 hrs[3]	2 hrs + 2 hrs to remove debris[1]	Y	4 People[2]	T=14 hours (Batteries depleted) (Reference Section 2.3.1)

Table 4 - Sequence of Events Timeline

Action Item	Activity	Start	Duration	Time Constraint/ Sensitive Action Y/N	Personnel	Requirement
14	Deploy BDB High Capacity Pump and initiate DWST replenishment from available water sources	6 hrs[3]	2 hrs + 2 hrs to remove debris[1]	Y	4 People[2]	T=22.8 hours (DWST volume depleted) May be initiated sooner depending on the requirements of Unit 2 (Reference Section 2.3.2)
15	Deploy Rapidcom for Off-Site Communications	8 hrs	2 hrs [1]	N	2 People[2]	No requirement. This is a backup to the Iridium Phones and Rapidcase for Off-site Communications. Equipment is stored in BDB Storage Dome.
16	Deploy 480 VAC Generators	10 to 24 hrs	5 hrs + 2 hrs to remove debris[1]	N	4 People[2]	Provide discretionary 480 VAC loads (Reference Section 2.3.2)
17	Deploy BDB AFW Pump	19 hrs	5 hrs[1]	N	4 People[2]	N/A. BDB AFW Pump is deployed in standby as a backup to the TDAFW pump

Table 4 - Sequence of Events Timeline

Action Item	Activity	Start	Duration	Time Constraint/ Sensitive Action Y/N	Personnel	Requirement
18	Deploy portable borated water tank (if RWST not available)	12 hrs	4 hrs	Y	4 People[2]	T=16 hrs
19	Deploy BDB RCS Injection pump and initiate RCS Injection [4]	14 hrs	2 hrs	Y	4 People[2]	T=20.8 hours (RCS inventory makeup to prevent loss of natural circulation) and T=25 hrs (for reactivity control) (Reference Section 2.3.2)
20	Route hose and add inventory to SFP	22 hrs	On-going	Y	4 People[2]	T=24 hours (10 hours to boiling / 50 hours to water level at 10 ft above fuel. (Reference Section 2.3.2).
21	Reduce temperature in containment	4-5 days	-	N	4 People[2]	Restore containment temperature to <120°F within 7 days to prevent affecting the function of key parameter instrumentation. (Reference Section 2.5.3)

Table 4 - Sequence of Events Timeline

Action Item	Activity	Start	Duration	Time Constraint/ Sensitive Action Y/N	Personnel	Requirement

Notes:

1. Debris removal time is assumed, and only needs to be included once.
2. Does not require licensed personnel and may include available, Chemistry, HP and Security. If the activity starts after 6 hours, Augmented Staff are available as well.
3. Two (2) Security personnel available after 2 hours (Debris Removal) to start deployment.
4. FSGs monitor Pressurizer level and Reactor Vessel Level Monitoring System to ensure makeup is initiated sooner if leakage is greater than expected.

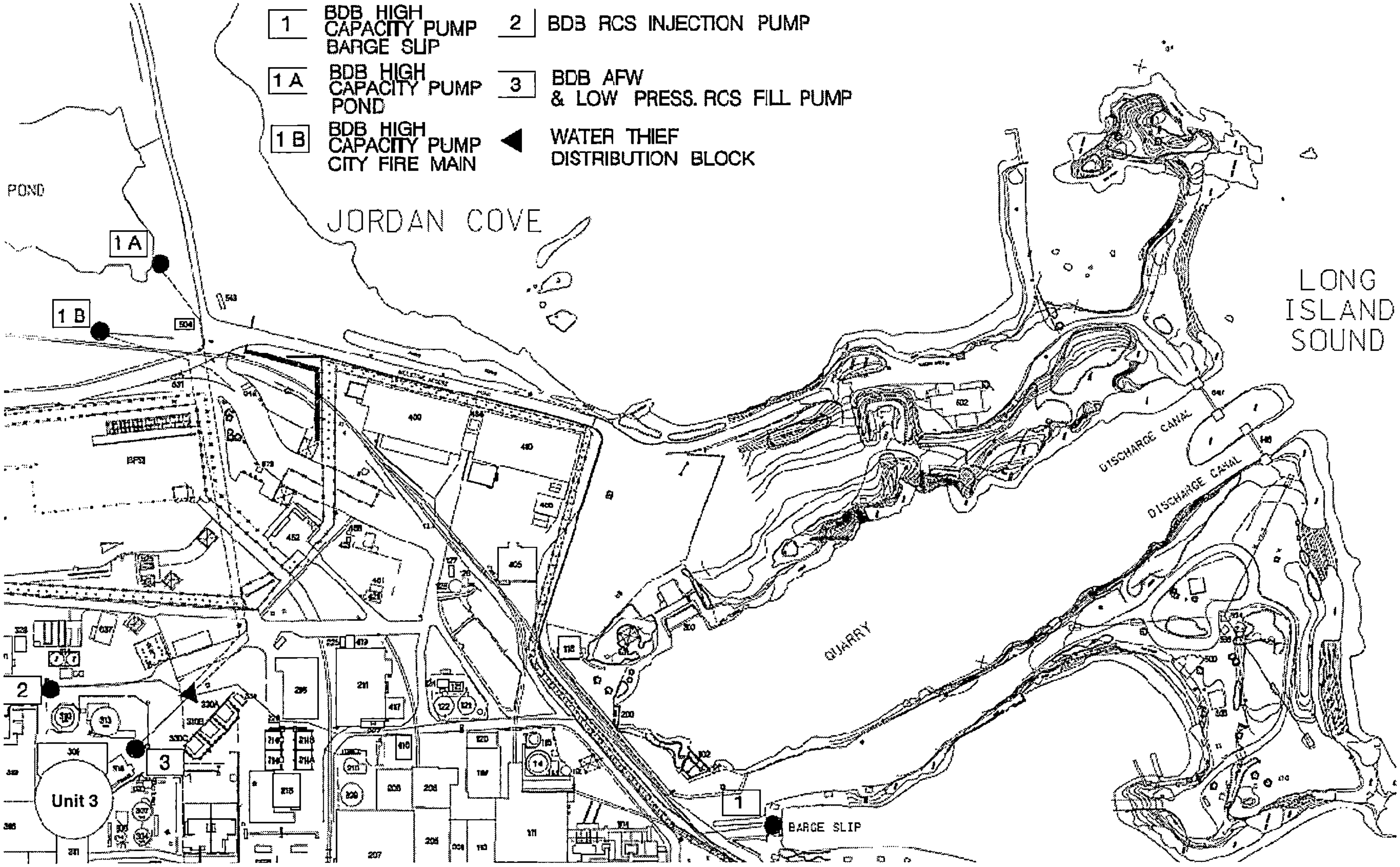

Figure 1: BDB FLEX Strategy Equipment and General Hose Layout

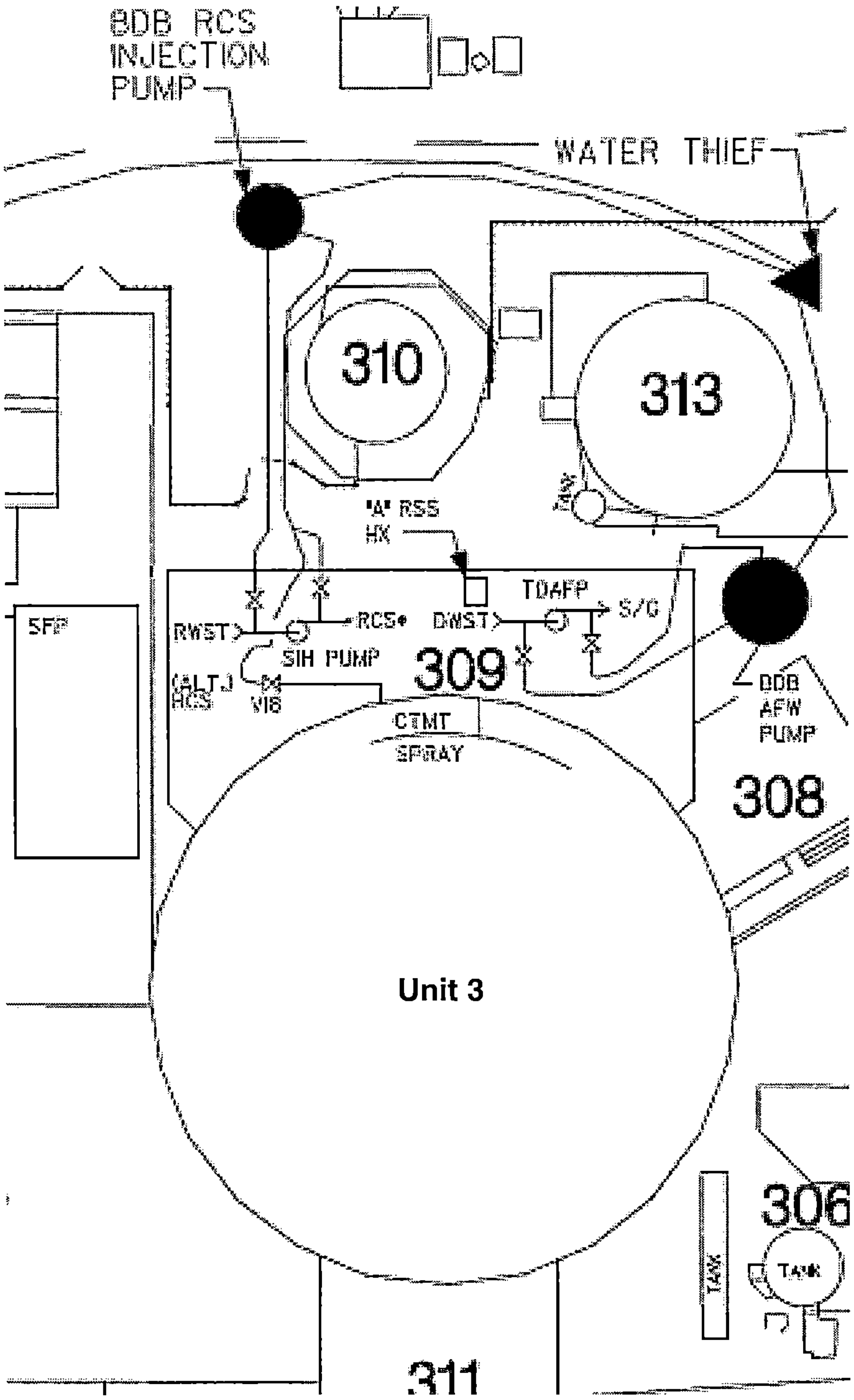

Figure 2: BDB FLEX Strategy Equipment and Detailed Hose Layout

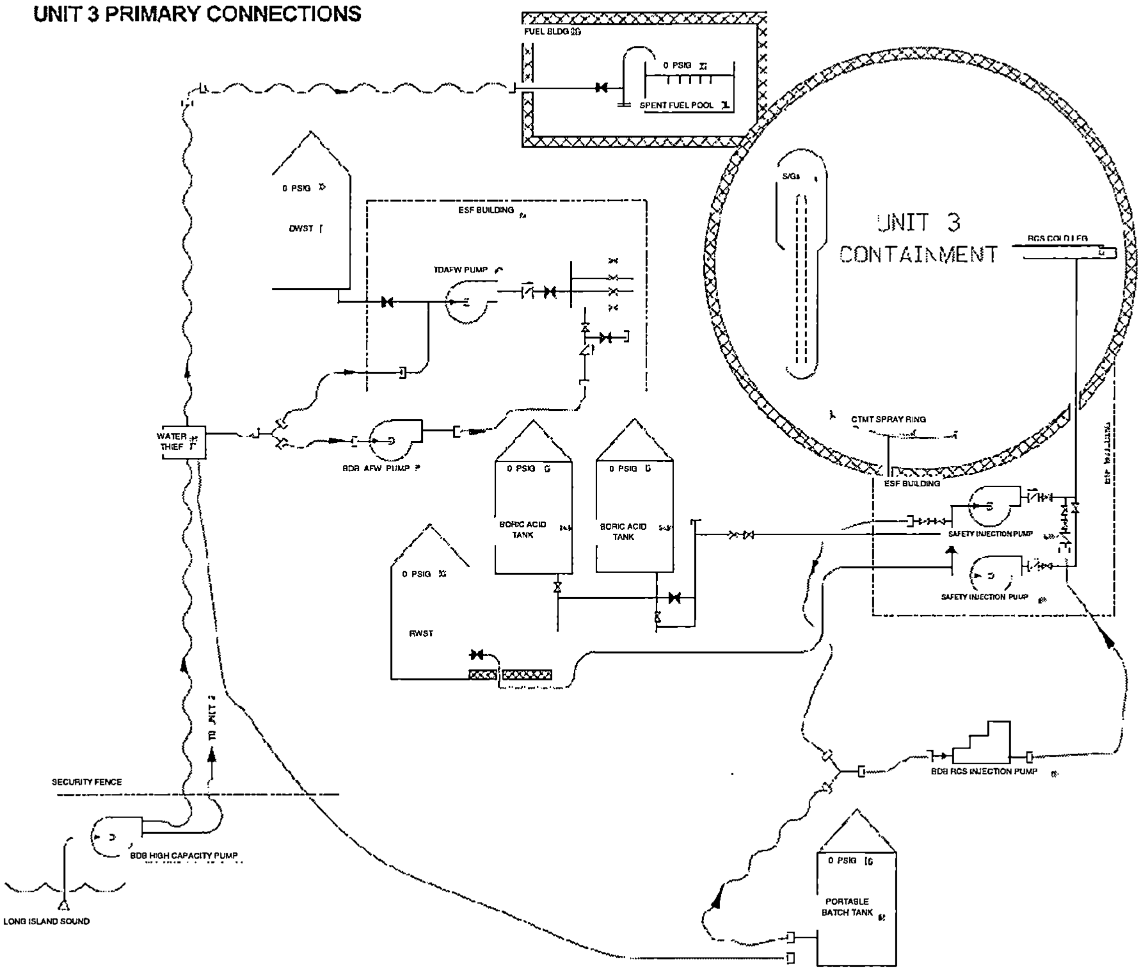

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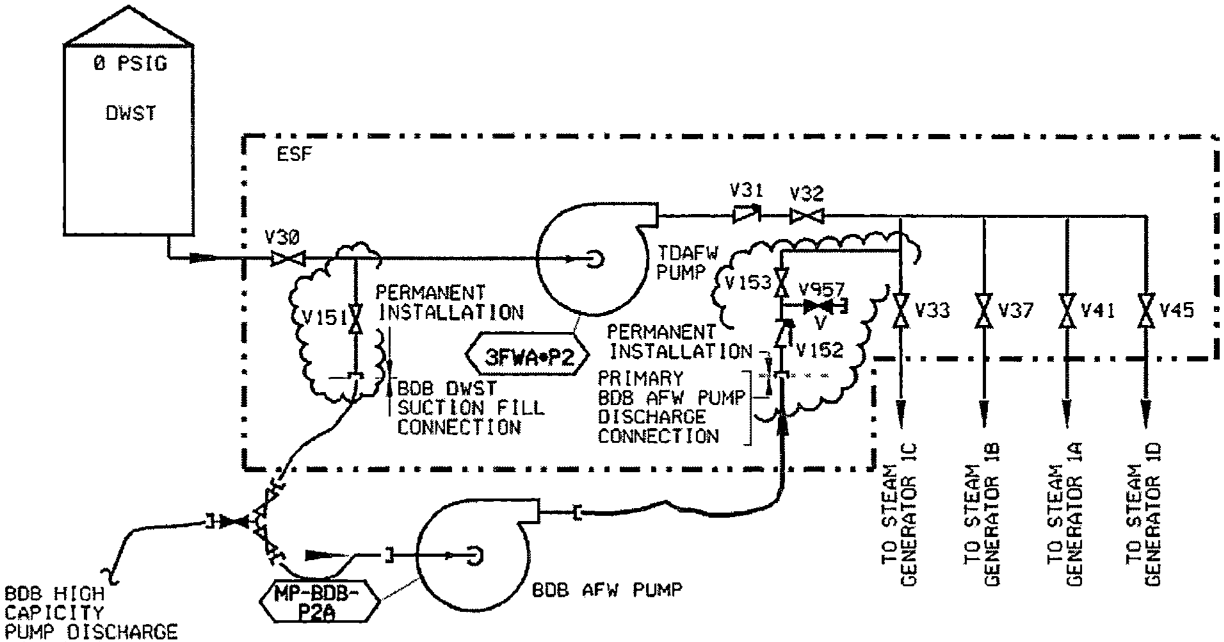
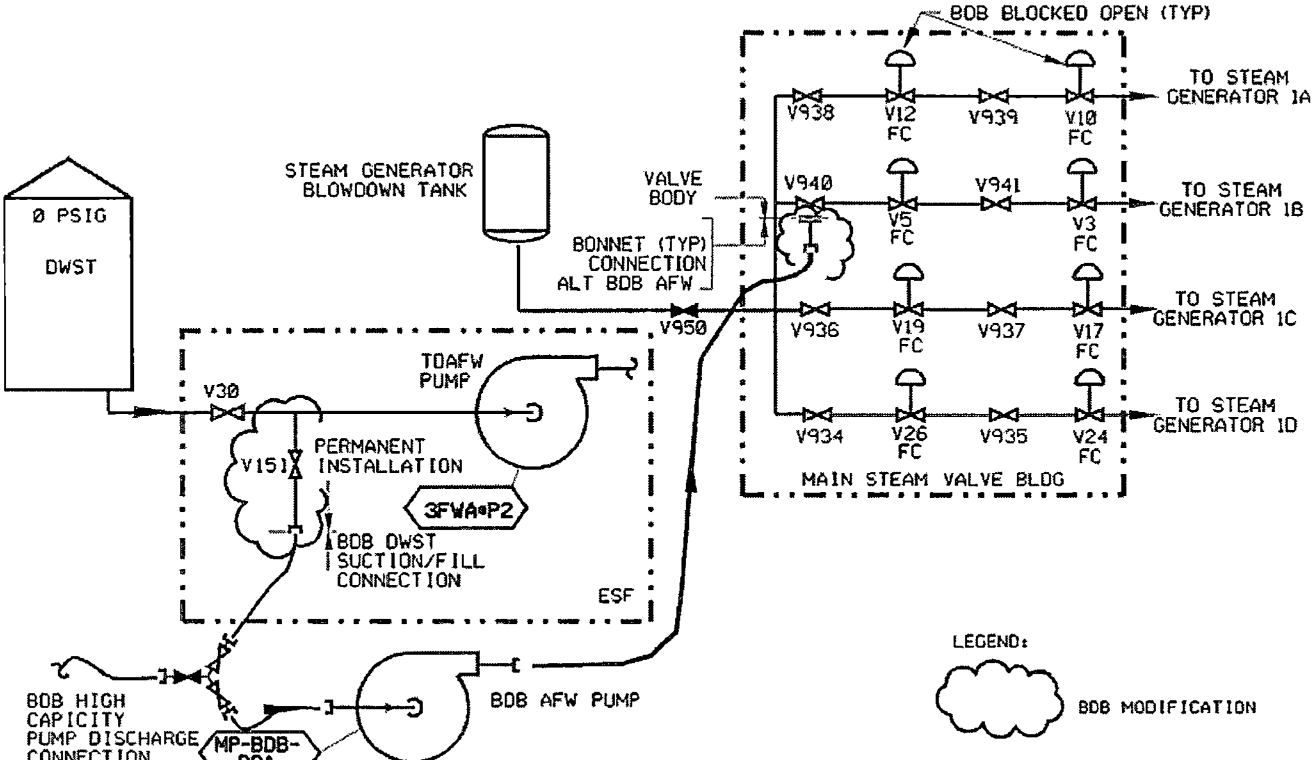
Figure 3: BDB FLEX Strategy Mechanical Connections Flow Diagram



PRIMARY BDB AFW CONNECTIONS



ALTERNATE BDB AFW CONNECTION

Figure 4: BDB FLEX AFW Primary and Alternate Mechanical Connections

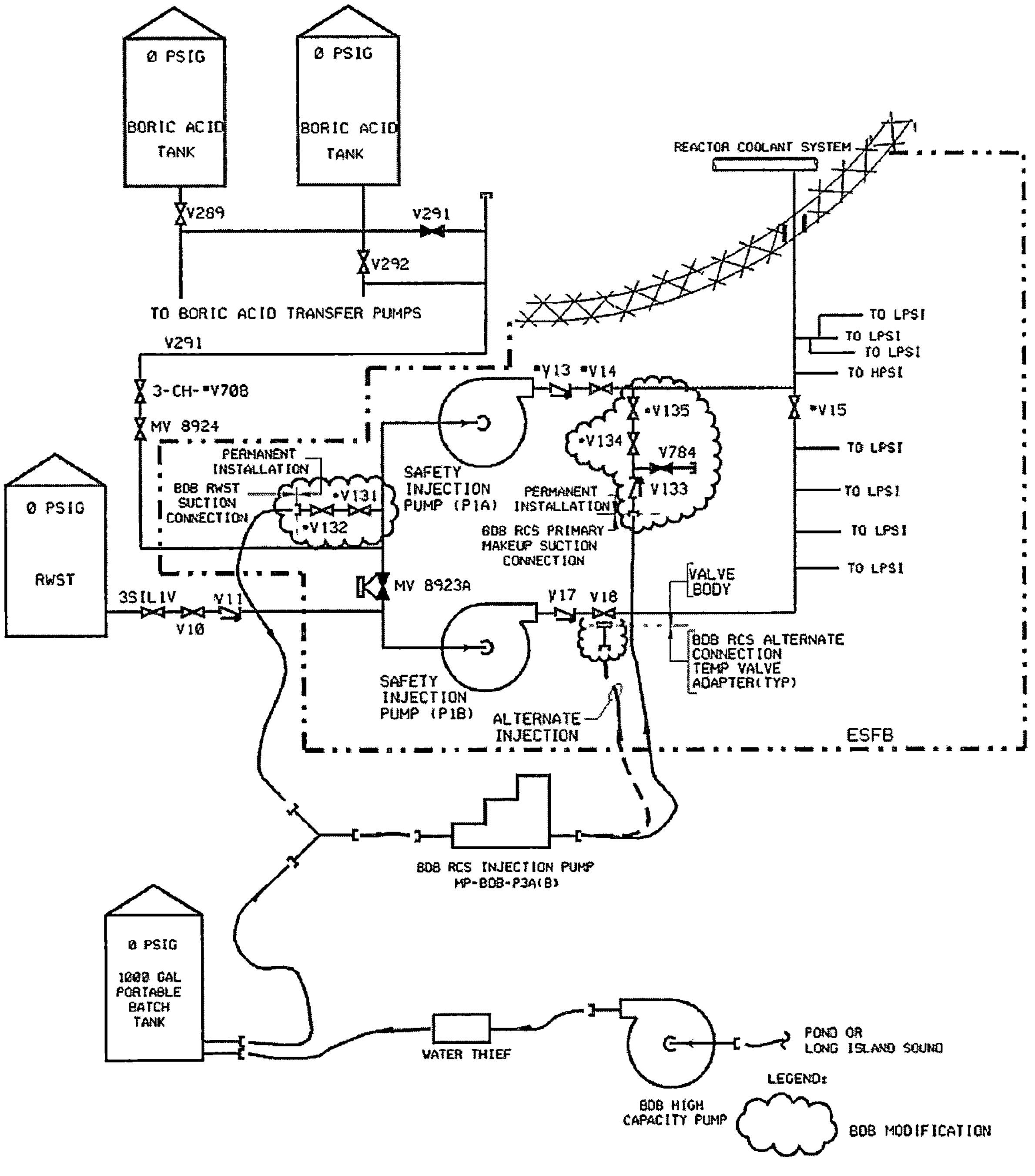


Figure 5: BDB FLEX RCS Makeup Primary and Alternate Mechanical Connections

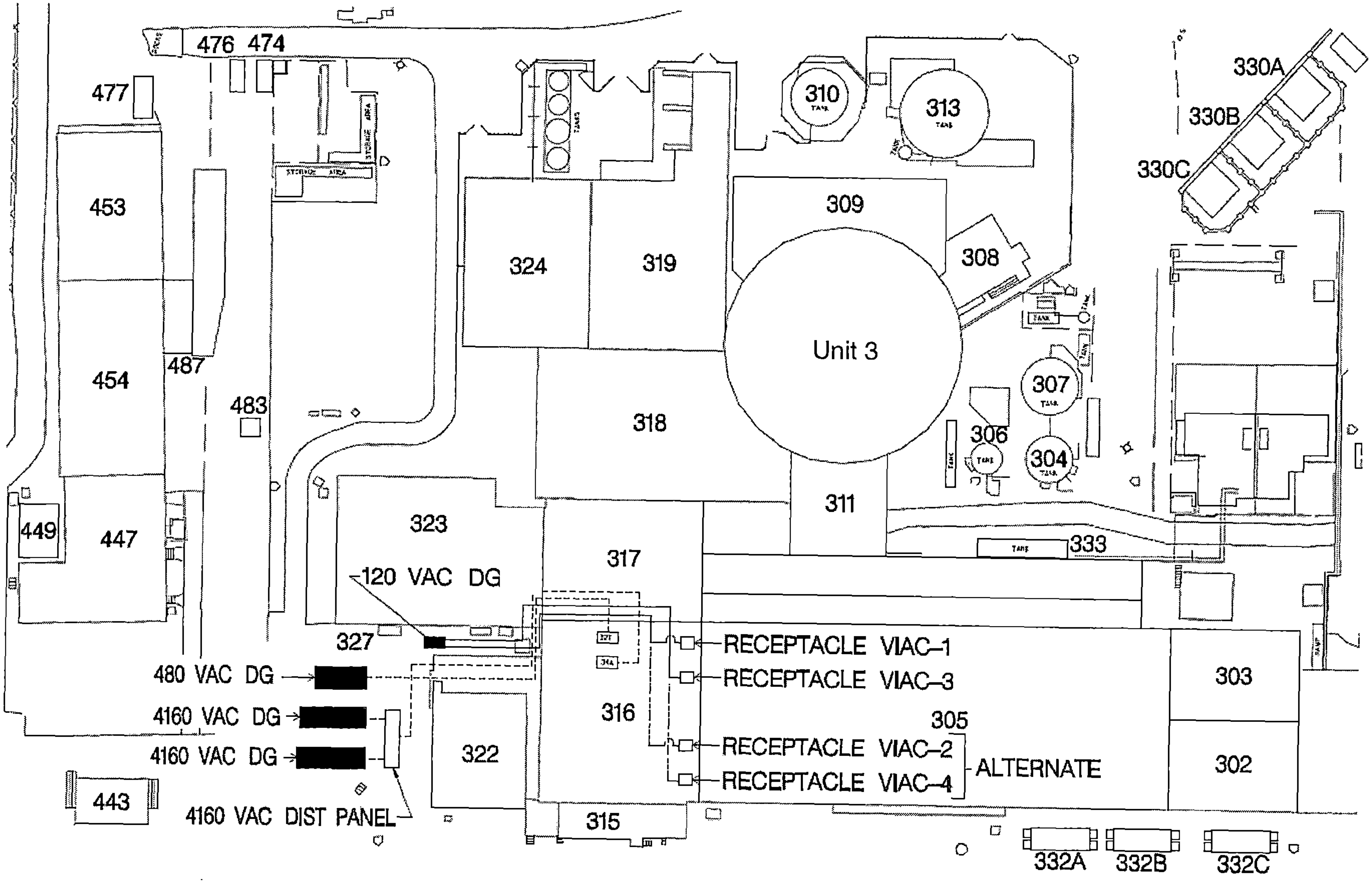


Figure 6: BDB Electrical Connections 120 VAC, 480 VAC, & 4160 VAC General Layout

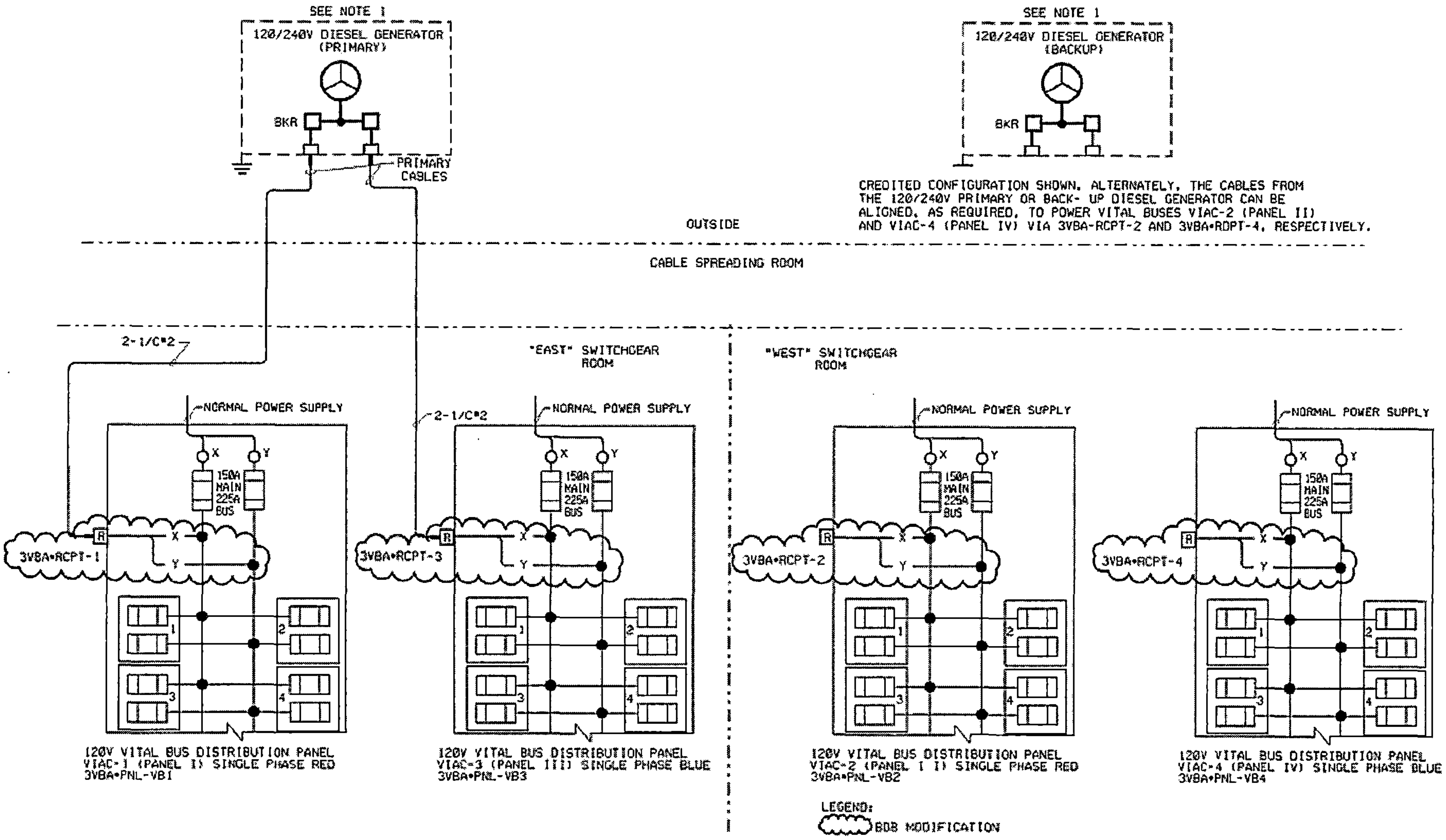
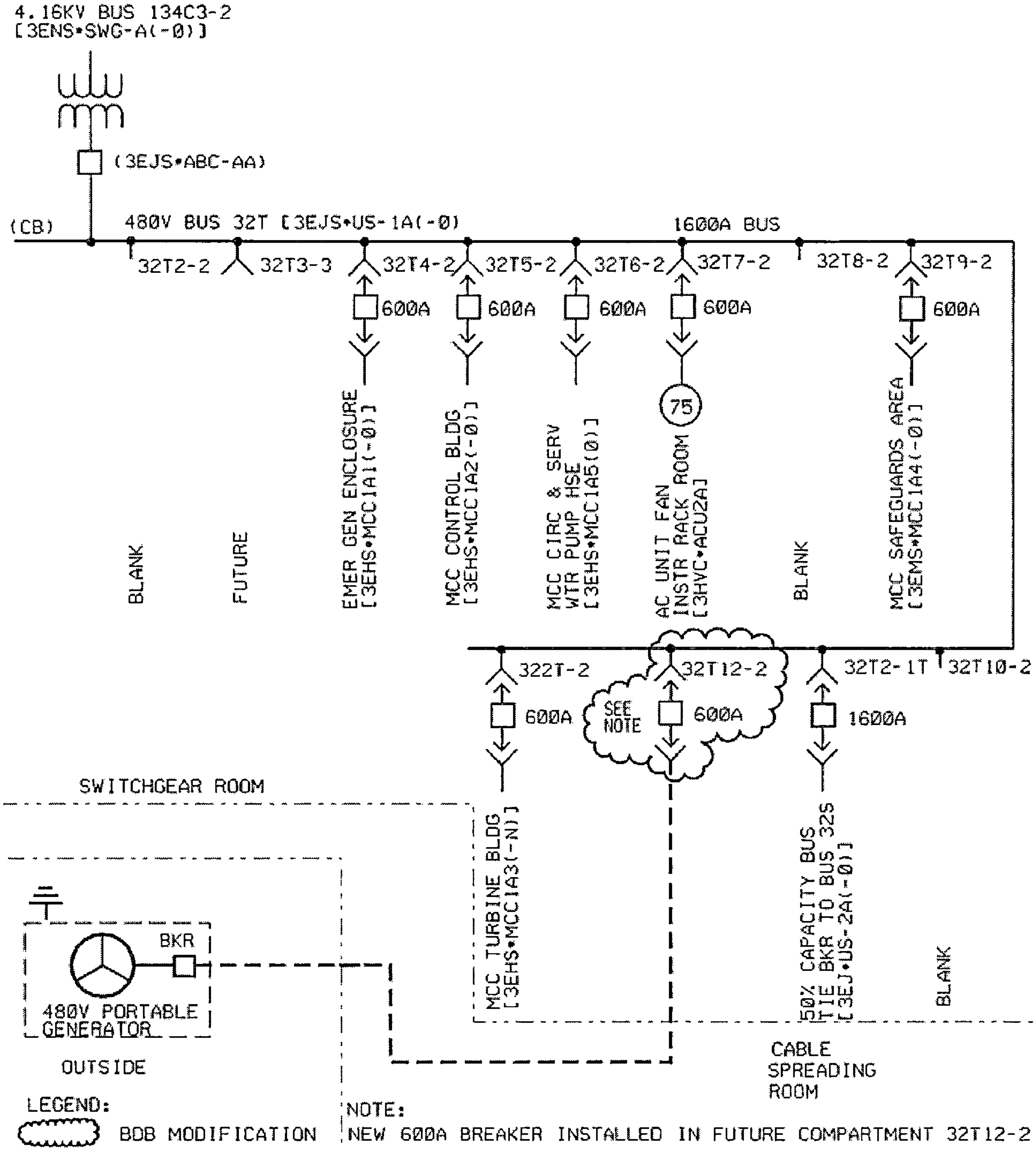
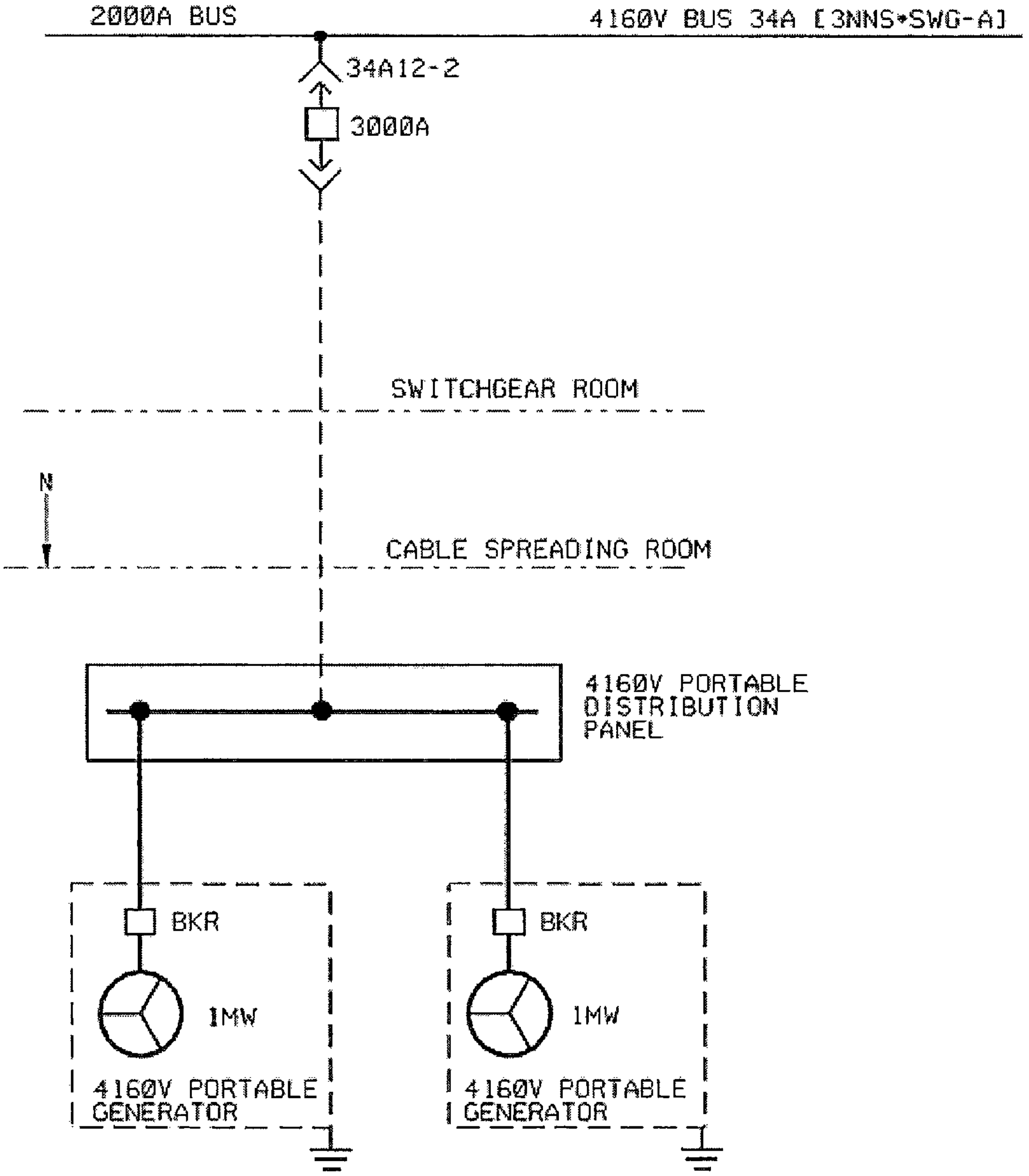


Figure 7: 120/240 VAC FLEX Electrical Connections



NOTE:
NEW 600A BREAKER INSTALLED IN FUTURE COMPARTMENT 32T12-2

Figure 8: 480 VAC FLEX Electrical Connections



NOTE:
THE TWO 1MW 4160V GENERATORS PROVIDED BY THE NSRC AND CONNECTED TO AN EXISTING SPARE 3000A BREAKER INSTALLED IN 34A12-2 VIA A 4160V PORTABLE DISTRIBUTION PANEL

Figure 9: 4160 VAC FLEX Electrical Connections

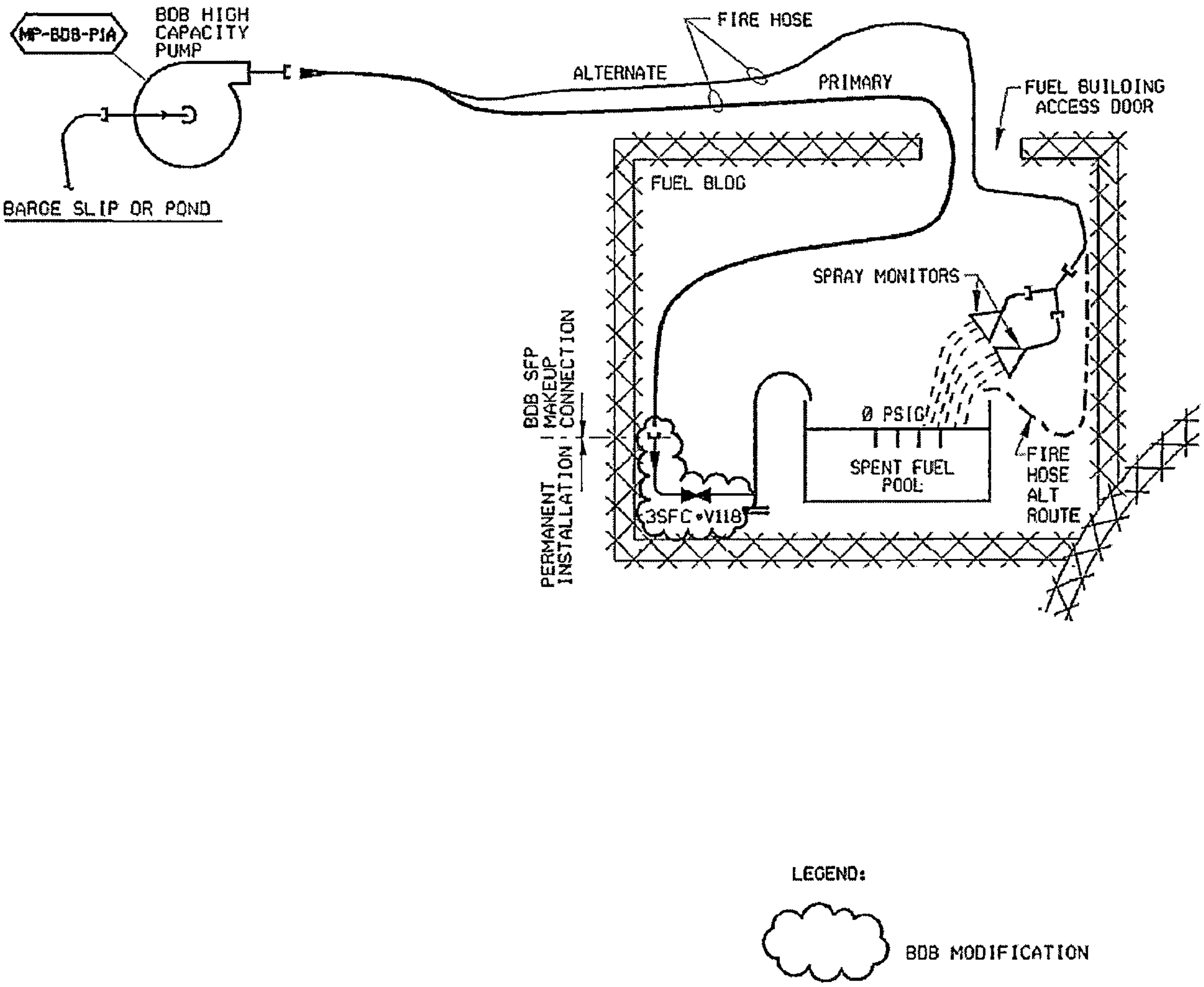


Figure 10: BDB FLEX SFP Primary and Alternate Mechanical Connections

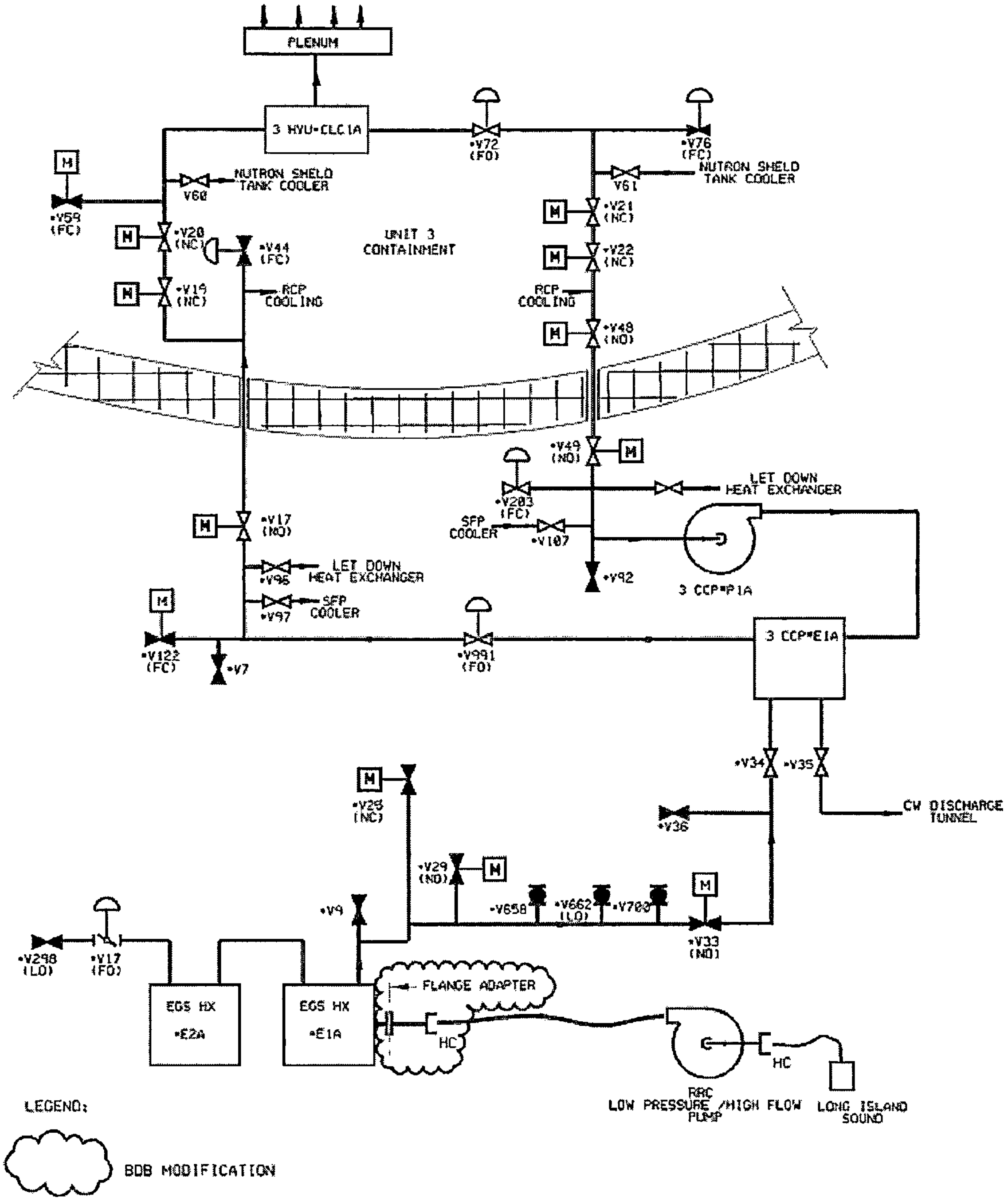


Figure 11: BDB FLEX Containment Cooling Ventilation Option Mechanical Connections

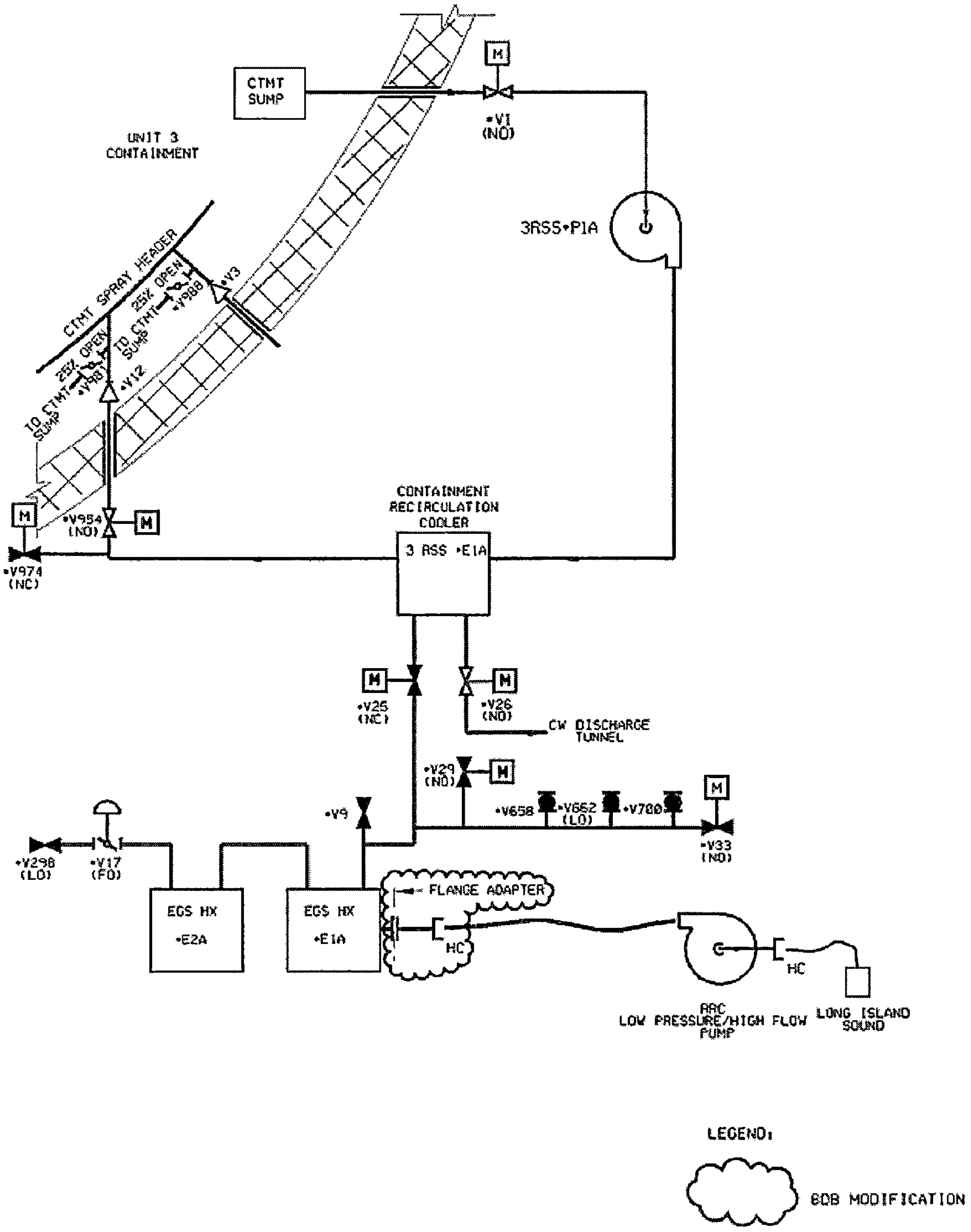


Figure 12: BDB FLEX Containment Cooling Spray Option Mechanical Connections

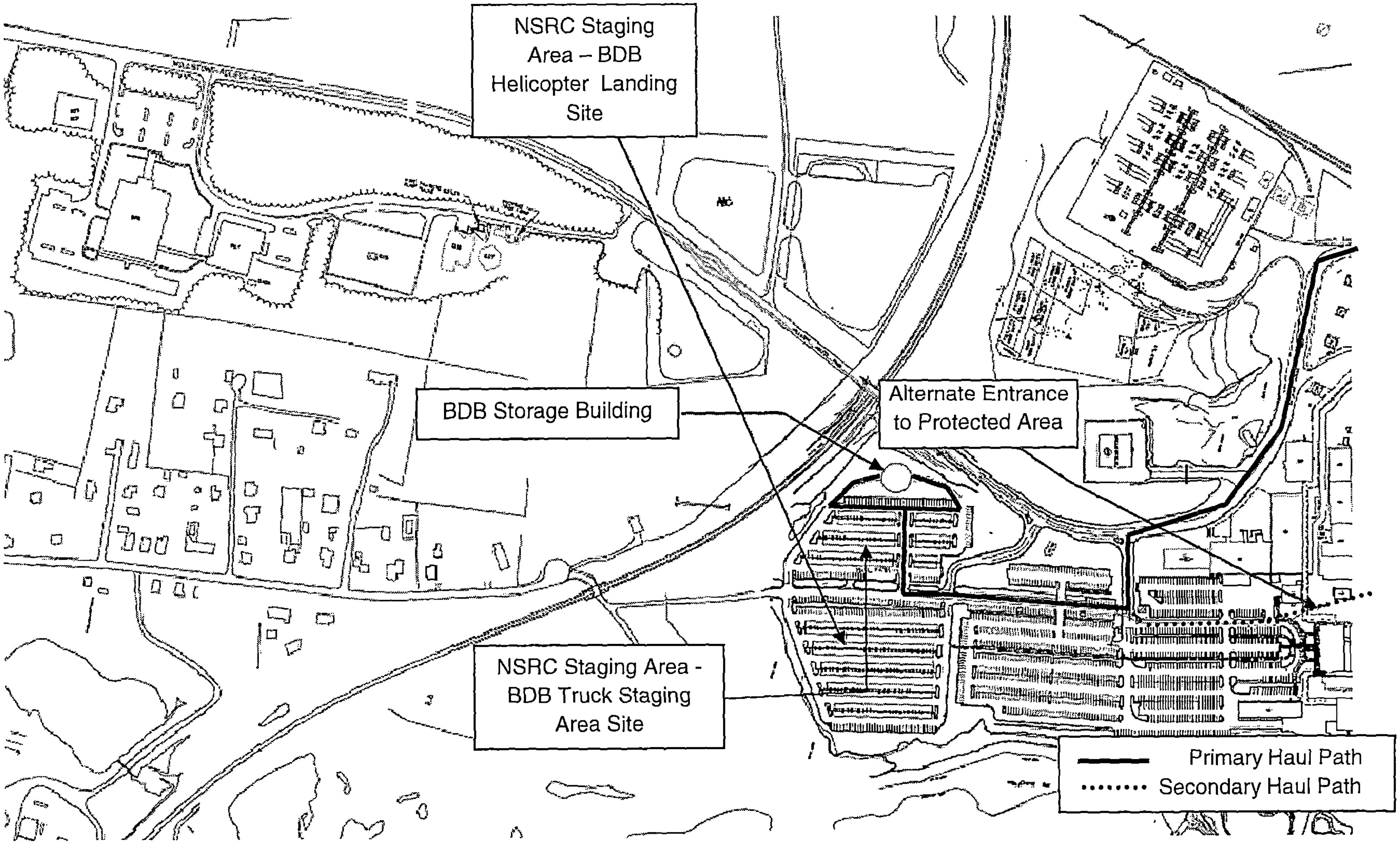


Figure 13: BDB Storage Building, NSRC Staging Area, and Haul Paths

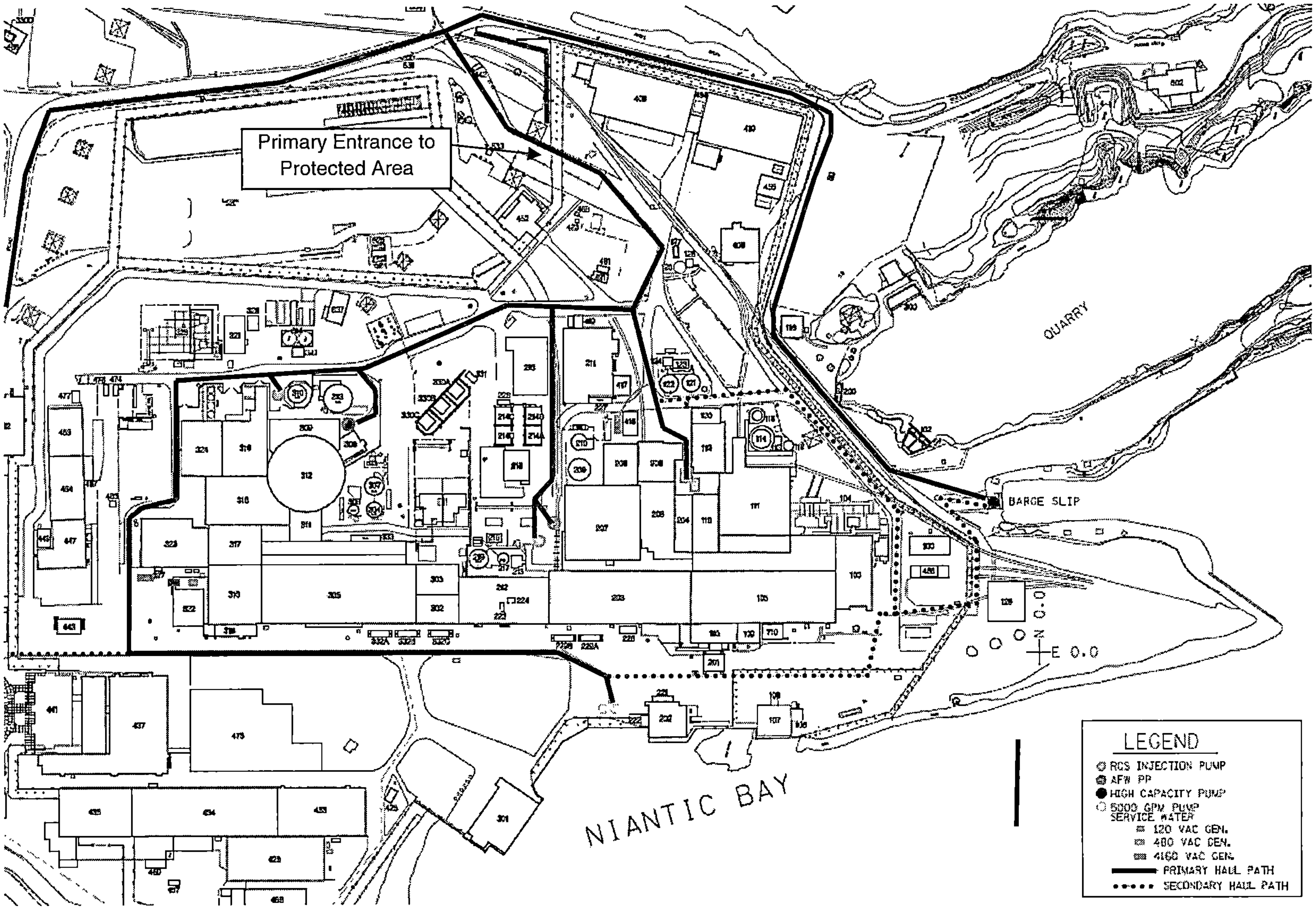


Figure 14: BDB FLEX Equipment Deployment Haul Paths (Protected Area)