Enclosure

Nine Mile Point Nuclear Station, Unit 2

Final Integrated Plan Document – Mitigating Strategies NRC Order EA-12-049

(102 pages)

Exelon Generation®

NINE MILE POINT NUCLEAR STATION

UNIT 2

FINAL INTEGRATED PLAN DOCUMENT – MITIGATING STRATEGIES NRC ORDER EA-12-049

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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 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 1) on March 12, 2012 to implement mitigation strategies for Beyond-Design-Basis External Events (BDBEEs). The order provided the following requirements for strategies to mitigate BDBEEs:

1. Licensees shall develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and SFP cooling capabilities following a BDBEE.
2. These strategies must be capable of mitigating a simultaneous loss of all AC power and loss of normal access to the ultimate heat sink and have adequate capacity to address challenges to core cooling, containment and SFP cooling capabilities at all units on a site subject to the Order.
3. Licensees must provide reasonable protection for the associated equipment from external events. Such protection must demonstrate that there is adequate capacity to address challenges to core cooling, containment, and SFP cooling capabilities at all units on a site subject to the Order.
4. Licensees must be capable of implementing the strategies in all modes.
5. Full compliance shall include procedures, guidance, training, and acquisition, staging or installing of equipment needed for the strategies.

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

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

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

The Nuclear Energy Institute (NEI) developed NEI 12-06 (Reference 5), which provides guidelines for nuclear stations to assess extreme external event hazards and implement the mitigation strategies specified in NRC Order EA-12-049. The NRC issued Interim Staff Guidance JLD-ISG-2012-01 (Reference 3), dated August 29, 2012, which endorsed NEI 12-06 with clarifications on determining baseline coping capability and equipment quality.

NRC Order EA-12-051 (Reference 2) required licensees to install reliable SFP instrumentation with specific design features for monitoring SFP water level.

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

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

NEI 13-02 (Reference 10) provided guidance to assist licensees with compliance with Order EA-13-109. The NRC issued Interim Staff Guidance JLD-ISG-2013-02 (Reference 9), dated November 14, 2013, which endorsed NEI 13-02 with exceptions and clarifications for installing a reliable hardened wetwell vent on Mark 1 and Mark 2 containment venting systems.

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

2.1 General Elements

2.1.1 Assumptions

The assumptions used for the evaluations of a Nine Mile Point Unit 2 ELAP/LUHS event and the development of FLEX strategies are stated below.

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

- The BDB external event occurs impacting both units at the site.
- Both reactors are initially operating at 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 control 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. The emergency cooling system initiates and operates normally, providing decay heat removal, thus obviating the need for further overpressure protection valve operation.
- On-site staff is at site administrative minimum shift staffing levels.
- No independent, concurrent events, e.g., no active security threat.
- All personnel on-site are available to support site response.
- The reactor and supporting plant equipment are either operating within normal ranges for pressure, temperature and water level, or available to operate, at the time of the event consistent with the design and licensing basis.

The following plant initial conditions and assumptions are established for the purpose of defining FLEX strategies and are consistent with NEI 12-06 Section 3.2.1, *General Criteria and Baseline Assumptions*, for Nine Mile Point Unit 2:

- No specific initiating event is used. The initial condition is assumed to be a loss of off-site power (LOOP) with installed sources of emergency on-site AC power 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 FLEX equipment stored in structures with designs that are robust with respect to seismic events, floods and high winds and associated missiles, remains available.
- Installed Class 1E electrical distribution systems, including inverters and battery chargers, remain available since they are protected.
- No additional accidents, events, or failures are assumed to occur immediately prior to or during the event, including security events.
- Reactor coolant inventory loss consists of unidentified and identified leakage at the upper limit of Technical Specifications (25 gpm), reactor recirculation pump seal leakage of 18 gpm per pump, and inventory loss through Safety Relief Valve (SRV) operation during Reactor Pressure Vessel (RPV) pressure control
- For the spent fuel pool, the heat load is assumed to be approximately the same as that associated with SFP decay heat 8 days after a full core offload condition
- 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 (license/site specific) requirements of 10CFR may be required.
- Site access is impeded for the first 6 hours, consistent with NEI 12-01 (Reference 7). Additional resources are assumed to begin arriving at hour

6 with limited site access up to 24 hours. By 24 hours and beyond, near-normal site access is restored allowing augmented resources to deliver supplies and personnel to the site.

This plan defines strategies capable of mitigating a simultaneous loss of all alternating current (AC) power and loss of normal access to the ultimate heat sink resulting from a BDB event by providing adequate capability to maintain or restore core, 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. These pre-planned strategies developed to protect the public health and safety have been incorporated into the unit emergency operating procedures in accordance with established emergency operating procedure (EOP) change processes, and their impact to the design and license bases capabilities of the unit 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 Specification (TSs) Requirements at the Surry Power Station", (TAC Nos. MC42331 and MC4332), dated September 12, 2006 (Reference 15).

2.2 Strategies

The objective of the FLEX Strategies is to establish an indefinite coping capability in order to 1) prevent damage to the fuel in the reactor, 2) maintain the Containment function and 3) maintain cooling and prevent damage to fuel in the spent fuel pool (SFP) using installed equipment, on-site portable equipment, and pre-staged off-site resources. This indefinite coping capability will address an extended loss of all AC power (ELAP) – loss of off-site power and emergency diesel generators, but not the loss of AC power to buses fed by station batteries through inverters – with a simultaneous loss of access to the ultimate heat sink (LUHS) and loss of motive force for UHS pumps, but the water in the UHS remains available and robust piping connecting the UHS to plant systems remains intact. This condition could arise following external events that are within the existing design basis with additional failures and conditions that could arise from a Beyond-Design-Basis external event.

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

The strategies for coping with the plant conditions that result from an ELAP/LUHS event involve a three-phase approach:

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

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

The 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, containment, and SFP cooling capabilities at Nine Mile Point Unit 2. Though specific strategies have been developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions. These pre-planned strategies developed to protect the public health and safety are incorporated into the Nine Mile Point emergency operating procedures in accordance with established EOP change processes, and their impact to the design basis capabilities of the unit evaluated under 10 CFR 50.59.

2.3 Reactor Core Cooling and Heat Removal Strategy

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

DC bus load shedding will ensure battery life is extended to 12 hours. Portable generators will re-power instrumentation prior to battery depletion. DC load shed of all non-essential loads would begin when it is recognized that the station is in a Station Blackout (SBO) condition, and completed within 4 hours. With DC load shedding, the useable station Class 1E battery life is calculated to be twelve (12) hours for NMP2.

RPV makeup provided by a portable diesel driven pump, hereinafter called the FLEX pump, will be available to be initiated by 4 hours from event onset, as a backup to RCIC, to ensure that reactor water level will remain above the Top of Active Fuel (TAF).

2.3.1 Phase 1 Strategy

2.3.1.1 Power Operation, Startup, and Hot Shutdown

At the initiation of the BDBEE, Main Steam Isolation Valves (MSIVs) automatically close, feed water flow to the reactor is lost, and Safety Relief Valves (SRV) automatically cycle to control pressure, causing reactor water level to decrease. Reactor Core Isolation Cooling (RCIC) will automatically initiate on low-low reactor water level (Reference 11) after the initiation of the SBO.

After determination that Emergency Diesel Generators (EDG) cannot be restarted and off-site power cannot be restored for a period greater than the SBO coping time (4 hours), the operating crew determines the event is an ELAP. Overall coping time for core cooling in Phase 1 is approximately 8 hours (onset of challenges to RCIC operation caused by elevated Suppression Pool temperature) (Reference 45). This assumes RCIC is in service at or near the onset of the event and adequate core cooling as a result of core submergence due to reactor water level staying above the TAF during this time period. This coping time is based on limited leakage from the reactor coolant pressure boundary as explained below

Total reactor coolant system leakage during an ELAP condition can be assumed to be less than or equal to 61 gallons per minute (gpm) (reactor recirculation pump total seal leakage is less than or equal to 36 gpm for both reactor recirculation pumps plus 25 gpm Technical Specification maximum allowable identified leakage). This seal leakage analysis is based on the 18 gpm leakage rate per seal recommended by the NUMARC 87-00 Page J-2 (Reference 16) for BWR SBO design.

Although the reactor water level will remain above the TAF plant personnel will proceed immediately with deployment of a portable FLEX diesel driven pump that will take suction from Lake Ontario at the dry hydrant in the Screenwell Building and discharge to the 'A' Residual Heat Removal System (RHS) via a portable manifold. This capability will be achieved within 4 hours from the onset of the ELAP. Alternate injection capability for core cooling from a portable FLEX diesel driven pump through the portable manifold to 'B' RHS (see Figure 4) can also be deployed in approximately 4 hours. The portable FLEX pump will be installed to take suction with non-collapsible hose from the Screenwell Building dry hydrants that connect to the intake bay/Lake Ontario or directly from the intake bay.

RCIC continues to operate to maintain RPV level above TAF while the containment continues to heat up and pressurize. The strategy to maintain RCIC for core cooling is to vent the Suppression Chamber (wetwell) at 10 psig to maintain Suppression Pool temperature and remove energy by steaming from the Suppression Pool through HCVS. With the Suppression Pool and Chamber at saturated conditions lowering pressure will lower temperature. Based on MAAP analysis (Reference 45), the HCVS will be opened when containment pressure reaches 10 psig (approximately 7 hours into the event) and remain open to control containment pressure and temperature to support continued operation of RCIC for core cooling which would otherwise begin to degrade significantly due to the Suppression Pool heatup. RCIC injection flow rate is slowly lowered thereby reducing the RCIC pump required NPSH, when Suppression Chamber venting has commenced, in order to prolong RCIC operation while maintaining RPV level above TAF.

With HCVS venting of the Suppression Chamber at 10 psig, Suppression Pool temperature slowly rises and reaches a peak temperature of just over 250°F at about 24 hours from ELAP/LUHS onset. RCIC survivability is significantly challenged after that time due to pump seal and bearing failure potentials and therefore transition to FLEX portable pumps for core cooling is probable. Portable pumps will be ready for injection via Residual Heat Removal System (RHS) 'A' or 'B' at 4 hours from event onset based on procedure validation.

2.3.1.2 Cold Shutdown and Refueling

The overall strategy for core cooling for Cold Shutdown and Refueling are, in general, similar to those for Power Operation, Startup, and Hot Shutdown.

If an ELAP occurs during Cold Shutdown, water in the reactor pressure vessel (RPV) will heat up. When temperature reaches 212°F, the RPV will begin to pressurize. During the heat up, as directed by EOPs, SRVs can be opened to prevent reactor heatup and re-pressurization. The primary strategies for Cold Shutdown are the same as those for Power Operation, Startup, and Hot Shutdown as discussed above for core cooling using portable pumps.

During Refueling, many variables impact the ability to cool the core. In the event of an ELAP during Refueling, there are no installed plant systems to provide makeup water to cool the core. Thus, the deployment of Phase 2 equipment will begin immediately. To accommodate the activities of RPV disassembly and refueling, water levels in the RPV and the reactor cavity are often changed. The most limiting condition is the case in which the reactor head is removed and water level in the RPV is at or below the reactor vessel flange. If an ELAP/LUHS occurs during this condition then (depending on the time after shutdown) boiling in the core may occur in a relatively short period of time (e.g. approximately 3 hours).

Per NEI Shutdown/ Refueling Position Paper (Reference 36) endorsed by the NRC (Reference 37), pre-staging of FLEX equipment can be credited for some predictable hazards, but cannot be credited for all hazards per the guideline of NEI 12-06. Deployment of portable FLEX pumps to supply injection flow should commence immediately from the time of the event. This is possible because more personnel are on site during outages to provide the necessary resources. During outage conditions, sufficient area and haul paths should be maintained in order to ensure FLEX deployment capability is maintained.

2.3.2 Phase 2 Strategy (Figures 4, 6, and 7)

Primary strategy: Deployment of Phase 2 portable equipment will begin when it is recognized an SBO/ELAP condition exists (within 1 hour) in Phase 1. A portable FLEX pump will be deployed and aligned to inject to the RPV through the 'A' Residual Heat Removal System (RHS) via a portable manifold. A portable diesel generator will be deployed and will enable re-energizing an existing safety related 600 VAC unit substation 2EJS*US1 and Battery Charger 2BYS*CHGR2A1 or 2BYS*CHGR2A2 for Division I Battery within the 12 hour battery coping time following DC load shed.

At two hours into the event (an hour being allowed for debris removal between the robust FLEX Storage Building and the staging area for the NMP1 and NMP2 pumps) a portable FLEX pump and associated suction and discharge hoses will be deployed to the NMP2 Screenwell Building. The suction hose will be routed to the dry hydrant on the north side of the Screenwell Building which ties into the Circulating Water tempering line for the intake tunnel providing for an indefinite supply of water for make up to the RPV and the SFP. An alternate staging area for the FLEX pump and suction hose directly into the intake bay is available from the northeast side of the Screenwell Building in the event the north side Screenwell area is not accessible. Discharge hoses from the FLEX pump will be routed to a portable distribution manifold in the Reactor Building where make up can be directed to the RPV, Suppression Pool, and SFP.

Alternate strategy: If the situation existed in which the FLEX pump was not able to discharge to 'A' Residual Heat Removal System, the capability exists to connect the discharge hose of a FLEX pump to a hose connection into the 'B' Residual Heat Removal System. The hose connections replace blank flanges installed at the cross tie between the Condensate Transfer System (CNS) and the RHS system for both 'A' and 'B' RHS systems.

Primary Strategy for repowering safety related 600 VAC and 125 VDC loads: Prior to depletion of the Class 1E 125 VDC safety related batteries, vital 125 VDC circuits will be re-powered to continue to provide key parameter monitoring instrumentation using portable diesel generators (DGs) stored on-site. The 125 VDC safety related batteries are available for up to 12 hours without recharging with nonessential load reduction actions performed (References 13 and 49). Before battery voltage can no longer support essential loads, a safety related battery charger will be repowered with AC power from a portable diesel generator using the 600 VAC safety related unit station. Once the 600 VAC unit substation is re-energized additional AC loads that support FLEX implementation will be recovered.

The strategy uses a portable diesel generator (DG) to power 600 VAC unit substation 2EJS*US1 to provide power to selected FLEX related loads and one of the existing Division I 600VAC /125VDC Battery Chargers 2BYS*CHGR2A1 or 2BYS*CHGR2A2. The connection between the portable diesel generator and the existing 600 VAC unit substation is via a Bus Connection Device (BCD) using temporary cables and connectors.

An alternate to powering up the 2EJS*US1 and 2BYS*CHGR2A1 or 2BYS*CHGR2A2 for Division I is to use the portable diesel driven generator to provide power to Division II to power up the 600 VAC unit substation 2EJS*US3 to recover selected FLEX loads and the 600VAC /125VDC Battery Chargers 2BYS*CHGR2B1 or 2BYS*CHGR2B2 via a Bus Connection Device (BCD) using temporary cables and connectors.

The portable generators are staged outside the east (primary) or west (alternate) side of the NMP2 Control Building.

The portable diesel generator is stored in the robust FLEX building. The necessary electrical cables are stored in a hallway closet just south of the Emergency Switchgear Rooms near their intended use. The Bus Connection Devices are stored in place in unit substations 2EJS*US1 and 2EJS*US3. The BCD is racked-in to seismically restrain it but is not connected to the bus. Preparation of the portable diesel generator for service will commence at 2.5 hours from the time of the initiating event (allowing two hours for debris removal and other operator actions). Placing the portable diesel generator into service can be completed in 5.5 hours after initiated. It is therefore reasonable to expect the portable diesel generator to be supplying power to the key instrumentation and other necessary loads for maintaining key safety functions within 12 hours of a BDB external event which initiates an ELAP event (Reference 35).

2.3.3 Phase 3 Strategy

The Phase 3 strategy is to use the Phase 2 connections, both mechanical and electrical, but supply water using Phase 3 portable pumps and AC power using Phase 3 portable generators if necessary. The Phase 3 equipment will act as backup or redundant equipment to the Phase 2 portable equipment and is deployed from an off-site facility and delivered to Nine Mile Point. The off-site facility supplying this equipment is the National SAFER Response Center (NSRC) through executed contractual agreements with Pooled Equipment Inventory Company (PEICo). The NSRC will support initial portable FLEX equipment delivery to the site within 24 hours of a request for deployment per the Nine Mile Point SAFER Response Plan (Reference 42). The NMP SAFER Response Plan defines the actions necessary to deliver pre-specified equipment to Nine Mile Point. Designated local staging areas have been selected to support deliveries of requested SAFER equipment from the NSRC to Nine Mile Point. Resources will be available, and sufficient, at the times required for Phase 3 implementation.

No plant modifications have been installed to support mitigating strategies for Phase 3. The connection of the majority of Phase 3 equipment can be made to connection points established for Phase 2 equipment and strategies. The remaining Phase 3 non-redundant equipment will be deployed as needed utilizing field established connections, without the reliance on plug and play type modifications. Other Phase 3 equipment that is not a backup or redundant to Phase 2 can be applied towards recovery efforts.

2.3.4 Systems, Structures, Components

2.3.4.1 Reactor Core Isolation Cooling System

The primary function of the Reactor Core Isolation Cooling system (RCIC) is to remove reactor decay heat when the vessel is isolated from the main heat sink. Following isolation, the reactor pressure will rise causing SRVs to cycle to control reactor pressure below safety valve set points. Normally, RCIC is placed into operation automatically by opening the steam admission valve by signals from RCIC logic on low-low reactor water level (~6 feet below minimum normal). The RCIC system directs steam from the 'B' Main Steam Line to drive a turbine-driven pump. The steam then exhausts to the Suppression Pool. The pump is supplied water from either the Condensate Storage Tanks or the Suppression Pool and is capable of delivering 600 gpm to the RPV via the RCIC/Head spray nozzle located inside the RPV Head.

The RCIC system includes one turbine-driven pump, one gland seal system DC powered air compressor, automatic valves, control devices for this equipment, and sensors and logic circuitry. Cooling water for the RCIC system turbine lube oil cooler is supplied from the RCIC pump discharge.

The RCIC controls are powered by the 125 VDC Division I DC system. Motive power for inboard isolation valves is by Division II standby AC power, while outboard isolation valves are driven by Division I standby AC power. The AC driven containment isolation valves are normally open and are expected to remain open following the onset of the ELAP/LUHS. The remaining valves (steam inlet, pump suction, RPV injection, turbine trip/throttle, min flow) are powered by the Division I DC system.

2.3.4.2 Batteries

The safety related batteries and associated DC distribution systems are located within safety related structures designed to meet applicable design basis external hazards and will be used to initially power required key instrumentation and applicable DC components required for monitoring RPV level and RCIC operation. Starting within 60 minutes of ELAP/LUHS event onset and completing within 4 hours, load shedding of non-essential equipment provides an estimated total service time of 12 hours of operation.

2.3.4.3 Primary RPV Make Up

Primary water make up to the RPV and SFP will be via a manifold, mounted on a push cart, located in the NMP2 Reactor Building Track Bay which will receive water from the FLEX pump via manifold valve 2BDB-V1 using 800 feet of 3 inch hose. When not in use, the manifold/cart will be stored locally, inside the Reactor Building, with the wheels chocked to prevent movement. When needed, the manifold/cart will be un-chocked and moved to the desired location in the Reactor Building track bay. This manifold provides the ability for a single operator to control the flow rates to each of the two injection points when deployment of the primary injection paths is successful for all three key safety functions.

Primary RPV make up consists of 200 feet of 2 inch hose routed from manifold valve 2BDB-V4, through the east-side Reactor Building hoist well up to Reactor Building 289' elevation to the tie-in at RHS'A', and interfaces with a flanged FLEX hose connection. An elevated platform is provided for access to the flange connection at RHS 'A'. The hose is stored near the RHS FLEX hose connections in boxes located on elevation 289' of the Reactor Building. RHS Injection Valve 2RHS*MOV24A is opened in order to allow injection into the RPV.

2.3.4.4 Alternate RPV Make Up

In the event the primary RPV make up method to the RPV via RHS 'A' is not available, an alternate make up connection is provided for RHS 'B'. A hose connection is also installed at a blank flange in the cross-tie between Condensate Transfer System (CNS) piping and Residual Heat Removal System (RHS) 'B' piping on Reactor Building 289' elevation. For this, 2 inch hose is routed from the FLEX manifold discharge to this hose connection via the Reactor Building east-side hoist well. The flanged hose connection and 200 feet of 2inch hose is stored in boxes near the RHS hose connection flanges. This hose connection is located close to floor level and no special equipment is needed for access. RHS Injection Valve 2RHS*MOV24B is opened in order to allow injection into the RPV.

2.3.4.5 Primary Electrical Connection

The primary strategy (Figure 8 and 9) uses a FLEX portable diesel generator (DG) to power the existing 600VAC safety related unit substation. This enables 600 VAC power restoration to key FLEX related loads and 600 VAC/125VDC Battery Charger 2BYS*CHGR2A1 or 2BYS*CHGR2A2 for Division I to restore and maintain charging of the Division I Battery 2BYS*BAT2A. The connection between the portable diesel generator and the existing 600VAC/125VDC battery charger 2BYS*CHGR2A1 or 2BYS*CHGR2A2 is via temporary cables and connectors to a Bus Connection Device (BCD) located at 600 VAC Division I unit substation 2EJS*US1.

2.3.4.6 Alternate Electrical Connection

The alternate strategy (Figure 8 and 9) uses a FLEX portable diesel generator (DG) to power the existing 600VAC safety related unit substation. This enables 600 VAC power restoration to key FLEX related loads and 600 VAC/125VDC Battery Charger 2BYS*CHGR2B1 or 2BYS*CHGR2B2 for Division II to restore and maintain charging of the Division II Battery 2BYS*BAT2B. The connection between the portable diesel generator and the existing 600VAC/125VDC battery charger 2BYS*CHGR2B1 or 2BYS*CHGR2B2 is via temporary cables and connectors to a Bus Connection Device (BCD) located at 600 VAC Division II unit substation 2EJS*US3.

2.3.5 Key Reactor Parameters

Instrumentation providing the following key parameters is credited for all phases of the reactor core cooling and decay heat removal strategy with the indication available in the NMP2 MCR:

- RPV Level: 2ISC*LR1623A (primary) and 2ISC*LR1623B (alternate), 2ISC*LI13A (primary) and 2ISC*LR1615 (alternate)
- RPV Pressure: 2ISC*PR1623A (primary) and 2ISC*PR1623B (alternate)
- RCIC Flow: 2ICS*FI101 (primary)

The above instrumentation is available prior to and after DC load shedding of the DC buses during SBO/ELAP response procedure implementation for up to 12 hours. Availability after 12 hours is dependent on actions to restore and maintain the Division I Battery Chargers 2BYS*CHGR2A1 or 2BYS*CHGR2A2 with the FLEX portable diesel generator (Primary) or the FLEX portable diesel generator supplying the Division II Battery Chargers 2BYS*CHGR2B1 or 2BYS*CHGR2B2 (Alternate).

In the unlikely event that the Division I or II Battery Bus infrastructures or supporting equipment are damaged and non-functional rendering key parameter instrumentation unavailable in the NMP2 Main Control Room, alternate methods for obtaining the critical parameters locally is provided in procedure N2-SOP-78A, EOP Key Parameter–Alternate Instrumentation.

2.3.6 Thermal Hydraulic Analysis

At the initiation of the loss of all AC power event, the main steam isolation valves (MSIVs) will automatically close, feedwater is lost, and SRVs automatically cycle to control pressure. The inventory passing through the SRVs causes reactor water level to decrease. When reactor water level reaches 108.8 inches, RCIC automatically starts with suction from the Condensate Storage Tanks (CSTs) (Reference 11 & Technical Specification (TS) 3.3.5.2 Reference 18) and operates to inject makeup water to the reactor vessel (note that the CSTs are not seismically qualified and if damaged, RCIC will automatically transfer suction to the Suppression Pool). This injection is sufficient to maintain reactor water level above top of active fuel (TAF) and to recover the reactor level to the normal band. MAAP4 computer code was used to simulate the ELAP event for NMP2 and is an acceptable method for establishing a timeline which meets the intent of NRC Order EA-12-049 (Reference 1).The specific MAAP4 analysis case that was used to validate the timing of mitigating strategies is documented in NMP2 document N2-2014-004 (Reference 45). MAAP Case No, "Vent Case 1F19a" evaluates the plant response during the ELAP when RCIC is taking suction from the Suppression pool.

The NMP2 FLEX strategy is to depressurize/cool down in pressure bands of 1000 psig to 500 psig for the first hour, 500 psig to 200 psig for the second hour, and approximately 200 psig to 150 psig (cooldown rate bounds 200 psig to 150 psig pressure band) in the third hour and beyond (Figure 1). The MAAP analysis for Vent Case 1F19a demonstrates that the cooldown rate will be, on average in the first two hour increment, less than 100 °F/hr assuming saturated steam. For the MAAP analysis used to simulate the plant response, a single SRV was assumed to be opened to perform the cooldown for modeling simplification purposes only.

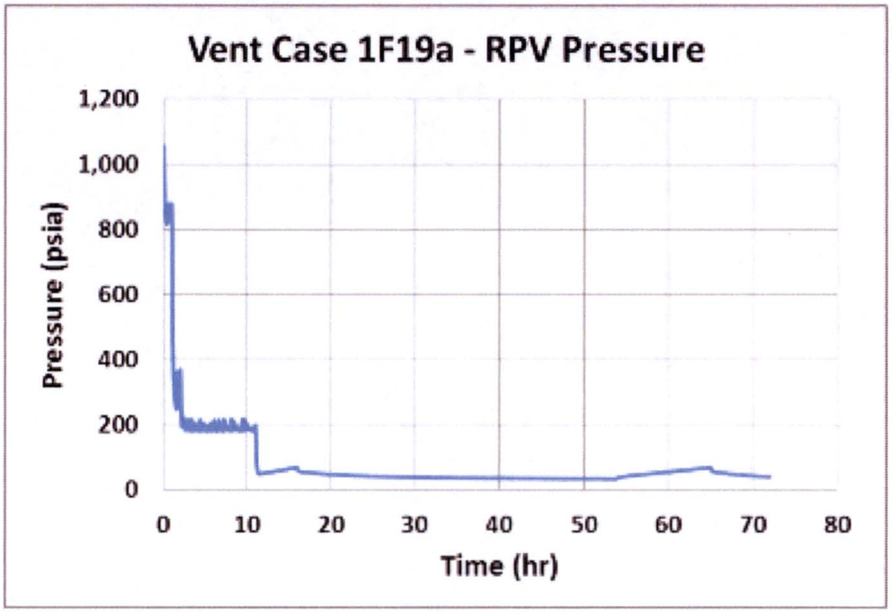


Figure 1 RPV Pressure – first 72 hours

For the representative MAAP run (Vent Case 1F19a), RPV water level remains above TAF for the duration of the analysis with just reactor core isolation cooling (RCIC). The lowest RPV level, calculated by MAAP, was approximately 31.90 ft. above the bottom of the reactor vessel. TAF is located at 30.52 ft. for NMP2. As such, the collapsed RPV water level remains approximately 1.4' above TAF when level recovers in the first hour and about 7.3' above TAF with the minimum alternate injection flow rate of 180 gpm later in the scenario as supplied by a FLEX portable pump (Figure 2).

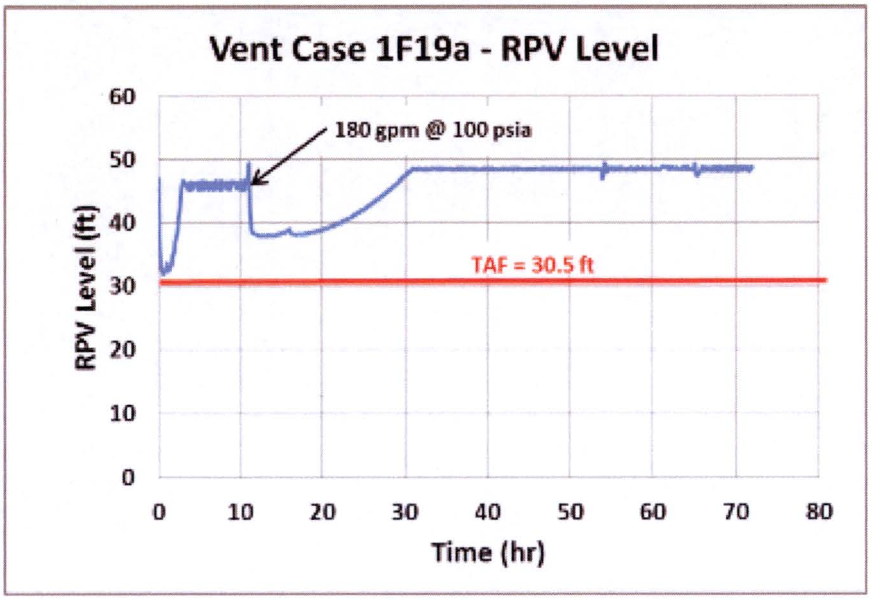


Figure 2 RPV Level – first 72 hours

2.3.7 Reactor Coolant System Leakage

Total reactor coolant pressure boundary leakage during ELAP conditions has been evaluated to be less than or equal to 61 gallons per minute (gpm) at rated pressure. The leakage consists of recirculation pump total seal leakage of less than or equal to 36 gpm plus 25 gpm Technical Specification maximum allowable identified leakage. The NMP2 seal leakage used is based on the 18 gpm leakage rates per pump seal for each of the two pumps which was recommended by NUMARC 87-00 Page J-2 (Reference 16, consistent with existing NMP2 SBO licensing bases calculation ES-266 (Reference 34).

2.3.8 Shutdown Margin Analysis

Per NEI 12-06 section 2, bounding conditions for the FLEX strategies includes the following:

> "Each reactor is successfully shut down when required (i.e.: all control rods inserted, no ATWS)."

The NMP2 Technical Specification (Reference 18) for the cold shutdown margin demonstration (T.S. Section 3.1.1) requires that the shutdown margin at any time during the fuel cycle be equal to or greater than: (1) 0.38% Δk/k with the highest worth rod analytically determined, or (2) 0.28% Δk/k with the highest worth rod determined by test. Core designs provide a minimum of 1% shutdown margin

This requirement is verified during the startup after each refueling by an in-sequence control rod withdrawal. Because core reactivity values will vary through core life as a function of fuel depletion and poison burnup, the demonstration of shutdown margin is performed in the cold (68°F), xenon-free condition and must show the core to be subcritical by at least R + 0.38% Δk/k. The value of R, in units of % Δk/k, is the difference between the calculated values of maximum core reactivity (cold, with the highest worth rod withdrawn) throughout the operating cycle, and that at beginning–of–cycle (BOC).

As reported in Section 4 of the Supplemental Reload Licensing Report for Reload 17/Cycle 16 (Reference 48) for the Spring 2016 refueling and current operating cycle, the value of R is 0.000 % Δk. Therefore the minimum shutdown margin that occurs is at BOC. The BOC cold $K_{effective}$ with the strongest rod withdrawn is 0.988. This translates to a minimum shutdown margin of 1.2% Δk/k, or approximately 3 to 4 times the Tech Spec requirement. Therefore, NMP2 will remain shut down during a simultaneous ELAP and LUHS event with all control rods fully inserted.

2.3.9 FLEX Pumps and Water Supplies

Consistent with NEI 12-06, Appendix C, RPV injection capability is provided using FLEX pumps through a primary and alternate connection. The FLEX pump is a Power Prime model 3419MX rated at 770 gpm (@ 363 psid) pump. The FLEX pump is a trailer-mounted, diesel engine driven centrifugal pump that is stored in the robust FLEX Storage Building.

A hydraulic calculation was performed (Reference 43) to verify the capability of the FLEX pumps and piping/hose system to deliver the required amount of water to each required location in the plant.

For RPV makeup, the hydraulic calculation A10.1-A-016 (Reference 43) conservatively determined an RPV makeup flowrate of 180 gpm was required with an assumed constant RPV leakage rate of 61 gpm despite lowering RPV pressure to the target band of 150 – 200 psig. As documented in NMP2 MAAP analysis report N2-2014-004 (Reference 45), the RPV leakage is assumed to be 61 gpm at the event onset but is RPV pressure dependent. The NMP2 MAAP analysis (Reference 45) uses an RPV makeup rate of 180 GPM (RPV leakage + SRV steam flow + margin) to verify that the RPV water level stays above Top of Active Fuel (TAF), assuming RCIC fails at 240°F Suppression Pool temperature and RPV emergency depressurization occurs in conjunction with alternate RPV injection from FLEX portable pumps at the time of RCIC failure.

For Spent Fuel Pool (SFP) makeup, 73 gpm is the calculated boiling rate of the pool for a full core offload as given in calculation A10-A-016 (Reference 43). The ability to supply 250 gpm is a requirement of NEI 12-06 (spray cooling), in the event of a crack in the pool or other means of unforeseen leakage. The 250 gpm is inclusive of the 73 gpm normal boil off rate and was therefore established as the SFP makeup in the hydraulic calculation (Reference 43).

The effect of the water source on FLEX pump performance as it relates to pump NPSH requirements was also evaluated in hydraulic calculation A10.1-A-016. The water source is taken from the intake tunnel via the NMP2 Circulating Water system Intake Bay tempering line which draws from Lake Ontario. Regular monitoring of the quality of water supplies drawn from Lake Ontario shows that water quality meets or exceeds public health standards for drinking supplies. Per the NMP2 USAR (Reference 11) the lowest regulated lake level elevation is 244'. To add conservatism, a minimum lake level of 243' was used. The water temperature was modeled at 84°F (NMP2 USAR, Reference 11), which is the maximum lake (raw) water temperature. The hydraulic calculation verifies that the FLEX pump NPSH available is greater than the NPSH required for the FLEX strategy flowrates being implemented.

Initial testing on the FLEX pumps was completed by NMP personnel to confirm pump performance at the beginning of the project. The test modeled the suction lift requirements for the pumps. The test results show that the pumps are capable of providing the required pressure and flow for NMP2 FLEX strategy makeup requirements (Reference 70).

For NMP2, one FLEX pump is capable of supplying the primary make up requirements to the RPV and Spent Fuel Pool. A second pump will have to be used if the maximum spent fuel pool make up flow of 250 gpm is required while the first pump is supplying maximum make up to the SFP and RPV.

2.3.10 Electrical Analysis

NMP 2 has two (2) Class 1E batteries that are utilized as part of the FLEX strategies. The Class 1E battery duty cycles for NMP2 were calculated (Reference 49) in accordance with the IEEE-485 methodology using manufacturer discharge test data applicable to the NMP2 FLEX strategy as outlined in the NEI white paper on Extended Battery Duty Cycles (Reference 53) resulting in 12 hours for Division I and Division II batteries, 2BYS*BAT2A and 2BYS*BAT2B, respectively. 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 six (6) hours for NMP2.

For FLEX Phase 2, the strategy to maintain the station's safety-related DC bus requires the use of a 600 VAC diesel powered (FLEX) generator to re-power installed station battery chargers via temporary connections utilizing a Bus Connection Device (BCD) stored in the safety related 600 VAC Unit Substations 2EJS*US1 and 2EJS*US3. The BCD is racked-in to seismically restrain it but is not connected to the bus. The electrical connections are made between the BCD and the FLEX generator using portable cables with quick connect TPC fittings. The cables are stored on a hallway closet near the safety related Unit Substations in the Control Building, at grade level. The portable FLEX generator is stored in the robust FLEX Storage Building.

The FLEX diesel generators are trailer-mounted units rated at 450 kW/563 kVA, 575 VAC, 3 phase, 60Hz, with integral 500 gallon fuel tank capable of supporting 15.6 hours of operation at full load. Per the FLEX diesel generator sizing calculation (Reference 50), the FLEX generator will be loaded to a total of 87% of its continuous duty rating when supplying AC power to both a NMP2 Battery Charger (2BYS*CHGR2A1 or 2BYS*CHGR2A2) and other optional loads specified in the calculation and delineated in the FLEX support procedure.

For FLEX Phase 3, the National SAFER Response Center (NSRC) will supply two (2) Turbine Marine 1.1 MW 480 VAC 3 phase generators with 600VAC step up transformer. This NSRC equipment is a backup to on-site phase 2 equipment. NSRC generators come with the same size connectors as the on-site Phase 2 FLEX generators and BCDs.

2.4 Containment Integrity

With an ELAP, containment cooling is lost and over an extended period of time containment temperature and pressure can be expected to slowly increase. An analysis was performed to determine the containment pressure profile during an ELAP/LUHS event, and to justify that the instrumentation and controls in containment which are relied upon by the operators are sufficient to perform their intended functions (N2-2014-004 NMP2 MAAP, Reference 45, 2015-01099 Reference 40). The result from this analysis was used to develop an appropriate mitigating strategy, including any necessary modifications.

Heat addition to the containment during Phase 1 is directly related to the radiative heat, leakage from the recirculation pump seals, SRV discharge to the Suppression Pool, and RCIC turbine exhaust to the Suppression Pool. Seal leakage is less than 61 gpm and does not result in any significant pressure or temperature challenge to the containment. Some heat addition does occur initially from Safety Relief Valves (SRV) automatically or manually cycled to control reactor pressure until Reactor Core Isolation Cooling System (RCIC) is placed into service.

Primary Containment heat addition continues to be primarily from the RCIC operation and SRV actuations to reduce RPV pressure to the target pressure band of 150 – 200 psig. RCIC is in service for the first 8 hours, rejecting decay heat to the Suppression Pool. A specific analysis was performed in order to establish strategies necessary to preserve RCIC operation until a FLEX portable pump has been deployed to support core cooling. The evaluation of RCIC durability during the ELAP event is documented in Report 2015-01099, RCIC Equipment Survivability Review (Reference 40). The analysis concluded that operation of the Hardened Containment Vent System (HCVS) when Suppression Chamber pressure reaches 10 psig is necessary to control containment heatup and pressurization which enables RCIC operation for up to 24 hours or longer, from event onset. Without containment venting at 10 psig, containment heatup results in RCIC operation for only 9 hours prior to reaching conditions which significantly challenge RCIC operation.

2.4.1 Phase I

During Phase 1, Primary Containment integrity is maintained by normal design features of the containment, such as the containment isolation valves. In accordance with NEI 12-06, the containment is assumed to be isolated following the event. SRVs cycle automatically or manually to control reactor pressure until RCIC is placed into service. RCIC may automatically start and inject to the RPV on low-low RPV level following the ELAP event onset. RCIC will remove the decay heat energy from the Reactor Pressure Vessel (RPV) and pump water to the RPV with RCIC turbine exhaust returning to the Suppression Pool. The energy deposited to the containment is from radiative heat transfer of the RPV and connected piping, leakage from the reactor recirculation pump seals, SRV discharge to the Suppression Pool, RCIC turbine exhaust to the Suppression Pool, and identified containment leakage. The total leakage to the containment is nominally 61 gpm based on Technical Specification maximum allowable identified leakage limit of 25 gpm plus 36 gpm recirculation pump seal leakage. RCIC continues to operate to maintain RPV level above TAF while the containment continues to heat up and pressurize. The strategy to maintain RCIC for core cooling is to vent the Suppression Chamber (wetwell) at 10 psig to maintain Suppression Pool temperature and remove energy by steaming from the Suppression Pool through HCVS. Based on MAAP analysis (Reference 40), the HCVS will be opened when containment pressure reaches 10 psig (approximately 7 hours into the event) and remain open to control containment pressure and temperature to support continued operation of RCIC for core cooling. Suppression Pool water level will be maintained as directed by Emergency Operating Procedures (EOP) using available sources, such as FLEX portable pumps. Portable pumps will be ready for injection via Residual Heat Removal System (RHS) 'A' or 'B' within 4 hours from event onset based on procedure validation and will be available to support Suppression Pool makeup while RCIC is injecting to support core cooling.

2.4.2 Phase 2

In Phase 2, containment integrity is maintained by normal design features of the containment, such as the containment isolation valves and the HCVS by venting the Suppression Chamber. Suppression pool temperature will be limited by controlling Suppression Chamber pressure. With the Suppression Pool and Chamber at saturated conditions lowering pressure will lower temperature. NMP2 containment design pressure is 45 psig (Reference 11). Containment pressure limits are not expected to be reached during RCIC operation as indicated by MAAP analysis (Reference 45), because the HCVS will be opened at 10 psig Suppression Chamber pressure well before approaching any containment pressure limits. Monitoring of containment pressure and temperature will be available in the Control Room via installed plant instrumentation powered by the safety related batteries and safety related uninterruptable power supplies (UPS). These batteries, and subsequently the UPSs, are maintained in Phase 2 by deployment of FLEX portable generators.

With HCVS venting of the Suppression Chamber at 10 psig, Suppression Pool temperature slowly rises and reaches a peak temperature of just over 250°F at about 24 hours from ELAP/LUHS onset. RCIC survivability is significantly challenged after that time due to pump seal and bearing failure potentials and therefore transition to FLEX portable pumps for core cooling is probable. Portable pumps will be ready for injection via RHS 'A' or 'B' at 4 hours from event onset based on procedure validation.

Once RCIC is no longer required to support core cooling when the transition to portable pumps is complete, Emergency RPV Depressurization is performed by opening 7 SRVs and the HCVS vent path is closed because venting is no longer required to maintain RCIC operation. Containment pressure is then controlled to maintain pressure within the Primary Containment Pressure Limit (PCPL) per EOPs. Per MAAP analysis (Reference 45), Drywell peak pressure is projected to be 45 psig with a peak temperature of 272°F. Suppression Chamber peak pressure is projected to 45 psig with Suppression Pool peak temperature of 280°F.

2.4.3 Phase 3

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

2.4.4 Systems, Structures, and Components

2.4.4.1 Hardened Containment Vent System

The Hardened Containment Vent System (HCVS) is designed (Reference 51) and installed to meet the operational requirements of NRC Order EA-13-109 (Reference 8). In general, the HCVS is initiated by first manually bursting rupture disc 2CPS*PSE55 with the associated argon purge system and then opening valves 2CPS*AOV109, *AOV111 and -AOV134. Only AOV134 will be closed to isolate the vent. The HCVS system can be operated from either the Main Control Room via new Panel 2CEC-PNL801 or from the remote operating station (ROS), located in the Reactor Building Track Bay. Pneumatic supply to valves and DC power for instrumentation and controls are provided by nitrogen bottles and a HCVS battery located in the Reactor Building Track Bay. Both are sized to be capable of supporting system operation for at least 24 hours without replenishment.

2.4.5 Key Containment Parameters

Instrumentation providing the following key parameters is credited for all phases of the Containment Integrity strategy:

- Suppression Pool Temperature: 2CMS*TI174 (alternate), 2CMS*CMS*TI175 (primary)
- Suppression Pool Level: 2CMS*LI9A (primary), 2CMS*LR9B (alternate), 2CMS*LI11A (primary), 2CMS*LI11B (alternate)
- Suppression Chamber Pressure: 2CMS*PI7A (primary), 2CMS*PR7B (alternate)
- Drywell Ambient Temperature: 2CMS*TRX130 (primary), 2CMS*TRX140 (alternate)
- Drywell Pressure: 2CMS*PI2A (primary), 2CMS*PR2B (alternate)

In the unlikely event that the Division I or Division II Safety Related Battery Bus infrastructures or supporting equipment is damaged and non-functional rendering key parameter instrumentation unavailable in the NMP2 Main Control Room, alternate methods for obtaining the critical parameters locally is provided in procedure N2-SOP-78A, EOP Key Parameter–Alternate Instrumentation (Reference 17).

2.4.6 Thermal-Hydraulic Analyses

MAAP4 computer code (Modular Accident Analysis Program, or MAAP) evaluations were used to simulate ELAP conditions for NMP2 (Reference 45). Several NMP2 MAAP cases were run to analyze methods of containment heat removal, including containment venting strategies, to control containment heatup and pressurization. Using the FLEX strategies developed, the MAAP cases have shown that Primary Containment temperature and pressure will remain below containment design limits and that key parameter instruments subject to the containment environment will remain functional for a minimum of 7 days.

Critical inputs to the analysis are as follows:

- RCIC automatically starts on low-low reactor water level immediately at the ELAP onset and injects to the RPV from the Suppression Pool suction at 600 gpm to recover RPV water level to 178" above top of active fuel (TAF).
- Safety Relief Valves (SRV) are operated consistent with EOP guidance to reduce RPV pressure to a band of 150 – 200 psig while RCIC is in service.
- Containment venting using the HCVS system occurs prior to reaching the Primary Containment Pressure Limit (PCPL)
- The reactor coolant leakage is no more than 61 gpm at normal operating conditions.

- RCIC fails when Suppression Pool temperature reaches 240°F and then Emergency RPV Depressurization is performed by opening 7 SRVs to support RPV injection with FLEX portable pumps.

MAAP analysis documented in NMP2 report 2015-01099 (Reference 40) identified that operating the HCVS at 10 psig containment pressure reduces the challenges to RCIC operation caused by elevated Suppression Pool temperatures. With the Suppression Pool and Chamber at saturated conditions lowering pressure will provide for lower Suppression Pool temperature. It also extends RCIC operation from 9 hours to 15 hours prior to failure while controlling containment heatup and pressurization. Venting of the containment at 10 psig is only for the period of time that RCIC is in service for core cooling. Once transition to FLEX portable pumps occurs, an Emergency RPV Depressurization is performed by opening 7 SRVs to support RPV injection with FLEX portable pumps and containment pressure is controlled to maintain pressure less than the PCPL in accordance with EOPs.

2.4.7 FLEX Pump and Water Supplies

Consistent with NEI 12-06, Appendix C, RPV injection capability is provided using FLEX pumps through a primary and alternate connection. The FLEX pump is a Power Prime model 3419MX rated at 770 gpm (@ 363 psid) pump. The FLEX pump is a trailer-mounted, diesel engine driven centrifugal pump that is stored in the robust FLEX Storage Building.

A hydraulic calculation was performed (Reference 43) to verify the capability of the FLEX pumps and piping/hose system to deliver the required amount of water to each required location in the plant. Water supplies are as described in Section 2.9.1 (Makeup Water Supply) and Section 2.15 (Water Sources).

The NSRC is providing additional pumps in Phase 3 that can be used if required to provide water for containment cooling.).

2.5 Spent Fuel Pool Cooling/Inventory

The NMP2 Spent Fuel Pool (SFP) is a wet spent-fuel storage facility located on the refueling floor in the Secondary Containment (Reactor Building). It provides specially designed underwater storage space for the reactor spent fuel assemblies which require shielding and cooling during storage and handling. Normal makeup water source to the SFP is from the Condensate Transfer System. The basic FLEX strategy for maintaining SFP cooling is to monitor SFP level and provide makeup water to the SFP sufficient to maintain substantial radiation shielding for a person standing on the SFP operating deck and cooling for the spent fuel.

2.5.1 Phase 1 Strategy

Evaluations estimate that with no operator action following a loss of SFP cooling, at the SFP maximum design heat load (outage condition, full core offload, SFP gates installed), the SFP will reach 212°F in 5.4 hours and boil off to a level 10 feet above the top of fuel in 30 hours from initiation of the ELAP / LUHS event (Reference 22 and 43). During non-outage conditions, the time to boiling in the pool is significantly longer typically greater than 24 hours. The FLEX strategy during Phase 1 of an ELAP / LUHS event for SFP cooling is to utilize the SFP water level instrumentation installed in response to NRC Order EA-12-051 to monitor the SFP water level. Within the first 16 hours, stage a FLEX pump for the addition of makeup water to the SFP as it is needed in order to restore and maintain the normal level in Phase 2.

2.5.2 Phase 2 Strategy (Figures 5 through 7)

At SFP normal operating level of 23 feet above the top of the fuel storage racks, it will take approximately 30 hours to reach a level 10 feet above the spent fuel (the level below which is assumed to prohibit access to the refuel floor from a radiological perspective). Thus, the transition from Phase 1 to Phase 2 for SFP cooling function is conservatively established to occur in Phase 2 within 24 hours of the onset of the ELAP/LUHS event.

SFP cooling will be established in Phase 2 utilizing a portable FLEX pump to makeup to the SFP keeping the spent fuel covered with water. Phase 2 actions to have the pump connected and available for makeup are targeted to occur at less than or equal to 16 hours from onset of the ELAP/LUHS event. By then, SFP water level should only have lowered by approximately 8 feet or 15 feet above the fuel storage racks. The Phase 2 Primary strategy uses a hose connection point on Reactor Building 289' elevation for a FLEX portable pump to supply lake water to the SFP.

Primary SFP make-up strategy: It uses a flanged hose connection point on Reactor Building 289' elevation at RHS 'B' loop via the FLEX manifold for a FLEX pump to supply lake water to the SFP. The FLEX pump takes suction from Lake Ontario at the NMP2 Intake Bay tempering line in the Screenwell Building to supply water from the intake to the portable distribution manifold in the Reactor Building with a discharge connection point to the flanged hose connection on RHS 'B' loop. From the portable distribution manifold, 200 feet of 2 inch SFP makeup hose is routed to the flanged connection point on elevation 289' of the Reactor Building which provides SFP makeup water to RHS 'B' piping and via manually opened cross-tie valves on Reactor Building 215' into the SFC cooling system up to the SFP on Reactor Building elevation 353'.

Alternate SFP make-up strategy: It uses a flanged hose connection point on Reactor Building 289' elevation at RHS 'A' loop via the FLEX manifold for a FLEX pump to supply lake water to the SFP. The FLEX pump takes suction from Lake Ontario at the NMP2 Intake Bay tempering line in the Screenwell Building to supply water from the intake to the portable distribution manifold in the Reactor Building with a discharge connection point to the flanged hose connection on RHS 'A' loop. From the portable distribution manifold, 200 feet of 2 inch SFP makeup hose is routed to the flanged connection point on elevation 289' of the Reactor Building which provides SFP makeup water to RHS 'A' piping and via manually opened cross-tie valves on Reactor Building 215' and 240' into the SFC cooling system up to the SFP on Reactor Building elevation 353'.

Backup SFP make-up strategy (Figure 5 and 7): A second FLEX pump is used to supply lake water to the SFP. The FLEX pump takes suction from Lake Ontario at the NMP2 Intake Bay tempering line in the Screenwell Building to supply water from the intake to the SFP make-up hoses. 1000 feet of 3 inch hose is routed from the FLEX pump discharge at the NMP2 Screenwell Building, into the Reactor Building north stair tower via doors NA262-1, NA262-2, and R261-3, then into the Reactor Building and up the nearby stairs to elevation 328'. On Reactor Building elevation 328', a valved hose splitter is used to create two 200 foot hose paths to the SFP, one routed to the side of the spent fuel pool and connected to an oscillating spray nozzle (Ozzi), and the other is tied down to the SFP railing on the side of the pool for direct SFP makeup. The oscillating spray nozzle can be used to provide spray flow over the SFP for cooling if the SFP integrity has been compromised. The 3 inch hoses from the splitter on Reactor Building 353' to the SFP are already stored on Reactor Building elevation 353', intended for NMP2's 10CFR50.54(hh)(2) capability.

2.5.3 Phase 3 Strategy

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

2.5.4 Structures, Systems, and Components

2.5.4.1 Spent Fuel Pool and Spent Fuel Pool Cooling and Cleanup System

The spent fuel storage pool is a Category I reinforced concrete structure lined with stainless steel. The stainless steel liner is designed to remain in place and retain its leak-tight integrity during a Safe Shutdown Earthquake (SSE). The stainless steel liner plates are seam welded together and the liner is anchored to the concrete walls with reinforcing S-beam stiffeners. Except for a floor cover plate joint which is backed by a redundant weld, each liner seam is backed by a leak chase channel which forms a test cavity to verify the leak-tightness of the welds. The leak chase system also provides a means for detecting leaks in the spent fuel pool and prevents the uncontrolled loss of contaminated water into the Reactor Building. The general arrangement of the spent fuel racks in the pool permit the storage of approximately 4,000 fuel assemblies.

The Spent Fuel Pool Cooling and Cleanup System (SFC) consists of two sections, one for cooling and one for maintaining water purity and clarity. The cooling portion of the system is classified as Safety Class 3, Category I in accordance with Reg Guide 1.26 and 1.29, respectively. The spent fuel pool cooling section is nuclear safety related and consists of redundant 100-percent capacity circulating pumps, 100-percent capacity heat exchangers and spent fuel pool surge tanks, complete with necessary piping, valves, and instrumentation.

The design function of the SFC cooling portion of the system is to remove decay heat from spent fuel bundles after removal from the Reactor, maintaining the Spent Fuel Pool water temperature at or below 125°F under normal operating conditions and below a maximum Spent Fuel Pool design temperature of 150°F under all other conditions, while the Spent Fuel Pool water provides radiation shielding to Refueling Floor personnel. Spent Fuel Pool level is maintained automatically by level control valves providing demineralized water from the Condensate Storage Tanks to maintain water level 23 feet above the spent fuel storage racks. No connections are provided to the spent fuel pool below the normal water level that may cause the pool to be drained and, therefore, the fuel would not be uncovered should these lines fail.

The Spent Fuel Pool cooling portion of the system can be cross-tied to the Residual Heat Removal Systems (RHS) 'A' and 'B' trains by operation of manual valves located on Reactor Building elevations 240' and 215'. This feature is designed to allow RHS 'A' or 'B' systems to provide spent fuel pool cooling. These cross-ties are utilized in Phase 2 FLEX strategies for SFP cooling.

Spent Fuel Pool Wide Range level indication consists of two independent channels of the through-air radar type level indication, utilizing a wave guide pipe on Reactor Building elevation 353' down to the transmitter located on the elevation below on Reactor Building 328'. SFP level indication is available on the Control Building 288' elevation in the east and west cable chase-ways on panels 2CEC*PNL878A and 2CEC*PNL878B

2.5.4.2 Residual Heat Removal System

The Residual Heat Removal System (RHS) consists of three independent loops. Each loop is provided with a motor-driven pump, piping, suction strainers, valves, instrumentation, and controls. Each loop has a suction source from the Suppression Pool and is capable of discharging water to the reactor vessel or to the Suppression Pool via a full-flow test return line. In addition, the 'A' and 'B' trains have heat exchangers which are cooled by the Service Water System (SWP). Trains 'A' and 'B' can also take suction from the Reactor Recirculation System (RCS) or the Spent Fuel Pool Cooling System (SFC), and can discharge into the reactor recirculation pump discharge lines, Spent Fuel Pool cooling, or to the Suppression Chamber and Drywell spray rings.

Cross-tie connections between the SFC System and the 'A' and 'B' RHS trains permit the 'A' or 'B' RHS heat exchanger to cool the Spent Fuel Pool. Manual isolation valves are provided in each line in both the RHS and SFC systems. This RHS feature is used whenever an abnormally high heat load is placed on the spent fuel pool cooling system, as in a full core offload of irradiated fuel. The arrangement is established and secured by operator action. These cross-tie features are utilized in Phase 2 FLEX strategies for SFP cooling Primary and Alternate strategies.

2.5.4.3 <u>Ventilation</u>

During an ELAP/LUHS event, normal and emergency Reactor Building ventilation will be non-functional. In addition to the spent fuel pool, the NMP2 Reactor Building will have heat addition from RCIC operation and seal leakage, and from HCVS operation radiative heat. FLEX manual actions have to be performed on the Reactor Building elevation 353' following an ELAP/LUHS event. To identify any limitations, temperatures on Reactor Building elevation 353' (Spent Fuel Pool) and elevation 328' (SFP level instrument electronics) were evaluated in calculation ES-289 Reactor Building Thermal Response Following an ELAP (Reference 39). The area temperature on Reactor Building 353' is predicted to be less than 120°F for the first 17 hours. The temperature rise is due to the loss of decay heat removal from the spent fuel pool. The peak temperature in Reactor Building 353' elevation is about 172°F at 65 hours into the event.

Based on the calculation, operator response actions in the NMP2 Reactor Building on 353'elevation following an ELAP/LUHS event should be completed within the first 17 hours after the event onset. Therefore, the SFP Backup strategy to deploy hoses on Reactor Building elevation 353' down to Reactor Building elevation 261' is directed before 7 hours have elapsed from the start of the event, in accordance with the SBO/ELAP procedure N2-SOP-01 (Reference 12).

Additional actions to initiate passive cooling and ventilation in the NMP2 Reactor Building to prevent excessive steam accumulation and high temperature conditions are directed within 8 hours of the event onset in accordance with the SBO/ELAP procedure N2-SOP-01. The results of the calculation ES-289 show Reactor Building temperatures on elevation 353' will rise and peak at less than 180°F provided passive cooling actions are implemented within 8 hours of the ELAP event. The passive cooling actions are to open specified doors in the Reactor Building at grade level and at the Reactor Building roof, to cooldown areas in the Reactor Building via natural convective cooling and channel potentially contaminated air/steam mixture from the Reactor Building roof to atmosphere.

2.5.5 Key SFP Parameters

The key parameter for the SFP Make-up strategy is the SFP water level. The SFP water level is monitored by the instrumentation that has been installed in response to Order EA-12-051, *Reliable Spent Fuel Pool Level Instrumentation* (Reference 2). SFP wide range level indicators were installed (Reference 52) to comply with NRC issued order EA-12-051, per design change ECP-13-000652 and complies with the industry guidance provided by the Nuclear Energy Institute guidance document NEI 12-02 (Reference 6).

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

- Spent Fuel Pool Level: 2SFC-LI413A (primary), 2SFC-LI413B (alternate), 2SFC-LIX413A (primary), 2SFC-LIX413B (alternate)

Spent Fuel Pool Wide range level instruments are a through-air radar type indication consisting of two (2) physically separate channels utilizing waveguides mounted at the northeast and northwest edges of the Spent Fuel Pool. The associated level transmitters are located on the elevation below the refueling floor on Reactor Building elevation 328'. SFP level can be monitored on indicators 2SFC-LI413A on panel 2CEC*PNL 878A located in the Control Building in the west cable chase and on 2SFC-LI413B on panel 2CEC*PNL 878B located in the Control Building in the east cable chase. Indication is also available in the plant on 2SFC-LIX413A located near northwest stairwell in Reactor Building 328' and on 2SFC-LIX413B located on northern side of the Reactor Building, east of SFP, elevation 328'. 100% scale is equivalent to 353.16'. 0% scale is equivalent to 329.99'. Accuracy of level measurement instrument under normal operating conditions is ± 1 inch considering both reference accuracy conditions and effects of losses in waveguide. Under conditions of saturated steam at the horn end of the waveguide seismically mounted over the Spent Fuel Pool and 176°F at the sensor, accuracy is ±3 inches. During an SBO/ELAP event, normal 120 VAC power will be restored by FLEX generators in Phase 2. Both level channels have backup batteries (24 VDC) which will automatically power unit on loss of normal power. The battery backup is designed to power the level indication loop for 7 days.

2.5.6 Thermal-Hydraulic Analyses

For NMP2, the normal SFP water level at the event initiation is approximately 23' feet over the top of the spent fuel seated in the storage racks. Maintaining the SFP full of water at all times during the ELAP/ LUHS event is not required; the requirement is to maintain adequate water level to protect the stored spent fuel and limit exposure to personnel on-site and off-site. For the purposes of this strategy, the objective is to maintain the SFP level at least 10 feet above the spent fuel seated in the spent fuel racks. This is conservatively identified as Level 2 in NEI 12-02, Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation" and is specified as at least 10 feet above the fuel seated in the spent fuel racks.

Current mode 1 conditions for SFP heat loads predict that the time to reach 200°F in the SFP is currently 66 hours. This prediction / calculation is performed daily in accordance with plant surveillance procedure N2-OSP-LOG-D001 (Reference 56).

Using the design basis maximum heat load, the SFP water inventory will heat up from 140°F to 212°F during the first 5.4 hours (Reference 22). Calculations identify that the required makeup rate to maintain the SFP filled during this time is 73 gpm. There are approximately 10,730 gallons per foot of level in the SFP. Using the makeup rate identified above, preliminary calculations identify that SFP water level will lower approximately 0.5 feet every hour. At SFP normal operating level of 23 feet above the top of the fuel storage racks, it will take approximately 48.5 hours to reach a level 10 feet above the spent fuel (the level below which is assumed to prohibit access to the refuel floor from a radiological perspective). Thus, the transition from Phase 1 to Phase 2 for SFP cooling function is conservatively established to occur in Phase 2 within 24 hours of the onset of the ELAP/LUHS event.

SFP cooling will be established in Phase 2 utilizing a FLEX pump to makeup to the SFP keeping the spent fuel covered. Phase 2 actions to have the pump connected and available for makeup are targeted to occur at less than or equal to 16 hours.

2.5.7 Flex Pump and Water Supplies

The FLEX pump is a Power Prime model 3419MX rated at 770 gpm (@ 363 psid) pump. The FLEX pump is a trailer-mounted, diesel engine driven centrifugal pump that is stored in the robust FLEX Storage Building.

A hydraulic calculation was performed (Reference 43) to verify the capability of the FLEX pumps and piping/hose system to deliver the required amount of water to each required location in the plant.

For Spent Fuel Pool (SFP) makeup, 73 gpm is the calculated boiling rate of the pool for a full core offload as given in calculation A10.1-J-045 (Reference 22) and justified to be an input in FLEX hydraulic calculation (Reference 43). The ability to supply 250 gpm is a requirement of NEI 12-06 (spray cooling), in the event of a crack in the pool or other means of unforeseen leakage. The 250 gpm is inclusive of the 73 gpm normal boil off rate and was therefore established as the SFP makeup in the hydraulic calculation.

For NMP2, one FLEX pump is capable of supplying the primary make up requirements to the RPV and Spent Fuel Pool. A second FLEX pump will have to be used if the maximum spent fuel pool make up flow of 250 gpm is required while the first pump is supplying maximum make up to the SFP and RPV.

Lake Ontario is the primary source of water for deployment of the Phase 2 strategy. The water source is taken from the intake tunnel of the NMP2 via the dry hydrants connected to Circulating Water system tempering line to the intake bay, which draws from Lake Ontario. Detailed water supply information is described in Section 2.9.1 (Makeup Water Supply) and Section 2.15 (Water Sources).

2.6 Characterization of External Hazards

2.6.1 Seismic

Seismic Hazard Assessment

Per the NMP2 Updated Safety Analysis Report (References 11), Sections 2.5.2.6 and 2.5.2.7, the seismic criteria for NMP2 include two design basis earthquake spectra: Operating Basis Earthquake (OBE) and the Safe Shutdown Earthquake (SSE). The OBE and the SSE are 0.075g and 0.15g, respectively; these values constitute the design basis of NMP2.

For NMP2, the original geological and seismic siting investigations were performed in accordance with Appendix A to 10 CFR Part 100 and meet General Design Criterion 2 in Appendix A to 10CFR50 (Reference 11, Section 3.1). Investigations of the origin and history of movement of both small displacement faults on the site proper and the large structural zone in close proximity to the site have been performed for NMP2 within the context of Appendix A to 10CFR100 (Reference 11, Section 2.5) and is used for the design of seismic Category I systems structures and components.

As part of design and licensing for NMP2, the maximum earthquake potential was represented by a Modified Mercalli Intensity VI earthquake adjacent to NMP2, resulting in a peak horizontal ground motion of 0.07g. A very conservative value of 15% of gravity (0.15g) was adopted (Reference 11, Section 2.5.2.4).

In accordance with the NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, Nine Mile Point developed a Seismic Hazard and Screening Report utilizing the guidance in NRC endorsed EPRI Report 1025287, "Seismic Evaluation Guidance, Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic (ML12333A170). The NMP Seismic Hazard and Screening Report was submitted to the NRC on March 31, 2014 (Reference 26).

For both NMP1 and NMP2, the Seismic Hazard and Screening Report determined that the SSE envelopes the Ground Motion Response Spectra (GMRS) in the frequency range of 1 to 10 Hz. Therefore per the SPID, Sections 3.2 and 7, NMP1 and NMP2 screen out of further seismic risk assessments in response to NTTF 2.1: Seismic, including seismic probabilistic risk assessment (SPRA) or seismic margin assessment (SMA), as well as spent fuel pool integrity evaluations. Additionally, NMP1 and NMP2 screen out of the Expedited Seismic Evaluation Process (ESEP) interim action per the "Augmented Approach" guidance document, Section 2.2. However for frequencies above 10 Hz the GMRS exceeds both NMP1 and NMP2 SSE. Therefore High Frequency Confirmation needs to be performed for both NMP1 and NMP2 per Reference 60 (ML15194A015). Exelon Generation submitted the "High Frequency Supplement to Seismic Hazard Screening Report (RS-15-288) to the NRC for NMP2 High Frequency Exceedance beyond 10 Hz showing that the GMRS exceedance area between the control point GMRS and SSE is "on the order of 10% or less" (Ref. 61) over the frequency range of exceedance. This is consistent with the criteria in Section 3.1.2 of Reference 61 endorsed by the NRC (Ref. 62) and is considered to be inconsequential based on the requirements contained in Section H.4.2 of Reference 63. Therefore, the FLEX strategies for NMP2 can be implemented as designed and no further seismic evaluations or mitigation strategies assessments are necessary

For NMP2 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.). Alternate FLEX strategies and alternate deployment paths have been developed to accommodate impact from a seismic event. Debris removal equipment is stored in the FLEX Storage Building.

Additional evaluation was performed to evaluate for soil liquefaction potential at Nine Mile Point. The evaluation concluded that based upon the original site borings, the extensive borings conducted for the installation of the Dry Spent Fuel Storage Facility (ISFSI) and the associate Heavy Haul Path, and the recent soil borings for the design of the new FLEX Storage Building, the soil liquefaction potential for the Primary and Alternate Deployment Paths is considered minimal.

2.6.2 External Flooding

Site Layout and Topography

The NMP site is located on the southeastern shore of Lake Ontario in the Lake Ontario watershed. That hydrologic setting generally provides an overland pathway for runoff directly into the lake with any streams mostly small and intermittent. The nearby Oswego River is one of only five major rivers that are exceptions to this condition for the entire lake.

Plant grade for NMP2 is approximately elevation 261 feet. The NMP site, in the immediate vicinity of the plant, is graded to carry onsite runoff to Lake Ontario. In addition, exterior barriers (i.e., berms) located on all three land sides of the immediate plant area divert offsite surface water flow from the watershed adjacent to the plant from reaching the plant site. The flood control berms also prevent onsite runoff from leaving the site in most directions. Surface water flow inside the flood control berms, and directly adjacent to plant facilities, are generally controlled by two outlets: a site drainage channel that discharges to Lake Ontario and overland flow to the north, next to the plant structures (Reference 11 and 31). The shoreline adjacent to NMP is protected by a 1,000 foot long rock dike adjacent to NMP1 transitioning to a revetment ditch adjacent to NMP2, both with a top elevation of 263 feet. The lake shore is approximately 200 feet from the nearest safety-related building. The intermediate area, starting from the shoreline, includes a shore protection dike adjacent to NMP1 constructed from rock with soil fill at an elevation of 263 feet and 50 feet wide, and a revetment and interior drainage ditch adjacent to NMP2 at an elevation of 263 feet and averaging 24 feet wide. The ditch, with an elevation ranging from 254 feet to 249 feet, allows crashing waves to break and flow back to the lake to the southwest end of the dike. Finally, the plant grade rises along the protected area security fence, 80 feet to 100 feet from the shoreline to at least elevation 260 feet. Encompassing the NMP site are two watersheds. The berms located east, west and south of the plant physically separate these watersheds from the plant site. However, the Lake Road culvert connects the upgradient of one of the watersheds to the plant south side allowing a portion of drainage from the watershed to enter the plant inside the flood control berm. This culvert also connects to the plant main drainage located south of the Cooling Tower which continues along the south side of the plant going west and then north into the lake. There are four culverts along the main site drainage.

Current Design Basis Flood Elevations

The current design basis and related flood elevations for NMP2 are described in the USAR (Reference 11). NMP2 was designed to satisfy the requirements stated in the NRC SRP criteria for external floods, NUREG-0800. In particular, the design basis floods for NMP Unit 2 are in accordance with NRC Regulatory Guide 1.59, Design Basis Floods, and the maximum flood level is based on the assumptions that the storm drains are inoperable and the culverts located southwest of the NMP Unit 1 switchyard are not blocked. The evaluation of the conditions resulting in the worst site-related flood probable at NMP Unit 2 has been made in conformance with ANSI N170-1976/ANS 2.8. Based on the analyses performed, the probable maximum flood (PMF) level in the vicinity of the plant buildings is elevation 262.5 ft and was determined from a local Probable Maximum Precipitation (PMP) event.

Current Licensing Basis Flood Protection and Mitigation Features

For NMP Unit 2, the structures housing safety-related equipment and systems, such as the Reactor Building, Diesel Generator Building, and Control Building are constructed with reinforced concrete walls below grade level. The personnel entrance and equipment access to these buildings are at or above 261' elevation. All penetrations through the exterior walls below grade level have watertight penetration sleeves. Underground cables are protected from wetting or flooding by being housed in watertight conduits which are enclosed in reinforced concrete encasements to form electrical duct lines. As electrical duct lines enter the structure, the joints are provided with water stops to prevent in-leakage of the design basis groundwater or floodwater into the structures (Reference 11).

Flood Protection Components

NMP2 relies on exterior barriers (i.e., berms) located on all three land sides of plant site that divert PMF flow from the watershed adjacent to the plant to prevent the offsite surface water flow from reaching the plant site. Also, an armor stone revetment (breakwall) will protect the plant from lake wave action to elevation 263'. In addition, NMP2 flood protection components include:

1. Exterior doors listed in USAR Table 2.4-15 (Reference 11);
2. Diesel Generator stop logs;
3. Railroad wooden logs;
4. Seals on exterior penetrations below grade.

Flood Hazard Reevaluation

Since the original submittal of the Integrated Plan, Nine Mile Point has completed and submitted the Flood Hazard Reevaluation Report (FHRR) (Reference 38) requested by the 10 CFR 50.54(f) letter dated March 12, 2012. The reevaluation represents the most current flooding analysis for Nine Mile Point Units 1 and 2. The reevaluation results were mostly bounded by the original Nine Mile Point UFSAR/USAR site flooding vulnerabilities and characteristics evaluations. No new flooding hazards were identified in the reevaluation and the limiting flood event for Nine Mile Point continues to be a Local Intense Precipitation (LIP) event.

The NMP FHRR report describes the approach, methods, and results from the reevaluation of flood hazards at NMP1 and NMP2. The eight flood-causing mechanisms and a combined effect flood are described in the report along with the potential effects on NMP1 and NMP2. Only one reevaluated flood mechanism, Local Intense Precipitation (LIP) for both NMP1 and NMP2, exceeded the current design basis flood. For both NMP1 and NMP2, the assumed flood duration (water level above EL 261') has increased from 20 minutes to 20 hours. The calculated flooding duration change and the flooding elevation change will impact the amount of water ingress into structures for both units. Details of the LIP event can be obtained from Section 2.1 of the FHRR (Reference 38). Flooding protective measures have been proceduralized (Reference 66) and integrated into FLEX strategy implementation. The reevaluated flood hazard will not prevent NMP2 from implementing FLEX strategies provided the specified flooding protective measures planned are implemented.

The NRC reassessed the external flooding issue and issued the Staff Requirements for closure (Reference 64). The Industry implemented these in NEI 12-06, Rev. 2 (Reference 63) and Integrated Assessment Guidelines (Reference 64). These are the NRC endorsed (Reference 65) current guidelines for resolution of external flooding issues. In accordance with Reference 63 and 64, NMP Flooding Impact Assessment Process (FIAP) will involve comparison of Mitigating Strategy Flooding Hazard Information (MSFHI) with the FLEX strategy and show that MSFHI is bounded by FLEX strategies. This is Path G.3 and Path 3 respectively in Reference 63 and 64 i.e., Focused Evaluation for Local Intense Precipitation (LIP).

2.6.3 Severe Storms with High Wind

Per NEI 12-06 Figure 7-1, NMP has a 1 in 1 million chance per year of a hurricane induced peak-gust wind speed of > 120 miles per hour (mph). Thus, NMP2 does not need to address high straight wind hazards.

Per NEI 12-06 Figure 7-2, NMP has a 1 in 1 million chance of tornado wind speeds of 169 mph. This is greater than the threshold of 130 mph and therefore NMP2 has evaluated tornado hazards, including tornado missiles, impacting FLEX deployment.

NMP2 may have some warning time prior to the event in which a significant tornado event could occur within the vicinity of the site. The most probable approach direction is from the south-west. Site debris would most likely include all types of building material (metal siding, roofing, lumber, etc.), power lines and poles, Sea-vans, vehicles, light poles, trees and stored material. Minimal debris impacting deployment routes would be generated from offsite sources. Flex portable N and N+1 equipment is stored in the tornado and tornado missile proof FLEX Storage Building. Travel routes for FLEX deployment are considerably wide in most areas providing a drivable path even with debris. FLEX trucks and trailers should be able to travel over small debris such as sheet metal, vegetation and other similar objects. Some FLEX hoses, cables, and connection points for FLEX pumps and generators are located in designated areas of NMP2 structures that maintain safe shutdown capability in the event of a tornado (Reference 11). Deployment pathways blocked by tornado debris can be cleared using the FLEX pay loader and other debris removal tools such as chainsaw, disaster saw, tow chains, etc., which are stored in the FLEX Storage Building.

Although both stacks at NMP site are not designed for tornado loads, the NMP2 stack has been evaluated to a tornado wind speed up to 360 mph without exceeding 90% of allowable stresses (Reference 11). Therefore, the NMP2 stack can withstand the maximum tornado wind speed of 360 mph.

The NMP1 stack can fall during the high winds resulting from a tornado. The NMP1 stack diameter is 20.5 feet at 110 feet from the bottom and this is the approximate distance from the stack to the deployment locations (north and west). Given the separation of the north and west deployment locations of about 60 feet and the diameter of the stack at about 20 feet, it is not expected that the stack will impact both deployment locations; therefore one of them is preserved for all events. Given the diverse capability in place for deployment of the FLEX pumps at NMP2 (i.e. north side or east side of the Screenwell Building), the capability for deployment is maintained if the NMP1 stack falls on one or the other location.

2.6.4 Ice, Snow and Extreme Cold

The guidelines provided in NEI 12-06 (Section 8.2.1) generally include the need to consider extreme snowfall at plant sites above the 35th parallel. NMP2 site is located at 43°31' 17" N latitude and 76° 24' 36" W longitude. The NMP2 site is located above the 35th parallel (Reference 5); thus, the capability to address hindrances caused by extreme snowfall with snow removal equipment will be provided. Per Section 8.2.1 of NEI 12-06, "It will be assumed that this same basic trend applies to extremely low temperatures". The lowest recorded temperature at or near NMP2 is -26°F and occurred in 1979. The NMP2 site is located within the region characterized by the Electric Power Research Institute (EPRI) as ice severity level 5 (Reference 5).

Snow and ice storms can provide enough buildup to affect travel within the site. However, reasonable warning time should provide enough time for progressive snow / ice removal by normal means. Clearing of FLEX deployment pathways has been incorporated into the Nine Mile Point Snow and Ice Removal Plan. The FLEX pay loader can be used for snow removal of FLEX deployment pathways along with the FLEX tractor which is equipped with a snow removal blade during the winter months. The FLEX pay loader, tractor, trucks, generators, and pumps are housed in the FLEX Storage Building which is temperature controlled. Each of the vehicles, generators, and pumps is also equipped with a starting battery trickle charger to maintain the batteries at full charge for cold weather starts.

The FLEX generators are rated for full load operation at temperatures as low as -25°F. Freeze protection for FLEX pumps and hoses is provided by maintaining flow in the pump/hose through the use of a minimum flow line controlled at the FLEX distribution manifold by the operator.

Diesel fuel for FLEX equipment is treated with a fuel additive during cold weather conditions to prevent gelling.

2.6.5 High Temperatures

Per NEI 12-06 Section 9.2, "all sites will address high temperatures" for impact on deployment of FLEX equipment. The maximum temperature observed at NMP was 98°F and occurred in 1953. Extreme high temperatures are not expected to impact the utilization of off-site resources or the ability of personnel to implement the required FLEX strategies.

Portable diesel equipment and portable static battery charger will be operated in areas outdoors, where the temperature will effectively be ambient. Vendor information has been reviewed to verify the equipment is expected to operate at high temperatures.

The maximum temperature referenced in the NMP2 Updated Safety Analysis Report, Section 2.3.1.2.2. Climatological Normals and Extremes, is 102°F (Reference 11).

The FLEX generators vendor manual shows a max ambient temperature of 158°F for the control unit and 122°F for the cooling system.

The FLEX pumps were built with John Deere 6068HF485 diesel engines. The application review done by John Deere reports that the Limiting Ambient Temperature for the engines is 132° F. Per Power Prime, the FLEX pump manufacturer, the pump limiting temperature component is the rubber goods in the seals and there should be no concerns for ambient temperatures below 180°F.

The FLEX hoses are manufactured to NFPA 1961 standards. Over-aging tests are done at a temperature of 158°F +/- 3.6°F for 96 hrs. The hoses and fittings for the FLEX equipment will be cooled by the lake water flowing through them.

The FLEX cables used with the portable generator are TPC Power Cable, 2000V rated, stranded copper, Super-Trex type W, type RHH/RHW-2, single conductor #4/0 AWG, 90°C (194°F) conductor temperature rating.

The FLEX Storage Building has its own heating and ventilation system. Per the building design (Reference 41), the maximum predicted temperature of 105.34°F inside the building is based on a maximum outdoor temperature of 103°F (Reference 11). This 105.34°F temperature does not challenge the FLEX portable equipment capabilities.

2.7 Planned Protection of Flex Equipment

Nine Mile Point has constructed a single hardened FLEX storage structure of approximately 8,400 square feet that will meet the requirements for the external events identified in NEI 12-06, such as earthquakes, external floods, storms (high winds, and tornadoes), extreme snow, ice, extreme heat, and cold temperature conditions (Reference 41). The FLEX Storage Building is located inside the Protected Area (PA) fence on the west side of NMP1, south of the Sewage Treatment Plant (STP) and north of the Independent Spent Fuel Storage Installation (ISFSI) area.

The FLEX Storage Building is designated as a seismic Category I and QA Category II structure (Non-Safety Related). The building design is based on SDC-1, Structural Design Criteria Rev 07 (NMP2's CLB design for SSC for external hazards). The top of the slab (floor elevation) is 263.3 feet which is significantly above the reevaluated flood hazard maximum probable flood elevation of 261.8 feet in that area of the site. The FLEX Storage Building was designed and constructed to prevent water intrusion and built to protect the housed FLEX equipment from other hazards identified in Section 2.6 above. The FLEX Storage Building has its own heating and ventilation, and fire suppression system.

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

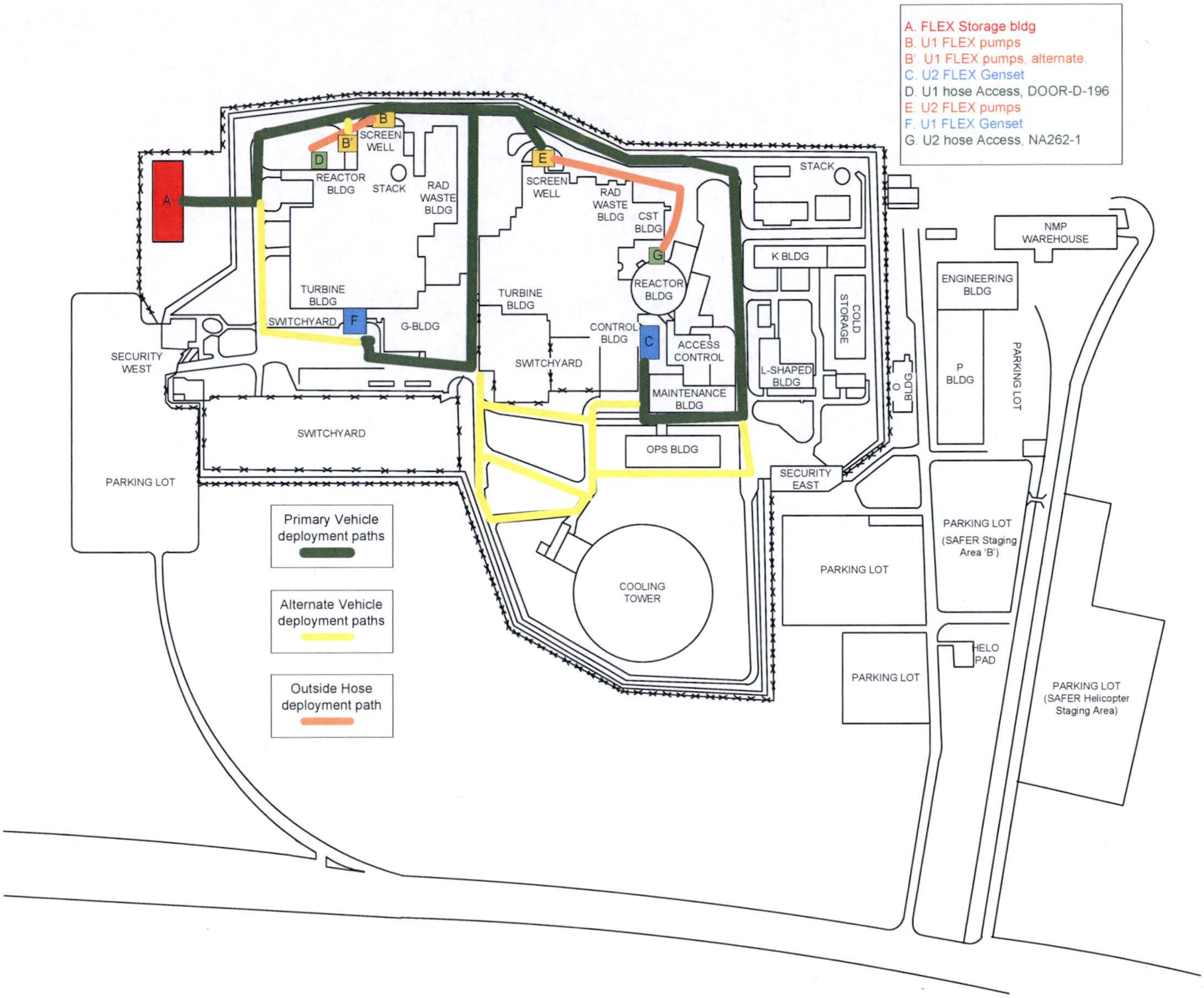
Debris removal equipment such as the FLEX pay loader and tractor are stored inside the FLEX Storage Building in order to be reasonably protected from external events such that the equipment will remain functional and deployable to clear obstructions from the pathway between the FLEX Storage Building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

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

As required by NEI 12-06, all equipment credited for implementation of the FLEX strategies at NMP2 is either stored in the FLEX Storage Building or in a plant structure that meets the station's design bases for Safe Shutdown Earthquake (SSE), specifically the NMP2 Reactor Building, Control Building, and Screenwell Building (below grade level).

Figure 3:

FLEX Storage Building Location and Haul Route



2.8 Planned Deployment of Flex Equipment

2.8.1 Haul Paths and Accessibility

Pre-determined, preferred haul paths have been identified and documented in procedures N2-DRP-FLEX-MECH (Reference 28) and N2-DRP-FLEX-ELEC (Reference 29). Figure 3 shows the haul paths from the FLEX Storage Building to the various deployment locations. These haul paths have been reviewed for possible obstructions (Reference 44). Debris removal equipment is stored inside the FLEX Storage Building to be 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 FLEX Storage Building and the deployment location(s).

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 required 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 is security and is discussed below. However, other barrier functions include fire, flood, radiation, ventilation, tornado, and HELB. As barriers, 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/LUHS event, FLEX coping strategies require the routing of hoses and cables to be run through various barriers in order to connect FLEX equipment to station fluid and electrical systems. For this reason, certain barriers (gates and doors) will be opened and remain open. This violation of 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 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.

The deployment of onsite FLEX equipment to implement coping strategies beyond the initial plant capabilities (Phase 1) requires that pathways between the FLEX Storage Building and various deployment locations be clear of debris resulting from seismic, high wind (tornado), excessive snow/ice, or flooding events. Clearing of FLEX deployment pathways has been incorporated into the Nine Mile Point Snow and Ice Removal Plan. Signs requiring paths and areas to remain clear of obstructions have been posted along deployment pathways and at FLEX equipment deployment locations.

The FLEX debris removal equipment includes a John Deere 4-wheel drive tractor equipped with a snow removal attachment and rear tow connections in order to move or remove debris from the needed travel paths. A Case 621 pay loader is also available to deal with more significant debris conditions. FLEX debris removal hand tools such as tow chains, chainsaw, demolition saw, axe, sledgehammer, and bolt cutters are also available. All equipment is stored in the FLEX Storage Building.

Phase 3 of the FLEX strategies involves the receipt of equipment from offsite sources including the NSRC with various commodities such as fuel and supplies. Transportation of these deliveries will be through airlift or via ground transportation utilizing the Nine Mile Point SAFER Response Plan (Reference 42). Debris removal for the pathway between Staging Areas 'A' and the NSRC receiving location Staging Area 'B' and from the various plant access routes may be required based on conditions present.

2.9 Deployment of strategies

2.9.1 Makeup Water Supply Strategy

NMP is located on the southeastern shore of Lake Ontario, which is the ultimate heat sink for the plant. Nine Mile Point has chosen to use Lake Ontario as the primary water source throughout the ELAP/LUHS event. This allows the FLEX strategy to position the FLEX pumps at a source that can provide make-up water that is unlimited (Table 3).

The makeup water source is taken from the intake tunnel of the NMP2 Service Water system which draws from Lake Ontario. The suction of the FLEX pump is connected to dry hydrants which tap into the intake water tempering line located in the NMP2 Service Water system intake shaft upstream of the trash rakes at elevation 228', 15 feet below the minimum lake level (Reference 46). The 16 inch tempering line is normally used during winter operating conditions to divert up to 5000 gpm of main condenser cooling water into the intake shaft when incoming lake water temperature is less than 38°F. The tempering line is perforated with holes approximately 1 inch in diameter arranged in two rows of 40 holes each for a total of 80 holes which act to restrict debris. The dry hydrant connections are located on the north side of the Screenwell Building in a missile protection enclosure. The intake tunnels where the tempering line is located are Class I seismic structures. The inlet of the intake tunnels are at a minimum, 1000' off shore, near the lake floor (well under the surface of the lake). Lake Ontario water is normally clear with little particulate or debris. At the required pump flow rates, intake water will be flowing at a very low velocity (500 gpm = 0.014 ft/sec) such that it is not expected that significant debris will be carried into the area where the FLEX pumps will be taking their suction.

An alternate staging area for the FLEX pump and suction hose is from the west side of the Screenwell Building in the event the north side Screenwell Building area is not accessible. The FLEX pump suction hose will be installed in an opening upstream of the intake trash rakes. The 6 inch suction hose will then be routed from the FLEX pump suction to the Service Water System intake bay where water will be drawn through a strainer to limit solid debris. The cross sectional area through this strainer is large compared to the cross sectional area of the suction hose such that pressure losses are expected to be negligible. Should debris block a portion of the inlet strainer, there will still be enough flow area to prevent significant pressure loss that would jeopardize the NPSH at the pump suction. Particulate small enough to pass through the inlet strainer will also pass through the FLEX pumps without adverse impact. The suction end of the barrel strainer will be located below the low level elevation of the lake at least 4 feet below the water surface (marked line on suction hose), but well above the floor of the intake tunnel, preventing any debris that may have settled on the bottom of the tunnel to be lifted into the suction hose.

2.9.2 RPV Make-up Strategy

Make up water from the FLEX pump discharge to the RPV and SFP will be via a manifold, mounted on a push cart, located in the NMP2 Reactor Building Track Bay, which receives water from the FLEX pump via manifold valve 2BDB-V1 using 800 feet of 3 inch hose. The hose is stored on the FLEX pump deployment vehicle bed and is deployed in 100 foot sections, outside from the dry hydrants located on the north side of the Screenwell Building eastward into the Reactor Building through northeast Reactor Building airlock doors NA262-1, NA262-2, RS261-1, and R261-3 and connected to the manifold at valve 2BDB-V1. When not in use, the manifold/cart will be stored locally, inside the Reactor Building, with the wheels chocked to prevent movement. When needed, the manifold/cart will be un-chocked and moved to the desired location in the Reactor Building Track Bay. This manifold provides the ability for a single operator to control the flow rates to each of the two injection points (RPV and SFC) while in communication with a

Control Room operator via hand-held radio or sound-powered headset monitoring RPV, SFC, and Containment parameters. A connection on the manifold at valve 2BDB-V2 is used as a minimum flow line and 400 feet of 1.5 inch hose is routed back through airlock doors NA262-1, NA262-2, RS261-1, and R261-3 to outside the Reactor Building. If the pump is ready to be started, but injection is not yet required, the pump can still be started and water can flow through the minimum flow line to ready the pump for service. The min flow line also supports the FLEX freeze protection strategy of maintaining flow in supply hoses routed outside of buildings.

Primary RPV make-up utilizes 200 feet of 2 inch hose routed between the manifold valve 2BDB-V4, through the east-side Reactor Building hoist well up to Reactor Building 289' elevation to the tie-in at RHS'A', and interfaces with a flanged FLEX hose connection. An elevated platform is provided for access to the flange connection at RHS 'A'. The hose is stored near the RHS FLEX hose connections in boxes located on elevation 289' of the Reactor Building and is lowered to the elevation below for connection to the manifold near the Track Bay. Tools for making the flange and hose connection along with spare studs, nuts, and gaskets for the flange are stored with the hose on 289' elevation. In order to allow injection into the RPV once FLEX connections are complete, RHS RPV Injection Valve 2RHS*MOV24A is opened from either the Control Room, if FLEX power has been restored, or locally with the valve handwheel at the valve on Reactor Building 289' elevation. An alternate injection path using the Shutdown Cooling return to RPV valve 2RHS*MOV40A, evaluated for use in the FLEX hydraulic calculation (Reference 43), is also available for RPV injection in the event 2RHS*MOV24A is unable to be opened. Valve 2RHS*MOV40A is located on Reactor Building elevation 240' and is readily accessible by operators locally if FLEX power has not yet been established for remote Control Room operation.

In the event the primary RPV make up method to the RPV via RHS 'A' is not available, an alternate strategy make up connection is provided for RHS 'B' which is a completely independent RHS train. A hose connection for RHS 'B' is also installed at a blank flange in the cross-tie between Condensate Transfer System (CNS) piping and Residual Heat Removal System (RHS) 'B' piping on Reactor Building 289' elevation. Similarly, 2 inch hose is routed between the FLEX manifold discharge valve 2BDB-V4 to this hose connection via the Reactor Building east-side hoist well. This second set of flanged hose connection and 200 feet of 2 inch hose is stored in boxes near the RHS hose connection flanges along with necessary tools for making up the connections. The RHS 'B' hose connection is located close to floor level and no special equipment is needed for access. RHS Injection Valve 2RHS*MOV24B is opened in order to allow injection into the RPV.

In order to allow injection into the RPV once FLEX connections are complete, RHS RPV Injection Valve 2RHS*MOV24B is opened from either the Control Room, if the Alternate FLEX power strategy is used, or locally with the valve handwheel at the valve on Reactor Building 289' elevation. An alternate injection path using the Shutdown Cooling return to RPV valve 2RHS*MOV40B, evaluated for use in the FLEX hydraulic calculation (Reference 43), is also available for RPV injection in the event 2RHS*MOV24B is unable to be opened. Valve 2RHS*MOV40B is located on Reactor Building elevation 240' and is readily accessible by operators locally if FLEX power has not yet been established for remote Control Room operation.

2.9.3 Spent Fuel Pool Make-up Strategy

Primary SFP make-up strategy: The FLEX pump takes suction from the dry hydrants located north of the Screenwell Building and discharges it to the portable distribution manifold in the Reactor Building. This is the same FLEX 3 inch water supply hose and manifold deployed and used for FLEX RPV makeup. The strategy uses the same flanged hose connection point on Reactor Building 289' elevation at RHS 'B' loop that is used by FLEX RPV Alternate injection but is connected to the FLEX manifold discharge valve 2BDB-V3 for supplying makeup water to the SFP. From the portable distribution manifold, 200 feet of 2 inch SFP makeup hose is routed through the Reactor Building east side hoist well to the flanged connection point on elevation 289' of the Reactor Building for RHS 'B'. Once connections are completed SFP makeup water is pumped into to RHS 'B' piping and subsequently via manually opened RHS 'B' to SFP cross-tie valves, 2RHS*V248 and 2RHS*V249, into the SFC cooling system up to the SFP on Reactor Building elevation 353' through the SFP cooling system sparger. Manual valves 2RHS*V248 and 2RHS*V249 are located on Reactor Building 215' and are readily accessible by operators. Makeup flow to the SFP is controlled by the operator at the manifold in the track bay. Manifold valve 2BDB-V3 is throttled to approximately 32% open when only one FLEX pump is operation to ensure adequate makeup flow to the RPV is maintained.

Alternate SFP make-up strategy: Similar to the Primary SFP makeup strategy, the FLEX pump takes suction from the dry hydrants located north of the Screenwell Building and discharges it to the portable distribution manifold in the Reactor Building. This is the same 3 inch water supply hose and manifold deployed and used for FLEX RPV makeup. The strategy uses the same flanged hose connection point on Reactor Building 289' elevation at RHS 'A' loop that is used by FLEX RPV Primary injection but is connected to the FLEX manifold discharge valve 2BDB-V3 for supplying makeup water to the SFP. From the portable distribution manifold, 200 feet of 2 inch SFP makeup hose is routed through the Reactor Building east side hoist well to the flanged connection point on elevation 289' of the Reactor Building for RHS 'A'. Once connections are completed, SFP makeup water is pumped into to RHS 'A' piping and subsequently via manually opened RHS 'A' to SFP cross-tie valves, 2RHS*V304 and 2RHS*V309, into the SFC cooling system up to the SFP on Reactor Building elevation 353' through the SFP cooling system sparger. Manual valves 2RHS*V304 and 2RHS*V309 are located on Reactor Building 240' and 215' elevations and are readily accessible by operators. Makeup flow to the SFP is controlled by the operator at the manifold in the track bay. Manifold valve 2BDB-V3 is throttled to approximately 32% open when only one FLEX pump is operation to ensure adequate makeup flow to the RPV is maintained.

For the Backup SFP make-up strategy (Figure 7), a second FLEX pump is used to supply 250 gpm of makeup water to the SFP either via direct makeup to the Spent Fuel Pool or by spray using an oscillating spray nozzle. The second FLEX pump takes suction from one of the two dry hydrants located north of the Screenwell Building and discharges it to supply water from the intake to the SFP make-up hoses. Twelve hundred (1200) feet of 3 inch hose which is stored on the FLEX pump deployment vehicle bed and is deployed in 100 foot sections, is routed from the FLEX pump discharge at the NMP2 Screenwell Building, into the Reactor Building north stair tower via doors NA262-1, NA262-2, and R261-3, and then into the Reactor Building north stair tower. On Reactor Building elevation 353', a valved hose splitter that is removed from Fire Hose Reel Station 2FPW-HR91 near the Reactor Building north stair tower, is used to create two 200 foot hose paths to the SFP. One hose path is routed to the side of the spent fuel pool and connected to an oscillating spray nozzle (Ozzi), and the other is tied down to the SFP railing on the side of the Spent Fuel Pool for direct SFP makeup. The oscillating spray nozzle can be used to provide spray flow over the SFP for cooling in the SFP integrity has been compromised. The 3 inch hoses from the splitter on Reactor Building 353' to the SFP are already stored on Reactor Building elevation 353', intended for NMP2's 10CFR50.54(hh)(2) capability. The hose splitter on elevation 353' is moved to elevation 328' of the north stair tower through door RS-353-2 and an additional 400 feet of 3 inch hoses stored in a box with necessary connection tools on Reactor Building 328,' are connected and routed down the north stair tower to connect with the discharge hose from the second FLEX pump. The hose splitter contains two integrated shutoff valves and when moved to elevation 328' in the Reactor Building north stair tower, allows operators to initiate and control makeup flow rates and paths from the second FLEX pump without having to access the refueling floor which may become inaccessible later in the event when the Spent Fuel Pool reaches boiling conditions.

2.9.4 <u>Electrical Strategy</u>

The strategy uses a portable 450 kW FLEX diesel generator to power one of the existing safety related 600VAC safety related unit substations. This enables 600 VAC power restoration to key FLEX related loads and 600 VAC /125VDC Battery Chargers in either Division I or Division II, in order to maintain vital DC loads, necessary to support FLEX strategy implementation. The connection between the portable FLEX diesel generator and the 600VAC unit substation 2EJS*US1 (Division I) or 2EJS*US3 (Division II) is via temporary 4/0 cables with quick connect fittings to Bus Connection Devices (BCD) located in 2EJS*US1 and 2EJS*US3 (Reference 47). These unit substations are the normal 600 VAC power supply to the battery chargers. The Bus Connection Devices are stored in place in unit substations 2EJS*US1 and 2EJS*US3. The BCD is racked-in to seismically restrain it but is not connected to the bus. The electrical cables are stored on reels in a hallway closet located just south of the Emergency Switchgear Rooms near their intended use. The FLEX portable generators, BCDs and temporary cables have been evaluated for the powering the required and optional loads for support of the Phase 2 FLEX strategy implementation per calculation EC-206 (Reference 50).

The FLEX generator is deployed from the FLEX Storage Building using either the FLEX F650 truck or the FLEX tractor to the east side of the NMP2 Control Building near equipment access door C261-29 through which the temporary cables will be routed. The alternate route for connecting the FLEX generator to 2EJS*US1 or 2EJS*US3 is to deploy into the east side of the NMP2 115 KV Switchyard and route temporary cables through access door C261-24 located on the west side of the Control Building. FLEX generators are stored in the FLEX Storage Building and are protected against snow, ice, high and low temperatures, seismic, flood, high wind and associated wind-driven missiles. The BCDs and temporary cables are stored inside the Control Building in the Emergency Switchgear Rooms at grade elevation 261' which is a qualified structure for protection from external hazards.

The Primary strategy for maintaining power to the vital DC bus is to deploy the FLEX portable generator to one of the existing Division I 600VAC /125VDC Battery Chargers 2BYS*CHGR2A1 or 2BYS*CHGR2A2 which are normally supplied 600 VAC power from unit substation 2EJS*US1. The connection between the FLEX portable diesel generator and the existing 600VAC/125VDC battery charger 2BYS*CHGR2A1 or 2BYS*CHGR2A2 is via a Bus Connection Device (BCD) in 2EJS*US1 using temporary cables and connectors to supply 600 VAC power to the unit substation and then supply 600VAC the charger. The 240 foot long cables stored in the hallway closet south of the Emergency Switchgear Rooms on reels are deployed, two per phase, and connected to the FLEX generator through Control Building door C261-29 using TPC quick connect fittings and into the Division I Emergency Switchgear Room to the BCD in 2EJS*US1 using a cable extender and splitter. The splitter allows for combining the two cables per phase into one for connection at the BCD using TPC quick connect fittings. Each TPC quick connect fitting is color-coded to ensure matching each cable to the correct connection for proper phase rotation. The 240 foot neutral connection is made at the FLEX generator using TPC quick connect fitting and then routed into the Division I Emergency Switchgear Room and connected to the neutral/ground bus inside 2EJS*US1 using a clamp. .

The Alternate strategy, similar to the Primary strategy, is to use the FLEX portable generator to provide power to one of the existing Division II 600VAC /125VDC Battery Chargers 2BYS*CHGR2B1 or 2BYS*CHGR2B2 which are normally supplied 600 VAC power from unit substation 2EJS*US3. The connection between the FLEX portable diesel generator and the existing 600VAC/125VDC battery charger 2BYS*CHGR2B1 or 2BYS*CHGR2B2 is via a Bus Connection Device (BCD) using temporary cables and connectors. The 240 foot long cables stored in the hallway closet south of the Emergency Switchgear Rooms on reels are deployed, two per phase, and connected to the FLEX generator through Control Building door C261-29 using TPC quick connect fittings and into the Division II Emergency Switchgear Room to the BCD in 2EJS*US3 using a cable extender and splitter. The splitter allows for combining the two cables per phase into one for connection at the BCD using TPC quick connect fittings. Each TPC quick connect fitting is color-coded to ensure matching each cable to the correct connection for proper phase rotation. The 240 foot neutral connection is made at the FLEX generator using TPC quick connect fitting and then routed into the Division II Emergency Switchgear Room and connected to the neutral/ground bus inside 2EJS*US3 using a clamp..

2.9.5 Fueling of Equipment

The FLEX strategies for safety functions and/or maintenance of safety functions involves several elements including the supply of fuel to necessary diesel powered generators, pumps, hauling vehicles, etc. The general coping strategy for supplying fuel oil to diesel driven portable equipment, i.e., pumps and generators, being utilized to cope with an ELAP / LUHS, is to draw fuel oil out of the NMP2 Emergency Diesel Generator Fuel Oil Storage Tanks. NMP1 Emergency Diesel Generator Fuel Oil Storage Tanks are below grade and will not be accessible per the reevaluated flood hazard. In order to ensure proper sizing and strategies for appropriate response for the eventual simultaneous full implementation of FLEX mitigation strategies at both NMP units, calculations associated with fuel consumption were performed assuming the equipment required for full implementation of mitigation strategies at both NMP1 and NMP2 are in operation simultaneously. The usage rates are based on the associated equipment vendor manual specifications for fuel tank capacity and fuel consumption rate.

Fuel consumption for both NMP1 and NMP2 portable equipment to support FLEX (4 diesel driven portable pumps, 2 diesel driven portable generators and 1 diesel driven portable air compressor) is approximately 130 gallons per hour (GPH) for all items operating at full load. The Technical Specification (TS) minimum fuel storage on site is over 141,000 gallons in the Emergency Diesel Generator Fuel Oil Storage and Day Tanks. The fuel at NMP1 is not being credited because fuel is not accessible during flooding conditions which cover tank access ports. Fuel available at NMP2 is assumed with one (1) of three (3) Emergency Diesel Generator Fuel Oil Storage Tanks unavailable (i.e. TS allowable).

Equipment	Fuel Tank Capacity	Full Load Consumption Rate	Total Run Time	Run Time to 20% of FO Tank Capacity
FLEX Pump	~190 gal	14 gal/hr	13.57 hrs	10.85 hrs
FLEX Generator	~500 gal	32 gal/hr	15.6 hrs	12.5 hrs
FLEX Air Compressor (NMP2 only)	~40 gal	5.3 gal/hr	7.5 hrs	6 hrs.

The remaining capacity of the two NMP2 Emergency Diesel Generator Fuel Oil Storage Tanks is greater than 85,000 gallons and will provide over 25 days of fuel for all FLEX portable equipment. The FLEX Phase 3 equipment from the NSRC designated for use at Nine Mile Point acts as replacement or backup to Phase 2 on-site portable diesel driven equipment. NSRC equipment can theoretically increase fuel consumption rate to 270 GPH if all NSRC equipment were deployed and operated at full load. The higher rate is due to design differences and larger equipment (i.e. 1.1MW turbine generator versus 450kW diesel generator). Even at this higher consumption rate, on-site fuel reserves would provide greater than 13 days of operation without off site replenishment. It is expected that the emergency response organization can ensure delivery of replenishment fuel as required within the times identified above.

As delineated in site procedure S-DRP-OPS-004 (Reference 30), Nine Mile Point will utilize two (2) 528 gallon fuel tanks mounted on separate trailers equipped with a 12 VDC/20 gpm, 1 inch transfer pump kit w/automobile nozzle, and stored in the FLEX Storage Building to support FLEX diesel driven equipment refueling. Each FLEX refuel tank's pump is powered from an on-board battery or the towing vehicle's DC power and will be used to refuel the FLEX portable equipment. These 528 gallon tanks will be filled from the on-site NMP2 Emergency Diesel Generator Fuel Oil Storage Tanks using portable fuel oil transfer pumps. The fuel oil transfer pumps and fuel to operate them are stored in the FLEX Storage Building, and are used to pump the fuel oil out of the NMP2 Emergency Diesel Generator Fuel Oil Storage Tanks into the trailer-mounted refueling tanks. The transfer pumps have been tested on-site and provide over 31 gpm flowrate (1860 GPH). The pump capacity of the deployment tank pump/nozzle is approximately 20 gpm (1200 GPH). These delivery rates are well above the full load usage rate of all FLEX Phase 2 portable equipment.

Assuming a portable FLEX refuel tank pump out rate of 20 gpm, and a FLEX fuel oil transfer pump fill rate of 30 gpm, one cycle of filling the FLEX refuel tank and discharging its contents is approximately 44 minutes (0.75 hours) excluding travel time and setup. There will be a total of four (4) fill-and-distribute evolutions to refuel all portable FLEX equipment assuming one (1) for each FLEX generator and one (1) for each 'set' of two FLEX pumps at each unit for a total refuel evolution time of 360 minutes (6 hours). This bounds the consumption rates identified above, and provides significant conservatism to be able to continue portable equipment refueling without challenging the transfer rates or running out of fuel on any piece of Phase 2 portable FLEX equipment. The total refueling cycle should take less than 6 hours with one truck and tank performing FLEX refueling duty. In order to refuel the FLEX pumps and generators before they reach a level of 20% fuel tank capacity, the refueling effort should start at approximately 10 hours into the event. The FLEX air compressor used for NMP2 FLEX will need refueling commencing 6 hours after placing the compressor into service.

2.10 Offsite Resources

2.10.1 National SAFER Response Center

The industry has established two (2) National SAFER Response Centers (NSRCs) to support utilities during BDB events. Nine Mile Point has established contracts and issued purchase orders to Pooled Inventory Management (for participation in the establishment and support of two (2) National SAFER Response Centers (NSRC) through the Strategic Alliance for FLEX Emergency Response (SAFER). Each NSRC will hold five (5) sets of equipment, four (4) of which will be able to be fully deployed when requested. The fifth set will have equipment in a maintenance cycle. In addition, on-site BDB/FLEX equipment hoses 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. For Nine Mile Point the local assembly area is the Syracuse Hancock International Airport. From there, equipment can be taken to the Nine Mile Point site and staged at Staging Area 'B' by helicopter if ground transportation is unavailable or inhibited. Communications will be established between the Nine Mile Point site and the SAFER team via satellite phones and required equipment moved to the site as needed. First arriving equipment will be delivered to the site within 24 hours from the initial request. The order at which equipment is delivered is identified in the Nine Mile Point SAFER Response Plan documented in procedure CC-NM-118-1001 (Reference 42).

2.10.2 Equipment List

The equipment stored and maintained at the NSRC for transportation to the NMP Staging Area 'B' to support the response to a BDB external event at Nine Mile Point is listed in Table 5. Table 5 identifies the equipment that is specifically credited in the FLEX strategies for Nine Mile Point but also lists the equipment that will be available for backup/replacement should on-site equipment break down. Since all the equipment will be located at the NMP Staging Area 'B', the time needed for the replacement of a failed component will be minimal.

2.11 Habitability and Operations

2.11.1 Equipment Operating Conditions and Personnel Habitability

Following a BDB external event and subsequent ELAP/LUHS event at Nine Mile Point, 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 (BDBEE) resulting in an ELAP/LUHS. The primary concern with regard to ventilation is the heat buildup which occurs with the loss of forced ventilation in areas that continue to have heat loads. The effects of loss of HVAC in an extended loss of AC power event are being addressed for both equipment operability and habitability and have been incorporated in the FLEX strategies. The environmental conditions in the areas where the critical equipment, which is relied upon by the operators, and in the areas where operators will require access, has been evaluated via review of existing calculations and/or development of new calculations. These areas include: Primary Containment, Secondary Containment, Control Building (Control Room and Battery Rooms), and RCIC Pump Room. Equipment operability and habitability are confirmed for all the concerned areas. To protect station personnel from the adverse effects of performing FLEX related mitigation actions in thermally elevated environments, an evaluation (Reference 54) of the plant areas requiring access for mitigation actions was performed and compensatory actions or restrictions were identified and incorporated into procedures.

2.11.1.1 Primary Containment Equipment Operability

A MAAP computer model (Reference 45 – Calculation N2-2014-004) has been developed to determine the primary containment environmental conditions following an extended loss of AC power. The peak pressure and temperature during the ELAP with containment venting are as follows:

- Drywell: peak pressure: 45 psig and peak temperature: approximately 272°F
- Wetwell Pool: peak pressure: 45 psig and peak temperature: approximately 280°F.

The critical equipment that operators will rely on during an ELAP that is located in the primary containment are the RPV Safety Relief Valves. (SRV).The SRV's are operated via pneumatics supplied via solenoid operated valves. The SRV solenoid valves are solenoid coils (Eugen Seitz Model Type 6A39) mounted on the Eugen Seitz Model 1133 control valve assembly on the Dikkers Main Steam SRVs. Environmental Qualification Document Package 2EQDP-SOV011 establishes environmental qualification of the Eugen Seitz, A. G. Model Type 6A39 Solenoid Coil in accordance with the NMP EQ Program. The SRV solenoid coil qualifications contained in 2EQDP-SOV011 were compared to the results contained in MAAP report N2-2014-004. The highest Containment temperature modeled by MAAP report N2-2014-004 was approximately 272°F. SRV solenoid coil qualifications documented in 2EQDP-SOV011 (Reference 57), indicate that the solenoid coils would operate at temperature up to 355°F providing sufficient margin to the temperatures projected in the MAAP report.

There are no critical monitoring instruments required for the ELAP that are located in the primary containment.

2.11.1.2.Secondary Containment – Reactor Building

There are three major sources of heat in the Reactor Building following event onset: 1) RCIC operation, 2) Spent Fuel Pool decay heat, 3) Hardened Containment Vent System operation. The Spent Fuel Pool decay heat affects the upper elevations of the Reactor Building while RCIC and HCVS heat influences lower elevations. Actions have been proceduralized to mitigate Reactor Building heatup as a result of the ELAP. Per procedure N2-SOP-01 Section RA, the RCIC Room door is blocked open within the first two hours to mitigate RCIC Room heatup. Reactor Building passive ventilation actions as described in calculation ES-289 (Reference 39), and directed by N2-SOP-01 section SFP, within the first eight hours, block open designated doors from outside at ground level to allow outside air flow through the Reactor Building to the roof to provide natural convective cooling. Both actions reduce challenges to equipment and improve environmental conditions for habitability from heat produced by the three sources.

Equipment Functionality

A Reactor Building heat up calculation using a GOTHIC model (Calculation ES-289, Reference 39) has been performed to evaluate the environmental conditions in the Reactor Building, including pressurization of the refueling floor following an extended loss of AC power. The peak temperature at elevation 328', where the reliable wide range SFP water level instrumentation has been installed in accordance with the requirements of NRC Order EA-12-051, is determined to be 115°F, which is below the 176°F limiting temperature for the level sensing devices. The humidity is predicted to be 100%, which is also within the capability of the level sensing device. The FLEX strategy (including opening the door to release air/steam mixture) has incorporated these environmental conditions.

A list of critical instruments located in the Reactor Building that are relied on during the ELAP has been reviewed and found acceptable under the ELAP environmental condition. These instruments are located in the Reactor Building on elevations 328', 261', 215', and 175'. With the exception of the wide range SFP water level instruments discussed above, all transmitters located in the Reactor Building are qualified to at least 203 °F for 25 days per the respective instrument Environmental Qualification Document Package (Reference 68) in accordance with the NMP EQ Program. Suppression Pool instruments are qualified to 340 °F per Environmental Qualification Document Package (Reference 69) in accordance with the NMP EQ Program. Implementation of Reactor Building passive ventilation actions as described in calculation ES-289 and directed by N2-SOP-01 will limit Reactor Building temperatures below the refueling floor (elevation 353') to well below the qualification limits of the instruments.

An analysis for long term RCIC Pump Room temperatures (for equipment qualification and habitability) under ELAP conditions considering elevated Suppression Pool and Secondary Containment temperatures using GOTHIC computer code was performed to support the ELAP coping strategies (Reference 40). The analysis includes the effects of blocking open the RCIC Room door open within the first two hours to mitigate RCIC Room heatup. In addition, it evaluates the effect of Reactor Building passive ventilation actions within the first eight hours to block open designated doors from outside at ground level through the building to the Reactor Building roof in order to provide convective cooling to the Reactor Building.

The RCIC Room equipment has a 10-hour qualified life temperature at 175°F based on existing SBO calculation ES-268 (Reference 58). The GOTHIC model results indicates that the temperature in the RCIC pump room does not exceed 175°F until 12 hours into the event when considering the heat absorption capability of the RCIC Room concrete floor and walls. With anticipatory Primary Containment venting to control Suppression Pool water temperature rise, RCIC has been evaluated to support operation for up to 15 hours with Suppression Pool temperature of less than 250°F (Reference 40).

Habitability

The temperature at the refueling floor is predicted to be below 120 °F during the first 17 hours into the ELAP event (Reference 39. Access to the refueling floor to deploy FLEX equipment will be limited to the first 16 hours of the ELAP event due to the Spent Fuel heatup. Procedure N2-SOP-01directs Spent Fuel Pool makeup and spray hoses deployed within 7 hours following event onset as a backup measure to ensure makeup hoses are ready to support Spent Fuel Pool makeup prior to environmental conditions on the refueling floor precluding access.

The RCIC room will become uninhabitable at 8 hours without anticipatory venting and 11 hours with anticipatory venting due to possibility of boiling water on the floor. Personnel access to the RCIC Room is possible for up to 9 hours from RCIC start using personal protective equipment as room temperature approaches and subsequently exceeds 120°F.

2.11.1.3 Control Building

Equipment Functionality

Procedural direction is provided in Station Blackout/ELAP procedure N2-SOP-01 (Reference 12) to secure heat producing equipment (such as the Process Computer) which are not necessary within the first hour and to block open Control Room and Relay Room access doors and panels for additional cooling within the first 30 minutes when normal ventilation is lost. Existing SBO Calculation ES-198 (Reference 23) was reviewed and determined to bound a 72-Hour ELAP event. Therefore, the operability of the components in the Main Control Room and Computer and Relay Room are not impacted. When selected electrical loads in the Control Room are restored following the deployment of the FLEX Generator in Phase 2, one of the Control Room air conditioning fans (2HVC*ACU1A or 2HVC*ACU1B) may be restored. Outside air (1500 CFM) will also be available through either the Division I or Division II Special Filter Train (2HVC*FN2A or 2HVC*FN2B) to provide air circulation and makeup air from outside. These fan loads are within the FLEX generator load capability (Reference 50).

Battery Room Station Blackout Calculation ES-198 (Reference 23) determined that after 8 hours the safety related Battery Room ambient temperature reaches 99°F. After 8 hours the calculation indicates that if cooling to the room is not restored, the temperature will continue to trend upwards very slowly at a rate of <0.5°F/hr. The battery vendor manual states that the normal battery operating temperatures are between 60°F and 90°F. Batteries operated in high ambient temperatures will result in reduced life over longer durations. However, the effect of slightly higher ambient temperatures on the battery life for this limited duration in the first 8 hour is negligible. Additionally, the capacity of the battery will increase as room temperature increases.

Phase 2 of the NMP2 FLEX strategy will re-power a safety related battery charger from a FLEX generator within 12 hours of event onset. In addition, the FLEX strategy (Reference 29) also requires restoration of the power to Battery Room exhaust fans (2HVC*FN4A or 2HVC*FN4B) to remove hydrogen gases and replenish Battery Room air volume. Therefore, the temperature in the Battery Room after 8 hours into the event will be maintained below 104°F per Calculation HVC-064 (Reference 32) with a maximum outdoor ambient design temperature of 93°F. As such, the effect of slightly higher than vendor recommended normal battery operating temperature during the ELAP is negligible.

Station battery coping evaluations performed in response to an ELAP assumed a minimum battery temperature of 65°F (Calculation EC-203, Reference 49). At NMP2, the Battery Rooms are not susceptible to a significant cool down following an ELAP event. The Battery Rooms are located within the Control Building at ground Elevation 261 and the Battery Room walls are not exposed to the outside weather conditions. Therefore, low temperature is not expected to be a concern since the Battery Rooms are enclosed in the Control Building. A simple calculation concludes that the minimum temperature in the Control Building/Battery Room would not decrease below 65°F for a winter outdoor temperature of -10°F until approximately 22 hours. This is well after the 12-hour duration that the batteries are relied upon during Phase 1 of an ELAP scenario.

Habitability

Procedural direction is provided in Station Blackout/ELAP procedure N2-SOP-01 (Reference 12) to secure heat producing equipment (such as the Process Computer) which are not necessary within the first hour and to block open Control Room and Relay Room access doors and panels for additional cooling within the first 30 minutes when normal ventilation is lost. Since the maximum temperature in the Main Control Room is 100 °F, per existing SBO calculation (ES-198) which bounds a 72-hour ELAP event, the Control Room habitability is not a concern. If necessary following the deployment of the FLEX Generator and re-energization of a 600 VAC switchgear to recover loads, such as Control Room lighting, one of the Control Room air conditioning fans (2HVC*ACU1A or 2HVC*ACU1B) may be restored. Outside air (1500 CFM) will also be available through either the Division I or Division II Special Filter Train (2HVC*FN2A or 2HVC*FN2B) to provide air circulation and makeup air from outside. All of the fans described above are identified as supported equipment in Calculation EC-206, 600VAC FLEX Phase II Portable 450kW Diesel Generator Sizing Calculation (Reference 50), and are within the generator load capability.

2.11.2 Foul Weather Gear

Nine Mile Point has on-hand thirty (30) sets of cold weather garments (coats, boots, and gloves) and thirty (30) sets of rain gear, in various sizes, for responders to wear during foul weather conditions supporting outside FLEX deployment actions. Portable heaters and shelters are also available for deployment when outside actions during adverse weather conditions are needed for extended periods. All the foul weather equipment is stored in the FLEX Storage Building.

2.11.3 Heat Tracing

Most of the equipment used to support the FLEX strategies is stored in the FLEX Storage Building which is designed and protected from snow, ice, and extreme cold in accordance with NEI 12-06, and is temperature controlled. FLEX connection points are located inside qualified structures which are temperature controlled therefore heat tracing is not used or required. The FLEX dry hydrants are enclosed in a missile protection structure which contains a radiant heater to protect the pipes within from freezing when the hydrants are not in use. Equipment/tools needed to support making the connections are stored in areas immediately adjacent to the deployment connections. Major components for FLEX strategies such as tow vehicles and generators are provided with cold weather packages. FLEX pumps once deployed will be monitored for icing conditions with minimum flow lines provided to prevent freezing of hoses when flow is not required for make-up to the RPV or SFP. The FLEX manifold located in the Reactor Building track bay has an additional connection to allow water to flow from the FLEX pump, into the manifold and back out through valve 2BDB-V2. A hose attached at this location is to be routed back out of the Reactor Building and towards Lake Ontario. The purpose of this hose is to allow the FLEX pump to continue to operate and flow water during low or zero system demand in order to meet minimum pump flow requirements. This will also aid in freeze protection if operating in cold weather. In lieu of installing flow instrumentation to monitor FLEX Pump flow, the pump vendor manual explains that a temperature rise between the pump intake and discharge of greater than 18°F is indicative of low flow. The FLEX procedure requires temperature monitoring of the pump intake and discharge (via a handheld infrared temperature sensor, or similar instrument), or to keep the minimum flow line always open, and close as needed to provide required pressure and flow to the RPV and/or SFP.

2.12 Personnel Habitability

Personnel habitability was evaluated as in section 2.11 above 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, an evaluation of the tasks to be performed and the available lighting in the designated task areas 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, and component manipulations.

Battery powered (10CFR50 Appendix "R") emergency lights were determined to provide adequate lighting for all Primary FLEX connection points in the FLEX strategies including the illumination for all interior travel pathways needed to access the connection points. These emergency lights are designed and periodically tested to insure the battery pack will provide a minimum of eight (8) hours of lighting with no external AC power sources. This lighting may not be available following a seismic event.

Restoration of Control Building and Emergency Diesel Generator Room emergency lighting is performed in the Phase 2 FLEX strategies when the FLEX generator is deployed and placed into service. These additional loads have been evaluated in FLEX generator load calculation EC-206 (Reference 50) as acceptable.

Battery-powered portable hand lights have been provided for use by the Fire Brigade and other operations personnel required to achieve safe plant shutdown. A supply of flashlights, headlights, batteries and other lighting tools are routinely used by operators. Fire cabinet supplies including flashlights are provided in strategic storage locations throughout the site. These are checked per S-PM-004 on a periodic basis. There are two EOP tool boxes in the NMP2 Main Control Room containing 5 flashlights each, and the SBO tool box just outside the Main Control Room containing 22 flashlights, that are inventoried and tested quarterly per N2-PM-Q008.

There are no emergency lighting fixtures in the outside areas of the protected area to provide necessary lighting in those areas where portable FLEX equipment is to be deployed. The tow vehicles for the FLEX portable pump and generator carry hand held flash lights and head lamps that can be used while deploying the pump and hoses, generator and cables. In addition, the FLEX Storage Building contains a stock of eight (8) flashlights & batteries, four (4) head lamps and batteries, and twenty (20) battle lanterns (rated for 30 hours each) that are on constant charge, to further assist the staff responding to a BDB event during low light conditions.

For Phase 3, the NSRC is deploying portable lighting towers per the Nine Mile Point SAFER Response Plan. The deployment of six (6) 6 kW, 440,000 lumens, diesel-driven lighting towers from SAFER will support Nine Mile Point exterior lighting for equipment staging areas and FLEX deployment locations.

2.14 Communications

2.14.1 Onsite

Initial communication announcements to on-site personnel during a BDB external event will be via the NMP Plant Paging and Announcement systems which are battery backed-up. If the Plant Paging and Announcement system is not available for on-site communications, bull horns that are stored in the FLEX Storage Building, with spare batteries, will be used by designated on-site individuals for performing notification of site personnel.

Communication between operators in NMP2 Main Control Room (MCR) and FLEX deployment locations will utilize either the 450 MHz radios in the radio-to-radio or 'talk around' mode, or the installed sound powered phone system.

The primary strategy for on-site communications is utilization of hand-held portable 450 MHz radios using the radio-to-radio feature also known as 'talk-around' mode. There are twelve (12) radios in the NMP2 MCR and twelve (12) radios in the OSC/TSC. In addition, there are six (6) radios in each of the three (3)

Fire Brigade Storage cabinets. Forty eight (48) spare radio batteries on chargers are stored in the FLEX Storage Building to provide extended radio service time. Battery chargers for the radio equipment will be powered from the small portable generators that are stored in the FLEX Storage Building as needed during an ELAP/LUHS event.

The backup strategy for on-site communications uses Sound Powered Phones (SPP) between FLEX deployment locations and the Main Control Rooms. Five (5) SPP kits with headsets and cords to reach the local FLEX deployment location SPP jack and SPP kits for the MCR operators to use have been staged in plant storage boxes, FLEX deployment vehicles, and NMP2 MCR. Testing was performed to validate communication functionality via SPP system.

FLEX communication equipment is protected from hazards by storage in the FLEX Storage Building or designated in-plant storage boxes in buildings that meet the plant's design bases for the Safe Shutdown Earthquake (SSE). Portable communications equipment is inventoried and functional checked per station procedures S-PM-FLEX, S-PM-004, EP-NM-124-1001, and EP-NM-124-1002.

2.14.2 Offsite

Offsite communications will utilize portable iridium satellite phones staged in the NMP2 Main Control Room and Technical Support Center. There are four (4) portable satellite phones located in the TSC, one (1) located at the EOF, one (1) in NMP1 MCR, and one (1) in NMP2 MCR, all on chargers. Four (4) additional high capacity batteries and chargers are also at located the TSC. The EOF has an installed backup generator at the facility to support satellite phone battery chargers. Satellite phones in the TSC and MCR's will be charged from small portable generators that are stored in the FLEX Storage Building. Satellite phones are inventoried and functional checked per station procedure and EP-NM-124-1002.

2.15 Water Sources

NMP2 is located on the southeastern shore of Lake Ontario, which is the ultimate heat sink for the plant. Nine Mile Point has chosen to use Lake Ontario as the primary water source throughout the ELAP/LUHS event. This allows the FLEX strategy to position the FLEX pumps at a source that can provide make-up water to the RPV, Primary Containment, and Spent Fuel Pool that is unlimited. Refer to Table 3.

The EPRI Severe Accident Management Guidance Technical Basis Report (EPRI Report 1025295) Volume 2, Section DD states the following regarding the use of raw water:

> "The reactors are designed to have borated and demineralized water sources available to accomplish these objectives, but if the circumstances of the accident sequence dictate that these designed water sources are either exhausted or unavailable and cannot be made-up (replenished) sufficiently rapidly to remove the decay heat, the available water sources should be used immediately.
>
> The service water source would be an available source at every reactor site and there may be other water sources that are specific to a given site. These water sources may include dissolved (gases, salts and minerals) and materials that are not dissolved (trace concentrations of other fluids, as well as dirt or entrained materials). When these are the only choices available, these should be used without delay with the largest available water inventory being the preferred choice."

As indicated, when faced with the choice of injection of low quality water or no injection, the action will always be to inject low quality water. NMP2 EOPs require that injection sources be selected based on core and debris cooling requirements, reliability, resource requirements, effects on other severe accident response strategies, and the quality of the water source. If multiple systems are capable of fulfilling injection requirements, higher quality sources (lower dissolved or suspended solids) should be used if possible. Raw water sources should generally be used only as a last resort, since injection of low quality water could complicate recovery actions and entrained debris could accumulate in the RPV, obstructing internal flow paths. If other systems become available, injection lineups should be shifted to higher quality sources to minimize use of raw water. The FLEX water source is taken from the intake tunnel of the NMP2 Service Water system which draws from Lake Ontario. Water from Lake Ontario is of drinking water quality. Regular monitoring of the quality of water supplies drawn from Lake Ontario shows that water quality meets or exceeds public health standards for drinking supplies.

According to the FLEX pump vendor specification (Reference 43) the maximum solid debris size for the pump is 0.70 inches. Typically, a suction strainer is used to remove solids from the flow. However, a suction strainer will not be used in this configuration since there is reasonable justification provided below for assuming that debris of an adverse size will not be entrained in the flow path to the pump suction.

The suction of the FLEX pump is connected to dry hydrants which tap into the intake water tempering line located in the NMP2 Service Water system intake shaft upstream of the trash rakes at elevation 228 ft., 15 feet below the minimum lake level. The 16 inch tempering line is normally used during winter operating conditions to divert up to 5000 gpm of main condenser cooling water into the intake shaft when incoming lake water temperature is less than 38°F. The tempering line is perforated with holes approximately 1 inch in diameter arranged in two rows of 40 holes each for a total of 80 holes. One row is in the horizontal plane, the other row 30 degrees upward from the horizontal plane.

FLEX pumps will be deployed within 4 hours of the ELAP event onset. During the deployment time, all flow in the intake tunnels will have stopped allowing any entrapped debris or suspended solids to float to the surface or settle to the bottom of the intake shaft. At the required FLEX pump flow rates, intake water will be flowing at a very low velocity (maximum of 500 gpm = 0.014 ft/sec) such that it is not expected that significant debris will be carried into the area where the FLEX pump will be taking a suction.

The alternate staging area for the FLEX pump and suction hose may be used from the west side of the Screenwell Building in the event the north side Screenwell Building area is not accessible. The FLEX pump suction hose will then be installed in an opening upstream of the intake trash rakes. The 6 inch suction hose will then be routed from the FLEX pump suction to the Service Water System intake bay where water will be drawn through a strainer to limit solid debris. The cross sectional area through this strainer is large compared to the cross sectional area of the suction hose such that pressure losses are expected to be negligible. Should debris block a portion of the inlet strainer, there will still be enough flow area to prevent significant pressure loss that would jeopardize the NPSH at the pump suction. Particulate small enough to pass through the inlet strainer will also pass through the FLEX pumps without adverse impact. The suction end of the barrel strainer will be located below the low level elevation of the lake at least 4 feet below the water surface (marked line on suction hose), but well above the floor of the intake tunnel, preventing any debris that may have settled on the bottom of the tunnel to be lifted into the suction hose.

The source and discharge point of all the cooling water required by NMP2 is Lake Ontario. Six pumps supply water to the Service Water system (USAR Section 9.2.1, Reference 11). Two identical intake structures are located approximately 950 and 1,050 ft from the existing shoreline. The structures are located at lake bottom contour, el 223.5 ft. A minimum water depth of approximately 10 ft over the structures, as recommended by the U.S. Corps of Engineers and the U.S. Coast Guard, is provided during the navigational season when the mean low water elevation is 244 ft. The structures are hexagonal in shape with a 22.5-ft width between opposite faces. The structures include a 4.5-ft bottom sill to limit the amount of sediment entering the structure, six intake openings each 7.5 ft wide by 3.0 ft high, and a 1.6-ft thick roof. The total area of the 12 openings, 6 on each structure, is designed to provide a maximum approach velocity of 0.5 ft/sec while drawing water through both structures. The 12 openings are equipped with vertical bar racks with a 10-in clear spacing between the bars, which prevents large debris from entering the intake system.

Each structure is independently connected to the onshore Screenwell by a 4.5-ft diameter concrete intake encasement. The encasements are located within two 13 1/2 by 13 ft shotcreted tunnels. Tunnel 1 (the west tunnel) contains electrical conduits and has a cross-sectional area to accommodate plant discharge flow with a minimum of 60 sq ft. Tunnel 2 (the east tunnel) contains a 3.5-ft diameter fiberglass fish return pipe and electrical conduits for the heating elements in the bar racks in addition to the encased intake pipe. Both tunnels and the intake pipes are sloped downward toward the shoreline at a minimum of 0.01 ft/ft.

The design maximum service water flow is 52,461 gpm, yielding the maximum velocity of 3 ft/sec. As stated above, the maximum velocity from the FLEX pumps at 500 gpm is 0.014 ft/sec, which is 0.47% of the maximum. There is not sufficient flow velocity to allow debris floating on the top surface of the water or debris that has settled to the bottom of the intake tunnel to be drawn up into the tempering line holes. Likewise, with the expected flow of no more than 400 gpm (with a maximum of 500 gpm as stated above) compared to the design flow rates, and the design of the sand trap, no suspended solids are expected to make it to the RPV.

The NMP2 ELAP injection point utilizing FLEX pumps is into one of the residual heat removal (RHR) systems (either A or B). The injection into the RPV will be through the RHR LPCI injection line, which discharges directly inside the core shroud just below the upper grid. If debris blockage of the fuel assembly inlets were to occur, which is not expected due to the water quality, water will flood the bypass region and ultimately spill over into the fuel assemblies. This is based on BWROG report, BWROG-TP-15-007 (Reference 55).

This report states "BWR fuel can be adequately cooled when the core inlet is postulated to be fully blocked from debris injected with the makeup coolant. The fuel is effectively cooled when the inside shroud is flooded, and this is accomplished by either injecting makeup coolant inside the shroud or by maintaining the water level above the steam separator return elevation if injecting make-up in the downcomer." This report also references an analysis performed for Byron and Braidwood for steam generator fouling. In the worst case, the evaluations determined that a deposition of ~6 cubic feet of debris occurs in a 72 hour period in a steam generator.

The resulting heat transfer degradation from the effective reduction in U-tube surface area from deposited solids and the buildup of scale caused by the boil off of raw water was calculated to be 5.8% of rated heat transfer capability. This level of degradation is well below the threshold at which heat transfer capability is effectively lost for the decay heat load that exists at the point in time post shutdown that the heat transfer degradation occurs. Applying these results to a BWR reactor vessel which has a greater volume and more heat transfer surface area associated with the fuel cladding would imply that the results would be on a similar order of magnitude in that significant degradation in heat transfer capability is not anticipated. This will ensure cooling for at least 72 hours after commencing injection from the UHS. During this time, Nine Mile Point will develop recovery methods that will utilize a clean source of water. The recovery methods would include transition back to the reactor water grade sources, arranging for clean water sources, or other methods to filter water prior to injecting into the core.

2.16 Shutdown and Refueling Analysis

Nine Mile Point Nuclear Station will follow the guidance provided by the Nuclear Energy Institute (NEI) position paper titled "Shutdown/Refueling Modes" (Reference 36) addressing mitigating strategies in shutdown and refueling modes. This position paper is dated September 18, 2013 and has been endorsed by the NRC staff (Reference 37) and incorporated into Exelon procedure OU-AA-103, Shutdown Safety Management Program.

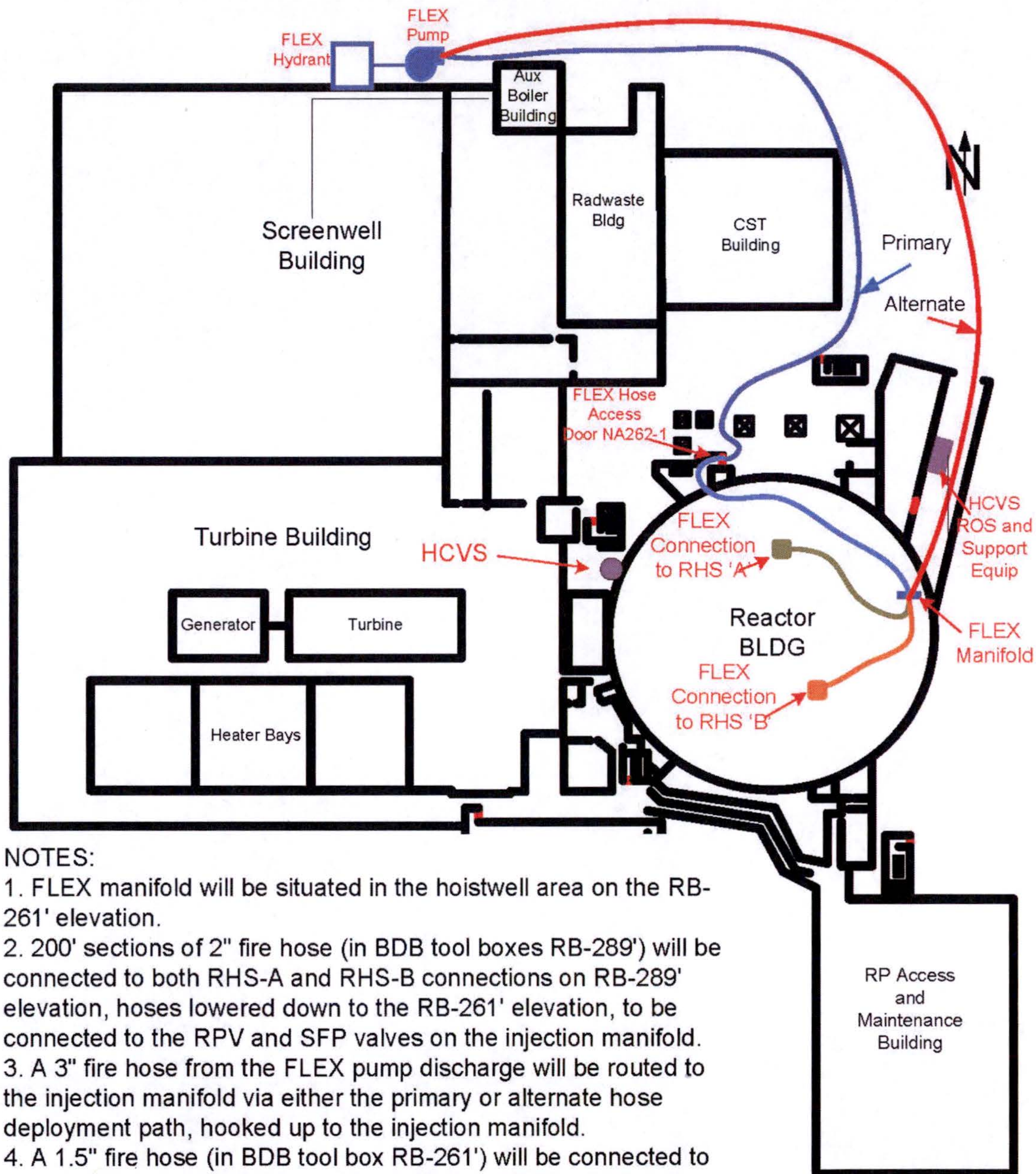
For planned outages and early in an unplanned outage, an outage risk profile is developed per Exelon Shutdown Safety Management Program, OU-AA-103. This risk assessment is updated on a daily bases and as changes are made to the outage schedule. Contingency actions are developed for high risk evolutions and the time needed for such evolutions is minimized. During the outage additional resources are available on site and during the high risk evolutions individuals are assigned specific response actions (e.g. response team assigned to close the containment equipment hatch). The risk assessment accounts for, among other things, environmental conditions and the condition of the grid. In order to effectively manage risk and maintain safety during outages, Nine Mile Point Nuclear Station develops contingencies to address the conditions and response actions for a loss of cooling. These contingencies not only direct actions to minimize the likelihood for a loss of cooling but also direct the actions to be taken to respond to such an event. Nine Mile Point has procedures in place to determine the time to boil for all conditions during shutdown periods.

The FLEX strategies for Cold Shutdown are the same as those for Power Operation, Startup, and Hot Shutdown. If an ELAP/LUHS event occurs during Cold Shutdown, water in the Reactor Pressure Vessel (RPV) will heat up. During the heat up when reactor coolant temperature reaches 212°F, the Safety Relief Valves (SRV) are manually cycled as directed by station procedure N2-EOP-RPV, RPV Control, to control heatup and pressurization. FLEX portable pumps are immediately deployed and connected for injection to provide core cooling.

When in Refueling mode with the RPV head removed, many variables exist which may impact the ability to cool the core. In the event of an ELAP/LUHS event during this condition, installed plant systems cannot be relied upon to cool the core; therefore transition to FLEX Phase 2 will begin immediately and is directed by N2-SOP-01, Station Blackout/ELAP. All efforts will be made to expeditiously provide core cooling and minimize heat-up. To accommodate the activities of vessel disassembly and refueling, water levels in the reactor vessel and the reactor cavity are often changed. The most limiting condition is the case in which the reactor head is removed and water level in the vessel is at or below the reactor vessel flange. If an ELAP/LUHS event occurs during this condition then (depending on the time after shutdown) boiling in the core may occur quite rapidly. Again, deployment and implementation of portable FLEX pumps to supply injection flow must commence immediately from the time of the event. This should be plausible because more personnel are on site during outages to provide the necessary resources. Strategies for makeup water may include special FLEX deployment briefings, just in time training or deployment walkthroughs, tabletop discussions of mitigation strategies, or actual deployment of FLEX equipment (pump/generator) to make it ready. It should be noted that pre-deployment (i.e.: FLEX equipment in deployment location immediately ready to support the key safety function) of equipment exposes it to the very external hazards that it is intended to be protected from in order to provide prompt response capability for a beyond design basis external event. If pre-deployment is selected as a contingency to mitigate high risk conditions during an outage, the "+1" equipment will be used first and the "N" equipment will remain protected. In addition, guidance (station postings/signage and markings) per procedure CC-NM-118-101 Beyond Design Basis Administrative Controls, has been provided to ensure that travel paths are available for deployment and that deployment areas remain accessible without interference from outage related equipment.

Figure 4

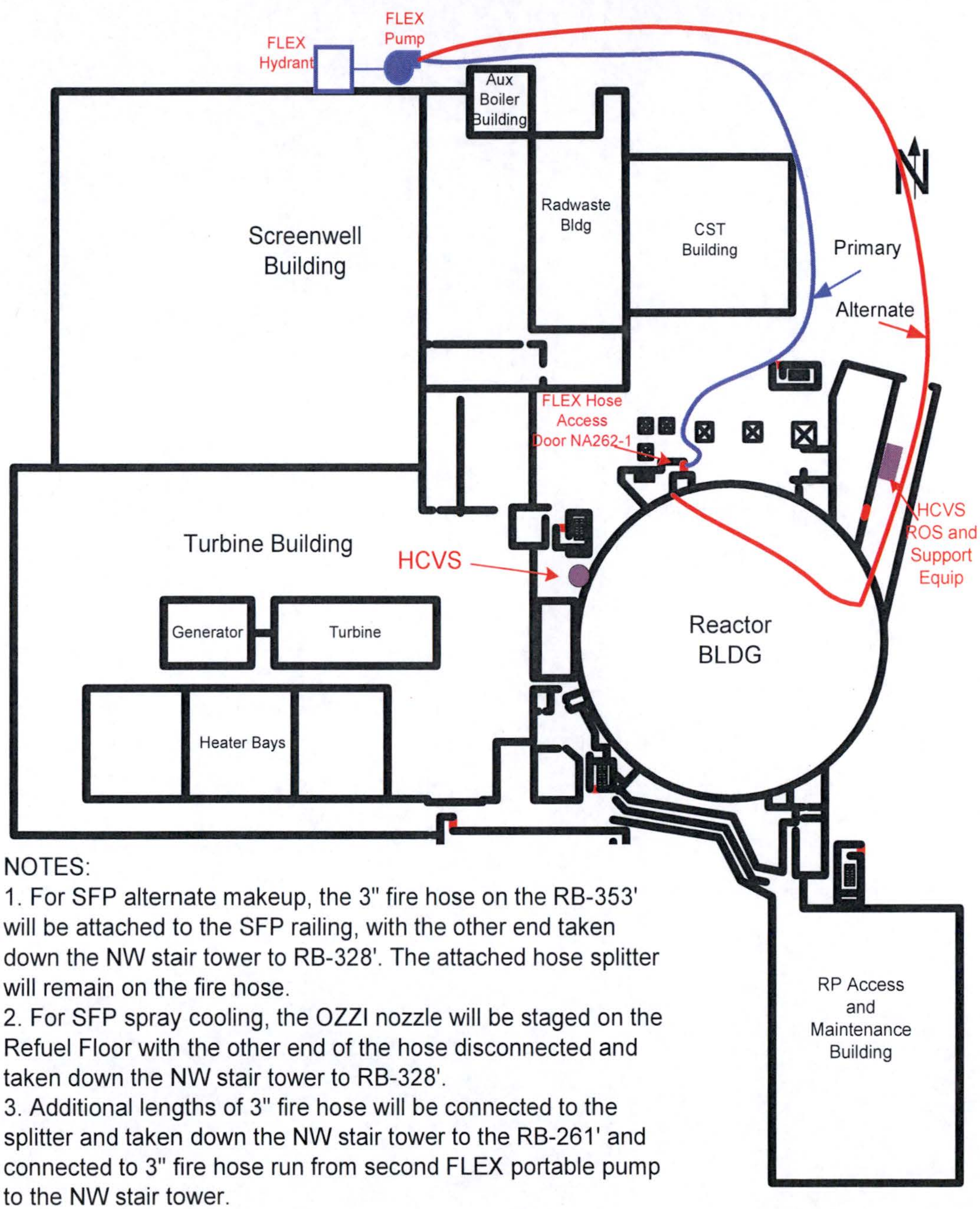
RPV/SFP Makeup Hose Deployment Options



NOTES:
1. FLEX manifold will be situated in the hoistwell area on the RB-261' elevation.
2. 200' sections of 2" fire hose (in BDB tool boxes RB-289') will be connected to both RHS-A and RHS-B connections on RB-289' elevation, hoses lowered down to the RB-261' elevation, to be connected to the RPV and SFP valves on the injection manifold.
3. A 3" fire hose from the FLEX pump discharge will be routed to the injection manifold via either the primary or alternate hose deployment path, hooked up to the injection manifold.
4. A 1.5" fire hose (in BDB tool box RB-261') will be connected to the injection manifold and routed outside the RB for min flow/freeze protection purposes.

Figure 5

SFP Alternate Makeup and Spray Cooling Hose Deployment Options



NOTES:

1. For SFP alternate makeup, the 3" fire hose on the RB-353' will be attached to the SFP railing, with the other end taken down the NW stair tower to RB-328'. The attached hose splitter will remain on the fire hose.
2. For SFP spray cooling, the OZZI nozzle will be staged on the Refuel Floor with the other end of the hose disconnected and taken down the NW stair tower to RB-328'.
3. Additional lengths of 3" fire hose will be connected to the splitter and taken down the NW stair tower to the RB-261' and connected to 3" fire hose run from second FLEX portable pump to the NW stair tower.

Figure 6

RPV and SFP Makeup Connections – Primary

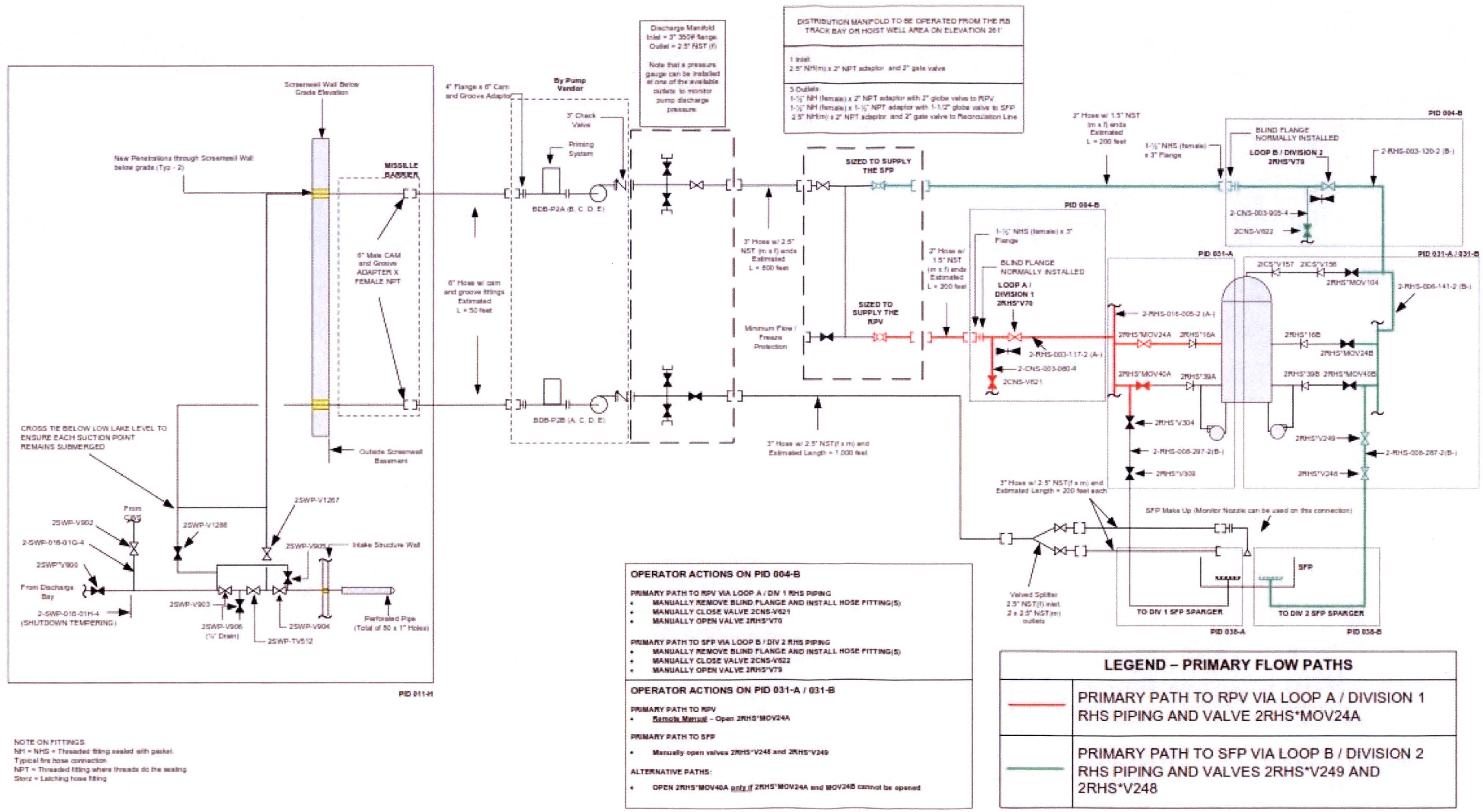


Figure 7

RPV and SFP Makeup Connections – Secondary and Alternate

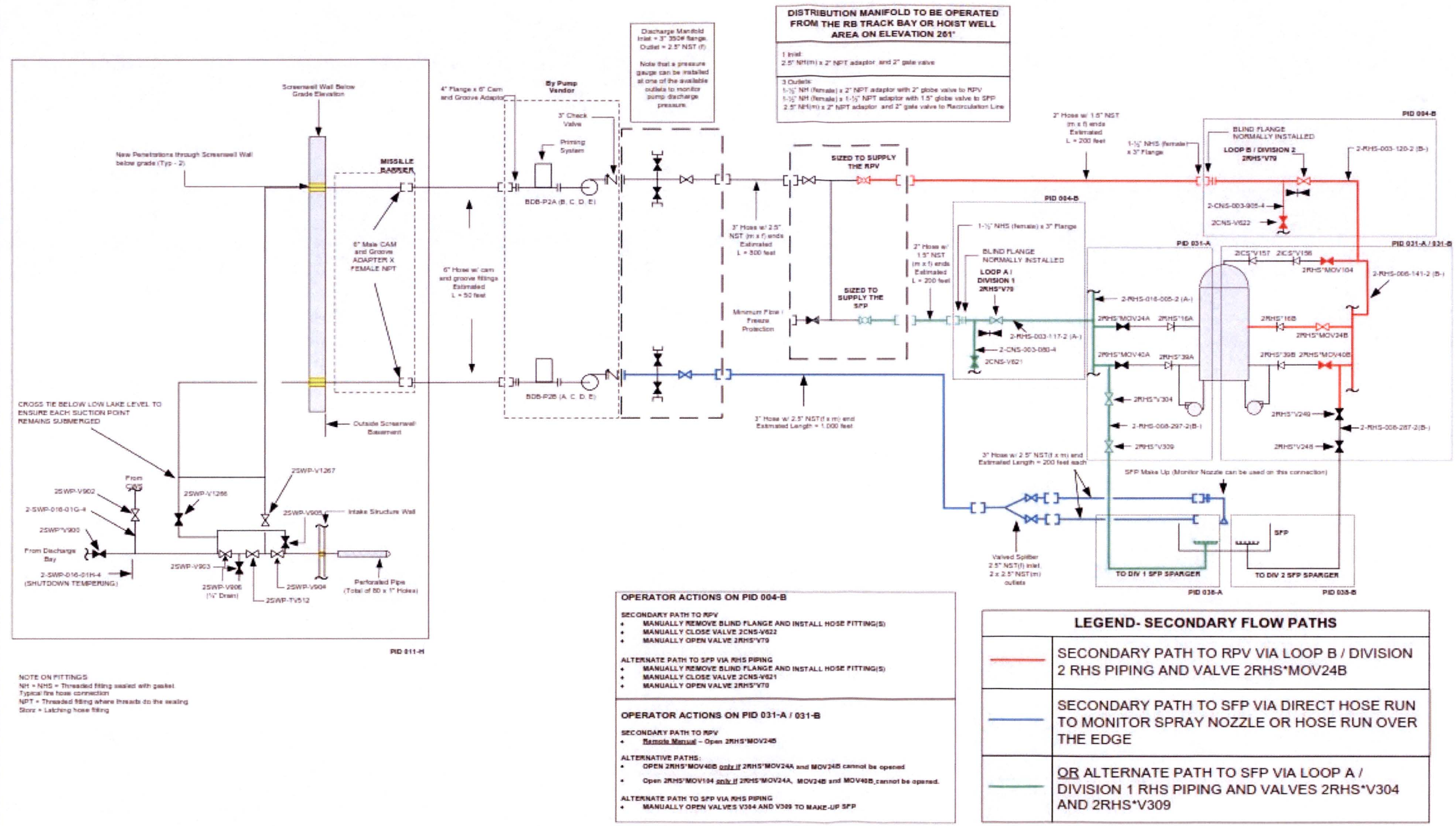


Figure 8

Electrical Connections – Primary and Alternate

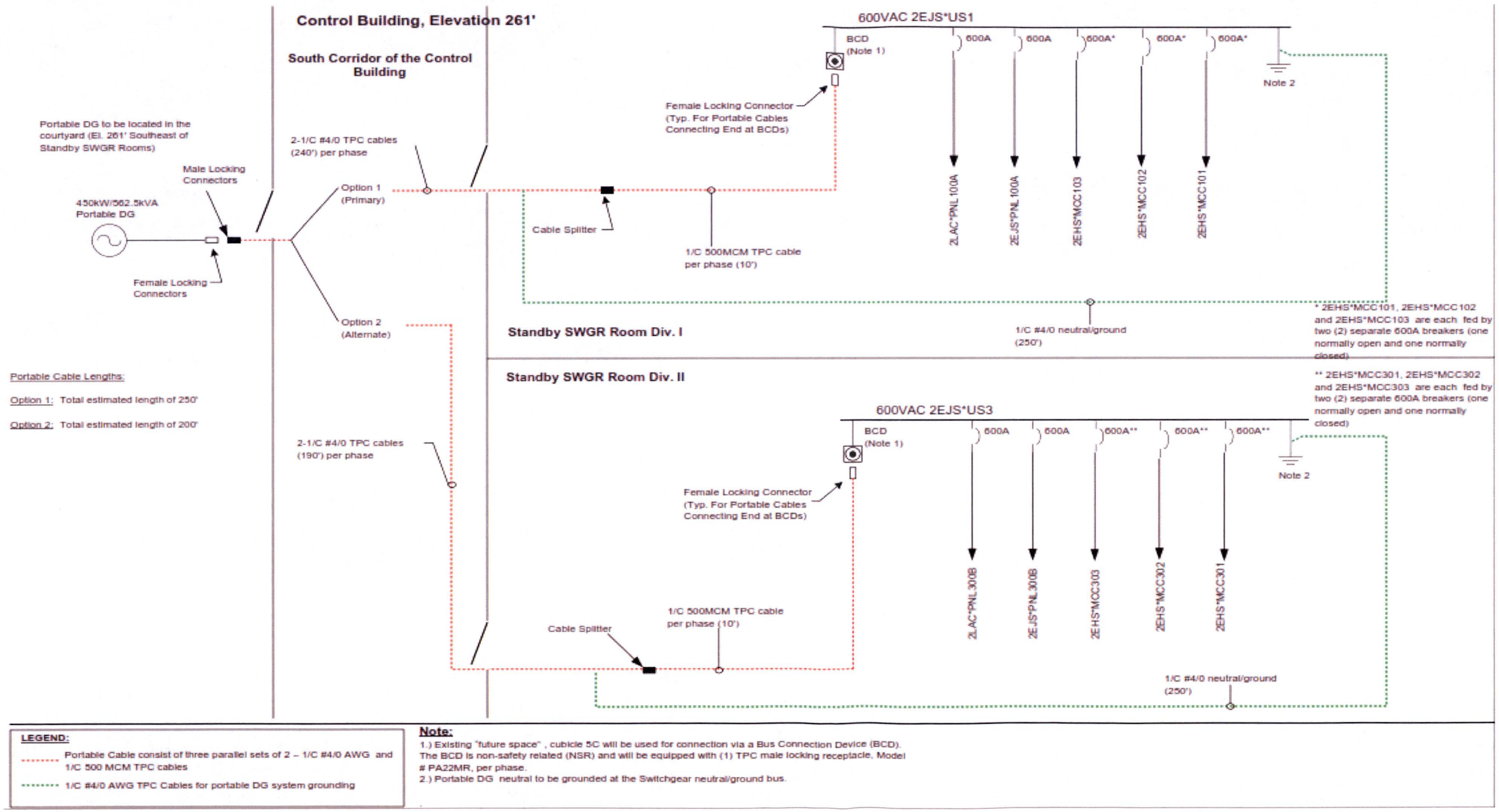
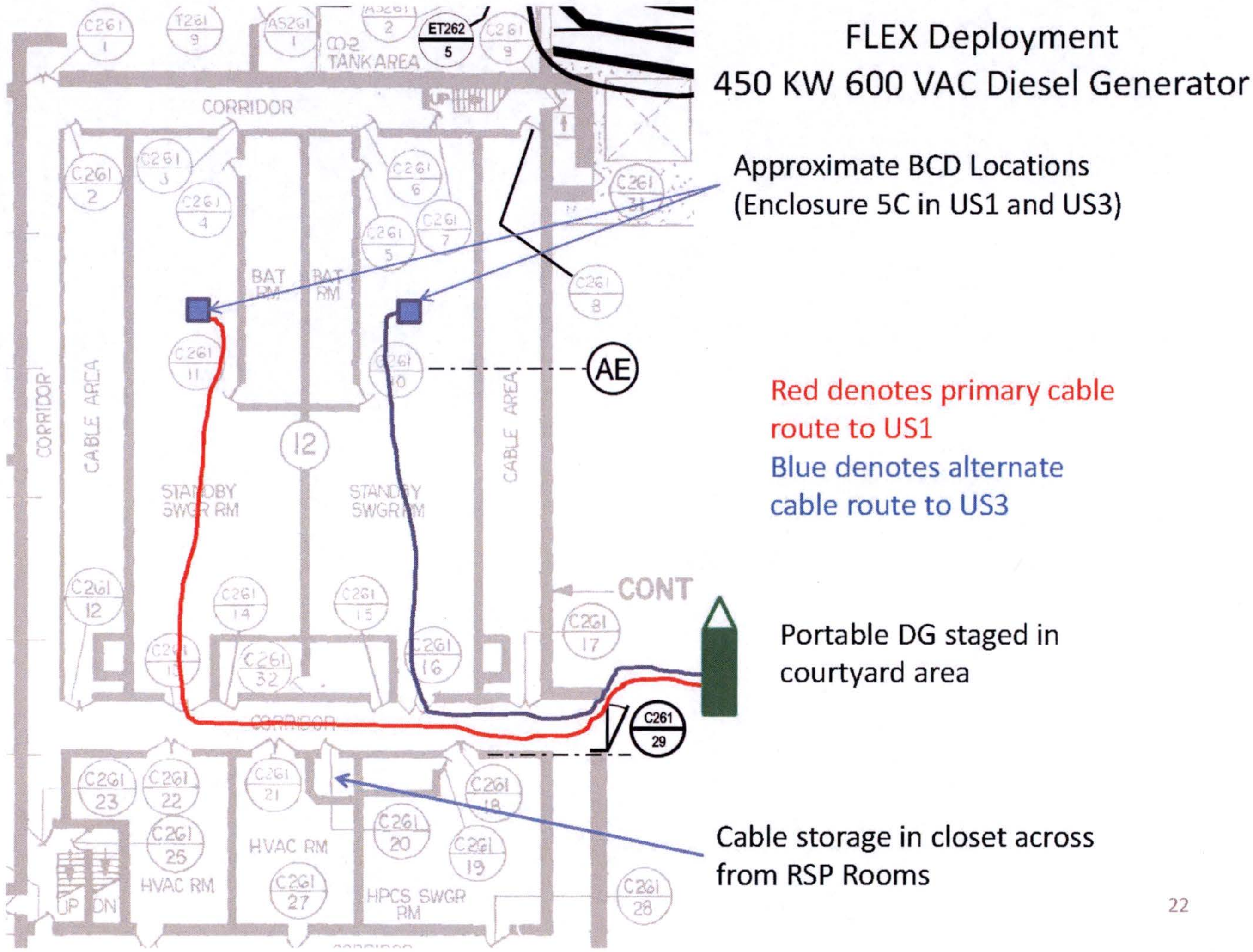


Figure 9

Electrical Deployment – Primary and Alternate



2.17 Sequence of Events

The Table 1 below presents a Sequence of Events (SOE) Timeline for an ELAP/LUHS event at NMP2. Validation of each of the Flex time constraint actions has been completed in accordance with the Flex Validation Process document issued by NEI (Reference 27) and includes consideration for staffing. Time to clear debris to allow equipment deployment is assumed to be up to 2 hours. This time is considered to be reasonable based on site reviews of the deployment paths and the location of the FLEX Storage Building. Debris removal equipment is stored in the FLEX Storage Building.

Table 1: Sequence of Events Timeline

Action Item	Elapsed Time	Action	FLEX Time Constraint Y/N	Remarks/Applicability
	0	Event Starts	N/A	Plant scram / no AC Power, SBO event response required
1	15 sec	Enter N2-SOP-101C Reactor Scram procedure	N	Reactor Operator (RO) Immediate Actions
2	1-2 min.	Enter N2-SOP-01 Station Blackout/ELAP	Y Level A	Within **2 min** Unit Supervisor (US) enters and remains in the procedure for the duration of the SBO/ELAP
3	1-2 min.	Enter EOPs	N/A	US action that occurs in parallel with Reactor Scram and SBO/ELAP procedures
4	1-10 min.	Dispatch Equipment Operator (EO) for debris removal IAW N2-DRP-FLEX-MECH	Y Level A	Directed by US upon entry in N2-SOP-01. Need to clear NMP2 pump deployment area in **1 hour** - continues for 2 hours total.

Action Item	Elapsed Time	Action	FLEX Time Constraint Y/N	Remarks/Applicability
5	1-2 min.	Direct actions to shut down plant process computer IAW N2-SOP-02	Y Level A	US directs actions, to be completed within **60 minutes**
6	2-5 min.	Direct actions for DC load shed IAW N2-SOP-02	Y Level A	Within **5 minutes** US directs DC load shed. Control Building heat load shed completed within **1 hour** of ELAP declaration; Lighting load shed completed within **2 hours** of ELAP declaration; Safety-related load shed completed within **4 hours** of ELAP declaration
7	2-5 min.	Direct bypassing RCIC isolations IAW N2-SOP-02, Att. 4	Y Level A	US directs bypassing all RCIC isolations within **5 minutes** of T=0
8	3-8 min.	Perform actions for bypassing RCIC isolations IAW N2-SOP-02, Att. 4	Y Level A	RO bypasses RCIC isolations from MCR within **15 minutes** of T=0
9	10-15 min.	Direct actions for FLEX portable pump deployment for RPV/SFP makeup IAW N2-DRP-FLEX-MECH	Y Level A	Pump deployed within **1 hour**

Action Item	Elapsed Time	Action	FLEX Time Constraint Y/N	Remarks/Applicability
10	30 min.	Direct actions for FLEX diesel generator deployment IAW N2-DRP-FLEX-ELEC	Y Level A	Diesel generator deployed within **3 hours**
11	2-60 min.	Perform actions for Plant Process Computer shutdown, IAW N2-SOP-02, Att. 1	Y Level A	EO performs actions to shut down plant computers within **1 hour** to address heat and electrical load concerns
12	10-60 min.	Perform actions for DC load shed IAW N2-SOP-02, Att. 3, Step 3.1	Y Level A	EO performs load shed for Control Building within **1 hour** to conserve SR battery power and reduce Control Building heat loads.
13	45-60 min.	Notify NSRC that SAFER equipment deployment should begin	N/A	SM notification to Nuclear Duty Officer (NDO) to contact SAFER for deployment of FLEX Phase 3 equipment to NMP. (FLEX Phase 1 and 2 actions not dependent on this notification.) SBO coping time is 4 hrs. Determination of ELAP event will occur within **4 hours** of T=0
14	15 min. to 2 hrs.	Perform actions for reducing lighting loads IAW N2-SOP-2, Att. 3, Step 3.2	Y Level A	EO performs actions to reduce lighting loads and conserve NSR battery power within **2 hours.**

Action Item	Elapsed Time	Action	FLEX Time Constraint Y/N	Remarks/Applicability
15	2-4 hrs.	Perform actions for load reduction IAW N2-SOP-2, Att. 3, Step 3.3	Y Level A	EO performs load shed within **4 hours** to conserve SR battery power and set up for portable generator connection
16A (B)(C)	15 min. to 1 hr.	Perform actions to deploy first FLEX pump for RPV/SFP makeup	Y Level A	Pump deployment is within **1 hour** of T=0. Deployment pathway debris removal occurs in parallel within first hour. Preferred hose pathway is through door NA262-1; alternate path is through RB Track Bay. Alternate suction source is directly from intake in Screenwell building if dry hydrants not available.
17A (B)	30 min. to 3 hrs.	Perform actions to deploy portable diesel generator to charge Div. 1 Battery Charger	Y Level A	Deployment of portable diesel generator begins within **3 hours** of T=0. With load shed, Div. 1 Battery can support required loads for **12 hours** without a charger. Portable diesel generator will connect into power supply for preferred Div. 1 (or Div. 2) battery charger and other 600V loads.

Action Item	Elapsed Time	Action	FLEX Time Constraint Y/N	Remarks/Applicability
18	5-7 hrs.	Perform actions for Refuel floor hose deployment IAW N2-SOP-02, Att. 11	Y Level A	Deployment of 3 inch hoses completed by **7 hours** following event initiation. RB 353' elevation is projected to rise to ~120°F in about 15 hours.
19A (B)	5-8 hrs.	Perform actions to implement Reactor Building Passive Cooling and Ventilation	Y Level A	Within **8 hours** of T=0 for habitability of Operators. Doors on RB 261' opened when RPV/SFP makeup hose deployed to RB hoist well area. Other doors on Refuel Floor and stair towers can be opened during refuel floor hose deployment.
20	6 hrs.	Augmented Staff arrive on Site	N/A	Reference NEI 12-01
21A (B)	8 hrs.	Perform actions to deploy second FLEX pump to dry hydrant for Alternate SFP Makeup - Preferred or Alternate Hose Path	Y Level A (B)	Alternate suction source is directly from intake in Screenwell building if dry hydrants not available.

Action Item	Elapsed Time	Action	FLEX Time Constraint Y/N	Remarks/Applicability
22	10 hrs.	Perform actions to refuel Portable Equipment	Y Level B	Refueling portable diesel equipment begins at ~**10 hours** from T=0, evaluation supports refueling cycle completed within 6 hours of start, using two EOs with one truck and 528 gallon fuel cube on trailer filled from on-site storage tanks
23	12-14 hrs.	Perform actions to deploy FLEX portable air compressor to repressurize 2IAS*TK4(5) via Emergency Truck Fill Connection	Y Level B	Given proximity of connections, it would take same amount of time for demonstrating repressurization of tank 5 therefore there is no need to duplicate the task.

2.18 Programmatic Elements

2.18.1 Overall Program Document

NMP procedure CC-NM-118 (Reference 14) provides a description of the Diverse and Flexible Coping Strategies (FLEX) Program for Nine Mile Point Nuclear Station. This procedure implements Exelon fleet program document CC-AA-118 which contains governing criteria and detailed requirements. The key elements of the program include:

- Summary of the NMP FLEX strategies
- Maintenance of the FSGs including any impacts on the interfacing procedures (EOPs, OPs, SOPs, etc.)
- Maintenance and testing of FLEX equipment (i.e., SFP level instrumentation, emergency communications equipment, portable FLEX equipment, FLEX support equipment, and FLEX support vehicles)
- Portable equipment deployment routes, staging areas, and connections to existing mechanical and electrical systems
- Validation of time sensitive operator actions (TSAs)

- The FLEX Storage Building and the National SAFER Response Center
- Supporting evaluations, calculations, and FLEX drawings
- Tracking of commitments and FLEX equipment unavailability
- Staffing and Training
- Configuration Management
- Program Maintenance

The instructions required to implement the various elements of the FLEX Program at NMP2 and thereby ensure readiness in the event of a Beyond Design Basis External Event are contained in Exelon fleet program document CC-AA-118, Diverse and Flexible Coping Strategies (FLEX) and Spent Fuel Pool Instrumentation Program Document.

Existing design control procedures CC-AA-102, Design Input and Configuration Change Impact Screening (Reference 67), has been revised to ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies.

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

2.18.2 Procedural Guidance

The inability to predict actual plant conditions that require the use of BDB equipment makes it impossible to provide specific procedural guidance. As such, the FSGs provide guidance that can be employed for a variety of conditions. Clear criteria for entry into FSGs will ensure that FLEX strategies are used only as directed, and are not used inappropriately in lieu of existing procedures. When FLEX equipment is needed to supplement EOPs or Abnormal Procedures (SOPs) strategies, the EOP or SOP, Severe Accident Mitigation Guidelines (SAMGs), or Extreme Damage Mitigation Guidelines (EDGMs) will direct entry into and exit from the appropriate FSG procedure.

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

Procedural interfaces have been incorporated into N2-SOP-01, Station Blackout/ELAP, 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:

- N2-SOP-02, Station Blackout/ Extended Loss of AC Power Support Procedure
- N2-SOP-78A,EOP Key Parameter-Alternate Instrumentation
- N2-OP-102, Meteorological Monitoring

Changes to FSGs are controlled by Exelon fleet procedure AD-AA-101, Processing of Procedures and T&RMs (Reference 33). FSG changes will be reviewed and validated by the involved groups to the extent necessary to ensure the strategy remains feasible. Validation for existing FSGs has been accomplished in accordance with the guidelines provided in NEI APC14-17, FLEX Validation Process, issued July 18, 2014 (Reference 27).

2.18.3 Staffing

Using the methodology of NEI 12-01, Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities, an assessment of the capability of NMP2 on-shift staff and augmented Emergency Response Organization (ERO) to respond to a Beyond Design Basis External Event (BDBEE) was performed. The results were provided to the NRC in a letter dated December 4, 2015 (Reference 35).

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

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

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

NMP2 Operations personnel conducted a table-top review of the on-shift response to the postulated BDBEE and extended loss of AC power for the Initial and Transition Phases using the FLEX mitigating strategies. Resources needed to perform initial event response actions were identified from the Emergency Operating Procedures (EOPs) and Special Operating Procedures (SOPs). 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.

This Phase 2 Staffing Assessment concluded that the current minimum on-shift staffing as defined in the Emergency Response Plan for NMP2, as augmented by site auxiliary personnel, is sufficient to support the implementation of the FLEX strategies on Unit 2, as well as the required Emergency Plan actions, with no unacceptable collateral duties.

The Phase 2 Staffing Assessment also identified the staffing necessary to support the Expanded Response Capability for the BDBEE as defined for the Phase 2 staffing assessment. This staffing will be provided by the current Nine Mile Point site resources, supplemented by Exelon fleet resources, as necessary.

2.18.4 Training

Nine Mile Point's Nuclear Training Program has been revised to assure personnel proficiency in the mitigation of BDB external events is adequate and maintained. These programs and controls were developed and have been implemented in accordance with the Systematic Approach to Training (SAT) Process (References 19, 20, 21).

Using the SAT process, Job and Task analyses were completed for the new tasks identified as applicable to the FLEX Mitigation Strategies. Based on the analysis, training for Operations was designed, developed and implemented for Operations continuing training. "ANSI/ANS 3.5, Nuclear Power Plant Simulators for use in Operator Training" certification of simulator fidelity is considered to be sufficient for the initial stages of the BDB external event scenario training. Full scope simulator models have not been explicitly upgraded to accommodate FLEX training or drills. Overview training on FLEX Phase 3 and associated equipment from the SAFER NSRCs was also provided to NMP2 Operators. Upon SAFER equipment deployment and connection in an event, turnover and familiarization training on each piece of SAFER equipment will be provided to station operators by the SAFER deployment/operating staff.

Initial 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 mitigation strategies for BDB external events have received the necessary training to ensure familiarity with the associated tasks, considering available job aids, instructions, and mitigating strategy time constraints.

Where appropriate, integrated FLEX drills will be organized on a team or crew basis and conducted periodically; with all time-sensitive actions to be evaluated over a period of not more than eight years. It is not required to connect/operate temporary/permanently installed equipment during these drills.

2.18.5 Equipment List

The equipment stored and maintained at the Nine Mile Point FLEX Storage Building and various pre-staged locations at NMP2 necessary for the implementation of the FLEX strategies in response to a BDB external event at NMP are listed in Table 4. Table 4 identifies the quantity, applicable strategy, and capacity/rating for the major BDB/FLEX equipment components only, as well as, various clarifying notes. Details regarding fittings, tools, hose lengths, consumable supplies, etc. are not in Table 4, but are detailed in S-PM-FLEX, FLEX Equipment Inventories and Checklists.

2.18.6 Equipment Maintenance and Testing

Periodic testing and preventative maintenance of the BDB/FLEX equipment conforms to the guidance provided in INPO AP-913 (See Table 2). A fleet procedure has been developed to address Preventative Maintenance (PM) using EPRI templates or manufacturer provided information/recommendations, equipment testing, and the unavailability of equipment.

EPRI has completed and has issued "Preventive Maintenance Basis for FLEX Equipment – Project Overview Report" (Reference 25). Preventative Maintenance Templates for the major FLEX equipment including the portable diesel pumps and generators have also been issued.

The PM Templates include activities such as:

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

The EPRI PM Templates for FLEX equipment conform to the guidance of NEI 12-06 providing assurance that stored or pre-staged FLEX equipment are being properly maintained and tested. EPRI Templates are used for equipment where applicable. However, in those cases where EPRI templates were not available, Preventative Maintenance (PM) actions were developed based on manufacturer provided information/recommendations and Exelon fleet procedure ER-AA-200, Preventive Maintenance Program. Detailed information on FLEX and FLEX support equipment PM's is contained in FLEX program document CC-NM-118 (Reference 14).

The unavailability of FLEX equipment and applicable connections that directly perform a FLEX mitigation strategy for core, containment, and SFP is controlled and managed per Nine Mile Point procedure CC-NM-118-101 (Reference 59), Beyond Design Basis Administrative Controls, such that risk to mitigating strategy capability is minimized. The guidance in this procedure 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

FLEX support equipment is defined as equipment not required to directly support maintenance of the key safety functions. There are no requirements specified in NEI12-06 for unavailability time for any of the FLEX support equipment. This equipment is important to the successful Implementation of the NMP2 FLEX strategy and Exelon Generation Company (EGC) requires establishment of an unavailability time (Reference 24).

- One or more pieces of FLEX support equipment available but not in its evaluated configuration for protection restore protection within 90 days
- One or more pieces of FLEX support equipment is unavailable, restore the equipment to available within 45 days AND implement compensatory measures for the lost function within 72 hours

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

1. Identified equipment deficiencies shall be entered into the Corrective Action Program (CAP).
2. Equipment deficiencies that would prevent FLEX equipment from performing the intended function shall be worked under the station priority list in accordance with the work management process.
3. Equipment that cannot perform its intended functions shall be declared unavailable. Unavailability **shall** be tracked per CC-NM-118-101, Beyond Design Basis Administrative Controls, utilizing the electronic Equipment Status Log (ESL).

Table 2: NMP2 FLEX Equipment Test and Maintenance Overview							
Equipment[1]	**Quantity**	**Weekly**	**Quarterly**	**6 Month**	**Annual**	**3 Year**	**Notes**
Diesel Pump 3419MX	3	Walk down		Functional Test and Inspection (Dry Run) per S-PM-001			Performance Test, Inspection and PM (Wet Run) once per cycle per S-PM-005
Diesel Generator (Cummins 450 kW)	2	Walk down		Functional Test and Inspection (Unloaded Run)	Performance Test, Inspection and PM (30% Loaded Run)	Performance Test, Inspection and PM (100% Loaded Run)	
Air Compressor	2	Walk down		Functional Test and Inspection			S-PM-002
Cables	Stored in Plant and FLEX Building				Visual Inspection and assessment		Replace every 20 years or test and justify extension/life
Hoses	Stored in Plant and FLEX Building				Visual Inspection and assessment		Replace every 10 years

Table 3 – Water Sources

Water sources and associated piping that fully meet ALL BDB hazards, i.e., are FLEX qualified

Water Sources	Usable Volume (Gallons)	Applicable Hazard					Time Based on Decay Heat	Cum. Time Based on Decay Heat
		Satisfies Seismic	Satisfies Flooding	Satisfies High Winds	Satisfies Low Temp	Satisfies High Temp		
Water from Lake Ontario via FLEX pump (Phase 2&3)	Unlimited - up to 50,000 gpm flowrate	Y	Y	Y	Y	Y	Indef.	Indef.

Table 4 – BWR Portable Equipment Stored On-Site at NMP

Use and (Potential / Flexibility) Diverse Uses						Performance Criteria
List Portable Equipment	Core	Containment	SFP	Instrumentation	Accessibility	
FLEX diesel-driven pumps (5) [3,4] and associated hoses and fittings	X	X	X			341 gpm @ 245 psig, Supports core, containment and SFP cooling
FLEX generators (3) [4] and associated cables, connectors	X	X		X		450 kW, 600 VAC, Supports instrumentation and controls
FLEX Air Compressor (2) [2], and associated air hoses	X	X		X		375 CFM, Support pneumatic supply to SRVs
Tow vehicles (3)	X	X	X		X	Support large FLEX equipment deployment

Table 4 – BWR Portable Equipment Stored On-Site at NMP						
Use and (Potential / Flexibility) Diverse Uses						**Performance Criteria**
List Portable Equipment	Core	Containment	SFP	Instrumentation	Accessibility	
Payloader (1) [1]					X	Debris Removal of deployment paths
Fuel trailer (2) with 528 gal. tank and pump	X	X	X	X	X	Support adding fuel to diesel engine driven FLEX equipment
Fuel transfer pumps (2)[1]	X	X	X	X	X	Support adding fuel to diesel engine driven FLEX equipment
Communications equipment [1] (SPP, spare radio batteries and chargers, handheld satellite phones)	X	X	X	X	X	Support on-site and off-site communications

Table 4 – BWR Portable Equipment Stored On-Site at NMP						
Use and (Potential / Flexibility) Diverse Uses						
List Portable Equipment	Core	Containment	SFP	Instrumentation	Accessibility	**Performance Criteria**
Communications small portable generators (6)[1] and associated and associated extension cords and power strips	X	X	X	X	X	9 kW, 120 VAC, Support communication equipment
Misc. debris removal equipment[1] (demolition saw, chain saw, axe, tow chains)					X	Support FLEX deployment
Misc. Support Equipment[1] (hand tools, flashlights & batteries, jumper cables, foul weather gear, battle lanterns, TruFuel gasoline, extension cords, power strips, spill kits, rope)					X	Support FLEX deployment

Table 4 – BWR Portable Equipment Stored On-Site at NMP
NOTES: 1. Support equipment. Not required to meet N+1. 2. FLEX Air Compressor is for NMP2 FLEX strategies only. 3. One FLEX pump is needed to implement the FLEX spray SFP cooling strategies at NMP1 and one FLEX pump is needed to implement the FLEX spray SFP cooling strategies at NMP2. 4. The +1 pump and generator are shared by NMP1 and NMP2.

Table 5 – BWR Portable Equipment From NSRC

	Use and (Potential / Flexibility) Diverse Uses								Performance Criteria		Notes
List Portable Equipment	Quantity Req'd /Unit	Quantity Provided / Unit	Power	Core Cooling	Cont. Cooling/ Integrity	Access	Instrumentation.	RCS Inventory			
Medium Voltage Generators	0	2	Jet Turb.	X	X		X		4.16 kV	1 MW	(1)
Low Voltage Generators	1	1	Jet Turb	X	X		X		480VAC	1100 KW	(1)
High Pressure Injection Pump	0	1	Diesel					X	2000psi	60 GPM	(1)
SG / RPV Makeup Pump	1	1	Diesel	X	X			X	500 psi	500 GPM	(1)
Low Pressure / Medium Flow Pump	1	1	Diesel	X	X			X	300 psi	2500 GPM	(1)

Table 5 – BWR Portable Equipment From NSRC

Use and (Potential / Flexibility) Diverse Uses									Performance Criteria		Notes
List Portable Equipment	**Quantity Req'd /Unit**	**Quantity Provided / Unit**	**Power**	**Core Cooling**	**Cont. Cooling/ Integrity**	**Access**	**Instrumentation.**	**RCS Inventory**			
Low Pressure / High Flow Pump	0	1	Diesel	X	X			X	150 psi	5000 GPM	(1)
Lighting Towers	3	3	Diesel			X				440,000 Lu	(1)
Diesel Fuel Transfer	1	1	AC/DC	X	X	X	X	X	30 GPM AC, 20 GPM DC	500 Gal	(1)
Suction Booster Lift Pump	2	2	Diesel	X	X			X	26 Feet Lift	5000 GPM	(2)
Low Voltage Step-Up Transformer	1	1	N/A	X	X		X		480 VAC to 600 VAC	1375 KVA	(3)

Note 1 - NSRC Generic Equipment – Not required for Phase 2 FLEX Strategy – Provided as Defense-in-Depth.
Note 2 - NSRC Non-Generic Equipment needed to support use of NSRC Generic pumps due to suction lift requirements using Lake Ontario as source of make-up water – Not required for Phase 2 FLEX Strategy – Provided as Defense-in-Depth
Note 3 - NSRC Non-Generic Equipment Needed to support use of NSRC Low Voltage Generator at NMP – Not required for Phase 2 FLEX Strategy – Provided as Defense-in-Depth

References

1) NRC Order EA-12-049, Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, March 12, 2012
2) NRC Order EA-12-051, Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, March 12, 2012
3) 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, August 29, 2012
4) NRC Interim Staff Guidance JLD-ISG-2012-03, Compliance with Order EA-12-051., Reliable Spent Fuel Pool Instrumentation, Revision 0, August 29, 2012
5) NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, August 2012
6) NEI 12-02, Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation", Revision 1, August 2012
7) NEI 12-01, Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities, Revision 0, April 2012
8) NRC Order 13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions, June 6, 2013
9) NRC Interim Staff Guidance JLD-ISG-2013-02, Revision 0, Compliance with Order EA-13-109 Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions , November 14, 2013
10) NEI 13-02, Industry Guidance for Compliance with NRC Order EA-13-109, BWR Mark I & II Reliable Hardened Vents Capable of Operation Under Severe Accident Conditions, Revision 1, April 2015
11) Nine Mile Point Unit 2 Updated Safety Analysis Report, Revision 21, October 2014
12) N2-SOP-01, Station Blackout/Extended Loss of AC Power, Revision 01400, May 2016
13) N2-SOP-02, Station Blackout/Extended Loss of AC Power Support Procedure, Revision 1100.00, May 2016
14) CC-NM-118, Site Implementation of Diverse and Flexible Strategies (FLEX) and Spent Fuel Pool Instrumentation Program, Revision 001, May 2016
15) Task Interface Agreement (TIA) 2004-04, "Acceptability of Proceduralized Departures from Technical Specification (TSs) Requirements at the Surry Power Station", (TAC Nos. MC42331 and MC4332), dated September 12, 2006, ADAMS Accession No. ML060590273
16) NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Revision 01, August 1991
17) N2-SOP-78A, EOP Key Parameters--Alternate Instrumentation, Revision 1.00, May 2016

References (cont'd)

18) Nine Mile Point Unit 2 Technical Specifications
19) TQ-AA-1, Systematic Approach to Training Process Description, Revision 004, July 2015
20) CNG-TR-1.01-1031, Emergency Response Training Program, Revision 00200, April 2015
21) TQ-AA-150, Operator Training Programs, Revision 013, March 2016
22) Calculation A10.1-J-045 Core Offload Starting 48 Hours After Reactor Shutdown – Refueling Outages & Emergency Core Offload, Revision 01.00, April 2004
23) Calculation ES-198, Control Building Station Blackout Analysis, Revision 01.00, November 1985
24) Exelon Position Paper EXC-WP-12, Required Actions for FLEX Support Equipment, Revision 0, January 2015
25) EPRI Preventive Maintenance Basis for FLEX Equipment – Project Overview Report, Report #3002000623, September 2013
26) Seismic Hazard and Screening Report (CEUS Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, FLL 14-013, March 2014
27) NEI APC14-17, FLEX Validation Process, July 2014
28) N2-DRP-FLEX-MECH, Emergency Damage Repair – BDB/FLEX Pump Deployment Strategy, Revision 00100.00, May 2016
29) N2-DRP-FLEX-ELEC, Emergency Damage Repair – BDB/FLEX Generator Deployment Strategy, Revision 00000.00, May 2016
30) S-DRP-OPS-004, Refueling Diesel Portable Equipment, Revision 0101, May 2015
31) Nine Mile Point Nuclear Station Unit 1, Final Safety Analysis Report Updated, Revision 24, March 2016
32) CalculationHVC-064, Heat Gain & Cooling Requirement for Standby Switchgear Room Control Building Elevation 261 Foot 6 Inch, Revision 03.00, July 1996
33) AD-AA-101, Processing of Procedures and T&RMs, Revision 027, December 2014
34) Calculation ES-266, NMP2 Station Blackout – Reactor Vessel and Primary Containment Response, Revision 02.00, August 2006
35) Response to March 12, 2012, Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations of the Near Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, Enclosure 5, Recommendation 9.3, Emergency Preparedness – Staffing, Requested Information Items 1, 2, and 6 - Phase 2 Staffing Assessment, RS-15-271, December 2015

References (cont'd)

36) NEI Position Paper Shutdown and Refueling: ADAMS Accession No. ML13273A514
37) NRC Endorsement of NEI Shutdown and Refueling paper: ADAMS Accession No. ML13267A382
38) Nine Mile Point Flood Hazard Reevaluation Report (FHRR), ADAMS Accession No. ML130740943
39) Calculation ES-289 NMP2 Reactor Building Thermal Response Following an Extended Loss of AC Power, Revision 01.00, April 2016
40) Calculation 2015-01099 RCIC Equipment Survivability Review, Revision 01.00, May 2016
41) Nine Mile Point Engineering Change Package ECP-13-001069, 60' x 140' Robust FLEX Storage Building
42) CC-NM-118-1001, Nine Mile Point SAFER Response Plan, Revision 000, March 2015
43) Calculation A10.1-A-016, NMP2 Hydraulic Analysis of NMP2 FLEX Water makeup to the RPV and SFP, Revision 00, May 2016
44) NMP FLEX Position Paper, NMP-WP-01 BDBEE Debris Removal for NMP Station, Revision 01, March 2016
45) N2-2014-004, MAAP 4.0.6 Analysis of Nine Mile Point Unit 2 Loss of All AC Power Scenario with Successful FLEX Short Term - Cases 1F19a, 1F20a, and , Revision 3, May 2016
46) Nine Mile Point Engineering Change Package ECP-13-001035, Unit 2 FLEX RPV and SFP Make-up Water Piping
47) Nine Mile Point Engineering Change Package ECP-13-001068, Unit 2 FLEX Fukushima FLEX Phase 2 Electrical Generator Connections
48) Engineering Change Package ECP-15-000607, NMP2 Cycle 16 Core Reload Design Change Package
49) Calculation EC-203, Battery 2BYS*BAT2A AND 2BYS*BAT2B Load Shed Coping Time for ELAP Event, Revision 00, July 2014
50) Calculation EC-206, 600 VAC FLEX Phase II Portable 450kW Diesel Generator Sizing Calculation, Revision 00, May 2016
51) ECP-13-000087, NMP2 Reliable Hardened Containment Vent System, Revision 05, May 2016
52) Engineering Change Package ECP-13-000652, Fukushima Spent Fuel Pool Level Monitoring System
53) NEI Letter dated August 27, 2013, "Subject: EA-12-049 Mitigating Strategies Resolution of Extended Battery Duty Cycles Generic concern", ML13241A182

References (cont'd)

54) NMP FLEX Position Paper, NMP-WP-08, Heat Stress Mitigation for Personnel Required to Carry Out FLEX Strategy During an ELAP, April 2016
55) BWROG TP-15-007, Raw Water Issue: Heat Transfer Capability, Revision 0, June 2015
56) N2-OSP-LOG-D001, Daily Checks Log, Revision 2100.00, October 2015
57) Environmental Qualification Document Package 2EQDP-SOV011, Eugen Seitz A.G. Solenoid Coil Type 6A39, Revision 01.00, May 2012
58) Calculation ES-268 Station Blackout Reactor Core Isolation Cooling Pump Turbine Room, Revision 00.00, May 1993
59) CC-NM-118-101 Beyond Design Basis Administrative Controls, Revision 002, May 2016
60) USNRC Letter dated October 27, 2015: Final Determination of Licensee Seismic Probabilistic Risk Assessments under the request for Information pursuant to Title 10 of the Code of Federal Regulations 50.54(f) regarding Recommendation 2.1 "Seismic" of the Near-Term Task Force review of Insights from Fukushima Dai-Ichi Accident
61) NEI Letter, Request for NRC Endorsement of High Frequency Program: Application Guidance for Functional Confirmation and Fragility evaluation (EPRI 3002004396), dated July 30, 2015 (ML 15223A100/ML15223A102)
62) NRC Letter, September 17, 2015 to NEI: Endorsement of Electric Power Research Institute Final Draft Report 3002004396: High Frequency Program: Application Guidance for Functional Confirmation and Fragility (ML15218A569)
63) NEI 12-06 (Rev. 2), December 2015: Diverse and Flexible Coping Strategies (FLEX) Implementation Guide
64) NEI 16-05, Rev. 0, External Flooding Integrated Assessment Guidelines, April 2016
65) USNRC Document JDL-ISG-2016-01: Guidance for Activities Related to Near-Term Task Force Recommendation 2.1, Flooding Hazard Reevaluation; Focused Evaluation and Integrated Assessment
66) N2-OP-102, Meteorological Monitoring, Revision 1800.00, April 2016
67) CC-AA-102, Design Input and Configuration Change Impact Screening, Revision 29
68) Equipment Qualification Document Package 2EQDP-XMTR001, Rosemount Transmitter 1153 Series B, Revision 05.00, September 2015
69) Equipment Qualification Document Package 2EQDP-TE003, Pyco Inc. Temperature Elements Model Number 102-3171, 102-9039, and 122-7039 Series, Revision 01.00, May 2012
70) Calculation S0-FLEX-F001, NMP1 FLEX Hydraulic Flow Evaluation, Revision 00, April 2015