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Eric W. Olson
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RBG-47329

February 28, 2013

U.S. Nuclear Regulatory Commission
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SUBJECT: River Bend Station 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)
River Bend Station – Unit 1
Docket No. 50-458
License No. NPF-47

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 (ADAMS Accession No. ML12054A736) (RBC-51013)
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, August 2012
4. Entergy letter to NRC (RBG-47302), *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 24, 2012

Dear Sir or Madam:

On March 12, 2012, the 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.

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

Reference 3, Section 13, contains submittal guidance for the Overall Integrated Plan. The enclosure to this letter provides River Bend Station's Overall Integrated Plan pursuant to Reference 3.

Reference 4 provided the River Bend Station 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 is earlier. Future status reports will be provided as required by Section IV, Condition C.2, of Reference 1.

This letter contains no new regulatory commitments. Should you have any questions regarding this submittal, please contact Mr. Joseph Clark, Manager – Licensing, at 225-381-4177.

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

Sincerely,

Eric W. Olson

EWO/JCR/JAC/wjf

Enclosure: River Bend Station Diverse and Flexible Coping Strategies (FLEX) Overall Integrated Implementation Plan

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Enclosure to

RBG-47329

River Bend Station Diverse and Flexible Coping Strategies (FLEX)

Overall Integrated Implementation Plan

General Integrated Plan Elements (RBS)

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 River Bend Station (RBS or River Bend) are seismic, flooding, ice, high winds and high temperature as detailed below:

Seismic Hazard Assessment:

Per the RBS Updated Safety Analysis Report (USAR) [Reference 1, Section 2.5], the seismic criteria for RBS include two design basis earthquake spectra: Operating Basis Earthquake (OBE) and the Safe Shutdown Earthquake (SSE). The OBE and the SSE are 0.05g and 0.10g, respectively; these values constitute the design basis of RBS. Per NEI 12-06 Section 5.2 (Reference 2), all sites will consider the seismic hazard.

The RBS USAR was reviewed to perform a limited evaluation of the liquefaction potential outside the power block area for a design basis earthquake (SSE) event.

Liquefaction potential for a design basis earthquake with maximum vibratory acceleration of 0.10g has been analyzed for the yard area and several structures (including the reactor building, the radwaste building, and the control building) at RBS [Reference 1, Section 2.5.4.8]. Results show a minimum factor of safety of 3 with respect to initial liquefaction for buried channel sands and gravels. Data clearly indicate a large margin of safety with respect to liquefaction of the foundation soil and compacted backfill supporting the Seismic Category I structures at RBS. Similar analyses for the soil supporting the turbine building under OBE loading indicate large margins of safety against liquefaction.

Therefore, the likelihood of liquefaction at the site for a design basis earthquake spectra appears to be low based on the information presented in the USAR.

Thus the River Bend site screens in for an assessment for seismic hazard except for liquefaction.

External Flood Hazard Assessment:

The design basis flood level (DBFL) at River Bend is 96 ft mean sea level (MSL) which is limited by regional precipitation [Reference 1, Table 3.4-1]. The grade level at River Bend is a minimum of 90 ft MSL and the average plant grade is 94.5 ft MSL. Therefore, RBS screens in for an assessment of 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 River Bend plant site is located at 30°45'26" N latitude and 91°19'54" W 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.

The River Bend site is located within the region characterized by EPRI as ice severity level 3

[Reference 2, Figure 8-2]. As such, the River Bend site is subject to the existence of considerable amounts of ice that could cause low to medium damage to electrical transmission lines.

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

High Wind Hazard Assessment:

River Bend Station, Unit 1 is centered at 30°45'26" N latitude and 91°19'54" W longitude [Reference 1, Section 2.1.1.1] . Per NEI 12-06 guidance, hurricane and tornado hazards are applicable to River Bend [Reference 2]. NEI 12-06 Figures 7-1 and 7-2 were used for this assessment.

Thus the River Bend 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. The climate of the River Bend site can be described as humid subtropical. Summer daily maximum temperatures average about 91°F, with rare periods of extremely hot temperatures over 100°F [Reference 1]. An extreme high temperature of 110°F was recorded in August 1909 at the old weather station located in the south end of the Baton Rouge business district.

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

Summary of Extreme External Hazards Assessments:

The hazards applicable to River Bend are seismic, flooding, ice, high wind and high temperature.

References:

1. River Bend Station, Unit 1 Updated Safety Analysis Report, Rev. 23
2. Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, NEI 12-06, Rev. 0, August 2012

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 10CFR may be required.* • *Deployment resources are assumed to begin arriving at hour 6 and fully staffed by 24 hours.* • *Certain Technical Specifications cannot be complied with during FLEX implementation.*

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

- 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 and submitted, appropriate issues will be entered into the corrective action system and addressed.
- Following conditions exist for the baseline case:
  - Seismically designed DC battery banks are available.
  - Seismically designed AC and DC distribution 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 SSC assumed, except those in the base assumptions, i.e. EDG operation. Therefore, Reactor Core Isolation Cooling (RCIC) will perform as intended per the guidance in NEI 12-06.
- Installed non-safety related SSCs used in the Phase 1 coping strategy will be verified by analysis or test to meet or exceed the current plant design basis for the applicable external hazards.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 design 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 equipment will be available after the event they were designed to mitigate.
- Deployment strategies and deployment routes are assessed for hazards impact.
- The Emergency Response Organization is expected to be fully staffed 6 hours after the event.
- Maximum environmental room temperatures for habitability or equipment availability is based on NUMARC 87-00 [Reference 1] guidance if other design basis information or industry guidance is not available. Extreme high temperatures are not expected to impact the utilization of off-site resources or the ability of personnel to implement the required FLEX strategies.
- This plan defines strategies capable of mitigating a simultaneous loss of all alternating current (AC) power and loss of normal access to the UHS (Ultimate Heat Sink) resulting from a BDBEE (Beyond Design Basis External Event) by providing adequate capability to maintain or restore core cooling, containment, and SFP (Spent Fuel Pool) 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

into the unit emergency procedures/guides in accordance with established emergency procedure/guide change processes, and their impact to the design basis capabilities of the unit evaluated under 10 CFR 50.59. The plant Technical Specifications contain the limiting conditions for normal unit operations to ensure that design safety features are available to respond to a design basis accident. The result of the beyond-design-basis event may place the plant in a condition where it cannot comply with certain Technical Specifications and/or with its Security Plan, and, as such, may warrant invocation of 10 CFR 50.54(x) and/or 10 CFR 73.55(p) [Reference 2].

- Analysis to be performed on behalf of the BWROG by GEH will conclude that (a) temporarily exceeding the suppression pool temperature design limit of 185°F during the event is acceptable and (b) Exceeding the Heat Capacity Temperature Limit (HCTL), Pressure Suppression Pressure Limit (PSPL), and Safety Relief Valve (SRV) Tail Pipe Level Limit (SRVTPLL) as specified by Emergency Operating Procedures without performing emergency depressurization is acceptable [Reference 3].

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

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

1. Beyond-design-basis external event impact on requirements in existing licensing documents will be determined based on input from the industry groups and direction from the NRC.

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

References:

1. NUMARC 87-00, *Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors*, Revision 1
2. Task Interface Agreement (TIA) 2004-04, "Acceptability of Proceduralized Departures from Technical Specifications (TSs) Requirements at the Surry Power Station," (TAC Nos. MC4331 and MC4332)," dated September 12, 2006. (Accession No. ML060590273)
3. BWROG 13013 – Frederick P. "Ted" Shiffley, II, BWROG to David Skeen, USNRC, "Transmittal of NEDC-3371P Revision 1 and NEDO-33771 Revision 1, Boiling Water Reactors Owners' Group Technical Report, 'GEH Evaluation of the FLEX Implementation Guidelines', January 2013 (TPN: BWROG-TP-13-XXX)," January 31, 2013

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 JLD-ISG-2012-01 and NEI 12-06 for the FLEX implementation at RBS. If deviations are identified, then the deviations will be communicated in a future 6 month update following identification.

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

Discussion of time constraints identified in Attachment 1A

- 1 hour: Operators initiate the ELAP/FLEX procedure. Time critical at a time greater than 1 hour. A time period of 1 hour gives the operators sufficient time to investigate the plant's condition following a Beyond Design Basis External Event (BDBEE). A formal validation of the timeline will be performed once the procedure guidance is developed and related staffing study is completed.
- 1 hour: Start manual depressurization of RPV to between 100-200 psig. This will delay entry into the unsafe regions of the HCTL curve. Time critical at the point of entering the unsafe region of the HCTL curve (approximately 4 hours) [Reference 2]. Maintain RCIC operating in level control mode. Operators are well versed in depressurizing the reactor and operating RCIC in level control mode.
- 1 hour: Perform deep DC load shedding to extend divisional battery life. This requires opening 25 breakers in the Control Room and 19 breakers in the Diesel Generator Building. The panels are readily available for operator access in the Control Room and the Diesel Generator Building since it is adjacent to the Control Building. It is assumed that operators can perform this action in 15 minutes. Battery life calculations [Reference 4] indicate that additional time for this task could be allowed considering the follow-up actions for cross-tying the Division II batteries to the Division I DC bus. A formal validation of the timeline will be performed once the procedural guidance is developed and staffing study is completed.

- 1 hour: Start removal of main control room ceiling tiles to maintain control room habitability. Completion of this task in 70 minutes will maintain the temperature in the control room at 104°F or less through 72 hours, when it is expected that equipment will have arrived from the RRC. Current SBO procedures have demonstrated that this can be initiated within 1 hour and completed within 70 minutes.
- 3 hours: Deploy hydrogen igniter diesel generator (if allowed by other priorities). This action only becomes time critical should core cooling fail and fuel becomes damaged. Current SBO procedures have demonstrated that this can be done within 3 hours.
- 5 hours: Start re-alignment of RCIC to take suction from the upper containment pool. This is done to ensure adequate NPSH for continued operation of RCIC. SP temperature becomes critical at approximately 6 hours when it approaches 190°F. This operation requires operators to manually manipulate three (3) valves and control room operators to operate two (2) battery powered valves from the control room. A formal validation of the timeline will be performed once the procedure guidance is developed and related staffing study is completed.
- 7 hours: Cross-tie the Division II batteries and the Division I DC bus using new breakers on BYS-SWG01D. Normally open circuit breakers installed in cabinet BYS-SWG01 will be used to make the cross-tie. This action becomes critical at the time when the Division I batteries are depleted (approximately 7.9 hours) [Reference 4]. A formal validation of the timeline will be performed once the procedure guidance is developed and related staffing study is completed.
- 6 hours: Start alignment of Standby Service Water (SSW) FLEX Pump and Suppression Pool Cleanup/Alternate Decay Heat Removal System (SPC) Pump for suppression pool cooling. Initiate operation of the pumps by 8 hours:
  - Connect staged FLEX pump in the G-Tunnel or the portable FLEX pump outside near the SSW basin using spool piece/hose connections to line from the bottom of the SSW basin.
  - Perform valve alignments to provide cooling water from the SSW basin to the SPC Heat Exchanger. This requires operators to manually manipulate twelve (12) valves.
  - Perform valve alignments to provide water from the suppression pool to the SPC pump and return to the suppression pool. This requires operators to manually manipulate six (6) valves.
  - Connect one FLEX diesel generator to the staged FLEX pump in the G-Tunnel or the portable FLEX pump outside near the SSW basin. Connect second FLEX diesel generator to SPC Pump 1A or SPC Pump 1B. The only actions required are to deploy the FLEX diesel generators, plug into receptacles, and start the diesel generators.. The current SBO procedure demonstrates that a similar action can be performed in four hours.

  This action becomes critical shortly after 8 hours when the SP would begin to boil [Reference 2]. A formal validation of the timeline will be performed once the procedure guidance is developed, required modifications are implemented and related staffing study is completed.

- 8 hours: Connect the FLEX/SBO diesel generator to Division 1 battery charger through installed connection point to begin recharging of Division 1 batteries and provide DC power. The only actions required are to deploy the FLEX diesel generator, plug it into a receptacle, and start the diesel generator. The current SBO procedure demonstrates that a similar action can be performed in four hours. This action becomes critical when the Division II batteries, which are aligned to the Division I bus deplete (approximately 12 hours) [Reference 4]. A formal validation of the timeline will be performed once the procedure guidance is developed, required modifications are implemented and related staffing study is completed.
- 8 hours: Connect compressed air cylinder supply to SRVs and instruments. Compressed air cylinders are stored in the vicinity of the connection point. Operators are fully aware of procedural requirements to connect compressed air cylinders. A formal validation of the timeline will be performed once the procedure guidance is developed and related staffing study is completed.
- ~60 hours: When RCIC is no longer available, depressurize the RPV and align SPC pump with suction from suppression pool, through SPC heat exchanger, to the RPV, via E12-MOVF042C. The SRVs will continue to be maintained open to return water to the suppression pool. This requires operators to manually manipulate eleven (11) valves. This action becomes critical when the UCP, which is providing RCIC suction depletes (approximately 64 hours) [Reference 2]. A formal validation of the timeline will be performed once the procedure guidance is developed, required modifications are implemented and related staffing study is completed.

<u>Technical Basis Support Information</u>

1. On behalf of the Boiling Water Reactor Owners Group (BWROG), GE-Hitachi (GEH) developed NEDC-33771P, Revision 1 [Reference 7] to supplement the guidance in NEI 12-06 by providing additional BWR-specific information regarding the individual plant response to the ELAP and loss of access to Ultimate Heat Sink (UHS) events. Based on the initial results of this evaluation, the BWROG has initiated additional analyses for the BWR/6 design with Mark III containments to develop additional strategies for containment cooling that are not currently included in this revision of the report. These additional strategies specifically address actions necessary to mitigate the suppression pool heat-up during ELAP events that could challenge containment integrity. These strategies include suppression pool inventory addition/letdown, alternate suppression pool cooling methods, and/or aligning FLEX equipment to provide AC power to installed plant equipment for containment heat removal. This information is expected to provide support for the strategies that River Bend has selected to address FLEX. The additional analyses will be provided to the NRC Staff once they are completed and reviewed by the BWROG members [Reference 8].
2. A best estimate bounding decay heat curve was developed by GEH using ANSI 5.1 for use in NSSS modeling[Reference 1].
3. River Bend containment integrity for Phases 1 through 3 was evaluated by use of GOTHIC computer code [Reference 2].
4. River Bend core cooling for Phases 1 through 3 was evaluated by the use of GOTHIC computer code [Reference 2].

5. Environmental conditions within the station areas were evaluated utilizing methods and tools in NUMARC 87-00 [Reference 3] or Gothic 8.0 (EPRI software).
6. River Bend divisional battery life was calculated in Reference 4.
7. River Bend times for boiling and uncovering fuel in the spent fuel pool and the upper containment pool were calculated in Reference 5.
8. River Bend Control Room Habitability for Phases 1 through 3 was evaluated by the use of GOTHIC computer code [Reference 6].
9. Per the guidance in 10 CFR 50.63 and Regulatory Guide 1.155, RBS is a four (4) hour coping plant for SBO considerations. Applicable portions of the analysis described in the RBS USAR [Reference 9, Appendix 15C] have been used as starting points for evaluations performed to meet the guidance from NEI 12-06. Key assumptions not addressed in the EA-12-049 order were per the existing SBO evaluations. Some of these SBO based assumptions used for ELAP are:
   a) Credit is taken for operator actions where appropriate.
   b) Equipment needed for the SBO coping duration is available at the site once Phase 2 is implemented.
   c) There is reasonable assurance that the equipment will remain operable during and subsequent to an SBO event.

<u>References</u>:

1. Document No. 722.251-000-016A, GE TPO Uprate Project, "Transmittal of Decay Heat Tables for PNPs, RBS, and GGNS," Revision 300, 9/28/2009
2. ENTGRB125-CALC-003, River Bend Station Containment GOTHIC Model for Extended Loss of Offsite Power (FLEX), Rev. 0
3. NUMARC 87-00, Station Blackout, Revision 1
4. ENTGRB125-CALC-007, Station Division I Battery ENB-BAT01A and Division II Battery ENB-BAT01B Discharge Capacity during Extended Loss of AC Power, Revision 0
5. ENTGRB125-CALC-005, River Bend Spent Fuel Pool and Upper Containment Pool Time to Boil and Uncover Fuel for Extended Loss of Offsite Power (FLEX), Revision 0
6. ENTGRB125-CALC-006, River Bend Station MCR Heatup for Extended Loss of Offsite Power (FLEX), Revision 0
7. NEDC-33771P Revision 1 and NEDO-33771 Revision 1, Boiling Water Reactors Owners' Group Technical Report, "GEH Evaluation of the FLEX Implementation Guidelines", January 2013 (TPN: BWROG-TP-13-xxx)
8. BWROG 13013 – Frederick P. "Ted" Shiffley, II, BWROG to David Skeen, USNRC, "Transmittal of NEDC-3371P Revision 1 and NEDO-33771 Revision 1, Boiling Water Reactors Owners' Group Technical Report, 'GEH Evaluation of the FLEX Implementation Guidelines', January 2013 (TPN: BWROG-TP-13-XXX)," January 31, 2013
9. River Bend Station, Unit 1 Updated Safety Analysis Report, Rev. 23

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 River Bend deployment strategy will be included within an administrative program.

- River Bend procedures and programs will be 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 River Bend.
- Figure 3 [Reference 1, Figure 5.7] identifies the proposed deployment paths on-site 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.

References:

1. ENTGRB125-PR-002, 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

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 study 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.*

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

- *Equipment Quality:* The equipment for extended loss of AC power (ELAP) will have unique identification numbers. Installed structures, systems and components pursuant to 10CFR50.63(a) will continue to meet the augmented quality guidelines of Regulatory Guide 1.155, Station Blackout.
- *Equipment Protection:* River Bend will construct structures to provide protection of the FLEX equipment to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined.
- *Storage and Deployment:* River Bend will develop procedures and programs to address storage structure requirements and deployment/haul path requirements relative to the hazards applicable to RBS.
- *Maintenance and Testing:* River Bend 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.
- *Design Control:* River Bend will follow the current programmatic control structure for existing processes such as design and procedure configuration.

Describe training plan	*List training plans for affected organizations or describe the plan for training development*
New training of station staff and emergency response personnel will be performed in 2015, prior to the RBS 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*
River Bend will utilize the industry Regional Response Centers (RRC) for Phase 3 equipment. River Bend has contractual agreements in place with the Strategic Alliance for FLEX Emergency Response (SAFER). The two (2) industry RRC 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.	

Maintain Core Cooling

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

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

BWR Installed Equipment Phase 1:

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

Power Operation, Startup, and Hot Shutdown

At the initiation of the BDBEE and reactor scram (i.e. t=0 hours), main steam isolation valves (MSIVs) automatically close, feedwater is lost, and SRVs automatically cycle to control pressure, causing reactor water level to decrease. When reactor water level reaches –43 inches, RCIC automatically starts [Reference 1]. Since the Condensate Storage Tank (CST) is assumed to be unavailable, RCIC suction will immediately swap to the suppression pool (SP) due to sensed low CST level by E51-LT-N035A(E), located on safety related piping. The instrument loop and the suction valves are DC powered and the valves will change position as designed to align to the SP. Injection recovers the vessel water level to the normal band. The SRVs, cycling in low-low set mode, control vessel pressure between 956 and 1063 psig [Reference 2, SR 3.3.6.4.3]. SP temperature and level begin to increase due to the heat addition from the SRV discharge and the RCIC turbine exhaust. Water will begin to spill into the drywell when SP level reaches the top of the weir wall at t~3 hours [Reference 6].

After determination that Emergency Diesel Generators (EDGs) cannot be restarted, at approximately t=1 hour during performance of AOP-0050 [Reference 3], the operating crew concludes that the event is a beyond-design-basis event (FLEX) and the plant will have a loss of power for an extended period of time. RCIC is maintained feeding the reactor vessel with suction from the SP. Operators will have overridden RCIC high area temperature isolation interlocks as part of the operator immediate actions of AOP-0050. They will also override the other RCIC trip signals and isolation signals that could possibly prevent operation when needed during the ELAP. Instructions are provided in plant procedure EOP-0005 [Reference 4].

Once it is determined that a FLEX event has occurred, the operators will depressurize the vessel in a controlled manner using SRVs in accordance with existing procedures and cooldown limits until a vessel pressure between 100 and 200 psig is reached. This is in anticipation of SP heatup, and will provide initial margin to the HCTL curve [Reference 5] so that emergency depressurization (ED) is not forced by the Emergency Operating Procedures (EOPs) as SP temperature increases (Note that it is likely that this limit will eventually be exceeded regardless. This is discussed further below.). This pressure range will also allow continued operation of RCIC (the only vessel injection source available) above its stall pressure of ~60 psig [Reference 3].

[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.

At approximately t=4 hours, as determined by the GOTHIC model [Reference 6], SP temperature reaches ~175 – 180°F. As the SP temperature approaches this point, several challenges arise. Calculations for RCIC indicate that RCIC net positive suction head (NPSH) may begin to be challenged [Reference 7]. NPSH requirement at the flows which will be required going forward of 300 gpm is 12-14 feet [Reference 8]. NPSH available will be adequate at normal SP level until SP temperature exceeds 200°F, at which time cavitation may occur. Further, the elevated temperature may impact the RCIC equipment. Current procedures warn of exceeding RCIC oil temperature of 180°F. The oil cooler is cooled by RCIC suction flow, and current procedures also caution against exceeding the SP temperature of 140°F for both oil heatup and piping design limit considerations [Reference 9].

The BWROG has commissioned GEH to perform an evaluation of the effects of RCIC system operation at extended pumped fluid temperatures [Reference 10]. The purpose of the study is to identify recommendations for allowing 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 study has not been issued as final; however, the draft study has been issued for industry review and comment. The draft study provides recommendations for increasing the availability for the RCIC system for the extended fluid temperatures. Also, based on experience derived from Fukushima, the RCIC system can run at a much higher lube oil temperature and suction source temperature [Reference 11].

As SP temperature increases, the current HCTL curve will eventually be reached. For example, at 200 psig vessel pressure and normal (~20') SP level, the HCTL is ~168°F [Reference 5]. This would require emergency depressurization, thus rendering RCIC non-functional. The BWROG is issuing new guidance which allows operators to remain at mid-range pressures such as directed here without performing emergency depressurization [Reference 12]. As pool temperature increases, the River Bend containment/SP design temperature of 185 °F will be exceeded at t~5 hours with RCIC taking suction from the suppression pool. While industry initiatives are underway to relax this limit for FLEX scenarios for Mark III plants, it is desirable to limit the temperature increase as much as possible [Reference 12]. A key assumption in the River Bend FLEX strategy presented herein is that exceeding the 185 °F is allowed.

Based on the discussion above, it is necessary to provide a cooler suction source for RCIC as well as to inject into the vessel cooler water than that being provided by the suppression pool at elevated temperature. The CST is assumed unavailable due to not meeting FLEX requirements for seismic and wind/missile protection. The only other reasonably available path using installed equipment is from the Upper Containment Pool (UCP). In order to do this, a modification is required to install a permanent cross-tie line from Spent Fuel Cooling (SFC) system lines from the UCP to the RCIC/HPCS suction line from the CST. A convenient place to perform this cross-tie is in the E-tunnel pipe chase where these lines are in close proximity. The recommended SFC line (SFC-008-76-3) is located in a shielded chase at ~88' elevation above the recommended RCIC/HPCS supply line (CSH-016-1-2) at ~83' elevation. A chain operated gate valve would be suitable for this valve manipulation. The connection should be made at a convenient location in the E-Tunnel such as between Auxiliary Building grid lines 1 and 4 as shown on drawings EP-108E and EP-108F. The cross-connect will be an 8" line with an 8" gate valve. This will be adequate to accommodate the 6" RCIC suction line. Connection into the drained SFC line could be made by installing a "T" in this line, with flanged connection for the valve and appropriate pipe routing down to the supply line. A hole may be needed in the concrete shield lip to allow pass through. Connection into the 16" CSH line could be via a "hot tap" with flanged nipple for the valve. A check valve (E22-VF002) is already present to isolate the supply line back to the CST since that path is assumed to be open to atmosphere due to the BDBEE. Further, the E51-MOVF031 valve must be closed and the E51-MOVF010 valve opened for the path proposed. It is preferable to manipulate these valves manually if possible to preserve battery capacity. The valves are accessible. If the valves are operated remotely, care must be taken not to fully isolate RCIC suction from a source more than momentarily.

In addition to the modification described above, siphon breakers in the UCP must be left closed during normal operation. Defeating the siphon breakers would slightly increase the chance of inadvertently draining the UCP (note that no fuel may be stored in the UCP during normal operation). However, there are additional valves that are normally closed in the drain path. Further, manual valve SFC-V126 will be closed. New precautions will be added to appropriate procedures.

Prior to the SP reaching 185°F (t~5 hours), the operators will line up the UCP suction path to RCIC. This will provide water at ~90-100°F to RCIC suction for injection into the vessel [Reference 15]. The magnitude of this sudden change in water temperature (~100 °F) is not extreme compared to other potential changes which could be experienced at RCIC suction during a design basis accident (DBA) response (e.g., swapping from CST suction to SP suction in a DBA). Further, operation of RCIC under more extreme conditions is being examined by the BWROG [Reference 10].

The operators will maintain vessel water level below the RCIC cutoff level of +51" with the RCIC flow controller from the control room to the extent possible. It is important to note that allowing the DC powered RCIC valves to automatically cycle on vessel level is not desirable because battery life could be shortened considerably; however, some cycling may not be avoidable due to minimum RCIC flow limitations discussed below. From Reference 16 the UCP will contain >400,000 gal of available water in modes 1 - 3 for supply to RCIC. This volume of water would allow RCIC operation for >60 hours [Reference 6]. However, Phase 2 discusses plans for implementing other methods well before that time. RBS procedures contain precautions about avoiding operation of RCIC at less than 50% flow for extended periods of time [Reference 9]. Once it becomes necessary to run RCIC < 300 gpm for level control, operators may elect to allow the E51-F045 and E51-F013 to cycle on level. Estimates from FLEX calculations are that the cycling time is approximately 30 minutes [Reference 6]. Note that the drain pot drain valves, E51-AOVF004 and E51-AOVF005, fail closed on loss of air and will not open when the E51-F045 valve closes if required due to high pot level. Therefore, it will be necessary to manually open these valves to remove the potential for turbine and piping damage, if it is necessary to restorat the RCIC turbine after it has been in use.

It is also evident that supplying a large amount of water to the suppression pool via injection to the vessel and discharging from the SRVs will soon result in reaching the top of the drywell weir wall at RBS. River Bend is designed with only about 1.5 feet of freeboard to that point, which can accommodate ~79,000 gallons [Reference 17]. This would exceed the EOP SRVTPLL and the Pressure Suppression Pressure (PSP) limit curves, each of which require ED. These limits for RBS are 21'3" (top of weir wall) and 21'6", respectively [Reference 5]. Thus, RCIC injection would have to be terminated to prevent requiring ED by approximately 12 hours or sooner. Performing ED would result in loss of RCIC as well. Loss of RCIC as the injection source would require that Phase 2 actions be ready to begin immediately to prevent core damage within approximately 2 to 3 hours following the loss of RCIC [Reference 18].

Phase 2 actions are planned to be ready sooner than 12 hours, but the intent of the initial stage of Phase 2 is to allow RCIC to run until all water is depleted from the UCP. Thus, it is necessary to allow RCIC injection to continue to inject water into the vessel and ultimately into containment via discharge from the SRVs. Drywell flooding will begin once SP water reaches the top of the weir wall (t~3 hrs) [Reference 6]. Although drywell flooding is terminated at about 85' by a positive drywell-containment differential pressure developed at t~14 hrs, the drywell pressure will ultimately decrease due to cooling and a significant amount of water will spill into the drywell later in the event. Once external injection from the UCP is depleted and cooling occurs, the drywell water level is expected to be ~97', which is ~ 5 feet below the bottom of the vessel. Although some equipment such as recirculation pump/motors, drywell coolers, and TIP indexers could be covered, this will not impact the success of the strategy.

It is important that injection of cool water from the UCP to the vessel via RCIC be able to continue as SP level increases to slow the rapid heat up of the SP. This requires relaxation of the SRVTPLL and the PSP level limit. The BWR Owners Group is sponsoring industry initiatives to attempt to accomplish relaxation of these limits [Reference 12]. A key assumption of the primary Phases 1 and 2 Reactor Core Cooling strategy for RBS is that the containment related EOP limits requiring ED will be relaxed at lower vessel pressures so that RCIC can continue to run as long as possible. Under this assumption, RCIC will continue to inject relatively cool water into the vessel from the UCP until Phase 2 measures can begin.

The only air operated valves which are required to be cycled using air during the FLEX event are the SRVs. The instrument air system will be lost due to the FLEX event. The SRVs have back-up air accumulators adequate for a four hour SBO [Reference 13, Section 15C.2.5.3]. Automatic Depressurization System (ADS) SRV air accumulators are sized to provide 4 to 5 actuations per valve at atmospheric pressure in the drywell. A total of 28-35 ADS SRV actuations are available. The non-ADS SRV accumulators can provide a minimum of 37 valve-cycles. This is enough for a 4 hour SBO, which is predicted to require 22 SRV operations [Reference 13, Section 15C.2.5.3]. However, this capacity may not be enough for all of FLEX Phase 1 which is desired to last for ~8 hours to allow time for personnel resource arrival and Phase 2 equipment staging. It is therefore necessary to provide another means for continuing to use SRVs well into Phase 1.

The backup to the IAS compressor is air bottles which may be connected in the auxiliary building, 141' level [Reference 3]. All equipment for backup air bottles will be located in the auxiliary building, 141' level, and secured for seismic protection during normal operations. A location near the connection point for one of the divisions, SVV-V48 or V51, will be utilized. In addition, the SP level indication to be used (CMS-LT23A) has a bubbler type instrument which requires air. The same connection used to provide backup air to the SRVs will also supply this level instrument. Plant procedures will be modified to open SVV-MOV1A or B continuously for air supply to the bubbler.

Cold Shutdown and Refueling

If an ELAP occurs during mode 4 (Cold Shutdown), water in the vessel will unavoidably heatup from whatever temperature is being maintained. When temperature reaches 212°F, (i.e., mode 3, Hot Shutdown) the vessel will begin to pressurize. RCIC 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 to provide injection flow. When pressure rises to the SRV setpoints the pressure will be controlled by SRVs. See the strategies for modes 1 - 3 above for core cooling.

During mode 5, there are many variables which impact the ability to cool the core. To accommodate the activities of vessel disassembly and refueling, water levels in the reactor vessel and the reactor cavity are often changed. The most limiting condition is the case in which the reactor head is removed or de-tensioned and water level in the vessel is at or below the reactor vessel flange. If an ELAP/LUHS occurs during this condition then (depending on the time after shutdown) boiling in the core occurs quite rapidly. Makeup water to the upper containment pool would be provided by repowering SPC Pump P1A and aligning valves to pump water from the Suppression Pool to the upper containment pool. This method would provide makeup water to both the upper fuel pool and the refueling cavity. The SPC pumps will be powered directly from a FLEX diesel generator (DG) positioned at grade outside the auxiliary building on the west side ("west canyon"). Note that all SPC logic and control power is assumed lost such that direct powering of the pumps at the motors themselves is required. This method for cooling the UCP would provide cooling for the reactor if the reactor head is removed.

There may be short periods of time during Mode 5 where plant configuration may preclude use of this strategy. For example, as indicated in procedure OSP-0037 [Reference 19] if the event occurs at 1 day after shutdown, boiling will occur in less than 1 hour with fuel uncovering in less than 7 hours.

If the ELAP/LUHS were to occur during Mode 5 with the vessel head still in place, the SPC pump would be used to provide cooling water from the Suppression Pool to the reactor, via valves RHS-AOV64, RHS-V3022, and E12-MOVF042C. This would have to be established in less than 7 hours (i.e., 1 hour less than assumed during modes 1-3). It has been determined that it is reasonable to assume that power to the SPC pump and valve lineups could be established in 7 hours due to the increased number of people on-site due to the refueling outage, and the fact that only the SPC pump needs to be repowered, while the SSW Basin FLEX pump does not need to be operable until Phase 3 (i.e., 72 hours). Once the off-site equipment arrived from the RRC, normal shutdown cooling would be established

Pre-staging of FLEX equipment cannot be credited per the guideline of NEI 12-06 since an event could disable any pre-staged equipment unless such equipment is protected. Staging and implementation of FLEX portable pumps to supply injection flow must commence immediately from the time of the event. This is reasonable because more personnel are on site during outages to provide the necessary resources. However, care must be taken to ensure that sufficient area is available for staging and that haul paths remain accessible without interference from outage equipment.

<u>References</u>:

1. River Bend Technical Requirements Manual, TR 3.3.5.2, Revision 9
2. River Bend Station, Technical Specifications, as revised through Amendment 174
3. AOP-0050, Station Blackout, Rev. 043, April 12, 2012
4. EOP-0005, Emergency Operating and Severe Accident Management Procedures Enclosures, Rev. 311, April 24, 2012
5. EOP-0002, Emergency Operating Procedure - Primary Containment Control, Rev. 014, June 6, 2008
6. ENTGRB125-CALC-003, River Bend Station Containment GOTHIC Model for Extended Loss of Offsite Power (FLEX), Rev. 0

7. ENTGRB125-CALC-008, River Bend Station RCIC NPSH for Extended Loss of Offsite Power (FLEX), Rev. 0
8. Vendor Manual 32214510000001B, Reactor Core Isolation Cooling Pump, River Bend 1, Bingham-Willamette Co, September 1, 1981
9. SOP-0035, Reactor Core Isolation Cooling System (SYS #209), Rev. 043, September 17, 2012
10. 0000-0155-1545-Draft A, BWROG RCIC Pump and Turbine Durability Evaluation – Pinch Point Study
11. 0000-0143-0382-R0 (proprietary), GEH Feasibility Study of RCIC System Operation in Prolonged Station Blackout
12. BWROG 13013 – Frederick P. "Ted" Shiffley, II, BWROG to David Skeen, USNRC, "Transmittal of NEDC-33771P Revision 1 and NEDO-33771 Revision 1, Boiling Water Reactors Owners' Group Technical Report, 'GEH Evaluation of the FLEX Implementation Guidelines', January 2013 (TPN: BWROG-TP-13-XXX)'," January 31, 2013
13. River Bend Station, Unit 1 Updated Safety Analysis Report, Rev. 23
14. License Amendment Request LAR-1996-0052, "LAR for MR 95-0010, Suppression Pool Cleanup and Alternate Decay Heat Removal System"
15. Readings taken by Operations from local UCP temperature indicator during normal operation, November, 2012.
16. ENTGRB125-CALC-010, River Bend Station Volume of Water in the Upper Containment Pool during Modes 1, 2, and 3, Rev. 0
17. TSG-0001 Technical Support Guidelines (Onsite Water Sources), Rev. 1, January 17, 2000
18. Calculation Number PRA-RB-08-010, RBS MAAP 4.07 T/H Analysis, Revision 0
19. OSP-0037, Shutdown Operations Protection Plan (SOPP), Rev. 028, November 15, 2012

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

- A modification is required to allow RCIC suction from the UCP.
- Arrange for protected storage of air bottles and tools for IAS backup supply to SRVs
- Defeat siphon breaker during normal operation in Upper Containment Pool
- Change normal configuration of identified SFC valves for RCIC suction to UCP.
- Modify instruments or power supply such that the following instruments are powered from station batteries via inverters: 1) Suppression Pool Temperature; and 2) Primary Containment Temperature.

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

Reactor Vessel Essential Instrumentation	**Safety Function**
RPV Level (B21-LTN091A)	Reactor vessel inventory and core heat removal
RPV Pressure (B21-PTN062A)	Reactor vessel pressure boundary and pressure control
Containment Essential Instrumentation	**Safety Function**
Primary Containment Pressure (CMS-PT4A)	Containment integrity
Suppression Pool Water Level (CMS-LT23A)	Containment integrity
Suppression Pool Temperature (CMS-RTD40A)	Containment integrity
Primary Containment Temperature (CMS-RTD41A)	Containment integrity
Spent Fuel Pool Essential Instrumentation	**Safety Function**
SFP Level (to be determined per EA-12-051 response)	SFP inventory
Other	**Safety Function**
Division I DC Voltage (ENB-SWG01A-VM)	Remaining battery voltage

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.

Suppression Pool Cooling Heat Removal

Reactor core cooling will be maintained using RCIC from the UCP with the operators adjusting the RCIC flow controller until RCIC flow is reduced to the minimum allowed by procedures (~300 gpm). At this point (t=8 hrs), it is crucial to begin cooling the suppression pool to remove decay heat being deposited into the containment and prevent SP boiling. This will allow progress toward ultimately stabilizing SP temperature and containment pressure as vessel cool down continues until Phase 3 equipment can be put into service. To do this, the SPC system is placed into service.

The SPC pumps will be powered directly from a FLEX diesel generator (DG) positioned at grade outside the auxiliary building on the west side ("west canyon"). Should this preferred connection be inaccessible, an alternate connection will be established by routing cables through doors on the east side of the Auxiliary Building. The SPC pump motors require 227 amps at 100% load and 1195.2 amps locked rotor (LR). These conditions have been assumed in determining the DG size of 200 kW with a peak motor starting of at least 994 kVA. Note that all SPC logic and control power is assumed lost such that direct powering of the pumps at the motors themselves is required. SPC system AOVs will fail closed on loss of instrument air. Valves which require manipulation located outside of containment are accessible. These valves will be manually opened and/or gagged open. The procedure to be followed for running the system will be that of SOP-0140 [Reference 1] to the extent possible.

The majority of the SPC system is non-safety related. It will be evaluated to meet rugged standards as defined in NEI guidance. This system was designed to higher standards than ASME B31.1 originally. The 10CFR 50.59 Evaluation [Reference 4] states that Class 4 piping in the auxiliary building is seismically qualified to prevent damaging other equipment, and the piping in the E-Tunnel (a seismic structure) meets or exceeds seismic II/I requirements and will maintain structural integrity during a seismic event. Also, the USAR [Reference 5, Section 9.8.3.1] states that SPC piping and components located in the Auxiliary Building are seismically qualified and supported. Thus, it is likely that use of this system can be justified for FLEX use.

The SPC system is presently sized to handle up to ~60-70 MBTU/hr heat load at design conditions [Reference 1]. This represents the reactor decay heat at ~20 hours after shutdown. Thus, placing the SPC system into service to cool the suppression pool at 8 hours will challenge the system's capabilities at present, but will still provide significant cooling to the pool. Information obtained from Alfa Laval for the Model MX25-BFD plate heat exchanger (HX) currently installed at RBS indicates that as much as 118 MBTU/HR would be removed with a 200°F inlet temperature and 90°F outlet temperature, which would be more than adequate to remove the expected decay at 8 hours of ~90 MBTU/hr [Reference 2]. This results in a fairly high, but not prohibitive, SSW return temperature of 178°F [Reference 3].

Two 2500 gpm FLEX pumps (electric motor-driven and powered from a FLEX diesel generator) provide primary and alternate connection points for cooling water to the SPC Heat Exchanger.

Maintain Core Cooling

BWR Portable Equipment Phase 2:

Either pump would be powered by a single 480VAC, 200 kW FLEX DG.

- One pump (FLEX1 Pump) will be permanently staged (but not connected) in the tunnel from the SSW basin to the auxiliary building (G-Tunnel). The FLEX1 pump will be permanently staged in G-Tunnel, 70' level near the west end tunnel termination hatchway. The pump must be adequately secured against seismic events. The pump suction will be connected to line SWP-030-219-3 near the point where it is capped off at the west end of the tunnel. This line extends into the bottom of the SSW basin and was originally intended as a connection to the Unit 2 basin. It will allow the pump to take suction from near the pool bottom via valve SWP-V353, which is operated by a reach rod at basin elevation 118'. The connection into the line may be via a "hot tap" with a welded nipple (10") and flanged connection. A gate valve (FLEX2 valve) will be provided between the flange and an adapter for connecting the pump suction. An adapter and a gate valve (FLEX3 valve) will be provided at an existing flange in the SSW 'B' supply line (at approximately 80' elevation. New (10") permanent piping will be provided from the pump discharge to a location near the FLEX3 valve. The pump will only be connected at the time of the event or for testing. Either short spool pieces or hose runs will be used to make these final connections. Portable lighting from FLEX equipment stores will be required to connect this pump as well.
- A second pump (FLEX2 Pump) will be deployed at grade southeast of the SSW basin near the "west" (Div. II) pipe chase wall. Alternate SSW connections are provided to allow connection of this pump from outside of the pipe chase. A hard line (10") must be run from line SWP-030-219-3 near the point where it is capped off at the west end of the G-Tunnel to the west pipe chase and up to grade level. At this point, a penetration through the west chase outside wall will be made to allow connection to the FLEX2 pump suction. Valve FLEX4 will be added at the connection point with hose connection for the pump. Another line must be run from line SWP-030-26-3 connected at the same point as the FLEX1 pump in the G-tunnel, through the west pipe chase to grade level, and through another penetration in the outside wall. The FLEX2 pump discharge can be connected to this line (through valve FLEX5) from outside the pipe chase into the 'B' train SSW line.

Staging and connecting a FLEX pump in the G-Tunnel to supply SSW water requires consideration of potential flooding of the tunnel. Also, access is needed to the adjoining E-Tunnel for valve manipulations. While these tunnels themselves are not subject to site flooding and are protected from extreme precipitation, winds, seismic events, etc., there are several lines in the tunnels which are non-safety related, class 4 piping. The largest of these lines is 12", with most being smaller. These lines are part of several systems which may at any time contain water and/or connection to water supplies. Systems are:

- Radwaste
- Floor & Equipment Drains
- Condensate Makeup, Storage, & Transfer
- Reactor Plant Closed Cooling Water

Maintain Core Cooling

BWR Portable Equipment Phase 2:

- Makeup Water
- Fuel Pool Cooling

In the unlikely event that a pipe-break occurred in any of these lines, it potentially could render the tunnels temporarily inaccessible until the flooding was controlled. Since these lines are in close proximity to safety-related piping in the tunnel, they are typically designed as seismic category II/I so that any failure cannot damage the category I equipment. Thus, these lines will be evaluated to withstand seismic events sufficiently to be considered seismically rugged per NEI Guidelines. Some additional pipe supports may be required.

The DBFL at RBS is 96' MSL. Connections for the FLEX pump at grade should be above this level on the SSW basin pipe chase wall. In the event of a maximum flood, the area proposed for staging this pump may not be available unless the pump is located on a trailer or skid which raises its level sufficiently. If flooding precludes use of the FLEX2 pump, the FLEX1 pump can still be used provided that the associated FLEX DG is deployed to higher ground.

With the arrangement above, reactor decay heat will be rejected to the standby SSW cooling tower (UHS). Since the fans are not powered due to ELAP, heat removal by the tower will be significantly reduced and will only be provided by natural draft. The natural draft cooling and evaporation is expected to be sufficient enough to allow continued use of the SSW basin water well into Phase 3.

GOTHIC calculations [Reference 6] show that placing the present SPC system in service as described above at t= 8 hours, will result in SP temperature peaking at ~210°F at 8 hours into the event. When the UCP is depleted at 60-65 hours into the event, the temperature is predicted to be reduced to near 170°F.

Suppression pool level will reach about 98 feet once the UCP is depleted of water.

Reactor Vessel Injection

When the UCP is depleted, a new injection source will be required. To accomplish this, the vessel will be completely depressurized by opening five SRVs and the SPC system will be aligned to feed the vessel. There will be a spike in SP temperature to about 185 °F when depressurization is completed, after which the temperature reduction in the SP will recommence due to cooling of the SP water by the SPC HX prior to vessel injection. Flow returns to the SP through the open SRVs. The vessel injection lineup must be performed in advance of depressurizing so that level control may continue uninterrupted once RCIC is no longer available.

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

<u>References</u>:

1. SOP-0140, Suppression Pool Cleanup and Alternate Decay Heat Removal (SYS #656), Rev. 025, February 20, 2012
2. ENTGRB125-CALC-009, River Bend Station Decay Heat and Makeup Flow Requirements after Shutdown for Extended Loss of Offsite Power (FLEX), Rev. 0
3. Informal Calculation by Alfa-Laval, Thermal Performance Check for MX25BXFD

Maintain Core Cooling	
BWR Portable Equipment Phase 2:	
Exchanger with Serial # 30101-86027, Transmitted to K.L. Walker (ENERCON) from J. Dafgek (Alfa-Laval) 4. License Amendment Request LAR-1996-0052, "LAR for MR 95-0010, Suppression Pool Cleanup and Alternate Decay Heat Removal System" 5. River Bend Station, Unit 1 Updated Safety Analysis Report, Rev. 23 6. ENTGRB125-CALC-003, River Bend Station Containment GOTHIC Model for Extended Loss of Offsite Power (FLEX), Rev. 0	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
RBS 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*
• Incorporate a method of directly powering the SPC pumps and blower. • Acquire permanently staged and alternate FLEX pumps and install electrical connections • Perform modifications to connect permanently staged and alternate FLEX pumps and add FLEX valves • Install a permanent connection and conduit running from the EJS-SWG1A to a connection point for the FLEX diesel generator	
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 have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment will be protected or scheduled to protect*
Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined. • RBS procedures and programs are being developed to address storage structure requirements,	

Maintain Core Cooling	
BWR Portable Equipment Phase 2:	
haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.	
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level	*List how equipment will be protected or scheduled to protect*
Flooding procedures to provide protection of the FLEX equipment will be written to meet the applicable requirements in NEI 12-06, Section 6.2.3.1.1.c. The schedule to write and implement these procedures is still to be determined. • RBS procedures and programs are being developed to address moving of FLEX equipment from storage areas to areas above the DBFL once it has been determined that a DBF is feasible.	
Severe Storms with High Winds	*List how equipment will be protected or scheduled to protect*
Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined. • RBS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.	
Snow, Ice, and Extreme Cold	*List how equipment will be protected or scheduled to protect*
Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined. • RBS procedures and programs are being developed to address storage structures requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.	
High Temperatures	*List how equipment will be protected or scheduled to protect*
Storage structures will be ventilated to allow for equipment to function. Active cooling systems are not required as normal room ventilation will be utilized per Reference 1. The schedule to construct structures is still to be determined. • RBS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.	

<table>
<tr><th colspan="3">Maintain Core Cooling</th></tr>
<tr><th colspan="3">BWR Portable Equipment Phase 2:</th></tr>
<tr><th colspan="3">Deployment Conceptual Modification
(Attachment 3 contains Conceptual Sketches)</th></tr>
<tr><th>Strategy</th><th>Modifications</th><th>Protection of connections</th></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>Storage location and structure have not yet been decided. Attachment 3 identifies the proposed deployment paths on-site for the transportation of FLEX equipment.</td><td>Determine the number and location of storage and staging locations. Perform hazards analysis on locations and design to ensure they are capable of withstanding FLEX event</td><td>• Plant piping and valves for FLEX connections will be missile protected and enclosed within a Seismic Category 1 or seismically 'rugged' structure, which will inherently protect it from local hazards such as vehicle impact.
• New FLEX piping shall be installed to meet necessary seismic requirements.
• Connection points for the FLEX pump discharge will be designed to withstand the applicable hazards.
• Electrical connection points for the DGs will be established and designed to withstand the applicable hazards.</td></tr>
<tr><td colspan="3">Notes:
<u>References</u>:
1. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide", Rev. 0, August 2012</td></tr>
</table>

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.

With the arrival of additional FLEX equipment from the RRC, the reactor core cooling strategy is to place one loop of RHR into the normal Shutdown Cooling (SDC) mode. One of the two 2500 gpm FLEX pumps (i.e., the FLEX pump being used in the Phase 2 strategy) will provide flow from the basin to the SSW piping. This flow will be routed to the RHR B heat exchangers to allow cooling through that path. The RHR heat exchangers are designed to remove ~126 MBTU/hr under design conditions for suppression pool cooling with 5800 gpm SSW flow [Reference 1]. Estimates are that with 2500 GPM from the SSW FLEX pump, this will be limited to about 60-80 MBTU/hr for SDC. At 72 hours, the decay heat removal requirement is ~48 MBTU/hr [Reference 3]. Thus, SDC will be able to handle the necessary heat removal to keep vessel temperature <200°F, even with reduced SSW flow to the heat exchangers. [Reference 2]. Temperature of water in the SSW basin will have increased due to the heat addition from cooling the SP during the first 72 hours of the event. Conservative estimates assuming no cooling associated with natural convective and evaporative cooling of the return water indicate that the basin temperature could increase by approximately 75-80°F.

Because of the heat removal capability of the RHR heat exchangers, the reduced service water flow, and higher than normal service water inlet temperatures, there is potential for heating the service water outlet flow to temperatures greater than 200°F if SDC is placed in service too soon. The SSW basin temperature should be cooled down to < 140°F (if possible) before aligning SDC.

This will be accomplished by powering up the Division II SSW basin fans from the ENS-SWG01B 4160V bus utilizing a 4160V FLEX portable diesel generator (from the RRC). A DG with >1000 kW capacity is required and unneeded loads must shed before the distribution is reenergized. The fans are powered by EHS-MCC16B (480V) fed from the ENS-SWG01B 4160V bus.

Once conditions in the SSW basin permit establishing SDC, RHR 'B' pump and support equipment/valves can be energized from the Division II electrical distribution. RHR flow may be throttled as needed through the E12-MOVF053B (Div. II power available) to provide cooling capability. The RHR flow path must be established by opening the inboard E12-MOVF009 valve (Div. II power from EHS-MCC2K) remotely. This valve is interlocked closed on high RCIC/RHR area temperature or reactor pressure >135 psig. It may be necessary to jumper these interlocks to open this valve from the control room. Outboard valve E12-MOVF008 (Div. I power) will be unpowered and must be opened manually in the auxiliary building steam tunnel. Line fill pump E12-PC003 will also be brought into service to refill the system. The RHR 'B' system will be readied for service (i.e. filled, vented, warmed, flushed) per plant procedures to the extent possible given plant conditions.

As heated water is returned to the UHS from the plant and the fans are repowered, evaporation of the basin water will increase. Makeup to the basin will eventually be required. This will be done via hauling of water from the Mississippi River using trucks provided by the RRC.

Maintain Core Cooling	
BWR Portable Equipment Phase 3:	
References: 1. SDC-204, Residual Heat Removal System Design Criteria System Number 204, Rev. 004, December 18, 2006 2. ENTGRB125-CALC-012, RHR Heat Exchanger Heat Duty Sensitivity Study for RB FLEX Phase III Coping Strategy, Rev. 0 3. ENTGRB125-CALC-009, River Bend Station Decay Heat and Makeup Flow Requirements after Shutdown for Extended Loss of Offsite Power (FLEX), Rev. 0	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
Entergy will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.	
Identify modifications	*List modifications*
• Install plug in connections to the 4160V buses for the >1MW DG supplied by the RRC.	
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 have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	

Maintain Core Cooling		
BWR Portable Equipment Phase 3:		
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 will be 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 staged at the point of use location (pumps and generators) or temporarily stored at the lay down area shown on Figure 3 until moved to the point of use area. Deployment paths identified on Figure 3 will be used to move equipment as necessary.	No modifications identified for Phase 3 deployment issues	• Plug in connections to the 4160V buses for the 2MW DG supplied by the RRC will be designed to withstand the applicable hazards.

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, with the exception of those MOVs which will fail as-is. SBO procedure AOP-0050 [Reference 1] contains instructions for manual isolation of important containment isolation valves. Valves SFC-MOV121 and SFC-MOV139 are normally open. These valves are AC powered motor operated valves which isolate on vessel Level 2 or high drywell pressure. Since all AC power is immediately lost in the ELAP event, in accordance with NEI 12-06, these valves are assumed not to close. These valves are essential to the success of the response strategy; however, it is prudent to ensure that they remain open following declaration of the FLEX event. Procedures will be changed to include specific instructions not to close or manually open, if necessary, valves SFC-MOV129 or SFC-MOV131 which will be used to supply UCP water. Since, in accordance with NEI 12-06, no non-mechanical valve or pipe failures need be postulated, the containment is assumed to be isolated following the event. As the SP heats up, the containment atmosphere will begin to heat up and slightly pressurize. By 8 hours containment pressure will reach ~5 psig, which is well under the 15 psig design pressure [Reference 2, Section 6.2.1.1.1-1.c].

The containment design temperature of 185°F for the suppression pool will likely be exceeded within 5 hours regardless of actions that can be taken. This limit normally comprises part of the consideration in maintaining containment integrity; however, industry consensus is that this limit should not be inviolable at the conditions and limited time period contemplated for FLEX. Industry initiatives are underway to confirm this position [Reference 7]. Also, Grand Gulf Nuclear Station has had its SP design limit increased to 210°F [Reference 3] by analysis.

SP water level will also be a factor when addressing containment integrity. SRVTPLL and PSP level limit will be likely be exceeded. There is agreement among Mark III owners that at very low vessel pressure such as contemplated for FLEX starting early in Phase 1, these limits may be exceeded without endangering containment integrity. This is being explored further under BWROG initiatives [Reference 7].

Hydrogen Igniters

The NEI guidelines state that hydrogen igniters for Mark III containment units should have a "prioritization approach for deployment." That is, under the extreme conditions postulated in the guidance, a prioritization approach should be outlined to support on-site staff decision-making on whether resources should focus on deployment of FLEX capabilities for fuel damage prevention

[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.

versus for containment protection following fuel damage. This is required even though the FLEX scenario does not postulate that the fuel becomes uncovered such that significant hydrogen production is expected. If the plant staff determines that the installed equipment is functioning well, repowering of hydrogen igniters may become a lower priority than deploying other coping equipment.

Hydrogen igniters are normally AC powered by EHS-MCC2A - Div. I and EHS-MCC2K - Div. II. This power will be lost in the FLEX event. Procedure AOP-0050, Attachment 14 [Reference 1], contains the steps needed to repower the igniters using HCS-ENG1, hydrogen igniter generator. This generator is presently stored on site at the Outside Maintenance Shop, immediately south of the Field Administration Building. In order to take credit for the hydrogen igniter generator as FLEX equipment, it will be moved to protected FLEX storage. The current procedure requires that the generator be deployed and the igniters powered within 3 hours (i.e. Phase 1) following an SBO event. As allowed by the FLEX guidelines, however, consideration of other higher priority activities is allowed. Once ERO personnel arrive at the site, this activity could be carried out more easily because available on-shift operations would most likely be used to perform and prepare for core cooling and containment control tasks.

The igniter system is designed to be turned on before any significant amount of hydrogen has been generated. Therefore, any decision to delay deployment of the igniter generators should take into consideration whether there is currently adequate core cooling and the likelihood that the cooling will continue since no hydrogen will be generated as long as there is adequate core cooling. Since neither EA-12-049 [Reference 4] nor NEI 12-06 [Reference 5], requires the assumption of core damage, for an ELAP event, the igniter generator will be staged and connected but not started. This would free up resources required to monitor and maintain the diesel generator in operation for other FLEX related actions. If adequate core cooling is lost as indicated by vessel level falling below top of active fuel or coolant injection being interrupted for more than 15 minutes, those resources would be redirected to the igniter diesel generator.

As indicated in Attachment 14 of Procedure AOP-0050 [Reference 1], only 1 division of igniters will be energized. One division provides igniter coverage for the entire containment [Reference 6 Bases Section B 3.6.3.2]. Which one is chosen will depend on access available to the East or West Auxiliary Building doors based on any debris issues, flooding, or other considerations.

<u>References</u>:

1. AOP-0050, Station Blackout, Rev. 043, April 12, 2012
2. River Bend Station, Unit 1 Updated Safety Analysis Report, Rev. 23
3. Grand Gulf Engineering Report, GGNS-ER-10-00075, Rev. 002, January 20, 2012
4. U.S. Nuclear Regulatory Commission, EA-12-049, *Order to Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events*, ML12054A735, March 12, 201
5. Nuclear Energy Institute, NEI 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide*, Revision 0, August 2012
6. River Bend Station, Technical Specifications, as revised through Amendment 174.
7. BWROG 13013 – Frederick P. "Ted" Shiffley, II, BWROG to David Skeen, USNRC, "Transmittal of NEDC-33771P Revision 1 and NEDO-33771 Revision 1, Boiling Water Reactors Owners' Group Technical Report, 'GEH Evaluation of the FLEX Implementation Guidelines', January 2013 (TPN: BWROG-TP-13-XXX)'," January 31, 2013

Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
RBS 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*
None	
Key Containment Parameters	*List instrumentation credited for this coping evaluation.*

Containment Essential Instrumentation	Safety Function
Primary Containment Pressure (CMS-PT4A)	Containment integrity
Suppression Pool Water Level (CMS-LT23A)	Containment integrity
Suppression Pool Temperature (CMS-RTD40A)	Containment integrity
Primary Containment Temperature (CMS-RTD41A)	Containment integrity

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. At t~8 hours, SP cooling is initiated using the SPC system as described in Core Cooling Phase 2. This will result in a gradual reduction in SP temperature after peaking at around 210°F at about 8 hours, falling to about 170°F in 65 hours. Containment pressure increases to approximately 13 psig prior to decreasing due to pool cooling. SP level will continue to rise until external sources of injection (i.e. UCP) are terminated. Water will reach a level of ~97' in the containment (and eventually in the drywell). *Hydrogen Igniters* Phase 2 will utilize the hydrogen igniter diesel generators as discussed in Phase 1.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
See procedures listed in Phase 1 section	
Identify modifications	*List modifications*
See modifications listed in Core Cooling Phase 2 section	
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.*
See instrumentation listed in Phase 1 section Phase 2 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment will be protected or scheduled to protect*
Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined. • RBS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.	

Maintain Containment	
BWR Portable Equipment Phase 2:	
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	*List how equipment will be protected or scheduled to protect*
Flooding procedures to provide protection of the FLEX equipment will be written to meet the applicable requirements in NEI 12-06, Section 6.2.3.1.1.c. The schedule to write and implement these procedures is still to be determined. • RBS procedures and programs are being developed to address moving of FLEX equipment from storage areas to areas above the DBFL once it has been determined that a DBF is feasible.	
Severe Storms with High Winds	*List how equipment will be protected or scheduled to protect*
Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined. • RBS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.	
Snow, Ice, and Extreme Cold	*List how equipment will be protected or scheduled to protect*
Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined. • RBS procedures and programs are being developed to address storage structures requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.	
High Temperatures	*List how equipment is protected or schedule to protect*
Storage structures will be ventilated to allow for equipment to function. Active cooling systems are not required as normal room ventilation will be utilized per Reference 1. The schedule to construct structures is still to be determined. • RBS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.	

Maintain Containment		
BWR Portable Equipment Phase 2:		
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*
Hydrogen igniters will be deployed as stated in Phase 1	None	Hydrogen igniters will be stored in FLEX structures. Connection points will be designed to withstand the applicable hazards.

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 Phase 3 containment strategy continues from Phase 2 until RHR shutdown cooling mode can be placed in service as discussed in core cooling Phase 3. In this mode, the SSW cooling water previously being supplied to the SPC heat exchangers is routed to the RHR B heat exchangers. This essentially terminates significant heat addition to the containment, allowing the SP and containment to begin cooling down via natural convection and conduction. Should level control be required, SPC may be used to inject SP water into the vessel through the vessel injection path described in core cooling Phase 2. *Hydrogen Igniters* Recovery of EHS-MCC2K in Phase 3 will return power to Div. II hydrogen igniters.

Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
See Phase 2 discussion.	
Identify modifications	*List modifications*
None	
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.*
See Phase 2 discussion. Phase 3 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	

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

Maintain Spent Fuel Pool Cooling	
Determine Baseline coping capability with installed coping[3] modifications not including FLEX modifications, utilizing methods described in Table 3-1 of NEI 12-06: • **Makeup with Portable Injection Source**	
BWR Installed Equipment Phase 1:	
Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain spent fuel pool cooling. Identify methods (makeup with portable injection source)and strategy(ies) utilized to achieve this coping time There are no phase 1 actions required at this time that need to be addressed. Fuel in the SFP is cooled by maintaining 23' of water over top of fuel.	
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 to 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, Specification 3.7.6]	
Identify modifications	*List modifications*
• Modification to install SFP level instrumentation per Order EA-12-051	
Key SFP Parameters	*List instrumentation credited or recovered for this coping evaluation.*
Per NRC Order EA-12-051	
Notes: <u>References</u> 1. River Bend Station, Technical Specifications, as revised through Amendment 174.	

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

Maintain Spent Fuel Pool Cooling
BWR Portable Equipment Phase 2:

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

Primary Strategy – Method 1

Based on design loading conditions in the SFP, the time to reach 212°F and begin boiling will occur at t= 9.8 hours [Reference 1]. The required makeup rate to maintain the SFP volume during this time is 34.5 gpm [Reference 1].

Makeup to the SFP is provided by one of three baseline capabilities. The first method is with the FLEX3 pump connected to the SSW basin and running hose to the SFP as described in OSP-0066 [Reference 2], Attachment 13, Section 3.2.

Venting will be provided by opening the fuel building doors as described in the Safety Functions Support Phase 2 section below.

Alternate Strategy – Method 2

The second means to provide water to the SFP utilizes the FLEX pump connected to the SSW basin and running hose to valve SFC-V66 on line SFC-010-36-3. This will feed water directly into the suppression pool.

Alternate Strategy – Method 3

The third method is to connect a hose to the spray nozzle on the refuel floor as described in OSP-0066 [Reference 2], Attachment 13, Section 3.2.7.

Refueling

During modes 5, using the design basis heat load, the SFP could begin to boil at approximately t= 4.5 hours and fuel could be uncovered at approximately t=87.6 hours [Reference 1]. Also, if fuel were being stored in the upper containment pool, the upper containment pool could begin to boil at approximately t= 2.3 hours and fuel could be uncovered at approximately t=44.9 hours [Reference 1]. A total makeup flow rate of 54.7 gpm is sufficient to maintain the water level in both the UCP and the RPV. An additional 34.5 gpm would be required for the SFP. [Reference 1].

Primary Strategy

Makeup water to the SFP will be provided using the same method as Modes 1, 2, and 3, as described above.

Makeup water to the upper containment pool will be provided by repowering SPC Pump P1A and aligning valves to pump water from the Suppression Pool to the upper containment pool The SPC pumps will be powered directly from a FLEX diesel generator (DG) positioned at grade outside the auxiliary building on the west side ("west canyon"). Note that all SPC logic and control power is assumed lost such that direct powering of the pumps at the motors themselves is required.

Alternate Strategy

The alternate strategy for makeup water to the SFP is the same as alternate strategy used in modes 1-

Maintain Spent Fuel Pool Cooling	
BWR Portable Equipment Phase 2:	
3, as described above. Makeup water to the upper containment pool could be provided by repowering SPC Pump P1B and aligning valves to pump water from the Suppression Pool to the upper containment pool as described above. References: 1. ENTGRB125-CALC-005, River Bend Station Spent Fuel Pool and Upper Containment Pool Time to Boil and Uncover Fuel for Extended Loss of Offsite Power (FLEX), Rev. 0 2. OSP-0066, Extensive Damage Mitigation Procedure, Rev. 018, February 29, 2012 3. Nuclear Energy Institute, 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*
RBS 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 Parameters	*List instrumentation credited or recovered for this coping evaluation.*
Per NRC Order EA-12-051 Phase 2 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment will be protected or scheduled to protect*
Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined. • RBS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.	

<table>
<tr><td colspan="2">Maintain Spent Fuel Pool Cooling</td></tr>
<tr><td colspan="2">BWR Portable Equipment Phase 2:</td></tr>
<tr><td>Flooding
Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.</td><td>List how equipment will be protected or scheduled to protect</td></tr>
<tr><td colspan="2">Flooding procedures to provide protection of the FLEX equipment will be written to meet the applicable requirements in NEI 12-06, Section 6.2.3.1.1.c. The schedule to write and implement these procedures is still to be determined.
• RBS procedures and programs are being developed to address moving of FLEX equipment from storage areas to areas above the DBFL once it has been determined that a DBF is feasible.</td></tr>
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<tr><td colspan="2">Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined.
• RBS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.</td></tr>
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• RBS procedures and programs are being developed to address storage structures requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.</td></tr>
<tr><td>High Temperatures</td><td>List how equipment will be protected or scheduled to protect</td></tr>
<tr><td colspan="2">Storage structures will be ventilated to allow for equipment to function. . Active cooling systems are not required as normal room ventilation will be utilized per Reference 1. The schedule to construct structures is still to be determined.
• RBS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.</td></tr>
</table>

Maintain Spent Fuel Pool Cooling		
BWR Portable Equipment Phase 2:		
Deployment Conceptual Design **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection will be protected*
• The pumps used to provide the SFP cooling and makeup function will be stored and deployed similarly to pumps required for core cooling Phase 2 • The monitor spray nozzle and fire hoses needed to spray and or makeup to the SFP will kept at an accessible and protected area	• None	Connection points will be designed to withstand the applicable hazards.

Maintain Spent Fuel Pool Cooling	
BWR Portable Equipment Phase 3:	
Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain spent fuel pool cooling. Identify methods (makeup with portable injection source) and strategy(ies) utilized to achieve this coping time. Same as Phase 2.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
N/A	
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 Phase 3 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	

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

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 habitability must be maintained for the duration of the ELAP. During the ELAP, some control room vital electronics, instrumentation, and emergency lighting remain energized from emergency DC power sources. The current calculation for MCR heatup shows that at the end of Phase 1, the MCR temperature will reach approximately 88°F [Reference 1]. This assumes load shedding of non-vital loads and removing of ceiling tiles as specified in the SBO procedure. The Phase 1 strategy is to shed DC loads, remove 80 ceiling panels and to open the control room doors through the elevator corridor to the stairwell once the control room temperature exceeds the outdoor ambient temperature. The doors will be propped open from the stairwell to the door on the roof. Portable battery powered fans will be placed in the doorways to provide cool air, once the air in the control room exceeds the outside ambient temperature. The calculation does not assume that the doors to the control room are opened, however, if the control room temperature ever exceeds the outside ambient temperature, this would be an effective mitigation to cool the control room.

RCIC Room Accessibility

The RCIC room will have a large heat load under ELAP conditions, as RCIC is utilized throughout the event as the primary source of core cooling. The RCIC room ambient temperature limit is 186.4°F [Reference 2, Specification 3.3.6.1]. An ELAP GOTHIC calculation [Reference 3] was performed to evaluate RCIC room heatup for two scenarios: 1) the RCIC room remains isolated throughout the event; and 2) the RCIC room door to the RHR C room is opened at t=1 hour into the ELAP. Both cases were run through to 72 hours (i.e. Phase 1 and Phase 2 of the ELAP). At the end of Phase 1 (i.e., 8 hours) with the RCIC room isolated, the temperature rises to approximately 166°F. With the RCIC room door to the RHR C room opened at t=1 hour, the temperature in the RCIC room rises to approximately 142°F at 8 hours. Therefore, the RCIC room will be well below the 186.4°F limit in both cases. If personnel access becomes necessary, the door between the RCIC room and the RHR room could be opened and supplemental measures to satisfy plant heat stress guidelines [Reference 4].

The Gland Seal Compressor for RCIC will not be maintained on the dc power system. The loss of the Gland Seal Compressor will make the RCIC room an airborne contamination area. Therefore, if

[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.

personnel habitability becomes necessary, personnel will be required to wear the appropriate PPE due to airborne contamination.

Standby Switchgear and DC Equipment Rooms

Standby Switchgear rooms have a significant heat load during an ELAP, and thus must be evaluated for equipment functionality. Based on calculations performed for ELAP [Reference 5] switchgear rooms rise to a temperature of 130°F at 72 hours. This is assuming that operators are able to open the doors to the switchgear rooms as required by the Station Blackout procedure [Reference 6]. The loss of control building ventilation procedure demonstrates that this can be performed with 30 minutes. The doors to the Standby DC Equipment Room A and B (Doors C116-13 and C116-6, respectively) will also need to be opened within the first 30 minutes of the ELAP/LUHS as required by the Station Blackout procedure. Additional analysis will be performed to determine the need for and sizing of portable fans.

References:

1. ENTGRB125-CALC-006, River Bend Station MCR Heatup for Extended Loss of Offsite Power (FLEX), Rev. 0
2. River Bend Station, Technical Specifications, as revised through Amendment 174.
3. ENTGRB125-CALC-004, River Bend Station RCIC Room Heatup for Extended Loss of Offsite Power (FLEX), Rev. 0
4. EN-IS-108, Working in Hot Environments, Rev 010, October 26, 2011
5. ENTGRB125-CALC-002, River Bend Station Switchgear Room Heatup for Extended Loss of Offsite Power (FLEX), Rev. 0
6. AOP-0050, Station Blackout, Rev. 043, April 12, 2012

Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
Entergy 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*
None	
Key Parameter	*List instrumentation credited for this coping evaluation phase.*
None	

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 described above. Based on the results of the MCR heatup calculation, which assumes deep load shedding, removal of ceiling tiles, and the temperature at t=0 hours is 75°F, the temperature at t=72 hours is 101°F. This is well below the 120°F control room temperature limit, therefore, no additional actions would be required to maintain MCR temperatures below 120°F.

Primary Strategy

MCR Appendix R lighting is assumed to fail at the end of Phase 1 (i.e. 8 hours). In order to recharge the divisional batteries, a FLEX diesel generator will be connected to either EJS-SWG1A or EJS-SWG1B. These buses power EHS-MCC14A or EHS-MCC14B, respectively [Reference 1]. EHS-MCC14A provides power to POP-LTGR02, while EHS-MCC14B provides power to POP-LTGR03, two of the control room backup lighting system receptacles [Reference 2]. Therefore, by connecting the FLEX diesel generator to either bus EJS-SWG1A or EJS-SWG1B control room lighting would be available.

Alternative Strategy

Supplemental lighting will be provided in Phase 2 for control room operators.

RCIC Room Accessibility

As described above, an ELAP GOTHIC model was created to determine the maximum RCIC room temperature through Phase 2 (i.e., 72 hours). The results of the GOTHIC model determined that at t=72 hours, with RCIC room isolation, the maximum room temperature is 174°F. If the RCIC room door to RHR C is opened at t=1 hour into the ELAP, the maximum room temperature is 167°F. Both of these temperatures are below the 186.4°F Tech Spec limit. Based on these results, the door to the RCIC room is not required to be opened at any time throughout the ELAP. Not opening this door has an added benefit of reducing airborne contamination due to RCIC gland seal leakage in the RCIC room. If personnel are required to enter the RCIC room, the door from RHR C could be opened and supplemental measures to satisfy plant heat stress guidelines [Reference 3] considered. Due to the gland seal leakage, the RCIC room would be an airborne contamination area and appropriate PPE would be required to enter the RCIC room and potentially the RHR C room if the door between the two rooms is opened.

Standby Switchgear and Standby DC Equipment Rooms Accessibility

Based on the results described in Phase 1, no additional actions are required for Phase 2 for functionality of equipment in the Standby Switchgear or the Standby DC Equipment rooms. As stated in the Phase 1 discussion, additional analysis will be performed to determine the need for and

Safety Functions Support
BWR Portable Equipment Phase 2

sizing of portable fans.

SPC Pump Room Accessibility

Accessibility for the SPC Pump Room is provided by cooling water supplied to the SPC Pump Room Unit Cooler via the Standby Service Water System. The SPC FLEX DG will be connected via a permanently installed connection to the SPC Room Unit Cooler. When flow to the SPC Heat Exchanger is established in Phase 2, cooling to the room is also established.

Battery Room Ventilation

Calculations performed for the battery rooms show that the room temperatures do do not exceed 125°F through Phase 2 (i.e., 72 hours) [Reference 4]. However, during battery charging operations in Phase 2 and Phase 3, ventilation is required in the battery rooms due to hydrogen generation as a result of battery charging. Hydrogen generation does not begin until battery charging begins. The Division I battery room fans are powered from bus EHS-MCC14A, which is powered by EJS-SWG1A [Reference 1 and Reference 2]. The Division II battery room fans are powered from bus EHS-MCC14B, which is powered by EJS-SWG1B [Reference 1 and Reference 2]. During the ELAP, the batteries would be charged in one of three ways: 1) connect FLEX diesel generator to EJS-SWG1A which powers battery charger ENB-CHGR1A which provides 125VDC to ENB-SWG01A that charges the Division I batteries; 2) connect FLEX diesel generator to EJS-SWG1B which powers battery charger ENB-CHGR1B which provides 125VDC to ENB-SWG01B that charges the Division II batteries; or 3) connect the FLEX diesel generator to the swing charger BYS-CHGR1D, which is capable of recharging either of the divisional batteries.

Primary Strategy

Connecting the FLEX diesel to either EJS-SWG1A or EJS-SWG1B would not only charge the batteries, but would also provide power to the respective battery room fan. However, connecting the FLEX diesel generator to the swing charger (i.e. BYS-CHGR1D) would not repower the battery room fans. The battery room fans are efficient at removing sufficient hydrogen as to maintain the hydrogen concentration below the lower explosive limit (LEL) as determined by calculation G13.18.2.1-092 [Reference 5].

Alternate Strategy

If the swing charger were to be used, temporary battery powered fans and ductwork would be utilized to remove sufficient hydrogen to remain below the LEL.

Spent Fuel Pool Area

Per NEI 12-06 [Reference 6] guidance, a baseline capability for Spent Fuel Cooling is to provide a vent pathway for steam and condensate from the SFP. In order to establish a vent pathway for steam and condensate, the double doors on the 95' elevation (door F95-1) to the new fuel receiving area will be opened. Door F113-2 will be opened to the stairwell and door F171-1 will be opened on the roof. Because cooler air will be allowed to enter the fuel building through the F95-1 doors, a chimney effect will be established through the stairwell to the roof.

References:

Safety Functions Support	
BWR Portable Equipment Phase 2	
1. EE-001AC, Start Up Electrical Distribution Chart, Rev. 45 2. EE-001WA, 480V One Line Diagram EHS-MCC14A & B Standby Switchgear Room 1A, Rev. 11 3. EN-IS-108, Working in Hot Environments, Rev 010, October 26, 2011 4. ENTGRB125-CALC-001, River Bend Station Battery Room Heatup for Extended Loss of Offsite Power (FLEX), Rev. 0 5. G13.18.2.1-092, Control Building Div. I and II Battery Rooms Hydrogen Concentration, Rev. 0, November 20, 2008 6. Nuclear Energy Institute, 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*
Entergy will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.	
Identify modifications	*List modifications*
• Install a connection to the SPC Room Unit Cooler from the FLEX SPC Pump DG	
Key Parameter	*List instrumentation credited for this coping evaluation phase.*
Phase 2 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment will be protected or scheduled to protect*
Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined. • RBS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.	
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	*List how equipment will be protected or scheduled to protect*

Safety Functions Support	
BWR Portable Equipment Phase 2	
Flooding procedures to provide protection of the FLEX equipment will be written to meet the applicable requirements in NEI 12-06, Section 6.2.3.1.1.c. The schedule to write and implement these procedures is still to be determined. • RBS procedures and programs are being developed to address moving of FLEX equipment from storage areas to areas above the DBFL once it has been determined that a DBF is feasible.	
Severe Storms with High Winds	*List how equipment will be protected or scheduled to protect*
Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined. • RBS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.	
Snow, Ice, and Extreme Cold	*List how equipment will be protected or scheduled to protect*
Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined. • RBS procedures and programs are being developed to address storage structures requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.	
High Temperatures	*List how equipment will be protected or scheduled to protect*
Storage structures will be ventilated to allow for equipment to function. . Active cooling systems are not required as normal room ventilation will be utilized per Reference 1. The schedule to construct structures is still to be determined. • RBS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to RBS.	

Safety Functions Support		
BWR Portable Equipment Phase 2		
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 fans that will be deployed for room cooling will be stored in the FLEX Storage Building and deployed via identified and evaluated haul routes to the power block and their staging areas.	• No other modifications are necessary, beyond those already identified (buildings) for deployment of the strategies associated with the Phase 2 support function	• Connection points will be protected from applicable hazards.
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 MCR will continue to heat up as the result of operating equipment, lights, and personnel habitability. In order to reduce the temperature in the MCR, portable fans and ductwork will be provided by the RRC to effectively reduce the temperature in the MCR.

RHR Room Accessibility

Primary Strategy

During Phase 3 the RHR B pump room will begin to heat up as a result of operating the RHR B pump. In order to reduce the temperature in the RHR B pump room, portable fans and ductwork will be provided by the RRC to effectively reduce the temperature in the RHR B pump room.

Alternate Strategy

Alternatively, the RHR B pump room coolers could be reenergized and valves could be opened to supply cooling water from the SSW basin. However, in order to preserve service water volume for core cooling, the preferred solution is to use portable fans and ductwork supplied by the RRC.

Other Support Requirements

Other areas of support required in Phase 3 are the same as described in the Phase 2 section of Safety Function Support.

References:

None

Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
See Phase 2 discussion.	
Identify modifications	*List modifications*
See Phase 2 discussion.	
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.*
Phase 3 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	

Safety Functions Support		
BWR Portable Equipment Phase 3		
Deployment Conceptual Design **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection will be protected*
See Phase 2, Safety Functions Support	See Phase 2, Safety Functions Support	See Phase 2, Safety Functions Support

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
Staged SSW FLEX Pump	X	X				2500 gpm	Will follow EPRI template requirements
Portable SSW FLEX Pump	X	X				2500 gpm	Will follow EPRI template requirements
Two (2) 480V Diesel Generators	X	X		X	X	200kW to charge divisional batteries	Will follow EPRI template requirements
Two (2) 480V diesel generators	X	X				200kW to provide power to staged SSW FLEX pump or portable SSW FLEX pump	Will follow EPRI template requirements
Two (2) 480V diesel generators	X	X				200kW to provide power to SPC Pump 1A or 1B and associated unit cooler	Will follow EPRI template requirements
Two (2) diesel powered Pumps			X			200 gpm to provide makeup water to the SFP	Will follow EPRI template requirements
Two (2) Hydrogen Igniter Diesel Generators		X				20kW generators to provide power to hydrogen igniters	Will follow EPRI template requirements
Air Bottles	X			X		Supplied air to maintain SRV operational and SP Level indicator	Will follow EPRI template requirements
Two (2) Trucks					X	Vehicles with sufficient rating that can tow the pumps and DGs	Will follow EPRI template requirements
Two (2) flatbed trailers					X	Used to move equipment	N/A
Two (2) fuel trailers	X	X	X	X	X	Used to provide fuel to diesel generators	N/A

Notes:

(1) The number of storage locations has not been determined. For the purposes of this table two storage locations have been assumed 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) 4160VAC Diesel Generators	X	X	X	X		4160 VAC	To power RHR, etc.
Two (2) 480VAC Diesel Generators	X	X				480 VAC	To power various smaller loads
Two (2)sets of Cables for connecting portable generators	X	X	X	X		N/A	Supply as required
Four (4) Portable ventilation fans	X	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
Two (2) Water Trucks	X	X	X			Used to provide makeup water from Mississippi River to SSW basin	

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	Time Constraint Y/N [5]	Remarks / Applicability
	0	**Event Starts**	NA	Plant @100% power
1	60 sec	RCIC starts	N	Reactor operator initiates or verifies initiation of reactor water level restoration with steam driven RCIC
2	~60 sec	RCIC Suction swaps from CST to SP based on low water in CST	N	Automatic
3	10-60 min	Operators attempt to restart EDGs	N	.
4	1 hr	Operators enter ELAP/FLEX Procedure	Y	Time critical at a time greater than 1 hour. Entry into ELAP provides guidance to operators to perform ELAP actions.
5	1 hr	Using manual control of SRVs depressurize the RPV IAW EOPs (to approximately 100 - 200 psig) to keep in the Safe Region of the HCTL curve.	Y	Time critical at the point of entering the Unsafe Region of the HCTL Curve (Approximately 3 hours). EOPs require operators to keep reactor pressure and temperature from causing entry into unsafe region of HCTL curve
6	1 hr	DC Load shed begins	Y	DC buses are readily available for operator access
7	1 hr	Remove ceiling tiles in MCR	Y	Maintains MCR habitability

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

Action item	Elapsed Time	Action	Time Constraint Y/N [5]	Remarks / Applicability
8	3 hr	Deploy hydrogen igniter	N	Maintain containment integrity. This action only becomes critical if core cooling is lost and fuel is damaged. Deploying the generator is a contingency action that addresses containment integrity.
9	5 hr	Start valve re-alignment to swap RCIC suction from SP to UCP to preserve RCIC availability	Y	Preserves RCIC suction
10	~ 6 hr	Initiate cross-tie of Division II batteries to Division I bus	Y	Extends battery life
11	6 hr	Start alignment of SSW FLEX Pump and SPC Pump and initiate operation by 8 hours	Y	Provides containment heat removal by cooling suppression pool
12	8 hr	SBO/FLEX Divisional battery diesel generator operational	Y	Supplies power to divisional batteries
13	8 hr	Connect compressed air cylinders	Y	Maintains operation of SRVs and SP level indicator
14	8 hr	Begin makeup to SFP as necessary to maintain adequate level. (Boiling under design basis conditions begins at about 4.5 hours, reaches top of fuel at ~87 hours, and requires 54.7 gpm makeup). Vent the SFP area to minimize condensation during pool boiling by opening doors.	N	Boil-off rate is slow with a large volume of water in the SFP. Time shown assumes worst case emergency offload heat load
15	~60 hr	Depressurize RPV and align SPC system to provide core cooling. SPC pump suction is from the SP and return water from the RPV is through the SRVs back to the SP.	Y	This will reduce pressure so SPC pumps can inject directly into vessel and continue core cooling
16	72 hr	Transition from Phase 2 to Phase 3 for core cooling function by placing RRC diesel generator in service and aligning SDC via SSW basin	N	SDC established

Attachment 1B
NSSS Significant Reference Analysis Deviation Table
(NEDC 33771P, GEH Evaluation of FLEX Implementation Guidelines)

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

Attachment 2
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}*
October 2012	Submit 60 day Status Report	Complete
Feb. 2013	Submit Overall Integrated Implementation Plan	Complete
	Purchase Equipment	
Aug 2013	Submit 6 Month Status Report	
	Develop Mods	
	Develop Strategies (Playbook) with RRC	
	Procure Equipment	
Feb 2014	Submit 6 Month Status Report	
	Issue FPs	
	Create Maintenance Procedures	
Aug 2014	Submit 6 Month Status Report	
	Procedure Changes Training Material Complete	
	Develop Training Plan	
Feb 2015	Submit 6 Month Status Report	
Feb 2015	Implementation Outage*	
	Implement Training	
Aug 2015	Submit 6 Month Status Report	
	Perform Staffing Study	
Feb 2016	Submit 6 Month Status Report	
Aug 2016	Submit 6 Month Status Report	
Dec 2016	Implement Non-Outage Mods*	
Dec 2016	Submit Completion Report	

*(Full compliance by 12/31/2016 since second refueling outage is after 12/31/2016)

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 River Bend Station FLEX Strategies

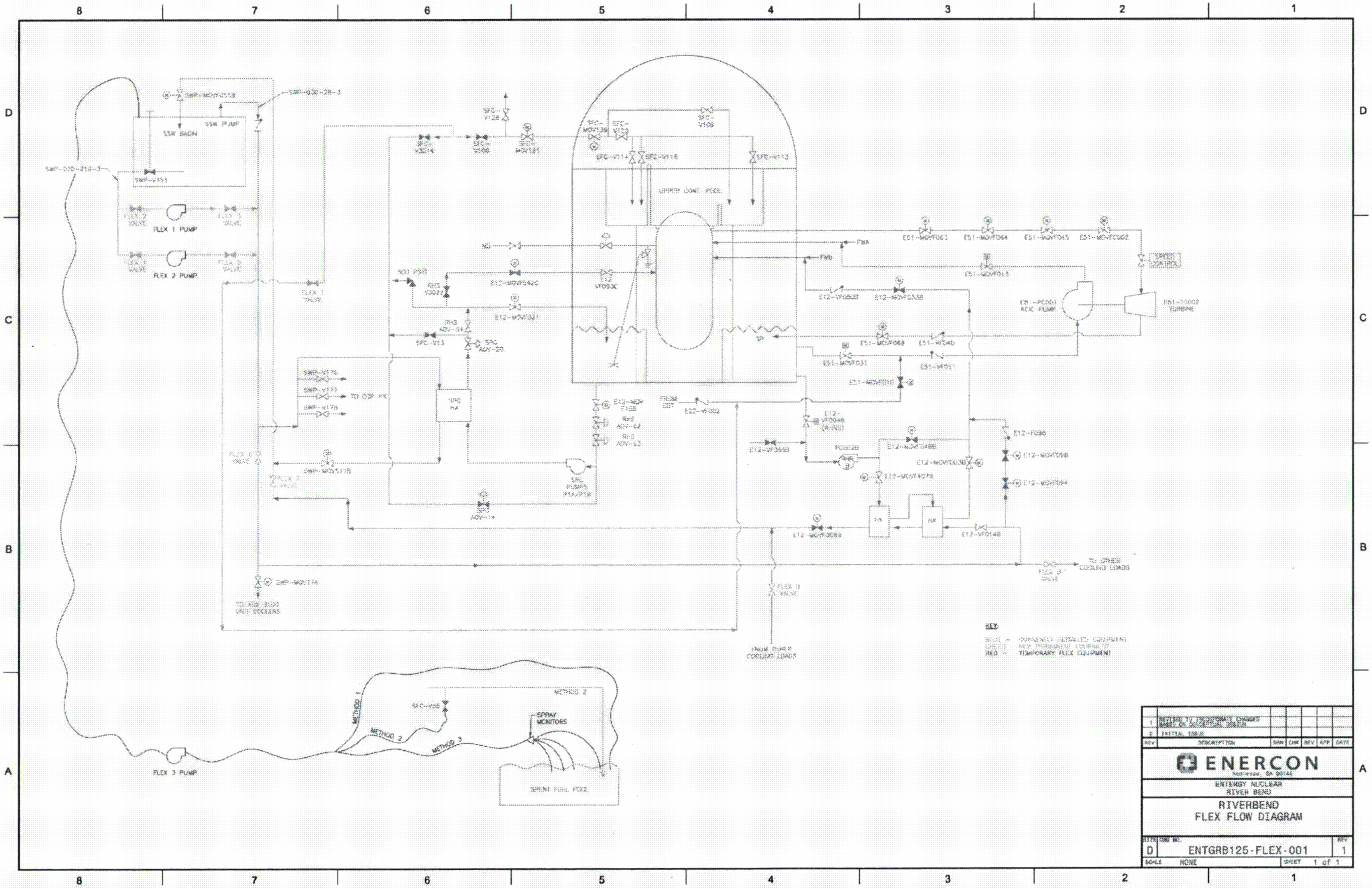
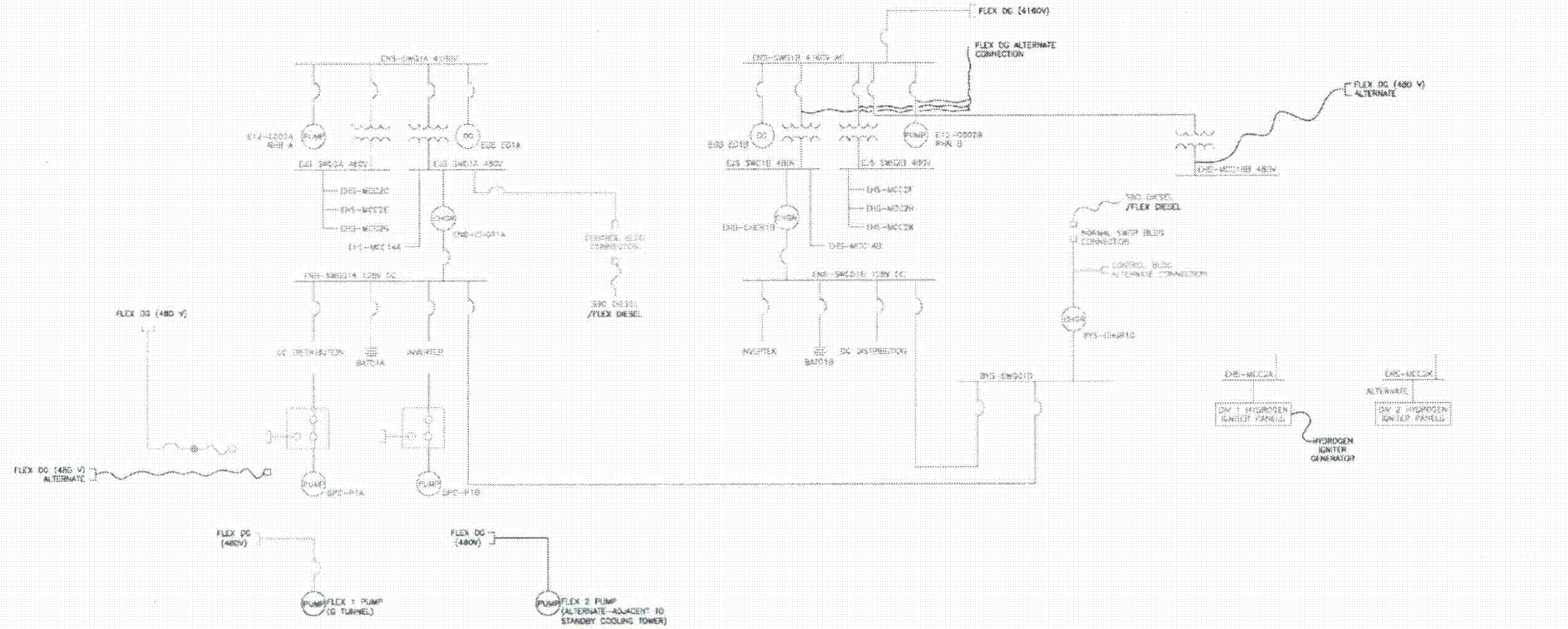


Figure 2 - Electrical Diagram for River Bend Station FLEX Strategies



PHASE I	125V DC		120V AC BUS		480V AC BUS		4160V AC BUS	
	STRATEGY	METHOD	STRATEGY	METHOD	STRATEGY	METHOD	STRATEGY	METHOD
	PROVIDE CRITICAL INSTRUMENTATION RCIC	125V DC BUSES SUPPLIED BY BATTERIES (CROSSTIE IF NECESSARY)	120V VITAL AC POWER AVAILABLE	VITAL AC POWER SUPPLIED BY INVERTERS	480V POWER NOT AVAILABLE	N/A	4160V AC POWER NOT AVAILABLE	N/A
PHASE II	CHARGE 125V DC BATTERIES CRITICAL INSTRUMENTS EMERGENCY LIGHTING	POWER BATTERY CHARGER FROM SBO DIESEL/FLEX DG	POWER 120 VITAL AC	VITAL AC POWER SUPPLIED BY INVERTERS	480V POWER FOR SFC PUMP P1A OR P1B EMERGENCY LIGHTING	DIRECT CONNECTION OR FLEX DIESEL TO PUMP	4160V AC POWER NOT AVAILABLE	N/A
PHASE III	CHARGE 125V DC BATTERIES CRITICAL INSTRUMENTS EMERGENCY LIGHTING MISCELLANEOUS LOADS	POWER BATTERY CHARGER FROM FLEX DG	POWER 120 VITAL AC	VITAL AC POWER SUPPLIED BY INVERTERS	POWER 480V MCCS EJS-SWG1A AND SWG2A POWER BATTERY CHARGERS POWER 480V MCC	POWER 480V MCCS EJS-SWG1A AND SWG2A	POWER 4160V AC BUS	POWER 4160V AC BUS VIA OFFSITE DG

ENERCON
ENTERGY NUCLEAR
RIVER BEND
RIVERBEND
FLEX ELECTRICAL DIAGRAM
SIZE D DWG NO. ENTGRB125-FLEX-002 REV 1
SCALE NONE SHEET 1 OF 1

Figure 3 – River Bend Station Site Layout