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GNRO-2013/00015

February 27, 2013

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

SUBJECT: Overall Integrated Plan in Response to March 12, 2012, Commission Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)
Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

REFERENCES:

1. NRC Order Number EA-12-049, *Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events*, dated March 12, 2012 (ML12054A735)

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 (ML12229A174)

3. Nuclear Energy Institute (NEI) 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide*, Revision 0, dated August 2012

4. Initial Status Report in Response to March 12, 2012, *Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)*, dated October 25, 2012, GNRO-2012/0129 (ML12305A207)

Dear Sir or Madam:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued an order (Reference 1) to Entergy Operations, Inc. (Entergy). Reference 1 was immediately effective and requires provisions for mitigating strategies for Beyond-Design-Basis External Events. Specific requirements are outlined in the Enclosure 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, and endorses industry guidance document Nuclear Energy Institute (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 attachment to this letter provides Grand Gulf Nuclear Station's (GGNS) Overall Integrated Plan pursuant to Reference 3.

Reference 4 provided the GGNS initial status report regarding mitigation strategies for Beyond-Design-Basis External Events, as required by Reference 1. Entergy 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 comes first. Future status reports will be provided as required by Section IV, Condition C.2, of Reference 1.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact Thomas Thornton at (601) 437-6176.

I declare under penalty of perjury that the foregoing is true and correct; executed on February 27, 2013.

Sincerely,

KJM/slw

Attachment: Grand Gulf Nuclear Station's Diverse and Flexible Coping Strategies (FLEX) Overall Integrated Plan

cc: (see next page)

cc: U. S. Nuclear Regulatory Commission
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Attachment to GNRO-2013/00015

Grand Gulf Nuclear Station's

Diverse and Flexible Coping Strategies (FLEX)

Overall Integrated Plan

General Integrated Plan Elements (Boiling Water Reactors)	
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 extreme external hazards for Grand Gulf Nuclear Station (GGNS) are seismic, ice, high winds and high temperature as detailed below:

Seismic Hazard Assessment:

Per the GGNS Updated Final Safety Analysis Reports (UFSAR) (Reference 1) Section 2.5, the seismic criteria for GGNS include two design basis earthquake spectra: The Operating Basis Earthquake (OBE) and the Design Basis Earthquake (DBE) (Safe Shutdown Earthquake). The DBE and the OBE are 0.15 g and 0.075 g, respectively; these values constitute the design basis of GGNS. Per Nuclear Energy Institute (NEI) 12-06 Section 5.2 (Reference 2), all sites will consider the seismic hazard.

The GGNS UFSAR was reviewed to perform a limited evaluation of the liquefaction potential outside the power block area for a DBE event. There are margins of safety for liquefaction susceptible soils within the areas of the principle structures for a DBE event with a maximum horizontal acceleration equal to 0.15 g, according to GGNS UFSAR Section 2.5 (Reference 1). Therefore, the likelihood of liquefaction at the site for a DBE event with a maximum horizontal acceleration equal to 0.15 g appears to be low based on the information presented in the GGNS UFSAR. Since the Diverse and Flexible Coping Strategies (FLEX) storage locations have not been finalized, evaluation of storage locations and deployment routes to confirm the absence of adverse impacts due to liquefaction must be performed.

Thus the GGNS site screens in for an assessment for seismic hazard.

External Flood Hazard Assessment:

Per GGNS UFSAR the plant site is at a grade elevation of 132.5 feet (ft). This elevation is well above the water levels of the Mississippi River which has a 100 year flood elevation of 93.1 ft (Reference 1, Section 2.4.1.1). Site flooding is driven by Probable Maximum Precipitation (PMP). Evaluation of the PMP event demonstrates that the maximum floodwater elevations near the power block do not exceed elevation 133 ft 3 inches (in) (Reference 1, Sections 2.4.2.2 and 2.4.3.5.3). Per the guidance in NEI 12-06 Section 6.2.1 and Regulatory Guide 1.102 (Reference 3) GGNS is classified as a dry site since it is built above the design basis flood level.

Thus the GGNS site screens out for an assessment for external flooding.

Extreme Cold Hazard Assessment:

The guidelines provided in NEI 12-06 (Section 8.2.1) generally exclude the need to consider extreme snowfall at plant sites in the southeastern U.S. below the 35th parallel. The GGNS plant site is located below the 35th parallel at 32°0'27" (degrees/minutes/seconds) latitude and 91°2'53" longitude (Reference 1 Section 2.1.1.1) and thus the capability to address hindrances caused by extreme snowfall with snow removal equipment need not be provided.

General Integrated Plan Elements (Boiling Water Reactors)

The GGNS site is located within the region characterized by the Electric Power Research Institute (EPRI) as ice severity level 4 (Reference 2, Figure 8-2). Ice storms in the general area surrounding the plant site have occurred with accumulated ice coatings in excess of 0.5 inches. As such, the GGNS site is subject to severe icing conditions that could also cause catastrophic destruction to electrical transmission lines.

Thus the GGNS site screens in for an assessment for extreme cold for ice only.

High Wind Hazard Assessment:

The GGNS plant site is located below the 35th parallel (Reference 1 Section 2.1.1.1). Per NEI 12-06 guidance hurricanes and tornado hazards are applicable to GGNS. NEI 12-06 Figures 7-1 and 7-2 were used for this assessment.

Thus the GGNS site screens in for an assessment for High Wind Hazard.

Extreme High Temperature Hazard Assessment:

Per NEI 12-06 Section 9.2, all sites will address high temperatures. Mississippi summers are warm and humid, with limited periods of extremely hot weather over 100° Fahrenheit (F) (Reference 1 Section 2.3.2.1.2).

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. Site industrial safety procedures currently address activities with a potential for heat stress to prevent adverse impacts on personnel.

Thus the GGNS site screens in for an assessment for extreme High Temperature.

Summary of extreme external hazards Assessments:

The hazards applicable to GGNS are seismic, ice, high wind and high temperature.

References:

1. GGNS Nuclear Plant Updated Final Safety Analysis Report, Revised 11/12
2. Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, NEI 12-06, Revision 0, August 2012
3. U.S. Nuclear Regulatory Commission, "Flood Protection For Nuclear Power Plants", Reg. Guide 1.102, Rev. 1, September 1976.

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 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 on a schedule commensurate with other licensing bases changes.* • *Exceptions for the site security plan or other (license/site specific) requirements of 10 CFR may be required.*

General Integrated Plan Elements (Boiling Water Reactors)	
	• *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 GGNS are described below:

- Flood and seismic re-evaluations pursuant to the Title 10 *Code of Federal Regulations* (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.
- Following conditions exist for the baseline case:
  - Seismically designed direct current (DC) battery banks are available.
  - Seismically designed alternating current (AC) and DC distribution systems are available.
  - Plant initial response is the same as Station Blackout (SBO) event.
  - Best estimate analysis and decay heat is used to establish operator time and action.
  - No single failure of systems, structures, components (SSCs) assumed (except those in the base assumptions, i.e., emergency diesel generator (EDG) operation, and motive force of the Ultimate Heat Sink (UHS) pumps). Therefore, Reactor Core Isolation Cooling (RCIC) system will perform either via automatic control or with manual operation capability per the guidance in NEI 12-06.
- The designed hardened connections are protected against external events or are established at multiple and diverse locations.
- FLEX components will be designed to be capable of performing in response to screened in hazards in accordance with NEI 12-06. Portable FLEX components will be procured commercially.
- Margin will be added to the design of the FLEX components and hard connection points to address future requirements as re-evaluation warrants. This margin will be determined during the detailed design or evaluation process.
- Phase 2 FLEX components stored at the site will be protected against the "screened in" hazards in accordance with NEI 12-06. At least N sets of FLEX equipment will be available after the event they were designed to mitigate. Backup Phase 2 FLEX equipment will be provided by the Regional Response Center (RRC).
- Deployment strategies and deployment routes are assessed for hazards impact.
- Phase 3 FLEX equipment will be provided by the RRC.
- Additional staff resources are expected to begin arriving at 6 hours and the site will be fully staffed 24 hours after the event.
- Maximum environmental room temperatures for accessibility or equipment availability is based on NUMARC 87-00 (Reference 1) guidance if other design basis information or

General Integrated Plan Elements (Boiling Water Reactors)

industry guidance is not available.

- 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 external event (BDBEE) by providing adequate capability to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities at all units on a site. Though specific strategies 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 (EOP) 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 (TSs) 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, as such, may warrant invocation of 10 CFR 50.54(x) and/or 10 CFR 73.55(p). (Reference 2)

Exceptions for the site security plan or other (license/site specific) requirements of a nature requiring U.S. Nuclear Regulatory Commission (NRC) approval will be communicated in a future 6 month update following identification.

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

1. Structure, content and details of the Regional Response Center playbook will be determined.

<u>References</u>:

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.*

Entergy has no known deviations to the guidelines in Japan Lessons Learned Project Directorate (JLD) Interim Staff Guidance (ISG) JLD-ISG-2012-01 and NEI 12-06 for the FLEX implementation at GGNS. If deviations are identified, then the deviations will be communicated in a future 6 month update following identification.

General Integrated Plan Elements (Boiling Water Reactors)	
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).* *Technical Basis Support information, see attached NSSS Significant Reference Analysis Deviation Table (Attachment 1B)*

Discussion of time constraints identified in Attachment 1A table.

- 1 hour, Entry into Extended Loss of AC Power (ELAP) (table item 2) - Time critical at a time greater than 1 hour. Time period of one (1) hour is selected conservatively to ensure that ELAP entry conditions can be verified by main control room staff and it is validated that emergency diesel generators (EDG) are not available. One hour is a reasonable assumption for system operators to perform initial evaluation of the EDGs. Entry into ELAP provides guidance to operators to perform ELAP actions.
- 2 hours, 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 effect a deep load shed (Reference 9). From the time that ELAP conditions are declared, it is reasonable to expect that operators can complete the DC bus load shed in approximately 10 minutes.
- 2 hours, When the suppression pool heats up to 150°F (Approximately 2 hours per Modular Accident Analysis Program (MAAP) analysis [Reference 5]), swap RCIC suction from suppression pool to upper containment pool (UCP) to preserve RCIC availability (table item 6) - As the suppression pool temperature increases due to safety/relief valve (SRV) cycling and RCIC operation, the net positive suction head (NPSH) available for RCIC starts to diminish. This action becomes time critical at the point where NPSH begins to affect the operation of RCIC. This time is estimated (by MAAP) to be greater than 2 hours. Indications of RCIC flow and discharge pressure are provided in the main control room (MCR) for operators to observe as they operate RCIC during the ELAP (Reference 6, Table 7.5-1).
- 4 hours, Reactor pressure control to keep from entering Unsafe Region of Heat Capacity Temperature Limit (HCTL) Curve (table item 7) - Using manual control of SRVs, depressurize the reactor pressure vessel (RPV) in accordance with (IAW) EOPs (to approximately 200 – 400 pounds per square inch gage (psig)) to keep in the Safe Region of the HCTL curve (Reference 2). Time critical at the point of entering the Unsafe Region of the HCTL Curve (Approximately 4 hours per MAAP analysis (Reference 5)). SRV control is maintained from the control room with sufficient DC power and pneumatic pressure to operate the SRVs throughout Phase 1. Per MAAP analysis, SRVs will go through

General Integrated Plan Elements (Boiling Water Reactors)

approximately 100 actuations in the first 10 hours. Per Reference 8, Section 5.6.1.3, there is sufficient pneumatic pressure for 200 open/close cycles. If necessary, backup nitrogen bottles can be connected in accordance with Reference 15 to provide additional capacity.

- 4 hours, Prior to when the suppression pool heats up to 200°F (approximately 4 hours per MAAP analysis [Reference 5]), initiate use of the modified containment vent to control containment parameters within the limits that allow continued use of RCIC (table item 8) - Time critical when containment begins to pressurize. Containment vent path should be opened prior to the suppression pool reaching 200°F (approximately 4 hours) to control containment pressurization and to limit the suppression pool temperature. Based on MAAP analysis (Reference 5) the suppression pool is expected to reach 212°F in approximately 6.5 hours. The constraint can be met because the containment cooling system 20 inch vent path will be modified to be able to be opened during ELAP conditions and qualified to be seismically rugged.

- 11 hours, Power up both divisions of station Class 1E battery chargers using a FLEX 480 Volts AC (VAC) diesel generator (DG) to supply power to both divisions of Class 1E emergency 480 VAC Load Centers (LC) 15BA6 and 16BB6 (table item 11) - Time critical after 11 hours. With non-credited DC load shedding, battery durations are calculated to last at least 11.9 hours for Division I and 12 hours for Division II (Reference 9). Per the FLEX Engineering Report, (Reference 8), the FLEX DG will be maintained in on-site FLEX storage locations/structures, will be transferred via haul routes evaluated for impact from external hazards, and will be available for use beginning at approximately 8-10 hour time frame. Modifications to Class 1E LCs 15BA6 and 16BB6 and to the Category I Control Building will be implemented to facilitate the connections and operational actions required to supply LCs 15BA6 and 16BB6 from the FLEX DG (Reference 8). Programs and training will be implemented to support operation of the FLEX DG. Two hours is a reasonable assumption to transfer and place the FLEX portable DG into service.

- 20 hours, Power up the Alternate Decay Heat Removal (ADHR) pumps and either Division 1 or Division 2 Suppression Pool Makeup (SPMU) Dump Valves using a FLEX 400 kilowatt (KW) 480 VAC DG (table item 14) - Time critical at the point of initiating the feed-and-bleed mode of core cooling with FLEX pumps through the SRVs. For the FLEX strategy the ADHR pumps are supplied power, following facility modification, from installed and portable cables that run from the FLEX DG connection point on the Category I Auxiliary Building south wall directly to the ADHR motors or to the end of the motor feeder cables at the LC 14BE1 end of the cable. The normal power supply, LC 14BE1, is not safety related (Reference 8) and cannot be credited without further qualification. Powering the SPMU dump valves is accomplished, following facility modification, by supplying power from the 480 volts (V) FLEX DG to the safety related motor control centers (MCCs) that normally supply the valves. Class 1E MCC 15B21 provides power to Division 1 SPMU dump valves (E30F001A/F002A). Class 1E MCC 16B41 supplies power to Division 2 SPMU dump valves (E30F001B/F002B) (Reference 13). When FLEX DG power is restored to the components they can be operated from normal control stations in the MCR (References 11 and 13). Two hours is a reasonable assumption to transfer and place the FLEX DG into service.

General Integrated Plan Elements (Boiling Water Reactors)

- 24 hours, Transition from Phase 1 RCIC to Phase 2 Feed and Bleed method for Core cooling by placing diesel driven FLEX pumps in service to feed the reactor pressure vessel (RPV) (table item 15) – The diesel driven FLEX pumps will be deployed beginning at approximately 6-8 hours (Reference 8). The Phase 1 core cooling method that uses the combined suppression pool and upper containment pool credited volume is estimated to last 24-30 hours (Reference 5). Per the FLEX Engineering Report (Reference 8), the diesel driven FLEX pumps will be maintained in on-site FLEX storage locations/structures, will be transferred via haul routes evaluated for impact from external hazards and will be available for use for core cooling or for Spent Fuel Pool (SFP) makeup at approximately 8-10 hours. Modifications to the High Pressure Core Spray Service Water System (HPCS SW) and Residual Heat Removal (RHR) System will be implemented to facilitate the connections and operational actions required to provide makeup to the reactor vessel as necessary (Reference 8). Programs and training will be implemented to support operation of diesel driven FLEX pumps. Two hours is a reasonable assumption to transfer and place FLEX portable pumps into service.
- 24 hours, Open the room door and remove the equipment hatch for the ADHR pump room to provide sufficient cooling to the room. (table item 16) - Time critical at the point of starting the ADHR pumps. The results of the room heatup evaluation (Reference 14) indicate that if the door to the room and the equipment access hatch are opened, the temperature will be approximately 119°F.
- 72 hours, Transition from Phase 2 to Phase 3 for Core Cooling function by placing diesel driven RRC FLEX Pumps in service to cool plant down to cold shutdown. Requires deployment and operation of a Portable 4160 VAC RRC FLEX DG (to provide power to RHR B in shutdown cooling mode) and RRC heat removal equipment (table item 17) – Time critical at 72 hours. NPSH available to the Phase 2 FLEX pumps becomes insufficient when UHS temperature reaches approximately 140°F. 140°F could be reached (at the earliest) at approximately 56 hours after initiation of Phase 2 feed and bleed core cooling. Therefore the transition from Phase 2 to Phase 3 for core cooling becomes time critical at the point of having insufficient NPSH available for the Phase 2 FLEX pumps. If Phase 2 feed and bleed commences at 24 hours then the estimated time for reaching the NPSH limit is 80 hours. Therefore 72 hours is selected as the time required for this action. The RRC FLEX pumps will be specified to be able to operate with a suction temperature of at least 140°F.

<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 0 [Reference 4]) to supplement the guidance in NEI 12-06 by providing additional BWR-specific information regarding the individual plant response to the ELAP and loss of Ultimate Heat Sink (LUHS) 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 BWR's long term containment analysis for the ELAP analysis. As part of this document, a generic BWR 6/Mark III containment nuclear steam supply system (NSSS) evaluation was performed. The BWR 6/Mark III containment analysis is applicable to the

General Integrated Plan Elements (Boiling Water Reactors)

GGNS (a BWR 6 Mark III plant) coping strategy because it supplements the guidance in NEI 12-06 by providing BWR 6-specific information regarding plant response for core cooling and containment integrity. The guidance provided was utilized as appropriate to develop coping strategies and for prediction of the plant's response.

2. GGNS containment integrity for Phases 1 through 3 was evaluated by use of computer code MAAP 4.06 (References 5 and 10).
3. MAAP uses the American National Standards Institute (ANSI)/American Nuclear Society (ANS) decay heat correlation from ANSI/ANS-5.1-1979 for use in NSSS modeling.
4. Environmental conditions within the station areas were evaluated utilizing methods and tools in NUMARC 87-00 (Reference 7) or GOTHIC 7.2b (EPRI software, Reference 19).
5. Per the guidance in 10 CFR 50.63 and Regulatory Guide 1.155 GGNS is a 4 hr coping plant for Station Blackout (SBO) considerations. Applicable portions of supporting analysis have been used in ELAP evaluations (Reference 5, GGNS UFSAR Section 8A.1).

<u>References</u>:

1. ENERCON Calculation ENTGGG111-CALC-005, Control Room Heatup for Extended Loss of AC Power, Revision 0
2. 05-S-01-EP-2, RPV Control, Revision 43
3. 05-S-01-EP-3, Containment Control, Revision 28
4. NEDC-33771P, Project Task Report BWROG GEH Evaluation of FLEX Implementation Guidelines, Revision 0
5. ENERCON Calculation ENTGGG111-CALC-006, Containment Analysis of FLEX Strategies (MAAP Calculation), Revision 0
6. GGNS Nuclear Plant Updated Final Safety Analysis Report, Revised 11/12
7. NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Revision 1
8. ENERCON Report ENTGGG111-PR-002, Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 0
9. ENERCON Calculation ENTGGG111-CALC-004, Station Division I Battery 1A3 and Division II Battery 1B3 Discharge Capacity during Extended Loss of AC Power, Revision 0
10. MAAP 4 Modular Accident Analysis Program for LWR Power Plants, Computer Code Manual, June 2005, prepared under MAAP Users Group's MAAP Maintenance Contract QA3068-10 Amendment 12 for EPRI
11. 04-1-01-E12-1, System Operating Instruction, Residual Heat Removal System, Revision 142
12. E1015, One Line Meter and Relay Diagram 480 Volt Bus 14BE1 and 14BE2, Revision 15
13. 04-1-01-E30-1, system Operating Instruction, Suppression Pool Makeup System, Revision 25
14. MC-Q1T51-93022, Revision 000, Determine the Temp in the HPCS LPCS & RHR C

General Integrated Plan Elements (Boiling Water Reactors)	
Pump Room with no Cooling With & Without Ventilation Available 15. 05-1-02-I-4, Loss of AC Power, Revision 44 16. Drawing A-0113, Control Bldg - Switchgear Rms., Fl. Plan at El. 111'-0", Revision 16 17. ENERCON Calculation ENTGGG111-CALC-005, Revision 000, Control Room Heatup for ELAP 18. NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Revision 1 19. GOTHIC Containment Analysis Package User Manual, Version 7.2b(QA), March 2009	
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.*
The GGNS deployment strategy will be included within an administrative program. • GGNS procedures and programs are being developed in accordance with NEI 12-06 to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to GGNS. • Figure 5 identifies the proposed deployment paths onsite for the transportation of FLEX equipment to the deployment areas. • The identified paths and deployment areas will be accessible during all modes of operation. The administrative program will have elements that ensure pathways will be kept clear or will require actions to clear the pathways. • The chosen pathways will be evaluated for applicable hazards including the liquefaction for the non-power block areas utilized for the deployment path or storage locations for phase 2.	

General Integrated Plan Elements (Boiling Water Reactors)

Provide a milestone schedule. This schedule should include:
• **Modifications timeline**
  o **Phase 1 Modifications**
  o **Phase 2 Modifications**
  o **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

See attached milestone schedule in 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.*

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

- The equipment for ELAP will have unique identification numbers. Installed structures, systems and components pursuant to 10 CFR50.63(a) will continue to meet the augmented quality guidelines of Regulatory Guide 1.155, Station Blackout.
- GGNS will utilize the standard EPRI industry Preventative Maintenance (PM) process for establishing the maintenance and testing actions for 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.
- GGNS will follow the current programmatic control structure for existing processes such as design and procedure configuration.

General Integrated Plan Elements (Boiling Water Reactors)	
Describe training plan	*List training plans for affected organizations or describe the plan for training development*
New training of general station staff and Emergency Preparedness (EP) will be performed in 2016, prior to GGNS design implementation. 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.* ▪ *Site-specific RRC plan* ▪ *Identification of the primary and secondary RRC sites* ▪ *Identification of any alternate equipment sites (i.e. another nearby site with compatible equipment that can be deployed)* ▪ *Describe how delivery to the site is acceptable* ▪ *Describe how all requirements in NEI 12-06 are identified*
GGNS will utilize the industry RRC for phase 3 equipment. GGNS has contractual agreements in place with the Strategic Alliance for FLEX Emergency Response (SAFER). The two (2) RRCs will be established to support utilities in response to beyond design-basis external events (BDBEE). 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. Communications will be established between the affected nuclear site and the SAFER team and required equipment mobilized as needed. Equipment will initially be moved from an RRC to a local staging area, established by the SAFER team and the utility. The equipment will be prepared at the staging area prior to transportation to the site. 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.	
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. <u>Power Operation, Startup, and Hot Shutdown</u> At the initiation of the BDBEE, main steam isolation valves (MSIVs) automatically close, feedwater is lost, and SRVs automatically open to control pressure, causing reactor water level to decrease. When reactor water level reaches its low level set point (level 2), reactor core isolation cooling (RCIC) (Reference 3), with suction from the non-seismic Condensate Storage Tank (CST), automatically starts and operates to inject makeup/cooling water to the reactor vessel. This injection recovers the reactor level to the normal band. The CST is the normal standby lineup for the RCIC system (Reference 3). If prior to or during the initiating events the CST inventory becomes unavailable, the RCIC suction is automatically transferred to the suppression pool (Reference 3). The SRVs, cycling in low-low set mode, control reactor pressure between approximately 930-1100 psig (Reference 5, Table 5.2-2). The RCIC system valves and controls are powered by station Division I 125 Volts DC (VDC) power (Reference 3). The SRV low-low set logic is powered by station Division I and II 125VDC power (Reference 6). RCIC provides all makeup flow to the reactor vessel. After determination that EDGs cannot be started, the Shift Manager determines the event is a beyond-design-basis event at approximately 1 hour. For the analyzed scenario, the CST is assumed unavailable and RCIC is initially maintained feeding the reactor vessel with suction from the suppression pool. RCIC trip signals and isolation signals that could prevent operation during the ELAP will be overridden. The suppression pool continues to heat up due to RCIC injection and SRV cycling. At approximately time T=2 hours, (as determined by MAAP analysis [Reference 11]), prior to reaching conditions where RCIC net positive suction head (NPSH) requirements are no longer satisfied, when the suppression pool temperature reaches approximately 150°F the RCIC suction is swapped to the upper containment pool (UCP) which is a cooler suction source. Preliminary analysis shows that RCIC NPSH is not a concern until above approximately 185°F (Reference 12) but the transfer needs to occur with sufficient margin to ensure RCIC functionality is maintained. During the time that suppression pool temperature is increasing, operators will reduce reactor pressure to a pressure range which provides margin to the Unsafe Region of the HCTL curve (Reference 1). When the temperature reaches the Unsafe Region of the HCTL an emergency depressurization is required which would render the RCIC system non-functional and terminate the only source providing makeup for core cooling for Phase 1 coping. Therefore, per BWROG guidance, EOPs will be revised to halt depressurization at 200 to 400 psig to allow continued RCIC operation when needed for core

[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
cooling (Reference 1). Automatic and manual depressurization requires intermittent operation of SRVs to maintain reactor pressure above the level to maintain RCIC operation. SRVs require DC control power and pneumatic pressure (supplied by station batteries and the instrument air system) to open. At event initiation the normal non-safety related pneumatic makeup supply is lost, however, the SRV accumulators automatically supply backup pneumatic pressure for SRV operation (Reference 6). The SRVs that are relied upon for pressure control are provided air from the safety-related SRV accumulators and air receiver tanks, which contain enough pneumatic pressure for 200 open/close cycles (Reference 15). Per MAAP analysis, SRVs will go through approximately 100 actuations in the first 10 hours and a total of 126 actuations in 72 hours. As outlined in existing Off-Normal Event Procedure for loss of AC power, (Reference 14), prior to depletion of the air in the SRV accumulators and receivers, operators will valve in backup nitrogen bottles so that operation of SRVs can continue during the BDBEE. The maximum level allowed in the suppression pool while the reactor vessel is pressurized is governed by curves in the EOPs (Reference 7). Calculation XC-Q1111-99001, EP/SAP Calculations (Reference 8), developed the curves used in the EOPs for HCTL, SRV Tailpipe Level Limit (SRVTPLL), and Pressure Suppression Pressure Limit (PSP) each of which provide limits or requirements that govern or prescribe actions such as emergency depressurization based on or related to level in the suppression pool. Only the HCTL requirements are expected to be exceeded to support the FLEX coping strategy (Reference 11). The primary option for core cooling is to supply high quality water via RCIC with suction first from the suppression pool, as discussed above, and then with a FLEX modified suction from the UCP. By using the cool water source (UCP) for the RCIC system from the reactor cavity drain line, approximately 380,000 gallons is available for injection to the reactor vessel based on parameters in Reference 13. Preliminary analysis shows that when lined up two hours after the event initiation, the UCP will provide an injection source for RCIC operation for approximately 30 hours (Reference 11). The station Division I and II Class 1E 125 VDC batteries 1A3 and 1B3 provide DC power to the critical instruments, emergency lighting, RCIC system, and other required DC loads during Phase 1 (Reference 10). To extend battery availability and the Phase 1 coping period, non-essential DC loads will be shed or transferred as early as possible from the Division I and Division II batteries. The actions of deep load shedding and load transfer will ensure that sufficient battery capacity will be available to support critical Phase 1 coping functions including critical instrumentation and the automatic operation of RCIC for at least 11.9 hours following event occurrence (Reference 10). <u>Cold Shutdown and Refueling</u> The strategy for core cooling for Cold Shutdown is similar as that for Power Operation, Startup, and Hot Shutdown with the added benefit that decay heat levels in the core are significantly lower. If an ELAP occurs during Cold Shutdown, then water in the vessel will heatup. When the water temperature reaches 212°F, the vessel will begin to pressurize. The RCIC system is generally available for emergency use at the beginning and end of an outage, thus during the pressure rise RCIC can be returned to service with suction from the suppression pool or the UCP (if available) to provide injection flow. When pressure rises to the SRV setpoints then pressure will be

Maintain Core Cooling

controlled by SRVs. See the strategies for Power Operation, Startup, and Hot Shutdown above for core cooling.

The transition from Cold Shutdown to Refuel mode at the beginning of each refueling outage requires draining the drywell cavity and removing the drywell head to gain access to the RPV head. Once one or more RPV head bolts are de-tensioned the strategy discussed for Cold Shutdown is assumed to not be available since the RPV pressure boundary is compromised. For an ELAP in this configuration, RPV injection using a diesel driven FLEX pump is required. Based on calculation MC-Q1B21-90020 (Reference 9) and applying an adjustment for EPU conditions, the time to the top of active fuel (TAF) based on the boiling of reactor water is approximately 3.6 hours assuming an initial water level in the normal range.

During Refuel mode (RPV head removed), many variables exist which impact the ability to cool the core with water level in the reactor cavity having the largest impact. The most limiting condition is the case in which the reactor head is removed and water level in the vessel is at or below the reactor vessel flange. If an ELAP/LUHS occurs during this condition then, as with the Cold Shutdown scenario described above, boiling in the core occurs quite rapidly. If the event is conservatively assumed to occur at 1 day after shutdown, boiling will occur in less than 1 hour with fuel uncovering in less than 4 hours as discussed above for the Cold Shutdown scenario.

Pre-staging of FLEX equipment can be credited per the guideline of NEI 12-06 as long as the pre-staged equipment is protected from the natural hazards. However, the equipment staging area is typically not protected from natural hazards, so deployment and implementation of portable diesel driven FLEX pumps to supply injection flow during Refuel and Cold Shutdown must commence immediately from the time of the event. This should be plausible because more personnel are on site during outages to provide the necessary resources. Guidance will be provided to ensure that sufficient area is available for deployment and that haul paths remain accessible without interference from outage equipment. The haul path restrictions should be maintained until the reactor cavity is flooded thereby ensuring additional time is available to implement the FLEX strategy.

References:

1. ENERCON Report ENTGGG111-PR-002, Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 0
2. NEDC-33771P, Project Task Report BWROG GEH Evaluation of FLEX Implementation Guidelines, Revision 0
3. SDC-E51, Reactor Core Isolation Cooling, Revision 3
4. 0000-0147-5233-R0, BWROG Project Task Report, RCIC Pinch Points, Operation in Prolonged Station Blackout, Feasibility Study, Revision 0
5. GGNS Nuclear Plant Updated Final Safety Analysis Report, Revised 11/12
6. SDC-B21, Nuclear Boiler System (B21), Revision 3
7. 05-S-01-PSTG, Plant Specific Technical Guidelines, Revision 5
8. XC-Q1111-99001, EP/SAP Calculations, Revision 9
9. MC-Q1B21-90020, Revision 000, Limiting Reactor Vessel Boiloff & Drainage
10. ENERCON Calculation ENTGGG111-CALC-004, Station Division I Battery 1A3 and Division II Battery 1B3 Discharge Capacity during Extended Loss of AC Power, Rev 0

Maintain Core Cooling	
11. ENERCON Calculation ENTGGG111-CALC-006, Containment Analysis of FLEX Strategies (MAAP Calculation), Revision 0 12. ENERCON Calculation ENTGGG111-CALC-001, Revision 000, Grand Gulf Nuclear Station (GGNS) Reactor Core Isolation Cooling (RCIC) Net Positive Suction Head (NPSH) Available Calculation for a Beyond Design Basis External Event (BDBEE) 13. ENERCON Calculation ENTGGG111-CALC-003, Grand Gulf Nuclear Station Water Requirements and Availability for a Beyond Design Basis External Event, Revision 0 14. 05-1-02-I-4, Loss of AC Power, Revision 44 15. GGNS-NE-10-00034, Revision 001, GGNS EPU Station Blackout	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
GGNS 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*
• Modify RCIC suction piping to allow connection to the upper containment pool as a suction source for injection to the RPV during beyond-design-basis external events (BDBEE). This modification will include the addition of a new safety-related manual isolation valve to the 12" UCP drain line outside of containment and the requirement for two currently closed manual valves inside of containment (1G41F201 and 1G41F215) to be locked open. Because 1G41201 is the inboard isolation valve for containment penetration 54 per UFSAR Section 6.2 Table 6.2-44 this modification must also ensure compliance with General Design Criteria 56 for containment penetrations.	
Key Reactor Parameters	*List instrumentation credited for this coping evaluation.*

Reactor Vessel Essential Instrumentation	**Safety Function**
RPV Level – wide range (B21-UR-R623A, B) Shutdown & Fuel range (B21-UR-R615A, B)	Reactor vessel inventory and core heat removal
RPV Pressure (B21-UR-R623A,B)	Reactor vessel pressure boundary and pressure control
Containment Essential Instrumentation	**Safety Function**
Drywell Pressure (M71-PDR-R601A(B))	Containment integrity
Containment Pressure (M71-PDR-R601A(B)	Containment integrity
Containment Air Temperature (M71-TR-R602A(b)/R603A(B))	Containment integrity
Supp. Pool Temperature (M71-TR-R605A (B, C, D)	Containment integrity
Suppression Pool Water Level (E30-LR-R600A (B))	Containment integrity

Maintain Core Cooling	
Spent Fuel Pool Essential Instrumentation	**Safety Function**
SFP Level (Component # TBD)	SFP inventory

Notes: The duration of the station batteries was calculated to last at least 11.9 hours for Division I and 12 hours for Division II (Reference 1).

References:

1. ENERCON Report ENTGGG111-PR-002, Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 0

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

As discussed in Maintain Core Cooling BWR Installed Equipment Phase 1 above, sufficient inventory is available to feed the RPV using RCIC from the UCP beyond 24 hours (i.e., with operators controlling the RCIC flow controller). Once RCIC operation is no longer possible, core cooling will transition to core and containment cooling in an alternate shutdown cooling mode using a 'feed-and-bleed' process with RPV feed supplied by portable diesel driven FLEX pumps at approximately 2000 gallons per minute (gpm) via modified HPCS SW and RHR C LPCI injection lines. The FLEX pumps will take suction from the seismic Category I UHS (Standby Service Water (SSW) cooling tower basins). In this cooling process, RPV level is raised to above the MSL and flows out from the RPV to the suppression pool via the SRVs. Although not required in support of Phase 2 core cooling, hot suppression pool water is pumped from containment to the UHS using the ADHR pumps at 2000 gpm to complete the "bleed" element of the process (see Figures 1 and 3 for a Flow Diagram of FLEX Strategies (Phases 1 & 2) and a Site Layout).

The feed flow rate of 2000 gpm is well beyond the flow rate required to ensure core cooling and to prevent boiling in the reactor. This flow rate is within the capability of the ADHR pumps to pump suppression pool water to the UHS (Reference 5) and was shown by the MAAP analysis (Reference 6) to remove decay and sensible heat sufficient to reduce suppression pool temperature. Since injection from the diesel driven FLEX pump is accomplished using the UHS inventory for vessel makeup, boiling and the associated accumulation of impurities in the RPV is avoided by establishing alternate shutdown cooling (RPV to suppression pool via open SRVs). The bleed rate closely matches the feed rate such that suppression pool level is controlled by plant operators.

The flowpath to establish Phase 2 core cooling is as follows (reference Figure 1):

- Portable diesel driven FLEX pumps, suction hoses, and discharge hoses are deployed to the UHS (SSW) basins to take a suction from the UHS basin and discharge to the HPCS SW piping inside the SSW pump house via one of two seismically qualified, missile protected connection points on the side of the SSW pump house
- Flow is established through the HPCS SW supply line into the HPCS diesel generator (DG) room of the Category I Diesel Generator Building
- From the HPCS SW line in the HPCS DG room of the DG Building upstream of valve P41F185A to RHR C piping upstream of valve E12F042C via new piping and penetrations in the DG Building and the Auxiliary Building
- Into the reactor through the RHR C injection line
- Through the SRVs into the suppression pool
- From the suppression pool through the ADHR pump suction piping
- From the ADHR pump discharge piping to a location on the HPCS SW return line downstream of valve P41F186A via new piping, through the HPCS SW return line
- Finally from the HPCS SW return line to both UHS basins via new piping that is capable of

Maintain Core Cooling
BWR Portable Equipment Phase 2:

manual alignment to bypass the HPCS SW cooling tower.

The transition to Phase 2 using the diesel driven FLEX pump to feed the RPV requires the RPV to be depressurized to allow sufficient diesel driven FLEX pump injection flow through the SRVs. If necessary, emergency N2 bottles may be connected to the SRV accumulators prior to exhaustion in accordance with procedure 05-1-02-I-4 (Reference 1). The MAAP analysis (Reference 6) demonstrated that depressurization from the 200-400psig range used for RCIC operation adds significant heat to the suppression pool. To compensate for this additional heat added to the suppression pool, prior to entering the "bleed" element of the Phase 2 containment integrity strategy, one division of SPMU will be repowered and manually initiated just prior to the RPV depressurization to establish alternate shutdown cooling. Since RCIC operation taking suction from the UCP does not impact the portion of the normal SPMU volume in the separator pool (Reference 3), this volume (~12,000 cubic feet [Reference 9]) is available to transfer to the suppression pool using the SPMU system regardless of how long RCIC has operated. SPMU initiation prior to 24 hours will not be implemented to maximize the use of the higher quality UCP inventory for RCIC operation. The MAAP analysis (Reference 6) demonstrated that this addition to the suppression pool reduces the pool temperature approximately 9°F and raises suppression pool level approximately 2 ft. This temperature reduction has the added benefit of providing additional NPSH for the Phase 2 start of the ADHR pumps. See Containment Integrity, BWR Portable Equipment Phase 2 section for discussion of ADHR NPSH requirements during the feed and bleed operations.

The MAAP analysis (Reference 6) demonstrates that cooling the core and suppression pool using the feed and bleed process results in decreasing suppression pool temperatures and containment vent flow being reduced to zero.

Prior to the need for utilization of the portable diesel driven FLEX pumps, station personnel must commence deployment and connection activities. The onsite diesel driven FLEX pumps stored in the FLEX Storage locations are transported to the deployment area at the UHS (see Figure 5 for Site Layout). Given that sufficient volume is available in the UCP to support RCIC operation for approximately 30 hours (Reference 6), core cooling will be transferred from (Phase 1) RCIC operation at approximately 24 hours to the (Phase 2) diesel driven FLEX pump configuration to deliver water from the UHS cooling tower basin to the RPV. This strategy provides sufficient margin for configuring the plant for the feed and bleed operation. Initiating the feed and bleed operation later into the BDBEE also maximizes the use of the higher quality UCP inventory and provides the maximum overlap with the Phase 3 strategy. See Figure 1, Flow Diagram.

<u>Battery Chargers</u>

The 125 VDC Division I and Division II batteries are available for up to approximately 12 hours (Reference 7) based upon recommended load shedding and will be available long term when a 480 VAC, FLEX DG is connected to repower the installed Class 1E battery chargers associated with the batteries. One portable FLEX 200 KW DG will be deployed and connected for Phase 2 operation with sufficient capacity to power a battery charger on Division I and Division II, and also power the Safeguards Switchgear and Battery Room Exhaust Fan to remove hydrogen gas produced while the batteries recharge. Class 1E LCs 15BA6 and 16BB6 that supply power to the battery chargers and Class 1E MCCs 15B61 and 16B61 are located in the Division I and Division II switchgear rooms on

Maintain Core Cooling
BWR Portable Equipment Phase 2:
Elevation 111' of the seismic Category I Control Building, respectively. The LCs have spare breakers that will be connected to new seismically support cables routed to the LCs from a connection point located outside the Control Building. The 200 KW DG will connect to the new cables at the outside location. See Figure 4 for Electrical Strategy Diagram. <u>ADHR pumps</u> ADHR pumps must also be repowered for Phase 2 operations. Both the "A" and "B" train ADHR pumps are normally powered from non-safety related LC 14BE1, which will lose its source of power following initiation of the event. However, LC 14BE1 is not safety related or seismically qualified so it is not credited. Access to the pump motor cables within the LC cabinet is credited. Therefore, the ADHR pumps will be repowered via a portable 400 KW 480 V AC FLEX DG deployed as shown on site layout drawing (Figure 5) and connected to protected cables terminated at the outside location on the south side of the Auxiliary Building using RRC standard cable connections. Outside 480VAC electrical connection receptacles, Auxiliary Building penetration, and cables to support the FLEX strategy contained in seismically supported raceways will be installed from the Auxiliary Building penetration location to a location near LC 14BE1. Terminal boxes, disconnects, motor starters, and receptacles will be installed at the LC 14BE1 location. Short lengths of connecting cable to connect to ADHR pump motor cables at 14BE1 will be stored in the FLEX storage location / structure. LC 14BE1 is located on Elevation 119' of the Auxiliary Building, one floor above the ADHR pumps located in the RHR C Pump Room. The existing ADHR pumps and motors are seismically qualified (Reference 8). <u>SPMU Dump Valves (E30F001A/B, E30F002A/B)</u> Suppression Pool Makeup valves E30F001A and E30F002A are powered from MCC 15B21. Valves E30F001B and E30F002B are powered from MCC 16B41. The core/containment cooling strategy assumes opening one train of these normally closed valves after approximately 24 hours to provide a makeup path to the suppression pool from the upper containment pool. MCCs 15B21 and 16B41 will lose their power source following the initiation of the event. The portable 400 KW 480V AC FLEX DG (described in the ADHR section above) can be used to power one of the following MCCs: 15B21 (primary strategy) or 16B41 (alternate strategy) to operate one train of makeup valves. A separate cable to support the FLEX strategy will be run to these MCCs. MCC 15B21 is located in Electrical Penetration Room 1A410 on Elevation 166' of the Auxiliary Building. MCC 16B41 is located in Electrical Penetration Room 1A320 on Elevation 119' of the Auxiliary Building. As the primary strategy, new power cables will be routed from an outside connection point (where the 400 KW FLEX DG will connect) to a spare breaker located on MCC 15B21. The cable will be routed in seismically supported raceways. The MCC will be repowered via the spare breaker connected to the FLEX DG after the MCC's normal supply is isolated and not credited loads are removed. The breaker will be administratively taken out-of-service during normal plant operation and will only be used to operate the valves during the implementation or testing of a FLEX strategy requiring its use. <u>Alternate Strategy for Phase 2 Core Cooling</u> The alternate strategy for Phase 2 core cooling employs the same general method used in the primary strategy except that a different diverse point of connection is used to connect the diesel

Maintain Core Cooling
BWR Portable Equipment Phase 2:

driven FLEX pumps to the HPCS SW piping. While the primary connection point is located on the east side of the SSW "A" pump house, the alternate connection point is located on the north side of the SSW "A" pump house.

An alternative strategy is also provided to be used in the event the normal electrical distribution system (LC 15BA6, 16BB6) is not available. A termination box with disconnects and welding type receptacle will be installed in the switchgear rooms to allow the cable installed to support the FLEX strategies from the 200 KW FLEX DG to be connected directly to Division I Class 1E Battery Charger 1DA5 and Division II Class 1E Battery Charger 1DB5 and the Unit 1 Safeguards Switchgear and Battery Room Exhaust Fan, without reliance on their respective LCs. All connections to be used are to be standardized for use with RRC equipment.

If the ADHR LC (14BE1) or other distribution components are not available then longer plug in cables will be stored and deployed to connect at the new FLEX terminal box to be routed along the floor, down a nearby stairwell, and across the floor to the RHR C Pump Room. This cable will be terminated directly at the ADHR pump motor.

In the event SPMU valves MCC 15B21 is not available or the outside permanent FLEX DG connection station is not accessible due to debris or damage, MCC 16B41 will be repowered via a portable 400 KW 480 V AC FLEX DG deployed at the alternate location as shown on plant layout drawing (Figure 5). Stored cables will be deployed and routed from the FLEX DG through the Auxiliary Building/Diesel Generator Building breezeway, Auxiliary Building entrance door 1A318, and across the elevation 139' floor to electrical penetration room 1A320. The cable will be connected to a spare breaker on MCC 16B41 to power the required loads (Reference 4).

For Cold Shutdown and Refueling_strategies see the discussion in the Phase 1 section above.

Sufficient diesel fuel for the Phase 2 FLEX equipment shall be stored with the FLEX equipment to minimize refueling evolutions. Additional diesel fuel is available in the underground EDG fuel storage tanks and the EDG day tanks. The Division I & II EDG fuel oil storage tanks contain a minimum of 68,744 gallons of fuel oil; the HPCS DG fuel oil storage tank contains a minimum of 44,616 gallons of fuel oil; and the EDG and HPCS DG day tanks contain a minimum of 220 gallons of fuel oil (Reference 10). The underground EDG fuel oil storage tanks contain sufficient fuel oil to support all Phase 2 strategies. The day tanks are located in the EDG Building and can be easily accessed. If the normal procedure for transferring fuel from the underground storage tanks is not possible due to flooding, the fuel oil can be obtained from the underground storage tanks by removing the screens covering the tank vents and using a manual, air, or battery operated pump to pump the fuel into a transfer tank. (See Reference 4).

<u>References</u>:

1. 05-1-02-I-4, Loss of AC Power, Revision 44
2. GGNS Nuclear Plant Updated Final Safety Analysis Report, Revised 11/12
3. SDC-E30, Suppression Pool Makeup System, Revision 1
4. ENERCON Report ENTGGG111-PR-002, Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049,

Maintain Core Cooling	
BWR Portable Equipment Phase 2:	
Mitigation Strategies for Beyond-Design-Basis External Events, Revision 0 5. 04-1-01-E12-1, System Operating Instruction, Residual Heat Removal System, Revision 142 6. ENERCON Calculation ENTGGG111-CALC-006, Containment Analysis of FLEX Strategies (MAAP Calculation), Revision 0 7. ENERCON Calculation ENTGGG111-CALC-004, Station Division I Battery 1A3 and Division II Battery 1B3 Discharge Capacity during Extended Loss of AC Power, Revision 0 8. QP0372-000218, Seismic Qualification Review for ADHRS Pump & Motor Fuel Pool Pump & Motor, Revision 002 9. MC-Q1E30-90112, Revision 001, Calculation in Support of UFSAR Table 6.2-50 Support Pool Geometry-GGNS-Valve 10. Grand Gulf Nuclear Station Technical Specifications & Bases, thru Amendment 191, dated 7-20-2012	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
GGNS 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*
• Modify HPCS SW to install connection points on the HPCS SW piping and new building penetrations at the Category I SSW pump house for the diesel driven FLEX pump discharge hose connections. (Primary and alternate strategies) • Modify HPCS SW to install new cross-tie piping to run from the HPCS SW piping in the HPCS DG room of the DG Building through new penetrations in the DG Building and the Auxiliary Building and then to the RHR C injection piping in the RHR C pump room. (Primary and alternate strategies) • Modify RHR C injection piping to make the connection from the HPCS SW cross-tie piping. • Modify ADHR system discharge piping to add a cross tie to the HPCS SW return line. • Modifications necessary to provide adequate NPSH to the ADHR pumps during Phase 2 cooling. This modification includes replacement of the ADHR pumps. • Modify HPCS SW return line to add a manually aligned cooling tower bypass line that discharges into both UHS basins (this modification is necessary because the HPCS SW natural draft cooling towers are rated for 500 gpm each (Reference 2) while over 2000 gpm of flow is required and to minimize aerosolizing the reactor water being pumped into the basin). • Modify/refurbish spare breaker on Class 1E LC 15BA6/16BB6 as necessary to make	

Maintain Core Cooling
BWR Portable Equipment Phase 2:

connections from 480 V FLEX DG.

- Provide cable and raceway that will be permanently installed and seismically supported from the 480V FLEX DG connection outside the Control Building to LCs 15BA6 and 16BB6 to power the Division I and II battery chargers and battery room exhaust fan.
- Install power cables routed from an outside connection point (where the 480 V 400 KW FLEX DG will connect) to a location near LC 14BE1 (ADHR power supply). The cables will be routed in seismically supported raceways and terminate in a terminal box with suitable motor starters and plug in receptacles. A short plug in cable will connect to the existing pump motor leads at LC 14BE1.
- Modify MCC 15B21 (power supply to Division I SPMU valves) by installing a connection point and new permanent cable and conduit such that it will be ready to receive backup power from the 480 V FLEX DG during a BDBEE. Refurbish spare breaker as necessary.
- Modify power supply to battery chargers to install welding type receptacles, termination box, disconnects, and cable for quick connection directly to the battery chargers 1DA5/1DB5 and battery exhaust fans.

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

Same as instruments listed in above section, Core Cooling Phase 1

Phase 2 FLEX equipment will include the installed, commercial 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 will be protected or scheduled to be protected*

Locations / structures to provide protection of the FLEX equipment will be fabricated / constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to fabricate / construct the locations / structures is still to be determined.

GGNS procedures and programs are being developed to address storage location / structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to GGNS.

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 be protected*

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 be protected*	
See response for the Seismic hazard above.		
Snow, Ice, and Extreme Cold	*List how equipment will be protected or scheduled to be protected*	
See response for the Seismic hazard above.		
High Temperatures	*List how equipment will be protected or scheduled to be protected*	
See response for the Seismic hazard above.		
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*
Storage locations / structures have not yet been decided. Figure 5 identifies clear deployment paths onsite for the transportation of FLEX equipment. For this function a clear deployment path has been shown from the identified roads to the diesel driven FLEX pump and FLEX DG deployment areas next to the SSW basin and the Control Building.	• Modify HPCS SW to install connection points and new building penetrations at the SSW pump house for the diesel driven FLEX pump discharge hose connections. • Install connection point for 200 KW 480V FLEX DG connection outside the Control Building for power to 15BA6 and 16BB6 for battery chargers • Install connection point for 400 KW 480V FLEX DG connection outside the Auxiliary Building for power to MCC 15B21	• Connection points for the diesel driven FLEX pump discharge will be outside the SSW pump house and designed to withstand the applicable hazards. • Electrical connection points for the FLEX 480 VAC DGs will be established at the Control Building west wall and Auxiliary Building and designed to withstand the applicable hazards.

Notes:

References:

1. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide", Rev. 0, August 2012
2. SDC-P41, Standby Service Water System (P41), Revision 3

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

For Phase 3, the reactor core cooling strategy is to place RHR B into the Alternate Shutdown Cooling mode. This will be accomplished by powering up RHR pump B from the 16AB Class 1E 4160 V bus utilizing a portable 4160 V FLEX DG (from the RRC) and supplying the B RHR Heat Exchanger and necessary support equipment with water utilizing large portable diesel driven FLEX pumps (from the RRC) at the SSW basins via the safety-related Division II SSW supply piping.

Since the SSW Cooling Towers are assumed to be unavailable, a method for removing heat from the SSW cooling tower basins must be provided within approximately 56 hours of initiation of the Phase 2 feed and bleed strategy (Reference 6). NPSH available to the Phase 2 FLEX pumps becomes insufficient when UHS temperature reaches approximately 140°F. 140°F could be reached (at the earliest) at approximately 56 hours after initiation of Phase 2 feed and bleed core cooling. Heat removal equipment from the RRC will be utilized to place in line with the flow returning from the RHR heat exchanger before being returned to the basin (see Figure 2). The Phase 3 heat removal equipment from the RRC will be sized to perform the following key functions:

1) Remove the decay heat of the reactor core at 72 hours after the BDBEE
2) Remove the decay heat of the SFP and UCP (if fuel is in the UCP)
3) Remove the decay and sensible heat transferred to the suppression pool and UHS in response to the BDBEE. The suppression pool and UHS temperature profiles are calculated in Calculation ENTGGG111-CALC-006 (Reference 3)
4) Provide cooling water to miscellaneous SSW loads which include the RHR room cooler, RHR pump seal cooler, fuel pool cooling room cooler, main control room heating, ventilating and air conditioning (HVAC) system, and the Engineer Safety Features (ESF) Electrical Switchgear room coolers.

The heat removal capability of the Phase 3 heat removal equipment from the RRC will be nearly equivalent to the heat removal capability of the SSW B cooling tower cells. Based on SDC-P41 (Reference 2) and Engineering Report GGNS-NE-10-00051 (Reference 7), the total heat removal requirement of both SSW B cooling tower cells is 231 million British thermal units (MBTU)/ hour (hr). Therefore, the Phase 3 heat removal equipment from the RRC will be required to remove approximately 231 MBTU/hr. Heat removal equipment with a higher capability would allow the UHS basin to cool down more quickly which would quicken the transition from the Phase 2 feed and bleed strategy to the Phase 3 strategy. Heat removal capability of less than approximately 231 MBTU/hr would extend Phase 2 for a longer period of time.

Per calculation M-1.1.053-Q and Supplement 1 to the calculation (References 4 and 5), there is 33.41 ft of NPSH available for the RHR B Pump taking suction through a clean strainer in the Suppression Pool with the Suppression Pool water temperature at 125°F. For the Phase 3 core cooling strategy, it is assumed that the Suppression Pool water temperature could be as high as

Maintain Core Cooling
BWR Portable Equipment Phase 3:

212°F. By subtracting the difference between the vapor pressures at 212°F and at 125°F, the NPSH available at a water temperature of 212°F is 2.59 ft. at the runout flow of the pumps. The NPSH required is 2 ft. Therefore, the RHR pumps will have sufficient NPSH available if the Suppression Pool water temperature is at 212°F and suppression pool level is maintained above approximately 12'8" (equivalent to elevation 105'8" [Reference 10]).

In addition, a different case that was evaluated in calculation MC-Q1E12-11002 (Reference 9) determined the RHR pump NPSH at EPU accident conditions. Per Section 9.6 of this calculation, the minimum NPSH available at any RHR pump is 7.96 ft when operating at maximum flow, with a clean strainer, Suppression Pool water level at an elevation of 107.5 ft, and the Suppression Pool water temperature at 212°F. The NPSH required for the pumps is 2 ft; therefore, the RHR pumps will have sufficient NPSH available to operate under the Phase 3 conditions for a BDBEE.

The 4160 V FLEX DG will be capable of carrying approximately 3500 KW load which is sufficient to carry all of the required FLEX loads on the Class 1E 4160 V bus 16AB which includes an RHR pump and its support equipment (i.e., motor-operated valves (MOVs), jockey pump, room coolers, etc.). The expected load on the FLEX DG will be less than 1350 KW, providing for a margin of 61% (Reference 1). Even though the installed SSW equipment (pumps, SSW pump room ventilation, cooling tower fans), could be repowered if available, this equipment has not been credited in Phase 3. See Figure 4 for Electrical Strategy Diagram.

FLEX equipment used during Phase 2 for the Division I Class 1E 480 VAC buses and 120 VAC ESF Uninterruptible Power Supply (UPS) buses remain in service during Phase 3. Onsite portable 480VAC FLEX DGs are connected to the Division I Class 1E 480 V LCs and MCCs to power the Class 1E 125VDC battery chargers, the 120 VAC Instrument Buses, Switchgear and Battery Room Exhaust fan, ADHR pumps, and motor-operated valves (MOVs) to supply long term power to the required equipment. Onsite portable 120VAC DGs are connected to the hydrogen igniters. The Phase 3 long term primary strategy is to use offsite portable 4160 V FLEX DG to power large Division II equipment. A portable 3500 KW 4160 VAC DG supplied by the offsite RRC will be deployed near the Control Building (see site layout drawing Figure 5) and connected to protected cable terminations at the outside wall of the Control Building using RRC standard cable connections. It will power the Division II Class 1E 4160 V switchgear 16AB and the Division II RHR pump. Outside 4160 V electrical connection receptacles, Control Building penetration, and cables with seismically supported raceways and cables will be installed from the Control Building penetration location to a spare 4160 V breaker on Class 1E switchgear 16AB. The switchgear will be repowered via the spare breaker connected to the 4160 V FLEX DG. With the Division II electrical distribution system powered up, the 480V FLEX DG utilized in Phase 2 would likely be removed from Division II, but remains connected to Division I to power the Division I Class 1E battery charger.

<u>Alternate Strategy</u>

Alternate means of core cooling can be provided by maintaining the Phase 2 equipment in service as described in the Phase 2 Core Cooling section and using phase 3 equipment to cool and makeup to the UHS so that the phase 2 core cooling strategy can continue to cool the reactor.

The alternate means of providing power to the Division II B RHR pump in the event that the Class

Maintain Core Cooling	
BWR Portable Equipment Phase 3:	
1E switchgear 16AB is not available for shutdown cooling (SDC) operation is to de-terminate the RHR pump power cable at its switchgear breaker and attach it directly to a new 4160 V cable from the 4160 V RRC FLEX DG. This cable from the RRC 4160 V FLEX DG will be laid across the ground to enter the Control Building stairwell through an outside door, down the stairwell to Elevation 111', and through an interior door to the Division II switchgear. If the primary RRC 4160 V FLEX DG outside location (outside Control Building) is not accessible due to debris or damage, the second alternate strategy deploys the RRC 4160 V FLEX DG near the Auxiliary Building as shown on plant layout drawing (Figure 5). A 4160 V cable from the 4160 V FLEX DG will be laid across the ground to enter the Auxiliary Building through an outdoor Auxiliary Building entrance door, down a stairwell to Auxiliary Building Elevation 119', across the floor and down the stairwell to the B RHR pump on Elevation 93'. The existing pump motor power cable will be de-terminated and the cable from the 4160V FLEX DG will be connected to the motor. <u>References</u>: 1. ENERCON Report ENTGGG111-PR-002, Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 0 2. SDC-P41, Revision 003, System Design Criteria for Standby Service Water System P41 3. ENERCON Calculation ENTGGG111-CALC-006, Revision 000, Grand Gulf Containment Analysis of FLEX Strategies 4. M1.1.053, Revision 000, ECCS Pumps NPSH Calculation 5. M1.1.053-1 Supplement 1, Revision 000, ECCS Pumps NPSH Calculation 6. ENERCON Calculation ENTGGG111-CALC-010, Revision 000, Grand Gulf Nuclear Station (GGNS) FLEX Pump Net Positive Suction Head (NPSH) Available Calculation for a Beyond Design Basis External Event (BDBEE) 7. SDC-E12, Revision 003, System Design Criteria for Reactor Heat Removal System E12 8. Engineering Report GGNS-NE-10-00051, Revision 001, GGNS EPU Standby Service Water System 9. MC-Q1E12-11002, Revision 000 EC31524, RHR Pump NPSH Calculations at EPU Accident Conditions 10. M6.10.16-N, Revision 1, Suppression Pool Volume	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
GGNS 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	
BWR Portable Equipment Phase 3:	
Identify modifications	*List modifications*
• Modify SSW B pump discharge piping at the UHS basin so that large diesel driven RRC pumps can be connected to the SSW B system and provide cooling water to the RHR B heat exchanger for Alternate Shutdown Cooling operations. (Primary Strategy) • Modify SSW B return piping to add a line to return hot suppression pool water to RRC supplied heat removal equipment including the capability of manual alignment to bypass the UHS cooling towers. • Modification for connection of 4160 VAC RRC FLEX DG to the Class 1E 16AB 4160 VAC bus is made by modifying a spare or available 4160 V breaker cubicle to be able to accept the cable connections from the RRC DG such that in Phase 3 a breaker can be inserted into the spare or available breaker slot to connect the DG to the bus. (Primary Strategy) • Provide cable and raceway that will be permanently installed, seismically supported, and ready to connect the Phase 3 4160 V RRC FLEX DG to Class 1E 4160 V switchgear 16AB. • Modify/refurbish spare breaker to MCC 16B31 to provide sufficient capacity to power train B RHR support loads (RHR jockey pump, room cooler fans, RHR MOVs) from the Phase 2/3 480V FLEX DG.	
Key Reactor Parameters	*List instrumentation credited or recovered for this coping evaluation.*
Same as Phase 1 not including instrumentation to support portable equipment. Phase 3 FLEX equipment will include the installed, commercial 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 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*
Phase 3 equipment will be provided by the Regional Response Center (RRC) which is to be located in Memphis, TN. Equipment transported to the site will be either immediately deployed at the point of use location (diesel driven pumps and generators)	• Install penetration and connection point for diesel driven FLEX RRC pump to connect to SSW B pump discharge piping at the UHS basin • Install connection points (including isolation valve and hose manifold) on the	• The diesel driven FLEX/RRC pump makeup connections and the return line connection points at the SSW Basin, and connection points at Control Building electrical penetrations will be designed to withstand the applicable hazards or

Maintain Core Cooling		
BWR Portable Equipment Phase 3:		
or temporarily staged at a lay down area established for that purpose, until moved to the point of use area. Deployment paths identified on Figure 5 will be used to move equipment as necessary.	SSW B return line that allows for hose connections to Phase 3 heat removal equipment • Install penetration and connections for RRC FLEX 4160 VAC DG cable terminations at the outside wall of the Control Building	have diverse connections.
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 containment integrity. 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, suppression pool and the modified containment vent. Since, in accordance with NEI 12-06 (Reference 2), no non-mechanical valve failures need be assumed, the containment is isolated following the event. As the suppression pool heats up the containment will begin to heat up and pressurize. The strategy is to open the current EOP containment vent path (Reference 5) prior to the suppression pool reaching 200°F (approximately 4 hours) to control containment pressurization and to limit the suppression pool temperature. Without a heat removal mechanism for containment, the suppression pool is expected to reach 212°F in approximately 6.5 hours (Reference 4). Because preventing core damage is initially a higher priority consideration than containment integrity, venting will be initiated once adequate core cooling is established using the RCIC system with the RCIC pump suction aligned to the UCP. In this case, the modified containment cooling system 20" vent path is used to vent containment in a controlled manner. To determine the containment response, MAAP analysis assessed the use of a 16" vent to account for line losses in the 20" vent pathway (Reference 4). The results of the MAAP analysis demonstrate that, if a 16" containment vent is opened, containment remains only slightly above atmospheric pressure and that the suppression pool temperature is maintained below 220°F. Note that the current GGNS analyzed limit of the suppression pool structure is 215°F (Reference 3). Thus, the containment function is maintained throughout Phase 1 following event initiation. As indicated by MAAP analysis (Reference 4), the containment requires venting approximately 4 hours after event initiation (prior to or at approximately 200°F suppression pool temp). Monitoring of containment pressure and temperature will be available via normal plant instrumentation as listed in the instrumentation section below. The venting will eventually be terminated once the Phase 2 strategy is implemented. An alternative strategy for containment during Phase 1 is not provided, because containment integrity is maintained by the plant's design features. <u>References</u>: 1. GGNS Nuclear Plant Updated Final Safety Analysis Report, Revised 11/12 2. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide", Rev. 0, August 2012 3. Calculation CC-Q1M10-10001 (EC31524), Revision 000, Evaluation of Containment Wall

[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.

Maintain Containment	
for Extended Power Uprate 4. ENERCON Calculation ENTGGG111-CALC-006, Containment Analysis of FLEX Strategies (MAAP Calculation), Revision 0 5. EOP 05-S-01-EP-1, Revision 028, Emergency/Severe Accident Procedure Support Documents, Attachment 13	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
Existing GGNS EOP, 05-S-01-EP-3, Primary Containment Control (Reference 1) directs operators in protection and control of containment integrity. GGNS 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*
Perform necessary modifications to allow opening the containment cooling system containment vent path (Reference 2) during a BDBEE, i.e., seismic qualification, power and motive force for valves.	
Key Containment Parameters	*List instrumentation credited for this coping evaluation.*

Containment Essential Instrumentation	Safety Function
Drywell Pressure (M71-PDR-R601A(B)) (Ref. 1)	Containment integrity
Containment Pressure (M71-PDR-R601A(B)	Containment integrity
Containment Air Temperature (M71-TR-R602A(B)/R603A(B)) (Ref. 1)	Containment integrity
Supp. Pool Temperature (M71-TR-R605A (B, C, D) (Ref. 1)	Containment integrity
Suppression Pool Water Level (E30-LR-R600A (B)) (Ref. 1)	Containment integrity

Notes:

References:

1. 05-S-01-EP-3, Containment Control, Revision 28
2. EOP 05-S-01-EP-1, Revision 28, Emergency/Severe Accident Procedure Support Documents, Attachment 13

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 containment integrity. Identify methods (containment vent or alternative / Hydrogen Igniters) and strategy(ies) utilized to achieve this coping time.

The strategy for Phase 2 transitions from use of containment venting (Phase 1) to one that cools the suppression pool (using the RHR system (E12) ADHR pumps and the same cooling components and system lineups as that used for Phase 2 core cooling) so that containment venting is no longer required. The start of this Phase 2 strategy is at approximately 24 hours (see the core cooling section for a discussion on implementation timing). Given the limited equipment available following the ELAP and LUHS, one of the most effective heat transfer mechanisms to reduce suppression pool temperature is through the addition of cool water and removal of high temperature water from the suppression pool. The objective of the Phase 2 strategy is to use FLEX equipment and the ADHR equipment of the RHR system in a feed and bleed method of core and containment (suppression pool) cooling to transfer decay and sensible heat from the containment to the UHS.

Water addition to the suppression pool will be accomplished by the following two external sources: 1) The transition from core cooling with RCIC injection from the UCP with the reactor pressurized to core cooling with diesel driven FLEX pump injection from the UHS with the reactor depressurized will result in a net increase in suppression pool inventory because the injected water from the UHS will reach the suppression pool through the SRVs before boiling occurs; and 2) Opening one division of the SPMU system dump valves will dump approximately 1/3 of the normal SPMU volume (which is the volume of the separator storage pool below the level of the UCP weir wall) to the suppression pool. Dumping this volume of the upper pool will quickly raise the level of the suppression pool by approximately 2 feet (Reference 2). The EOP SRV Tail Pipe Level Limit is not a concern for GGNS pool levels up to the top of the drywell weir wall provided RPV pressure is below 925 psig (Reference 3). Reactor pressure will be well below this value as operators maintain reactor pressure at 200 – 400 psig. MAAP analysis (Reference 2) indicates that the suppression pool will not rise above the level limits for approximately 24 hours of RCIC operation with suction source from the UCP including the remaining UCP volume dumped to the suppression pool via the SPMU system.

Removal of high temperature water from the suppression pool will be accomplished using both of the ADHR pumps to pump the suppression pool water to the UHS at approximately 2000 gpm. Analysis shows that the NPSH available to the ADHR pumps is insufficient to pump the high temperature water from the suppression pool at the necessary flow of approximately 1000 gpm per pump , however, system modifications will be completed as necessary to ensure that the ADHR pumps function in this mode. When the UCP is dumped to the suppression pool, the addition of that cooler inventory will reduce suppression pool temperature to provide additional NPSH prior to use of the ADHR pumps. MAAP analysis (Reference 2) shows a step decrease of approximately 9°F in suppression pool temperature after SPMU dump. Initiating the SPMU dump just prior to depressurization to initiate the feed and bleed provides two benefits. The cool water addition reduces the suppression pool temperature transient during the depressurization and also provides additional NPSH for the ADHR pumps.

The UHS contains approximately 13.3 million gallons of usable inventory (Reference 1) that is

Maintain Containment
BWR Portable Equipment Phase 2:
capable of storing a large amount of energy. With the feed and bleed strategy initiated at 24 hours after the BDBEE, the UHS temperature will average less than a 1°F/hour increase for the duration of Phase 2 (Reference 4). MAAP analysis conservatively confirms that 2000 gpm of feed and bleed flow at approximately 24 hours is adequate to lower the temperature of the suppression pool which will allow venting to be terminated (Reference 2). Hydrogen Igniter Operation Hydrogen igniters are normally AC powered by Division I and Division II AC power. One division of igniters will be repowered using a portable diesel generator based on access availability to the Auxiliary Building and on debris issues. Procedure 05-S-01-STRATEGY, Alternative Strategies (Reference 5), contains procedures to repower the igniters using a portable hydrogen igniter generator. This generator will be stored in the FLEX storage locations / structures. The current procedure requires that the generator be deployed and the igniters powered early following an event in which they are needed. As allowed by the FLEX guidelines (Reference 6, Section 3.2.2), however, consideration of other higher priority activities is allowed. Once resources arrive for Phase 2, this activity will be carried out more easily because available Phase 1 resources would be directed to perform and prepare for core cooling and containment heat removal tasks. References: 1. SDC-P41, Standby Service Water System (P41), Revision 3 2. ENERCON Calculation ENTGGG111-CALC-006, Containment Analysis of FLEX Strategies (MAAP Calculation), Revision 0 3. XC-Q1111-99001, Revision 009, EP/SAP Calculations 4. ENERCON Calculation ENTGGG111-CALC-003, Revision 000, GGNS Water Needs and Availability for a Beyond Design Basis External Event 5. 05-S-01-STRATEGY, Alternative Strategies, Revision 012 6. NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, August 2012

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*
The strategy for Phase 2 containment control employs the system lineups, components, flow paths, and modifications described in the Phase 2 Core Cooling section. See Phase 2 core cooling modification section.	

Maintain Containment	
BWR Portable Equipment Phase 2:	
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.*
See instrumentation listed in Phase 1 section	
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment will be protected or scheduled to be protected*
See Phase 2, Maintain Core Cooling section.	
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 be protected*
Not applicable per NEI 12-06 as outlined within the first section of this Integrated Plan.	
Severe Storms with High Winds	*List how equipment will be protected or scheduled to be protected*
See Phase 2, Maintain Core Cooling section.	
Snow, Ice, and Extreme Cold	*List how equipment will be protected or scheduled to be protected*
See Phase 2, Maintain Core Cooling section.	
High Temperatures	*List how equipment will be protected or scheduled to be protected*
See Phase 2, Maintain Core Cooling section.	

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*
The strategy for containment control employs the system lineups, components, flow paths, and modifications of the Phase 2 Core Cooling section. See Phase 2 core cooling modification section of See Phase 2, Maintain Core Cooling section.	The strategy for containment control employs the system lineups, components, flow paths, and modifications of the Phase 2 Core Cooling section. See Phase 2, Maintain Core Cooling section.	The strategy for containment control employs the system lineups, components, flow paths, and modifications of the Phase 2 Core Cooling section. See Phase 2, Maintain Core Cooling section.

Maintain Containment
BWR Portable Equipment Phase 2:
Notes:

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 containment integrity. Identify methods (containment vent or alternative / Hydrogen Igniters) and strategy(ies) utilized to achieve this coping time.
The strategy for Phase 3 containment control employs the system lineups, components, flow paths, and modifications of the Phase 3 Core Cooling section. Specifically, the reactor core cooling strategy is to place one loop of RHR into the Alternate Shutdown Cooling mode. This will be accomplished by powering up RHR B pump from the Division II Class 1E 16AB 4160V bus utilizing a portable 4160 VAC FLEX DG (from the RRC) and supplying the RHR B Heat Exchanger and necessary support equipment with water utilizing large portable diesel driven FLEX pumps (from the RRC) at the SSW basins via the Division II SSW supply piping. The SSW basin return piping will be modified to allow manual bypass of the cooling towers to complete the flow path and to minimize aerosolizing the cooled water returned from the RRC supplied heat removal equipment. Thus, RRC equipment will be utilized to cool the UHS inventory. The 4160V FLEX DG provided by the RRC will be capable of carrying approximately 3500 KW load which is sufficient to carry all of the required FLEX loads on Class 1E 4160 V bus 15AA or 16AB which includes an RHR pump and its support equipment (i.e., MOVs, jockey pump, room coolers, etc.). The expected electrical load on the 4160V FLEX DG from the above mentioned components will be less than 1350 KW, for a Margin to Rated Capacity of 61% (Reference 2) <u>Containment Strategy for Cold Shutdown and Refueling</u> During Modes 4 (Cold Shutdown) and 5 (Refueling) Technical Specifications allow primary and secondary containment to be breached to provide opportunity for maintenance and testing. Often times, during outages containment equipment hatches, penetrations, and airlocks are opened with each breach of containment tracked by limiting condition for operation (LCO) or by procedure. These conditions should continue to be monitored and tracked closely during outages so that the breached penetrations can be closed as expeditiously as possible. If an ELAP event should occur these breached penetrations, to the maximum extent possible, should be closed unless needed for core cooling or containment heat removal. When penetrations are closed then the same FLEX strategy would be employed as in Modes 1 (Power Operation), 2 (Startup) and 3 (Hot Shutdown), i.e. use of the modified containment vent would be employed if suppression pool temperature increases or if steam is being released into the containment atmosphere. <u>References</u>: 1. 05-S-01-STRATEGY, Alternative Strategies, Revision 012 2. ENERCON Report ENTGGG111-PR-002, Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 0

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<tr><td colspan="3">Maintain Containment</td></tr>
<tr><td colspan="3">BWR Portable Equipment Phase 3:</td></tr>
<tr><td colspan="3">Details:</td></tr>
<tr><td>Provide a brief description of Procedures / Strategies / Guidelines</td><td colspan="2">Confirm that procedure/guidance exists or will be developed to support implementation</td></tr>
<tr><td colspan="3">See procedures listed in Phase 1 section.</td></tr>
<tr><td>Identify modifications</td><td colspan="2">List modifications</td></tr>
<tr><td colspan="3">See Phase 3 Core Cooling discussion.</td></tr>
<tr><td>Key Containment Parameters</td><td colspan="2">List instrumentation credited or recovered for this coping evaluation.</td></tr>
<tr><td colspan="3">See instrumentation listed in Phase 1 section</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">Deployment Conceptual Design
(Attachment 3 contains Conceptual Sketches)</td></tr>
<tr><td>Strategy</td><td>Modifications</td><td>Protection of connections</td></tr>
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<tr><td>See Phase 3 Core Cooling discussion.</td><td>See Phase 3 Core Cooling discussion.</td><td>See Phase 3 Core Cooling discussion.</td></tr>
<tr><td colspan="3">Notes:</td></tr>
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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 Phase 1 of the FLEX SFP cooling strategy is reliant upon system design and on-site personnel actions. The system design credited for cooling the SFP and UCP is that the fuel in the SFP and UCP is cooled by maintaining ≥ 23' of water over the top of fuel (Reference 1, LCO 3.7.6). With this design and under the worst case conditions for fuel offload, the earliest time that fuel could be uncovered from boil-off is approximately 57 hours in the SFP and approximately 49 hours in the UCP (Reference 2). Control blades in the SFP could be uncovered in approximately 29 hours. The personnel actions include deployment of pre-staged hoses and opening ventilation pathways. The timing for these actions is dependent on SFP conditions and the timing for the BDBEE. If the SFP integrity is compromised then the Phase 2 actions listed in the next section would need to be taken very early in the event. If a full core offload had just taken place it also could require earlier action. If SFP integrity is maintained and the plant is late in the cycle, then these actions can be delayed. Access to the SFP is expected to be limited by temperature and airborne radiation but not direct radiation from uncovered control blades or fuel. References: 1. Grand Gulf Nuclear Station Technical Specifications & Bases, thru Amendment 191, dated 7-20-2012 2. ENERCON Calculation ENTGGG111-CALC-003, GGNS Water Needs and Availability for a Beyond Design Basis External Event, Revision 0	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
Phase 1 strategy is to use plant design to maintain cooling of fuel in the SFP. Water level is maintained at least 23 feet above the top of irradiated fuel assemblies seated in the SFP (Reference 1).	
Identify modifications	*List modifications*
Modification to install SFP level instrumentation per 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	
Key SFP Parameters	*List instrumentation credited or recovered for this coping evaluation.*
Per NRC Order EA-12-051	
Notes: References 1. Grand Gulf Nuclear Station Technical Specifications & Bases, thru Amendment 191, dated 7-20-2012	

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 normal SFP water level at the event initiation is 23 feet (Reference 1) over the top of the stored spent fuel. The Phase 2 strategy for limiting fuel damage to spent fuel involves providing for makeup to ensure that the fuel remains covered with water. If level in the UCP or SFP is not maintained due to the BDBEE, then spray would benefit both cooling of the spent fuel and scrubbing of the air. Analysis was used to determine the time it would take for the water to boil in each of these pools and the time it would take for the pool water levels to reach the top of active fuel.

Using the worst case design basis heat load and worst case full core offload timing, the SFP water temperature will heat up to 212°F at 5.17 hours after cooling is lost (Reference 2). At least 90 gpm of makeup will be required for the makeup strategy and at least 250 gpm of spray will be provided for spray. Using the design basis heat load and a normal refueling outage time of 20 days, the SFP will start boiling at 11.91 hours after cooling is lost with a boil off rate of 39 gpm. For a full core offload into the UCP, the pool will start boiling 3.54 hours after cooling is lost with a boil off rate of 60 gpm (Reference 2). All of these times to boil and boil off rates are calculated using very conservative assumptions. Full Core Offload would typically use the upper containment pool for fuel storage. Timing for the implementation of the SFP cooling strategies is dependent on pool conditions, as discussed above, at the time of the BDBEE. The minimum flow rate to be provided is 500 gpm which is enough for spray to both the UCP and the SFP. The pressure requirements are dependent on the spray nozzles used.

Based on NEI 12-06 guidance three methods of providing makeup flow and a means of venting steam from the refuel floor are provided to meet the baseline capability for SFP cooling.

<u>Method 1 – Makeup via hose</u>

Method 1 strategy for SFP cooling is to makeup to the SFP via a hose with makeup water supplied from the UHS and a portable diesel driven FLEX pump (see Figure 1). This strategy will require connection of hoses from modified HPCS SW piping in the Auxiliary Building to the SFP. As the SFP area may be inaccessible due to high temperatures and radiation levels, these hoses can be pre-staged to minimize the need for personnel to access the SFP area after the BDBEE. Makeup flow and spray flow to the SFP via hose will be accomplished by use of the same components and flowpath (into the Auxiliary Building) as the core cooling and containment integrity strategy (i.e., makeup from the diesel driven FLEX pumps at the UHS via the HPCS SW piping) and new FLEX piping for SFP makeup/spray (see Figure 1). A pre-staged hose will be deployed from this new SFP makeup connection on the refuel floor to discharge into the SFP. If the UCP also contains fuel, it will be verified that the transfer canal remains open so that the two pool volumes are connected. If the transfer canal is closed, manual valves in the fuel pool cooling and cleanup system can be aligned to allow makeup from the SFP into the UCP (References 4 and 5).

This strategy minimizes the time that is required on the SFP floor and minimizes the time needed to initiate makeup to the SFP. Instead of a long run of hose from the UHS to the SFP and/or UCP,

Maintain Spent Fuel Pool Cooling

BWR Portable Equipment Phase 2:

only short lengths of hoses need to be run locally to the SFP. As with any strategy for SFP cooling, flow to the SFP is throttled by plant operators to ensure the SFP is not overfilled. In this strategy, flow is throttled in the HPCS DG room of the DG Building at the new FLEX piping connected to the HPCS SW piping.

Method 2 – Makeup via spray

The method 2 strategy is to use the spray nozzle to spray the fuel in the SFP (see Figure 1). The spray makeup strategy is similar to the hose makeup strategy. However, instead of positioning the deployed hose to discharge directly into the pool, the hose is routed to two monitor nozzles which will be set up to spray the SFP. Procedure 05-1-02-III-1 (Reference 3) contains instructions for setup of the monitor nozzles. Additional monitor nozzles will be set up on the refuel floor and hose will be routed through the 208' El. Personnel airlock or through the equipment hatch for cases in which spent fuel is in the UCP and the BDBEE requires spray to be directed to the UCP fuel racks.

Method 3 – Makeup via permanent piping

In addition to the hose makeup strategy, NEI 12-06 guidance requires makeup to the SFP without accessing the SFP area. Accessing the area may not be practical due to high temperature and airborne radiation in addition to direct radiation from stored fuel or control blades if significant boiloff has occurred. This makeup strategy is accomplished by modifying the SFP supply piping upstream of valve 1G41F007 to connect to the HPCS SW line in the HPCS Diesel Room in the Diesel Generator Building (see Figure 1). If in Mode 5 (Refueling) and the UCP also contains fuel, it will be verified that the transfer canal is open so that the two pools can communicate. If the transfer canal must remain closed, valve 1G41F007 will be isolated locally, and other system valves will be aligned manually to establish a flowpath to makeup to the UCP (requires closing G41-F006, F008 and F034 and opening G41-F005, F028 and F041A/B)..

Venting SFP area

For discussion of venting the SFP area see Spent Fuel Pool Area in the Safety Function Support, Phase 2 section of this report.

References:

1. Grand Gulf Nuclear Station Technical Specifications & Bases, thru Amendment 191, dated 7-20-2012
2. XC-Q1111-03001, Required Flow Rates and Heatup Times for Fuel Storage Pools after a loss of all Power, Revision 1
3. 05-1-02-III-1, Inadequate Decay Heat Removal, Revision 36
4. M1085C, Revision 018, P & I Diagram Residual Heat Removal System Unit 1
5. M1088E, Revision 019, P & I Diagram Fuel Pool Cooling & Cleanup System Unit 1

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*
GGNS 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*
• Modification to install SFP level instrumentation per Order EA-12-051 • Modification to install hard pipe with dual isolation valves from a connection point on the HPCS SW line upstream of valve P41F185A to a new SFP FLEX connection upstream of valves Q1G41F007 or Q1G41F008. • Modification to provide two separate lines from the new SFP line discussed in the bullet above, to two locations in the spent fuel pool area for a SFP FLEX hose connection and a SFP FLEX spray connection.	
Key SFP Parameters	*List instrumentation credited or recovered for this coping evaluation.*
Per NRC Order EA-12-051	
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment will be protected or scheduled to be protected*
Diesel driven FLEX pumps will be stored in storage locations / structures designed and fabricated / constructed to meet the requirements of NEI 12-06.	
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 be protected*
Not applicable per NEI 12-06 as outlined within the first section of this Integrated Plan.	
Severe Storms with High Winds	*List how equipment will be protected or scheduled to be protected*
See response for the Seismic hazard above.	

<table>
<tr><th colspan="3">Maintain Spent Fuel Pool Cooling</th></tr>
<tr><th colspan="3">BWR Portable Equipment Phase 2:</th></tr>
<tr><td>Snow, Ice, and Extreme Cold</td><td colspan="2">List how equipment will be protected or scheduled to be protected</td></tr>
<tr><td colspan="3">See response for the Seismic hazard above.</td></tr>
<tr><td>High Temperatures</td><td colspan="2">List how equipment will be protected or scheduled to be protected</td></tr>
<tr><td colspan="3">See response for the Seismic hazard above.</td></tr>
<tr><th colspan="3">Deployment Conceptual Design
(Attachment 3 contains Conceptual Sketches)</th></tr>
<tr><td>Strategy</td><td>Modifications</td><td>Protection of connections</td></tr>
<tr><td>Identify Strategy including how the equipment will be deployed to the point of use.</td><td>Identify modifications</td><td>Identify how the connection is protected</td></tr>
<tr><td>• The pumps used to provide the SFP cooling and makeup functions are the same diesel driven FLEX pumps described in the Core Cooling section. See Phase 2 Core Cooling for discussion of deployment strategy for diesel driven FLEX pumps.
• The monitor spray nozzle and fire hoses needed to spray and or makeup to the SFP will be deployed from the onsite FLEX storage locations / structures or will be staged at an accessible and protected area of the refueling floor or Auxiliary Building.</td><td>• See Phase 2 Core Cooling for discussion of modifications necessary to deploy the diesel driven FLEX pumps.
• Piping modifications will be installed to provide flow from the HPCS SW piping in the HPCS DG room of the DG Building at grade elevation 133' to the refueling floor.</td><td>See Phase 2 Core Cooling for discussion of protection of connection points for diesel driven FLEX pumps.</td></tr>
<tr><td colspan="3">Notes:</td></tr>
</table>

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.	
Phase 3 of the FLEX cooling strategy is reliant on the transition from SFP and UCP makeup/boiloff to use of the installed SFP equipment repowered by a RRC 4160 VAC FLEX DG to cool the SFP and UCP (Figure 3). Cooling for the SFP heat exchanger will be provided by a diesel driven FLEX pump via the installed safety related SSW piping. 480VAC power to the B SFP cooling pump and its room cooler fan will be provided by the RRC 4160 VAC FLEX DG powering Class 1E 4160 VAC Switchgear 16AB and corresponding Class 1E 480V LCs and MCCs. Connections to the RRC 4160 VAC FLEX DG and the diesel driven FLEX pumps are described in the Phase 3 core cooling section. To satisfy the NPSH requirements of the SFP cooling pumps, and to initiate the strategy of cooling the SFP with the SFP cooling pump and SFP heat exchanger, the SFP/UCP water temperature must be reduced to 190°F or less and the fuel pool drain tank must be filled. Phase 2 cooling will continue until the water temperature is lowered to below 190°F.	
Schedule:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
GGNS 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*
Modification to install SFP level instrumentation per Order EA-12-051	
Key SFP Parameter	*List instrumentation credited or recovered for this coping evaluation.*
Spent Fuel Pool Level Per Order EA-12-051	

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*
The diesel driven pumps and diesel generators used in Phase 3 for SFP cooling are the same as those used in the Phase 3	See Phase 3 core cooling discussion	See Phase 3 core cooling discussion

Maintain Spent Fuel Pool Cooling		
BWR Portable Equipment Phase 3:		
core cooling function. See Phase 3 core cooling for deployment strategy.		
Notes:		

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. Main Control Room Accessibility MCR accessibility will be maintained for the duration of the ELAP. During the ELAP, some main control room vital electronics, instrumentation and emergency lighting remain energized from emergency DC power sources. The current calculation for MCR heatup, MC-Q1Z10-92053 (Reference 1), documents the loss of ventilation analysis for the MCR as a result of a SBO. This calculation shows that the temperature of the main control room is steady at approximately 110°F 4 hours after a SBO. As described in NUMARC 87-00 (Reference 2), 110°F is the assumed maximum temperature for efficient human performance. Therefore, additional analysis was performed to demonstrate that the main control room will be accessible during Phases 1 and 2. Results of the additional analysis (Reference 5) indicate that temperatures in the MCR remain below 110°F for greater than 10 hours. RCIC Accessibility The design area temperature limit in the RCIC room for equipment qualification is 212°F for a 12 hour period (Reference 3). GGNS-ME-12-00009 (Reference 3) calculated the temperature of the RCIC room to be 175°F at 4 hours using conservative NUMARC 87-00 methodology. Because the RCIC pump and turbine need to be functional for longer than 4 hours, additional analysis (Reference 6) was performed to confirm functionality assuming similar conditions to Reference 3. Results of this calculation indicate that the RCIC pump room temperature remains below 150°F during the 72 hour period following a BDBEE with no operator actions needed to provide portable ventilation. For the core cooling strategies at GGNS, after approximately 24 hours, RCIC will not be required due to the Phase 2 diesel driven FLEX pump being put into service. The BWROG commissioned GEH to perform an evaluation of the effects of RCIC system operation at extended pumped fluid temperatures (Reference 7). The purpose of the study is to identify recommendations to allow the RCIC turbine/pump to operate at extended pump fluid temperatures (as high as 300°F) for an extended period of time (up to 168 hours). The draft study, issued for industry review and comment, provides typical recommendations for increasing the availability for the RCIC system for the extended fluid temperatures if necessary for site specific coping strategies. Control Building Safeguard Switchgear and Battery Rooms Accessibility The Control Building ESF switchgear heatup during the BDBEE is bounded by existing calculation MC-QSZ77-09004 (Reference 4) that discusses what doors to open to establish an air flow path for

[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

the Division II switchgear room (OC802, OC221, and OC219) if all ventilation is secured during normal operation. For the BDBEE, doors OC211, OC203, and OC217 will additionally be opened to provide an air flow path for the Division I switchgear room and Division I and II battery rooms (Reference 9). Opening these doors leads to adequate ventilation for keeping these rooms below 120°F indefinitely. This calculation used normal heat loads and determined that the time available for personnel to open these doors is a little more than one hour. Since the ELAP battery and switchgear room heat loads will be less than normal operation heat loads, opening the required doors at 1 hour after the start of the BDBEE will maintain these rooms below 120°F.

SFP Area Accessibility

Accessibility to the SFP area may be necessary during Phase 1 to establish flow paths and set up hoses/monitor nozzles for SFP makeup and cooling or to establish a vent flow path for the SFP area. The SFP area will be accessible during Phase 1 of the strategy. Per Reference 10, SFP boiling could occur under worst case conditions as soon as 5.17 hours, but uncovery of fuel due to boiloff of the SFP inventory, even under worst case conditions for fuel offload, will not occur before 57 hours. The SFP level will be monitored during a BDBEE. The SFP makeup/cooling water hose and spray monitor may be connected and placed in the proper locations during Phase 1 so that spray or makeup could be initiated, if necessary, without entering the SFP area at a later time. The valves that will control flow for makeup and spray will be located in a separate area to ensure they are accessible even after the SFP begins to boil.

Corridors and Other Areas Accessibility

Other areas of the plant may require accessibility for operators or other station personnel during Phase 1 of a BDBEE. Generally, these areas are not expected to require mitigating actions or modifications for accessibility; however the areas will be evaluated to confirm accessibility.

Site industrial safety procedures currently address activities with a potential for heat stress to prevent adverse impacts on personnel.

References:

1. MC-Q1Z10-92053, Control Room and Control Cabinet Area Station Blackout Heatup Analysis, Revision 001
2. NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Revision 1
3. GGNS-ME-12-00009, Station Blackout Evaluation for Grand Gulf Nuclear Station, Revision 0
4. MC-QSZ77-09004, Alternate Ventilation for Safeguard Switchgear and Battery Rooms, Revision 0
5. ENERCON Calculation ENTGGG111-CALC-005, Revision 000, Control Room Heatup for ELAP
6. ENERCON Calculation ENTGGG111-CALC-007, Revision 000, Grand Gulf Nuclear Station RCIC Heatup for Extended Loss of Offsite Power (FLEX)
7. 0000-0155-1545-R0-DRAFTA - BWROG RCIC Pump and Durability Evaluation - Pinch Point Study, Revision 0

Safety Functions Support	
8. SDC-E51, Reactor Core Isolation Cooling, Revision 3 9. Drawing A-0113, Control Bldg - Switchgear Rms., Fl. Plan at El. 111'-0", Revision 16 10. XC-Q1111-03001, Revision 001 EC30935, Required Flow Rates and Heatup Times for Fuel Storage Pools After a Loss of all Power	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
GGNS 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*
No modifications to safety function support systems required for Phase 1	
Key Parameter	*List instrumentation credited for this coping evaluation phase.*
None	
Notes:	

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.

Main Control Room Accessibility

The environment of the MCR during Phase 2 will be maintained using the same strategies as in Phase 1 and by deploying equipment to provide forced ventilation. After 10 hours, Phase 2, 6000 cubic feet per minute (CFM) of unconditioned ventilation is provided to the MCR via the deployment of portable ventilation fans for use at Doors OC504 & OC505. Installation of the fans results in MCR temperatures remaining below approximately 105°F for at least 72 hours. (Reference 3). The two 6000 CFM fans are powered from a portable FLEX 120 VAC 3 KW DG deployed at the entrance to the Control Building. A power cable will be routed from the FLEX DG up the stairwell to the location of the fans.

RCIC Room Accessibility

The primary strategy for maintaining the environment of the RCIC room will use the same strategy as in Phase 1 section above.

Control Building Safeguard Switchgear Rooms Accessibility

For Phase 2, the rooms containing the Class 1E 480 VAC Safeguard LCs will be begin to heat up as the Class 1E 15BA6 and 16BB6 LCs and battery chargers are energized by the FLEX 480VAC DG; therefore, they were evaluated for limiting temperatures for equipment survivability. The calculations performed for Station Blackout, indicate that switchgear rooms rise to 135°F at the end of a four hour coping period. Under ELAP conditions, the Class 1E 4160 V switchgear and Class 1E 480V LCs are de-energized at the onset of the ELAP. The Class 1E 4160 V switchgear remains de-energized until Phase 3. Class 1E 480 V LCs 15BA6 and 16BB6 and associated battery chargers are reenergized by the FLEX 480 VAC DG during Phase 2. Therefore, in Phase 2 following the energization of some of the Class 1E 480 VAC LCs by the FLEX 480 VAC DG, the rooms will begin to heat up and a coping period for the duration of Phase 2 must be considered.

The design basis temperature limit for the Control Building HVAC system is 110°F. GGNS UFSAR Section 9.4.5.5.5 (Reference 1) describes the Safeguard Switchgear and Battery Room HVAC System that supplies the 480 VAC LC areas. This UFSAR section states equipment in these rooms have been evaluated for temporary operation at temperatures up to 120 degrees F. During normal plant operation these areas are cooled using outside air only. For Phase 2, one system exhaust fan in high speed will be powered by the 480 V FLEX DG to exhaust room air, with air entering the room from outside and adjacent areas (supply fans not operating) through open doors (OC315, OC313, OC312, OC311, OC221, OC219, OC211, OC203, and OC217) (References 5 and 6). The Safeguard switchgear were judged to be bounded by existing calculation MC-QSZ77-09004 (Reference 3). As noted in the Phase 1 section on Control Building Safeguard Switchgear and Battery Rooms Accessibility, opening the doors alone leads to adequate ventilation for keeping these rooms below 120°F indefinitely. This calculation used normal heat loads and determined that the time available for personnel to open these doors is a little more than one hour. Since the ELAP battery and switchgear room heat loads will be less than normal operation heat loads, opening the

Safety Functions Support
BWR Portable Equipment Phase 2

required doors at 1 hour after the start of the ELAP and operating one exhaust fan in high speed at the time the 480 V FLEX DG reenergizes the Phase 2 LCs and battery chargers is sufficient to maintain these rooms below 120°F.

Battery Room Accessibility

During battery charging operations in Phase 2 and 3, ventilation is required in the main battery rooms due to hydrogen generation. Calculation E0046 (Reference 1) states that if a loss of ventilation occurs during charging operations, then the time for the room to reach a dangerous concentration of 2% hydrogen is approximately 24 hours under worst case conditions. During Phase 2 battery charging operations, the FLEX DG described in the Phase 2 core cooling section will be used to repower a Safeguard Switchgear and Battery Room exhaust fan to dissipate any accumulating hydrogen gas during charging.

ADHR Area Accessibility

The ADHR pumps are located in the piping penetration room that connects to the RHR C room in the Auxiliary Building. These pumps will be used to pump suppression pool water to the ultimate heat sink (SSW cooling tower basins) as part of the feed-and-bleed process of Phase 2 core cooling. Calculation MC-Q1T51-93022 (Reference 2) was performed to determine the temperature rise in the RHR C room with a loss of ventilation and the RHR C pump running during a LOCA scenario. The results of this calculation indicate that if the door to the room and the equipment access hatch were opened, the temperature would be approximately 119°F. The ADHR pumps and motors are much smaller than the RHR C pump and motor, so the results of this calculation give reasonable assurance that the ADHR pumps could be operated during the ELAP with the room door and equipment access hatch similarly opened. Additional analysis must be performed to confirm this configuration.

Spent Fuel Pool Area Accessibility

On-site personnel actions for venting the SFP area include blocking open door 1A601 to the Auxiliary Building northwest stairwell on the 208' elevation and blocking open the Auxiliary Building southwest stairwell door 1A605 to the roof on the 229' elevation. Additional analysis and/or modification to door 1A605 must be performed to confirm that missiles cannot prevent this door from opening after the BDBEE. Additional analysis must be performed to demonstrate this ventilation strategy and confirm there is no need for portable ventilation.

Other Areas Accessibility

Other areas of the plant will require accessibility for operators or other station personnel during Phase 2 of a BDBEE. Generally, these areas are not expected to require mitigating actions or modifications for accessibility; however the areas will be evaluated to confirm accessibility.

References:

1. E0046, Hydrogen Gas Evolution from Class 1E and Non-Class 1E Batteries, Revision 1
2. MC-Q1T51-93022, , Determine the Temp in the HPCS LPCS & RHR C Pump Room with no Cooling With & Without Ventilation Available, Revision 000
3. MC-QSZ77-09004, Alternate Ventilation for Safeguard Switchgear and Battery Room, Revision 000

Safety Functions Support	
BWR Portable Equipment Phase 2	
4. ENERCON Calculation ENTGGG111-CALC-005, Revision 000, Control Room Heatup for ELAP 5. Drawing A-0113, Control Bldg - Switchgear Rms., Fl. Plan at El. 111'-0", Revision 16 6. Drawing A-0100, Control Bldg. Floor Plans, Revision 25	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
GGNS 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 Core Cooling section for discussion of modifications necessary for connection of Phase 2 FLEX DGs. These FLEX DGs will supply power to the battery room ventilation fans and the portable fans used in the MCR.	
Key Parameter	*List instrumentation credited for this coping evaluation phase.*
Phase 2 FLEX equipment will include the installed commercial 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 will be protected or scheduled to be protected*
See discussion for storage / protection of equipment for the FLEX DG in the Phase 2 section of Core Cooling.	
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 be protected*
Not applicable per NEI 12-06 as outlined within the first section of this Integrated Plan.	
Severe Storms with High Winds	*List how equipment will be protected or scheduled to be protected*
See discussion for storage / protection of equipment for the FLEX DG in the Phase 2 section of Core Cooling.	

Safety Functions Support	
BWR Portable Equipment Phase 2	
Snow, Ice, and Extreme Cold	*List how equipment will be protected or scheduled to be protected*
See discussion for storage / protection of equipment for the FLEX DG in the Phase 2 section of Core Cooling.	
High Temperatures	*List how equipment will be protected or scheduled to be protected*
See discussion for storage / protection of equipment for the FLEX DG in the Phase 2 section of Core Cooling.	

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*
The FLEX DGs used to provide power to the fans used to for ventilating the battery rooms and the MCR are the same FLEX DGs used for Phase 2 core cooling functions. For Deployment Conceptual Design for Safety Function Support see Phase 2 Core Cooling section. The fans that will be deployed for room cooling in the MCR will be stored in the FLEX storage locations / structures and deployed via identified and evaluated haul routes to the power block and their deployment areas.	See Phase 2 Core Cooling section for discussion regarding the FLEX DGs	See Phase 2 Core Cooling section for discussion regarding connections for the FLEX DGs
Notes:		

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. Main Control Room Accessibility During Phase 3 the 4160 V RRC FLEX DG primary strategy will provide sufficient power to power up the safety related main control room HVAC system. Cooling water for the main control room HVAC system will be supplied by a Phase 3 diesel driven FLEX pump via the SSW B system piping. The SSW B return water will be cooled by RRC heat removal equipment as it is returned to the UHS SSW basins. In this mode of operation the main control room HVAC system will maintain main control room accessibility indefinitely. If Class 1E switchgear 16AB is not available in Phase 3, the alternate Phase 3 electrical strategy will be to continue the Phase 2 strategy for Main Control Room ventilation. Safeguard Switchgear and Battery Rooms Accessibility The Phase 3 primary strategy using the 4160 V RRC FLEX DG will power up the safety related switchgear and battery rooms HVAC system. The switchgear and battery room HVAC system will maintain acceptable temperatures in the switchgear and battery rooms indefinitely. In addition, the switchgear and battery rooms HVAC system will maintain hydrogen concentration in the battery rooms below the 2% limit. If Class 1E switchgear 16AB is not available in Phase 3, the alternate Phase 3 electrical strategy will not power up the entire switchgear and battery room HVAC system. In this case, the Phase 2 strategy for Safeguard Switchgear and Battery Rooms ventilation will be continued. RHR Room Accessibility As part of Phase 3 strategies, the B RHR pump is placed into service in order to perform alternate shutdown cooling. This will result in heat addition to the B RHR pump room due to heat generated by the RHR pump motor as well as heat dissipated from the associated piping and RHR heat exchanger. For long term RHR pump operation, the RHR pump room must be cooled to maintain acceptable room temperatures. The Phase 3 4160 V RRC FLEX DG will provide power for all of the necessary support equipment (room coolers) to maintain the RHR pump functional indefinitely. Service water from a Phase 3 RRC diesel driven FLEX pump will provide the cooling water to the room coolers via the Division II SSW supply piping, as described in Phase 3 core cooling section, to operate the RHR pump indefinitely. References: None

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

Safety Functions Support		
BWR Portable Equipment Phase 3		
procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.		
Identify modifications	*List modifications*	
See Phase 3 Core Cooling section for discussion of modifications required to connect the RRC diesel driven FLEX pumps and FLEX DG.		
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.*	
Phase 3 FLEX equipment will include the installed, commercial 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 is protected*
See Phase 3, Core Cooling Section	See Phase 3, Core Cooling section	See Phase 3, Core Cooling section
Notes:		

BWR Portable Equipment Phase 2							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Maintenance*
List portable equipment (1)	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
Qty (4) Diesel Driven FLEX Pumps	X	X	X			Diesel Driven Pump Capable of 1250 gpm at 405 ft with a suction lift of at least 12 ft and capable of pumping water up to at least 145°F	Will follow EPRI template requirements
Two (2) Super Duty Pickup Trucks					X	Super duty pickup truck capable of towing diesel pumps and diesel generators. The diesel pumps have a wet weight of 13,250 lbs. (Ford F-350 or similar)	Will follow EPRI template requirements
Qty (4) Portable Ventilation Fans					X	6000 CFM - Fans are required to ensure the Main Control Room is accessible for the operators	Will follow EPRI template requirements
Two (2) 480 VAC Diesel Generators	X	X		X		200 KW Cables – 480 VAC rated cable of sufficient length to connect the 200 KW DG to outside connection station	Will follow EPRI template requirements
Two (2) 480 VAC Diesel Generators	X	X				400 KW Cables – 480 VAC rated cable of sufficient length to connect the 400 KW DG to outside connection station; connect to MCC 16B31 on Elevation 116' of Auxiliary Building; connect to the ADHR pumps (two sets of cable) on Elevation 93' of the Auxiliary Building.	Will follow EPRI template requirements
Qty (2) 120 VAC Diesel Generators for Hydrogen Igniters		X				15 KW Cables – 120 V rated cable of sufficient length to connect 120 VAC DG to the electrical penetration room in the Auxiliary Building	Will follow EPRI template requirements
Qty (1) 120 VAC Diesel Generator for MCR fans					X	3 KW Cables – 120 V rated cable of sufficient length to connect 120 VAC DG to the fan locations at doors OC504 and OC505	Will follow EPRI template requirements
Two (2) Flatbed Trailers					X	Means to store and transport hoses, strainers, cables, and miscellaneous equipment.	Will follow EPRI template requirements

BWR Portable Equipment Phase 2							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Maintenance*
List portable equipment (1)	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
Two (2) Front Loaders for Debris Removal					X	Existing front loaders or similar debris removal equipment at the plant can be used. They will be stored in the appropriate locations.	Will follow EPRI template requirements
Two (2) Flat Bed Trailers for equipment transport					X	Existing flat beds at the site can be used. They will be stored in appropriate locations	Will follow EPRI template requirements
Two (2) diesel fuel transfer pumps	X	X	X	X		Manual, battery, or air operated. Transfer rate of pump and transfer cart size to be determined based on final diesel usage of FLEX equipment	Will follow EPRI template requirements
Eight (8) Nitrogen bottles and pressure regulator for SRV accumulator charging	X					Equivalent bottles to those stored outside of Unit 1 warehouse referenced in procedure 05-1-02-1-4. 4 bottles stored in each FLEX storage location.	Will follow EPRI template requirements
Two (2)Air compressors for long term air supply needs	X					300 CFM @200 pounds per square inch (psi) (Sullair Model 300HH or equivalent)	Will follow EPRI template requirements

Notes: Although the number of storage locations has not been finalized, for the purposes of this table two storage locations have been specified which results in the number of sets of FLEX equipment to be equal to 2N.

BWR Portable Equipment Phase 3							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Notes*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		
Two (2) Diesel Driven Large FLEX Pumps	X					6,000 gpm per pump minimum at 300 ft	Capacity to supply SSW B/RHR B heat exchanger for cold shutdown
One (1) 4160 VAC Diesel Generator	X	X	X	X		4160 VAC 3500 KW	To power Class 1E 4160 V switchgear, RHR pump, etc.
One (1) 480 VAC Diesel Generator	X	X				480 VAC 100 KW	To power RHR pump room cooling fans, jockey pump, RHR MOVs (alternate strategy if Class 1E 4160 V switchgear is not available)
Heat removal equipment (air or water cooled heat exchangers)	X	X	X			231 MBTU/hr	Largest available portable chiller is 750 ton (9 MBTU/hr) heat removal capability.26 chiller units are required.
Two (2) sets of Cables for connecting portable generators	X			X	X	N/A	Supply as required
Six (6) Portable ventilation fans	X	X	X	X		N/A	Supply as required
Two (2) Diesel Generator fuel transfer pump and hoses	X	X	X	X		N/A	Supply as required. To ensure transfer capability of site fuel to portable equipment
Water supply trucks	X					10,000 gal capacity, quantity as needed	Water needed to makeup to UHS basins. Quantity of trucks dependent on spray requirements for SFP/UCP and evaporative losses.

Phase 3 Response Equipment/Commodities	
Item	**Notes**
Radiation Protection Equipment • Survey instruments • Dosimetry • Off-site monitoring/sampling	
Commodities • Food • Potable water	
Fuel Requirements • Diesel Fuel	
Heavy Equipment • Transportation equipment • Debris clearing equipment	
Portable Lighting	
Portable Toilets	

Attachment 1A
Sequence of Events Timeline

Action item	Elapsed Time	Action	ELAP New Time Constraint Y/N [5]	Remarks / Applicability
	0	Event Starts	N	Plant @100% power
1	60 sec	RCIC starts	N	Reactor operator initiates or verifies initiation of reactor water level restoration with steam driven high pressure injection
2	1 hr	Attempts to start EDGs have been unsuccessful. Enter ELAP Procedure.	Y	Time critical at a time greater than 1 hour. Entry into ELAP provides guidance to operators to perform ELAP actions
3	1 hr	Open Control Building Safeguard Switchgear and Battery Rooms doors (OC802, OC221, OC219, OC211, OC203, and OC217) to provide cooling/ventilation to the Control Building Safeguard Switchgear and Battery rooms.	N	Control Building Safeguard Switchgear and Battery Room doors are opened at approximately 1 hour. Opening doors is necessary to maintain temperature in rooms at less than 120°F. The heatup of the switchgear/inverter room area for SBO conditions is addressed in station SBO analysis in UFSAR Section 8A.6.5 (Reference 1).
4	2 hr	DC Load shed complete	Y	DC buses are readily available for operator access. Battery load shedding for SBO conditions is addressed in the station SBO analysis in UFSAR Section 8A.4 (Reference 1).
5	2 hr	Open doors to main control room (OC504 and OC505) to minimize heatup of the MCR during Phase 1.	N	Analysis indicates that opening these doors will help to maintain MCR temperature below 110°F. MCR heatup and peak temperature is addressed in the station SBO analysis in UFSAR Section 8A.6.1 (Reference 1).
6	2 hr	Operators swap the RCIC suction from the suppression pool to the UCP at a suppression pool temperature of approximately 150°F to preserve RCIC availability.	Y	As the suppression pool temperature increases due to SRV cycling and RCIC operation, the NPSH available for RCIC starts to diminish. This action is time critical prior to the point

[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
				where NPSH begins to adversely affect the operation of RCIC. This time is estimated (by MAAP) to be greater than 2 hours.
7	4 hr	Using manual control of SRVs depressurize the RPV IAW EOPs (to approximately 200 – 400 psig) to maintain operation in the Safe Region of the HCTL curve.	Y	Manual SRV operation to depressurize to approximately 200 – 400 psig must occur prior to the point of entering the Unsafe Region of the HCTL Curve (Approximately 4 hours [by MAAP]). EOPs require operators to keep reactor pressure and temperature from causing entry into Unsafe Region of HCTL curve. Manual operation of SRVs for RPV pressure control is addressed in analysis in UFSAR Section 15.2.9.3.4.1 (Reference 1).
8	4hr	Initiate use of modified EOP containment vent path to control containment parameters.	Y	Time critical when containment begins to pressurize. Containment vent path should be opened prior to the suppression pool reaching 200°F (approximately 4 hours [by MAAP]) to control containment pressurization and to limit the suppression pool temperature. Based on MAAP analysis the suppression pool is expected to reach 212°F in approximately 6.5 hours. The constraint can be met because the containment cooling system 20" vent path will be modified to be able to be opened during ELAP conditions and qualified to be seismically rugged.
9	4 hr	At the SFP set up hoses/monitor nozzles for SFP makeup and cooling and establish the SFP area vent flowpath.	N	The SFP makeup/cooling water hose and spray monitor may be connected and placed in the proper locations during Phase 1 so that spray or makeup can be initiated, if necessary, without entering the SFP area at a later time. The SFP area will be accessible during Phase 1 to allow these actions. SFP boiling could occur under worst case conditions as soon as 5.17 hours, but uncovery of fuel due to boiloff of the SFP inventory, even under worst case conditions for fuel offload, will not occur before 57 hours. The SFP level will be monitored during a BDBEE. The valves that will control flow for

Action item	Elapsed Time	Action	ELAP New Time Constraint Y/N [5]	Remarks / Applicability
				makeup and spray will be located in a separate area to ensure they are accessible even after the SFP begins to boil. Actions for providing makeup to the SFP are addressed in station SBO analysis covered in UFSAR Sections 8A.12 and 9.1.3.3 (Reference 1)
10	10 hr	Deploy FLEX 120 VAC DG outside the Control Building and 2 6000 CFM fans to MCR doors OC504 and OC505 to provide unconditioned forced ventilation to the MCR.	N	During Phase 1 the MCR temperature is estimated to increase to approximately 110°F. At approximately 10 hours, Phase 2 actions are necessary to provide forced ventilation. Forced ventilation with 6000 CFM is initiated to reduce the estimated temperature to approximately 105°F. The FLEX 120 VAC DG provides power to fans. MCR heatup and peak temperature is addressed in station SBO analysis in UFSAR Section 8A.6.1 (Reference 1)
11	11 hr	Initiate transition from Phase 1 installed equipment to Phase 2 FLEX portable equipment by placing the FLEX 480 VAC DG in service to supply power to Class 1E LCs 15BA6 and 16BB6 and power up the station battery chargers.	Y	Time critical after 11 hours with non-credited DC load shedding. Batteries durations are calculated to last at least 11.9 hours
12	11	Deploy the FLEX H2 Igniter DG and Initiate H2 igniters.	N	Igniters require deployment and operation of a portable diesel generator to provide power. This activity should be initiated as soon as practical during Phase 2 when sufficient personnel from the ERO are available for assistance. Hydrogen is not expected to be generated in amounts that would be considered dangerous.
13	11 hr	Place diesel driven FLEX pump in service to begin makeup to SFP as necessary to maintain adequate level in the SFP. (Boiling under design basis conditions begins at approximately 12 hours and requires 39 gpm make-up). Vent the refuel floor to prevent pressurization during pool boiling by opening doors and releasing steam to the outside.	N	Boil-off rate is slow with a large volume of water in the SFP
14	20	Power up either Class 1E MCCs	Y	Time critical at the point of initiating

Action item	Elapsed Time	Action	ELAP New Time Constraint Y/N [5]	Remarks / Applicability
		15B21 or 16B41 using a FLEX 400 KW 480 VAC DG to supply power to the SPMU dump valves and to directly power the ADHR pump motors.		feed-and-bleed mode of core cooling with FLEX pumps through the SRVs.
15	24	Transition from Phase 1 core cooling with RCIC to Phase 2 core cooling with the diesel driven FLEX pumps in the feed-and bleed mode with suction from UHS (SSW basins). Reactor must be depressurized at this time to allow sufficient diesel driven FLEX pump injection flow through SRVs. Following opening of the SPMU dump valve, the ADHR pumps suction is aligned to the suppression pool for discharge to the SSW basins.	Y	Becomes time critical at the point of UCP level being depleted. Sufficient volume is available in the UCP to support RCIC operation for approximately 30 hours; however it is recommended that core cooling be transferred from RCIC operation at approximately 24 hours to the Phase 2 diesel driven FLEX pump feed-and-bleed configuration.
16	24	Open the door and remove the equipment hatch of the ADHR pump room to provide sufficient cooling to the room.	Y	Time critical at the point of starting the ADHR pumps. The results of the room heatup evaluation indicate that if the door to the room and the equipment access hatch are opened, the temperature will be approximately 119°F.
17	72 hr	Transition from Phase 2 to Phase 3 for Core Cooling function by placing diesel driven RRC FLEX Pumps in service to cool plant down to cold shutdown. Requires deployment and operation of Portable 4160 VAC RRC FLEX DG	Y	NPSH available to the Phase 2 FLEX pumps becomes insufficient when UHS temperature reaches approximately 140°F. 140°F is reached at approximately 56 hours after initiation of Phase 2 feed and bleed core cooling. Therefore the transition from Phase 2 to Phase 3 for core cooling becomes time critical at the point of having insufficient NPSH available for the Phase 2 FLEX pumps. If Phase 2 feed and bleed commences at 24 hours then the estimated time for reaching the NPSH limit is 80 hours. Therefore 72 hours is selected as the time required for this action.

References

1. GGNS Nuclear Plant Updated Final Safety Analysis Report, Revised 11/12

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 0, December 2012)	NEDC page	Plant applied value	Gap and discussion
1	Vent Size	12 inch	2	16 inch	NEDC 33771, Revision 1, evaluated the containment response using a 12 inch vent. The GGNS vent size is 20 inch with assumed line losses equivalent to a 16 inch vent. NEDC 33771 will be revised by the BWROG to similarly evaluate the containment response using a 16 inch vent.

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
	Develop Strategies	
	Purchase Equipment	
	Issue FSGs	
Aug. 2013	Submit 6 Month Status Report	
	Develop Strategies/ Contract with RRC	
	Procure Equipment	
	Perform Staffing Analysis	
Feb. 2014	Submit 6 Month Status Report	
May 2014	Develop Mods (Design Start)	
	Create Maintenance Procedures	
Aug. 2014	Submit 6 Month Status Report	
	Procedure Changes Training Material Complete	
Nov. 2014	Develop Mods (Design Complete)	
	Develop Training Plan	
Feb. 2015	Submit 6 Month Status Report	
	Implement Training	
Aug. 2015	Submit 6 Month Status Report	
Feb. 2016	Submit 6 Month Status Report	
Mar. 2016	Implementation Outage*	
Aug. 2016	Submit 6 Month Status Report	
Dec. 2016	Implement Mods	
Dec. 2016	Submit Completion Report	

*(Full compliance after second listed refueling outage)

[It is understood that this table can add more granularity with respect to site-specific milestones and resource planning. This format can be altered as required. Dates which correspond to full compliance of the order need to be identified in this section.]

Attachment 3
Conceptual Sketches

(Conceptual sketches, as necessary to indicate equipment which is installed or equipment hookups necessary for the strategies.)

Figure 1 -Flow Diagram for FLEX Strategies (Phases 1 & 2)

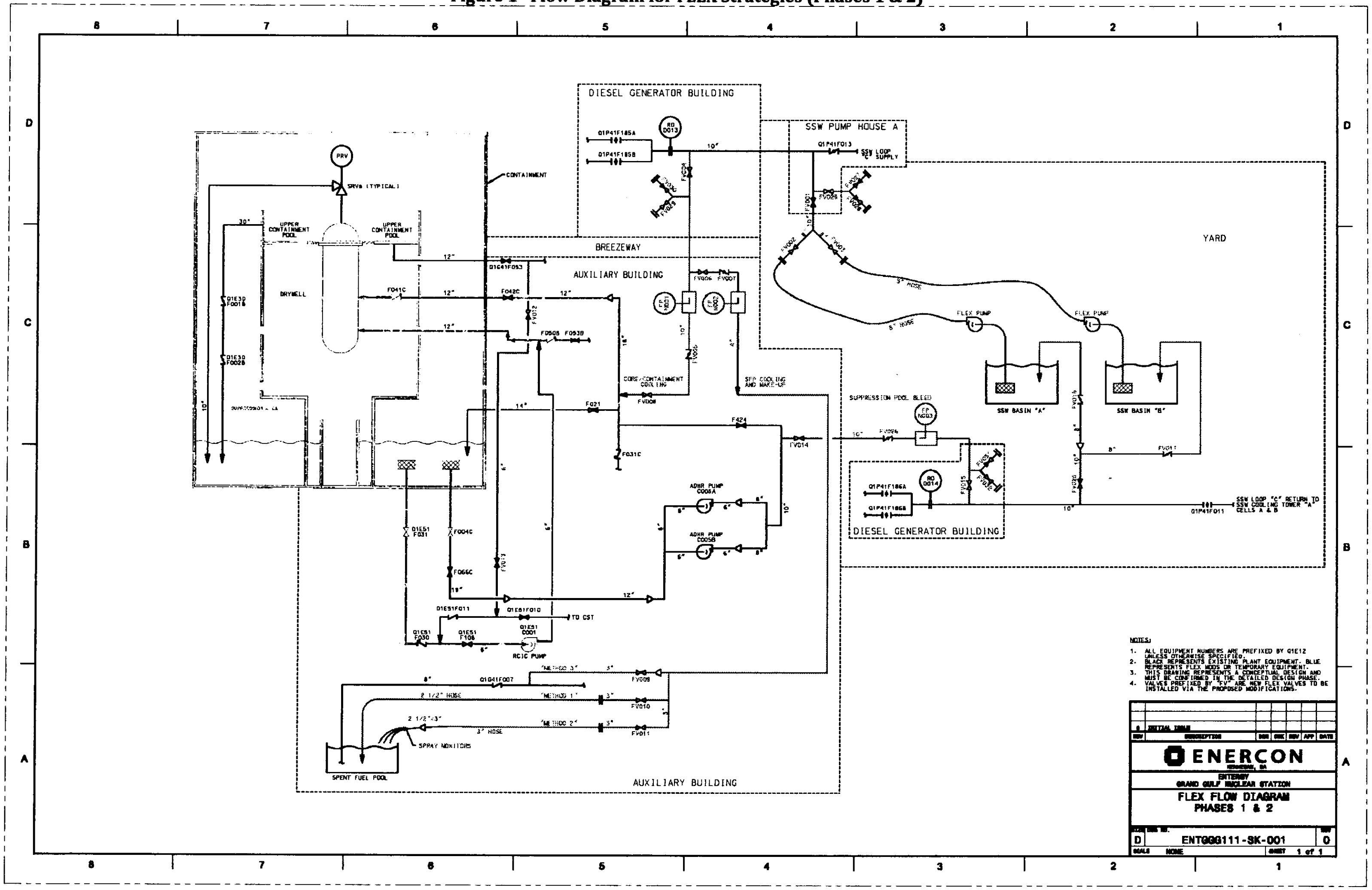

Figure 2 - Flow Diagram for FLEX Strategies (Phase 3)

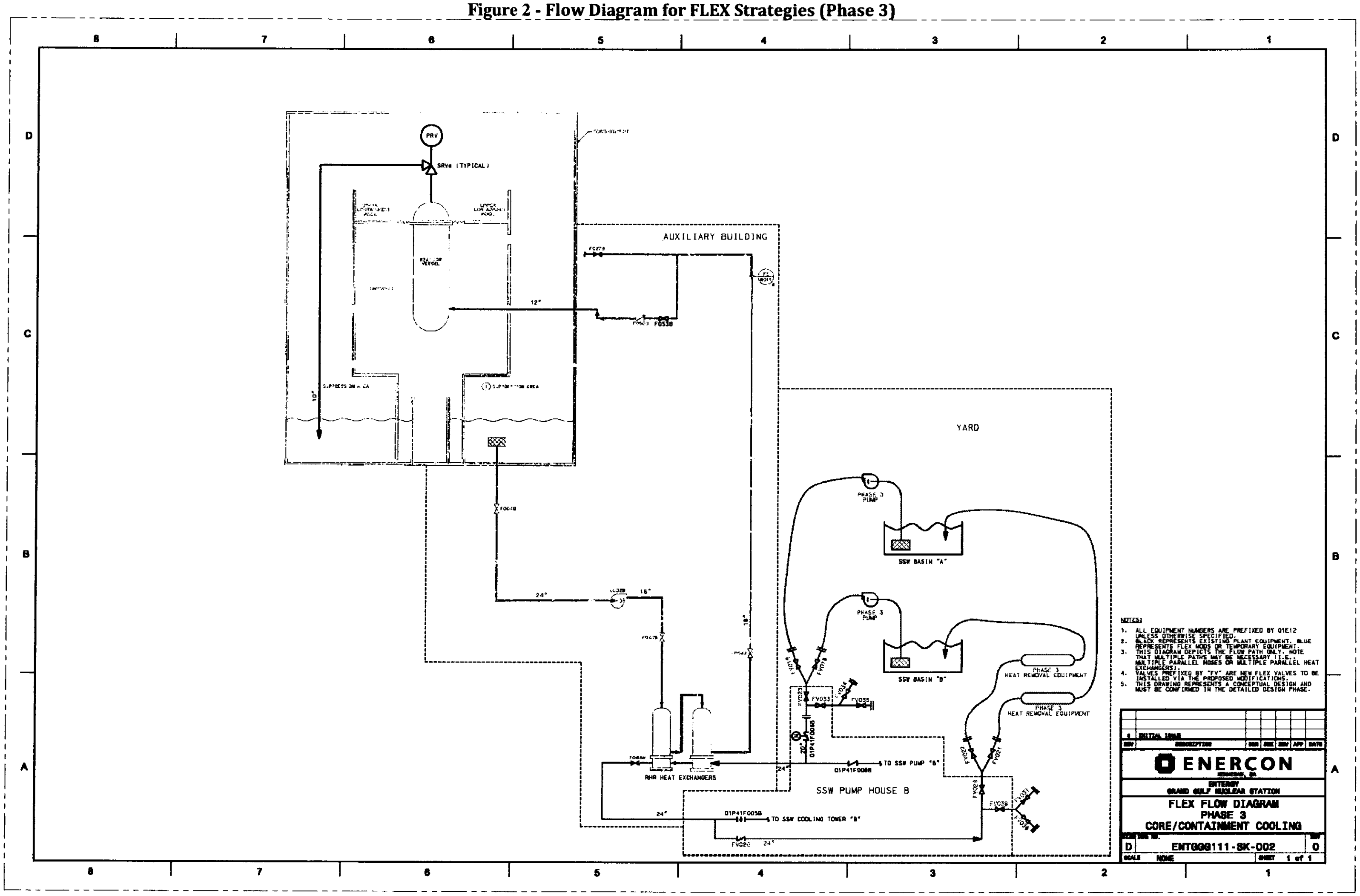

Figure 3 - Flow Diagram for FLEX Strategies (Phase 3 SFP Cooling)

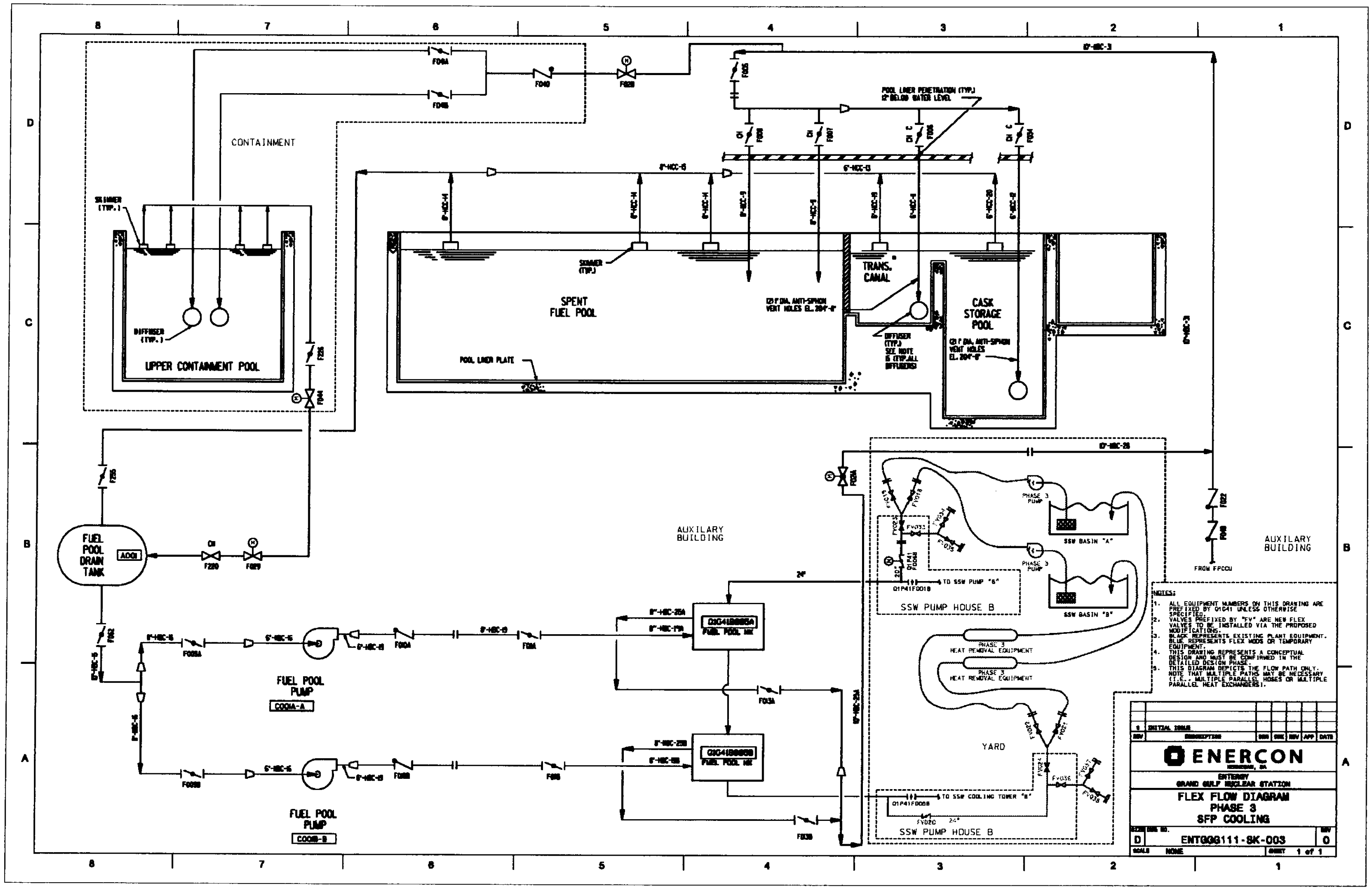

Figure 4 -Electrical Diagram for FLEX Strategies

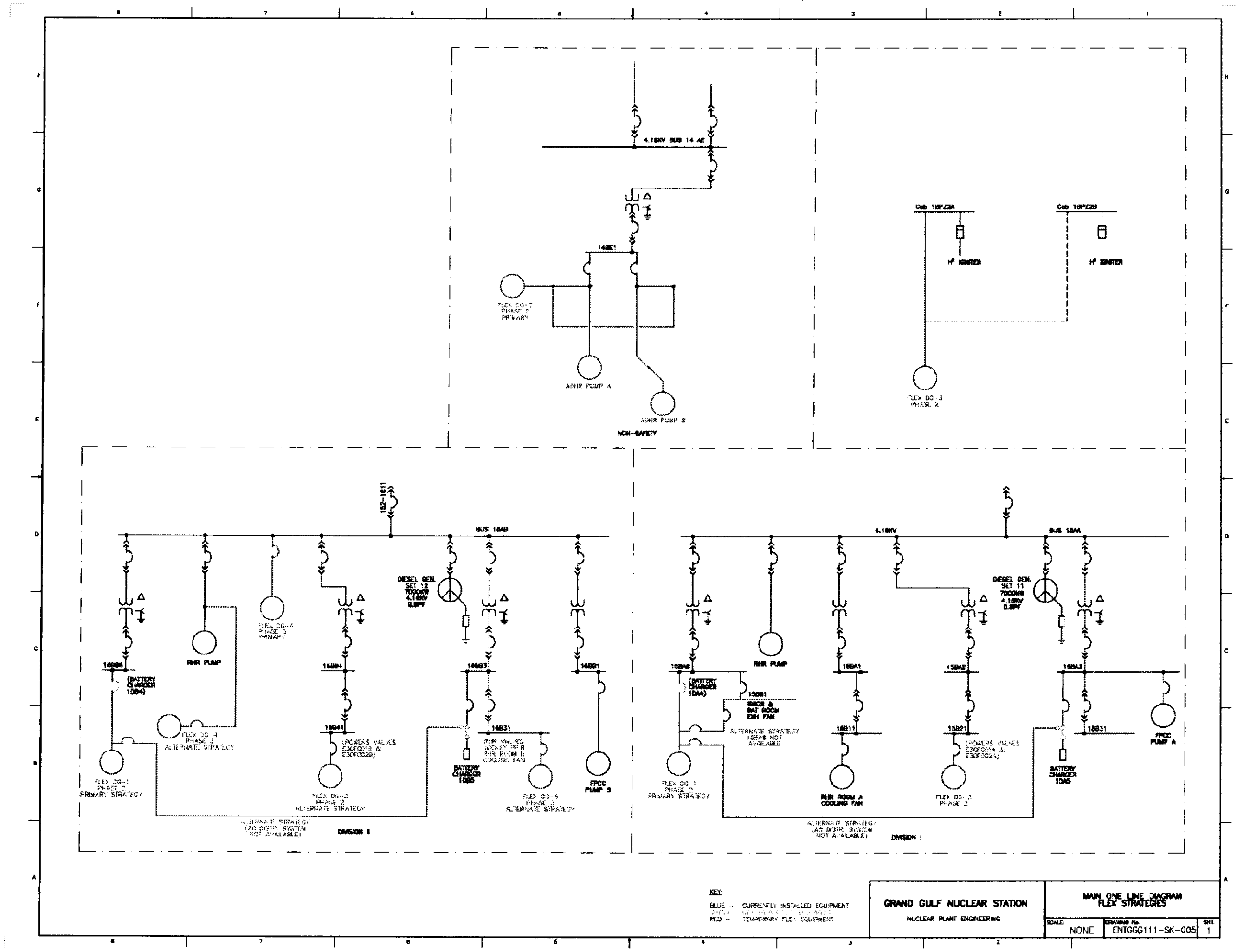

Figure 5 –Site Layout