Entergy

Entergy Nuclear Operations, Inc.
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Robert G. Smith, P.E.
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February 28, 2013

U.S. Nuclear Regulatory Commission
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SUBJECT: Overall Integrated Plan in Response To March 12, 2012, Commission Order Modifying Licenses With Regard To Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)

Pilgrim Nuclear Power Station
Docket No. 50-293
License No. DPR-35

REFERENCES:

1. NRC Order Number EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events", dated March 12, 2012 (PNPS Letter 1.12.013)
2. NRC Interim Staff Guidance JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events", Revision 0, dated August 29, 2012 (ML 12229A174)
3. Nuclear Energy Institute (NEI) NEI 12-06, Revision 0, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide", dated August 2012
4. Pilgrim Nuclear Power Station Letter to NRC, "Initial Status Report in Response to March 12, 2012, Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)", dated October 29, 2012 (PNPS Letter 2.12.072)

LETTER NUMBER 2.13.012

Dear Sir or Madam:

On March 12, 2012, the Nuclear Regulatory Commission ("NRC" or "Commission") issued an order (Reference 1) to Entergy Nuclear Operations, Inc. (Entergy).

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Reference 1 was immediately effective and directs Entergy to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities in the event of a beyond-design-basis external event. Specific requirements are outlined in Attachment 2 of Reference 1.

Reference 1 requires submission of an Overall Integrated Plan by February 28, 2013. The NRC Interim Staff Guidance (Reference 2) was issued August 29, 2012 which endorses industry guidance document NEI 12-06, Revision 0 (Reference 3) with clarifications and exceptions identified in Reference 2. Reference 3 provides direction regarding the content of this Overall Integrated Plan. The purpose of this letter is to provide that Overall Integrated Plan pursuant to Section IV, Condition C.1, of Reference 1.

Reference 3, Section 13, contains submittal guidance for the Overall Integrated Plan. The enclosure to this letter provides Pilgrim Nuclear Power Station's (PNPS) Overall Integrated Plan pursuant to Reference 3.

Reference 4 provided the PNPS initial status report regarding Mitigation Strategies for Beyond-Design-Basis External Events, as required by Reference 1. PNPS has not yet identified any impediments to compliance with the Order, i.e. within two refueling cycles after submittal of the integrated plan, or December 31, 2016, whichever is earlier. Future status reports will be provided as required by Section IV, Condition C.2, of Reference 1 which will discuss any changes in compliance method, schedule, and any need for relief including basis.

Entergy and PNPS have performed in-depth reviews of the INPO 11-005 Special Report on the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station (w/Addendum) and other available studies of the events at the Fukushima Daiichi plants in Japan following the March 11, 2011 earthquake and tsunamis. As a result of this review, a "FLEX" Strategy has been developed that provides substantial new capabilities that are simple, robust, and independent, to the extent practicable, from permanent plant systems that may be affected by even the most unforeseen Beyond-Design-Basis-External-Events. These capabilities are focused on the principal and highest priority goal of maintaining core cooling and submergence under all conditions using the most reliable methods available that can be implemented under potentially severe environmental conditions with only on-site assets, and subsequently maintaining that capability indefinitely with additional off-site resources. It is our belief that the proposed PNPS FLEX Strategy addresses the serious shortcomings in the original response to the Fukushima events, and that these actions, if ever required, would preclude the occurrence of any core damage and the resulting serious complications from similar events that include an Extended Loss of AC Power together with a Loss of Ultimate Heat Sink and significant damage to plant systems.

This letter contains no new regulatory commitments. Should you have any questions concerning the content of this letter, please contact Mr. Joseph R. Lynch at (508) 830-8403.

I declare under penalty of perjury that the foregoing is true and correct; executed on February 28, 2013.

Sincerely,

Robert G. Smith
Site Vice President

RGS/rmb

Enclosure: Pilgrim Nuclear Power Station Overall Integrated Plan For Diverse and Flexible Coping Strategies (FLEX) for Requirements for Mitigation Strategies for Beyond-Design-Basis External Events

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NRC Resident Inspector
Pilgrim Nuclear Power Station

ENCLOSURE

To

PNPS Letter 2.13.012

PILGRIM NUCLEAR POWER STATION OVERALL INTEGRATED PLAN FOR DIVERSE AND FLEXIBLE COPING STRATEGIES (FLEX) FOR REQUIREMENTS FOR MITIGATION STRATEGIES FOR BEYOND-DESIGN-BASIS EXTERNAL EVENTS

General Integrated Plan Elements (BWR)

Determine Applicable Extreme External Hazard **Ref: NEI 12-06 section 4.0 -9.0** **JLD-ISG-2012-01 section 1.0**	*Input the hazards applicable to the site; seismic, external flood, high winds, snow, ice, cold, high temps.* *Describe how NEI 12-06 sections 5 – 9 were applied and the basis for why the plant screened out for certain hazards.*

The applicable external hazards for Pilgrim Nuclear Power Station (PNPS) are seismic, high wind, snow, ice, & extreme cold, and extreme high temperatures, as detailed below.

Seismic Hazard Assessment:

All sites will consider the seismic hazard according to NEI 12-06 (Reference 1) Section 5.2. From the PNPS FSAR (Reference 2) Section 2.5.3.3.2, the Safe Shutdown Earthquake (SSE) maximum horizontal ground acceleration is 0.15 g.

The possibility for soil liquefaction that could impede movement following a seismic event was evaluated according to FSAR Section 2.5.3.2. It was concluded that it is highly unlikely that liquefaction of the foundation material would occur under the postulated earthquake conditions at PNPS.

Thus, the PNPS site screens in for an assessment for seismic hazard except for liquefaction.

External Flood Hazard Assessment:

The PNPS Site general elevation of 23 ft above mean sea level (msl) places it in the category of "dry sites" according to NEI 12-06, Section 6.2.1, based on the following design basis flood level from FSAR Section 2.4.4.2, "Tide Levels".

Extreme Storm Tide = +13.5 ft msl

Extreme Low Tide = -10.1 ft msl

The datum relationship at the site is that msl is 4.8 ft above mean low water (mlw) level. It has been calculated that the 100 year storm could produce a still water level of +15.8 ft mlw. This is a combination of storm surge combined with astronomical high tide. The hydrometeorological section of the U.S. Weather Bureau has established a standard northeaster for New England. Using this storm, the peak storm surge, having a return frequency of 1,000 years, is 6.6 ft.

The concurrence of peak storm surge with an astronomical high tide of (+)11.7 ft mlw would give an extreme storm tide level of (+)18.3 ft mlw, such that +18.3 ft mlw = +13.5 ft msl, with a probability of occurrence of once every 4,000 yr. Additionally the climatological precipitation quantities in eastern Massachusetts show that the region does not have a wet or a dry season. Monthly averages vary from about 3 in to 4 1/2 inches at Plymouth. The maximum 24 hour rainfall is 6.88 inches from FSAR table 2.3-16. All Class I structures are designed for flood protection in the event of a maximum probable flood (Reference 2).

Therefore, because PNPS is built above the design basis flood level and is considered a "dry"

General Integrated Plan Elements (BWR)

site by the NEI 12-06, Section 6.2.1 guidance, PNPS is not required to evaluate flood-induced challenges.

Severe Storms with High Wind Hazard Assessment:

The PNPS design basis does not meet the NEI 12-06 definition of "sites with the potential to experience severe winds from hurricanes based on winds exceeding 130 mph." The applicable wind hazards are bounded by the tornado event. The maximum 5 Minute sustained wind speed is 87 mph due to the Hurricane of 1938 from FSAR Table 2.3-18.

Severe tornado activity in eastern Massachusetts is not common. The proximity to the ocean and the terrain in the vicinity of the site are unfavorable to severe tornado activity. The Tornado Design Criteria for PNPS is included in Appendix H of the FSAR and is summarized as follows:

Per the FSAR, the velocity components are applied as a 300 mph horizontal wind applied over the full height of the structure. The pressure differential is applied as a 3 psi positive (bursting) pressure occurring in 3 seconds. The missiles are applied, as follows:

- A 4 inch x 12 inch x 12 ft long wood plank (108 lb) traveling end-on at 300 mph over the full height of the structure.
- A 3 inch diameter Schedule 40 pipe 10 ft long traveling end-on at 100 mph over the full height of the structure.
- A passenger auto (4,000 lb) traveling end-on at 50 mph with a contact area of 20 ft2 and at a height not greater than 25 ft above ground.

The FLEX strategy will consider high winds and comply with the requirements of NEI 12-06 and ASCE 7-10 for structures that store FLEX equipment. PNPS is within the zone defined per NEI-12-06 where the tornado wind is established as 165 mph.

Snow, Ice and Extreme Cold Hazard Assessment:

The guidelines provided in NEI 12-06 (Section 8.2.1) determine that an assessment of extreme cold conditions must be performed for sites above the 35th parallel. PNPS is located above the 35th parallel; therefore, the effects of snow, ice, and extreme cold will be considered for the storage and deployment of FLEX equipment. The design bases winter outdoor condition is 10°F dry bulb, which corresponds to the 97.5% exceedance values for the site location with an extreme minimum of (-)14°F as described in FSAR Table 10.9-1. During the winter months of December, January, and February, there will be approximately 54 hours at or below the 97.5% value based on the ASHRAE design standards. The PNPS site historical lowest recorded temperature is also noted to be (-)14°F from FSAR Table 2.3-15. The PNPS historical low seawater temperature is 28°F from FSAR Figure 2.4-2. The maximum 24 hour snowfall is 16 inches from FSAR Table 2.3-17. As noted in FSAR 2.3.6 a few times each winter a weather situation favorable for ice glaze formation develops. The coastal location of the site reduces the likelihood of a glaze forming storm compared to nearby inland locations. During the period of record 1928 to 1936, the site area experienced between six and eight storms which deposited ice glaze 0.25 in thick or more.

General Integrated Plan Elements (BWR)

Extreme High Temperature Hazard Assessment:

All sites will address high temperatures in accordance with NEI 12-06 (Reference 1), Section 9.2. The design bases temperature for HVAC System design ambient temperature is 88°F from TDBD-110 (Reference 3), and this represents a standard 1% exceedance value with a short-term peak design temperature of 102°F as described in FSAR Table 10.9-2. The 1% value would be expected to be exceeded for a total of 30 hours during the summer months (June to September) based on the ASHRAE design standards. The PNPS site historical highest recorded temperature is also noted to be 102°F from FSAR Table 2.3-15. The FLEX equipment will be procured to function in high temperatures and consideration will be given to the impacts of these high temperatures on equipment storage and deployment; however, 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.

References

1. Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, NEI 12-06, Revision 0, August 2012
2. PNPS Final Safety Analysis Report, Revision 28, 11/12
3. TDBD-110 Control Room Habitability Revision 1

Key Site assumptions to implement NEI 12-06 strategies. **Ref: NEI 12-06 section 3.2.1**	*Provide key assumptions associated with implementation of FLEX Strategies:* • *Flood and seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 are not complete and therefore not assumed in this submittal. As the re-evaluations are completed, appropriate issues will be entered into the corrective action system and addressed on a schedule commensurate with other licensing bases changes.* • *Exceptions for the site security plan or other (license/site specific) requirements of 10CFR may be required.* • *Deployment resources are assumed to begin arriving at hour 6 and fully staffed by 24 hours.* • *Certain Technical Specifications cannot be complied with during FLEX implementation.*

Key assumptions associated with implementation of FLEX Strategies for PNPS are described below:

General Integrated Plan Elements (BWR)

- Flood and seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 are not completed and therefore not assumed in this submittal. As the re-evaluations are completed, appropriate issues will be entered into the corrective action system and addressed.

The following conditions exist for the baseline case:

- Seismically designed DC battery banks are available.
- Seismically designed 120 VAC and 125 & 250 VDC distribution systems are available.
- Plant initial response is the same as Station Black-Out (SBO) event.
- Decay heat curve used for Reactor Pressure Vessel (RPV) Core Cooling and Containment Heat Removal thermal calculations is the ANSI/ANS 5.1-1979 decay heat nominal values calculated based on a maximized full power end-of-cycle power history, with additional allowances for miscellaneous Actinides and Activation Products, that is the Current Licensing Basis for Accident Analysis Containment Heat Removal when used with 2-Sigma Uncertainty Adders.
- Decay heat curve used for RPV and Spent Fuel Pool (SFP) Refueling Mode conditions is the NRC Branch Technical Position ASB 9-2 Rev 2 that is the Current Licensing Basis for SFP Thermal and Heatup Analyses.
- No additional failures of safety-related SSC assumed except those in the base assumptions, i.e., Extended Loss of AC Power and Loss of Ultimate Heat Sink. Therefore, the steam-driven RCIC, and HPCI if available, will operate either via automatic control or with manual operation capability per the guidance in NEI 12-06.

- Margin will be added to design FLEX components and hard connection points to bound future increases as re-evaluation warrants. All components will be procured commercially and tested or evaluated, as appropriate, for seismic, environmental, and radiological conditions.
- The design hardened connections are protected against external events or are established at diverse locations.
- Implementation strategies and roads are assessed for hazards impact.
- All Phase 2 components are stored at the site and will be protected against the "screened in" hazards in accordance with NEI 12-06. At least N sets of equipment will be available after the event they were designed to mitigate.
- Additional staff resources are expected to arrive beginning at 6 hours and the site will be fully staffed 24 hours after the event. The FLEX Strategy can be implemented through Phase 2 and into Phase 3 with only on-site resources if necessary.
- Maximum environmental room temperatures for habitability or equipment

General Integrated Plan Elements (BWR)

availability is based on NUMARC 87-00 (Reference 1) guidance if other design basis information or industry guidance is not available. 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.

- 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 beyond-design-basis event by providing adequate capability to maintain or restore core cooling, containment, and SFP cooling capabilities at all units on a site. Though specific strategies are being 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 will be incorporated into the unit emergency procedures and guidelines in accordance with established change processes, and their impact to the design basis 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 beyond-design-basis 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). (Reference 2)

NEI 12-06
The assumptions listed in NEI 12-06, Section 3.2.1, are applicable to PNPS.

Open items where PNPS does not have clear guidance to complete an action related to this submittal are listed below:

1. Beyond-design-basis external event impact on requirements in existing licensing documents will be determined based on input from the industry groups and direction from the NRC.
2. Structure, content and details of the Regional Response Center playbook will be determined.

General Integrated Plan Elements (BWR)

References:

1. NUMARC 87-00, *Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors*, Revision 1
2. Task Interface Agreement (TIA) 2004-04, "Acceptability of Proceduralized Departures from Technical Specifications (TSs) Requirements at the Surry Power Station," (TAC Nos. MC4331 and MC4332)," dated September 12, 2006. (Accession No. ML060590273).

Extent to which the guidance, JLD-ISG-2012-01 and NEI 12-06, are being followed. Identify any deviations to JLD-ISG-2012-01 and NEI 12-06. **Ref: JLD-ISG-2012-01 NEI 12-06 13.1**	*Include a description of any alternatives to the guidance, and provide a milestone schedule of planned action.*

PNPS has no known deviations to the guidelines in JLD-ISG-2012-01 and NEI 12-06. If deviations are identified, then the deviations will be communicated in a future 6 month update following identification.

Provide a sequence of events and identify any time constraint required for success including the technical basis for the time constraint. **Ref: NEI 12-06 section 3.2.1.7 JLD-ISG-2012-01 section 2.1**	*Strategies that have a time constraint to be successful should be identified with a technical basis and a justification provided that the time can reasonably be met (for example, a walkthrough of deployment).* *Describe in detail in this section the technical basis for the time constraint identified on the sequence of events timeline Attachment 1A.* *See attached sequence of events timeline (Attachment 1A).*

General Integrated Plan Elements (BWR)

Discussion of time constraints identified in Attachment 1A table.

1. 1 hour, Entry into ELAP (table item 3) - PNPS SBO procedures (Reference 1) direct the operator to start the Emergency Diesel Generators and if neither Emergency Diesel Generator can be started, then, within 10 minutes of the beginning of the event, start the Station Blackout (SBO) Diesel Generator to repower an emergency bus. This gives the operator 10 minutes to determine that neither the Emergency Diesel Generators or the SBO Diesel Generator will start from the control room and dispatch personnel to troubleshoot the EDGs. Time critical at a time greater than 1 hour. Time period of one (1) hr is selected conservatively to ensure that ELAP entry conditions can be verified by control room staff, and it is validated that Emergency Diesel Generators (EDG) are not available. (Reference 1)
2. 2 hour, DC Load shed complete (table item 4) - DC buses are readily available for operator access and breakers will be appropriately identified (labeled) to show which are required to be opened to affect a deep load shed (Reference7). From the time that ELAP conditions are declared, it is reasonable to expect that operators can complete the DC bus load shed in approximately 1 hour. The 125 VDC Distribution Panels are in locations in the Turbine Building EL 23 ft and 37 ft that are immediately adjacent to or just below and readily accessible from the Main Control Room.
3. 6 hour, Reactor pressure control will be required to keep within the acceptable region of the Heat Capacity Temperature Limit (HCTL) Curve. (table item 7) - When the Torus reaches 170°F a controlled reactor depressurization is commenced based on EOP-11 HCTL curve (Reference 2, 3). The reactor will be depressurized by manually opening the SRVs in conjunction with continued RCIC operation to reduce reactor pressure to approximately 120 psig over a three hour period, at which time the Torus will heat up to 235°F. Time is critical at this point to complete the RPV depressurization to as low a pressure as possible to preclude exceeding the HCTL Curve and to minimize continued operation of the RCIC or HPCI System at elevated Torus temperatures, expected to be at approximately 9 hours per PNPS Calculation M1380 and ENERCON MAAP analysis (Reference 8, 9). SRV control is maintained from the control room with sufficient DC power and pneumatic pressure to operate the SRVs throughout Phase 1 (Reference 7).
4. 8 hour, Transition from Phase 1 to Phase 2 using two (2) FLEX 480 VAC 3-PH 100 kVA Portable Diesel Generators (DGs) to supply power to any of the five (5) 125V & 250V DC Station Battery Chargers (Normal & Backup) that provide charging power to the 125V and 250V batteries - Time critical after 8 hours. It is anticipated that the decision to deploy the FLEX DGs will be made during the initial response phase; however battery durations are calculated to last at least 8 hours without credit for load shed during the initial Phase 1 response (Reference 14, 15, 16). Two (2) of the required FLEX DGs will be maintained in on-site FLEX storage buildings (Reference 7). The third FLEX DG (N +1) will be pre-staged in the Turbine Building Truck Lock area, which is a protected area in close proximity to the Battery Charger and Switchgear Rooms. This will allow for more rapid deployment of the first FLEX DG

General Integrated Plan Elements (BWR)

for ELAP events where that is possible. The two FLEX DGs from the storage sites will be transferred and staged via haul routes and staging areas evaluated for impact of external hazards (Reference 7, 17). Modifications will be implemented to facilitate the connections and operational actions required to repower any of the Station Battery Chargers (Normal & Backup) directly from the FLEX DGs. This will be accomplished utilizing AC Power Transfer Switches and Portable Cable Connections that are local to each Battery Charger and serve to completely disconnect from the normal 480 VAC bus source to allow the external 480 VAC feed from the FLEX DGs (Reference 7). Programs and training will be implemented to support operation of FLEX DGs. Six hours is a reasonable assumption for transferring and placing the FLEX portable DGs into service. The cabling required will be pre-staged in the vicinity of the Battery Charger and Switchgear Rooms.

5. 9 hour, Transition from RCIC to FLEX equipment for the low pressure Core Cooling Function by placing the diesel powered FLEX Low Pressure Pumps in service with injection from the UHS through a duplex strainer cart with flow monitoring and into the common CST suction line to the HPCI and RCIC Pumps and feeding through either pump to inject into the RPV (table item 9). At 9 hours, the Torus is calculated to be at 235°F (Reference 8, 9) and, when no other preferred sources of water are available, seawater is used for low pressure injection at subcooling flow rates to the RPV from the UHS. The required FLEX Pumps will be maintained at the on-site FLEX storage locations (Reference 7). FLEX Pumps will be transferred and staged via haul routes and staging areas evaluated for impact from external hazards (Reference 7). Modifications to the 18" HPCI/RCIC Suction Line in the Condensate Storage Tank (CST) Vault on the plant-side of the CST 18" Isolation Valves 26-HO-78 & 79 will be implemented to facilitate the connections and operational actions required to provide makeup to the RPV, as necessary (Reference 7). Programs and training will be implemented to support the deployment and operation of FLEX Pumps. With the resources assumed available on-site, three hours is a reasonable assumption to transfer and place the FLEX Portable Pumps into service by 9 hours. The first of two tandem FLEX Diesel Pumps take suction from the UHS and feeds a pressurized suction to the second pump to achieve sufficient flow capacity and total head for RPV injection. The diesel pumps are operated under manual speed control to achieve the desired pressure and flow as read locally on the duplex strainer cart flow meter and totalizer. Once the FLEX Diesel Pumps are deployed using 5" hose connections with Y-connection valving at each component, the engine-driven pumps are initiated, purged, and vented and flow is established through an open-ended discharge return hose to ensure the pumps are operating and ready to inject to the RPV. As the RPV depressurization is completed and the RCIC steam supply is isolated, the FLEX Pumps, which are already running at idle speed with flow out the return hose, are realigned using the Y-connection valves and RPV injection is commenced, preferably by flowing through the idle HPCI Pump flow path, but alternately through the now idle RCIC Pump. Engine speed controls are used to ramp the pump up to the initial injection rate (approximately 400 GPM) sufficient to

General Integrated Plan Elements (BWR)

immediately sub-cool the RPV and begin filling the vessel to discharge heated liquid via the SRVs to the Torus, a process that will take 30 minutes to an hour. RPV pressure will remain at or above 50 PSIG, which is the back pressure required to maintain the SRVs open, plus the Torus pressure at the time.

6. 16 hour, Initiate use of Hardened Containment Vent System (HCVS) per EOPs to maintain containment parameters within design temperature limit of 281°F (table item 10). A Torus water temperature of 280°F is calculated to occur at 16 hours by PNPS calculation and validated by MAAP analysis (Reference 8, 9). Opening the HCVS Torus Vent at this time provides effective Containment Heat Removal at a rate sufficient to preclude additional rise in the Torus temperature, which stabilizes and then begins to slowly drop over the subsequent hours. The reliable operation of HCVS can be met because the HCVS is fully qualified and powered by the 125 VDC system and will be provided with an independent pneumatic system supplied from nitrogen bottles to operate the HCVS valves. Critical instruments associated with containment and the HCVS are DC powered and can be read locally and in the MCR. The HCVS system is addressed as part of order EA-12-050 (Reference 19).

7. 32 hour, Begin makeup to SFP as necessary to maintain essentially normal full water level in the SFP (table item 12). Boiling under design basis conditions begins at 32 hours and requires 12 GPM makeup. The makeup water is taken from the Dryer & Separator Storage Pool that is maintained filled below EL 97 ft to provide makeup water for this purpose. The Pool has a usable volume of 30,000 GPM that will provide a 42 Hr supply of makeup water at a boil-off rate of 12 GPM. A pre-staged Submersible Air-Powered Diaphragm Pump with a bottom suction and capacity up to 120 GPM will be used and the initial volume of 30,000 GPM will provide a 42 Hr supply of makeup water at a boil-off rate of 12 GPM.

8. 32 hour, Establish natural free convection ventilation to exhaust the humid atmosphere from the EL 117 ft SFP/Refuel Floor Area with an outside air inlet at a lower elevation though the Reactor Building Truck Lock at EL 23 ft (table item 13). This action will be required to be performed prior to the onset of SFP boiling (as water temperature approaches 200 °F). Procedural guidance will be provided for Operations to open the Reactor Bldg. Hatch while also opening a ground level ventilation inlet.

9. 72 hour, Transition from Phase 2 to Phase 3 for Core Cooling function by placing the station Groundwater Wells in service feeding to the Water Storage Frac Tank, or backup Bladder Tank, if needed. In Phase 3, a FLEX diesel Pump takes suction from the Water Storage Frac Tank and discharges through a resin demineralizer skid and the duplex strainer and flow monitoring cart to the RPV to begin a long-term makeup and boiling strategy at constant RPV water level. (table item 14) – The Water Storage Frac Tank will be pre-filled and readied for the diesel powered FLEX Low Pressure Pumps to switch suction to the Water Storage Frac Tank for RPV injection. After transferring the FLEX Pump suction to the Water Storage Frac Tank, the RPV is flushed with water from the Water Storage Frac Tank at an initial

General Integrated Plan Elements (BWR)

rate sufficient to continue sub-cooling and flushing the RPV with heated liquid discharge via the SRVs to the Torus while using a portion of the potential 21,000 Gallon capacity from the Water Storage Frac Tank to flush the RPV. When ready, the FLEX Pump injection rate is slowed down and the RPV is allowed to boil down to a stable water level with only makeup water added. The transition from Phase 2 to Phase 3 is determined at a time based on Torus inventory and is to be implemented before a net addition of 400,000 Gallons to the Torus, which is not expected to occur before 72 Hour after shutdown. This consideration maintains the Torus water level below the Drywell-to-Torus Vacuum Breaker operating level, to ensure communication and equalization of Drywell and Wetwell pressure is maintained. Torus Water Level is also measured directly and available in the MCR. Once in Phase 3, the plant can be maintained in a stable condition with FLEX Pumps in service for injection to the RPV at a stable water level, and heat removal provided by the HCVS Torus Vent at a steadily reducing Torus temperature, pressure, and water inventory. There is no need to reject liquid water from the Torus at any time, as the venting capacity exceeds the makeup rate and Torus pressure will drop below 15 PSIG shortly after entering Phase 3. The plant is in a stable condition with outside resources available to maintain stable conditions indefinitely. (References 7, 8) There are no time-critical actions required to restore additional plant systems to maintain core cooling.

Technical Basis Support Information

1. On behalf of the Boiling Water Reactor Owners Group (BWROG), GE-Hitachi (GEH) developed a document (NEDC-33771P, Revision 1 (Reference 10)) to supplement the guidance in NEI 12-06 by providing additional BWR-specific information regarding the individual plant response to the Extended Loss of AC Power (ELAP) and loss of Ultimate Heat Sink (UHS) events. The document includes identification of the generic event scenario and expected plant response, the associated analytical bases and recommended actions for performance of a site-specific gap analysis. In the document, GEH utilized the NRC accepted SUPERHEX (SHEX) computer code methodology for the BWR's long term containment analysis for the ELAP analysis. As part of this document, a generic BWR 3/Mark I containment NSSS evaluation was performed. The BWR 3/Mark I containment analysis is applicable to the PNPS (a BWR 3 Mark I plant) coping strategy because it supplements the guidance in NEI 12-06 by providing BWR-specific information regarding plant response for core cooling and containment integrity. The guidance was utilized as appropriate to develop coping strategies and for prediction of the plant's response.
2. Containment integrity for Phases 1 through 3 was calculated by M1380 Rev 0, PNPS FLEX Strategy Thermal-Hydraulic analysis (Reference 8) and validated by the use of computer code MAAP 4.0.5. (Reference 9)
3. Environmental conditions within the station compartments were evaluated following methods and tools in NUMARC 87-00 (Reference 13) or GOTHIC 7.2b (EPRI

General Integrated Plan Elements (BWR)

software).

4. 10 CFR 50.63 and Regulatory Guide 1.155. PNPS utilizes an alternate AC Power Station Blackout EDG along with a short term coping analysis for Station Blackout (SBO) compliance in accordance with NUMARC 87-00. (Reference 13)

References:

1. PNPS 5.3.31 Rev 16 Station Blackout
2. EOP03 Rev 10 Primary Containment Control
3. EOP11 Rev 4 Figures, Cautions, and Icons
4. PNPS 2.2.22 Rev 72 Reactor Core Isolation Cooling System (RCIC)
5. PNPS 2.2.21 Rev 80 High Pressure Coolant Injection System (HPCI)
6. PNPS 5.3.26 Rev 26 RPV Injection During Emergencies
7. PNPS FLEX Mitigation Strategy – Gaps to NRC Order EA-12-049 Interim Staff Guidance. March 12, 2012
8. Calculation M1380 Rev 0, PNPS FLEX Strategy Thermal-Hydraulic Analysis
9. ENERCON Calculation ENTGPG012-CALC-001, Rev. 0, PNPS Containment Analysis of FLEX Strategy
10. NEDC-33771P, Project Task Report BWROG GEH Evaluation of FLEX Implementation Guidelines, Rev 1
11. Submittal for NRC Order EA-12-050, Hardened Containment Vent System
12. Final Safety Analysis Report Rev 28 (PNPS FSAR) 21-NOV-2011
13. NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Revision 1
14. PNPS Calculation PS233B, 125 Volt Battery A System Voltage, Rev 1.
15. PNPS Calculation PS233C, 125 Volt Battery B System Voltage, Rev 1
16. PNPS Calculation PS233D, 250 Volt Battery System Voltage Calculation, Rev 1.
17. DWG. C2, Rev. 10, Site Plan
18. TBDB-110, Rev. 1, Control Room Habitability
19. Submittal for NRC Order EA-12-050, Hardened Containment Vent System

Identify how strategies will be deployed in all modes. **Ref: NEI 12-06 section 13.1.6**	*Describe how the strategies will be deployed in all modes.*

General Integrated Plan Elements (BWR)

Deployment routes to be utilized to transport FLEX equipment are via the normal site roadways and access points as shown in Figure 8 & 9 of Attachment 3. The paths will be accessible during all modes of operation and comply with NEI 12-06, Section 5.3.2. This strategy will be included within an administrative program in order to keep pathways clear. Portable, road-towable equipment that is designed for over the road transport as is typically used in construction / remote sites is deemed sufficiently rugged and will be provided.

The FLEX Strategies employed during the various Power Operation, Hot & Cold Shutdown, and the most limiting Refueling Modes are described in the "Maintain Core Cooling" section and for the various Refueling Modes in the "Maintain Spent Fuel Pool Cooling" section. The evaluation of the many various shutdown and refueling modes was performed by defining a minimum number of cases that are the most limiting for Core and/or Spent Fuel Pool Cooling and which bound all other potential conditions.

Provide a milestone schedule. This schedule should include: **1. Modifications timeline** **a. Phase 1 Modifications** **b. Phase 2 Modifications** **c. Phase 3 Modifications** • **Procedure guidance development complete** o **Strategies** o **Maintenance** • **Storage plan (reasonable protection)** • **Staffing analysis completion** • **FLEX equipment acquisition timeline** • **Training completion for the strategies** • **Regional Response Centers operational** **Ref: NEI 12-06 section 13.1**	*The dates specifically required by the order are obligated or committed dates. Other dates are planned dates subject to change. Updates will be provided in the periodic (six month) status reports.* See attached milestone schedule, Attachment 2

Identify how the programmatic controls will be met. **Ref: NEI 12-06 section 11** **JLD-ISG-2012-01 section 6.0**	*Provide a description of the programmatic controls equipment protection, storage and deployment and equipment quality. See Section 11 in NEI 12-06. Storage of equipment, 11.3, will be documented in later sections of this template and need not be included in this section.* *See section 6.0 of JLD-ISG-2012-01.*

General Integrated Plan Elements (BWR)

PNPS will implement an administrative program for implementation and maintenance of the PNPS FLEX strategies in accordance with NEI 12-06 guidance.

- A program owner will be assigned with responsibility for configuration control, maintenance and testing.
- The equipment for ELAP will have unique identification numbers.
- Installed structures, systems and components pursuant to 10CFR50.63 (a) will continue to meet the augmented quality guidelines of Regulatory Guide 1.155, "Station Blackout."
- PNPS will utilize the standard EPRI industry PM process to establish maintenance and testing requirements for all FLEX components. The administrative program will include maintenance guidance, testing procedures and frequencies established based on type of equipment and considerations made within the EPRI guidelines..
- PNPS will follow the current programmatic control structure for existing processes such as design and procedure configuration.

Describe training plan	*List training plans for affected organizations or describe the plan for training development*

New training of general station and Emergency Planning (EP) staff will be performed, prior to design implementation. Simulation and licensed operator training will not be impacted. These programs and controls will be implemented in accordance with the Systematic Approach to Training.

Describe Regional Response Center plan	*Discussion in this section may include the following information and will be further developed as the Regional Response Center development is completed.* *i. Site-specific RRC plan* *ii. Identification of the primary and secondary RRC sites* *iii. Identification of any alternate equipment sites (i.e. another nearby site with compatible equipment that can be deployed)* *iv. Describe how delivery to the site is acceptable* *Describe how all requirements in NEI 12-06 are identified.*

General Integrated Plan Elements (BWR)

PNPS will utilize the industry Regional Response Centers (RRC) for additional and/or backup supplies of Phase 3 equipment, as needed, and to replenish consumable items. PNPS has contractual agreements in place with the Strategic Alliance for FLEX Emergency Response (SAFER). The two (2) industry RRCs will be established to support utilities during Beyond-Design-Basis External Events (BDBEE). Communications will be established between the affected nuclear site and the (SAFER) team and required equipment mobilized as needed. Equipment will be moved from an RRC to a local Assembly Area established by the SAFER team and the utility. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request.

Maintain Core Cooling

Determine Baseline coping capability with installed coping[1] modifications not including FLEX modifications, utilizing methods described in Table 3-1 of NEI 12-06:

- **RCIC/HPCI/IC**
- **Depressurize RPV for injection with portable injection source**
- **Sustained water source**

BWR Installed Equipment Phase 1:

Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain core cooling. Identify methods (RCIC/HPCI/IC) and strategy(ies) utilized to achieve this coping time.

Power Operation

At the initiation of the BDBEE, the Reactor Scrams, Main Steam Isolation Valves (MSIVs) automatically close, Feedwater is lost, and Safety Relief Valves (SRVs) automatically cycle to control pressure, causing Reactor Water Level to drop (Reference 22). When reactor water level reaches the RPV Low-Low Water Level (-46.3 inches), Reactor Core Isolation Cooling (RCIC) and High Pressure Coolant Injection (HPCI) (References 22) automatically start with suction from the Condensate Storage Tank (CST) and operate to inject makeup water to the Reactor Pressure Vessel (RPV). Because the CST is not seismically qualified, it is considered unavailable for the BDBEE (Reference 1), and the RCIC suction will be manually switched to the Suppression Pool (Torus) (Reference 19, 22). The HPCI system suction will automatically switch to the Torus on a low CST level and HPCI will then be secured when the Low-Low Water Level Trip (-46.3 inches) clears (Reference 22). This is assumed to happen within the first two (2) minutes of the event. The RCIC system will continue to operate after the reactor level returns to the normal band. During the first 6 hours after shutdown, the reactor remains isolated and pressurized with RCIC providing the core cooling, drawing water from the Torus. The SRVs control reactor pressure (Reference 22). The operator is directed to take steps to minimize the load on the station batteries by shedding unnecessary loads in accordance with station SBO procedures (Reference 22). One (1) hour into the event, the determination that the Emergency Diesel Generators (EDGs) cannot be restarted is made and the operating crew classifies the event as a beyond-design-basis event and anticipates a loss of power for an extended time period. The RCIC trip signals and isolation signals that could possibly prevent RCIC operation when needed during the ELAP will be overridden in accordance with procedural direction. Additionally, the Automatic Depressurization System (ADS) should be placed in 'inhibit' or closely monitored to prevent automatic initiation of ADS (Reference 22). This is necessary to ensure reactor pressure is not reduced to a pressure which would prevent operation of RCIC.

At six (6) hours after the reactor shutdown, the Torus will be at 170°F and a controlled reactor

[1] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

Maintain Core Cooling

depressurization is commenced based on EOP-11 HCTL curve (Reference 24). The RPV will be depressurized by manually cycling the SRVs in conjunction with continued RCIC operation to reduce reactor pressure to 120 psig over a three hour period, at which time the Torus will heat up to 235°F (Reference 7, 9). The SRVs are powered off of the 125 VDC batteries and the existing High Pressure Backup SRV Nitrogen Cylinder Supply to SRVs RV-203-3B and C will be modified to provide a set of pressure regulators for a continuous source of backup nitrogen at any time that the Drywell Essential Instrument Air Nitrogen Makeup System pressure drops below 90 psig.

The BWROG has performed a RCIC study (Reference 5) that assesses the operation of the RCIC System for long term operation at elevated Suppression Pool temperatures exceeding 230°F. For the successful implementation of the PNPS FLEX Strategy, the RCIC System is operated for approximately 9 hours total time, at the end point of which the Torus temperature is just exceeding 230°F. This short term operation of RCIC at elevated temperatures is considered well within the capabilities of the system, and there is additional margin to allow operation for a longer period of time at these conditions if it were necessary due to delays in implementing the Phase 2 low pressure injection. The PNPS FLEX Strategy does not include Containment Venting until after reactor depressurization and thereby will not affect the Containment Pressure available for RCIC or HPCI Pump NPSH at 230°F Torus temperature during the time that these pumps may be operating (Reference 7, 9).

At 9 hours after shutdown the reactor remains isolated and pressurized with RCIC providing core cooling, drawing water from the Suppression Pool (Torus). At this time the core cooling strategy will transition from RCIC to diesel powered FLEX Low Pressure Injection Pumps, which will be staged and connected from the Ultimate Heat Sink (UHS) to the CST suction line for injection via either the HPCI or RCIC Pump flow path, by injecting through the idle pump and into the normal pump discharge path to the RPV Feedwater lines. An alternate FLEX injection point is to the RHR System via the readily accessible Firewater to Service Water Cross-Tie to RHR, which provides a path to inject into the RPV, Drywell Spray, or Torus via the RHR System. Both FLEX injection points will be similarly outfitted with 5" Storz hose connections, as will all other FLEX connectors to the pumps, strainers, water tanks, and demineralizer tanks.

Hot & Cold Shutdown and Early Refueling Modes

The Hot & Cold Shutdown conditions (other than Refueling Modes) are bounded by the FLEX Strategy for Power Operation. The FLEX Strategy response times for an event that occurs while already in Hot or Cold Shutdown are longer than for the Power Operation condition because the RPV is initially repressurized to allow use of the steam-driven RCIC or HPCI Systems for Core Cooling. The subsequent Phase 1, 2, & 3 actions are the same as for Power Operation, but occur later as the decay heat is lower and heatup times longer, dependent on the elapsed time since shutdown.

The most limiting shutdown condition event occurs during the early Reactor disassembly stages while in the Refueling Mode. After achieving Cold Shutdown and entering the Refueling Mode, the Drywell Head is removed and the RPV head detensioning process is begun (Reference 6). First, the Reactor Pressure Vessel (RPV) Head Vent piping is removed from the 4" Reactor Head

Maintain Core Cooling

Nozzle N8 and an FME/HEPA Adapter Flange is installed after the vessel head insulation is removed. Once the vessel head insulation assembly is removed, the Reactor Head Strongback Assembly is used to install the stud tensioners used to detension the RPV studs and that process is commenced, typically no earlier than 24 Hours after Reactor shutdown. Once the detensioning process has progressed to the Second Pass, typically no earlier than 36 Hours after Reactor shutdown, it would not be prudent to allow any significant repressurizing of the RPV if Shutdown Cooling were lost. For the FLEX Strategy planning, the bounding Refueling Outage time period to consider is at 36 Hours after Reactor shutdown, at which point the loss of all AC power and Shutdown Cooling is assumed to occur, with the following conditions (Reference 6, 25, 26):

- Time-to-Boil @ 36 Hrs = 1.9 Hrs (based on 125°F starting temp)
- Boil-Off Rate @ 36 Hrs = 80 GPM (Reference 26, Table 212)
- Boil-Down to TAF @ 36 Hrs = 11.2 Hrs (RPV Flange to Top-of-Active Fuel)

Prior to the start of the Reactor disassembly stages of a refueling outage, it shall be confirmed that no extreme weather events are imminent and certain FLEX equipment shall be pre-staged to provide more rapid implementation of the elements of the FLEX Strategy that are appropriate. The pre-staging shall include the following activities:

Providing or staging AC power and hose connections to the FLEX Groundwater Wells with sufficient capacity to provide 80 GPM total makeup water to the storage tank.

Providing or staging hose connections to the FLEX Pump, to Demin Tank, to Duplex Strainer, and final discharge hose connection to the Hydraulic Connection Point at the Condensate Storage Tank (CST) Vault that is connected to the 18" HPCI / RCIC Suction Line.

Installation of the 4" Reactor Head Nozzle N8 FME/HEPA Adapter Flange that is modified to include an Isolation Valve and discharge nozzle to allow filling of the Reactor Basin by flowing out of the N8 Nozzle, if needed.

In the event of a BDBEE the pre-staged equipment will be placed in service and core cooling will immediately transition to Phase 2, if needed.

References:

1. PNPS Technical Specifications & Bases, Rev 269
2. Final Safety Analysis Report Rev 28 (PNPS FSAR) 21-NOV-2011
3. 0000-0143-0382-R0 (proprietary), GEH Feasibility Study of RCIC System Operation in Prolonged Station Blackout
4. NEDC-33771P, Project Task Report BWROG GEH Evaluation of FLEX Implementation Guidelines, Rev 1
5. 0000-0147-5233-R0, BWROG Project Task Report, RCIC Pinch Points, Operation in Prolonged Station Blackout, Feasibility Study, Revision 0
6. PNPS FLEX Mitigation Strategy – Gaps to NRC Order EA-12-049 Interim Staff

Maintain Core Cooling
Guidance. 7. Calculation M1380 Rev 0, PNPS FLEX Strategy Thermal-Hydraulic Analysis 8. EC-0000042259 Design Input Record (DIR) 9. ENERCON Calculation ENTGPG012-CALC-001, Rev. 0 PNPS Containment Analysis of FLEX Strategy 10. ENERCON Calculation ENTGPG012-CALC-002, Rev. 0 PNPS FLEX RCIC Flow Path Hydraulic Analysis 11. ENERCON Calculation ENTGPG012-CALC-003, Rev. 0 PNPS MCR Heatup for Extended Loss of Offsite Power (FLEX) 12. Dwg M209 Rev 67 P&ID Condensate & Demineralized Water Storage & Transfer Systems 13. Dwg M243 Rev 53 P&ID HPCI System 14. Dwg M244SH1 Rev 31 P&ID HPCI System 15. Dwg M245 Rev 35 P&ID RCIC System 16. Dwg M246SH1 Rev 32 P&ID RCIC System 17. SBDB-13 System Design Basis Document for RCIC system. Rev. E0 18. SBDB-23, System Design Basis Document for HPCI system. Rev. 1 19. PNPS 2.2.22 Rev 72 Reactor Core Isolation Cooling System (RCIC) 20. PNPS 2.2.21 Rev 80 High Pressure Coolant Injection System (HPCI) 21. PNPS 5.3.26 Rev 26 RPV Injection During Emergencies 22. PNPS 5.3.31 Rev 16 Station Blackout 23. EOP03 Rev 10 Primary Containment Control 24. EOP11 Rev 4 Figures, Cautions, and Icons 25. PNPS 3.M.4-48.2 Rev 35 Opening and Closing of Reactor Pressure Vessel, Disassembly 26. Calculation M907 Rev 0 Refueling Outage Decay Heat Evaluation

Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
PNPS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.	

Maintain Core Cooling

Identify modifications	*List modifications*

Modify the existing High Pressure Backup SRV Nitrogen (N2) Cylinder Supply to Safety Relief Valves (SRVs) RV-203-3B & C to provide a set of Pressure Regulators for a continuous source of Backup N2 Supply at any time that the Drywell Essential Instrument Air Nitrogen Makeup System pressure drops below 90 psig.

PNPS will take the necessary actions to allow RCIC operation at elevated temperatures (>230°F). These actions could be procedures, maintenance practices or modifications.

Key Reactor Parameters	*List instrumentation credited for this coping evaluation.*

RPV Essential Instrumentation	**Safety Function**
RPV Level – NR (LI-640-29A/B) (Ref. 1) MCR Panel C905 FW CONTROL LEVEL NARROW RANGE (0 to +60 inch) 120VAC/250 VDC Pnl Y2	RPV inventory and core heat removal
RPV Level – NR (LI-263-100A/B) (Ref. 1) MCR Panel C905 REACTOR WATER LEVEL NARROW RANGE (-50 to +50 inch) 120VAC/125VDC Pnl Y3/Y4/D36/D37	RPV inventory and core heat removal
RPV (LI-263-106A/B) (Ref. 1) MCR Panel C903 RX FUEL ZONE LEVEL (-277.5 to +22.5 inch) 120VAC/125VDC Pnl Y3/Y4/D36/D37	RPV inventory and core heat removal
RPV Level – NR (LIS-263-72A/B/C/D) (Ref. 1) CS Room Instr Racks C2233A & B REACTOR WATER LEVEL NARROW RANGE (-50 to +50 inch) 120VAC/125VDC Pnl Y3/Y4/D36/D37	RPV inventory and core heat removal

Maintain Core Cooling	
RPV Level –Fuel Zone (LIS-263-73A/B) (Ref. 1) CS Room Instr Racks C2233A & B RX FUEL ZONE LEVEL (-277.5 to +22.5 inch) 120VAC/125VDC Pnl Y3/Y4/D36/D37	RPV inventory and core heat removal
RPV Level – NR Gauge (LI-263-59A/B) (Ref. 1) Local Rack C2205A/B & C2206A/B REACTOR WATER LEVEL NARROW RANGE (-50 to +50 inch) NA - Analog Gage	RPV inventory and core heat removal
RPV Pressure (PI-640-25A/B) (Ref. 1) MCR Panel C905 REACTOR PRESSURE (0 to 1200 PSIG) 120VAC/250 VDC Pnl Y2	RPV pressure boundary and pressure control
RPV Pressure (PI-263-49A/B) (Ref. 1) MCR PAM Panels C170 & C171 REACTOR PRESSURE (0 to 1500 PSIG) 120VAC/125VDC Pnl Y3/Y4/D36/D37	RPV pressure boundary and pressure control
RPV Pressure (PIS-263-49A/B) (Ref. 1) CS Room Instr Racks C2233A & B REACTOR PRESSURE (0 to 1500 PSIG) 120VAC/125VDC Pnl Y3/Y4/D36/D37	RPV pressure boundary and pressure control
RPV Pressure (PIS-263-50A/B) (Ref. 1) CS Room Instr Racks C2233A & B REACTOR PRESSURE (0 to 1200 PSIG) 120VAC/125VDC Pnl Y3/Y4/D36/D37	RPV pressure boundary and pressure control
RPV Pressure (PIS-263-52A/B) (Ref. 1) CS Room Instr Racks C2233A & B REACTOR PRESSURE (0 to 1200 PSIG) 120VAC/125VDC Pnl Y3/Y4/D36/D37	RPV pressure boundary and pressure control

Maintain Core Cooling	
RPV Pressure (PI-263-60A/B) Local Gauge (Ref. 1) Local Rack C2205A/B & C2206A/B REACTOR PRESSURE (0 to 1500 PSIG) NA - Analog Gage	RPV pressure boundary and pressure control
Containment Essential Instrumentation	**Safety Function**
Drywell Pressure - Low Range (PIS-1001-89A/B/C/D) (Ref. 1) CS Room Instr Racks C2233A & B LOW RANGE DRYWELL PRESSURE (0 to 5 PSIG) 120VAC/125VDC Pnl Y3/Y4/D36/D37	Containment integrity
RCIC Suction Pressure MCR Panel C904 RCIC PUMP SUCTION PRESSURE (30 inch Hg Vac to 85 PSIG) 120VAC/250 VDC Pnl Y2	Pump Operation & Containment integrity
HPCI Suction Pressure MCR Panel C903 HPCI PUMP SUCTION PRESSURE (30 inch Hg Vac to 85 PSIG) 125 VDC Pnl D5	Pump Operation & Containment integrity
Spent Fuel Pool Essential Instrumentation	**Safety Function**
SFP Instrumentation New Instruments to be added Reference NRC Order EA -12-051 120 VAC / Independent 24 VDC	SFP inventory

Maintain Core Cooling

Notes: The 250 VDC System provides backup power to the Vital MG Set DC Drive Motor such that it provides uninterrupted 120 VAC Power to Vital AC Panel Y2 during a Station Blackout.

ECCS Analog Monitoring & Trip System Racks C2233A & B, which are located in the Cable Spreading (CS) Room and which transmit certain Reactor Pressure and Water Level signals to the Main Control Room (MCR) Panels C903 & C905. CS Room Racks C2233A & B include dual power source feeds from 120 VAC Panels Y3 & Y4 and from 125 VDC Panels D36 & D37 to their respective 24 VDC Power Supplies that provide parallel 24 VDC Power Source Outputs, either of which can provide power to all of the C2233A & B connected instruments.

References

1. M253 Sh1/2 Nuclear Boiler Vessel Instrumentation Rev. 45/29
2. M231 P&ID Fuel Pool Cooling and Demin System Rev. 43
3. M227 Sh1/2 Containment Atmospheric Control System Rev. 59/49

Maintain Core Cooling

BWR Portable Equipment Phase 2:

Provide a general description of the coping strategies using on-site portable equipment including modifications that are proposed to maintain core cooling. Identify methods (RCIC/HPCI/IC)and strategy(ies) utilized to achieve this coping time.

Primary Strategy – (Power Operation) When the Torus exceeds 230°F and no other sources of water are available, the UHS (seawater) will be used to provide subcooling flow to the RPV and the core cooling strategy will transition from using installed equipment to using portable equipment stored on-site (Reference 1). The strategy for this transition phase (Phase 2) will be capable of maintaining core cooling capabilities from the time it is implemented until offsite resources are provided in the final phase. The duration of the transition phase will provide sufficient overlap with both the initial and final phases to account for the time it takes to install equipment and for uncertainties (Reference 1). Prior to transition to Phase 2, at approximately 6 to 9 hours after shutdown, two diesel powered FLEX Low Pressure Pumps are set up near the UHS in tandem using 5" hoses with a suction lift from the UHS. The pump discharge line includes a duplex strainer, flow rate meter and a totalizer with an injection connection point located at the vault between the CST tanks feeding into the underground HPCI/RCIC common suction line as shown on Figure 2 in Attachment 3 (Reference 6, 10, 11) A hydraulic calculation was performed to demonstrate the feasibility of the flowpath (Reference 3). The HPCI/RCIC common suction line in CST vault location will have a removable protective housing to facilitate connection and provide hardened protection. 100 kVA mobile generators will also be staged and connected to re-power the 125 and 250 volt DC battery chargers to maintain critical instruments and vital AC power. (Reference 6, 10, 11)

The RPV will be depressurized by opening the SRVs and transitioning from RCIC drawing water from the Torus to the diesel powered FLEX Low Pressure Pumps injecting via the idle HPCI or RCIC Pump flow path. The final depressurization will be based on EOP-11 HCTL curve (Reference. 8, 9). The SRVs are remote manually held full open to depressurize the RPV for subcooling. When RPV pressure drops to approximately 50 psi above Torus pressure core cooling will be transitioned from RCIC operation to the diesel powered FLEX Low Pressure Pumps to subcool the RPV at minimum pressure. The tandem FLEX Pumps will provide subcooling injection flow to the RPV with heated liquid flow out the SRVs to the Torus. The flow thru the RPV will be maintained at twice the boil-off rate to preclude concentrating minerals from seawater in the RPV and to preclude any significant fouling of heat transfer surfaces. The initial FLEX flow rate during the final depressurization will be 400 GPM to restore RPV level after which the flow will be reduced to approximately 180 GPM for continuous subcooling of the core at 10 hours, and steadily reduced after that at a prescribed rate that will be used to control the FLEX Pump injection rate, via manual speed control of the pump. Torus water level will also be monitored and available in the Main Control Room to evaluate the Torus inventory and water level and make adjustments as-needed. At 10 hours after shutdown the Torus will be at 250°F and 15 psig and the Torus level will be slowly rising above the initial 132 inch water level (Reference 6, 10, 11).

Maintain Core Cooling
BWR Portable Equipment Phase 2:
At 16 hours after shutdown it is calculated that the Torus will heat up to 280°F. The torus vent AO-5025 will then be opened to provide containment heat removal. The Hardened Containment Vent System (HCVS) at PNPS which includes the 8" Air-Operated Butterfly Valve AO-5025 will be capable of venting the Wetwell (Torus) airspace to provide a means of Containment Heat Removal as part of the FLEX Strategy. The Torus steam venting rate will be equivalent to at least 60 GPM at these conditions (Reference 6, 10, 11). The Diesel powered FLEX Low Pressure Injection Pumps continue to provide subcooling of the core with heated liquid flow out the SRVs to the Torus. The flow rate required for subcooling will be continually reduced according to a schedule (Reference 6, 10, 11) and the flow totalizer readings. At this time, preparations are underway to power the station groundwater wells with a portable 100 kVA 480 VAC 3-PH generator and to begin adding water to completely fill the Water Storage Frac Tank to prepare for a Phase 3, long-term reactor feedwater makeup and boiling strategy. (Reference 6, 10, 11) *Alternate Strategy – (Power Operation)* If the RCIC system should fail such that the CST line to the RCIC Pump suction flow path were not available, the alternate FLEX Hydraulic water source injection point will be to the RHR System at the existing Fire Water to RHR System Cross-Tie 8-inch connection via a removable spool in the Auxiliary Bay EL 23 ft Water Treatment Area via 8-inch Fire Water Manual Isolation Gate Valve 10-HO-511 that feeds into the RHR System 18-inch Cross-Tie. (Reference 15, 16). A removable 8-inch FLEX spool piece connector with Victaulic Couplings would be installed to accept a 5-inch Hose Connector from the two diesel powered FLEX Low Pressure Pumps set up in tandem using 5" hoses with a suction lift from the UHS. The pump discharge line includes a duplex strainer, flow rate meter and a totalizer. PNPS 5.3.26 (Reference 17) provides the existing guidance on providing a low pressure injection source for this scenario. The strategy identifies the use of the Fire Water to RHR/SSW System Cross-Tie via 10-HO-511 (Reference 17). To recharge the 125 & 250 VDC batteries AC power transfer switches will be installed to disconnect the chargers from their 480 VAC electrical buses and provide a cable connector on the 480 VAC line side of each individual 125 & 250 VDC Station Battery Charger (Normal & Backup) to provide power directly to the battery chargers using a FLEX mobile 480 VAC 3-PH 100 kVA capacity AC Power Generator. One such generator will be deployed in the Turbine Building Truck Lock, a protected location that provides for rapid deployment. The primary strategy will be to connect the FLEX mobile 480 VAC 3-PH 100 kVA capacity AC Power Generator to the Normal 125 & 250 VDC Station Battery Chargers to maintain these systems operating indefinitely. The Alternate strategy will be to connect the FLEX mobile 480 VAC 3-PH 100 kVA capacity AC Power Generator to the Backup 125 & 250 VDC Station Battery Chargers. The ability to power any of the Normal and Backup 125 & 250 VDC Station Battery Chargers provides a diverse and flexible strategy to repower the 125 & 250 VDC Station Batteries. See Figure 7 of Attachment 3. (Reference 6)

Maintain Core Cooling

BWR Portable Equipment Phase 2:

Hot & Cold Shutdown and Early Refueling Modes

As noted in Phase 1, the Early Refueling condition is the most limiting Shutdown case and the FLEX equipment to power the station groundwater wells, the FLEX Pump and connection to the CST line to prepare for a long-term reactor feedwater makeup and boiling strategy will be prestaged and placed in service within the time period for RPV heatup to boiling. RPV cooling flow will be initiated from the FLEX Pump operating at the maximum available flow rate sufficient, at a minimum, to provide saturated makeup, and preferably to sub-cool the RPV via either of the following methods, depending on the status of the RPV head detensioning at the time. (Reference 6, 18) A modified 4" Reactor Head Nozzle N8 FME/HEPA adapter flange which includes an isolation valve and discharge nozzle to allow filling of the Reactor Basin by flowing out of the N8 Nozzle will be installed.

If the detensioning has progressed past the point where repressurizing the RPV would not be prudent, then flow will be established into the Reactor Basin with sub-cooled water discharging through the 4" Reactor Head Nozzle N8 Adapter Flange. If progress does not prevent repressurizing of the RPV, then the 4" Reactor Head Nozzle N8 Adapter Flange Isolation Valve will be closed and the SRVs are opened, this will require repressurizing the RPV to approximately 50 psig to discharge to the Torus and begin a long term reactor feedwater makeup and boiling strategy. (Reference 6)

References:

1. NEI 12-06 R0, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide NEI 12-06 R) August 2012
2. 0000-0143-0382-R0 (proprietary), GEH Feasibility Study of RCIC System Operation in Prolonged Station Blackout
3. ENERCON Calculation ENTGPG012-CALC-002, Rev. 0 PNPS FLEX RCIC Flow Path Hydraulic Analysis
4. NEDC-33771P, Project Task Report BWROG GEH Evaluation of FLEX Implementation Guidelines, Rev 1
5. 0000-0147-5233-R0, BWROG Project Task Report, RCIC Pinch Points, Operation in Prolonged Station Blackout, Feasibility Study, Revision 0
6. PNPS FLEX Mitigation Strategy – Gaps to NRC Order EA-12-049 Interim Staff Guidance.
7. PNPS Hardened Containment Vent System – Gaps to NRC Order EA-12-050 Interim Staff Guidance.
8. EOP03 Rev 10 Primary Containment Control
9. EOP11 Rev 4 Figures, Cautions, and Icons
10. Calculation M1380 Rev 0, PNPS FLEX Strategy Thermal-Hydraulic Analysis
11. ENERCON Calculation ENTGPG012-CALC-001 PNPS Containment Analysis of FLEX Strategy
12. Calculation M907 Rev 0 Refueling Outage Decay Heat Evaluation
13. EC-0000042259 Design Input Record (DIR)

Maintain Core Cooling	
BWR Portable Equipment Phase 2:	
14. Specification M300 Rev 108, Specification Report for Piping 15. Dwg M241SH1 Rev 87 P&ID Residual Heat Removal System 16. Dwg M241SH2 Rev 47 P&ID Residual Heat Removal System 17. PNPS 5.3.26 Rev 26 RPV Injection During Emergencies 18. PNPS 3.M.4-48.2 Rev 35 Opening and Closing of Reactor Pressure Vessel, Disassembly	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
PNPS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.	
Identify modifications	*List modifications*
• Provide the capability, via an AC Power Transfer Switch, to repower the 125V & 250V DC Station Battery Chargers (Normal & Backup) using a mobile AC Generator to maintain these systems operating indefinitely. (Primary and alternate strategies) • Provide for all 480 VAC 3-PH 4-Conductor Cable requirements for Portable Generators with 4-Wire 100 Amp Plugs, Connectors, and Receptacles for 125 & 250 VDC Battery Chargers and Well Pumps. (Primary and alternate strategies) • Provide for all 120/240 VAC 1-PH 3-Conductor Cable requirements for Portable Generators with 3 & 4-Wire 30 & 50 Amp Twist-Lock Plugs, Connectors, and Receptacles for AC Instrumentation Transfer Panels, Portable Fans, and Portable Lighting. (Primary and alternate strategies) • Install FLEX Hydraulic Connection Point for 400 GPM Capacity at the Condensate Storage Tank (CST) Vault that is connected to the 18" HPCI / RCIC Suction Line on the plant-side of the CST 18" Isolation Valves 26-HO-78 & 79. Include readily accessible dual-valved 5" Hose Connectors. (Primary and alternate strategies) • Provide a 4" Reactor Head Nozzle N8 FME/HEPA Adapter Flange modified to include an Isolation Valve and discharge nozzle to allow filling of the Reactor Basin by flowing out of the N8 Nozzle. (Primary and alternate strategies)	

Maintain Core Cooling	
BWR Portable Equipment Phase 2:	
Key Reactor Parameters	*List instrumentation credited or recovered for this coping evaluation.*
Same as instruments listed in above section, Core Cooling Phase 1, plus the following AC powered instruments that will be repowered in Phase 2 using a FLEX Portable Diesel Generator. Phase 2 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	
RPV Essential Instrumentation	**Safety Function**
RPV Level – WR (LI-1001-650A/B) MCR PAM Panels C170 & C171 RX SHUTDOWN LEVEL (WIDE RANGE) (-57 to +303 inch) 120 VAC	RPV inventory and core heat removal
RPV Level – WR (LI-263-101) MCR Panel C904 RX SHUTDOWN LEVEL (WIDE RANGE) (-57 to +303 inch) 120 VAC	RPV inventory and core heat removal
Containment Essential Instrumentation	**Safety Function**
Torus Bottom Pressure (PI-1001-69A/B) MCR Panel C903 TORUS BOTTOM PRESSURE (0 to 100 PSIG) 120 VAC	Containment integrity
Containment Pressure WR (PI-1001-600A/B) MCR PAM Panels C170 & C171 WIDE RANGE PRIMARY CONTAINMENT PRESSURE (0 to 225 PSIG) 120 VAC	Containment integrity
Containment Pressure - Low Range (PI-1001-601A/B)	Containment integrity

Maintain Core Cooling	
BWR Portable Equipment Phase 2:	
MCR PAM Panels C170 & C171 LOW RANGE PRIMARY CONTAINMENT PRESSURE (-5 to +5 PSIG) 120 VAC	
Torus Water Level (LI-1001-604A/B) MCR PAM Panels C170 & C171 TORUS WATER LEVEL (0 to 300 inches) 120 VAC	Containment integrity
Torus Water Temperature (TI-5021-01A/B) TORUS WATER LOCAL TEMP (30 to 230 degF) 120 VAC	Containment integrity TI to be rescaled to 30 to 400 degF.
Torus Water Temperature (TI-5021-02A/B) TORUS WATER BULK TEMP (30 to 230 degF) 120 VAC	Containment integrity TI to be rescaled to 30 to 400 degF.
Hardened Containment Vent System (HCVS) New Instruments to be added Reference NRC Order EA -12-050 HCVS Torus Vent AO-5025 Instrumentation: Upstream Pressure Sensor (0 to 250 PSIG) Downstream Steam Mass Flow Probe (5,000 to 80,000 Lbm/Hr Steam) Downstream Temperature Sensor (40 to 400 degF) Downstream Gamma Radiation Detector (0.010 to 10,000 Rad/Hr) 125VDC / Independent 24 VDC	Containment integrity

Maintain Core Cooling	
BWR Portable Equipment Phase 2:	
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment will be protected or scheduled to protect*
The storage provided for FLEX equipment will be configured to meet the requirements identified in NEI 12-06 section 11. The PNPS FLEX Equipment Storage Strategy is based on the use of seismically rugged, diverse, spatially separated locations. There will be two primary FLEX Equipment Storage Locations at opposite ends of the PNPS Site outside of the Protected Area. Each FLEX Equipment Storage Locations will have the required "N" quantity of items with the exception of the 100 kVA Diesel Generators that will have one at each location and one normally pre-staged in the Turbine Building. This provides a total "N+1" quantity on the site. This storage strategy provides a total "2N" quantity of the FLEX Equipment that is required during the initial 24 hour time period and "N+1" quantity for all equipment. The "2N" equipment is split between two locations each of which provides protection from Seismic, Flooding, Hurricane, and Extreme Temperature. For Extreme Wind & Tornado, with associated Missile Hazards, the strategy is based on "N" equipment remaining deployable based on the diverse storage locations and the localized effect of these events. The Primary Mobile 21,000 Gallon Water Storage Tank is not specifically hardened for Tornado missile hazards and, as an alternative, there are "2N" Backup 11,000 Gallon Collapsible Water Storage Bladder Tanks that can be used in place of the Primary Tank. PNPS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to PNPS.	
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level	*List how equipment will be protected or scheduled to protect*
Not applicable per NEI 12-06 as outlined within the first section of this Integrated Plan.	

Maintain Core Cooling	
BWR Portable Equipment Phase 2:	
Severe Storms with High Winds	*List how equipment will be protected or scheduled to protect*
Refer to description under Seismic Storage / Protection of Equipment.	
Snow, Ice, and Extreme Cold	*List how equipment will be protected or scheduled to protect*
Refer to description under Seismic Storage / Protection of Equipment. Stored equipment will be provided with a heated enclosure and/or diesel engine block (internal) heaters as needed to ensure equipment operability or prevent degradation under all temperature conditions.	
High Temperatures	*List how equipment will be protected or scheduled to protect*
Refer to description under Seismic Storage / Protection of Equipment. Stored equipment will be provided with environmental air conditioning or ventilation as needed to ensure equipment operability or prevent degradation under all temperature conditions.	

Deployment Conceptual Modification (Attachment 3 contains Conceptual Sketches)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection is protected*
The site map in Figure 9 of Attachment 3 shows the existing access points and site roadways to be used for the transportation of FLEX equipment. For this function a deployment path exists for the FLEX Pump staging areas next to the CST FLEX connection point.	1. Staging area will be provided for portable flex pumps to allow access to the intake canal for pump suction over the possible range of water levels.	2. Plant piping and valves for FLEX connections will be missile protected and enclosed within a Seismic Category 1 structure which will inherently protect it from local hazards such as vehicle impact. 3. Diverse connection points for the FLEX

Maintain Core Cooling		
BWR Portable Equipment Phase 2:		
A short section of FLEX Injection buried piping will be installed to cross under the Protected Area Security Perimeter to allow the FLEX Primary seawater suction pump to be deployed and readily connect to a 5" Hose Storz Connector to discharge to the FLEX Secondary tandem pump inside the Protected Area when raw seawater or other external water source is to be used.		Pumps will be provided with at least one protected from tornado missiles. 4. New FLEX piping shall be installed to meet necessary seismic requirements. 5. Connection points for the FLEX Pump discharge will be inside the CST Vault and designed to withstand the applicable hazards. 6. Electrical connection points for the FLEX 480 VAC DGs will be missile protected and enclosed within the Seismic Category 1 structure of the DC Power Battery Rooms and Switchgear.

References:

1. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide", Rev. 0, August 2012
2. EC-0000042259 Design Input Record (DIR)
3. DWG. C2 Rev. 10 Site Plan

Maintain Core Cooling

BWR Portable Equipment Phase 3:

Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain core cooling. Identify methods (RCIC/HPCI/IC)and strategy(ies) utilized to achieve this coping time.

Primary Strategy

The Torus cools down to 250°F at 72 hours after shutdown. The Torus Vent AO-5025 will still be open to provide containment heat removal. The Torus steam venting rate will be equivalent to a 60 GPM Torus makeup water flow rate. (Reference 3) The diesel powered FLEX Low Pressure Injection Pumps have been providing subcooling of the core with heated liquid flow out the SRVs to the Torus, which may be approaching the max level. At this time, the station groundwater wells have been powered by a portable 100 kVA generator and the Well Pumps are feeding the mobile water tank that will be seismically evaluated to demonstrate the maximum fill capacity for normal demineralized water storage. (Reference 1) The transition to Phase 3 will be completed by transferring the suction of the FLEX Pump to the mobile water tank to provide reactor makeup thru with the FLEX Pump discharging thru the Skid-Mounted Demineralizer Vessel to the RPV via the CST suction line to begin a long-term reactor feedwater makeup and boiling strategy. The vessel will be flushed with subcooled water from the mobile Frac tank to the Torus (via SRVs) and then the RPV will be allowed to boil down to a stable water level. The plant will be in a stable condition with outside resources available to maintain stable conditions indefinitely. There are no time-critical actions at this time that are required to restore additional plant systems. (Reference1, 2, 3, 4)

Alternate Strategy

The core cooling strategy for Phase 3 will be similar to Phase 2 where the RPV injection point will be thru the FLEX Hydraulic water source injection point to the RHR System at the existing Fire Water to RHR System Cross-Tie connection and the source of water being used will be from the Well Pumps supplying the mobile water tank and makeup thru the Skid-Mounted Demineralizer Vessel as described above.

References:

1. PNPS FLEX Mitigation Strategy – Gaps to NRC Order EA-12-049 Interim Staff Guidance.
2. PNPS Hardened Containment Vent System – Gaps to NRC Order EA-12-050 Interim Staff Guidance.
3. Calculation M1380 Rev 0, PNPS FLEX Strategy Thermal-Hydraulic Analysis
4. ENERCON Calculation ENTGPG012-CALC-001 PNPS Containment Analysis of FLEX Strategy

Maintain Core Cooling	
BWR Portable Equipment Phase 3:	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
PNPS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.	
Identify modifications	*List modifications*
• Install Groundwater Supply Wells that shall be capable of providing a Total "N" Flow Rate of 80 GPM with a total quantity of "N+1" Wells, each rated for 60 GPM @ 300 ft TH from a 6-inch well casing. The Wells shall include readily accessible protected Well-Heads that are robust with respect to seismic events, floods, and high winds, and associated missiles. • Provide for the pre-staging of a 21,000 Gallon Epoxy-Coated Steel Bi-Level Water Storage Tank with Inlet & Outlet Hose Connectors and power supply to energize electric heaters for freeze protection.	
Key Reactor Parameters	*List instrumentation credited or recovered for this coping evaluation.*
Same as Phase 1 not including instrumentation to support portable equipment.	

Deployment Conceptual Modification (Attachment 3 contains Conceptual Sketches)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection is protected*
All Phase 3 equipment is initially provided from the PNPS on-site FLEX storage facilities and will be maintained operating indefinitely with the added	No modifications are identified for Phase 3 deployment issues. It is anticipated that the Emergency Response Organization (ERO) will assess the damage to the station from	

Maintain Core Cooling		
BWR Portable Equipment Phase 3:		
resources provided by the Regional Response Center (RRC). Replenishment of consumable items, including fuel, protective gear, food, potable water, and disposable batteries will be required. Skid-Mounted Demineralizer resin tanks may be replaced with larger capacity water treatment trailers or complete mobile water treatment systems. Backup or alternate pumping and AC generator equipment transported to the site will be either immediately staged at the point of use location or temporarily stored at an appropriate lay down area until moved to the point of use area.	the BDBEE and formulate a restoration plan that utilizes appropriate off-site resources to repair or replace station AC power systems and equipment, where feasible, to restore the active cooling systems for the RPV, Torus, and/or SFP. The FLEX Strategy Phase 3 operating mode can maintain stable and improving plant conditions for the RPV, Torus, and SFP indefinitely while these efforts are undertaken.	

Maintain Containment

Determine Baseline coping capability with installed coping[2] modifications not including FLEX modifications, utilizing methods described in Table 3-1 of NEI 12-06:

- **Containment Venting or Alternate Heat Removal**
- **Hydrogen Igniters (Mark III containments only)**

BWR Installed Equipment Phase 1:

Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain core cooling. Identify methods (containment vent or alternative / Hydrogen Igniters)and strategy(ies) utilized to achieve this coping time.

During Phase 1, containment integrity is maintained by normal design features of the containment, such as the containment isolation valves and the Hardened Containment Vent System (HCVS). In accordance with NEI 12-06 (Reference 6), the containment is assumed to be isolated following the event. During the first 6 hours after shutdown, the reactor remains isolated and pressurized with RCIC providing core cooling drawing water from the suppression pool (Torus). As the Torus heats up due to RCIC operation, the containment will begin to heat up and pressurize. According to FLEX Strategy Thermal-Hydraulic Analysis the Torus temperature is the limiting factor for implementation of the ELAP strategy (Reference 3, 4). As discussed in the Phase 1 Core Cooling section above, after 6 hours the Torus temperature will be at 170°F and a controlled reactor depressurization is commenced based on the EOP-11 HCTL (Reference 2).

When the Torus heats up to 280°F at 16 hours after shutdown, the Torus vent AO-5025 is opened to provide containment heat removal and begin a long term strategy of reactor feedwater makeup and boiling to protect the core and containment. The PNPS FLEX Strategy is based on performing Torus Venting for Containment heat removal when the Drywell or Torus approaches the Design Temperature of 281°F, which corresponds to a Saturation Pressure of 35 psig which is well below the Primary Containment Pressure Limit (PCPL) of 60 psig as given in EOP-11 Figure 4.

The HCVS is used as implemented per EA-12-050 Reliable Hardened Containment Vents (Reference 5) with Torus Vent control and monitoring from the Main Control Room (MCR) and/or from an HCVS Local Instrument Panel & Pneumatic Control Station. The PNPS FLEX Strategy does not include Containment Venting until after Reactor depressurization and therefore will not affect the Containment Pressure available for RCIC or HPCI Pump NPSH during the time that these pumps may be operating (see Item 3.1 in the Hardened Containment Vent System (HCVS) Gap Analysis for NRC Order EA-12-050. (Reference 5))

The containment design pressure is 56 psig, as noted in FSAR table 5.2-1 (Reference 1), which is at a Low-Low Torus Water Level and corresponds to 60 psig Torus Bottom Pressure. Containment pressure limits are not expected to be reached during the event as indicated by FLEX Strategy Thermal-Hydraulic Analysis (Reference 3, 4), because the HCVS is opened prior to exceeding any containment pressure limits. Thus, containment integrity is not challenged and remains functional throughout the event. Monitoring of Containment Drywell & Torus Pressure and Torus Water Level & Temperature will be available via normal plant instrumentation.

Maintain Containment

Phase 1 (i.e., the use of permanently installed plant equipment/features) of containment integrity is maintained throughout the duration of the event; no non-permanently installed equipment is required to maintain containment integrity. Therefore, there is no defined end time for the Phase 1 coping period for maintaining containment integrity. An alternative strategy for containment during Phase 1 is not provided, because containment integrity is maintained by the plant's design features.

References:

1. Final Safety Analysis Report Rev 28 (PNPS FSAR) 21-NOV-2011
2. EOP03 Rev 10, Primary Containment Control
3. Calculation M1380 Rev 0, PNPS FLEX Strategy Thermal-Hydraulic Analysis Revision 0
4. ENERCON Calculation ENTGPG012-CALC-001 PNPS Containment Analysis of FLEX Strategy
5. EA 12-050, Interim Staff Guidance, "Reliable Hardened Containment Vents", Revision 0
6. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide", Rev. 0, August 2012

Details:

Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*

EOP03 Primary Containment Control exists to direct operators in protection and control of containment integrity.

Existing Procedures for the use of the Torus Vent Valve AO-5025 are in PNPS 2.2.70, which describes the precautions for inadvertent operation, and PNPS 5.4.6 for the venting and purging of the Primary Containment in accordance with the EOP-03.

PNPS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.

Identify modifications	*List modifications*

Hardened Containment Vent System (HCVS) (i.e., Reliable Hardened Vent) is currently installed but will be enhanced in accordance with NRC Order EA-12-050, Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents.

Maintain Containment	
Key Containment Parameters	*List instrumentation credited for this coping evaluation.*
Same as instruments listed in previous section, Core Cooling Phase 1, plus the additional AC powered instruments that will be repowered using a FLEX Portable Diesel Generator as listed in previous section Core Cooling Phase 2.	
References: 1. Dwg M227SH1 Rev 59 P&ID Containment Atmospheric Control System 2. Dwg M227SH2 Rev 49 P&ID Containment Atmospheric Control System	

[1] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

Maintain Containment	
BWR Portable Equipment Phase 2:	
Provide a general description of the coping strategies using on-site portable equipment including modifications that are proposed to maintain core cooling. Identify methods (containment vent or alternative / Hydrogen Igniters)and strategy(ies) utilized to achieve this coping time. Containment integrity is maintained by permanently installed equipment. Portable FLEX Diesel Generators will be employed, as discussed in Phase 2 Core Cooling section, to charge the station batteries and maintain DC bus voltage. See Phase 1 description for discussion of containment integrity applicable throughout the event.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
See procedures listed in Phase 1 section	
Identify modifications	*List modifications*
See modifications listed in Phase 1 section	
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.*
See Instruments listed in Phase 1 section Phase 2 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment is protected or schedule to protect*
The HCVS is currently installed but will be enhanced in accordance with NRC Order EA-12-050, Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents and guidance in JLD-ISG-2012-02. The HCVS will meet the design requirements as specified for reasonable protection per NEI 12-06.	

Maintain Containment	
BWR Portable Equipment Phase 2:	
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	*List how equipment is protected or schedule to protect*
Not applicable per NEI 12-06 as outlined within the first section of this Integrated Plan.	
Severe Storms with High Winds	*List how equipment is protected or schedule to protect*
The HCVS is currently installed but will be enhanced in accordance with NRC Order EA-12-050, Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents and guidance in JLD-ISG-2012-02. The HCVS will meet the design requirements as specified for reasonable protection per NEI 12-06.	
Snow, Ice, and Extreme Cold	*List how equipment is protected or schedule to protect*
The HCVS is currently installed but will be enhanced in accordance with NRC Order EA-12-050, Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents and guidance in JLD-ISG-2012-02. The HCVS will meet the design requirements as specified for reasonable protection per NEI 12-06.	
High Temperatures	*List how equipment is protected or schedule to protect*
The HCVS is currently installed but will be enhanced in accordance with NRC Order EA-12-050, Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents and guidance in JLD-ISG-2012-02. The HCVS will meet the design requirements as specified for reasonable protection per NEI 12-06.	

Deployment Conceptual Design **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection is protected*
HCVS is designed as permanently installed equipment. No deployment	The Hardened Containment Vent System (HCVS) is currently installed but will be	HCVS is designed as permanently installed equipment. No connection

Maintain Containment		
BWR Portable Equipment Phase 2:		
strategy is required.	enhanced in accordance with NRC Order EA-12-050, Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents and guidance in JLD-ISG-2012-02.	points are required.

Maintain Containment		
BWR Portable Equipment Phase 3:		
Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain core cooling. Identify methods (containment vent or alternative / Hydrogen Igniters)and strategy(ies) utilized to achieve this coping time. See Phase 2 discussion.		
Details:		
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*	
See Phase 2 discussion.		
Identify modifications	*List modifications*	
See Phase 2 discussion.		
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.*	
See Phase 2 discussion. Phase 3 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.		
Deployment Conceptual Design (Attachment 3 contains Conceptual Sketches)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection will be protected*
See Phase 2 discussion.	See Phase 2 discussion.	See Phase 2 discussion.

Maintain Spent Fuel Pool Cooling	
Determine Baseline coping capability with installed coping[3] modifications not including FLEX modifications, utilizing methods described in Table 3-1 of NEI 12-06: • **Makeup with Portable Injection Source**	
BWR Installed Equipment Phase 1:	
Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain spent fuel pool cooling. Identify methods (makeup with portable injection source)and strategy(ies) utilized to achieve this coping time There are no Phase 1 actions required at this time that need to be addressed. Fuel in the SFP will be cooled by maintaining the Spent Fuel Pool level at or above 33 feet.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
Phase 1 strategy will be use of plant design to maintain cooling for fuel in the SFP via the large inventory and heat capacity of water in the SFP. Water level in the Spent Fuel Pool will be maintained at or above 33 ft depth. (Reference 1). <u>References:</u> 1. PNPS Technical Specifications & Bases, Rev 269	
Identify any equipment modifications	*List Modifications*
Modification to install SFP level instrumentation per NRC Order EA-12-051	
Key SFP Parameter	*List instrumentation credited or recovered for this coping evaluation*
Per NRC Order EA 12-051	

[3] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

Maintain Spent Fuel Pool Cooling

BWR Portable Equipment Phase 2:

Provide a general description of the coping strategies using on-site portable equipment including modifications that are proposed to maintain spent fuel pool cooling. Identify methods (makeup with portable injection source)and strategy(ies) utilized to achieve this coping time.

The SFP will slowly heat up following the loss of the Normal SFP Cooling System due to loss of AC power. Calculations M588 "Fuel Pool Decay Heat and Heatup Times" and M907 "Refueling Outage Decay Heat Evaluation" "(References 6 and 7 respectively) provide the design basis SFP heat loads, heatup times, and boil-off rates for the SFP following a 20-Day Refueling Outage and a Maximum Normal Spent Fuel Discharge, which is a conservative bounding condition for the Spent Fuel Pool Heat Load. For the FLEX Strategy evaluation of the Spent Fuel Pool heat load, it is conservatively assumed that the Reactor is operating at 100% power and that it has been only 30-days since the last Reactor shutdown for refueling. The SFP conditions at this point in time are then:

- Time-to-Boil @ 30 Days = 32 Hrs (based on 125 °F starting temp)
- Boil-Off Rate @ 30 Days = 12 GPM (Reference 6 Table 6)

<u>*Refueling Mode Full Core Offload*</u>

The plant shutdown condition is also considered in which the Reactor full core has been off-loaded to the Spent Fuel Pool, and the SFP Gate has been installed to allow complete or partial draining of the Reactor Basin, such as might be done for some type of major vessel internals repair activity.

Per Reference 5, the earliest time that this plant configuration could be accomplished is assumed to be at least 150 Hrs after Reactor shutdown. The SFP conditions at this point in time are then:

- Time-to-Boil @ 150 Hrs = 7.3 Hrs (based on 125 °F starting temp)
- Boil-Off Rate @ 150 Hrs = 51 GPM (Reference 6, Table 7)

<u>*Refueling Mode Core Offload in Progress*</u>

The addition of up to 350,000 gallons required to complete the filling of the Reactor Basin and Dryer & Separator Pool, or an equal volume added to the Torus, will allow at least 72 Hours to either restore active cooling, or to begin providing makeup only at the total rate for the Reactor Full Core and Spent Fuel Pool that will be 68 GPM at 72 Hours after Reactor shutdown. (Reference 6) For the alternative plant shutdown conditions during which the Reactor normal or full core fuel discharge is in the process of transfer or has been completely off-loaded to the Spent Fuel Pool, the same FLEX equipment will be used to provide makeup water to the Reactor and/or Spent Fuel Pool at a rate equal to the maximum 51 GPM Boil-Off Rate at 150 Hrs after shutdown to maintain a nominally full water level. (Reference 6)

<u>*Primary Strategy Method 1*</u>

The initial source of SFP makeup water will be provided by storage of demineralized water in the

Maintain Spent Fuel Pool Cooling

BWR Portable Equipment Phase 2:

lower volume of the Dryer & Separator Storage Pool (below EL 97 ft). The capacity of this lower volume is 34,000 Gal. (Reference 7) Transfer of water from the Dryer & Separator Storage Pool to the Spent Fuel Pool will be via a hose connected to a Submersible Air-Powered Diaphragm Pump with a bottom suction and capacity up to 120 GPM. A Diesel Air Compressor (DAC) and hose will be pre-staged for use on the Reactor Building Refuel Floor to provide SFP makeup water transfer from the Dryer & Separator Storage Pool to the Spent Fuel Pool. A usable volume of 30,000 GPM will provide a 42 Hr supply of makeup water at a boil-off rate of 12 GPM. The total heatup Time to boiling and available makeup water supply is then 74 hours. (Reference 5)

Primary Strategy Method 2

There will be an existing capability to supply makeup water to the Spent Fuel Pool without accessing the refueling floor. This connection will be via the RHR to Fuel Pool Cooling System (RHR/FPC) Intertie from RHR System 6-inch valve 1001-104 to 19-HO-166 that connects to the Fuel Pool Cooling System 8-inch Return Header directly to the Spent Fuel Pool as described in the Design Basis Report MDBR11. (Reference 1) If the FLEX Pump will be the source of makeup water, it will be connected to the RHR System via the Fire Water to RHR / SSW System Cross-Tie via 10-HO-511 in accordance with PNPS 5.3.26 that installs an 8" Victaulic to 2-1/2" fire hose adaptor to the lower flange of the Fire Water to RHR crosstie pipe connection at the Aux Bay EL 23 ft location. (Reference 3, 4) The makeup source of water will be from the UHS and will satisfy the requirements of the primary strategy for makeup water at a boil-off rate of 12 GPM.

Primary Strategy Method 3

The case that requires spray cooling for the SFP greater than the makeup rate will utilize existing equipment that is intended to support the Mitigating Strategies Requirements from previous NRC Order EA-02-026, Section B.5.b, and 10 CFR 50.54(hh)(2). The regulatory guidance contained in NRC Order EA-02-026, Section B.5.b, as noted in JLD-ISG-2012-01 continues to provide an acceptable means of meeting the requirement to develop, implement and maintain the necessary guidance and strategies for that subset of beyond-design-basis external events. (Reference 1, 8)

References:

1. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide", Rev. 0, August 2012
2. Final Safety Analysis Report Rev 28 (PNPS FSAR) 21-NOV-2011
3. Dwg M241SH1 Rev 87 P&ID Residual Heat Removal System
4. Dwg M241SH2 Rev 47 P&ID Residual Heat Removal System
5. PNPS FLEX Mitigation Strategy – Gaps to NRC Order EA-12-049 Interim Staff Guidance.
6. Calculation M907 Rev 0 Refueling Outage Decay Heat Evaluation
7. Calculation M588 Rev 1 Fuel Pool Decay Heat and Heatup Times
8. JLD-ISG-2012-01 Rev. 0 Compliance with Order EA-12-049
9. MDBR11 Rev 14 Spent Fuel Pool Cooling and Demineralizer.

Maintain Spent Fuel Pool Cooling	
BWR Portable Equipment Phase 2:	
Schedule:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
PNPS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.	
Identify modifications	*List modifications*
10. Modification to install SFP level instrumentation per Order EA-12-051	
Key SFP Parameter	*List instrumentation credited or recovered for this coping evaluation.*
Per NRC Order EA-12-051 Phase 2 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment is protected or schedule to protect.*
FLEX equipment will be stored in storage structures designed and constructed to meet the requirements of NEI 12-06. One Air-Powered Diaphragm Pump and hoses will be pre-staged for use on the Reactor Building Refuel Floor to provide SFP makeup water transfer from the Dryer & Separator Storage Pool to the Spent Fuel Pool. One 125 CFM 100 psig Diesel Air Compressor (DAC) may be stored within a protected location in the Auxiliary Bay to be more easily deployed to operate the SFP Air-Powered Diaphragm Pump from the Reactor Building Truck Lock. The alternate DAC will be in FLEX Storage.	

Maintain Spent Fuel Pool Cooling	
BWR Portable Equipment Phase 2:	
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	*List how equipment is protected or schedule to protect.*
Not applicable per NEI 12-06 as outlined within the first section of this Integrated Plan.	
Severe Storms with High Winds	*List how equipment is protected or schedule to protect*
The piping used to provide makeup flow to the SFP from the RHR System is contained within the Reactor Building and Auxiliary Bay and is protected from storms and high winds. FLEX equipment will be provided with a Storage Strategy based on the use of seismically rugged, diverse, spatially separated locations to meet the requirements of NEI 12-06.	
Snow, Ice, and Extreme Cold	*List how equipment is protected or schedule to protect*
The piping used to provide makeup flow to the SFP from the RHR System is contained within the Reactor Building and Auxiliary Bay and is protected from snow, ice, and extreme cold. FLEX equipment will be provided with a Storage Strategy based on the use of seismically rugged, diverse, spatially separated locations to meet the requirements of NEI 12-06.	
High Temperatures	*List how equipment is protected or schedule to protect*
The piping used to provide makeup flow to the SFP from the RHR System is contained within the Reactor Building and Auxiliary Bay and is protected from high temperatures. FLEX equipment will be provided with a Storage Strategy based on the use of seismically rugged, diverse, spatially separated locations to meet the requirements of NEI 12-06.	

Deployment Conceptual Design (Attachment 3 contains Conceptual Sketches)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection will be protected*
• The Air-Powered	• See Phase 2 Core Cooling	See Phase 2 Core Cooling for

Maintain Spent Fuel Pool Cooling		
BWR Portable Equipment Phase 2:		
Diaphragm Pump and support equipment used to provide the initial SFP makeup function for the primary strategy are kept in an accessible and protected area of the Refueling Floor in the Reactor Building. • The site map in Figure 8 & 9 of Attachment 3 shows the existing access points and site roadways to be used for the transportation of FLEX equipment. • The Monitor Spray Nozzle and Hoses needed to provide spray and/or makeup to the SFP are kept at an accessible and protected area of the Refueling Floor in the Reactor Building.	for discussion of modification necessary to deploy the FLEX Pumps.	discussion of protection of connection points for FLEX Pumps.

Maintain Spent Fuel Pool Cooling	
BWR Portable Equipment Phase 3:	
Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain spent fuel pool cooling. Identify methods (makeup with portable injection source)and strategy(ies) utilized to achieve this coping time. Same as Phase 2.	
Schedule:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
PNPS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.	
Identify modifications	*List modifications*
See Phase 2 discussion.	
Key SFP Parameter	*List instrumentation credited or recovered for this coping evaluation.*
Spent Fuel Pool Level Per Order EA-12-051 Phase 3 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	

Deployment Conceptual Design (Attachment 3 contains Conceptual Sketches)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection will be protected*
Same as Phase 2.	Same as Phase 2.	Same as Phase 2.

Safety Functions Support
Determine Baseline coping capability with installed coping[4] modifications not including FLEX modifications.
BWR Installed Equipment Phase 1
Provide a general description of the coping strategies using installed equipment including station modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times. <u>Main Control Room Accessibility:</u> GOTHIC analysis (Reference 1) of the main control room (MCR) over a period of 72 hours following an extended loss of AC power shows that by opening Door 145 "Main Control Room to Stairway 8" within 30 minutes, the MCR temperature will be kept under 110°F, the limit for human performance as specified in NUMARC-87-00 (Reference 1). The GOTHIC analysis uses the conservative assumptions of a 102°F outside temperature and loss of offsite power heat loads for the MCR (Reference 1). No other actions or modifications are required for MCR Accessibility. <u>RCIC Room Accessibility:</u> It is not anticipated that the RCIC room will require occupation by personnel during the event. The only case where personnel would be required to enter the RCIC room will be during Phase 1 if remote operation fails. Also, RCIC room area temperatures of 160° to 170°F or RCIC valve station temperatures of 190° to 200°F will isolate both the inboard and outboard steam isolations valves. (Reference 4) The PNPS Probabilistic Safety Assessment (Reference 3) contains evaluations of the RCIC room heatup for station blackout conditions. One evaluation was performed using GOTHIC (Appendix M2) and another evaluation was performed by General Electric as part of a Station Blackout study (Appendix F7). The GOTHIC results indicate temperatures of 124.5°F for the RCIC Pump quadrant, 137.7°F for the RCIC Pump Quadrant Mezzanine, and 121.8°F for the RCIC Valve Station at 10 hours. The GE evaluation indicates temperatures of 112°F for a realistic 10 lbm/hr steam leakage rate and 137.5°F for an extreme 70 lbm/hr leakage rate at 10 hours. The RCIC isolation valves will not close in the first 10 hours, but if personnel access is required, mitigating actions such as using portable fans, water sprays, self-contained breathing equipment, and reduced stay times will be used. Entergy Industrial safety procedures currently address activities with a potential for heat stress to

[4] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

Safety Functions Support	
prevent adverse impacts on personnel. (Reference 5) References 1. ENERCON Calculation ENTGPG012-CALC-003 Rev. 0 PNPS MCR Heatup for Extended Loss of Offsite Power (FLEX). 2. NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Rev. 011. 3. PNPS-NE-07-00006, PNPS Probabilistic Safety Assessment (PSA), Rev. 2. 4. PNPS System Description, "Reactor Core Isolation Cooling System", Rev 4, Feb. 2005. 5. EN-IS-108 Rev 10, Working in Hot Environments.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation.*
PNPS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.	
Identify modifications	*List modifications and describe how they support coping time.*
No modifications are required.	
Key Parameters	*List instrumentation credited for this coping evaluation phase.*
Portable temperature instrumentation for the MCR and RCIC rooms will be available, if necessary, from the Instrument and Control (I&C) shop.	

Safety Functions Support
BWR Portable Equipment Phase 2
Provide a general description of the coping strategies using on-site portable equipment including station modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times. <u>Main Control Room Accessibility:</u> No portable equipment will be required to maintain control room Accessibility. The same Phase 1 strategy will be used. <u>RCIC Room Accessibility:</u> If personnel access is required, mitigating actions such as using portable fans, water sprays, self-contained breathing equipment, and reduced stay times will be used. <u>Battery Room Ventilation</u> The equipment and procedures to establish ventilation of the 125V & 250V Battery Rooms using portable fans to exhaust from the top of the room volumes to outside air using existing ventilation ducts will be provided to prevent H2 gas accumulation resulting from battery charging. <u>Spent Fuel Pool Area:</u> SFP bulk boiling will create adverse temperature, humidity, and condensation conditions in the Reactor Building. NEI 12-06 requires a ventilation vent pathway to exhaust the humid atmosphere from the EL 117 ft SFP / Refuel Floor Area with an outside air inlet at a lower elevation. The Reactor Building Roof Access Air Lock and Roof Hatch at EL 158 ft provides a high level vent outlet from the SFP/Refuel Floor while also opening a ground level ventilation inlet, such as the Reactor Building Truck-Lock. This action will be required to be performed prior to the onset of SFP boiling (as water temperature approaches 200 °F).

Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation with a description of the procedure / strategy / guideline.*
PNPS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.	

Safety Functions Support	
BWR Portable Equipment Phase 2	
Identify modifications	*List modifications necessary for phase 2*
No modifications are required for Phase 2.	
Key Parameters	*List instrumentation credited or recovered for this coping evaluation.*
None	
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment will be protected or scheduled to protect*
FLEX equipment will be stored at diverse locations that are each robust for seismic events. The site's FLEX Storage configuration is such that a minimum "N" quantity of FLEX equipment will be available after any of the applicable Beyond-Design-Basis-External-Events (BDBEEs).	
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	*List how equipment will be protected or schedule to protect*
FLEX storage includes two sites at two diverse locations that are above the site Protected Area grade level and are well above the highest postulated flood water levels.	
Severe Storms with High Winds	*List how equipment will be protected or schedule to protect*
FLEX equipment will be stored at diverse locations that are robust for weather-related events, except for direct-strike tornado hazards. The site's FLEX Storage configuration is such that a minimum "N" quantity of FLEX equipment will be available after any of the applicable Beyond-Design-Basis-External-Events (BDBEEs).	
Snow, Ice, and Extreme Cold	*List how equipment will be protected or schedule to protect*
FLEX equipment will be stored at diverse locations that are robust for weather-related and extreme temperature events, and include heating and environmental controls, where needed. The site's FLEX Storage configuration is such that a minimum "N" quantity of FLEX equipment will be available after any of the applicable Beyond-Design-Basis-External-Events (BDBEEs).	

Safety Functions Support		
BWR Portable Equipment Phase 2		
High Temperatures	*List how equipment will be protected or schedule to protect*	
FLEX equipment will be stored at diverse locations that are robust for weather-related and extreme temperature events, and include ventilation and environmental controls, where needed. The site's FLEX Storage configuration is such that a minimum "N" quantity of FLEX equipment will be available after any of the applicable Beyond-Design-Basis-External-Events (BDBEEs).		
Deployment Conceptual Design (Attachment 3 contains Conceptual Sketches)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection will be protected*
The "N" portable fans that will be deployed for Battery Room ventilation will be pre-staged in those areas with an additional "N" fans included at the FLEX Storage Locations.	No modifications are required	N/A

Safety Functions Support		
BWR Portable Equipment Phase 3		
Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times. <u>Main Control Room Accessibility:</u> The same Phase 1 strategy will be used for Phase 3. <u>Spent Fuel Pool Area:</u> The same Phase 2 strategy will be used for Phase 3.		
Details:		
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation with a description of the procedure / strategy / guideline.*	
See Phase 2 discussion		
Identify modifications	*List modifications necessary for phase 3*	
See Phase 2 discussion		
Key Parameters	*List instrumentation credited or recovered for this coping evaluation.*	
See Phase 2 discussion		
Deployment Conceptual Design **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection will be protected*
See Phase 2 discussion	No modifications are required	N/A

BWR Portable Equipment Phase 2							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Maintenance*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
Four (4) Godwin HL100M Dri Prime Diesel Pumps	X	X	X			400 GPM @ 350 ft TDH	Will follow EPRI FLEX PM Basis Database & Template requirements.
Three (3) 480 VAC Generator	X			X		480 VAC 3-PH 100 kVA w/ 120 VAC 1-PH	Same as above.
Two (2) 120/240 VAC Generator				X		120/240 VAC 1-PH 12 KW	Same as above.
Four (4) 120/240 VAC Generator				X		120/240 VAC 1-PH 6 KW	Same as above.
Two (2) Diesel Air Compressor			X			125 CFM @ 100 psig	Same as above.

BWR Portable Equipment Phase 2							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Maintenance*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
Two (2) Sandpiper HDF2-A TYPE 5 Air-Powered Diaphragm Pumps for Diesel Fuel Transfer, SFP Makeup Water, & General Dewatering Service	X		X			120 GPM @ 40 psig	Same as above.
Two (2) Sandpiper MSB2-A TYPE 3 Air-Powered Diaphragm Pumps for SFP Makeup Water & General Dewatering Service			X			120 GPM @ 20 psig	Same as above.

BWR Portable Equipment Phase 2							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Maintenance*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
Four (4) Portable Ventilation Fans 12" Duct Intrinsically Safe for Battery Room Exhaust 120 VAC 1-PH Motor				X			Same as above.
One (1) Primary Debris Removal Wheel Loader					X		Same as above.
8-inch spool piece connector with Victaulic Couplings to connect to the existing Fire Water to RHR / SSW System Cross-Tie via 10-HO-511.	X					Shall be provided as needed to accept a Hose Connector in addition to 2-1/2 inch National Standard (NST) Fire Hose Thread Swivel Connectors.	Same as above.

BWR Portable Equipment Phase 2							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Maintenance*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
4" Reactor Head Nozzle N8 FME/HEPA adapter flange modified to include an isolation valve and discharge nozzle to allow fill of the Reactor Basin.	X						Same as above.
Two (2) Pickup Trucks 3/4-Ton with Trailer Towing Attachments and Bed-Mounted 100 Gallon Fuel Storage Tank with Transfer Pump.	X		X	X		Provide mobile refueling capability for FLEX diesel engine driven equipment.	Same as above.

BWR Portable Equipment Phase 3							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Notes*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
One (1) Primary Mobile Demin Water Storage Tank Epoxy-Coated Steel Bi-Level Mobile Tank with Inlet & Outlet Hose Connectors	X					The Water Storage Tank shall have a capacity of 21,000 Gallons and shall be seismically evaluated to demonstrate the maximum fill capacity for normal demineralized water storage.	Tank condition monitoring will be performed on a routine PM basis. Tank temperature and heater operation will be monitored to prevent freezing when applicable, via a Surveillance PM.
Two (2) Backup Gal Collapsible Water Storage Bladder Multi-Use Water Storage Bladder Tanks with Inlet & Outlet Hose Connectors	X					11,000 Gallons capacity each	Collapsible Water Storage Bladder Tanks will have an established storage life at which interval they will be inspected or replaced via a PM requirement.

BWR Portable Equipment Phase 3							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Notes*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
Four (4) Skid-Mounted Demin Unit with Mixed Bed (MB) Resin Volume	X					FlexTrex 48 Skid-Mounted Demineralization Unit with 60 cu-ft Mixed Bed (MB) Resin Volume with 480 kgrain (31.2 Kgram) Ion Exchange Capacity 10 PSI Pressure Drop @ 250 GPM	The Demin Resin Tanks will have an established storage life at which interval they will be returned to the Water Treatment Vendor for recharging or replenishment as needed via a PM requirement.
Two (2) Duplex Strainer w/Flow Meter & Totalizer	X					400 GPM 1/8 inch Strainer Size	The Strainer Cart will have periodic inspection PM for the Tanks, Valves, Piping, Trailer, and the Flow Meter & Totalizer.

Phase 3 Response Equipment/Commodities	
Item	**Notes**
Radiation Protection Equipment • Survey instruments • Dosimetry • Off-site monitoring/sampling	This is existing Emergency Response Organization (ERO) equipment that has established PM program requirements for maintenance & calibration.
Commodities • Food • Potable water	Perishable commodities will have an established storage life at which interval they will be replaced as needed via a PM requirement.
Fuel Requirements • Diesel Fuel	Will follow EPRI FLEX PM Basis Database & Template requirements, and/or other applicable criteria for Diesel Fuel storage and replenishment.
Heavy Equipment • Transportation equipment • Debris clearing equipment	Will follow EPRI FLEX PM Basis Database & Template requirements.

Attachment 1A
Sequence of Events Timeline

(insert site specific time line to support submittal)

Action item	Elapsed Time	Action	ELAP New Time Constraint Y/N 5	Remarks / Applicability
	0	**Event Starts**	**NA**	Plant @100% power
1	60 sec	RCIC/HPCI starts	N	Reactor operator initiates or verifies initiation of reactor water level restoration with steam driven high pressure injection.
2	2 min	RCIC suction manually swapped to the Torus and HPCI secured.	N	HPCI will trip automatically when reactor level reaches the high level setpoint.
3	1 hr	Attempts to start EDGs have been unsuccessful. Enter ELAP Procedure	Y	Entry into ELAP provides guidance to operators to begin deep DC load shedding.
4	2 hr	DC Load shed complete	Y	DC buses are readily available for operator access and breakers will be appropriately identified (labeled) to show which are required to be opened.
5	2 hr	Commence deployment of one Prestaged FLEX 100 kVA 480 VAC 3-PH Diesel Generator (DG) for repowering any one of the 125 or 250 VDC Battery Chargers as soon as possible. Note: This action will be taken based on any extended loss of AC power condition, well before battery depletion, to commence active battery recharging and to maintain the station DC Power Systems operating indefinitely.	N	It is the intent to begin recharging the batteries well before they become fully depleted if the first pre-staged AC Diesel Generator (DG) is available after the event.

[5] Instructions: Provide justification if No or NA is selected in the remark column
If yes include technical basis discussion as required by NEI 12-06 section 3.2.1.7

Action item	Elapsed Time	Action	ELAP New Time Constraint Y/N 5	Remarks / Applicability
6	4 hr	Pre-staged FLEX 100 kVA 480 VAC 3-PH Diesel Generator in Turbine Bldg. deployed and available to repower any one of the 125 or 250 VDC Battery Chargers.	N	Each division of batteries will be recharged to approximately 70% capacity and the charging switched to alternate divisions to maximize the charging rate.
7	6 hr	Manually Depressurize RPV to 120 psig when Torus temperature reaches 170 deg F (based on EOP-11 HCTL curve). Requires intermittent operation of SRVs. Maintain auto control of RCIC.	Y	This is based on PNPS calculation (STATION BLACKOUT FLEX STRATEGY WITH NO PREFERRED WATER SOURCES FOR 72 HRS) and validated thru MAAP analysis.
8	8 hr	Transition from Phase 1 to Phase 2. At this time, at least two FLEX 100 kVA 480 VAC 3-PH DGs will have been deployed to repower the 125 & 250 VDC Battery Chargers to maintain the station DC Power Systems operating indefinitely.	Y	Battery durations are calculated to last at least 8 hours. FLEX 480VAC DGs will be staged beginning at approximately 2-8 hrs.
9	9 hr	Transition from RCIC steam-driven operation to FLEX portable equipment for the Core cooling function by placing the FLEX diesel powered pumps in service for low pressure injection from the UHS through a duplex strainer cart to the isolated CST common suction line to the HPCI & RCIC Pumps, while SRVs are opened to complete the depressurization to its minimum value of approximately 50 psig SRV backpressure. The injection flow rate is run sufficiently high (approximately 400 GPM) to sub-cool the vessel and raise water level to begin a heated liquid discharge to the Torus for continued vessel subcooling at a flow rate that is slowly reduced over the subsequent hours.	Y	FLEX Pumps will be staged beginning at approximately 6 – 9 hour time frame. Torus temperature is calculated to be at 235°F at 9 hours.
10	16 hr	When Torus heats up to 280°F, open the Hardened Containment Vent System (HCVS), which includes an 8" Air-Operated Butterfly Valve AO-5025 capable of venting the Wetwell	Y	The constraint can be met because HCVS is a fully qualified Safety-Related system and is powered by

Action item	Elapsed Time	Action	ELAP New Time Constraint Y/N 5	Remarks / Applicability
		(Torus) airspace through an 8" branch line between the two Primary Containment Isolation Valves (PCIVs) AO-5042A & B from 20" Torus Penetration X-227. The HCVS Torus Vent is opened per EOPs to provide Containment Heat Removal, and this action, taken at this time, will prevent additional rise in Torus temperature. The diesel powered FLEX Low Pressure Injection pumps continue to provide subcooling for the core with heated liquid flow out the SRVs to the Torus. The sub-cooling flow rate is slowly reduced based on procedure guidance that provides flow required versus time, as well as the actual Torus Water Level, and pump Flow Totalizer readings to control the net Torus inventory addition within the 400,000 gallon maximum.		125 VDC with pneumatic pressure supplied from independent Nitrogen bottles to operate the HCVS valves. Torus water temperature of 280°F is calculated to occur at 16 hours after shutdown by PNPS calculation and validated by MAAP analysis.
11	16 hr	Preparations will commence to power the station Groundwater Wells with a FLEX portable AC Diesel Generator and to begin adding water to fill the Mobile Frac tank (or a backup bladder tank) to prepare for a long-term Phase 3 reactor feedwater makeup and boiling strategy.	N	The Groundwater Wells are installed with protected well-head AC power from the FLEX DGs, and connections for 2-1/2" hoses to discharge to the Frac tank.
12	32 hr	Begin makeup to SFP as necessary to maintain essentially normal full water level in the SFP. (Boiling under design basis conditions begins at 32 hours and requires 12 GPM makeup). The makeup water is taken from the Dryer & Separator Storage Pool that is maintained filled below EL 97 ft to provide makeup water for this purpose. The Pool has a usable volume of 30,000 Gallons will provide a 42 Hr supply of makeup water at a boil-off rate of 12 GPM. A pre-staged Submersible Air-Powered Diaphragm Pump with a bottom suction and capacity up to 120 GPM will be used and the initial volume of 30,000 Gallons will provide a 42 Hr supply of makeup water at a boil-off rate of 12 GPM.	Y	The initial source of SFP makeup water will be provided by storage of demineralized water in the lower volume of the Dryer & Separator Storage Pool (below EL 97 ft). This is calculated to provide cooling until +74 hours.

Action item	Elapsed Time	Action	ELAP New Time Constraint Y/N 5	Remarks / Applicability
13	32 hr	Establish natural free convection ventilation to exhaust the humid atmosphere from the EL 117 ft SFP/Refuel Floor Area with an outside air inlet at a lower elevation though the Reactor Building Truck Lock at EL 23 ft.	Y	Procedural guidance shall be provided for Operations to open the Reactor Bldg. Hatch while also opening a ground level ventilation inlet. This action is required to be performed prior to the SFP boiling.
14	72 hr	Transition from Phase 2 to Phase 3 for Core Cooling function by maintaining the station Groundwater Wells in service feeding the water storage Frac tank, and drawing this water for injection via the FLEX diesel powered Pump through a demineralizer skid and duplex strainer cart to the RPV to begin a long-term makeup and boiling strategy at constant water level. There are no additional time critical actions for the next 30 days once this mode is established.	Y	The transition from Phase 2 to Phase 3 is determined at a time based on Torus inventory and is to implemented before a net addition of 400,000 Gallons to the Torus, which is not expected to occur before 72 Hour after shutdown. Once in Phase 3, the plant can be maintained in a stable condition with FLEX Pumps in service for injection to the RPV at a stable water level, and heat removal provided by the HCVS Torus Vent at a steadily reducing Torus temperature, pressure, and water inventory. There is no need to reject liquid water from the Torus at any time.

Attachment 2
Milestone Schedule

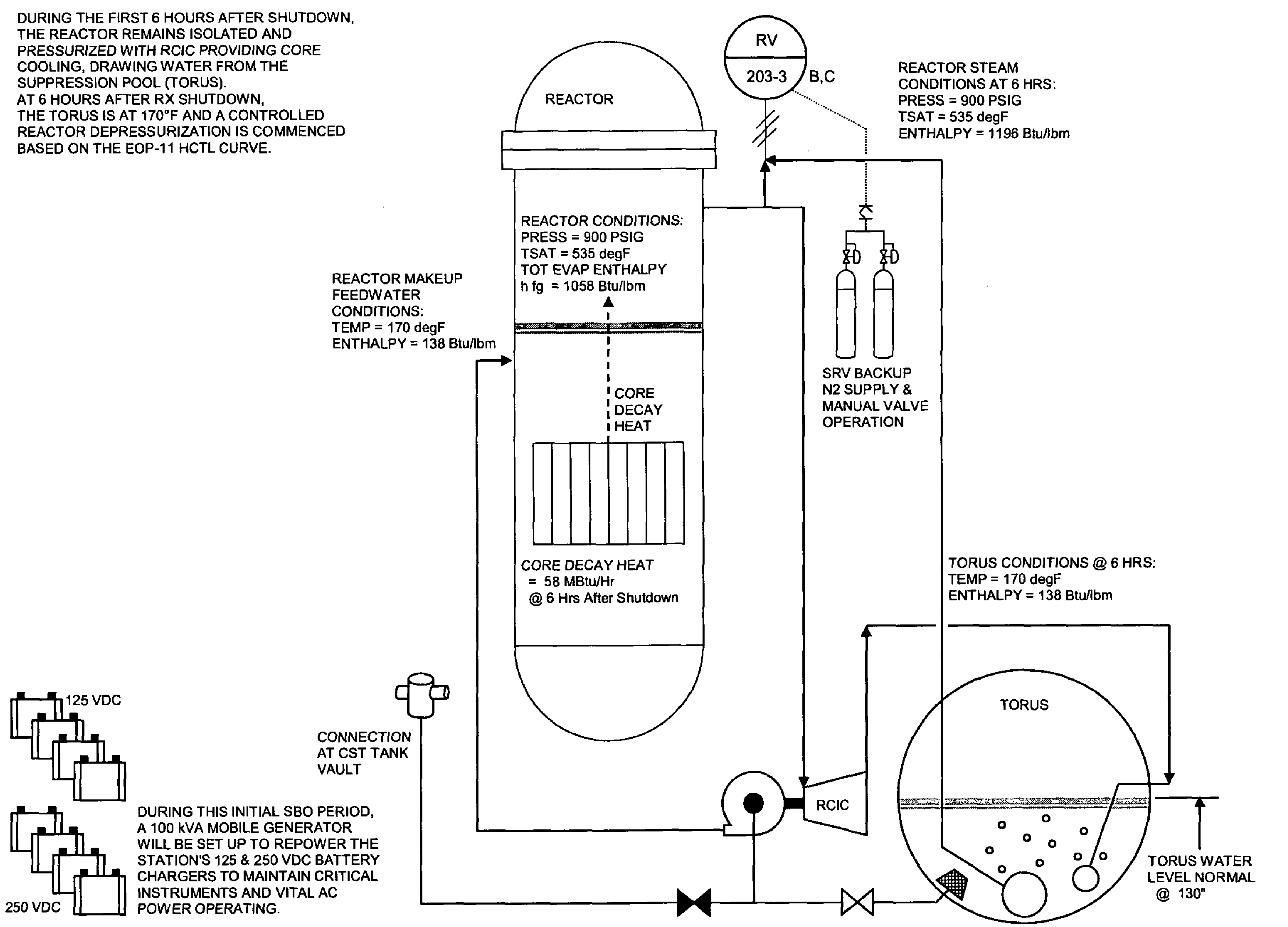
The following milestone schedule is provided. The dates are planning dates subject to change as design and implementation details are developed. Any changes to the following target dates will be reflected in the subsequent 6 month status reports.

Original Target Date	Activity	Status *{Include date changes in this column}*
Oct. 2012	Submit 60 Day Status Report	Complete
Feb. 2013	Submit Overall Integrated Implementation Plan	Complete
July 2013	Submit 6 Month Status Report	
Jan. 2014	Submit 6 Month Status Report	
Feb. 2014	Modifications Approved for Implementation	
Mar. 2014	Develop Training Plan	
July 2014	Submit 6 Month Status Report	
Oct. 2014	Procedure Changes Training Material Complete	
Jan. 2015	Submit 6 Month Status Report	
Mar. 2015	Implement Training (Schedule LORT Plan to Support Implementation)	
May 2015	Modification Implementation Complete	
June 2015	Demonstration / Functional Test	

July 2015	Submit 6 Month Status Report	
Dec 2015	Submit Completion Report	

Attachment 3
Conceptual Sketches

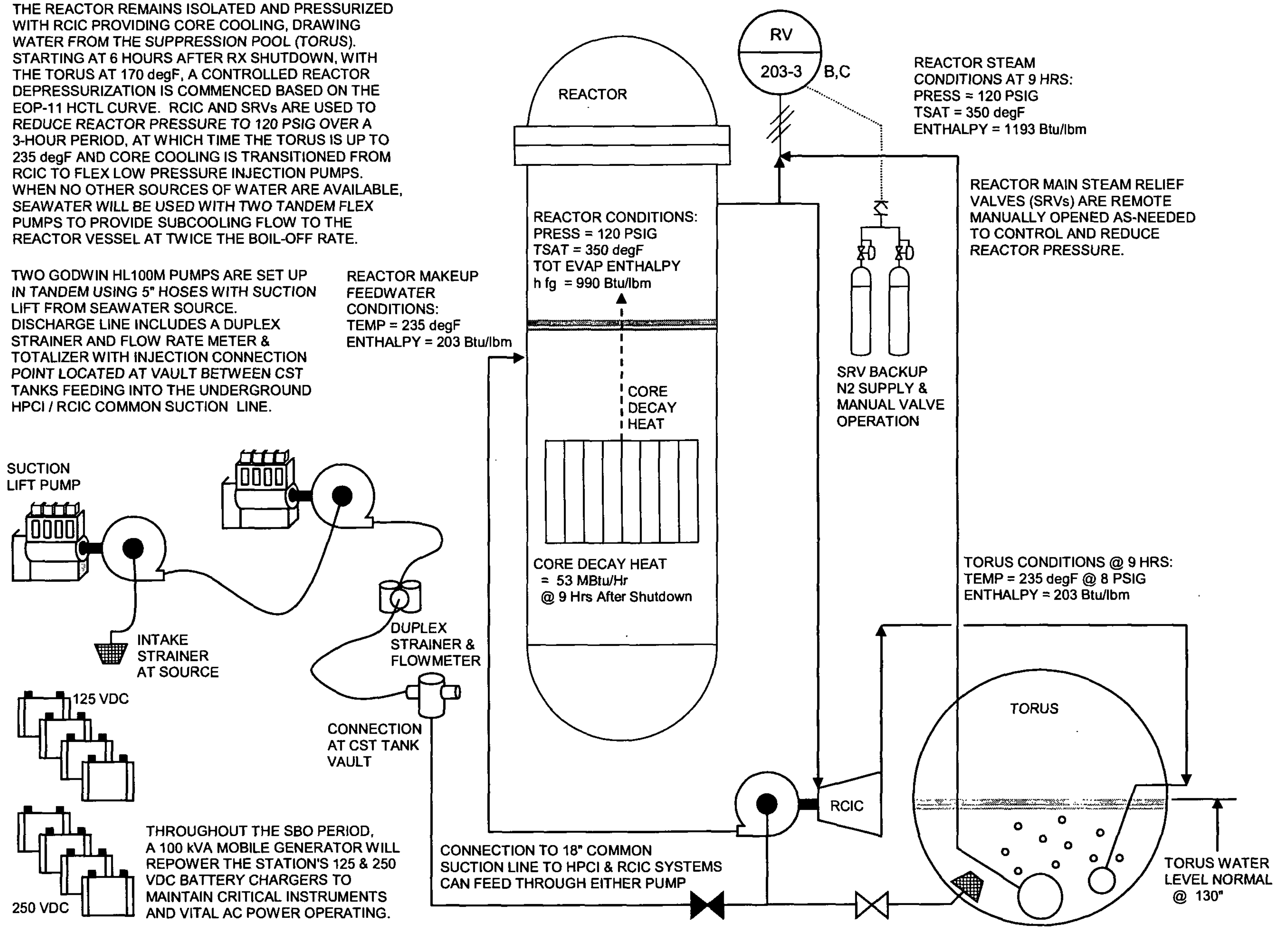
REACTOR / TORUS CONDITIONS DURING FIRST 6 HOURS **FIGURE 1**



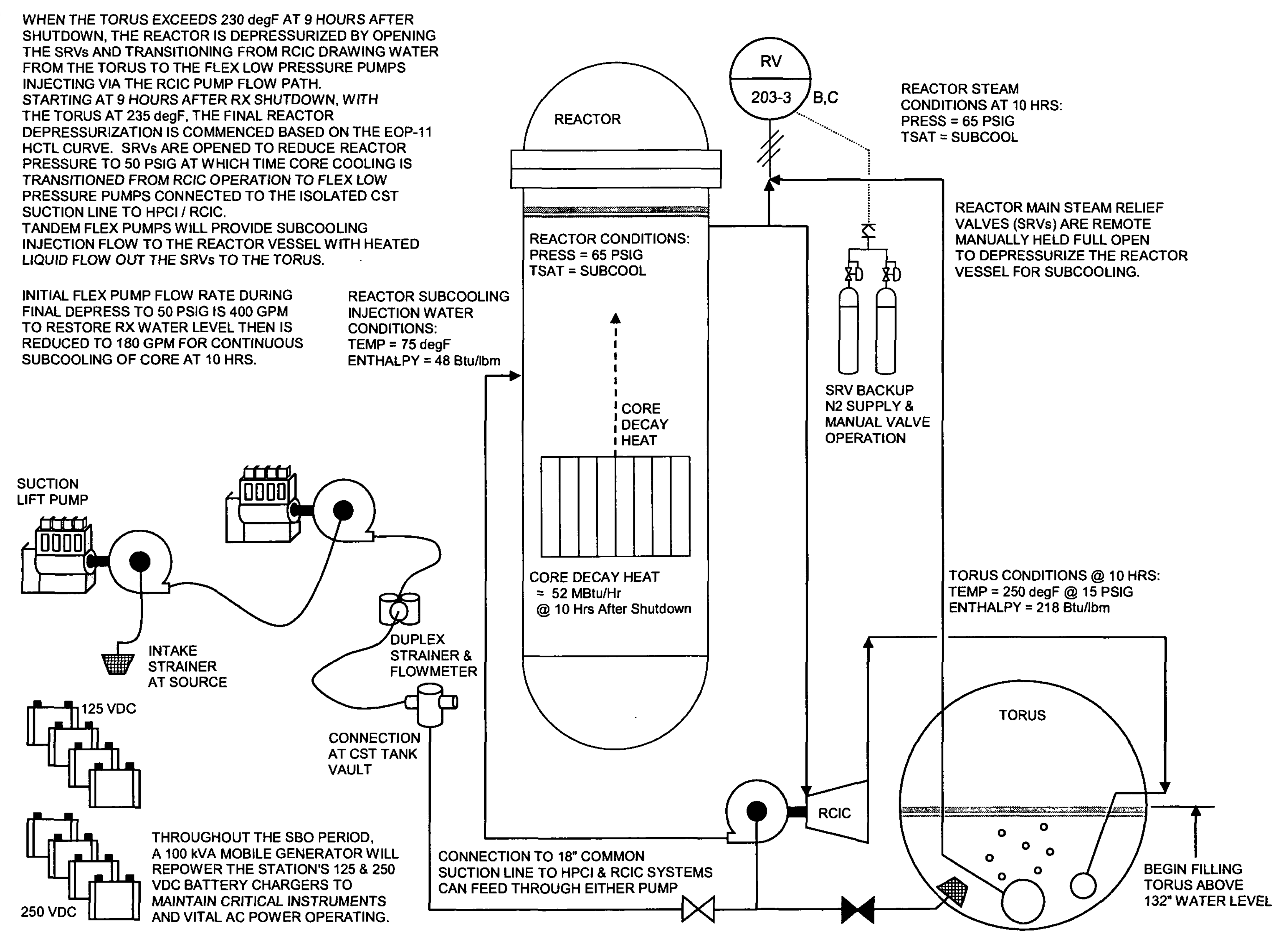
REACTOR / TORUS CONDITIONS DURING REACTOR DEPRESSURIZATION FROM 6 TO 9 HOURS **FIGURE 2**

DURING THE PERIOD 6 TO 9 HOURS AFTER SHUTDOWN, THE REACTOR REMAINS ISOLATED AND PRESSURIZED WITH RCIC PROVIDING CORE COOLING, DRAWING WATER FROM THE SUPPRESSION POOL (TORUS). STARTING AT 6 HOURS AFTER RX SHUTDOWN, WITH THE TORUS AT 170 degF, A CONTROLLED REACTOR DEPRESSURIZATION IS COMMENCED BASED ON THE EOP-11 HCTL CURVE. RCIC AND SRVs ARE USED TO REDUCE REACTOR PRESSURE TO 120 PSIG OVER A 3-HOUR PERIOD, AT WHICH TIME THE TORUS IS UP TO 235 degF AND CORE COOLING IS TRANSITIONED FROM RCIC TO FLEX LOW PRESSURE INJECTION PUMPS. WHEN NO OTHER SOURCES OF WATER ARE AVAILABLE, SEAWATER WILL BE USED WITH TWO TANDEM FLEX PUMPS TO PROVIDE SUBCOOLING FLOW TO THE REACTOR VESSEL AT TWICE THE BOIL-OFF RATE.

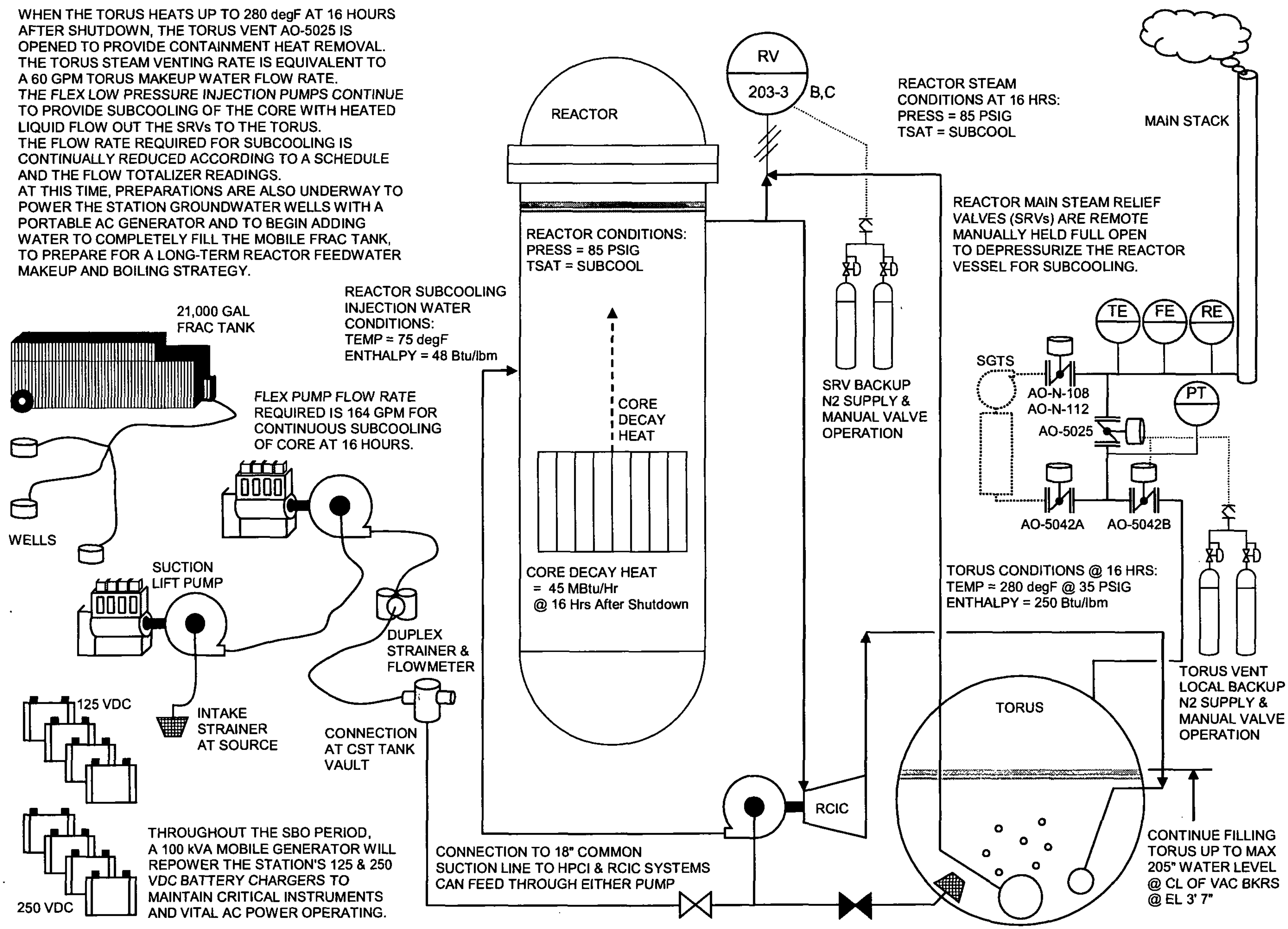
TWO GODWIN HL100M PUMPS ARE SET UP IN TANDEM USING 5" HOSES WITH SUCTION LIFT FROM SEAWATER SOURCE. DISCHARGE LINE INCLUDES A DUPLEX STRAINER AND FLOW RATE METER & TOTALIZER WITH INJECTION CONNECTION POINT LOCATED AT VAULT BETWEEN CST TANKS FEEDING INTO THE UNDERGROUND HPCI / RCIC COMMON SUCTION LINE.



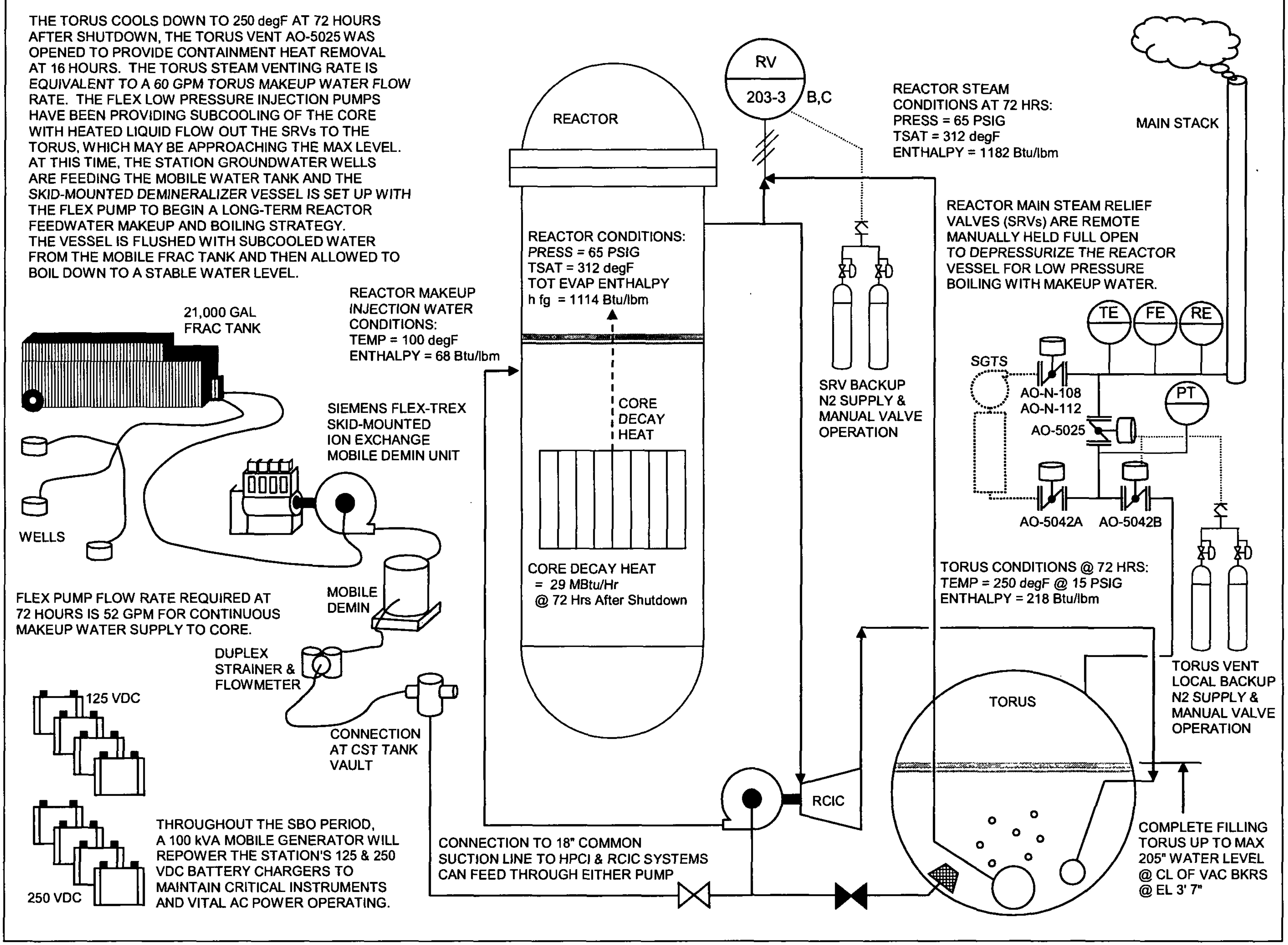
REACTOR / TORUS CONDITIONS DURING REACTOR FINAL DEPRESSURIZATION FROM 9 TO 10 HOURS **FIGURE 3**

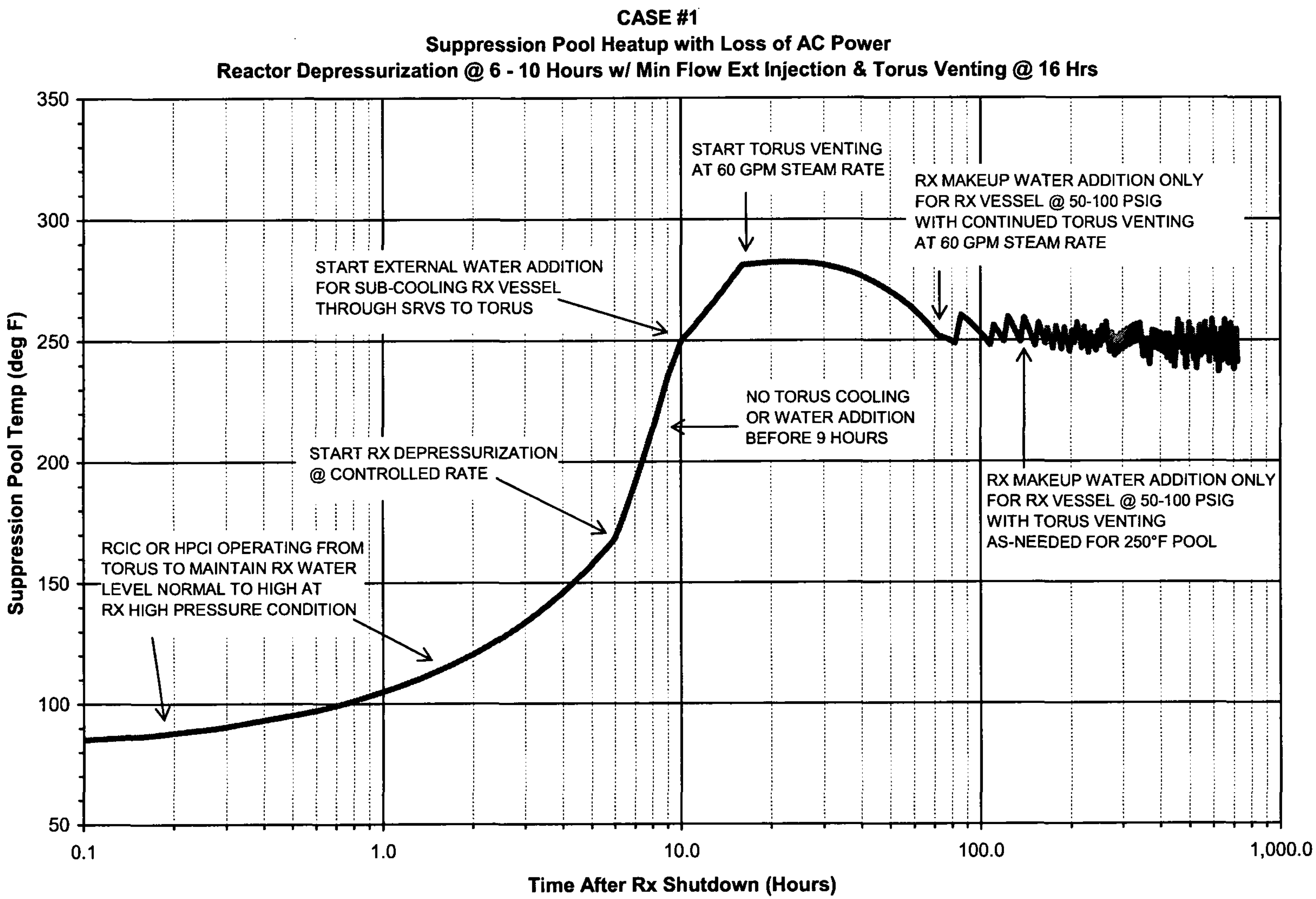


REACTOR / TORUS CONDITIONS FROM 10 HOURS TO THE START OF TORUS VENTING AT 16 HOURS **FIGURE 4**

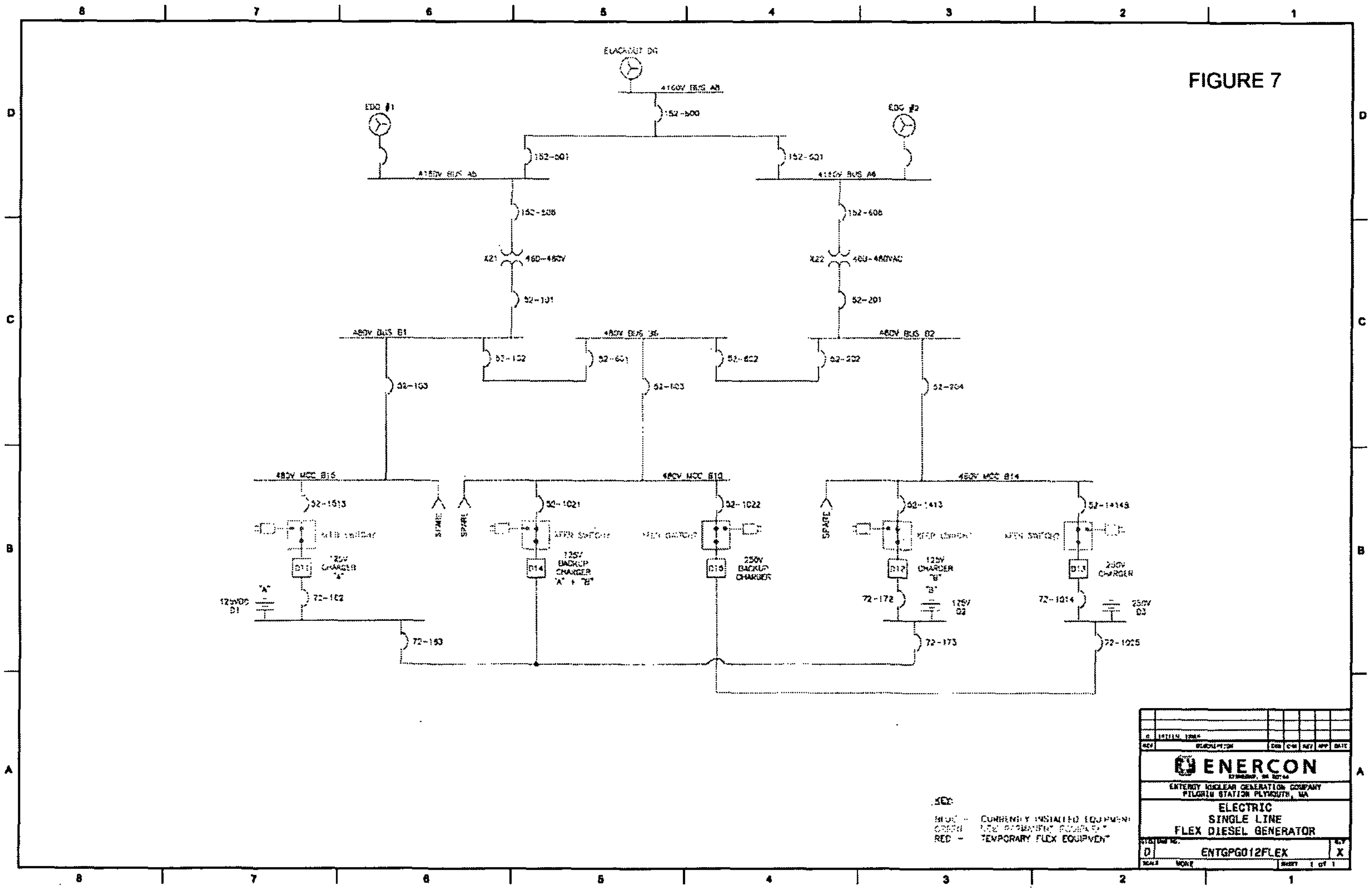


REACTOR / TORUS CONDITIONS DURING TORUS VENTING AFTER 16 HOURS TO MAKEUP MODE AT 72 HOURS **FIGURE 5**





SBO FLEX Strategy Calc 14-SEP-2012 File = SBO FLEX Case01.XLS


4160V BUS A8
152-500
EDG #1
EDG #2
152-601
4160V BUS A5
4160V BUS A6
152-506
152-606
X21
X22
460-480VAC
52-101
52-201
480V BUS B1
480V BUS B6
480V BUS B2
52-102
52-202
52-204
480V MCC B15
480V MCC B10
480V MCC B14
SPARE
52-1021
52-1022
52-1413
AFTER SWITCH
D11
D12
D13
D14
D15
125V CHARGER "A"
125V CHARGER "B"
125V BACKUP CHARGER "A" + "B"
250V BACKUP CHARGER
250V CHARGER
125VDC D1
125V D2
250V D3
72-172
72-173
72-1014
72-1025
RED - TEMPORARY FLEX EQUIPMENT
ENERCON
ELECTRIC
SINGLE LINE
FLEX DIESEL GENERATOR
ENTGPG012FLEX
FIGURE 7

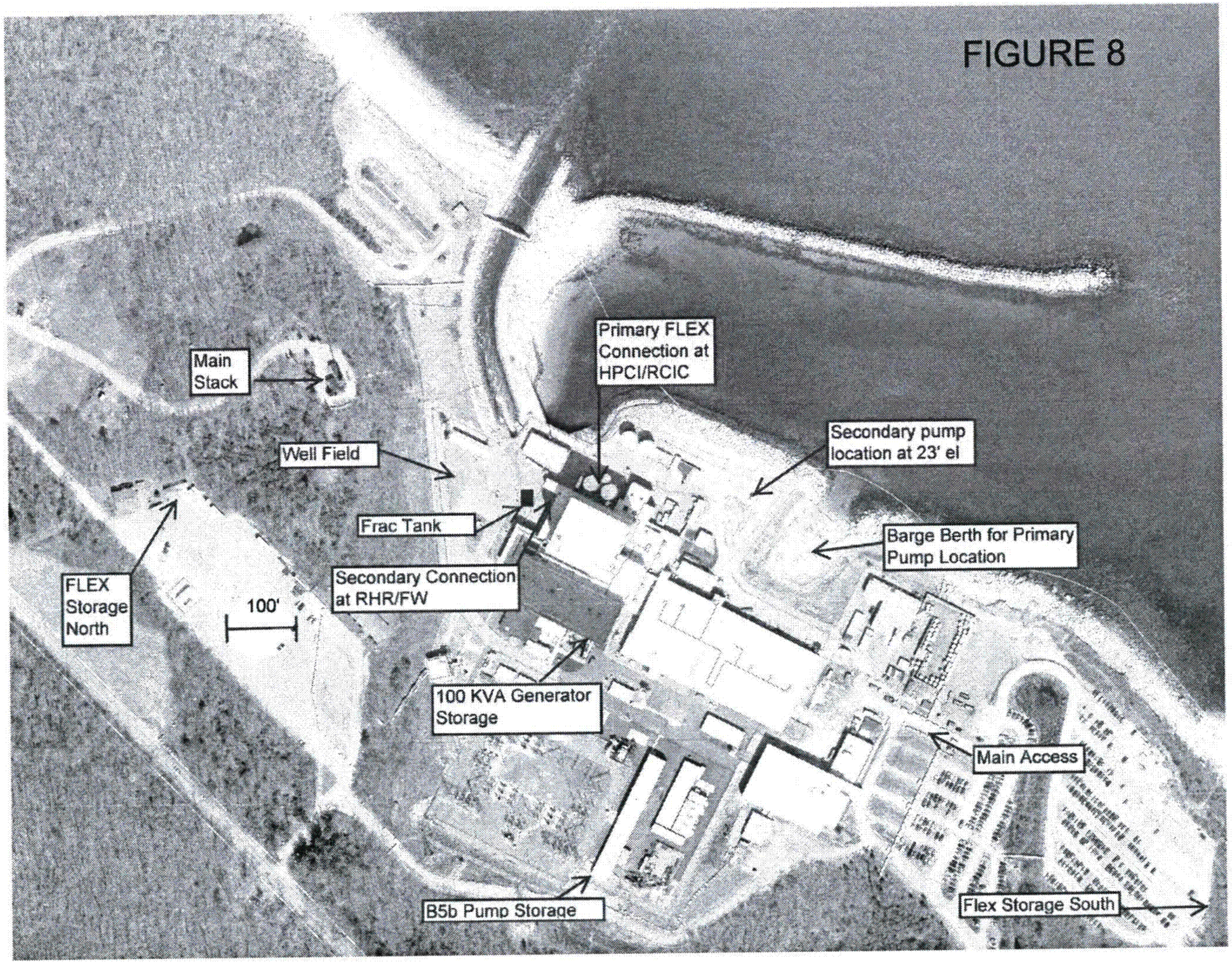


FIGURE 8
Primary FLEX Connection at HPCI/RCIC
Main Stack
Secondary pump location at 23' el
Well Field
Frac Tank
Barge Berth for Primary Pump Location
Secondary Connection at RHR/FW
FLEX Storage North
100'
100 KVA Generator Storage
Main Access
B5b Pump Storage
Flex Storage South

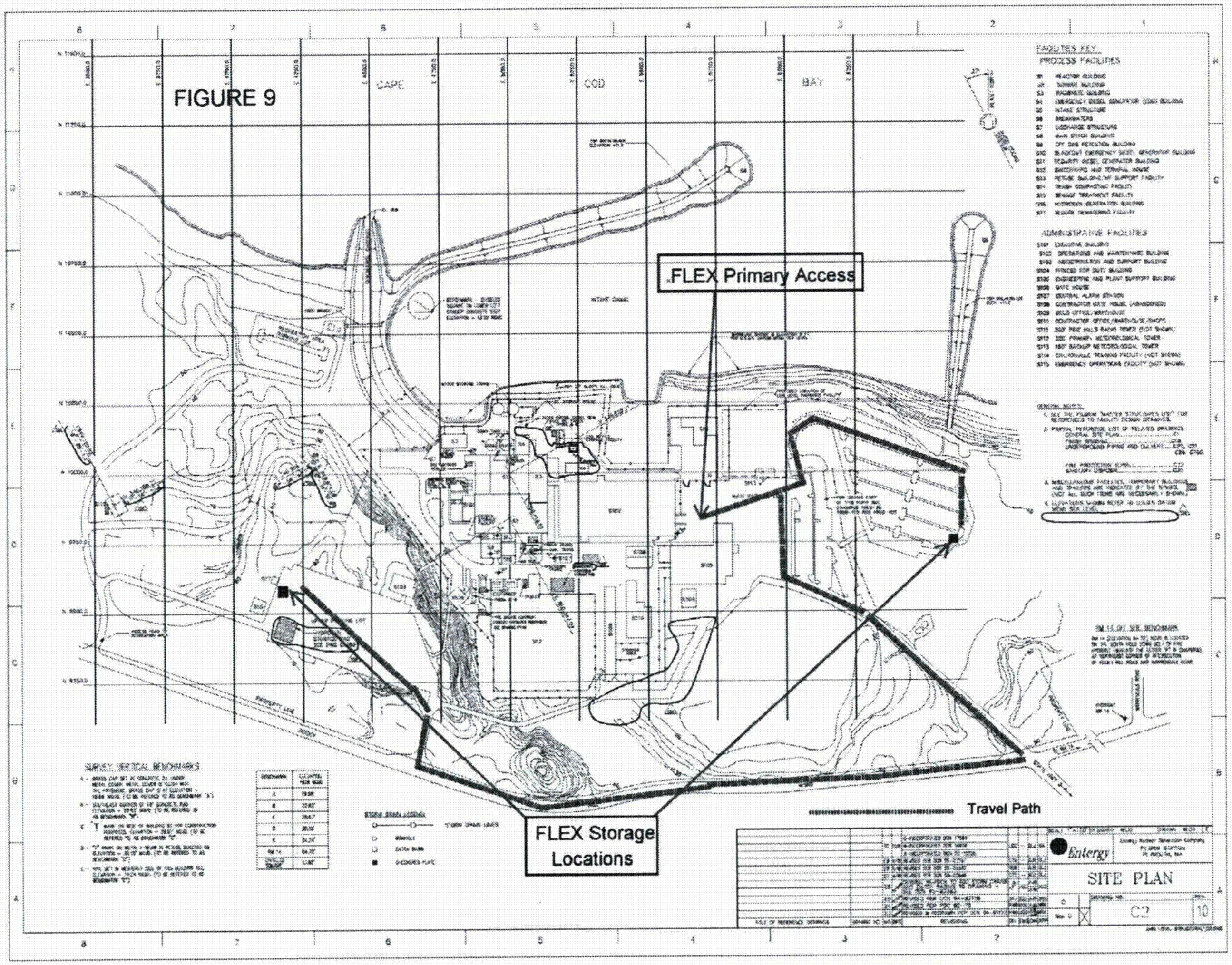


FIGURE 9
CAPE
COD
BAY
FLEX Primary Access
FLEX Storage Locations
Travel Path
Entergy
SITE PLAN
C2
10

Attachment 4
PNPS Matrix of Events & Available FLEX Equipment

In accordance with FLEX Guideline NEI 12-06, Appendix C, each site must maintain specific functions during a Beyond-Design-Bases-Extended-Event (BDBEE), with an Extended-Loss-AC-Power (ELAP) and Loss-Ultimate-Heat Sink (LUHS). The availability of FLEX Equipment to support NEI 12-06 Appendix C functions, considering applicable hazards is established as follows: (See Notes at end of Table)

Equipment / Event (Note 1)	Qty	Seismic	External Floods	Hurricane / Tornado	Snow, Ice, Cold	High Temps
Diesel Generators 480 VAC 3-PH 100 kVA Req'd N = 2 (Note 2)						
FLEX-North	1	1	1	1 or 0	1	1
FLEX-South	1	1	1	1 or 0	1	1
Turb Bldg On-Site	1	1	1	1 or 0	1	1
Total Available	N+1	N+1	N+1	N	N+1	N+1
Diesel Pumps 400 GPM @ 350 ft TH Req'd N = 2 (Note 3)						
FLEX-North	2	2	2	2 or 0	2	2
FLEX-South	2	2	2	2 or 0	2	2
B.5.b On-Site	1	0	0	1 or 0	1	1
Total Available (FLEX)	N+2	N+2	N+2	N	N+2	N+2
Diesel Air Comprs 125 CFM 100 PSIG Req'd N = 1 (Note 4)						
FLEX-North	1	1	1	1 or 0	1	1
Aux Bay, On-Site	1	1	1	1 or 0	1	1
Total Available	N+1	N+1	N+1	N	N+1	N+1

Equipment / Event (Note 1)	Qty	Seismic	External Floods	Hurricane / Tornado	Snow, Ice, Cold	High Temps
Duplex Strainer Trailer 400 GPM 1/8 Inch Size Req'd N = 1						
FLEX-North	1	1	1	1 or 0	1	1
FLEX-South	1	1	1	1 or 0	1	1
Total Available	N+1	N+1	N+1	N	N+1	N+1
Resin Demin Skid 60 cu-ft Mixed Bed Req'd N = 2						
FLEX-North	2	2	2	2 or 0	2	2
FLEX-South	2	2	2	2 or 0	2	2
Total Available	N+2	N+2	N+2	N	N+2	N+2
Frac or Bladder Tank Req'd N = 1						
On-Site North - Frac	1	1	1	1 or 0	1	1
FLEX-North - Bladder	1	1	1	1 or 0	1	1
FLEX-South - Bladder	1	1	1	1 or 0	1	1
Total Available	N+2	N+2	N+2	N	N+2	N+2
Air-Powered Diaphragm Pumps Req'd N = 2						
FLEX-North	2	2	2	2 or 0	2	2
FLEX-South	2	2	2	2 or 0	2	2
Refuel Floor	1	1	1	1 or 0	1	1
Total Available	N+3	N+3	N+3	N	N+3	N+3
Battery Room Fans						

Equipment / Event (Note 1)	Qty	Seismic	External Floods	Hurricane / Tornado	Snow, Ice, Cold	High Temps
(Note 5) Req'd N = 2						
FLEX-North	1	1	1	1 or 0	1	1
FLEX-South	1	1	1	1 or 0	1	1
Batt Room, Staged	2	2	2	2	2	2
Total Available	N+2	N+2	N+2	N+1	N+2	N+2
Small Diesel Generator, 120/240 VAC 1-PH Req'd N = 1 - 12 kW Req'd N = 2 - 6 kW						
FLEX-North	3	3	3	3 or 0	3	3
FLEX-South	3	3	3	3 or 0	3	3
Total Available	N+3	N+3	N+3	N	N+3	N+3
Debris Removal Wheel Loader On-Site, Req'd N = 1	N	N	N	N	N	N

Notes:

1. The Tornado Event is the most limiting and potentially results in only "N" FLEX Equipment available, including the loss of the B.5.b Pump, but this event has no potential to drain the SFP, which is the basis for the primary SFP Spray capability of the B.5.b Pump in accordance with 10 CFR 50.54(hh) for Security-Related Events. All other events will result in at least "N+2" FLEX Pumps available, each of which has the same capability as the B.5.b Pump and can provide SFP Spray at the same flow rates and conditions. The B.5.b requirement includes a SFP makeup rate of at least 500 GPM and SFP Spray requirement of 250 GPM and is not based on a particular leakage or boil-off makeup rate, it is the required spray flow needed to prevent exposed spent fuel from reaching the oxidation temperature after a SFP draindown. This B.5.b capability is not compromised in any way by the simultaneous deployment of FLEX Equipment. For all ELAP and LUHS Events, "N" FLEX Pumps provide the required capacity for Core Cooling, Containment Heat Removal, and SFP Makeup Water.

2. One FLEX Portable 480 VAC 3-PH 100 kVA Diesel Generator (DG) will normally be pre-staged in the Turbine Building Truck Lock, which is adjacent to the AC Switchgear and DC System Battery Rooms. This DG is thereby capable of early deployment (within 4 Hours) during any Station Black-Out (SBO) and is capable of maintaining both 125 VDC Battery Divisions, and the 250 VDC Battery, charged and operating indefinitely. Should this DG not be available due to the Event, there are two additional, identical, FLEX DGs in the Dual FLEX Equipment Storage Locations that will be deployed within the 8 Hour Battery capacity ratings and these two DGs can initially be dedicated to the repowering both 125 VDC Division Battery Chargers simultaneously. After the initial 8 Hour recharging period, a single AC Generator can maintain the batteries indefinitely by alternately recharging the batteries in each Division to 70% capacity and then alternating to the second Division before it is depleted.

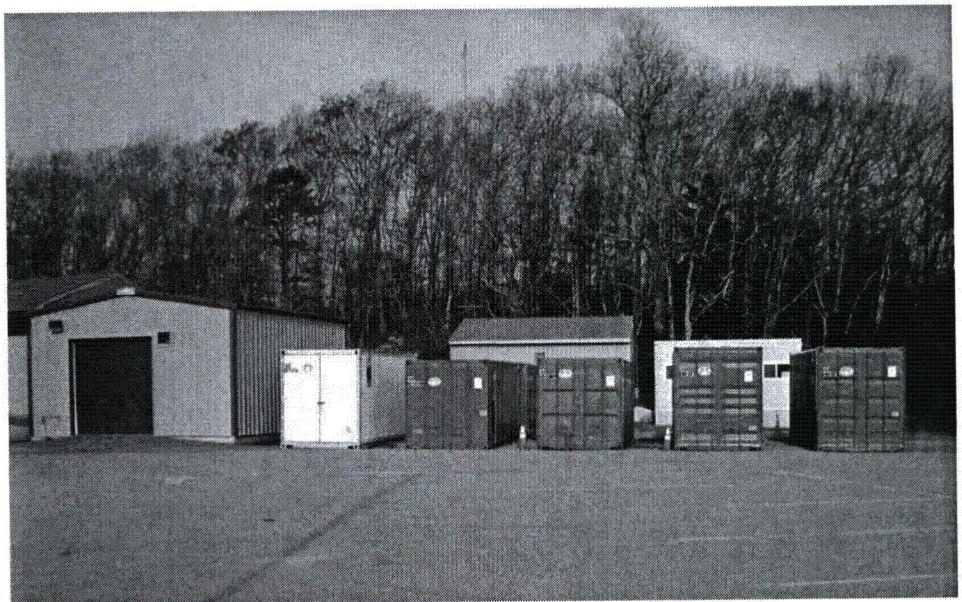
3. Two FLEX 400 GPM @ 350 ft TH Diesel Pumps are required to provide Core Cooling and SFP Makeup Water. Initially, for FLEX Phase 2, the two pumps are used in tandem to pump water from the UHS through the Duplex Strainer 400 GPM Trailer-Mounted Skid w/Flow Meter & Totalizer to the FLEX injection point. Later, in FLEX Phase 3, a single FLEX Pump draws fresh water from the Water Storage Tank and pumps through the Skid-Mounted Demin Tank and the Duplex Strainer Trailer to the FLEX injection point. The second FLEX Pump may then be used for SFP makeup water from the Water Storage Tank. The Groundwater Wells are powered by a FLEX Portable 480 VAC 3-PH 100 kVA DG and discharge to the Water Storage Tank.

4. One 125 CFM 100 PSIG Diesel Air Compressor (DAC) is the required pneumatic pressure source for the Air-Powered Diaphragm Pumps used for Diesel Fuel Transfer, SFP Makeup Water, & General Dewatering Service. A single DAC can support these functions simultaneously.

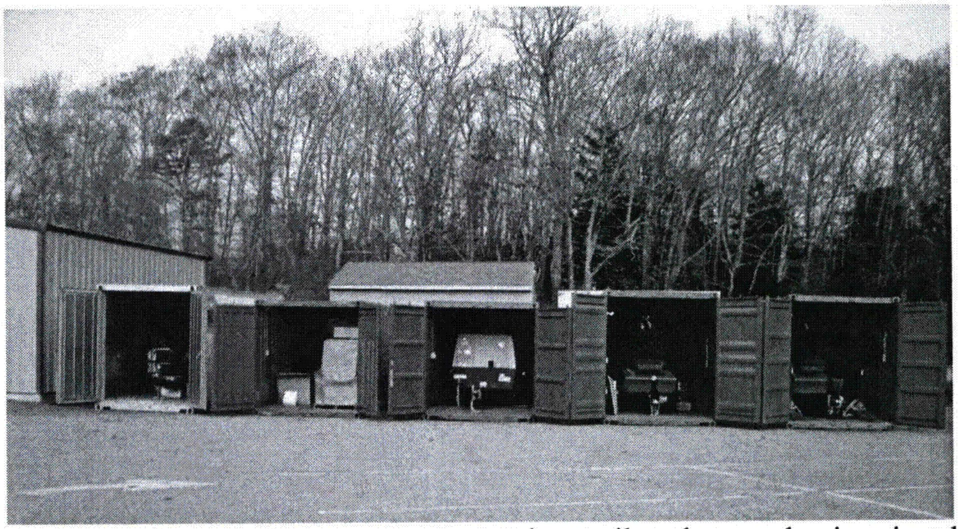
5. Two 12" Duct Intrinsically Safe Portable Ventilation Fans are to be deployed, one in each DC Power System Battery Room, to provide forced exhaust ventilation to prevent the accumulation of Hydrogen gas that evolves from lead-acid battery charging. The fans are 120 VAC 1-PH AC Motor driven and can be powered from the 120 VAC outlets on the 480 VAC 3-PH 100 kVA DG that is charging the batteries or from any one of the small 120/240 VAC 1-PH 6 kW or 12 kW DGs.

Attachment 5
PNPS FLEX Equipment Storage Sea Vans

PNPS will be storing FLEX equipment in Sea Vans at two separate locations at the opposite extremes of the Owner Controlled Area (approximately 1800ft geographically separated). The locations are also at the higher elevations on the site, a minimum of 30ft above mean sea level. The North Storage Area is partially established and is as shown in the photos below. The Sea Vans are supplied with AC power for equipment heaters and lighting, one Sea Van is environmentally controlled, and the others ventilated. The site storage is located and arranged to also support equipment testing, operability, and provide for rapid deployment.



FLEX Storage North; lighting and power is provided to each Sea Van.



During receipt period, generators mounted on trailers, hose racks since installed.

Typical Godwin Pump storage, with power for block heaters and battery charging.