February 28, 2013

NG-13-0084
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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-001

Duane Arnold Energy Center
Docket No. 50-331
Renewed Op. License No. DPR-49

NextEra Energy Duane Arnold, LLC's Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)

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, Accession No. ML12056A045
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, Accession No. ML12229A174
3. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 0, dated August, 2012, Accession No. ML12242A378
4. Letter, R. Anderson (NextEra Energy Duane Arnold, LLC) to U.S. NRC, "NextEra Energy Duane Arnold, LLC's Initial Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," NG-12-0426, dated October 29, 2012, Accession No. ML12305A378

On March 12, 2012, the Nuclear Regulatory Commission ("NRC" or "Commission") issued an order (Reference 1) to NextEra Energy Duane Arnold, LLC (hereafter, NextEra Energy Duane Arnold). Reference 1 was immediately effective and directs NextEra Energy Duane Arnold to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool cooling

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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 (ISG) (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.

Reference 4 acknowledged NextEra Energy Duane Arnold's receipt of Reference 2 and provided the initial status report regarding mitigation strategies, as required by Reference 1.

The purpose of this letter is to provide the Overall Integrated Plan pursuant to Section IV, Condition C.1, of Reference 1. This letter confirms NextEra Energy Duane Arnold has an Overall Integrated Plan developed in accordance with the guidance for defining and deploying strategies that will enhance the ability to cope with conditions resulting from beyond-design-basis external events that satisfies the requirements of Reference 1.

The information in the enclosure provides the NextEra Energy Duane Arnold Overall Integrated Plan for mitigation strategies pursuant to Reference 3. The enclosed Overall Integrated Plan is based on conceptual design information that is current as of this letter. As design details and associated procedural guidance are finalized, additional information, as well as revisions to the information contained in the enclosure to this letter, will be communicated to the NRC in the 6-month Integrated Plan updates as required by Reference 1.

This letter contains no new regulatory commitments.

If you have any questions or require additional information, please contact Ken Putnam at 319-851-7238.

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

Richard L. Anderson
Vice President, Duane Arnold Energy Center
NextEra Energy Duane Arnold, LLC

Enclosure: Duane Arnold Energy Center Overall Integrated Plan with Regard to Mitigation Strategies for Beyond-Design-Basis External Events

cc: NRC Regional Administrator (Region III)
NRC Resident Inspector (DAEC)
NRC Licensing Project Manager (DAEC)

Enclosure to NG-13-0084

Duane Arnold Energy Center
Overall Integrated Plan with Regard to
Mitigation Strategies for Beyond-Design-Basis External Events

51 Pages to Follow

I. General Integrated Plan Elements - BWR

Determine Applicable Extreme External Hazards **Ref: NEI 12-06, Section 4 - 9 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.* Duane Arnold Energy Center (DAEC) reactor center line is at latitude 42° 6' 02" N, longitude 91° 46' 36" W per UFSAR 2.1 (Reference 18). DAEC used NEI 12-06, Sections 4-9 and Appendix B to evaluate applicable external hazards. Each of the five classes of hazards identified applies to the DAEC site. Seismic: • Seismic design of DAEC safety related structures are discussed in UFSAR Section 3.7 (Reference 1). • The DAEC UFSAR was reviewed to perform a limited evaluation of the potential for soil liquefaction as result of a design bases earthquake. UFSAR Section 2.5.4.5.3 (Reference 2) discusses excavation practices used to ensure liquefaction will not occur in the building areas. Based on this no additional evaluations of liquefaction is planned for FLEX strategies unless storage and transport paths are over previously un-excavated ground (Action 29). • 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 process and addressed (Action 1). External Flooding: • Design Bases of site includes flooding from the Cedar River as a result of maximum precipitation. Warning time of several days exist for flooding of this nature, UFSAR 3.4 (Reference 3) • Design Bases flood (el. 764.1' msl) is above plant grade so FLEX strategies must address deployment with a flood present. • Flood 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 process and addressed (Action 2). Storms with High Winds: • DAEC plant site is located adjacent to the Cedar River approximately 2.5 miles northeast of Palo, Iowa (Reference 43) and is not a coastal site exposed to hurricanes. • Regional history with tornadoes exists for the DAEC. DAEC location falls in Region 1 of Figure 7.2 of NEI 12-06. This would correspond to a location with a one in a million probability of tornado winds speeds approaching 200 mph. The DAEC design bases (300 mph) for safety related structures bounds this value, UFSAR 3.3 (Reference 4). Snow, Ice and Low Temperatures: • Regional experience with snow, ice and low temperatures exist. From Figure 8.2 of NEI 12-06 DAEC is located in Region 5 corresponding to the highest region for ice severity. High Temperatures: • Regional experience with high temperatures exists for DAEC. Environmental design for DAEC electrical equipment is discussed in UFSAR section 3.11 (Reference 5). The normal environmental service conditions for areas containing safety related equipment at DAEC are described in a controlled document, QUAL-SC101 (Reference 6).
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:* All assumptions in NEI 12-06, Section 3.2.1 apply including the following: • Prior to the event the reactor has been operating at 100 percent rated thermal power for at least 100 days or has just been shut down from such a power history as required by plant procedures in advance of the impending event. • At the time of the postulated event, the reactor and supporting systems are within normal operating ranges

	for pressure, temperature, and water level for the appropriate plant condition. All plant equipment is either normally operating or available from the standby state as described in the plant design and licensing basis. • Off site personnel resources are assumed to begin arriving at 6 hours and the site will be fully staffed by 24 hours after the event. • 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 operating procedures in accordance with established EOP change processes, and their impact to the design basis capabilities of the unit evaluated under 10 CFR 50.59. 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 12). • Recovery of damaged plant equipment is conservatively excluded from FLEX. • No specific initiating event is used. The initial condition is assumed to be a loss of off-site power (LOOP) at a plant site resulting from an external event that affects the off-site power system either throughout the grid or at the plant with no prospect for recovery of off-site power for an extended period. The LOOP is assumed to affect all units at a plant site. • All installed sources of emergency on-site ac power and SBO Alternate ac power sources are assumed to be not

	available and not imminently recoverable. • Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles are available. • Normal access to the ultimate heat sink is lost, but the water inventory in the UHS remains available and robust piping connecting the UHS to plant systems remains intact. The motive force for River Water Supply pumps is assumed to be lost with no prospect for recovery. • Fuel for FLEX equipment stored in structures with designs which are robust with respect to seismic events, floods and high winds and associated missiles, remains available. • Permanent plant equipment that is contained in structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles, are available. • Other equipment, such as portable ac power sources, portable back up dc power supplies, spare batteries, and equipment for 50.54(hh)(2), may be used provided it is reasonably protected from the applicable external hazards. • Installed electrical distribution system, including inverters and battery chargers, remain available provided they are protected consistent with current station design. • No additional events or failures are assumed to occur immediately prior to or during the event, including security events. • Equipment designed to withstand external events is assumed to be available. • Spent fuel in dry cask storage is outside the scope of FLEX. • All boundaries of the SFP are intact, including the liner, gates, transfer canals, etc. • Although sloshing may occur during a seismic event, the initial loss of SFP inventory does not preclude access to

	the refueling deck around the pool. • SFP cooling system is intact, including attached piping. • SFP heat load assumes the maximum design basis heat load for the site.
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, Section 13.1**	*Include a description of any alternatives to the guidance, and provide a milestone schedule of planned action.* Full compliance with JLD-ISG-2012-01 (Reference 44) and NEI 12-06 (Reference 45) is expected. Where there are interpretations of NEI-12-06 or the Interim Staff Guidance requirements, DAEC will follow those interpretations jointly developed by the NRC and NEI.
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 walk through of deployment).* *Describe in detail in this section the technical basis for the time constraint identified on the sequence of events timeline Attachment 1A.* DAEC Response: Immediate operator actions for implementation of Phase 1 FLEX strategies are consistent with existing immediate actions specified for DAEC Station Blackout requirements under 10 CFR 50.63. Initial operator actions are as described in Abnormal Operating Procedure (AOP) 301.1 (Reference 21) consistent with the existing Station Blackout analysis described in UFSAR Section 15.3.2 (Reference 8) with the exception that emergency reactor vessel depressurization will not be performed when the suppression pool water temperature reaches the Heat Capacity Temperature Limit as listed in existing Emergency Operating Procedures (References 22 and 23). Revisions to these procedures will be made as noted in the Milestone Schedule (Attachment 4) (Action 3). The timeline for deployment of initial portable equipment under Phase 2 of the FLEX strategies are anticipated to be completed within approximately the first 4 hours. Experience with deploying similar equipment/strategies has shown that this is achievable with the on shift staff (Reference 24), but this will need to be verified via formal procedural validation when the final equipment, hookups and procedures are developed (Action 4).

	See attached sequence of events timeline (Attachment 1A). Time Constraint Sequence of Events: • 0 hours: LOOP and EDG Failure • 2 hours: Operators perform additional load shedding • 4-8 hours: Prior to depletion of station safety-related batteries, use a portable diesel generator to power station battery chargers • 4-8 hours: Prior to RCIC failure, align a portable diesel driven pump to inject water to the RPV, Manually depressurize the reactor using SRVs to allow low pressure injection. • 4-72 hours: Open vent path on the refuel floor to reduce moisture accumulation. Actual timing of this will vary with fuel loading in the pool and time since discharge (References 36 and 37) • 14-19 hours: Initiate re-fueling of portable equipment • 8-16 hours: Prior to containment failure, vent the containment through a reliable hardened vent. • 10-16 hours: Establish charging capability for batteries in portable communication equipment. • 45-72 hours: Prior to SFP water level decreasing to the top of spent fuel, initiate make-up to the SFP using a portable diesel driven pump. Actual timing of this will vary with fuel loading in the pool and time since discharge (References 36 and 37) • 24-72 hours: Supplement on site equipment with 4160 V AC diesel driven generator and portable pumps from Regional Response Center (RRS) to restore power to a 4160 V Essential bus and restoring water from the Cedar River. <u>Technical Basis Support Information</u> 1. On behalf of the Boiling Water Reactor Owners Group (BWROG), GE-Hitachi (GEH) developed a document (NEDC-33771P, Revision 1 (Reference 7)) 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 their NRC approved containment analysis code (SHEX) to develop the generic ELAP event response. As part of this document, generic Mark I containment and NSSS evaluations were performed. The analysis is applicable to the DAEC (a BWR 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, containment integrity, and spent fuel pool cooling. The guidance provided in the NEDC-33771P will be utilized as appropriate to develop coping strategies and for prediction of the plant's response. Plant specific analysis of Reactor Pressure Vessel (RPV) and containment response and impacts will be performed consistent with the final DAEC strategies as noted on the milestone schedule and as recommended in NEDC-33771P. In response to INPO IER 11-4 (Reference 25) DAEC performed a plant specific study of the stations capability to cope with an extended station blackout using the MAAP code (Reference 26). This study yielded similar results to NEDC 33771P and was used to inform the selection of planned improvements. 2. The existing analysis for 4 hour SBO coping is detailed in UFSAR 15.3.2. Final plant specific analysis for an ELAP will be performed with equivalent acceptance criteria with the exception of Condensate Storage Tank (CST) inventory and suppression pool level which will be altered in recognition of the external hazards and revised duration of the mitigating strategies (Action 5). Technical Basis Support information, see attached NSSS Significant Reference Analysis Deviation Table (Attachment 1B). Loss of access to the ultimate heat sink scenarios are bounded by ELAP scenarios as all installed River Water Supply pumps, which provide the plant makeup from the UHS, are AC powered. Phase 3 evaluations will ensure adequate inventory of water can be provided directly from the Cedar River or other sources independent of the normal River Water Supply pumps (Action 6).

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.* At DAEC, the FLEX strategies will be implemented by the use of approved procedures, qualified individuals and storage of portable support equipment in approved locations (Action 7). Emergency Management Guidelines provide an integrated overview of plant procedures used for any emergency event to facilitate integrated response by key decision makers regardless of plant mode (Reference 35). In addition, FLEX strategies will have administrative controls to ensure that during on-line maintenance and refueling outages, temporary equipment storage and utilization, will not adversely affect FLEX deployment (Action 8). Plant Modes are defined in Technical Specification Table 1.1-1. (Reference 27). FLEX strategies achieve acceptable results in all plant modes. • Mode 1 (Power Operations) - this is expected to be the limiting condition for FLEX strategies and forms the basic assumption for sizing and selection of equipment. • Mode 2 (Startup) - this mode exists for relatively short periods of time with lower levels of decay heat than if the event is initiated in Mode 1. No additional or modified strategies have been identified for this mode • Mode 3 (Hot Shutdown) - this mode exists for relatively short periods of time with lower levels of decay heat than if the event is initiated in Mode 1. No additional or modified strategies have been identified for this mode. • Mode 4 (Cold Shutdown) - this mode exists for relatively short periods of time and is expected to be less limiting than if the event is initiated in Mode 1. Core cooling strategies of Phase 1 using steam driven equipment will either not be used, or will only be used once plant heat up has occurred and steam is available. Portable equipment for Phase 2 is equally capable of performing required functions, and it is not anticipated that shorter response times will be needed than from Mode 1. • Mode (5 Refuel) - This mode exists for relatively short periods of time. Primary containment functions are not applicable in Mode 5. Core cooling functions would not rely on active installed equipment. Due to the lower decay heat level in the reactor, response times with portable equipment for core cooling are expected to be bounded by Mode 1 requirements. Fuel pool cooling assumptions for decay heat are sufficient to ensure

	adequate fuel pool makeup with portable equipment in Mode 5 (Reference 19).

Provide a milestone schedule. This schedule should include:
• **Modifications timeline**
  ○ **Phase 1 Modifications**
  ○ **Phase 2 Modifications**
  ○ **Phase 3 Modifications**
• **Procedure guidance development complete**
  ○ **Strategies**
  ○ **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 4
	
	DAEC Response:
	
	See attached Milestone Schedule, Attachment 4

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.* DAEC will implement a FLEX program, containing the necessary administrative procedures to control the FLEX equipment's physical protection, storage, deployment and quality. The procedure will identify ownership and responsibility, including but not limited to, configuration control, maintenance and testing (Action 8). FLEX equipment will be procured as commercial grade equipment, but with augmented quality requirements (Action 9). Design requirements for FLEX equipment will be documented

	and controlled via the existing plant modification process. Existing plant maintenance programs will be used to identify and document maintenance and testing requirements. Preventative Maintenance work orders (PMs) will be established and testing procedures will be developed in accordance with the PM program. Testing and PM frequencies will be established based on type of equipment and considerations made within EPRI PM Template guidelines (Action 10). The control and scheduling of the PMs will be administered under the existing site work control processes. DAEC will assess the addition of FLEX program description into UFSAR and Technical Requirements Manual (Action 11).
Describe training plan **Ref: NEI 12-06, Section 11**	*List training plans for affected organizations or describe the plan for training development* A Systematic Approach to Training (SAT) will be used to evaluate training requirements for station personnel based upon changes to plant equipment, implementation of FLEX portable equipment, and new or revised procedures that result from implementation of the FLEX strategies.. Training modules for personnel that will be responsible for implementing the FLEX strategies, and ERO personnel will be developed to ensure personnel proficiency in the mitigation of beyond-design-basis external events (BDBEEs). The training will be implemented and maintained per existing DAEC training programs. The details, objectives, frequency, and success measures will follow the plant's SAT process. FLEX training will ensure that personnel assigned to direct the execution of mitigation strategies for BDBEEs will achieve the requisite familiarity with the associated tasks, considering available job aids, instructions, and mitigating strategy time constraints. Training will be completed prior to final implementation of the requirements of this order per Milestone Schedule (Attachment 4) (Action 12).
Describe Regional Response Center plan	The industry will establish two (2) Regional Response Centers (RRC) to support utilities during beyond design basis events. Each RRC will hold five (5) sets of equipment, four (4) of which will be able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle. Equipment will be moved from an RRC to a local Assemble Area, established by the Strategic Alliance for FLEX Emergency Response (SAFER) team and the utility. Communications will be established between the affected nuclear site and the SAFER team and required

	equipment moved to the site as needed. First arriving equipment, as established during development of the nuclear site's playbook are planned to be delivered to the site within 24 hours from the initial request (Action 13). A contract has been issued to the administrator of SAFER for DAEC participation.
Notes:	

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. Staff Position from JLD-ISG-2012-01: NEI 12-06 provides an acceptable method of developing strategies to maintain or restore core cooling capabilities. DAEC Plan: DAEC will utilize NEI 12-06 as the method to develop core cooling strategies. During Phase 1, core cooling will be assured using installed equipment consistent with the existing station blackout analysis described in UFSAR Section 15.3.2 (Reference 8) using RCIC and/or HPCI to maintain reactor water level above the top of the fuel. The existing SBO analysis described in UFSAR 15.3.2 demonstrates Phase 1 core cooling is assured for a minimum of four hours. For initial strategy planning and development this four hours will continue to be assumed even though it is anticipated that further evaluations will likely demonstrate a longer coping period for Phase 1. The systems credited for Phase 1 core cooling, their functions and anticipated limitations are shown in Attachment 5. If the condensate storage tanks are unavailable, the suppression pool provides an inventory of water (Technical Specification 3.6.2.2, Reference 9) for make up during Phase 1 that is greater than the volume assumed in UFSAR 15.3.2. Evaluation of temperature affects from this alternate water source will be performed as noted in Attachment 5 and the associated analysis Schedule Milestone shown in Attachment 2 (Action 14).	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation* Procedure revisions to enhance Phase 1 core cooling strategies are in progress. Emergency Operating Procedures will be revised consistent with revised Boiling Water Reactor Owners Group (BWROG) recommendations to extend the availability of steam driven core cooling systems (Action 3). Enhanced battery load shedding guidance will be incorporated into station procedures for loss of AC power to extend the availability of DC power (Action 15).

[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.

Identify modifications	*List modifications* No modifications to installed equipment are planned for Phase 1 Core Cooling.
Key Reactor Parameters	*List instrumentation credited for this coping evaluation.* Reactor Pressure Vessel Level and Pressure are key parameters for indication to allow operators to successfully implement Phase 1 Core Cooling strategies (Reference 28) (See Attachment 6 for a summary of required instruments).
Notes:	

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. During Phase 2, core cooling will be ensured by using portable diesel driven pumps aligned to inject to the reactor pressure vessel. Plant modifications will be required to provide a second injection path beyond that in the existing procedures. To ensure the capability of the diesel driven pumps to inject requires that the reactor be depressurized. This is accomplished by using installed safety relief valves. Multiple safety relief valves are available with four dedicated safety related pneumatic accumulators (UFSAR Section 5.2.2.4.2, Reference 10). The accumulators are nominally 200 gallons in size and would allow for extended cycles under the conditions assumed for FLEX (Reference 29). DC power is required for operation of these valves (UFSAR 6.3.3.1.3) (Reference 30). DC power will be ensured by utilizing a portable diesel generator connected to the battery chargers via existing plug-in connections for the charger power supplies. If for any reason the station batteries and DC power distribution cannot be preserved, existing procedures provide an alternative method of supplying power directly to the safety relief valves utilizing a battery cart (Reference 31). To ensure that the portable equipment can be connected under flooding conditions defined in NEI 12-06, a plant modification is required to establish a flood staging area for portable equipment that preserves the capability to connect this equipment with the design bases flood present (Action 16) . Portable Phase 2 equipment is listed in Attachment 2. Deployment route from the staging area will be evaluated based on an assessment of the damage in the affected area and the equipment will be deployed in accordance with this assessment (Action 17).	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation* Existing severe accident management or abnormal operating procedures will be revised or new procedures developed to reflect the following (Action 7): • Addition of one portable 480 Volt generator and two 120 VAC generators for alternate instrument power connections • Diverse injection point for connection of portable pump to RPV • New portable equipment storage locations • Deployment locations for portable equipment during floods • Strategies for replenishing fuel supplies for portable equipment
Identify modifications	*List modifications* The following modifications are planned: • Install connections for a portable 480 V diesel generator to re-power 125 VDC battery chargers (1D12 and 1D120), 250 VDC

	battery charger 1D43 and 480 VAC load center 1B03 (Attachment 8) for required instruments shown in Attachment 6 or connect 120 VAC generator to 1Y11 and 1Y21 for required instruments shown in Attachment 6 or connect 120 VAC generator to the instruments locally. This will require a 120 VAC generator near the Control Room and a second 120 VAC generator near the 1A4 Essential Switchgear Room. The plant will be modified to allow quick connections. Connections would only have to be made to the instruments in one division as required by NEI 12-06 (Action 18). • Install connections for a portable diesel driven pump to allow makeup to the RPV. A 4" branch will be installed on the 12" GBC-005, Residual Heat Removal Service Water (RHRSW) piping upstream of MO1942 in South East (SE) Corner Room. A buried 8" suction pipe will be routed from Pump House to the south wall of the rollup door in Turbine Building (Attachment 7) (Action 19). • Construct two new storage facilities for storing portable equipment (Attachment 9) (Action 20).
Key Reactor Parameters	*List instrumentation credited or recovered for this coping evaluation.* Reactor Pressure Vessel Level and Pressure are key parameters for indication to allow operators to successfully implement Phase 1 Core Cooling strategies (Reference 28) (See Attachment 6 for a summary of required instruments). At least one set of instruments will be available for critical parameters.

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 is protected or schedule to protect* Storage building design will be consistent with NEI 12-06, Section 5.3.1 and will be constructed per Attachment 4, Milestone Schedule.
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* Storage building design will be consistent with NEI 12-06, Section 6.2.3.1 and will be constructed per Attachment 4, Milestone Schedule. If located below the flood level, procedures will be established to move equipment prior to flood levels impacting the equipment.
Severe Storms with High Winds	*List how equipment is protected or schedule to protect* Storage building design will be consistent with NEI 12-06, Section 7.3.1 and will be constructed per Attachment 4, Milestone Schedule. The buildings will be separated to minimize potential for single tornado path interacting with both buildings. The buildings will accommodate extreme straight winds for the area but tornado winds may damage structure. Portable equipment will be secured against wind.
Snow, Ice, and Extreme Cold	*List how equipment is protected or schedule to protect* Storage building design will be consistent with NEI 12-06, Section 8.3.1 and will be constructed per Attachment 4, Milestone Schedule.
High Temperatures	*List how equipment is protected or schedule to protect* Storage building design will be consistent with NEI 12-06, Section 5.3.1 and will be constructed per Attachment 4, Milestone Schedule.

Deployment Conceptual Modification **(Conceptual Sketches are included in attachments)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use. New storage buildings will be	*Identify modifications.* Two new commercial grade structures (Action 20). Modifications to connection points	*Identify how the connection is protected.* Portable equipment will be deployed to a connection point

constructed with physical separation. Paths for deployment will be reviewed to ensure they are not susceptible to significant soil liquefaction during a seismic event (Action 29).	to ensure protection are discussed above (Actions 18 and 19).	that is protected from external events.
Notes: DAEC has selected four FLEX building locations as shown on Attachment 9. They are Interim Spent Fuel Storage Installation (ISFSI) area, Well Water Road area, Switchyard Area and North of Construction Support Center (CSC) area. Out of these four DAEC will select two locations based on constructability and cost (Action 20).		

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.

During Phase 3, off site resources are expected to be available to replace or augment those core cooling capabilities describe in Phase 1 and 2. Use of Phase 2 strategies can maintain core cooling indefinitely provided an adequate inventory of water is available. Water can be pumped from the Cedar River to replenish inventories if needed (Action 6). Restoration of essential 4160 volt AC power via a portable diesel generator will be provided in Phase 3 (Action 21). With 4160 volt AC power restored, permanently-installed, safety related equipment required for make-up and cool down of Reactor Pressure Vessel (RPV) will again be available.

Details:

Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation* Severe accident management procedures will be revised or new procedures established to support mobilization of regional response center equipment and connection to station equipment (Actions 7 and 13).
Identify modifications	*List modifications* Connection points will be established for connection of an off site 4160 volt AC generator to an essential on site AC distribution, 4160 V Switchgear 1A4, (Attachment 10) (Acton 21).
Key Reactor Parameters	*List instrumentation credited or recovered for this coping evaluation.* Reactor Pressure Vessel Level and Pressure are key parameters for indication to allow operators to successfully implement Phase 3 Core Cooling strategies (See Attachment 6 for a summary of Required Instruments). Instrumentation required for Phase 3 is same as that required for Phase1 and Phase 2.

Deployment Conceptual Modification
(Conceptual Sketches are included in attachments)

Strategy	Modifications	Protection of connections
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications* Transfer panel (disconnect switch) will be installed in the turbine	*Identify how the connection is protected* Transfer panel (disconnect switch)

The portable 4160 volt AC generator will be moved into the turbine building truck bay (south) or turbine building (north). These are robust locations protected from flooding. Mobilization of the generator from the Regional Response Center in anticipation of flooding will be initiated by the flooding response procedure. Cables will be pre-located allowing ready connection (Attachment 10). Under conditions other than flooding the 4160 volt generator can be located outside and connection locations used will be determined based on equipment damage observed (Action 21). If needed, water will be pumped from the Cedar River to the plant to replenish water inventories (Action 7).	building (Action 21).	will be installed in the turbine building which is designed for the external conditions specified.
Notes:		

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 heat can be removed from containment via existing installed vents from the Torus. The vent capacity is sized to accommodate the decay heat required at the time of venting. DAEC is a Mark 1 containment and therefore, the vent capability will be upgraded in accordance with NRC Order EA-12-050 (Reference 32) to improve the reliability during a beyond-design-bases event. Containment performance using the venting strategy will be evaluated consistent with generic work performed by the BWROG in NEDC 33771P (Action 14).	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation* Initial containment isolation capability remains unchanged from that described in UFSAR 15.3.2 (Reference 8). Current procedures support the use of containment venting to control containment pressure (References 23, 33, and 34). Following modifications required by NRC Order EA-12-050 DAEC procedures will be revised to be consistent with the updated configuration.
Identify modifications	*List modifications* Modifications will be those defined by NRC Order EA-12-050.

[2] 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.

Key Containment Parameters	*List instrumentation credited for this coping evaluation.* Containment Pressure, Suppression Pool Temperature and Suppression Pool level are key parameters for indication to allow operators to successfully implement Phase 1 Containment strategies (See Attachment 6 for a summary of required instruments). Additional instruments noted in NRC Order EA-12-050 will be installed consistent with NRC Order EA-12-050.
Notes:	

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. During Phase 2 no additional strategies are needed beyond those defined in Phase 1. To add additional assurance of venting capability, provisions will exist to use portable pneumatic supplies to open containment vent valves assuming the loss of the normally installed electrical control power or pneumatic sources (Action 22). Electrical control power can be extended using portable 480 volt generators supplying battery chargers as discussed for Phase 2 Core Cooling strategies (Action 18).	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation.* Procedures will be revised to ensure the modified containment vent system can be opened using portable pneumatic supplies (Action 22).
Identify modifications	*List modifications.* No additional modifications.
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.* Containment Pressure, Suppression Pool Temperature and Suppression Pool level are key parameters for indication to allow operators to successfully implement Phase 1 Containment strategies (See Attachment 6 for a summary of required instruments) (Reference 28).
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment is protected or schedule to protect* Storage building design will be consistent with NEI 12-06, Section 5.3.1 and will be constructed per Attachment 3, Milestone Schedule.
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* Storage building design will be consistent with NEI 12-06, Section 6.2.3.1 and will be constructed per Attachment 3, Milestone Schedule. If located below the flood level, procedures will be established to move equipment prior to flood levels impacting the equipment.

Severe Storms with High Winds	*List how equipment is protected or schedule to protect* Storage building design will be consistent with NEI 12-06, Section 7.3.1 and will be constructed per Attachment 4, Milestone Schedule. The buildings will be separated to minimize potential for single tornado path interacting with both buildings. The buildings will accommodate extreme straight winds for the area but tornado winds may damage structure. Portable equipment will be secured against wind.
Snow, Ice, and Extreme Cold	*List how equipment is protected or schedule to protect* Storage building design will be consistent with NEI 12-06, Section 8.3.1 and will be constructed per Attachment 4, Milestone Schedule.
High Temperatures	*List how equipment is protected or schedule to protect* Storage building design will be consistent with NEI 12-06, Section 5.3.1 and will be constructed per Attachment 4, Milestone Schedule.

Deployment Conceptual Design
(Conceptual Sketches are included in attachments)

Strategy	Modifications	Protection of connections
Identify Strategy including how the equipment will be deployed to the point of use. New storage buildings will be constructed with physical separation (Action 20). Paths for deployment will be reviewed to ensure they are not susceptible to significant soil liquefaction during a seismic event (Action 29).	*Identify modifications* Two new commercial grade structures.	*Identify how the connection is protected* Portable equipment will be deployed to a connection point that is protected from external events.

Notes: DAEC has selected four FLEX building locations as shown on Attachment 9. They are ISFSI area, Well Water Road area, Switchyard Area and North of CSC area. Out of these four DAEC will select two locations based on constructability and cost (Action 20).

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.

During Phase 3 off site resources are expected to be available to replace or augment those containment cooling capabilities describe in Phase 1 and 2. Use of Phase 2 strategies can maintain containment indefinitely provided an adequate inventory of water is available. Water can be pumped from the Cedar River to replenish inventories if needed (Action 6). Restoration of essential 4160 Volt AC power via a portable diesel generator will be provided in Phase 3 (Action 21). With 4160 Volt AC power restored, permanent-installed, safety related equipment required for make-up and cool down of Suppression Pool will again be available.

Details:

Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation* Same as core cooling.
Identify modifications	*List modifications* Same as core cooling.
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.* Containment Pressure, Suppression Pool Temperature and Suppression Pool level are key parameters for indication to allow operators to successfully implement Phase 3 Containment strategies (See Attachment 6 for a summary of required instruments). Instrumentation required for Phase 3 is same as that required for Phase 1 and Phase 2.

Deployment Conceptual Design
(Conceptual Sketches are included in attachments)

Strategy	Modifications	Protection of connections
Identify Strategy including how the equipment will be deployed to the point of use. Same as core cooling.	*Identify modifications* Same as core cooling.	*Identify how the connection is protected* Same as core cooling.

Notes:

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.

DAEC will utilize NEI 12-06 as the method to develop strategies and guidance for Spent Fuel Pool (SFP) Cooling. UFSAR section 9.1.2.3.2 (Reference 19) discusses makeup requirements of 53.05 gpm at approximately 45 hours (Reference 20) after a complete loss of cooling assuming a maximum core off-load into a fuel pool. Cycle specific evaluations of actual spent fuel pool loading (References 36 and 37) indicate that substantially lower make up needs and substantially longer response periods would normally be available to respond to a loss of SFP cooling.

During Phase 1 the existing inventory of water in the spent fuel pool is relied on to maintain the spent fuel cool and prevent fuel damage. The installed configuration of the pool ensures an appropriate volume of water. The normal volume of water in the SFP is approximately 233,000 gallons (Reference 36). Technical Specification 3.7.8 (Reference 11) requires that the water level is maintained and periodically checked. NRC Order EA-12-051 (Reference 38) requires the installation of additional reliable fuel pool monitoring instruments to ensure operators have reliable indication of the status of spent fuel pool cooling. Once the SFP begins to boil, large quantities of high temperature moisture will enter the atmosphere in the reactor building. To reduce the potential that this moisture could adversely impact equipment performance or accessibility to the reactor building by personnel, a modification will be made to the refuel floor to create an alternate manual ventilation point that allows moisture to exit the building (Action 23). This conceptual modification is displayed in Attachment 11. Use of the manual ventilation path will impair the secondary containment but will allow the restoration of secondary containment when the alternate ventilation is no longer needed to vent moisture. During normal operation inadvertent opening of secondary containment via the alternate ventilation point will be positively precluded via administrative and physical controls.

Details:

Provide a brief description of Procedures / Strategies / Guidelines	Existing abnormal operating procedures (Reference 37) discuss operator response to a loss of spent fuel pool cooling. Procedures will be updated to reflect modifications to SFP indication and ventilation (Action 7).
Identify any equipment modifications	SFP Level indication will be modified per NRC Order EA-12-051. A manual ventilation capability (to provide a vent path for steam release from SPF to outside secondary containment) will be added to the refuel floor to

[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.

	minimize the consequences of boiling of the SFP (Attachment 11) (Action 23).
Key SFP Parameter	Per NRC Order EA-12-051 spent fuel pool level indication will be modified to provide enhanced indication for spent fuel pool cooling strategies.
Notes:	

<table>
<tr><th colspan="2">Maintain Spent Fuel Pool Cooling</th></tr>
<tr><th colspan="2">BWR Portable Equipment Phase 2:</th></tr>
<tr><td colspan="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.

It is expected that no operator actions are needed during the initial response to a loss of AC power to maintain the spent fuel covered with water. Once water inventory in the SFP begins to be depleted, make up using portable pumps can be established via any of several paths (Reference 37). Portable Phase 2 equipment is listed in Attachment 2. The capacity of the portable pump will be greater than the boil off rate for SFP.

Deployment route from the staging area will be evaluated based on an assessment of the damage in the affected area and the equipment will be deployed in accordance with this assessment.</td></tr>
<tr><th colspan="2">Schedule:</th></tr>
<tr><td>Provide a brief description of Procedures / Strategies / Guidelines</td><td>Confirm that procedure/guidance exists or will be developed to support implementation

Existing abnormal operating procedures (Reference 37) and severe accident management procedures (References 39 and 40) support make-up of water to the SFP. Procedure will be revised as necessary to reflect new portable equipment storage locations and redundancy (Action 7).</td></tr>
<tr><td>Identify modifications</td><td>List modifications

SFP Level indication will be modified per NRC Order EA-12-051. A manual ventilation capability (to provide a vent path for steam release from SPF to outside secondary containment) will be added to the refuel floor to minimize the consequences of boiling of the SFP (Attachment 11) (Action 23).</td></tr>
<tr><td>Key SFP Parameter</td><td>Per EA 12-051

Per NRC Order EA-12-051 spent fuel pool level indication will be modified to provide enhanced indication for spent fuel pool cooling strategies.</td></tr>
<tr><th colspan="2">Storage / Protection of Equipment :
Describe storage / protection plan or schedule to determine storage requirements</th></tr>
<tr><td>Seismic</td><td>List how equipment is protected or schedule to protect

Storage building design will be consistent with NEI 12-06, Section 5.3.1 and will be constructed per Attachment 4, Milestone Schedule.</td></tr>
<tr><td>Flooding</td><td>List how equipment is protected or schedule to protect</td></tr>
</table>

Note: If stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	Storage building design will be consistent with NEI 12-06, Section 6.2.3.1 and will be constructed per Attachment 4, Milestone Schedule. If located below the flood level, procedures will be established to move equipment prior to flood levels impacting the equipment.
Severe Storms with High Winds	*List how equipment is protected or schedule to protect* Storage building design will be consistent with NEI 12-06, Section 7.3.1 and will be constructed per Attachment 4, Milestone Schedule. The buildings will be separated to minimize potential for single tornado path interacting with both buildings. The buildings will accommodate extreme straight winds for the area but tornado winds may damage the structure. Portable equipment will be secured against wind.
Snow, Ice, and Extreme Cold	*List how equipment is protected or schedule to protect* Storage building design will be consistent with NEI 12-06, Section 8.3.1 and will be constructed per Attachment 4, Milestone Schedule.
High Temperatures	*List how equipment is protected or schedule to protect* Storage building design will be consistent with NEI 12-06, Section 5.3.1 and will be constructed per Attachment 4, Milestone Schedule.

Deployment Conceptual Design (Conceptual Sketches are included in attachments)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use. New storage buildings will be constructed with physical separation (Action 20). Paths for deployment will be reviewed to ensure they are not susceptible to significant soil liquefaction during a seismic event (Action 29).	*Identify modifications* Two new commercial grade structures.	*Identify how the connection is protected* Portable equipment will be deployed to a connection point in a protected area.
Notes: DAEC has selected four FLEX building locations as shown on Attachment 9. They are ISFSI area, Well Water Road area, Switchyard Area and North of CSC area. Out of these four DAEC will select two locations based on constructability and cost (Action 20).		

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. During Phase 3 off site resources are expected to be available to replace or augment those SFP cooling capabilities describe in Phase 1 and 2. Use of Phase 2 strategies can maintain SFP cooling indefinitely provided an adequate inventory of water is available. Water can be pumped from the Cedar River to replenish inventories if needed (Action 6). Restoration of essential 4160 Volt AC power via a portable diesel generator will be provided in Phase 3 (Action 21). With 4160 Volt AC power restored, permanently-installed, equipment required for make-up and cool down of the SPF will again be available.	
Schedule:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation* Spent fuel pool makeup with portable pump will continue until 4160V AC power is restored and forced cooling and heat transfer established.
Identify modifications	*List modifications* No additional modifications.
Key SFP Parameter	*Per EA 12-051* No additional indication.

Deployment Conceptual Design (Conceptual Sketches are included in attachments)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use. No additional strategies.	*Identify modifications* No additional modifications	*Identify how the connection is protected* Same as core cooling.
Notes:		

References:

1. UFSAR Section 3.7, Seismic Design, (Docketed)
2. UFSAR Section 2.5.4.5.3, Excavation, (Docketed)
3. UFSAR Section 3.4, Water Level (Flood) Design, (Docketed)
4. UFSAR Section 3.3, Wind and Tornado Loadings, (Docketed)
5. UFSAR Section 3.11, Environmental Design of Electrical Equipment, (Docketed)
6. QUAL-SC101, DAEC Environmental and Seismic Service Conditions
7. NEDC-33771P, Rev. 1, GEH Evaluation of FLEX Implementation Guidelines
8. UFSAR 15.3.2, Station Blackout, (Docketed)
9. Technical Specification 3.6.2.2, Suppression Pool Water Level, (Docketed)
10. UFSAR Section 5.2.2.4.2, Safety/Relief Valves, (Docketed)
11. Technical Specification 3.7.8, Spent Fuel Storage Pool Water Level, (Docketed)
12. Task Interface Agreement (TIA), 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), (Docketed)
13. CAL-E08-007, 250 VDC System Battery Sizing
14. CAL-E08-008, 125 VDC System Battery Sizing
15. APED-A61-089, SBO Compliance
16. EC 275056, Study of DAEC 125 VDC System
17. CAL-M06-007, Room Heat-up Analysis for DAEC during SBO
18. UFSAR 2.1, Geography and Demography, (Docketed)
19. UFSAR 9.1.2.3.2, Cooling Considerations, (Docketed)
20. CAL-M97-019, Thermal Hydraulic Evaluation of the DAEC SPF
21. AOP 301.1, Abnormal Operating Procedure 301.1 Station Blackout
22. EOP 1, RPV Control
23. EOP 2, Primary Containment Control
24. Fire Brigade Drill to Provide Makeup to the RPV and Drywell dated March 20, 2011
25. INPO IER L1-11-4 dated September 29, 2011, Near-Term Actions to Address the Effects of an Extended Loss of All AC Power in Response to the Fukushima Daiichi Event
26. Erin Engineering Report dated 11/11/11, Evaluation Report of DAEC Capabilities to Respond to Station Blackout for INPO IER L1-11-4
27. Technical Specification Table 1.1-1 Modes, (Docketed)
28. Technical Support Guideline Section 3 Control Parameter Assessment Guideline
29. CAL-M83-002, Adequacy of the Accumulator for ADS
30. UFSAR Section 6.3.3.1.3 Automatic Depressurization System, (Docketed)
31. SAMP 707, Emergency SRV Operation using DC Power
32. NRC EA-12-050 dated March 12, 2012, Issuance of Order to Modify License with Regard to Reliable Containment Hardened Vents, (Docketed)
33. Technical Support Guideline Appendix C Containment Venting Guideline
34. SEP 301.3, Torus Vent via Hard Pipe Vent
35. EMG, Rev. 7, Emergency Management Guideline
36. CAL-M12-022, DAEC Outage 23 (Cycle 24) Spent Fuel Decay Heat and Associated Calculations
37. AOP 435, Loss of Fuel Pool Cooling/Inventory
38. NRC EA-12-051 dated March 12, 2012, Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation
39. SAMP 712, Spent Fuel Pool Makeup and Spray
40. SAMP 718, Spent Fuel Pool Makeup via the RHR System with the Portable Diesel Fire Pump
41. Fire Brigade Drill to Provide Makeup Spent Fuel Pool dated March 21, 2011

42. NG-12-0430 Response to 50.54(f) Request for Information Regarding Near Term Task Force Recommendation 9.3 Emergency Preparedness
43. UFSAR 1.2, General Plant Description, (Docketed)
44. JLD-ISG-2012-01 dated August 2012, Compliance with Order EA-12-049, Order Modifying Licenses with regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events, (Docketed)
45. NEI 12-06 dated August 2012, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, (Docketed)
46. GEH Report 000-0155-1545-RO dated February 2013, RCIC Pump and Turbine Durability Evaluation-Pinch point Study

Attachment 1A
Sequence of Events Timeline

Action item	Elapsed Time	Action	ELAP New Time Constraint Y/N	Remarks / Applicability
	0	**Event Starts**	N	Plant @100% power
1	0-2 min	Automatic Plant Response	N	Consistent with UFSAR 15.3.2 (Reference 8) Reactor scrams, primary containment isolation Groups 1-5 occur, Safety Relief Valves (S/RV's) and Low-low set control reactor pressure, RCIC and HPCI initiate to control reactor water level. Following initial reactor vessel level recovery HPCI is secured and RCIC is the preferred make up system. For Phase 1, the installed equipment is designed to start automatically and procedures do address manual start if they fail to start automatically (Reference 22).
2	30 min	Controlled Reactor Depressurization	N	Operators initiate a controlled reactor depressurization using S/RV's. Sufficient pressure is maintained for steam driven systems (RCIC/HPCI) to operate, (References 8 and 21).
3	60 min	Operators use procedures to maintain adequate room cooling to ensure necessary equipment is maintained functional by opening cabinets and doors.	N	Reference UFSAR 15.3.2. Existing analysis addresses identified areas for ELAP with the exception of possible impacts on instrument inverters that could affect critical instruments. Additional analysis will be performed in accordance with the milestone schedule (Attachment 4) (Action 24).
4	2 hours	Operators perform load shedding	Y	Scoping studies indicate it is possible to extend availability of station batteries to approximately 8 hours if load shedding is performed at approximately 2 hours (Reference 16). Final load shedding analysis, revision to procedures and validation of time constraint will be performed in accordance with the milestone schedule (Attachment 4) (Action 15).
5	4-8 hours	Prior to depletion of station safety related batteries use a portable diesel generator to supply power to station battery chargers.	Y	Existing station battery design ensures a minimum of 4 hours of capacity (References 13 and 14).
6	4-8 hours	Prior to the loss of all steam driven reactor vessel make up, align a portable	Y	Existing analysis demonstrates adequacy of steam driven systems for a 4 hour coping period (Reference 15). BWROG RCIC Durability Study

Action item	Elapsed Time	Action	ELAP New Time Constraint Y/N	Remarks / Applicability
		diesel driven pump to inject water to the reactor. Manually depressurize the reactor using S/RV's to allow low pressure injection.		(Reference 46) performed by GEH will be screened to perform plant specific analysis beyond the current 4 hour coping period (Action 25). Final procedure revisions and validation of time critical actions (Actions 4 and 7), incorporating updated expected RCIC mission time, will be performed in accordance with the milestone schedule (Attachment 4).
7	4-72 hours	Prior to significant accumulation of moisture on the refuel floor due to fuel pool temperature, open a vent to minimize moisture accumulation.	Y	Actual timing of this will vary with fuel loading in the pool and time since discharge (References 36 and 37). Ventilation of the refuel floor to reduce environmental impacts of a boiling pool is planned. This will require modification of the plant. Procedure revisions and validation of procedures for venting the refuel floor will be performed in accordance with the milestone schedule (Attachment 4) (Actions 4, 7 and 23).
8	14 hours	Prior to portable equipment fuel depletion initiate re-fueling.	Y	Actual timing of refueling will vary with timing of use of portable equipment and how heavily loaded but based on typical consumption rates of portable equipment (Reference 25) (Action 27).
9	8-16 hours	Prior to exceeding containment limits, vent the containment through a reliable hardened vent.	Y	An existing containment hardened vent was installed under Generic Letter 89-16. Upgrades to that vent will be required under NRC Order EA-12-050 (Reference 32). Final analysis with respect to the upgraded hardened vent will be performed under that Order. Procedure revisions and validation of time critical actions will occur as part of that modification.
10	10-16 hours	Establish charging capability for batteries in portable communications equipment and ensure portable equipment is adequately fueled.	Y	During the DAEC assessment of communications under NRC recommendation 9.3 (Reference 42), it was identified that portable communication equipment could be enhanced by establishing a method to recharge batteries (Action 26) and ensure portable equipment is able to be re-fueled (Action 27).
11	45-72 hours	Prior to spent fuel pool water level decreasing to the top of spent fuel initiate make-up to the pool using a portable diesel driven pump.	Y	Existing analysis of loss of spent fuel pool cooling under conservative assumptions indicates that a minimum of 45 hours is available prior to water level decreasing to the top of stored fuel (Reference 20). Cycle specific evaluations of heat loads are performed and incorporated in operating procedures that indicate heat loads can be much less than this bounding analysis (References 36 and 37). Past experience indicates that deployment of a portable

Action item	Elapsed Time	Action	ELAP New Time Constraint Y/N	Remarks / Applicability
				pump can be completed in less than two hours (Reference 41). No additional time validation is warranted given the large margin in response time.
12	24-72	Supplement on site equipment with equipment from the Regional Response Center.	Y	An extended loss of AC power can be mitigated using a combination of installed equipment and portable equipment that will be stored on site. The Regional Response Center equipment provides a reliable back up to this on site equipment for extended operation. This will provide added assurance that consumables are replenished, and begin the transition to recovery by restoring power to a 4160 Volt Essential bus and restoring water from the Cedar River (Actions 6, 13 and 21).

Attachment 1B

NSSS Significant Reference Analysis Deviation Table
(NEDC 33771P, GEH Evaluation of FLEX Implementation Guidelines)

Item	Parameter of interest	NEDC value (NEDC 33771P Revision 1, January 2013)	NEDC page	Plant applied value	Gap and discussion
	None				

Attachment 2							
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) Diesel Driven Pumps	**X**	**X**	**X**			Sized consistent with existing requirements under 10CFR 50.54.hh	Will follow EPRI PM template requirements
Two (2) 480 VAC Generator	**X**	**X**		**X**	**X**	Sized for charging essential 125 and 250 VDC Batteries	Will follow EPRI PM template requirements
Two DC Power Carts	**X (Secondary)**	**X (Secondary)**				Sized for SRV solenoid operation	Will follow EPRI PM template requirements
Two (2) Nitrogen Bottles	**X (Secondary)**	**X (Secondary)**				Sized for operation of containment vent valves	Will follow EPRI PM template requirements
Four (4) 220/120 VAC Generators				**X (Secondary)**	**X (Secondary)**	Sized for powering critical instruments and area lighting	Will follow EPRI PM template requirements
Two (2) Fuel Oil Transfer Pump	**X (Support)**	**X (Support)**	**X (Support)**	**X (Support)**	**X (Support)**	Sized to refuel portable equipment	Will follow EPRI PM template requirements
Two (2) Tow Vehicles	**X (Support)**	**X (Support)**	**X (Support)**	**X (Support)**	**X (Support)**	Sized to transport on site portable equipment	Will follow EPRI PM template requirements
Two (2) Debris Removal Equipment	**X (Support)**	**X (Support)**	**X (Support)**	**X (Support)**	**X (Support)**	Sized to move typical concrete barriers on site	Will follow EPRI PM template requirements

Attachment 3							
BWR Portable Equipment Phase 3							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Maintenance*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
Three Portable high capacity pumps	**X**	**X**	**X**			Sized to pump water from the Cedar River to the DAEC Pump House at flow rates adequate to support plant cool down	
Two (2) 4160 VAC Generator	**X**	**X**	**X**	**X**	**X**	Sized to power essential loads needed to support plant cool down	**4160 Volt Generators will be mobilized to site during flood preparations or when requested by the DAEC emergency coordinator**

Attachment 4

Milestone Schedule

Original Target Date	FLEX Implementation Activity	Status
February 2013	Submit Overall Integrated Implementation Plan	Complete
August 2013	Submit 6 Month Status Report	Open
December 2013	Complete Revision to Emergency Operating Procedures to Extend Operation of Steam Driven Pumps	Open
February 2014	Submit 6 Month Status Report	Open
August 2014	Complete Regional Response Center Arrangements	Open
August 2014	Submit 6 Month Status Report	Open
RFO 24 (Fall 2014)	First Refueling Outage of Implementation Period	Open
January 2015	Complete Site Specific Analysis of NEDC-33771P Rev. 1	Open
February 2015	Submit 6 Month Status Report	Open
March 2015	FLEX Storage Buildings Completed	Open
May 2015	Identified Portable Equipment Stored on Site	Open
August 2015	Submit 6 Month Status Report	Open
December 2015	Issue Modification Packages	Open
February 2016	Submit 6 Month Status Report	Open
May 2016	Complete Staffing Study for Flex Implementation	Open
August 2016	Complete Implementing Procedure Development and Validation	Open
August 2016	Submit 6 Month Status Report	Open
September 2016	Complete Required Training	Open
RFO 25 (Fall 2016)	Final Implementation Outage for Modifications	Open
December 2016	Submit Completion Report	Open

Attachment 5	
Systems Credited for Core Cooling Baseline Coping (Reference 15)	
System	Function and Limitation on Core Cooling Coping Duration
Reactor Core Isolation Cooling (RCIC)	Provides the primary means for reactor vessel inventory control throughout the baseline coping period. In the event RCIC is unavailable, HPCI can be used as an alternate. RCIC may limit the coping duration for core cooling. RCIC may become unavailable due to environmental conditions, NPSH impacts on suction sources, depletion of control power, or system isolations or failure. A more detailed review of RCIC limitations on coping duration will be performed as a part of FLEX implementation (Action 25).
High Pressure Coolant Injection (HPCI)	Assists RCIC in initial recovery of reactor vessel inventory following the initial loss of AC power. Acts as a backup to RCIC in the event RCIC is unavailable. HPCI may become unavailable due to environmental conditions, NPSH impacts on suction sources, depletion of control power, or system isolations or failure. Sizing of HPCI is such that operation may be difficult when steam supply is limited later in the coping period. If the industry evaluations to extend the mission time for RCIC do not yield the required results, further evaluation will be performed on the HPCI system to determine if it can support RCIC operation to achieve the desired mission time.
125 VDC	Provides control power to RCIC, Safety Relief Valves (SRV's) and key instrumentation used for decision making. 125 V DC battery capacity will likely limit the baseline coping duration. A detailed review of battery capacity and potential enhancements to load shedding strategies will be performed as part of FLEX implementation (Action 15).
250 VDC	Provides control power to HPCI. 250 VDC battery capacity is not expected to alter baseline coping duration. A detailed review of 250 VDC battery mission time will not be performed unless the results of 125 VDC and RCIC reviews indicate there is a significant potential to alter the coping duration.
Safety Relief Valves (SRV)	Controls reactor pressure within specified limits during initial response to a loss of AC power. SRV functionality is required to allow the transition to Phase 2 of core cooling, the reactor must be sufficiently depressurized to allow portable low-head pumps to inject water to the RPV. SRV's may limit the coping duration due to environmental conditions, loss of control power, or depletion of pneumatic supply. A more detailed review of these limitations on SRV operation will be performed as a part of FLEX implementation (Action 28).

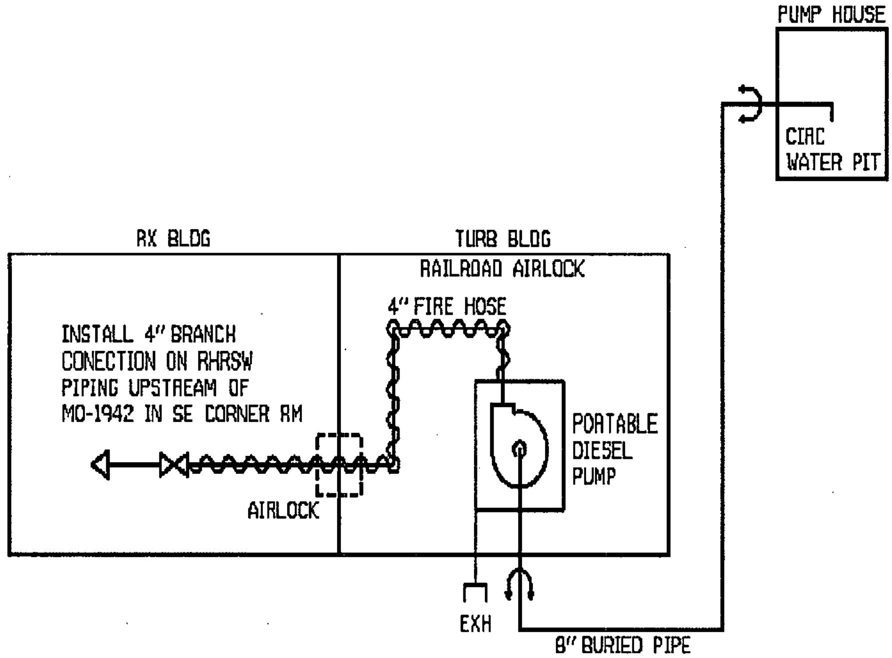
Low-Low Set Logic (LLS)	Controls safety relief valves in initial response to reactor pressure vessel isolation to limit stresses on SRV tail pipes. Shortly after initial operation the LLS logic will no longer be needed. Thus, the LLS logic does not limit coping duration.
Control Rod Drives (CRD)	Ensures reactor is shutdown as an immediate response to loss of AC power. Once shutdown, the reactor will remain shutdown regardless of the status of AC power. The CRD system does not limit the coping duration.
Reactor Protection System (RPS)	Ensures reactor is shutdown as an immediate response to loss of AC power. Once shutdown, the reactor will remain shutdown regardless of the status of AC power. RPS power also supplies instrumentation in portions of the containment isolation logic. However, these instruments trip (i.e. fail safe) on loss of RPS power. The RPS system does not limit the coping duration for core cooling.
Condensate Storage Tanks (CST)	Provides the preferred initial water inventory for RCIC and HPCI make-up to the RPV. CST's are not fully protected from external hazards such as tornado missiles. If the CST's are unavailable, the suppression pool will be the credited source of water inventory. Consequently, no detailed evaluation of the effect of CST's on coping duration will be performed as part of FLEX implementation.
Torus (Suppression Pool) and Containment Structure	Provides protected source of water inventory for RCIC and HPCI in the event the CST's are not available. Provides a suppression pool for SRV discharge. The suppression pool temperature may limit the coping duration for each Phase. RCIC and HPCI operation can be adversely affected by suction source water temperature. SRV operation can affect suppression pool temperature in any of the Phases. A more detailed review of suppression pool temperature response will be needed as part of FLEX implementation. This will be performed consistent with generic work being performed on this topic by the BWROG in NEDC 33771P (Action 14).
Nuclear Boiler and Main Steam	Provide a source of steam to the HPCI and RCIC turbines and maintains the floodable volume for core cooling. The nuclear boiler and main steam system do not limit the coping duration for core cooling under the FLEX strategies.
Nuclear Steam Supply Shutoff (NSSS)	Isolates the primary reactor coolant system as an immediate response to the loss of AC power. Once isolations are complete no further action is required by the NSSS system and the NSSS system will not affect the core cooling coping time.

Main Steam Isolation Valves (MSIV)	Isolates the main steam lines as an immediate response to the loss of AC power. Once isolations are complete no further action is required by the MSIV's and the system will not affect the core cooling coping time.
Room Heatup during an SBO (Reference 17)	Heat up of key plant locations was performed for existing station black out coping and up to 24 hours. This evaluation will need to be reviewed for the extended duration postulated for the FLEX strategies (Action 24).

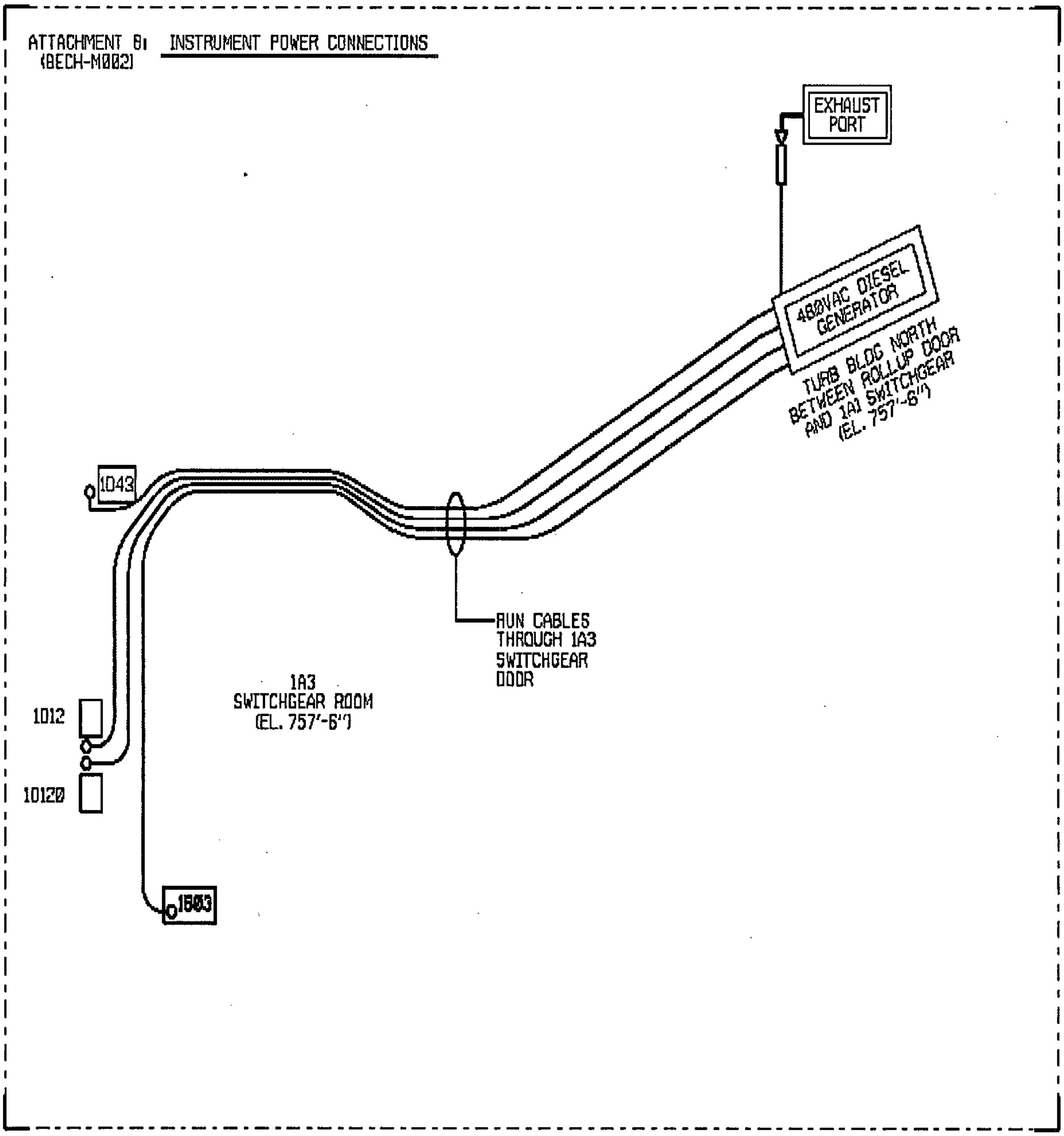
Attachment 6						
Required Instruments						
Parameter	Instrument	Components in Loop	Power Supply	Location of Components	Range	Breakers to Re-power Instrument Loop
Drywell Pressure	PR4385A	PT4365A	201CH (E/S)	1C22	-10 to 90 psig	1Y2127 1Y2128
		201CH (E/S)	1Y2127	1C142		
		PR4385A	1Y2128	1C29		
Drywell Pressure	PR4385B	PT4365B	213CH (E/S)	1C56	-10 to 90 psig	1Y1113 1Y1131
		213CH (E/S)	1Y1113	1C06		
		URS4384	1Y1131	1C29		
Drywell Temperature	TR4383A	TE4386G	1Y1128	Drywell	0 to 500 °F	1Y1128 1Y1131
		TT4386G	1Y1128	1C142		
		TE4386J	1Y1128	Drywell		
		TT4386J	1Y1128	1C142		
		TE4386L	1Y1128	Drywell		
		TT4386L	1Y1128	1C142		
		TR4383A	1Y1131	1C29		
Drywell Temperature	TR4383B	TT4386E	1Y2127	Drywell	0 to 500 °F	1Y2127 1Y2128
		TE4386E	1Y2127	1C142		
		TE4386K	1Y2127	Drywell		
		TT4386K	1Y2127	1C142		
		TE4386H	1Y2127	Drywell		
		TT4386H	1Y2127	1C142		
		TR4383B	1Y2128	1C29		
Torus Water Level	LI4397A	LT4397A	I/E4397A	Torus	1.5 to 16 ft	1Y1136
		I/E4397A	1Y1136	1C09		
		LI4397A	I/E4397A	1C03		
Torus Water Level	LI4397B	LT4396B	I/E4396B	Torus	1.5 to 16 ft	1Y2136
		I/E4396B	1Y2136	1C09		
		LI4396B	I/E4396B	1C03		
Torus Water	TIA4325	TE4325	I/E4325	Torus	20 to	1Y1128

Temperature		TT4325	1Y1128	1C142	220 °F	1Y1115 1Y1131 1Y1115
		TI4325	I/E4325	1C208		
		TY4325A	I/E4325	1C392		
		I/E4325	E/S4565A	1C03		
		TY4325	E/S4565A	1C03		
		E/E4325	E/S4565A	1C03		
		TIA4325	TY4325	1C03		
		E/S4565A	1Y1115	1C03		
		TR4386A	1Y1131	1C29		
		UR4325	1Y1115	1C03		
RPV Pressure	PI4599A	PT4599A	I/E4599A	1C56	0 to 1500	1Y1136
		I/E4599A	E/S4599A	1C09		
		E/S4599A	1Y1136	1C09		
		PI4599A	I/E4599A	1C03		
RPV Pressure	PI4599B	PT4599B	1Y2115	1C56	0 to 1500	1Y2136
		I/E4599B	E/S4599B	1C09		
		E/S4599B	1Y2136	1C09		
		PI4599B	I/E4599B	1C03		

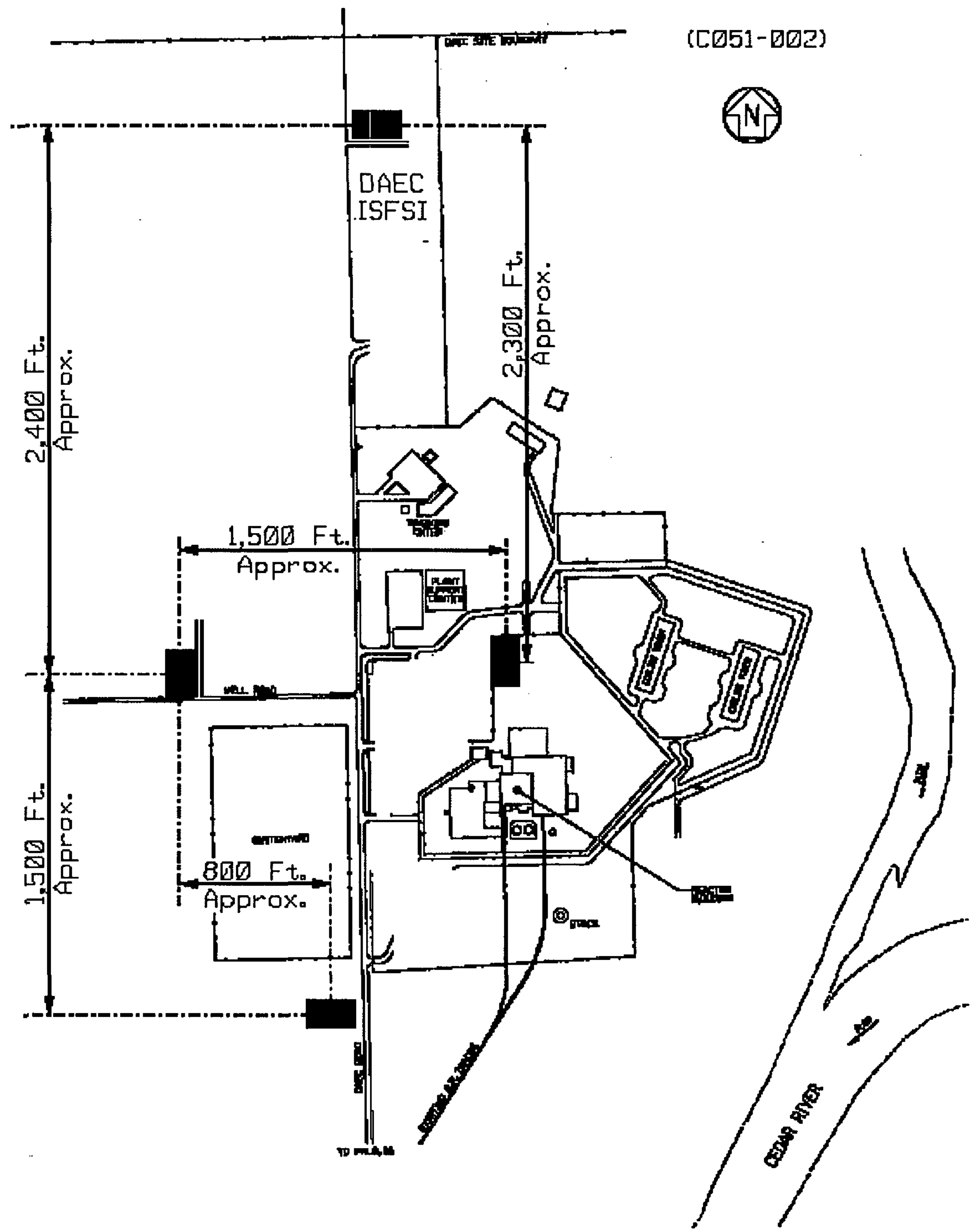
ATTACHMENT 7: INJECTION POINT TO RPV



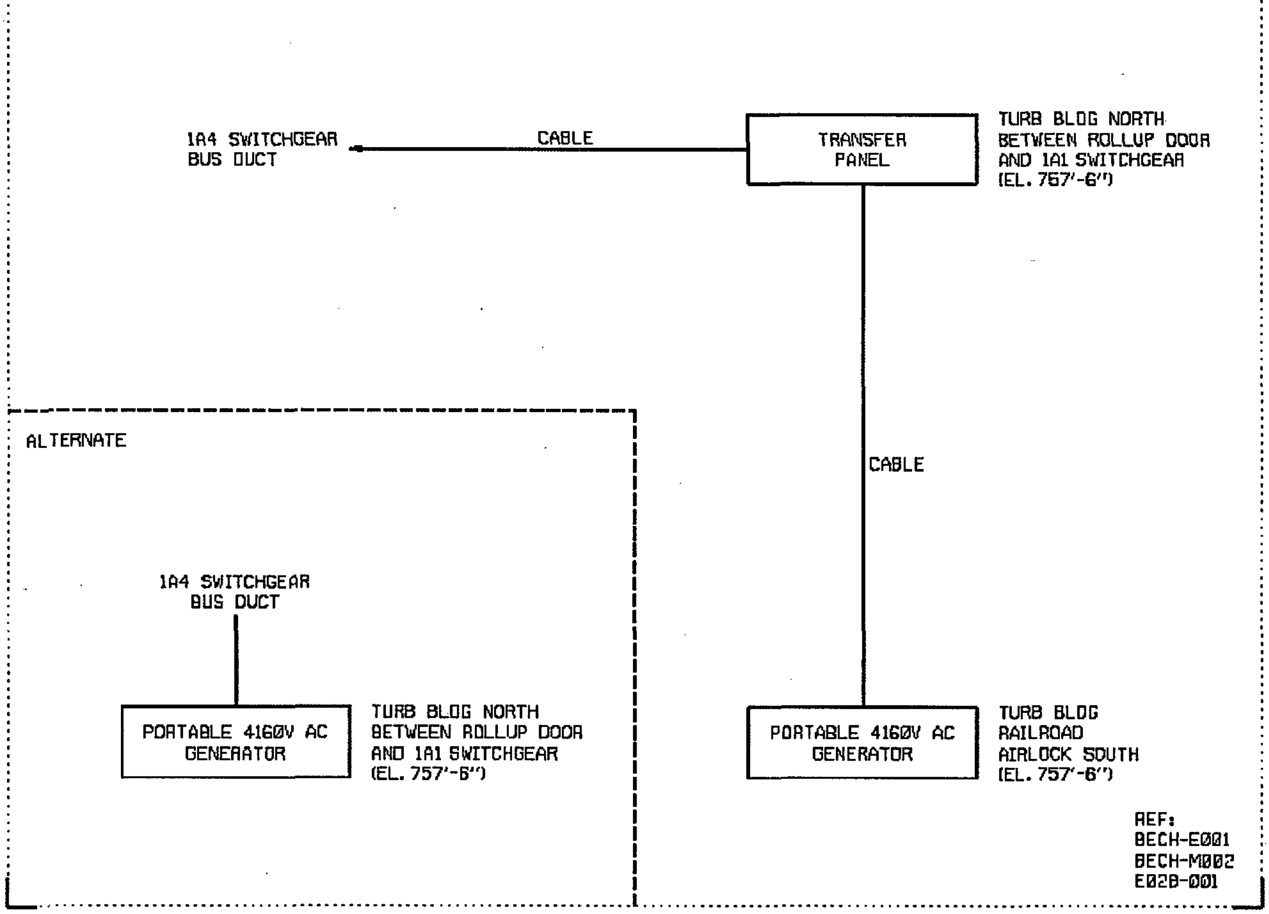
REF:
ISO-GBC-005-01
P&ID BECH-M113
P&ID BECH-M120
BECH-C127
BECH-C129
BECH-M233
BECH-M266


ATTACHMENT 8: INSTRUMENT POWER CONNECTIONS
(BECH-M002)
EXHAUST PORT
480VAC DIESEL GENERATOR
TURB BLDG NORTH BETWEEN ROLLUP DOOR AND 1A1 SWITCHGEAR (EL. 757'-6")
1D43
RUN CABLES THROUGH 1A3 SWITCHGEAR DOOR
1A3 SWITCHGEAR ROOM (EL. 757'-6")
1D12
1D120
1B03

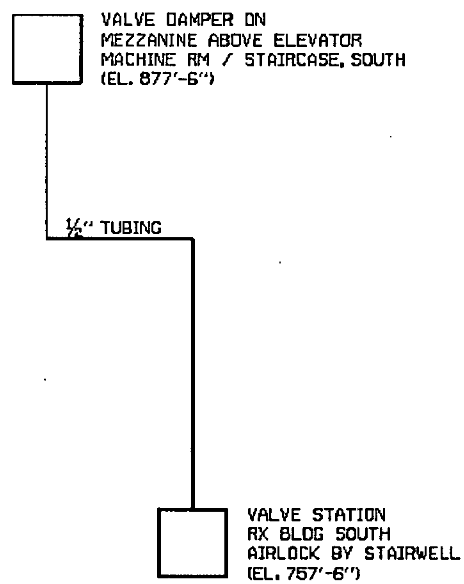
ATTACHMENT 9 - PROPOSED LOCATIONS OF STORAGE FACILITIES



ATTACHMENT 10: OFFSITE 4160 VAC CONNECTION TO AN ESSENTIAL BUS



ATTACHMENT 11: SPENT FUEL POOL VENT



REF:
BECH-C436
BECH-A029
BECH-M279

Attachment 12		
Implementation Action Items		
Number	Action	Status
1	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 process and addressed.	Open
2	Flood 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 process and addressed.	Open
3	Implement revisions to emergency operating procedures (EOP's) identified by the BWROG to extend operation of steam driven pumps for core cooling during ELAP.	Open
4	Validate implementing procedures can be performed in a timely manner.	Open
5	Final plant specific analysis for an ELAP will be performed with equivalent acceptance criteria with the exception of Condensate Storage Tank (CST) inventory and suppression pool level which will be altered in recognition of the external hazards and revised duration of the mitigating strategies.	Open
6	Phase 3 activities will ensure adequate inventory of water can be provided directly from the Cedar River or other sources independent of the normal River Water Supply pumps.	Open
7	Implement new and revised plant procedure for FLEX Strategies.	Open
8	Implement administrative controls for the FLEX Program.	Open
9	Procure FLEX portable equipment.	Open
10	Establish preventive maintenance and testing of FLEX portable equipment.	Open
11	Revise UFSAR and TRM as needed to reflect FLEX program.	Open
12	Complete training of applicable personnel.	Open
13	Establish "Playbook" for Regional Response Center interface with the DAEC.	Open
14	Review generic BWROG analysis of FLEX implementation and perform a detailed review of suppression pool temperature to support FLEX strategies.	Open
15	Perform analysis of final load shedding strategy for essential station batteries and implement in plant procedures.	Open
16	Modify the plant to establish a flood staging area for portable equipment.	Open
17	Evaluate deployment routes for portable equipment.	Open
18	Modify the plant to facilitate connection of portable power supplies. This will include connection points for a 480 volt generator to essential battery chargers and 480 volt distribution panel 1B03. Quick connection points will be established for 120 volt AC power to instrument power supplies.	Open
19	Modify the plant to add suction and injection connection points for portable pump. The portable pump suction will allow access to the circulating water pit (Pump House) from a protected area (Turbine Building) during a design bases flood. The injection point will provide a redundant connection point for RPV makeup located in a protected area (Reactor Building).	Open
20	Construct two FLEX portable equipment storage buildings. The buildings will be separated to minimize the potential for a single tornado path to interact with both buildings.	Open

21	Phase 3 activities will ensure essential bus can be re-powered using a portable 4160 V Generator. This will include a modification that establishes a transfer panel (disconnect switch) installed in the turbine building that provides a location for connection during a design bases flood and procedures for mobilization.	Open
22	Procedures will provide for opening containment vent valves using portable pneumatic supply.	Open
23	Modify the plant to establish a manual vent capability for the reactor building near the spent fuel pool.	Open
24	Update analysis of room heat-up during an ELAP.	Open
25	Screen BWROG RCIC Durability Study for extending RCIC operation during an ELAP and make applicable improvements.	Open
26	Establish methods to recharge communications equipment.	Open
27	Establish methods to re-fuel portable equipment.	Open
28	Review generic BWROG analysis of FLEX implementation and perform a detailed review of limitations on SRV operation to support FLEX strategies.	Open
29	If FLEX transport paths are over previously un-excavated ground, review path for potential soil liquefaction during a seismic event.	Open