ENCLOSURE 1, ATTACHEMENT 3 OF THIS LETTER CONTAINS SECURITY-RELATED INFORMATION AND MUST BE PROTECTED ACCORDINGLY. UPON SEPARATION OF THE ENCLOSURES, THIS LETTER IS DECONTROLLED.

TVA

L44 140207 002

Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-14-014

February 7, 2014

10 CFR 2.202

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

Watts Bar Nuclear Plant, Unit 1
Facility Operating License No. NPF-90
NRC Docket No. 50-390

Watts Bar Nuclear Plant, Unit 2
Construction Permit No. CPPR-92
NRC Docket No. 50-391

Subject: **Revised Overall Integrated Plan in Response to the 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) for Watts Bar Nuclear Plant (TAC Nos. MF0950 and MF1177)**

References:

1. Letter from TVA to NRC, "Tennessee Valley Authority (TVA) - Overall Integrated Plan in Response to the 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) for Watts Bar Nuclear Plant," dated February 28, 2013 (ML13067A030)

2. Letter from TVA to NRC, "First Six-Month 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) for Watts Bar Nuclear Plant," dated August 28, 2013 (ML13247A288)

3. Letter from NRC to TVA, "Watts Bar Nuclear Plant, Units 1 and 2 - Interim Staff Evaluation Relating to Overall Intergraded Plan in Response to Order EA-12-049 (Mitigation Strategies) (TAC Nos. MF0950 and MF1177)," dated December 20, 2013 (ML13343A025)

"Enclosure(s) transmitted herewith contain(s) SUNSI. when separated from Enclosure 1, Attachment 3, this transmittal document is decontrolled."

On February 28, 2013, the Tennessee Valley Authority (TVA) submitted an Overall Integrated Plan (OIP) in response to the March 12, 2012, Commission Order modifying licenses with regards to requirements for mitigation strategies for beyond-design-basis external events, Order number EA-12-049, for the Watts Bar Nuclear Plant (WBN), Units 1 and 2 (Reference 1). On August 28, 2013, TVA provided the first six-month status report to the OIP (Reference 2).

The OIP submitted in Reference 1 employed a strategy using reactor coolant pump (RCP) low leakage seals. TVA has revised its strategy to use the existing conventional RCP seals. This change in RCP seals requires a revision to the OIP submitted by Reference 1. These changes mainly impact Attachment 1A, "Sequence of Events Timeline," and required a revision to the reactor coolant inventory calculation supporting this strategy.

These changes were presented and discussed with the Nuclear Regulatory Commission (NRC) through the mitigation strategies audit process. Based on a review of TVA's plan, including the six-month update, and information obtained through the mitigation strategies audit process, the NRC concluded in its Interim Staff Evaluation that the plan, when properly implemented, will meet the requirements of Order EA-12-049 at WBN, Units 1 and 2 (Reference 3). The Interim Staff Evaluation included two open items. Open item 3.2.1.6.A requires revision to the Sequence of Events due to use of the conventional RCP seals, for reanalysis by the NRC. The revised OIP provides that information. The second open item, 3.2.4.8.A, requires resolution for justification regarding use of pre-staged diesel generators. TVA will provide justification regarding use of pre-staged diesel generators by February 28, 2014, to resolve Interim Staff Evaluation open item 3.2.4.8.A.

The purpose of this letter is to provide a revision to the OIP submitted by Reference 1. Specifically, Enclosure 1 of this letter provides the revised OIP. This revised OIP replaces in its entirety the OIP submitted by Reference 1. This revision includes the revised RCP seal strategy and supporting changes previously discussed. This OIP employs submersible intermediate and high pressure mitigation strategy (FLEX) pumps located on elevations 692 and 737 of the auxiliary building rather than FLEX pumps located on the auxiliary building roof. The revised OIP provides information for reanalysis regarding Reference 3, open item 3.2.1.6.A. This revision updates the status to the OIP "Open Items" table. OIP open items 2, 3, 5-8, 11, and 17 are closed and item 13 has started. OIP Attachment 2, "Milestone Schedule," has been revised as noted in the revised target completion date column. This letter also serves as the second six-month status report which is due by February 28, 2014.

The information provided in Attachment 3 to Enclosure 1 is considered to contain information concerning physical protection not otherwise designated as Safeguards Information and is designated "Security Sensitive Information" as defined in 10 CFR 2.390(d)(1). Accordingly, TVA request that the information provided in Attachment 3 to the Enclosure to this letter be withheld from public disclosure.

Enclosure 2 provides a list of regulatory commitments.

If you have any questions regarding this report, please contact Kevin Casey at (423) 751-8523.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 7th day of February 2014.

Respectfully,

J. W. Shea
Vice President, Nuclear Licensing

Enclosures:

1. Watts Bar Nuclear Plant, Mitigation Strategies for Beyond-Design-Basis External Events Revised Overall Integrated Plan
2. List of Commitments

cc (Enclosures):

NRR Director - NRC Headquarters
NRO Director - NRC Headquarters
NRC Regional Administrator - Region II
NRR Project Manager - Watts Bar Nuclear Plant
NRC Senior Resident Inspector - Watts Bar Nuclear Plant
NRR Mitigation Strategies Director - NRC Mitigation Strategies Directorate

ENCLOSURE 1

WATTS BAR NUCLEAR PLANT

MITIGATION STRATEGIES FOR BEYOND-DESIGN-BASIS EXTERNAL EVENTS
REVISED OVERALL INTEGRATED PLAN

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT

UNITS 1 AND 2

FLEX

OVERALL INTEGRATED PLAN

Revision 1

General Integrated Plan Elements Watts Bar Units 1 and 2	
Determine Applicable Extreme External Hazard **Ref: NEI 12-06 Section 4.0 -9.0** **JLD-ISG-2012-01 Section 1.0**	

The Watts Bar site has been evaluated and the following applicable hazards have been identified:

- Seismic events
- External flooding
- Severe storms with high winds
- Snow, ice, and extreme cold
- Extreme heat

The Watts Bar site has been reviewed against the Nuclear Energy Institute (NEI) guidance document NEI 12-06 (Reference 2) and determined that the hazards Flexible and Diverse Coping Mitigation Strategies (FLEX) equipment should be protected from include seismic; external flooding; severe storms with high winds; snow, ice and extreme cold; and extreme high temperatures. Watts Bar has determined the functional threats from each of these hazards and identified FLEX equipment that may be affected. The FLEX storage locations will provide the protection required from these hazards. Watts Bar is also developing procedures and processes to further address plant strategies for responding to these various hazards.

Seismic:

Per NEI 12-06 (Reference 2), seismic hazards must be considered for all nuclear sites. As a result, the credited FLEX equipment will be assessed based on the current Watts Bar seismic licensing basis to ensure that the equipment remains accessible and available after a beyond-design-basis external event (BDBEE) and that the FLEX equipment does not become a target or source of a seismic interaction from other systems, structures or components. From References 4 and 5, Sections 2.5.2.4 and 2.5.2.7, safe shutdown earthquake (SSE) requirements are 0.18g horizontal and 0.12 g vertical maximum rock accelerations. For an operating basis earthquake (OBE), the maximum horizontal and vertical ground accelerations are 0.09g and 0.06 g, respectively. The FLEX strategies developed for Watts Bar will include documentation ensuring that any storage locations and deployment routes meet the FLEX seismic criteria.

Liquefaction

TVA has assessed the potential liquefaction of its FLEX deployment routes and determined that the primary and backup deployment routes are not subject to detrimental liquefaction. (Reference 22)'

External Flooding:

The types of events evaluated to determine the worst potential flood included (1) probable maximum storm on the total watershed and critical sub-water sheds including seasonal variations and potential consequent dam failures and (2) dam failures in a postulated SSE or OBE with guide specified concurrent flood conditions.

Those safety-related facilities, systems, and equipment located in the containment structure are protected from flooding by the Shield Building structure with those accesses and penetrations below the maximum flood level designed and constructed as watertight elements (References 4 and 5, Section 2.4.2.2). From References 4 and 5, Section 2.4.3.6, the Diesel Generator Buildings to the north and the pumping station to the southeast of the main building complex must be protected from flooding to assure plant safety. The Diesel Generator Building's operating floors are at elevation

742.0 ft., which are above the maximum computed elevation, including wind wave run-up. Per References 4 and 5, Section 2.4.14.2.3, the intake pumping station is designed to retain full functional capability to maintain cooling of plant loads. All equipment required to maintain the plant safely during the flood is either designed to operate submerged, is located above the maximum flood level, or is otherwise protected.

Specific analysis of Tennessee River flood levels resulting from ocean front surges and tsunamis is not required because of the inland location of the plant (References 4 and 5, Section 2.4.6). Snow melt and ice jam considerations are also unnecessary because of the temperate zone location of the plant (References 4 and 5, Sections 2.4.2.2 and 2.4.7). Flood waves from landslides into upstream reservoirs required no specific analysis, in part because of the absence of major elevation relief in nearby upstream reservoirs and because the prevailing thin soils offer small slide volume potential compared to the available detention space in reservoirs (References 4 and 5, Section 2.4.2.2). Seiches pose no flood threats because of the size and configuration of the lake and the elevation difference between normal lake level and plant grade (References 4 and 5, Sections 2.4.2.2 and 2.4.5).

Per References 4 and 5, Section 2.4.2.2, the maximum plant site flood level from any cause is elevation 734.9 ft. This information has been superseded by Reference 9. The maximum plant site flood level from any cause is elevation 739.2 ft. (still reservoir). This elevation would result from the probable maximum storm. Coincident wind wave activity results in wind waves of up to 2.2 ft. (crest to trough). Run up on the 4:1 slopes approaching the Diesel Generator Building reaches elevation 741.6 ft. Wind wave run up on the critical wall of the Intake Pumping Station reaches elevation 741.7 ft. and wind wave run up on the walls of the Auxiliary, Control and Shield Buildings reaches elevation 741.0 ft (Reference 9).

In summary, all equipment required to maintain the plant safety during all flooding events including the design basis flood (DBF) is either designed to operate submerged, is located above the maximum flood level, or is otherwise protected. Accordingly, FLEX strategies will be developed for consideration of external flooding hazards. In addition, Watts Bar is also developing procedures and strategies for delivery of offsite FLEX equipment during Phase 3 which considers regional impacts from flooding.

High Wind:

Figures 7-1 and 7-2 from Reference 2 were used for this assessment.

Watts Bar is susceptible to hurricanes as the plant site is within the contour lines shown in Figure 7-1 of Reference 2.

It was determined the Watts Bar site has the potential to experience damaging winds caused by a tornado exceeding 130 mph. Figure 7-2 of Reference 2 indicates a maximum wind speed of 200 mph for Region 1 plants, including Watts Bar. Therefore, high-wind hazards are applicable to the Watts Bar site.

In summary, based on available local data and Figures 7-1 and 7-2 of Reference 2, Watts Bar is susceptible to severe storms with high winds so the hazard is screened in.

Snow, Ice, and Extreme Cold

Per the FLEX guidance all sites should consider the temperature ranges and weather conditions for their site in storing and deploying their FLEX equipment. That is, the equipment procured should be suitable for use in the anticipated range of conditions for the site, consistent with normal design practices.

Applicability of snow and extreme cold:

The Watts Bar Site is located approximately 50 miles northeast of Chattanooga in Rhea County, Tennessee, on the west bank of the Tennessee River at mile 528. The site is approximately 1-1/4 miles south of the Watts Bar Dam and approximately 31 miles north-northeast of the Sequoyah

Nuclear Plant (References 4 and 5, Section 2.1.1.1). The approximate site location is given below, from References 4 and 5, Section 2.1.1.1:

LATITUDE (degrees/minutes): 35°36' N
LONGITUDE (degrees/minutes): 84°47' W

From References 4 and 5, Section 2.3.2.2, mean temperatures at the Watts Bar site have been in the low 40s°F in the winter. Extreme minima temperatures recorded were -20°F at Decatur and -10°F at Chattanooga in the winter.

Outside environment normal operational conditions from Environmental Data Environment Drawing 47E235-36 are given as Average 60, Maximum 95°F and Minimum 13°F. These temperatures were used as a basis in establishing Operational Abnormal temperatures of Maximum 102°F and Minimum 6°F temperatures. This condition could exist for up to 12 hours per excursion and will occur less than 1% of plant life. (Reference 21).

Reference 2 states plants above the 35th parallel should provide the capability to address the hindrances caused by extreme snow and cold. The Watts Bar site is above the 35th parallel; therefore, the FLEX strategies must consider the hindrances caused by extreme snowfall with snow removal equipment, as well as the challenges that extreme cold temperature may present.

Applicability of ice storms:

The Watts Bar site is not a Level 1 or 2 region as defined by Figure 8-2 of Reference 2; therefore, the FLEX strategies must consider the hindrances caused by ice storms.

In summary, based on the available local data and Figures 8-1 and 8-2 of Reference 2, the Watts Bar site does experience significant amounts of snow, ice, and extreme cold temperatures; therefore, the hazard is screened in.

Extreme Heat:

Per Reference 2, all sites must address high temperatures. Virtually every state in the lower 48 contiguous United States has experienced temperatures in excess of 110˚F. Many states have experienced temperatures in excess of 120˚F. Sites that should address high temperatures should consider the impacts of these conditions on the FLEX equipment and its deployment. From References 4 and 5, Section 2.3.2.2, mean temperatures at the Watts Bar site can reach the upper 70s˚F in the summer. Extreme maxima temperature recorded was 108°F at Decatur, Tennessee and 106°F at Chattanooga, Tennessee in the summer.

Outside environment normal operational conditions from Environmental Data Environment Drawing 47E235-36 are given as Average 60, Maximum 95°F and Minimum 13°F. These temperatures were used as a basis in establishing Operational Abnormal temperatures of Maximum 102°F and Minimum 6°F temperatures. This condition could exist for up to 12 hours per excursion and will occur less than 1% of plant life. (Reference 21).

Therefore, for selection of FLEX equipment the Watts Bar site will consider the site maximum expected temperatures in their specification, storage, and deployment requirements, including ensuring adequate ventilation or supplementary cooling, if required.

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:* Assumptions are consistent with those detailed in NEI 12-06, Section 3.2.1. Analysis has been performed consistent with the recommendations contained within the Executive Summary of the Pressurized Water Reactor owners group (PWROG) Core Cooling Position Paper (Reference 13) and assumptions from that document are incorporated in the plant specific analytical bases.

NEI 12-06 Assumptions

The initial plant conditions are assumed to be the following:

- Prior to the event the reactor has been operating at 100 percent rated thermal power for at least 100 days or has just been shut down from such a power history as required by plant procedures in advance of the impending event.
- At the time of the postulated event, the reactor and supporting systems are within normal operating ranges for pressure, temperature, and water level for the appropriate plant condition. All plant equipment is either normally operating or available from the standby state as described in the plant design and licensing basis.

The following initial conditions are to be applied:

- No specific initiating event is used. The initial condition is assumed to be a loss of offsite power (LOOP) at a plant site resulting from an external event that affects the off-site power system either throughout the grid or at the plant with no prospect for recovery of off-site power for an extended period. The LOOP is assumed to affect all units at a plant site.
- All installed sources of emergency on-site ac power and station blackout (SBO) Alternate ac power sources are assumed to be not available and not imminently recoverable.
- Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles are available.
- Normal access to the ultimate heat sink (UHS) is lost, but the water inventory in the UHS remains available and robust piping connecting the UHS to plant systems remains intact. The motive force for UHS flow, i.e., pumps, is assumed to be lost with no prospect for recovery.
- Fuel for FLEX equipment stored in structures with designs which are robust with respect to seismic events, floods and high winds and associated missiles, remains available.
- Permanent plant equipment that is contained in structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles, are available.
- Other equipment, such as portable ac power sources, portable back up dc power supplies, spare batteries, and equipment for 50.54(hh) (2), may be used provided it is reasonably protected from the applicable external hazards per Sections 5 through 9 and Section 11.3 of NEI 12-06 and has predetermined hookup strategies with appropriate procedures/guidance and the equipment is stored in a relative close vicinity of the site.
- Installed electrical distribution system, including inverters and battery chargers, remain available provided they are protected consistent with current station design.
- No additional events or failures are assumed to occur immediately prior to or during the event, including security events.
- Reliance on the fire protection system ring header as a water source is acceptable only if the header meets the criteria to be considered robust with respect to seismic events, floods, and high winds, and associated missiles.

The following additional boundary conditions are applied for the reactor transient:

- Following the loss of all ac power, the reactor automatically trips and all rods are inserted.

- The main steam system valves (such as main steam isolation valves, turbine stops, atmospheric dumps, etc.), necessary to maintain decay heat removal functions operate as designed.
- Safety/Relief Valves (S/RVs) or Power Operated Relief Valves (PORVs) initially operate in a normal manner if conditions in the reactor coolant system (RCS) so require. Normal valve reseating is also assumed.
- No independent failures, other than those causing the extended loss of alternating current (ac) power (ELAP)/loss of normal access to the ultimate heat sink (LUHS) event, are assumed to occur in the course of the transient.

Sources of expected pressurized water reactor (PWR) reactor coolant inventory loss include:

- Normal system leakage
- Losses from letdown unless automatically isolated or until isolation is procedurally directed
- Losses due to reactor coolant pump (RCP) seal leakage (rate is dependent on the (RCP) seal design)

The initial spent fuel pool (SFP) conditions are:

- All boundaries of the SFP are intact, including the liner, gates, transfer canals, etc.
- Although sloshing may occur during a seismic event, the initial loss of SFP inventory does not preclude access to the refueling deck around the pool.
- SFP cooling system is intact, including attached piping.
- SFP heat load assumes the maximum design basis heat load for the site.

Containment Isolation Valves:

- It is assumed that the containment isolation actions delineated in current SBO coping capabilities is sufficient.

Assumptions Specific to Watts Bar Site

A1. The Auxiliary Feedwater Supply Tank (AFWST) and associated piping are seismically qualified or hardened against missiles and tornados. Watts Bar's AFWST will be qualified to be robust with respect to high winds and seismic events.

A2. Watts Bar Unit 1 is a mirror image of Unit 2, with only minor differences existing between plants. For this reason, any sections or sketches which are only shown for a single unit would be directly analogous to the other unit.

A3. The design hardened connections added for the purposes of FLEX are protected against external events or are established at multiple and diverse locations.

A4. Flood and seismic re-evaluations pursuant to the Title 10 of the Code of Federal Regulations (10 CFR) 50.54(f) letter of March 12, 2012 are not completed and therefore not assumed in this submittal. As the re-evaluations are completed, appropriate issues will be entered into the corrective action program.

A5. Required staffing levels will be determined consistent with guidance contained in NEI 12-06 for each of the site specific FLEX strategies. Assumed available staffing levels will be determined consistent with NEI 12-01, as described below.

A. Post event time: 6 hours – No site access. This duration reflects the time necessary to clear roadway obstructions, use different travel routes, mobilize alternate transportation capabilities (e.g., private resource providers or public sector support), etc.

B. Post event time: 6 to 24 hours – Limited site access. Individuals may access the site by walking, personal vehicle or via alternate transportation capabilities (e.g., private resource providers or public sector support).

C. Post event time: 24+ hours – Improved site access. Site access is restored to a near-normal status and/or augmented transportation resources are available to deliver equipment, supplies and large numbers of personnel.

Staffing levels will be assessed to confirm this assumption, or adjustments will be made to plant staffing or FLEX design to meet this requirement.

A6. Watts Bar will design one new storage location to protect portable FLEX equipment against all five external hazards. This location is referred to in this document as the FLEX equipment storage building (FESB). At present, the FESB is located outside the Protected Area boundary but close to access portals. FLEX equipment will be stored/staged in the FESB or inside of site Class I structures.

A7. Exceptions to the site security plan or other license/site specific requirements will be addressed, as required.

A8. Instrumentation on FLEX equipment will be used to confirm continual performance.

A9. This plan defines strategies capable of mitigating a simultaneous loss of all alternating current (ac) power and loss of normal access to the ultimate heat sink resulting from a beyond-design-basis event by providing adequate capability to maintain or restore core cooling, containment, and SFP cooling capabilities at all units on a site. Though specific strategies are being developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions. These pre-planned strategies developed to protect the public health and safety will be incorporated into the site emergency operating procedures in accordance with established EOP change processes, and their impact to the design basis capabilities of the unit evaluated under 10 CFR 50.59. The plant Technical Specifications contain the limiting conditions for normal unit operations to ensure that design safety features are available to respond to a design basis accident and direct the required actions to be taken when the limiting conditions are not met. The result of the beyond-design-basis event may place the plant in a condition where it cannot comply with certain Technical Specifications and/or with its Security Plan, and as such, may warrant invocation of 10 CFR 50.54(x) and/or 10 CFR 73.55(p). (Reference12)

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** **Ref: NEI 12-06 Section 13.1**	*Include a description of any alternatives to the guidance, and provide a milestone schedule of planned action.*

Watts Bar Nuclear plans to fully comply with the guidance in JLD-ISG-2012-01 (Reference 3) and NEI 12-06 (Reference 2) in implementing FLEX strategies for the Watts Bar site.

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 Reconciliation Table (Attachment 1B)*

The sequence of events and any associated times constraints are identified below for Watts Bar Reactor Core Cooling and Heat Removal (steam generators available) strategies for FLEX Phases 1 through Phase 3. See attached sequence of events timeline (Attachment 1A) and the technical basis support information in Attachment 1B for a summary of this information.

Discussion of action items identified in Attachment 1A table: (Non-Flood Event)

1. Declare ELAP – ELAP entry conditions can be verified by control room staff and it is validated that emergency diesel generators are not available. This step is time sensitive and needs to occur within 1 hour following the start of the event to provide operators with guidance to perform ELAP actions.
2. Align and place in service the 225 kva 480vAC Diesel Generators (480v FLEX Generators). This provides charging current to the 125v DC Vital Batteries and ensures 125v DC Vital Battery power (control) and through the Vital Inverters 120v AC Vital Instrument Power (instrument indication).
3. Verify 125v DC Vital Chargers energized and supplying required load to the 125v DC Vital Batteries.
   IF not,
   THEN complete Extended Load Shed for any Vital Battery not being supplied its required load within 90 minutes (1.5 hours) following the start of the event. This ensures 8-hour coping time for the 125v DC Vital Batteries.
4. Debris Removal (Access) - The earliest need for debris removal access paths is to support alignment of the Low Pressure (LP) FLEX Pumps to the essential raw cooling water (ERCW) headers at the Intake Pumping Station (IPS). This process will be initiated in order to support FLEX equipment deployment depending on the resources available.
5. Initiate Damage Assessment - Watts Bar will develop a post event damage assessment procedure. The damage assessment will evaluate and document the condition of plant systems, structures and components (SSCs) after an ELAP event. The assessment will be consistent with the guidelines contained in supplement 5 of Reference 16.
6. Stage and align the LP FLEX pumps (Dominator and Triton) - staged and aligned to take suction from the intake channel with discharge routed to the Essential Raw Cooling Water (ERCW) FLEX connections inside the Intake Pumping Station (IPS). An alternate or additional raw water source could come from the Condenser Circulating Water (CCW) Cooling Tower basin supplying suction to a Dominator LP FLEX Pump with its discharge routed to FLEX (or B.5.b) connection at the 5th DG Building.
7. Initiate RCS depressurization and cooldown to commence as soon as possible due to RCP seal failure probability. At rated pressure a potential leakage rate of 21 gpm per RCP following the event is possible. An RCS cooldown rate of 75-100 °F per hour should be sustained until stabilized

at ~ 300 PSIA Steam Generator (SG) Pressure. Maintain RCS pressure greater than 250 psig to avoid Cold Leg Accumulator (CLA) nitrogen injection into the RCS. The CLAs are maintained at a boron concentration of 3100 - 3300 ppm. Cooldown and depressurization should be stabilized within 4 hours.

8. Complete 3 MWe FLEX Diesel Generators (6.9KV FLEX Generators), 6.9KV Shutdown Boards and emergency feeder breakers and 480v Shutdown Board alignment. This is to ensure switching at the EDG building and shutdown board rooms are complete, potential board loading is reduced and interlocks are cleared to allow the emergency feeder breaker to be used to safely power the 6.9KV Shutdown Boards from the 6.9KV FLEX DG.

9. Energize the 6.9KV Shutdown Boards with the 6.9KV FLEX DGs. Place the following components in service and restore pressurizer level: Component Cooling Water Pumps and Safety Injection Pumps (SIPs), as required to recover and maintain RCS Pressurizer level. The SIPs take suction for the RWST which maintains a boron concentration of between 3100 and 3300 ppm.

Note: While the TDAFWP is not anticipated to fail, a secondary source of steam generator makeup can be provided by the MDAFWPs, if required, as soon as the 6.9KV FLEX DGs are in service. The Intermediate Pressure (IP) FLEX pumps will be staged and aligned as soon as feasible (within 24 hours).

10. Place the following equipment in service, if required: Verify 6.9KV FLEX DG loading between starts. Auxiliary Air Compressors, Motor Driven Auxiliary Feedwater Pumps (MDAFWPs) and/or Spent Fuel Pool (SFP) Cooling Pump.

11. Stage and align the High Pressure (HP) FLEX pumps (AB el. 692). The primary suction alignment is from the Refueling Water Storage Tanks RWST) which maintains a boron concentration of 3100-3300 ppm). The secondary suction alignment is from the Boric Acid Tank (BAT) which maintains a boron concentration of ~ 6900 ppm. Complete 480v AC power connections for these pumps.

12. Stage and align the IP FLEX Pumps at the AFWST as backup for SG makeup (backup to the TDAFWPs and MDAFWPs). Suction is aligned from the AFWST and discharge can be routed to FLEX connections upstream of the TDAFWP Level Control Valves (LCVs) (primary) or MDAFWP LCVs (alternate). These are diesel driven pumps.

13. Deploy hoses and spray nozzles to the SFP area as a contingency within 18 hours. Hoses can be routed to supply makeup from FLEX connections on the refuel floor or from the elevation below the refuel floor. This is the need time based on the most limiting SFP time when boil off occurs (Reference 18).

14. Alternate fuel supply will need to be established within 8 hours. This accounts for the 8 hours in which the FLEX equipment fuel supply depletes and the deployment time.

Note: If the Condensate Storage Tanks (CSTs) survive the event they will supply additional water reserve per unit to the Auxiliary Feedwater Pumps.

15. The AFWST will be depleted in 10 hours, makeup options will need to be evaluated and directed. Potential sources of clean water makeup are the Demineralized Water Storage Tank (DWST), U1 and U2 Primary Water Storage Tanks (PWST) and the Tritiated Water Storage Tank (TWST). If the AFWST is depleted the operating auxiliary feedwater pumps' suction will be realigned to the ERCW headers to extend core cooling.The LP FLEX pumps have been aligned to the ERCW headers to provide a raw water input prior to the AFWST depleting. Available raw water in the ERCW headers (without LP FLEX pumps supply) will deplete in 7 hours for Unit 1 and 4.7 hours for Unit 2 (Reference 23).

16. Acceptable control room lighting will be available for long term support. This is not a time constraint as control room lighting is available via batteries, and portable lighting will be available

if required.

17. The Vital Battery Room and Shutdown Board Room heating, ventilation, and air conditioning (HVAC) study determined that ventilation is not required until 24 hours into the ELAP event; at which point it can be monitored periodically, if needed (Reference 14).
18. The Main Control Room HVAC study determined that ventilation is not required until 24 hours into ELAP event; at which point it can be monitored periodically if needed (Reference 14).
19. The TDAFWP room HVAC study determined that ventilation is not required until 24 hours into ELAP event; at which point it can be monitored periodically if needed (Reference 14).
20. Venting of the SFP area will need to be evaluated within 24 hours based on the SFP time when boil off occurs. (Reference 18)
21. A time of 72 hours is assumed for alignment of a mobile water purification system to provide clean water to refill the AFWST. However, cooling water via the ERCW headers is available to be provided indefinitely.
22. Large fuel truck service will need to be established within 72 hours. This is based on the depletion of on-site supplies and supplying larger equipment.

<u>Discussion of action items identified in Attachment 1A table: (Flood Event)</u>

Note: An ELAP could occur at anytime during flood preparation or a flood event therefore FLEX equipment and strategies must be staged and ready for implementation if required.

Note: To assure that FLEX response actions do not impact on design basis flood mode preparations, Watts Bar will pre-stage FLEX Flood Mode equipment based on a 25 year flood warning from TVA's River Operations Forecasting group. Concurrent with full FLEX implementation at Watts Bar, River Operations procedure RVS-SOP-10.05.06, "Nuclear Notifications and Flood Warning Procedure", and AOI-7.01, "Maximum Probable Flood", will be revised to provide the notification and direct the pre-staging of FLEX equipment.

Note: The scenario described below assumes an ELAP event occurs post initial flood warning received from TVA's River System Operations and prior to a Stage 1 warning notification. This provides a 27 hour period before flood waters reach grade elevation. This flood preparation time period allows for initial use of the same strategy as a non-flood event for Steps 1-9 for stabilizing the plant and staging FLEX equipment for flood mitigation strategy.

1. Declare ELAP – ELAP entry conditions can be verified by control room staff and it is validated that emergency diesel generators are not available. This step is time sensitive and needs to occur within 1 hour following the start of the event to provide operators with guidance to perform ELAP actions.

2. Align and place in service the 225 kva 480vAC Diesel Generators (480v FLEX Generators). This provides charging current to the 125v DC Vital Batteries and ensures 125v DC Vital Battery power (control) and through the Vital Inverters 120v AC Vital Instrument Power (instrument indication).

3. Verify 125v DC Vital Chargers energized and supplying required load to the 125v DC Vital Batteries.
IF not,
THEN complete Extended Load Shed for any Vital Battery not being supplied its required load within 90 minutes (1.5 hours) following the start of the event. This ensures 8-hour coping time for the 125v DC Vital Batteries.

4. Debris Removal (Access) - The earliest need for debris removal access paths is to support alignment of the LP FLEX Pumps to the essential raw cooling water (ERCW) headers at the Intake Pumping Station (IPS). This process will be initiated in order to support FLEX equipment deployment depending on the resources available.

5. Damage Assessment - Watts Bar will develop a post event damage assessment procedure. The damage assessment will evaluate and document the condition of plant systems, structures and components (SSCs) after an ELAP event. The assessment will be consistent with the guidelines contained in supplement 5 of Reference 16.

6. Stage and align the LP FLEX pumps (Dominator and Triton) - staged and aligned to take suction from the intake channel with discharge routed to the Essential Raw Cooling Water (ERCW) FLEX connections inside the Intake Pumping Station (IPS).

7. Initiate RCS depressurization and cooldown to commence as soon as possible due to RCP seal failure probability. At rated pressure a potential leakage rate of 21 gpm per RCP following the event is possible. An RCS cooldown rate of 75-100 °F per hour should be sustained until stabilized at ~ 300 PSIA Steam Generator (SG) Pressure. Maintain RCS pressure greater than 250 psig to avoid Cold Leg Accumulator (CLA) nitrogen injection into the RCS. The CLAs are maintained at a boron concentration of 3100 - 3300 ppm. Cooldown and depressurization should be stabilized within 4 hours.

8. Align the 3MWe FLEX Diesel Generators (6.9KV FLEX Generators), 6.9KV Shutdown Boards and 480v Shutdown Boards for FLEX DG operation. This is to ensure switching at the EDG building and shutdown board rooms are complete, potential board loading is reduced and interlocks are cleared to allow the emergency feeder breaker to be used to safely power the 6.9KV Shutdown Boards from the 6.9KV FLEX DG.

9. Energize the 6.9KV Shutdown Boards with the 6.9KV FLEX DGs. Place the following components in service and restore pressurizer level: Component Cooling Water Pumps and Safety Injection Pumps (SIPs), as required to recover and maintain RCS Pressurizer level. The SIPs take suction for the RWST which maintains a boron concentration of between 3100 and 3300 ppm.

Note: While the TDAFWP is not anticipated to fail, a secondary source of steam generator makeup can be provided by the MDAFWPs, if required, as soon as the 6.9KV FLEX DGs are in service. The IP FLEX pumps will be staged and aligned as soon as feasible (within 24 hours).

10. Place the following equipment in service, if required: Verify 6.9KV FLEX DG loading between starts. Auxiliary Air Compressors, MDAFWPs and/or Spent Fuel Pool (SFP) Cooling Pump.

Note: The above design Basis components will be removed from service and protection transitioned to the FLEX strategies prior to flood waters reaching plant grade.

Note: The Auxiliary Feedwater Supply Tank (AFWST) will not be available as a water source once flood water reaches plant grade.

11. Stage and align a second Dominator LP FLEX Pump taking suction from a Condenser Circulating Water Cooling Tower Basin with its discharge routed to the B.5.b hose connections inside the 5th DG Building. Hoses will remain isolated and pump out of service until required.

12. Stage and align a second complete set of LP FLEX pumps (Dominator and Triton) to take suction from the road just south of the 5th Diesel Generator Building with discharge routed to the ERCW FLEX connections at the 5th Diesel Generator Building. Hoses will remain isolated and pumps out of service until required.

13. Stage and align the HP FLEX Pumps (AB el. 692) with suction hoses routed from the RWST FLEX connections on AB el. 692 and discharge hoses routed to the Safety Injection Pump Discharge Header FLEX connection (B Train (primary) or A Train (secondary) (AB el. 692). Complete 480v power supply connections for these pumps.

14. Stage and align the IP FLEX Pumps (AB el. 737) with suction hoses routed from the AB el. 737 ERCW FLEX connections and discharge hoses routed to FLEX connections upstream of the TDAFWP Level Control Valves (LCVs) (primary) (SMSVV el. 729) or MDAFWP LCVs (alternate) (AB el. 737). Complete 480v power supply connections for these pumps.

15. Deploy hoses and spray nozzles as a contingency for SFP makeup within 18 hours. Hoses can be routed to supply makeup from an AB el. 757 ERCW - CCS Spool Piece FLEX connection (next to the CCS Surge Tanks) to the SFP area or from an AB el. 737 FLEX connection to the demineralized water makeup header FLEX connection on AB el. 737. This is based on the time when boil off decreases the water level to 10 feet above the SFP racks, determined in analyses contained in Reference 18.

16. Alternate fuel supply will need to be established within 8 hours. This accounts for the 8 hours in which the FLEX equipment fuel supply depletes and the deployment time.

Note: If the Condensate Storage Tanks (CSTs) survive the event they will supply an additional reserve of water per unit to the Auxiliary Feedwater Pumps.

17. The AFWST will be depleted in 10 hours, makeup options will need to be evaluated and directed. Potential sources of clean water makeup are the Demineralized Water Storage Tank (DWST), U1 and U2 Primary Water Storage Tanks (PWST) and the Tritiated Water Storage Tank (TWST). If the AFWST is depleted the operating Auxiliary Feedwater System pumps' suction will be realigned to the ERCW headers to extend core cooling. LP FLEX pumps will be aligned to the ERCW headers to provide a raw water input prior to the AFWST depleting. Available raw water in the ERCW headers (without LP FLEX pumps supply) would deplete in 7 hours Unit 1 and 4.7 hours for Unit 2 (Reference 23).

18. Acceptable control room lighting will be available for long term support. This is not a time constraint as control room lighting is available via batteries, and portable lighting will be available, if required.

19. The Vital Battery Room and Shutdown Board Room heating, ventilation, and air conditioning (HVAC) study determined that ventilation is not required until 24 hours into the ELAP event; at which point it can be monitored periodically, if needed (Reference 14).

20. The Main Control Room HVAC study determined that ventilation is not required until 24 hours into ELAP event; at which point it can be monitored periodically if needed (Reference 14).

21. The TDAFWP room HVAC study determined that ventilation is not required until 24 hours into ELAP event; at which point it can be monitored periodically if needed (Reference 14).

22. Venting of the SFP area will need to be evaluated within 24 hours based on the SFP time when boil off occurs (Reference 18).

23. A time of 72 hours is assumed for alignment of a mobile water purification system to provide clean water to refill the AFWST. However, cooling water via the ERCW headers is available to be provided indefinitely.

24. Large fuel truck service will need to be established within 72 hours. This is based on the depletion of on-site supplies and supplying larger equipment.

To confirm the times given above, Watts Bar will prepare procedures for each task, perform time study walkthroughs for each of the tasks under simulated ELAP conditions and account for administrative procedures that may be required to perform the task. In addition, an evaluation on the impact of FLEX response actions on design basis flood mode preparations will be performed. This evaluation will include the potential for extended preparation time for FLEX. (Open Item OI 13)

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.*
Deployment of FLEX equipment is described for each FLEX function in the subsequent sections below and covers all operating modes. The broad-spectrum deployment strategies do not change for the different operating modes. The deployment strategies from the storage areas to the staging areas are identical and include debris removal, equipment transport, fuel transport, and power sources and requirements. RCS makeup connections are provided for the higher flow rates required during core cooling with SGs unavailable. Each of these strategies and the associated connection points are described in detail in the subsequent sections. The electrical coping strategies are the same for all modes. Figure A3-20 shows a visual representation of the deployment strategy.	

Provide a milestone schedule. This schedule should include:
 	
• **Modifications timeline**
  ○ **Phase 1 Modifications**
  ○ **Phase 2 Modifications**
  ○ **Phase 3 Modifications**
• **Procedure guidance development complete**
  ○ **Strategies**
  ○ **Maintenance**
• **Storage plan (reasonable protection)**
• **Staffing analysis completion**
• **FLEX equipment acquisition timeline**
• **Training completion for the strategies**
• **Regional Response Centers operational**
 	
Ref: NEI 12-06 Section 13.1	

The dates specifically required by the order are obligated or committed dates. Other dates are planned dates subject to change. Updates will be provided in the periodic (six month) status reports. See attached milestone schedule Attachment 2.	

Identify how the programmatic controls will be met. **Ref: NEI 12-06 Section 11** **JLD-ISG-2012-01 Section 6.0**	

Equipment associated with these strategies will be procured as commercial equipment with design, storage, maintenance, testing, and configuration control in accordance with NEI 12-06 Rev. 0 Section 11.

The unavailability of equipment and applicable connections that directly performs a FLEX mitigation strategy will be managed using plant equipment control guidelines developed in accordance with NEI 12-06 Rev. 0 Section 11.5.

Programs and controls will be established to assure personnel proficiency in the mitigation of beyond-design-basis events is developed and maintained in accordance with NEI 12-06 Rev. 0 Section 11.6.

The FLEX strategies and basis will be maintained in an overall program document. Existing plant configuration control procedures will be modified to ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies in accordance with NEI 12-06 Rev. 0 Section 11.8.

Procedure Guidance

Watts Bar is a participant in the PWROG project PA-PSC-0965 and will implement the FLEX Support Guidelines (FSGs) in a timeline to support the implementation of FLEX by the time of the Unit 2 startup. The PWROG has generated these guidelines in order to assist utilities with the development of site-specific procedures to cope with an ELAP in a manner compliant with the requirements of Reference NEI 12-06.

The proposed implementation strategy aligns with the procedure hierarchy described in NEI 12-06 in that actions that maneuver the plant are contained within the typical controlling procedure, and the Flex Support Instructions (FSIs) are implemented as necessary to maintain the key safety functions of Core Cooling, Spent Fuel Cooling, and Containment in parallel with the controlling procedure actions. The overall approach is symptom–based, meaning that the controlling procedure actions and FSIs are implemented based upon actual plant conditions.

Watts Bar will continue participation in PA-PSC-0965 and will update plant procedures upon the completion of the PWROG program. It is anticipated that the following FSGs will be incorporated into plant procedures in order to develop the FSG interface:

- Alternate Auxiliary Feedwater (AFW) Suction Source
- Alternate Low Pressure Feedwater
- ELAP Direct Current (DC) Load Shed/Management
- Initial Assessment and FLEX Equipment Staging
- Alternate CST Makeup
- Loss of DC Power
- Alternate RCS Boration
- Long Term RCS Inventory and Temperature Control
- Passive RCS Injection Isolation
- Alternate SFP Makeup and Cooling
- Alternate Containment Cooling
- Transition from FLEX Equipment

Maintenance and Testing

The FLEX mitigation equipment will be initially tested (or other reasonable means used) to verify

performance conforms to the limiting FLEX requirements. It is expected the testing will include the equipment and the assembled sub-systems to meet the planned FLEX performance. Additionally, Watts Bar will implement the maintenance and testing template upon issuance by the Electric Power Research Institute (EPRI). The template will be developed to meet the FLEX guidelines established in Section 11.5 of Reference 2. Staffing The FLEX strategies documented in the event sequence analysis assume: • On-site staff are at administrative minimum shift staffing levels, • No independent, concurrent events, and • All personnel on-site are available to support site response. Watts Bar will have to address staffing considerations in accordance with Reference 2 to fully implement FLEX at the site. Configuration Control Per NEI 12-06 and the Interim Staff Guidance (ISG), the FLEX strategies must be maintained to ensure future plant changes do not adversely impact the FLEX strategies. Therefore, Watts Bar will maintain the FLEX strategies and basis in an overall program document and will modify existing plant configuration control procedures to ensure changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies.	
Describe training plan	Training plans will be developed for plant groups such as the emergency response organization (ERO), Fire, Security, Emergency Preparedness (EP), Operations, Engineering, and Maintenance. The training plan development will be done in accordance with Watts Bar procedures using the Systematic Approach to Training, and will be implemented to ensure that the required Watts Bar staff is trained prior to implementation of FLEX.
Describe Regional Response Center plan	The nuclear industry will establish two RRCs to support utilities during beyond design basis events. Each RRC will hold five sets of equipment, four of which will be able to be fully deployed when requested the fifth set will have equipment in a maintenance cycle. Equipment will be moved from an RRC to a local Assemble Area, established by the Strategic Alliance for FLEX Emergency Response (SAFER) team and TVA. Communications will be established between Watts Bar and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of Watts Bar's playbook, will be delivered to the site within 24 hours from the initial request. TVA has established an agreement with the SAFER team in accordance with the requirements of Section 12 of Reference 2. Watts Bar has determined Phase 3 equipment staging locations.
Notes: 1. Maintenance and testing, configuration control, training, and regional response center plans are currently being developed.	

Maintain Core Cooling & Heat Removal	
Determine Baseline coping capability with installed coping[1] modifications not including FLEX modifications, utilizing methods described in Table 3-2 of NEI 12-06: • **AFW/EFW** • **Depressurize SG for Makeup with Portable Injection Source** • **Sustained Source of Water** **Ref: JLD-ISG-2012-01 Sections 2 and 3**	
PWR Installed Equipment Phase 1	
<u>Core Cooling with SGs Available</u> The coping strategy is to remove heat from the RCS by providing cooling water to the four SGs. The plant is assumed to be operating at full power at the start of the event. An SBO occurs to start the scenario and all ac power is assumed to be lost. The TDAFWP will start as designed and provide cooling through the SGs. Initial alignment of the TDAFWP suction is to the AFWST. The AFWST will provide approximately 10 hours of inventory to the suction of the TDAFWPs for each unit before the AFWST is depleted. If the CSTs survive the event an additional 10 hours per unit of cooling water would be available. When the AFWST is depleted, suction flow to the TDAFWP can be provided by standing water in the ERCW headers, for an additional 7 hours for Unit 1 and 4.7 hours for Unit 2. (Reference 23). <u>Core Cooling with SGs Not Available</u> Reactor core cooling and heat removal with SGs not available is provided during Phase 1 by heating up and boiling of the RCS coolant inventory. The lowest allowed level in the RCS, when SGs are not available to provide core cooling, is not more than one foot below the vessel flange during the removal of the reactor vessel head. RCS inventory during Phase 1 may be maintained by gravity feed from the RWST at each unit. The ability of the RWST at each unit to provide a gravity feed to the RCS is limited by the RWST fluid height, line losses through the gravity feed path, and pressure within the RCS. If it is determined that gravity feed is not effective to cool the RCS and prevent fuel damage, Watts Bar will take actions to proceduralize administrative controls to pre-stage FLEX equipment prior to entering a condition where the SGs cannot provide adequate core cooling. (Open Item 12) (Reference 20)	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation.* SBO Emergency Operating Instruction (EOI) ECA-0.0 currently addresses implementation of this strategy. The strategies in ECA-0.0 will be supported by the appropriate FSI for this strategy. (Reference 17)
Identify Modifications	List modifications and describe how they support coping time. 1. AFWST and connections to Unit 1 and Unit 2 Auxiliary Feedwater System. (DCN 60060, DCN 62324 & DCN 61422) - Provides 500,000 gallons of demineralized water from a seismically qualified source. 2. 8 Hour Battery Coping. (EDC/DCN 60976, DCN 60384 & PIC to DCN 54871) - Increases battery coping capability.

[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.

	3. The backup instrument air/nitrogen supply to the SG Atmospheric Relief Valves (ARVs) and Auxiliary Feedwater (AFW) Level Control Valves (LCVs) will be moved to above the probable maximum flood (PMF) elevation for flood mode response. (DCN 60996 & EDCR 60749)
Key Reactor Parameters	1. SG Wide Range Level or Narrow Range Level with AFW Flow indication 2. SG Pressure 3. AFWST Level RCS instrumentation that is assumed to also be available for this function: 1. Core Exit Thermocouple (CET) Temperature** 2. RCS Hot Leg (HL) Temperature (T_{hot}) if CETs not available 3. RCS Cold Leg (CL) Temperature (T_{cold})* 4. RCS Wide Range Pressure 5. Pressurizer Level 6. Reactor Vessel Level Indicating System (RVLIS) (backup to Pressurizer level) – available for up to 27 hours for limiting flood scenario, at which point pressurizer level is available again. 7. Neutron Flux For all instruments listed above the normal power source and the long-term power source is the 125v DC Vital Battery. *This instrumentation is only available until flood water enters the auxiliary instrument room. The potential validating indicator for Tcold is SG pressure when natural circulation is occurring. This substitution is allowed by guidance provided in Reference 16. **This instrumentation is only available until flood water enters the auxiliary instrument room. The potential validating indicator for CETs is RCS HL. This substitution is allowed by guidance provided in Reference 16. Watts Bar will develop procedures to read this instrumentation locally, where applicable, using a portable instrument as required by Section 5.3.3 of NEI 12-06.
Notes: 1. Core cooling strategies are provided for conditions where SGs are available or where SGs are not available but a sufficient RCS vent has been established to support core cooling. This assumption is per the guidance of NEI 12-06 FAQ 2012-19. Other configurations are not considered as these occur at short durations that are exempted per NEI-12-06 Table D.	

Maintain Core Cooling & Heat Removal
PWR 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 core cooling. Identify methods and strategy (ies) utilized to achieve this coping time.

Core Cooling with SGs Available

Transition to Phase 2 is required before the AFWST inventory and standing water in the ERCW headers is depleted at 7.0 hours for Unit 1 and 4.7 hours for Unit 2. (Reference 23)

The 6.9 KV FLEX DGs could be used to repower the Auxiliary Air Compressors and MDAFWPs to provide a secondary SG makeup source if required. This option would allow SG level and pressure control from the Main Control Room (MCR) or Auxiliary Control Room (ACR).

To provide an unlimited supply of water for core cooling during Phase 2, LP FLEX Pumps will be staged at the IPS and take suction from the intake channel and discharge to 4 ERCW FLEX connections inside the IPS. They will be used to pressurize the ERCW headers which can then be used for direct supply to the TDAFWP suction, if required. Surviving, non-seismic, clean water tanks can also be used to refill the AFWST using transfer pumps.

An IP FLEX Pump will be provided for supplying water to the SGs for core cooling after operating conditions of the TDAFWP cannot be maintained. The IP FLEX Pumps will supply water to FLEX connections upstream of the TDAFWPs or the Motor Driven Auxiliary Feedwater Pumps (MDAFWP) Level Control valves (LCVs). The IP FLEX pumps staging location for a non flood condition is near the AFWST which is the suction source for this condition. The IP FLEX pump staging location for a flood condition would be on AB el. 737 with suction supplied from the ERCW FLEX Connections supplied with raw water from the LP FLEX Pumps. Discharge hose routing would be the same as for a non-flood event. The storage locations, deployment paths and staging locations for the FLEX equipment are provided in Attachment 3.

For non-flood conditions, Watts Bar will gradually transition to a long term core cooling strategy. This will include the use of the LP FLEX pumps on-site to provide a source of cooling water flow to the component cooling system (CCS) heat exchangers. The 6.9 KV FLEX DGs could be used to repower components such as the Auxiliary Air Compressors, MDAFWPs, CCSPs, select ventilation equipment and other components as need and load capability allows.

For flood conditions the plant would supply water to the SGs using the IP FLEX pumps supplied from the ERCW headers and/or flood waters in the Auxiliary Building.

Core Cooling with SGs Not Available

For an event that occurs with a unit in core cooling with SGs not available, the transition to Phase 2 strategies will be required as inventory is lost from the RCS. Reactor core cooling and heat removal will be provided by using the IP FLEX pump to inject water into the RCS via the Safety Injection System FLEX connections.

Core cooling is maintained through heat removal from the RCS via coolant boil off. Prior to loss of gravity feed from the RWST, the IP FLEX pump must be aligned to take suction from the RWST or another acceptable alternate coolant source and deliver the coolant to the RCS.

The connections utilized for RCS Inventory Control/Long-Term Subcriticality will also be utilized for the reactor core cooling and heat removal with steam generators not available strategies (Modes 5 and 6). These connections are described in the RCS inventory control section. In addition, a flushing flow of 123 gpm at atmospheric conditions is required at 31 hours in order to preclude the RCS fluid from the incipient boric acid precipitation point. (Reference 20)

Details:

Maintain Core Cooling & Heat Removal	
PWR Portable Equipment Phase 2	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation with a description of the procedure / strategy / guideline.* Procedures and guidance to support deployment and implementation, including interfaces to EOPs, special event procedures, abnormal event procedures, and system operating procedures, will be developed in accordance with NEI 12-06, Rev. 0, Section 11.4. Further, the PWROG has developed generic guidance and Watts Bar's strategy aligns with the generic guidance and will consider the Nuclear Steam Supply System (NSSS) specific guidance once available.
Identify Modifications	*List modifications necessary for Phase 2* 1. The backup instrument air supply to the SG Atmospheric Relief Valves (ARVs) and Auxiliary Feedwater (AFW) Level Control Valves (LCVs) will be moved to above the probable maximum flood (PMF) elevation for flood mode response. (DCN 60996 & EDCR 60749) 2. Connections will be made on the ERCW headers in the Auxiliary Building for supplying water to the IP FLEX pump. (DCN 60684) 3. The primary connection point for SG cooling will be upstream of the SG LCVs on the TDAFWP discharge line. (DCN 60683, DCN 61784 & EDCR 60751) 4. The secondary connection point for SG cooling will be upstream of the SG LCVs in both the train A and train B MDAFWP discharge piping. A connection to both trains is needed for the secondary connection to ensure feed to all four SGs. (DCN 60683, DCN 61784 & EDCR 60751) 5. Auxiliary Feedwater Supply Tank (AFWST). (DCN 60060 & DCN 62324) 6. New connections to take suction from the AFWST are required. (DCN 60060 & DCN 61422) 7. New connections will be made at the ERCW headers in the Intake Pumping Station (IPS) for the LP FLEX Pumps to pressurize the ERCW headers during non-flood and flood conditions. (DCN 60684) 8. New connections will be made at the ERCW headers in the 5th Diesel Generator Building for the LP FLEX Pumps to pressurize the ERCW headers during flood conditions. (DCN 60684) 9. New connections will be made to the Tritiated Water Storage Tank (TWST), Primary Water Storage Tanks (PWSTs), and Demineralized Water Storage Tank (DWST) for transferring water to refill the AFWST. (DCN 60683, DCN 59397, DCN 60684, DCN 61784 & EDCR 60993) 10. FLEX connections at the Safety Injection Pumps for HP FLEX Pumps RCS makeup. (DCN 60683 & EDCR 60750) 11. RWST FLEX connections for HP FLEX pump or IP FLEX Pump (mode 5 &6) suction source. (DCN 60683, DCN 61784 & EDCR 60994) 12. BAT FLEX connection for HP FLEX Pump suction supply. (DCN 60684)

Maintain Core Cooling & Heat Removal	
PWR Portable Equipment Phase 2	
	13. FLEX Equipment Storage Building (FESB). DCN 59084) 14. 225kva DGs (480v FLEX DGS). (DCN 59675) 15. 3 MWe DGs (6.9KV FLEX DGs). (DCN 60853) 16. 8 Hour Battery Coping. (EDC/DCN 60976, DCN 60384 & PIC to DCN 54871)
Key Reactor Parameters	*List instrumentation credited or recovered for this coping evaluation.* 1. SG Wide Range Level or Narrow Range Level with AFW Flow indication 2. SG Pressure 3. AFWST Level RCS instrumentation that is assumed to also be available for this function: 1. CET Temperature** 2. RCS HL Temperature (T_{hot}) if CETs not available 3. RCS CL Temperature (T_{cold})* 4. RCS Wide Range Pressure 5. Pressurizer Level 6. RVLIS (backup to Pressurizer level) – available for up to 27 hours for limiting flood scenario, at which point pressurizer level is available again. 7. Neutron Flux For all instruments listed above the normal power source and the long-term power source is the 125v DC Vital Battery. *This instrumentation is only available until flood water enters the auxiliary instrument room. The potential validating indicator for Tcold is SG pressure when natural circulation is occurring. This substitution is allowed by guidance provided in Reference 16. **This instrumentation is only available until flood water enters the auxiliary instrument room. The potential validating indicator for CETs is RCS HL. This substitution is allowed by guidance provided in Reference 16. Watts Bar will develop procedures to read this instrumentation locally, where applicable, using a portable instrument as required by Section 5.3.3 of NEI 12-06.

Storage / Protection of Equipment :
Describe storage / protection plan or schedule to determine storage requirements

Seismic	Portable equipment required to implement this FLEX strategy will be maintained in the FESB, the Auxiliary Building and Intake Pumping Station, which are designed for seismic loading in excess of the minimum requirements of American Society of Civil Engineers (ASCE) 7-10. The design of the FESB provides a minimum High Confidence of Low Probability Failure (HCLPF) of 2x SSE. The 480v FLEX DGs are installed on the AB roof in a protected enclosure.
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	Portable equipment required to implement this FLEX strategy will be maintained in the FESB, which is sited in a suitable location that is above the PMF level and as such is not susceptible to flooding from any source. The 480v FLEX DGs are installed on the AB roof in a protected enclosure.
Severe Storms with High Winds	Portable equipment required to implement this FLEX strategy will be maintained in the FESB, which is designed to meet or exceed the licensing basis high wind hazard for Watts Bar. The 480v FLEX DGs are installed on the AB roof in a protected enclosure.
Snow, Ice, and Extreme Cold	The FESB will be evaluated for snow, ice and extreme cold temperature effects and heating will be provided as required to assure no adverse effects on the FLEX equipment. The FESB will have a standalone HVAC system. The 480v FLEX DGs are installed on the AB roof in a protected enclosure.
High Temperatures	The FESB will be evaluated for high temperature effects and ventilation will be provided as required to assure no adverse effects on the FLEX equipment. The FESB will have a standalone HVAC system. The 480v FLEX DGs are installed on the AB roof in a protected enclosure.

Deployment Conceptual Design

The figures provided in Attachment 3 show the deployment paths from each of the storage locations to the staging locations.

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*
SGs Available The primary connection for the IP FLEX pumps will be located in the South Main Steam Valve Vault (MSVV) el. 729' upstream of the LCVs on the TDAFWP discharge piping. For this alignment during non-flood conditions, suction to the IP FLEX Pump will be taken from the AFWST or ERCW headers. During flood conditions, suction will be taken from the ERCW headers and/or flood waters in the	Primary connection modifications: • A tee will be added to the TDAFWP discharge line. • An isolation valve will be added to the main line upstream of connection. • An isolation valve will be added to the new branch. • Storz cap/adapter will be added to new branch. AFWST modifications: Storz hose connections will be	All FLEX equipment connection points will be designed to meet or exceed Watts Bar design basis SSE protection requirements. The primary connection is located inside the South Main Steam Valve Vault (MSVV). The MSVV is a safety related structure and is protected from all external hazards except flooding. For flood conditions, procedures will ensure that hoses are connected before flood levels reach the connection. The connections to the AFWST

Auxiliary Building. Discharge of the IP FLEX Pump will be to the connection points shown in Attachment 3, Figure A3-1. The proposed hose routing for the primary connection and the associated equipment staging area can be found in Attachment 3, Figures A3-3 and A3-4. ERCW connections can be found in Attachment 3, Figures A3-17 and A3-18.	provided with the new AFWST. ERCW modifications: For non-flood conditions, one set of LP FLEX pumps will be staged next to the IPS. The existing ERCW piping in the IPS will be modified to add isolation valves with hose connections to allow the ERCW headers to be pressurized. An alternate raw water source could come from the Condenser Circulating Water (CCW) cooling tower basin supplying suction source to a Dominator LP FLEX Pump with its discharge routed to FLEX connections (or B.5.b connections) at the 5th DG Building. For flood conditions, a second Dominator LP FLEX Pump taking suction from a CCW Cooling Tower Basin with its discharge routed to the B.5.b hose connections inside the 5th DG Building would be stage and aligned. Hoses will remain isolated and pump out of service until required. A second complete set of LP FLEX pumps (Dominator and Triton) will be staged next to the 5th Diesel Generator Building. The existing ERCW piping inside the 5th Diesel Generator Building will be modified to add FLEX connections (isolation valves with hose connections) to allow the ERCW headers to be pressurized. To supply water to the suction of the IP FLEX pumps, existing ERCW header cleanout ports in the Auxiliary Building elevation 737 will be utilized. The cleanout ports will be modified to add Storz hose connections. Other tank modifications An isolation valve and Storz hose connections will be added to the TWST, PWSTs, and DWST for water transfer pump capability to	and ERCW will be seismically qualified and missile protected. For connections required during flood conditions, procedures will ensure that hoses are connected before flood levels reach the connection. Connections to other tanks are not protected since the connections are to non-protected tanks and would only be available if the tank survives the event. These connections are used to provide additional capability above the minimum FLEX requirements.

	supply clean water to the AFWST.	
<u>SGs Available</u> The secondary connection will be located in the Auxiliary Building on Elevation 737' upstream of the LCVs on the MDAFWP discharge piping. For this alignment, suction will be taken from the AFWST or ERCW and discharged through the IP FLEX Pumps to the connection points shown in Attachment 3, Figure A3-2. The proposed hose routing for the secondary connection and the associated equipment staging area can be found in Attachment 3, Figure A3-3 and Figure A3-5. ERCW connections can be found in Attachment 3, Figures A3-17 and A3-18.	<u>Secondary connection modifications:</u> • Hard piping will be installed between the high pressure fire protection (HPFP) Train A and Train B flood conditions supply piping and the MDAFWP Train A and Train B piping which will replace the existing removable spool pieces. • A tee will be added to this piping. • Add isolation valve to either side of new tee. • Add isolation valve on new branch. • Storz cap/adapter will be added to new branch. <u>AFWST, ERCW, and other tank modifications:</u> Same as primary.	All FLEX equipment connection points will be designed to meet or exceed Watts Bar design basis SSE protection requirements. The secondary connection is located inside the Auxiliary Building. The Auxiliary Building is a safety related structure and is protected from all external hazards except flooding. For flood conditions, procedures will ensure that hoses are connected before flood levels reach the connection. The connections to the AFWST and ERCW will be seismically qualified and missile protected. For connections required during flood conditions, procedures will ensure that hoses are connected before flood levels reach the connection. Connections to non-seismic tanks are not protected and would only be available if the tank survives the event. These connections are used to provide additional capability above the minimum FLEX requirements.
<u>Steam Generators Not Available</u> When SGs are not available, suction will be taken from the RWST Flex connections (AB el. 692) through the Modes 5 & 6 FLEX Pumps staged on AB el. 692 with pump discharge routed to the primary FLEX connections on the Train B Safety Injection Pumps discharge headers.	<u>Primary Connection Modification</u> • Install tees or weldolets, • Add isolation valves • Add a hose adapters <u>RWST Modifications:</u> • Install pipe taps on RWST supply lines to the Refueling Water Purification Pumps on AB el. 692. • Add an isolation valves on these connection locations. • Add Storz adapters with cap on branches. <u>Safety Injection Pump Discharge Header Modifications</u> FLEX connections on the Safety Injection Pumps discharge Headers for HP FLEX Pumps RCS makeup are located on AB	All FLEX equipment connection points will be designed to meet or exceed Watts Bar design basis SSE protection requirements. The primary connections for the Safety Injection Pump (SIP) Train B discharge header and RWST are located inside the Auxiliary Building. The Auxiliary Building is a safety related structure and is protected from all external hazards except flooding. For flood conditions, procedures will ensure that hoses are connected before flood levels reach the connection. The RWST connection is located inside the AB on el. 692. For connections required during flood conditions, procedures will ensure that hoses are connected before flood levels reach the connection.

	el. 692.	
<u>SGs Not Available</u> When SGs are not available, suction will be taken from the RWST FLEX connections (AB el. 692) through the Modes 5 & 6 FLEX Pumps staged on AB el. 692 with pump discharge routed to the secondary FLEX connections on the Train A Safety Injection Pumps discharge headers.	The secondary Mode 5 & 6 Flex connection modification for steam generators not available is identical to the primary, except for being located on the Safety Injection Pump (SIP) Train A discharge header. <u>BAT Modification</u> • Install tees on discharge lines of BAT A on AB el. 713. • Add an isolation valve on the branch. • Add a Storz adapter with cap on the branch.	All FLEX equipment connection points will be designed to meet or exceed Watts Bar design basis SSE protection requirements. The secondary FLEX connections for the Safety Injection Pump (SIP) Train A discharge header and the BAT are located inside the Auxiliary Building. The Auxiliary Building is a safety related structure and is protected from all external hazards except flooding. For flood conditions, procedures will ensure that hoses are connected before flood levels reach the connection. The BAT serves as a secondary source and is located inside the AB on el. 713. For connections required during flood conditions, procedures will ensure that hoses are connected before flood levels reach the connection.

Notes:

1. System modifications are described in the "Modifications" section above and are illustrated in Attachment 3.
2. Figures A3-3 through A3-5 in Attachment 3 provides the deployment routes from the staging locations for each IP FLEX pump to the pump suction source and to the primary and secondary connection points on the AFW system.
3. Core cooling strategies are provided for conditions where SGs are available or where SGs are not available but a sufficient RCS vent has been established to support core cooling. This assumption is per the guidance of NEI 12-06 FAQ 2012-19. Other configurations are not considered as these occur at short durations that are exempted per NEI-12-06 Table D.

Maintain Core Cooling & Heat Removal	
PWR 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 and strategy (ies) utilized to achieve this coping time. <u>Core Cooling with SGs Available</u> For Phase 3, Watts Bar will continue the Phase 2 coping strategies with additional assistance provided from offsite equipment/resources. Backup or alternate Phase 2 FLEX equipment will be provided by the RRC as necessary. Additionally, purification of water at each unit will be supported by a mobile water purification unit from the RRC. This unit will process water from the Tennessee River or other raw water sources to remove particulate and demineralize the water. The purification unit will be self supported. This water would then be used to refill or makeup to the AFWST. <u>Core Cooling with SGs Not Available</u> Reactor core cooling with SGs not available is adequately maintained via the Phase 2 strategy; however, borated sources are limited. Phase 3 deployment of a unit capable of generating borated water from the water processed through the purification unit can further extend coping times with respect to RCS inventory management. Watts Bar has determined where Phase 3 equipment will be staged.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	Procedures and guidance to support deployment and implementation, including interfaces to EOPs, special event procedures, abnormal event procedures, and system operating procedures, will be developed in accordance with NEI 12-06, Rev. 0, Section 11.4. Further, the PWROG has developed generic guidance and Watts Bar's strategy aligns with the generic guidance and will consider the NSSS specific guidance once available. Finally, Watts Bar will include in procedures notification of the RRC to arrange for delivery and deployment of off-site equipment and sufficient supplies of commodities.
Identify Modifications	Each of the Phase 3 strategies will utilize common connections where required as described for the Phase 2 connections to prevent any compatibility issues with the offsite equipment.
Key Reactor Parameters	*List instrumentation credited or recovered for this coping evaluation.* 1. SG Wide Range Level or Narrow Range Level with AFW Flow indication 2. SG Pressure 3. AFWST Level RCS instrumentation that is assumed to also be available for this function: 1. CET Temperature** 2. RCS HL Temperature (T_{hot}) if CETs not available 3. RCS CL Temperature (T_{cold})* 4. RCS Wide Range Pressure 5. Pressurizer Level 6. RVLIS (backup to Pressurizer level) – available for up to 27 hours for limiting flood scenario, at which point pressurizer level is available again.

Maintain Core Cooling & Heat Removal	
PWR Portable Equipment Phase 3	
	7. Neutron Flux For all instruments listed above the normal power source and the long-term power source is the 125v DC Vital Battery. *This instrumentation is only available until flood water enters the auxiliary instrument room. The potential validating indicator for Tcold is SG pressure when natural circulation is occurring. This substitution is allowed by guidance provided in Reference 16. **This instrumentation is only available until flood water enters the auxiliary instrument room. The potential validating indicator for CETs is RCS HL. This substitution is allowed by guidance provided in Reference 16. Watts Bar will develop procedures to read this instrumentation locally, where applicable, using a portable instrument as required by Section 5.3.3 of NEI 12-06.

Deployment Conceptual Design		
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*
A mobile water purification system will enable water from the Tennessee River or other raw water source to be purified. This unit would process the water source and discharge improved quality water to the AFWST. This unit would be self supported.	Each of the Phase 3 strategies will utilize common connections as described for the Phase 2 connections to prevent any compatibility issues with the offsite equipment.	All FLEX equipment connection points will be designed to meet or exceed Watts Bar design basis SSE protection requirements. The system will take suction directly from the Tennessee River or other raw water source. The discharge connections will be identical to the ones used for Phase 2. The protection of those connection points is described in the section for Phase 2.

Notes:

1. Core cooling strategies are provided for conditions where Steam Generators are available or where Steam Generators are not available but a sufficient RCS vent has been established to support core cooling. This assumption is per the guidance of NEI 12-06 FAQ 2012-19. Other configurations are not considered as these occur at short durations that are exempted per NEI-12-06 Table D.

Maintain RCS Inventory Control	
Determine Baseline coping capability with installed coping[2] modifications not including FLEX modifications, utilizing methods described in Table 3-2 of NEI 12-06: • **RCS makeup required (standard design RCP seals)** • **All Plants Provide Means to Provide Borated RCS Makeup**	
PWR Installed Equipment Phase 1:	
Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain RCS inventory control. Identify methods (Low Leak RCP Seals and/or borated high pressure RCS makeup) and strategy (ies) utilized to achieve this coping time. This section discusses RCS inventory control and subcriticality issues for conditions where SGs are available. RCS inventory control and subcriticality issues for conditions where SGs are not available are addressed in the reactor core cooling and heat removal section of this report. Following the declaration of an ELAP, a plant depressurization and cooldown will be initiated at approximately 1 hour of ELAP event. Natural circulation is maintained by ensuring adequate RCS inventory. Watts Bar Unit 1 and Unit 2 have standard Westinghouse RCP seals and given an ELAP event at rated RCS pressure a potential RCP seal leakage rate of 21 gpm exists. Utilizing WCAP-17601 methodology (Reference 8), Reference 20 summarizes the limiting plant-specific scenarios for RCS inventory control, shutdown margin, and Mode 5/Mode 6 boric acid precipitation control with respect to the guidelines set forth in NEI 12-06 (Reference 2). RCS inventory is a significant concern for the ELAP scenario due to the RCP seal design. Timely RCS cooldown and depressurization at 75 to 100°F per hour to ~ 300 PSIA SG pressure should result in an RCS pressure of ~325 PSIA and ~ 425°F Tavg. Holding RCS pressure to greater than 250 PSIG ensures no nitrogen injection into the RCS from Cold Leg Accumulators. RCS makeup is required to compensate for the RCP seal leakage and from shrinkage due to cooldown. For Phase 1 RCS makeup is provided from the Safety Injection System Cold Leg Accumulators. RCP seal leakage would be greatly reduced from the reduction in RCS pressure.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation* SBO EOI ECA-0.0 addresses procedural guidance required for maintaining RCS inventory during Phase 1. (Reference 17) Procedures and guidance to support implementation of a boration strategy, including interfaces to EOPs, special event procedures, abnormal event procedures, and system operating procedures, will be developed in accordance with NEI 12-06, Rev. 0, Section 11.4. Further, the PWROG has developed generic guidance and Watts Bar's strategy aligns with the generic guidance and will consider the NSSS specific guidance once available.
Identify Modifications	*List modifications* 1. 8 Hour Battery Coping. (EDC/DCN 60976, DCN 60384 & PIC to DCN 54871)

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

Maintain RCS Inventory Control	
	2. The backup instrument air/nitrogen supply to the SG Atmospheric Relief Valves (ARVs) and Auxiliary Feedwater (AFW) Level Control Valves (LCVs) will be moved to above the probable maximum flood (PMF) elevation for flood mode response. (DCN 60996 & EDCR 60749) 3. AFWST and connections to the Auxiliary Feedwater Systems (DCN 60060, DCN 62324 & DCN 61422)
Key Reactor Parameters	*List instrumentation credited for this coping evaluation.* 1. CET Temperature** 2. RCS HL Temperature (T_{hot}) if CETs not available 3. RCS CL Temperature (T_{cold})* 4. RCS Wide Range Pressure 5. Pressurizer Level 6. RVLIS (backup to pressurizer level) – available for up to 27 hours for limiting flood scenario, at which point pressurizer level is available again. 7. Neutron Flux For all instruments listed above the normal power source and the long-term power source is the 125v DC Vital Battery. *This instrumentation is only available until flood water enters the auxiliary instrument room. The potential validating indicator for Tcold is SG pressure when natural circulation is occurring. This substitution is allowed by guidance provided in Reference 16. **This instrumentation is only available until flood water enters the auxiliary instrument room. The potential validating indicator for CETs is RCS HL. This substitution is allowed by guidance provided in Reference 16. Watts Bar will develop procedures to read this instrumentation locally, where applicable, using a portable instrument as required by Section 5.3.3 of NEI 12-06.
Notes: None	

Maintain RCS Inventory Control	
PWR Portable Equipment Phase 2:	
Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain RCS inventory control. Identify methods (borated high pressure RCS makeup) and strategy (ies) utilized to achieve this coping time. This section discusses RCS inventory control and subcriticality issues for conditions where SGs are available. RCS inventory control and subcriticality issues for conditions where SGs are not available are addressed in the reactor core cooling and heat removal section of this report. Following the declaration of an ELAP, a plant cooldown will be initiated at approximately 1 hour of ELAP event. Natural circulation is maintained by ensuring adequate RCS inventory. Watts Bar Unit 1 and Unit 2 have standard Westinghouse RCP seals and given an ELAP event and at rated RCS pressure a potential RCP seal leakage rate of 21 gpm exists. Utilizing WCAP-17601 methodology (Reference 8), Reference 20 summarizes the limiting plant-specific scenarios for RCS inventory control, shutdown margin, and Mode 5/Mode 6 boric acid precipitation control with respect to the guidelines set forth in NEI 12-06 (Reference 2). RCS inventory is a significant concern for the ELAP scenario due to the RCP seal design. Timely RCS cooldown and depressurization at 75 to 100°F per hour to ~ 300 PSIA SG pressure should result in an RCS pressure of ~325 PSIA and ~ 425°F Tavg. Holding RCS pressure to greater than 250 PSIG ensures no nitrogen injection into the RCS from Cold Leg Accumulators. RCS makeup is required to compensate for the RCP seal leakage and from shrinkage due to cooldown. 6.9KV switchgear, 6.9KV and 480v Shutdown Boards are aligned and powered by the 6.9KV FLEX DGs within 5 hours of the event. With the 6.9KV Shutdown Boards energized CCS pumps and Safety Injection Pumps are restored taking suction from the RWST (3100 -3300 ppm boron) and injecting through all 4 cold legs to recover RCS pressurizer level. RCP seal leakage would be greatly reduced from the reduction in RCS pressure. The SIP operation would be as needed to maintain pressurizer level until the HP FLEX Pump assumed the task. A HP FLEX Pump would be available at 8.5 to 9 hours from the event. The HP FLEX pump suction would be routed from the RWST FLEX connections located on AB el.692 with the discharge routed to a Safety Injection Pump discharge header FLEX connection. The Boric Acid Storage Tank (BAT) provides a secondary source of makeup for the HP FLEX Pumps (~6900 PPM boron concentration).	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	Procedures and guidance to support deployment and implementation, including interfaces to EOPs, special event procedures, abnormal event procedures, and system operating procedures, will be developed in accordance with NEI 12-06, Rev. 0, Section 11.4. Further, the PWROG has developed generic guidance, and Watts Bar's strategy aligns with the generic guidance and will consider the NSSS specific guidance once available.

Maintain RCS Inventory Control	
PWR Portable Equipment Phase 2:	
Identify Modifications	*List modifications necessary for Phase 2* 1. The backup instrument air supply to the SG Atmospheric Relief Valves (ARVs) and Auxiliary Feedwater (AFW) Level Control Valves (LCVs) will be moved to above the probable maximum flood (PMF) elevation for flood mode response. (DCN 60996 & EDCR 60749) 2. FLEX connections will be made on the ERCW headers in the Auxiliary Building el. 737 for supplying water to the IP FLEX pump.(DCN 60684) 3. The primary connection point for SG cooling will be upstream of the SG LCVs on the TDAFWP discharge line. (DCN 60683, DCN 61784 & EDCR 60751) 4. The secondary connection point for SG cooling will be upstream of the SG LCVs in both the train A and train B MDAFWP discharge piping. A connection to both trains is needed for the secondary connection to ensure feed to all four SGs.(DCN 60683, DCN 61784 & EDCR 60751) 5. Auxiliary Feedwater Supply Tank. (DCN 60060 & DCN 62324) 6. New connections to take suction from the AFWST are required. (DCN 60060 & DCN 61422) 7. New connections will be made at the ERCW headers in the Intake Pumping Station (IPS) for the LP FLEX Pumps to pressurize the ERCW headers during non-flood and flood conditions. (DCN 60684) 8. New connections will be made at the ERCW headers in the 5th Diesel Generator Building for the LP FLEX Pumps to pressurize the ERCW headers during flood conditions. (DCN 60684) 9. New FLEX connections will be made to the Tritiated Water Storage Tank (TWST), Primary Water Storage Tanks (PWSTs), and Demineralized Water Storage Tank to transfer water to the AFWST. (DCN 60684, DCN 60683, DCN 61784 & EDCR 60993) 10. FLEX connections at the Safety Injection Pumps for HP FLEX Pumps RCS makeup. (DCN 60683 & EDCR 60750) 11. RWST FLEX connections for HP FLEX pump or IP FLEX Pump (mode 5 &6) suction source. (DCN 60683, DCN 61784 & EDCR 60994) 12. BAT FLEX connection for HP FLEX Pump suction supply. (DCN 60684) 13. FLEX Equipment Storage Building (FESB). DCN 59084) 14. 225kva DGs (480v FLEX DGs). (DCN 59675) 15. 3 MWe DGs (6.9KV FLEX DGs) (DCN 60853) 16. 8 Hour Battery Coping. (EDC/DCN 60976, DCN 60384 & PIC to DCN 54871)
Key Reactor Parameters	*List instrumentation credited or recovered for this coping evaluation.*

Maintain RCS Inventory Control	
PWR Portable Equipment Phase 2:	
	1. CET Temperature** 2. RCS HL Temperature (T_{hot}) if CETs not available 3. RCS CL Temperature (T_{cold})* 4. RCS wide range pressure 5. RCS Passive Injection Level 6. Pressurizer Level 7. RVLIS (backup to Pressurizer level) – available for up to 27 hours for limiting flood scenario, at which point pressurizer level is available again. 8. Neutron Flux For all instruments listed above the normal power source and the long-term power source is the 125v DC Vital Battery. *This instrumentation is only available until flood water enters the auxiliary instrument room. The potential validating indicator for Tcold is SG pressure when natural circulation is occurring. This substitution is allowed by guidance provided in Reference 16. **This instrumentation is only available until flood water enters the auxiliary instrument room. The potential validating indicator for CETs is RCS HL. This substitution is allowed by guidance provided in Reference 16. Watts Bar will develop procedures to read this instrumentation locally, where applicable, using a portable instrument as required by Section 5.3.3 of NEI 12-06.
Storage / Protection of Equipment: **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	In addition to equipment being stored in the FESB (as described in the Reactor Core Cooling and Heat Removal section) for this function, equipment will be stored in the Auxiliary Building, which is seismically qualified. The 480v FLEX DGs are installed on the AB roof in a protected enclosure.
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	In addition to equipment being stored in the FESB (as described in the Reactor Core Cooling and Heat Removal section) for this function, equipment will be stored in the Auxiliary Building. Equipment required for this function will be stored so that it can be deployed prior to any concerns with flooding. The 480v FLEX DGs are installed on the AB roof in a protected enclosure.
Severe Storms with High Winds	In addition to equipment being stored in the FESB (as described in the Reactor Core Cooling and Heat Removal section) for this function, equipment will be stored in the Auxiliary Building, which is protected from high winds. The 480v FLEX DGs are installed on the AB roof in a protected enclosure.
Snow, Ice, and Extreme Cold	In addition to equipment being stored in the FESB (as described in the Reactor Core Cooling and Heat Removal section) for this function, equipment will be stored in the Auxiliary Building, which is an environmentally controlled building and provides protection from snow, ice, and extreme cold effects. The 480v FLEX DGs are installed on the

Maintain RCS Inventory Control		
PWR Portable Equipment Phase 2:		
	AB roof in a protected enclosure.	
High Temperatures	In addition to equipment being stored in the FESB (as described in the Reactor Core Cooling and Heat Removal section) for this function, equipment will be stored in the Auxiliary Building, which is an environmentally controlled building and provides protection from high temperature effects. The 480v FLEX DGs are installed on the AB roof in a protected enclosure.	
Deployment Conceptual Modification (Attachment 3 contains Conceptual Sketches)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify Modifications*	*Identify how the connection is protected*
The primary RCS makeup FLEX connection will be on the SIP Train B discharge line, in the SIP room at elevation 692. For this alignment, suction will be taken from the RWST or the BAT and discharged through the HP FLEX pumps to the FLEX connection points shown in Attachment 3, Figure A3-6. The proposed hose routing for the primary connection and the associated equipment can be found in Attachment 3, Figures A3-8 through A3-10. During Mode 5 and 6 with SGs unavailable, suction will be taken from the RWST FLEX connections and discharged through the Mode 5 & 6 FLEX pumps (staged in AB el. 692. near the primary connection point.	<u>Primary Connection Modification</u> • Install tees or weldolets, • Add isolation valves • Add a hose adapters <u>RWST Modifications:</u> The RWST FLEX connections are located on el. 692 in the Auxiliary Building. <u>Safety Injection Pump Discharge Header Modifications</u> The FLEX connections on the Safety Injection Pumps discharge Headers for HP FLEX Pumps RCS makeup are located on AB el. 692.	All FLEX equipment connection points will be designed to meet or exceed Watts Bar design basis SSE protection requirements. The primary FLEX connection and RWST connection are located inside the Auxiliary Building. The Auxiliary Building is a safety related structure and is protected from all external hazards except flooding. The RWST FLEX connections will be seismically qualified and missile protected.
The secondary RCS makeup FLEX connection will be on the SIP Train A discharge line, in the SIP room at elevation 692'. For this alignment, suction will be taken from the RWST or BATs and discharged through the HP FLEX pumps to the connection points shown in Attachment 3, Figure A3-6. The	The secondary FLEX connection modification is identical to the primary, except for being located on SIP Train A discharge. <u>BAT Modification</u> • Install tees on discharge line of BAT A on AB el. 713. • Add an isolation valve on the branch. • Add a Storz adapter with cap	All FLEX equipment connection points will be designed to meet or exceed Watts Bar design basis SSE protection requirements. The secondary connection and BAT FLEX connection are located inside the Auxiliary Building. The Auxiliary Building is a safety related structure and is protected from all external hazards except

Maintain RCS Inventory Control		
PWR Portable Equipment Phase 2:		
proposed hose routing for the secondary RCS FLEX connection and the associated equipment can be found in Attachment 3, Figure A3-8. During Mode 5 and 6 with SGs unavailable, suction will be taken from the RWST and discharged through the Mode 5 and 6 FLEX pumps staged on el. 692 in the Auxiliary Building. Figure A3-11.	on branch. <u>Safety Injection Pump Discharge Header Modifications</u> The FLEX connections on the Safety Injection Pumps discharge Headers for HP FLEX Pumps RCS makeup are located on AB el. 692.	flooding. The RWST connections will be seismically qualified and missile protected. For connections required during flood conditions, procedures will ensure that hoses are connected before flood levels reach the connection.

Notes:

1. System modifications are described in the "Modifications" section above and are illustrated in Attachment 3.
2. N+1 HP FLEX Pumps will be staged in the Auxiliary Building. This satisfied N+1 NEI requirements.
3. Figures A3-8 through A3-10 in Attachment 3 provides the deployment routes from the staging locations for each HP FLEX Pump to the pumps suction piping and to the primary and secondary connection points on the RCS connected systems.

Maintain RCS Inventory Control	
PWR Portable Equipment Phase 3:	
Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain RCS Inventory Control. Identify method (borated high pressure RCS makeup) and strategy (ies) utilized to achieve this coping time. This section discusses RCS inventory control and subcriticality issues for conditions where SGs are available. RCS inventory control and subcriticality issues for conditions where SGs are not available are addressed in the reactor core cooling and heat removal section of this report. Reactor level and sub-criticality is adequately maintained via the Phase 2 strategy; however, borated sources are limited. Phase 3 deployment of a unit capable of generating borated water from the water processed through the purification unit can further extend coping times with respect to RCS inventory management. For Phase 3, Watts Bar will continue the Phase 2 coping strategies with additional assistance provided from offsite equipment/resources. Backup or alternate Phase 2 FLEX equipment will be provided by the RRC as necessary. Watts Bar will determine where Phase 3 equipment will be staged.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	Procedures and guidance to support deployment and implementation, including interfaces to EOPs, special event procedures, abnormal event procedures, and system operating procedures, will be developed in accordance with NEI 12-06, Rev. 0, Section 11.4. Further, the PWROG has developed generic guidance, and Watts Bar's strategy aligns with the generic guidance and will consider the NSSS specific guidance once available. Finally, Watts Bar will include in procedures notification of the RRC to arrange for delivery and deployment of off-site equipment and sufficient supplies of commodities.
Identify Modifications	Each of the Phase 3 strategies will utilize common connections as described for the Phase 2 connections to prevent any compatibility issues with the offsite equipment.
Key Reactor Parameters	*List instrumentation credited or recovered for this coping evaluation.* 1. CET Temperature** 2. RCS HL Temperature (T_{hot}) if CETs not available 3. RCS CL Temperature (T_{cold})* 4. RCS wide range pressure 5. RCS Passive Injection Level 6. Pressurizer Level 7. RVLIS (backup to Pressurizer level) – available for up to 27 hours for limiting flood scenario, at which point pressurizer level is available again. 8. Neutron Flux For all instruments listed above the normal power source and the long-term power source is the 125v DC Vital Battery. *This instrumentation is only available until flood water enters the auxiliary instrument room. The potential validating indicator for Tcold is SG pressure when natural circulation is occurring. This substitution is allowed by guidance provided in Reference 16.

Maintain RCS Inventory Control	
PWR Portable Equipment Phase 3:	
	**This instrumentation is only available until flood water enters the auxiliary instrument room. The potential validating indicator for CETs is RCS HL. This substitution is allowed by guidance provided in Reference 16. Watts Bar will develop procedures to read this instrumentation locally, where applicable, using a portable instrument as required by Section 5.3.3 of NEI 12-06.

Deployment Conceptual Modification (Attachment 3 contains Conceptual Sketches)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify Modifications*	*Identify how the connection is protected*
A mobile water purification system would allow demineralized water makeup to the AFWST. This unit would be self supported.	Each of the Phase 3 strategies will utilize common connections as described for the Phase 2 connections to prevent any compatibility issues with the offsite equipment.	All FLEX equipment connection points will be designed to meet or exceed Watts Bar design basis SSE protection requirements. The discharge connections will be identical to the ones used for Phase 2. The protection of those connection points is described in the section for Phase 2 for RCS Inventory Control.
Notes: None		

Maintain Containment	
Determine Baseline coping capability with installed coping[3] modifications not including FLEX modifications, utilizing methods described in Table 3-2 of NEI 12-06: • **Containment Spray** • **Hydrogen igniters (ice condenser containments only)**	
PWR Installed Equipment Phase 1:	
Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain containment. Identify method (Hydrogen igniter) and strategy (ies) utilized to achieve this coping time. Watts Bar will perform a containment evaluation based on the boundary conditions described in Section 2 of NEI 12-06. Based on the results of this evaluation, required actions to ensure maintenance of containment integrity and required instrumentation function will be developed. (Open item OI 4) There are no phase 1 actions required at this time that need to be addressed.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	Procedures and guidance to support implementation of this strategy, including interfaces to EOPs, special event procedures, abnormal event procedures, and system operating procedures, will be developed in accordance with NEI 12-06, Rev. 0, Section 11.4. Further, the PWROG has developed generic guidance, and Watts Bar's strategy aligns with the generic guidance and will consider the NSSS specific guidance once available.
Identify Modifications	*N/A*
Key Containment Parameters	*List instrumentation credited for this coping evaluation.* 1. Containment Pressure* 2. Containment Temperature** *For this instrumentation, the normal power source and the long-term power source is the 125v DC Vital Battery. **This instrumentation is only available until flood water enters the technical support center (TSC) inverter or station battery rooms. (Open item OI 10) Watts Bar will develop procedures to read this instrumentation locally, where applicable, using a portable instrument as required by Section 5.3.3 of NEI 12-06.
Notes: None	

[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 Containment	
PWR 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. Identify method (hydrogen igniters) and strategy (ies) utilized to achieve this coping time. Watts Bar will perform a containment evaluation based on the boundary conditions described in Section 2 of NEI 12-06. Based on the results of this evaluation, required actions to ensure maintenance of containment integrity and required instrumentation function will be developed. (Open item OI 4) Additionally, the 480v FLEX DGSs discussed in the safety functions support section will provide power directly to the hydrogen igniter supply transformers. The onsite 6.9KV FLEX DGs are available to provide power to Containment Air Return Fans or Lower Compartment Coolers (LCCs) for containment temperature control, if required. Cooling water would be provided to the LCCs by onsite LP FLEX pumps feeding the ERCW system headers.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	Procedures and guidance to support deployment and implementation, including interfaces to EOPs, special event procedures, abnormal event procedures, and system operating procedures, will be developed in accordance with NEI 12-06, Rev. 0, Section 11.4. Further, the PWROG has developed generic guidance, and Watts Bar's strategy aligns with the generic guidance and will consider the NSSS specific guidance once available.
Identify Modifications	Power capability will be installed to the hydrogen igniter supply transformers.
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.* 1. Containment Pressure* 2. Containment Temperature** *For this instrumentation, the normal power source and the long-term power source are the 125v DC Vital Battery. **This instrumentation is only available until flood water enters the TSC inverter or station battery rooms. (Open Item OI 10)
Storage / Protection of Equipment: **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	The 480v FLEX DGs will be pre-staged on the roof of the Auxiliary Building. A protection structure will be built around the DGs, which will be designed to the same Seismic Category I requirements as the Auxiliary Building. Seismic input for the design corresponds to the appropriate seismic accelerations at the roof of the Auxiliary Building. This design provides a minimum HCLPF of the protective structure of 2xSSE.
Flooding	The 480v FLEX DGs will be pre-staged on the roof of the Auxiliary Building, which is sited in a suitable location that is above the PMF and as such is not susceptible to flooding from any source.
Severe Storms with High Winds	The 480v FLEX DGs will be pre-staged on the roof of the Auxiliary Building. A protection structure will be built around the DGs, which is sited

<table>
<tr><th colspan="3">Maintain Containment</th></tr>
<tr><td></td><td colspan="2">in a suitable location that is protected from NRC region 1 tornado, missiles, and velocities as defined in Nuclear Regulatory Commission (NRC) Regulatory Guide 1.76 Revision 1.</td></tr>
<tr><td>Snow, Ice, and Extreme Cold</td><td colspan="2">The 480v FLEX DGs will be pre-staged on the roof of the Auxiliary Building. A protection structure will be built around the DGs, and will be evaluated for snow, ice and extreme cold temperature effects and heating will be provided as required to assure no adverse effects on the FLEX equipment.</td></tr>
<tr><td>High Temperatures</td><td colspan="2">The 480v FLEX DGs will be pre-staged on the roof of the Auxiliary Building. A protection structure will be built around the DGs, and will be evaluated for high temperature effects and ventilation will be provided as required to assure no adverse effects on the FLEX equipment.</td></tr>
<tr><th colspan="3">Deployment Conceptual Modification
(Attachment 3 contains Conceptual Sketches)</th></tr>
<tr><td>Strategy</td><td>Modifications</td><td>Protection of connections</td></tr>
<tr><td>Identify Strategy including how the equipment will be deployed to the point of use.</td><td>Identify Modifications</td><td>Identify how the connection is protected</td></tr>
<tr><td>The hydrogen igniters can be repowered by the 480v FLEX DGs that will be pre-staged on the roof of the Auxiliary Building or by the 6.9KV FLEX DGs. Cabling will be routed from the generators to one of the diverse transfer switches that will be installed.</td><td>Diverse transfer switches will be installed which directly supply the hydrogen igniter transformers. (DCN 59675 & DCN 60853).</td><td>The protection structure for the 480v FLEX DGs and the diverse transfer switches will be designed and installed such that each is protected from the five external hazards, as described in this section.</td></tr>
<tr><td colspan="3">Notes: None</td></tr>
</table>

Maintain Containment	
PWR Portable Equipment Phase 3:	
Provide a general description of the coping strategies using Phase 3 equipment including modifications that are proposed to maintain containment. Identify method (hydrogen igniters) and strategy (ies) utilized to achieve this coping time. Watts Bar will perform a containment evaluation based on the boundary conditions described in Section 2 of NEI 12-06. Based on the results of this evaluation, required actions to ensure maintenance of containment integrity and required instrumentation function will be developed. (Open item OI 4) The hydrogen igniters would continue to be repowered by the 480v FLEX DGS or 6.9KV FLEX DGs . A backup or alternate set of Phase 2 equipment will be provided by the RRC as needed.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	Procedures and guidance to support deployment and implementation, including interfaces to EOPs, special event procedures, abnormal event procedures, and system operating procedures, will be developed in accordance with NEI 12-06, Rev. 0, Section 11.4. Further, the PWROG has developed generic guidance, and Watts Bar's strategy aligns with the generic guidance and will consider the NSSS specific guidance once available. Finally, Watts Bar will include in procedures notification of the RRC to arrange for delivery and deployment of offsite equipment and sufficient supplies of commodities.
Identify Modifications	The same modification as Phase 2 applies for Phase 3.
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.* 1. Containment Pressure* 2. Containment Temperature** *For this instrumentation, the normal power source and the long-term power source is the 125v DC Vital Battery. **This instrumentation is only available until flood water enters the TSC inverter or station battery rooms. (Open Item OI 10) Watts Bar will develop procedures to read this instrumentation locally, where applicable, using a portable instrument as required by Section 5.3.3 of NEI 12-06.

Deployment Conceptual Modification (Attachment 3 contains Conceptual Sketches)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify Modifications*	*Identify how the connection is protected*
The same modification, as Phase 2 applies for Phase 3.	The same modification, as Phase 2 applies for Phase 3.	All FLEX equipment connection points will be designed to meet or exceed Watts Bar design basis safe shutdown earthquake (SSE) protection requirements. The same modification, as Phase 2 applies for Phase 3.
Notes: None		

Maintain Spent Fuel Pool Cooling
Determine Baseline coping capability with installed coping[4] modifications not including FLEX modifications, utilizing methods described in Table 3-2 of NEI 12-06: • **Makeup with Portable Injection Source**
PWR 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 via portable injection source) and strategy (ies) utilized to achieve this coping time.

Reference 18 summarizes that there will be no volume lost from the SFP due to sloshing. A small range of critical damping factors were investigated and it was shown that the critical damping factor had no influence on the amount of water sloshed out of the pool. However, for all critical damping factors, there was water lost into the ventilation ducts regardless of the direction of the seismic motion. The volume of the water lost in the ducts was conservatively calculated to be 59.5 ft^3. Access to the SFP area as part of Phase 2 response could be challenged due to environmental conditions near the pool. Therefore, the required action is to establish ventilation in this area and establish any equipment local to the SFP required to accomplish the coping strategies (such as the primary SFP cooling strategy discussed below). If the air environment in the SFP area requires the building to be ventilated, doors will be opened to establish air movement and venting the SFP building. For accessibility, establishing the SFP vent and any other actions required inside the fuel handling building should be completed before boil off occurs.

Operating, pre-fuel transfer or post-fuel transfer
Considering no reduction in SFP water inventory starting from nominal pool level, this results in a time when boil off decreases the water level to 10 feet above the SFP racks of approximately 85 hours for an SSE seismic event with an initial bulk water temperature in the pool of 100°F. This value was calculated using the normal operating decay heat load.

Considering the maximum possible loss of water through the vents in SFP water inventory starting from nominal pool level, this results in a time when boil off occurs of approximately 18.69 hours for an safe shutdown earthquake (SSE) seismic event and an initial bulk water temperature in the pool of 100°F. This value was calculated using the normal operating decay heat load. Time to boil the level to 10 ft above the fuel racks (~735 ft) for normal operating decay heat load is determined below. Note that the top of the fuel is at ~749 ft and the boil off rate for normal decay heat load is 32.56 gpm as stated in Reference 18. A volume of level per inch of 104.38 ft^3/in is from Reference 18.

Time to boil down to 10 ft above (749-735=14 ft = 168 in) fuel racks:

$$= 168\text{in} \times \frac{104.38\text{ft}^3}{\text{in}} \times \frac{1\text{gal}}{0.13368\text{ft}^3} \times \frac{1\text{min}}{32.56\text{gal}} \times \frac{1\text{hour}}{60\,\text{min}} = 67.15 + 18.69 = 85.84\text{hours}$$

Fuel in Transfer or Full Core Offload
For the maximum credible heat load and an initial water temperature in the pool of 140°F, the time when boil off decreases the water level to 10 feet above the SFP racks is approximately 30 hours.

Considering the maximum possible loss of water through the vents in SFP water inventory starting from nominal pool level, this results in a time when boil off occurs of approximately 4.58 hours for an SSE seismic event and an initial bulk water temperature in the pool of 140°F. This value was calculated using the maximum operating decay heat load, as summarized in Reference 18. Time to boil the level to 10 ft above the fuel racks (~735 ft) for normal operating decay heat load is determined below. Note that the top of the fuel is at ~749 ft and the boil off rate for normal decay heat load is 83.98 gpm as stated in Reference

[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.

18.

Time to boil down to 10 ft above (749-735=14 ft = 168 in) fuel racks:

$$= 168in \times \frac{104.38 ft^3}{in} \times \frac{1gal}{0.13368 ft^3} \times \frac{1\min}{83.98gal} \times \frac{1hour}{60\min} = 26.03 + 4.58 = 30.61hours$$

In order to keep the pool at a constant level of coolant (thus covering the top of the spent fuel), the LP FLEX pumps will pressurize the ERCW headers to provide makeup to prevent a decrease in the level of the SFP.

Details:	
Provide a brief description of Procedures / Strategies / Guidelines	Procedures and guidance to support implementation of this strategy, including interfaces to EOPs, special event procedures, abnormal event procedures, and system operating procedures, will be developed in accordance with NEI 12-06, Rev. 0, Section 11.4. Further, the PWROG has developed generic guidance, and Watts Bar's strategy aligns with the generic guidance and will consider the NSSS specific guidance once available.
Identify Modifications	N/A
Key SFP Parameter	The implementation of this parameter will align with the requirements of by NRC Order EA 12-051. This instrument will have initial local battery power; with the capability to be powered from the 480v FLEX DGs. Watts Bar will develop procedures to read this instrumentation locally, where applicable, using a portable instrument as required by Section 5.3.3 of NEI 12-06.
Notes:	

Maintain Spent Fuel Pool Cooling	
PWR 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 via portable injection source) and strategy (ies) utilized to achieve this coping time. The transition to Phase 2 strategies will be as the inventory in the SFP slowly declines due to boiling. SFP cooling through makeup and spray will be provided by using a FLEX pump to inject coolant directly into the pool, into existing SFP cooling piping, or spray the coolant into the pool using portable FLEX spray nozzles. A Spent Fuel Pool Cooling Pump may be energized utilizing 6.9KV FLEX DG to provide SFP cooling, if required. Operating, pre-fuel transfer or post-fuel transfer Considering no reduction in SFP water inventory starting from nominal pool level, this results in a time when boil off decreases the water level to 10 feet above the SFP racks of approximately 85 hours for an SSE seismic event with an initial bulk water temperature in the pool of 100°F. This value was calculated using the normal operating decay heat load, shown in the Phase 1 section for Maintain Spent Fuel Pool Cooling. Fuel in Transfer or Full Core Offload For the maximum credible heat load and an initial water temperature in the pool of 140°F, the time when boil off decreases the water level to 10 feet above the SFP racks is approximately 30 hours, shown in the Phase 1 section for Maintain Spent Fuel Pool Cooling. To provide an unlimited supply of water for SFP makeup during Phase 2, LP FLEX pumps will be used to pressurize the ERCW headers which can then be used for makeup to the SFP FLEX mitigation strategies. For restoration of SFP cooling Watts Bar intends to repower one train of normal pool cooling equipment. This will include the use of LP FLEX pumps on site to provide flow to the CCS heat exchanger and the onsite 6.9KV FLEX DGs to repower both the CCS and SFP cooling pumps. The primary SFP makeup flow method is from the ERCW header connections on Elevation 757' from FLEX connections at the ERCW to CCS spool pieces (next to the CCS Surge Tanks) through a hose or hoses to the SFP. The secondary SFP makeup is new FLEX connection added to the SFP Demineralized Water System (DWS) makeup line on elevation 737. Supply to this FLEX connection could come from an available clean water source via transfer pump, if available or an ERCW FLEX connection on elevation 737. This secondary makeup capability provides makeup control when the refueling floor is not accessible. Both FLEX connections can be accessed during both flood and non-flood conditions. Watts Bar will provide portable (fire-fighting) flow nozzle capability based on a flow of 500 gpm, which equals the FLEX requirement to provide 250 gpm of spray flow per unit to the spent fuel pool.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	Procedures and guidance to support deployment and implementation, including interfaces to EOPs, special event procedures, abnormal event procedures, and system operating procedures, will be developed in accordance with NEI 12-06, Rev. 0, Section 11.4. Further, the PWROG has developed generic guidance, and Watts Bar's strategy aligns with the generic guidance and will consider the NSSS specific guidance once available.
Identify Modifications	*List modifications*

Maintain Spent Fuel Pool Cooling	
	1. New connections will be made at the ERCW headers in the Intake Pumping Station (IPS) for the LP FLEX Pumps to pressurize the ERCW headers during non-flood and flood conditions. (DCN 60684) 2. New connections will be made at the ERCW headers in the 5th Diesel Generator Building for the LP FLEX Pumps to pressurize the ERCW headers during flood conditions. (DCN 60684) 3. FLEX connections will be made on the ERCW headers in the Auxiliary Building el. 737 for supplying raw water. (DCN 60684) 4. New FLEX connections will be made to the Tritiated Water Storage Tank (TWST), Primary Water Storage Tanks (PWSTs), and Demineralized Water Storage Tank for water transfer capability. (DCN 60684, DCN 60683, DCN 61784 & EDCR 60993) 5. The primary SFP FLEX connections with Storz fittings will be located at the ERCW to CCS spool pieces (next to the CCS Surge Tanks) on Refuel floor elevation 757. These can supply direct makeup or spray if required. (DCN 60684) 6. The secondary SFP FLEX connection is located on Auxiliary Building elevation 737 (a new tee, upstream isolation valve and FLEX connection) on the Demineralized Water System piping leading to the SFP. (DCN 60684).
Key SFP Parameter	The implementation of this parameter will align with the requirements of by NRC Order EA 12-051. These instruments will have initial local battery power with the capability to be powered from the 480v FLEX DGs.
Storage / Protection of Equipment: Describe storage / protection plan or schedule to determine storage requirements	
Seismic	Portable equipment required to implement this FLEX strategy will be maintained in the FESB, which will be designed for seismic loading in excess of the minimum requirements of American Society of Civil Engineers (ASCE) 7-10. The design of the FESB provides a minimum HCLPF of 2x SSE. The 480v FLEX DGS are installed on the AB roof in a protected enclosure.
Flooding	Portable equipment required to implement this FLEX strategy will be maintained in the FESB, which is designed to meet or exceed the licensing basis high wind hazard for Watts Bar. The 480v FLEX DGS are installed on the AB roof in a protected enclosure.
Severe Storms with High Winds	Portable equipment required to implement this FLEX strategy will be maintained in the FESB, which is sited in a suitable location that is protected from NRC region 1 tornado, missiles, and velocities as defined in NRC Regulatory Guide 1.76 coupled with 360 mph wind speeds (Reference 5 Paragraph 2.3.1). The 480v FLEX DGS are installed on the AB roof in a protected enclosure.

Maintain Spent Fuel Pool Cooling	
Snow, Ice, and Extreme Cold	The FESB will be evaluated for snow, ice and extreme cold temperature effects and heating will be provided as required to assure no adverse effects on the FLEX equipment. The FESB will have a standalone HVAC system. The 480v FLEX DGS are installed on the AB roof in a protected enclosure.
High Temperatures	The FESB will be evaluated for high temperature effects and ventilation will be provided as required to assure no adverse effects on the FLEX equipment. The FESB will have a standalone HVAC system. The 480v FLEX DGS are installed on the AB roof in a protected enclosure.

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 primary method is flow from the ERCW headers at two locations using adapters and hose connections at the 757' level. This strategy can be implemented in flood and non-flood conditions. The proposed hose routing for the primary method and the associated equipment can be found in Attachment 3, Figure A3-14 through A3-16. The system connection point can be found in Attachment 3, Figure A3-12. Note that SFP spray would be routed in an identical manner; however, the end of the hose could have the spray nozzle installed. ERCW connections can be found in Attachment 3, Figures A3-17 and A3-18.	The primary SFP FLEX connection modification will be an adapter where a hose connection can be installed at the ERCW supply valve to the CCS Surge Tank flood mode spool piece. (DCN 60684) ERCW Modifications The same modifications required to pressurize ERCW headers are described under Phase 2 Maintain Core Cooling and Heat Removal.	All FLEX equipment connection points will be designed to meet or exceed Watts Bar design basis SSE protection requirements. The primary and secondary connections are in the Auxiliary Building, which is seismically qualified and missile protected. The primary connection is above the PMF.
The secondary SFP connection will be to the DWS makeup line, on Elevation 737' of the Auxiliary Building. This strategy can be implemented in flood and non-flood conditions. FLEX hose will be routed from this location, across the floor on Elevation 737', to the ERCW cleanout port FLEX connections.	The secondary SFP FLEX connection modification includes: • A tee added to the DWS makeup line to the SFP • An isolation valve added to the main line upstream of the connection. • An isolation valve added to the new branch. • Storz cap/adapter added to the	All FLEX equipment connection points will be designed to meet or exceed Watts Bar design basis SSE protection requirements. The connection point is in the Auxiliary Building, which is seismically qualified and missile protected. Hose routing to the primary connection will be performed before flood conditions

Maintain Spent Fuel Pool Cooling		
The proposed hose routing for the secondary connection and the associated equipment can be found in Attachment 3, Figure A3-14 through A3-16. The system connection point can be found in Attachment 3, Figure A3-13. ERCW connections can be found in Attachment 3, Figures A3-17 and A3-18.	new branch. The modification to add FLEX connections to the ERCW cleanout ports described in the Reactor Core Cooling and Heat Removal section also applies to this case due to the location of the connection point. (DCN 60684)	make the area inaccessible.
Notes: 1. System modifications are described in the "Modifications" section above and are illustrated in Attachment 3. 2. Figures A3-14 through A3-16 in Attachment 3 provides the hose routing for the SFP makeup strategies.		

<table>
<tr><td colspan="3">Maintain Spent Fuel Pool Cooling</td></tr>
<tr><td colspan="3">PWR Portable Equipment Phase 3:</td></tr>
<tr><td colspan="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 via portable injection source) and strategy (ies) utilized to achieve this coping time.</td></tr>
<tr><td colspan="3">Details:</td></tr>
<tr><td colspan="3">The strategies described for Phase 2 can continue as long as there is sufficient inventory available to feed the strategies. As mentioned for the Reactor Core Cooling and Heat Removal function, a mobile water purification unit will be received from the RRC to provide continued purified water to support this function.

Watts Bar has determined where Phase 3 equipment will be staged

Also, a backup or alternate set of Phase 2 equipment will be provided by the RRC as needed.</td></tr>
<tr><td>Provide a brief description of Procedures / Strategies / Guidelines</td><td colspan="2">Procedures and guidance to support deployment and implementation, including interfaces to EOPs, special event procedures, abnormal event procedures, and system operating procedures, will be developed in accordance with NEI 12-06, Rev. 0, Section 11.4. Further, the PWROG has developed generic guidance, and Watts Bar's strategy aligns with the generic guidance and will consider the NSSS specific guidance once available. Finally, Watts Bar will include in procedures notification of the RRC to arrange for delivery and deployment of offsite equipment and sufficient supplies of commodities.</td></tr>
<tr><td>Identify Modifications</td><td colspan="2">N/A</td></tr>
<tr><td>Key SFP Parameter</td><td colspan="2">The implementation of this parameter will align with the requirements of NRC Order EA 12-051.

This instrument will have initial local battery power; with the capability to be powered from the 480v FLEX DGs.</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">Deployment Conceptual Design
(Attachment 3 contains Conceptual Sketches)</td></tr>
<tr><td>Strategy</td><td>Modifications</td><td>Protection of connections</td></tr>
<tr><td>Identify Strategy including how the equipment will be deployed to the point of use.</td><td>Identify Modifications</td><td>Identify how the connection is protected</td></tr>
<tr><td>The description for the mobile water purification system will be the same as was mentioned for the other functions.</td><td>The description for the mobile water purification system will be the same as was mentioned for the other functions.</td><td>The description for the mobile water purification system will be the same as was mentioned for the other functions.</td></tr>
<tr><td colspan="3">Notes: None</td></tr>
</table>

Safety Functions Support	
Determine Baseline coping capability with installed coping[5] modifications not including FLEX modifications.	
PWR 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. Watts Bar will rely on existing installed 125v DC Vital Batteries to power key instrumentation and emergency lighting. A battery coping calculation determined that the battery coping time is 8 hours. Preliminary analysis using conservative heat loads in the Auxiliary and Control Buildings has shown that installed equipment credited for mitigation response will remain available. In addition, accessibility of these areas for required actions is acceptable.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation.* Procedures and guidance to support deployment and implementation, including interfaces to EOPs, special event procedures, abnormal event procedures, and system operating procedures, will be developed in accordance with NEI 12-06, Rev. 0, Section 11.4. Further, the PWROG has developed generic guidance, and Watts Bar's strategy aligns with the generic guidance and will consider the NSSS specific guidance once available.
Identify Modifications	*List modifications and describe how they support coping time.* 8 Hour Battery Coping. (EDC/DCN 60976, DCN 60384 & PIC to DCN 54871). The replacement of incandescent lamps with LED lamps in emergency lighting for the Main Control Room, Shutdown Board Rooms and Appendix R Light Packs provides for additional margin on the 125v DC Vital Battery Systems.
Key Parameters	*List instrumentation credited for this coping evaluation phase.* • DC Bus Voltage For all instruments listed above the normal power source and the long-term power source are the 125v DC Vital Battery Systems.
Notes:	

[5] 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.

<table>
<tr><th colspan="2">Safety Functions Support</th></tr>
<tr><th colspan="2">PWR Portable Equipment Phase 2</th></tr>
<tr><td colspan="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.

The primary electrical need during Phase 2 is DC power for critical instrumentation. This will be accomplished by energizing the support power system and energizing battery chargers on both A and B trains in both Units 1 and 2.

The on-site 480v FLEX DGs are pre-staged to provide power to the 125v DC Vital Batteries and 120v AC Vital Instrument Power System. These generators will be pre-staged on the Auxiliary Building roof and will be protected from the external hazards with an adequate supply of fuel for 8 hours of operation. The 480v FLEX DGs will be connected to the battery chargers to power the DC and AC Vital Instrument Power System.

Additionally, the onsite 6.9KV FLEX DGs are pre-staged to provide power to the existing 6.9KV Shutdown Power System. The 6.9KV FLEX DGs may also serve as an alternative power source for the loads supplied by the on-site 480v FLEX DGs. These 6.9KV FLEX DGs will be staged in the FESB and protected from the external hazards discussed in this document.</td></tr>
<tr><th colspan="2">Details:</th></tr>
<tr><td>Provide a brief description of Procedures / Strategies / Guidelines</td><td>Confirm that procedure/guidance exists or will be developed to support implementation with a description of the procedure / strategy / guideline.

Procedures and guidance to support deployment and implementation, including interfaces to EOPs, special event procedures, abnormal event procedures, and system operating procedures, will be developed in accordance with NEI 12-06, Rev. 0, and Section 11.4. Further, the PWROG has developed generic guidance, and Watts Bar's strategy aligns with the generic guidance and will consider the NSSS specific guidance once available.</td></tr>
<tr><td>Identify Modifications</td><td>For the 480v FLEX DGs, two fused distribution panels will be used to provide power to the supplied loads. Each fuse panel provides connections to two Vital Battery chargers and one train of hydrogen igniters for each unit. Each fuse distribution panel will have a connection to 480v AC distribution to close Cold Leg Accumulator Isolation valves during cooldown.

Fuel for the 480v FLEX DGs will be provided by the installed EDG 7-day tanks. Fuel lines will be installed between the 7-day fuel tanks mounted under the Diesel Generator building and Auxiliary Building roof to provide fuel to the 480v FLEX DGs with a fuel transfer pump. (DCN 59675)

To connect the existing 6.9KV Shutdown Power System to the 6.9KV FLEX DGs during FLEX operation, the connection to the existing safety-related Diesel Generator circuit is opened and the circuits to the 6.9KV FLEX DGs are closed by operating the existing interlocked transfer switches 1A-A, 1B-B, 2A-A, or 2B-B. This will be done under administrative controls, ensuring that a no-load condition exists on the load</td></tr>
</table>

Safety Functions Support	
PWR Portable Equipment Phase 2	
	side of the transfer switches. The permanently installed electrical connection points for the 6.9KV FLEX DGs are from the DGs integral output connection panel through conduits within the FESB to underground conduits located on the outside of the FESB south wall. One 6.9KV FLEX DG will be assigned to power Train A on both units and the second 6.9KV FLEX DG will be assigned to power Train B of both units. The conduits will meet seismic Class I requirements for safety related and quality-related structures. Actual mechanical and electrical connections to the presently installed safety related DG equipment shall meet safety related requirements at the interfaces. Refueling of the 6.9KV FLEX DGs will be accomplished using a separate diesel fuel transfer pump dedicated for the purpose of transferring fuel from the 7-day tanks to the 6.9KV FLEX DGs' fuel oil day tanks. (DCN 60853)
Key Parameters	*List instrumentation credited or recovered for this coping evaluation.* • 125v DC Vital Batteries Bus Voltage For the instrument listed above the normal power source and the long-term power source are the 125v DC Vital Battery. Watts Bar will develop procedures to read this instrumentation locally, where applicable, using a portable instrument as required by Section 5.3.3 of NEI 12-06.
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	Equipment for this function will either be stored or pre-staged in the FESB, in the Auxiliary Building, Intake Pumping Station or on the Auxiliary Building roof. The protection of FLEX equipment for this hazard is addressed for each of these locations in the Reactor Core Cooling and Heat Removal and Maintain RCS Inventory Control sections.
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	Equipment for this function will either be stored or pre-staged in the FESB, in the Auxiliary Building, Intake Pumping Station or on the Auxiliary Building roof. The protection of FLEX equipment for this hazard is addressed for each of these locations in the Reactor Core Cooling and Heat Removal and Maintain RCS Inventory Control sections.
Severe Storms with High Winds	Equipment for this function will either be stored or pre-staged in the FESB, in the Auxiliary Building, Intake Pumping Station or on the Auxiliary Building roof. The protection of FLEX equipment for this hazard is addressed for each of these locations in the Reactor Core Cooling and Heat Removal and Maintain RCS Inventory Control sections.
Snow, Ice, and Extreme Cold	Equipment for this function will either be stored or pre-staged in the FESB, in the Auxiliary Building, Intake Pumping Station or on the Auxiliary Building roof. The protection of FLEX equipment for this hazard is addressed for each of these locations in the Reactor Core Cooling and Heat Removal and Maintain RCS Inventory Control sections.

Safety Functions Support		
PWR Portable Equipment Phase 2		
High Temperatures	Equipment for this function will either be stored or pre-staged in the FESB, in the Auxiliary Building, Intake Pumping Station or on the Auxiliary Building roof. The protection of FLEX equipment for this hazard is addressed for each of these locations in the Reactor Core Cooling and Heat Removal and Maintain RCS Inventory Control sections.	
Deployment Conceptual Design **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify Modifications*	*Identify how the connection is protected*
The strategy for this function is described above in the Identify Modifications section.	1. 225kva DGs (480v FLEX DGs). (DCN 59675) 2. 3 MWe DGs (6.9KV FLEX DGs) (DCN 60853) 3. 8 Hour Battery Coping. (EDC/DCN 60976, DCN 60384 & PIC to DCN 54871)	The protection structure for the 480v FLEX DGs will be designed and installed such that each is protected from the five external hazards, as described in this section. The fuse distribution panels for the 480v FLEX DGs will be located inside the Auxiliary Building which will provide protection from the external hazards, as described in this section.
Notes: None.		

Safety Functions Support	
PWR 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. A backup or alternate set of Phase 2 equipment will be provided by the RRC, as needed. Watts Bar has determined Phase 3 equipment staging locations.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	Procedures and guidance to support deployment and implementation, including interfaces to EOPs, special event procedures, abnormal event procedures, and system operating procedures, will be developed in accordance with NEI 12-06, Rev. 0, Section 11.4. Further, the PWROG has developed generic guidance, and Watts Bar's strategy aligns with the generic guidance and will consider the NSSS specific guidance once available. Finally, Watts Bar will include notification of the RRC in plant procedures to arrange for delivery and deployment of off-site equipment and sufficient supplies of commodities.
Identify Modifications	N/A
Key Parameters	No additional instrumentation is required to support the Phase 3 safety function support.

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*
A backup or alternate set of Phase 2 equipment will be provided by the RRC, as needed.	Each of the Phase 3 strategies will utilize common connections as described for the Phase 2 connections to prevent any compatibility issues with the offsite equipment.	There are no connection points for this strategy. All equipment will be provided by offsite resources.
Notes: None		

PWR Portable Equipment Phase 2							
Use and (potential / flexibility) diverse uses						*Performance Criteria*[1]	*Maintenance*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
Two Medium Voltage Diesel Generator (Repowers 6.9 KV Shutdown Boards)	X	X	X	X	X	6900v AC 3 MW	Will follow EPRI template requirements
Two Low Voltage Diesel Generators (Repowers the 125v DC Vital Battery System)	X	X	X	X	X	480v AC 225 kva	Will follow EPRI template requirements
Three (Dominator) Low Pressure FLEX Pumps (Pressurizes ERCW Headers)	X	X	X			5000 gpm 150 PSIG [350 ft. Total Dynamic Head (TDH)] Diesel Driven	Will follow EPRI template requirements
Three (Triton) Floating Booster Pumps (Supplies Low Pressure FLEX Pump)	X	X	X			5000 gpm 50 ft. lift Diesel Driven	Will follow EPRI template requirements
Two Intermediate Pressure FLEX Pumps (Core Cooling Makeup Pumps - Non-Flood Events)	X		X			150 gpm 400 PSIG (922 ft. TDH) Diesel Driven	Will follow EPRI template requirements

[1] Performance criteria of FLEX equipment is conservative and was determined during conceptual design as a basis for the selection of required FLEX equipment. (Reference 20).

PWR Portable Equipment Phase 2							
Use and (potential / flexibility) diverse uses						*Performance Criteria*[1]	*Maintenance*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
Two Intermediate Pressure FLEX Pumps (Core Cooling Makeup Pumps - Flood Event)	X					150 gpm 400 PSIG (922 ft. TDH) 480v AC	Will follow EPRI template requirements
Two Mode 5 & 6 FLEX Pumps (RCS Core Cooling and Makeup Pumps - Non-Flood or Flood Event)	X					150 gpm 400 PSIG (922 ft. TDH) 480v AC	Will follow EPRI template requirements
Three High Pressure FLEX Pumps (RCS Inventory Control)	X					40 gpm 600 PSIG (1384 ft. TDH) 480 v AC	Will follow EPRI template requirements
Two Water Transfer Pumps	X		X			500 gpm 165 PSIG (374 ft. TDH) Diesel Driven	Will follow EPRI template requirements
Two SFP Spray Nozzles			X			250 gpm	Will follow EPRI template requirements
One Tow Vehicle with bed mounted fuel tank and fuel transfer capability. (Deployment of FLEX Equipment and Fuel Transfer)	X	X	X	X	X	Capable of on-site transport of 14,000 Gross Vehicle Weight (GVW) trailer and fuel transfer with 500 gallon truck bed mounted fuel tank and fuel transfer pump.	Will follow EPRI template requirements

PWR Portable Equipment Phase 2							
Use and (potential / flexibility) diverse uses						*Performance Criteria*[1]	*Maintenance*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
Fuel Transfer Equipment • Two Fuel Tanks - Trailer Mounted • Two Diesel Powered Fuel Transfer Pumps	X	X	X	X	X	975 gallon trailer mounted fuel tanks. with fuel transfer pumps. 200 gpm Diesel Driven	Will follow EPRI template requirements
Debris Clearing Equipment Two Compact Track Loaders with Tow Hitches.	X	X	X		X	Capable of clearing trees, light poles, building and/or construction materials and miscellaneous debris. Provides additional FLEX equipment towing capability.	Will follow EPRI template requirements

PWR Portable Equipment Phase 3							
Use and (potential / flexibility) diverse uses						*Performance Criteria* [1]	*Notes*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		
Medium Voltage Diesel Generator Backup	X	X	X	X	X	6900v AC 3 MW	Will follow EPRI template requirements
Low Voltage Diesel Generator Backup	X	X	X	X	X	480v AC 225 kva	Will follow EPRI template requirements
Low Pressure FLEX Pumps (Dominator) (Pressurizes ERCW Headers)	X	X	X			5000 gpm 150 PSIG (350 ft TDH) Diesel Driven	Will follow EPRI template requirements
Floating Booster Pumps (Triton) (Supplies Low Pressure FLEX Pump)	X	X	X			5000 gpm 50 ft. lift Diesel Driven	Will follow EPRI template requirements
Intermediate Pressure FLEX Pumps (Core Cooling Backup Pumps Non-Flood Event)	X		X			150 gpm 400 PSIG (922 ft. TDH) Diesel Driven	Will follow EPRI template requirements
Intermediate Pressure FLEX Pumps (Core	X		X			150 gpm 400 PSIG (922 ft. TDH)	Will follow EPRI

[1] Performance criteria of FLEX equipment is conservative and was determined during conceptual design as a basis for the selection of required FLEX equipment. Reference 20.

PWR Portable Equipment Phase 3							
Use and (potential / flexibility) diverse uses						*Performance Criteria* [1]	*Notes*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		
Cooling Backup Pump - Flood Event)						480v AC	template requirements
Mode 5 & 6 FLEX Pumps (RCS Core Cooling and Makeup Pumps - Non-Flood or Flood Event)	X					150 gpm 400 PSIG (922 ft. TDH) 480v AC	Will follow EPRI template requirements
High Pressure FLEX Pumps Backup (RCS Inventory Control)	X					40 gpm 600 PSIG (3561 ft TDH) 480v AC	Will follow EPRI template requirements
Water Transfer Pumps Backup	X		X			500 gpm 165 PSIG (374 ft. TDH) Diesel Driven	Will follow EPRI template requirements
Fuel Transfer Equipment • Fuel Tankers • Diesel Fuel Transfer Pumps	X	X	X	X	X	Tanker - 500 gallons Minimum Transfer Pump - 200 gpm Diesel Driven	Will follow EPRI template requirements
Mobile Water Purification Unit	X		X				Supplied by RRC

Phase 3 Response Equipment/Commodities	
Item	**Notes**
Radiation Protection Equipment • Survey instruments • Dosimetry • Off-site monitoring/sampling • Radiological counting equipment • Radiation protection supplies • Equipment decontamination supplies • Respiratory protection • Portable Meteorological (MET) Towers	

Commodities
• Food
  ○ Meals ready to eat (MRE)
  ○ Microwaveable Meals
• Potable water	

Fuel Requirements • Diesel Fuel	
Heavy Equipment • Transportation equipment ○ 4 wheel drive tow vehicle • Debris clearing equipment	
Communications Equipment • Satellite Phones • Portable Radios	
Portable Interior Lighting • Flashlights • Headlamps • Batteries	
Portable Exterior Lighting • Diesel generator powered light units	

References

1. NRC EA-12-049, “Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” March 12, 2012. [ADAMS Accession Number ML12054A735]
2. NEI 12-06, Revision 0, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” August 2012.
3. NRC JLD-ISG-2012-01, Revision 0, “Compliance with Order EA-12-049, ‘Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,’” August 2012.
4. Watts Bar Nuclear Plant Updated Final Safety Analysis Report (UFSAR), Amendment 9, November 21, 2011.
5. Watts Bar Nuclear Plant Unit 2 Final Safety Analysis Report (FSAR), Amendment 109.
6. Not Used.
7. Not Used.
8. WCAP-17601-P, Revision 1, “Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering, and Babcock & Wilcox NSSS Designs,” PWROG Project PA-ASC-0916, January 2013.
9. LAR WBN-UFSAR-12-01, “Application to Revise Watts Bar Nuclear Plant Unit 1 Updated Final Safety Analysis Report Regarding Changes to Hydrologic Analysis, TAC No. ME8200,”July 19, 2012. (Accession No. ML12236A167)
10. TVA Drawings
    a. 46W501-1, Revision J, Architectural Plan El 676.0 & 692.0.
    b. 46W501-2, Revision J, Architectural Plan El 708.0 & 713.0.
    c. 46W501-3, Revision K, Architectural Plan El 729.0 & 737.0.
    d. 46W501-4, Revision K, Architectural Plan El 755.0 & 757.0.
    e. 46W501-5, Revision F, Architectural Plan El 782.0 & 786.0.
    f. 47W200-1, Revision 12, Equipment Plans - Roof
11. Replaced with References 18-20.
12. 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)
13. OG-12-482, Revision 0, “Transmittal of PA-PSC-0965 Core Team PWROG Core Cooling Management Interim Position Paper,” November, 2012.
14. FLEX Implementation HVAC Analysis Impact Study, Project No. 12938-012.
15. AOI-40, Rev. 16, “Station Blackout,” March 1, 2012.
16. OG-12-515, “Transmittal of Final Generic PWROG FLEX Support Guidelines and Interfaces (Controlling Procedure Interface and Recommended Instruments) from PA-PSC-0965,” Revision 0, December 2012.
17. 1-ECA-0.0, Rev. 0, Loss of Shutdown Power.
18. Westinghouse Calculation Note, CN-SEE-II-12-40, Revision 3, “Determination of Time to Boil in the Watts Bar Spent Fuel Pool after an Earthquake.”
19. Westinghouse Calculation Note, CN-SEE-II-12-20, Revision 2, “Supporting Chemistry Calculations for Alternate Cooling Source Usage during Extended Loss of All A.C. Power at Watts Bar Nuclear Units 1 and 2.”
20. Westinghouse Calculation Note, CN-SEE-II-13-26, Revision 0, “Watts Bar Unit 1 and Unit 2 Reactor Coolant System FLEX Evaluation with Standard Reactor Coolant Pump Seals.”
21. TVA Drawing 47E235-36, Environmental Data Environment
22. Watts Bar White Paper - Liquification of Haul Routes for FLEX and Subsurface Investigation and Foundation Report for the Watts Bar Nuclear Plant Unit 1 Steam Generator Replacement Project. (EDMS 24900-100-KOR-CY00-00001).

23. NPG Calculation Record of Revision, MDQ00006720120190, Evaluation ERCW Availability during Extended Station Blackout

Open Items

Open item Number	Description	Status	Notes
1	The current condensate storage tank (CST) is a non-seismic tank that is not missile protected. The site is currently pursuing two options; the qualification and hardening of the existing CST or the construction of a new seismically qualified and missile protected CST. One of these options must be completed before the volume of the CST can be credited.	Closed	A contract has been awarded for the new Auxiliary Feedwater Supply Tank (AFWST). DCN 60060 & DCN 62324 for AFW Tank DCN 61422 for tie in to existing plant piping (U1)
2	Liquefaction of haul routes for FLEX will be analyzed.	Closed	See Reference 22
3	No detailed analysis has been provided regarding initial FLEX fuel supplies to determine a need time for access to 7 day tank supplies or resupply of the 7 day tanks. It is assumed that each FLEX component is stored with a minimum supply of 8 hours of fuel at constant operation. This assumption will need to be assessed once all FLEX equipment has been purchased and equipment specifications are known.	Closed	Fuel consumption spreadsheet completed to show that fuel supply will last seven days.
4	No need time has been identified for action to protect containment. This includes actions to mitigate pressurization of containment due to steaming when reactor coolant system (RCS) vent paths have been established or actions to mitigate temperature effects associated with equipment survivability. An evaluation will be provided to prove indefinite containment coping.	Open	MAAP Analysis due Feb.14
5	The Phase 3 equipment staging area has not been determined.	Closed	Areas are identified and will be included with the Regional Response Center (RRC) playbook.

Open item Number	Description	Status	Notes
6	A strategy for clearing and removing debris will be determined.	Closed	Debris removal equipment is identified and storage determined
7	A thorough analysis of the makeup flow rate requirements and other equipment characteristics will be finalized during the detailed design phase of FLEX.	Closed	Detailed FLEX Operating Conditions and pump sizing has been completed (Reference 20)
8	The need time for spent fuel pool (SFP) cooling actions (deployment of hose, venting, and alignment of makeup) was determined using worst case heat loads. This item will continue to be assessed and later action times may be acceptable. Note that the timing for this step during an outage is different, but resources will be available to complete the required actions.	Closed	(Reference 18)
9	Functional requirements for each of the Phase 3 strategies, equipment and components will be completed at a later time and will be provided in the six month updates to the February 28, 2013 submittal.	Started	
10	Containment temperature instrumentation is only available until flood waters enter the technical support center (TSC) inverter or station battery rooms. A method to monitor containment temperature, post-flood, will be developed.	Started	MAAP Analysis to resolve
11	The heating, ventilation and air conditioning (HVAC) analysis is preliminary, and has not been finalized.	Closed	Calculation ID: MDQ0003602013000272. RIMS #: 130830 801
12	Verify ability to deploy FLEX equipment to provide core cooling in Modes 5 and 6 with steam generators (SGs) unavailable. If it is determined that gravity feed is not effective to cool the RCS and prevent fuel damage, Watts Bar will take actions to proceduralize administrative controls to pre-stage FLEX equipment prior to entering a condition where the SGs cannot provide adequate core cooling.	Open	Demonstration prior to implementation of the order and included as part of the FLEX strategy (Reference 20).

Open item Number	Description	Status	Notes
13	An evaluation of the impact of FLEX response actions on design basis flood mode preparations will be performed. This evaluation will include the potential for extended preparation time for FLEX. Changes which affect the Integrated Plan will be included in the six month update.	Open	An evaluation of the impact of FLEX response actions on design basis flood mode preparations will be performed. This evaluation will include the potential for extended preparation time for FLEX. Changes which affect the Integrated Plan will be included in the six month update.
14	Further analysis will be performed to determine the required timeline for implementing the 6.9 KV FLEX diesel generators (DGs) as an alternate power source for the loads supplied by the 480 V FLEX DGs.	Closed	The revised timelines show that the 6.9 KV FLEX DGs are available within 5 hours. Updated sequence of events for both flood and non-flood conditions have been completed by TVA. They are added to this letter in Attachment 1A, Sequence of Events Timeline.
15	The CETs are only available until water enters the auxiliary instrument room. A method to monitor CET, post flood, will be evaluated and developed, if required.	Closed	CETs will not be required for flood event.
16	Strategies to address extreme cold conditions on the refueling water storage tank (RWST) and/or boric acid tanks (BATs), including potential need to reenergize heaters have not been finalized.	Closed	Initial RWST Technical Specifications temperature requirements ensure that five hours is not challenged.
17	Establish an agreement with the Strategic Alliance for FLEX Emergency Response (SAFER) team in accordance with the requirements of Section 12 of NEI 12-06.	Closed	Agreement with Regional Response Center (RRC) is in place.

Open item Number	Description	Status	Notes
18	Manual station blackout (SBO) load shedding time in References 4 and 5, Section 8.3.2.1.1, will be revised from 30 minutes to 45 minutes as supported by the 8 hour extended loss of alternating current power (ELAP) battery calculations.	Closed	This open item from the OIP submittal no longer applies to the strategy since Watts Bar is no longer doing the initial load shed, as discussed in Attachment 1A, Sequence of Events Timeline.

ACRONYMNS

ABMT	auxiliary boration makeup tank
AC	alternating current
ACR	auxiliary control room
ACS	alternate coolant system
AFW	auxiliary feedwater
AFWST	auxiliary feedwater supply tank
AOI	abnormal operating instruction
AOP	abnormal operating procedure
AOV	air-operated valve
APM	available physical margin
ARV	atmospheric relief valve
AUO	assistant unit operator
BAT	boric acid tank
BCS	backup control station
BDB	beyond-design-basis
BDBEE	beyond-design-basis external events
CCS	component cooling system
CCW	condenser circulating water
CFR	Code of Federal Regulations
CLA	cold leg accumulator
CLB	current licensing basis
CST	condensate storage tank
CVCS	chemical and volume control system
CWST	cask washdown storage tank
DBFL	design basis flood level
DBE	design basis event
DC	direct current
DCN	design change notice
DG	diesel generator
DGB	diesel generator building
DWHT	demineralized water head tank
DWST	demineralized water storage tank
EDG	emergency diesel generator
EDC	engineering document change
EDCR	engineering document construction release

EDMG	extreme damage mitigation guideline
EFW	emergency feedwater
ELAP	extended loss of ac power
EOI	emergency operating instruction
EOP	emergency operating procedure
EPRI	Electric Power Research Institute
ERCW	essential raw cooling water
ERO	emergency response organization
ESF	engineered safety feature
FESB	FLEX equipment storage building
FLEX	Flexible and Diverse Coping Mitigation Strategies
FMBMS	flood mode boration makeup system
FSG	FLEX support guideline
FSI	FLEX support instructions
HCLPF	high confidence of low probability failure
HPFP	high pressure fire protection
HP FLEX Pump	high pressure (HP) FLEX pump
HVAC	heating, ventilation, and air conditioning
IER	Industry Event Report
INPO	Institute of Nuclear Power Operations
IP FLEX Pump	intermediate pressure (IP) FLEX pump
ISG	Interim Staff Guidance
LCV	level control valve
LOCA	loss of coolant accident
LOOP	loss of offsite power
LP FLEX Pump	low pressure (LP) FLEX pump
LUHS	loss of normal access to the ultimate heat sink
MCC	motor control centers
MCR	main control room
MDAFWP	motor driven auxiliary feedwater pump
MOV	motor operated valve
MRE	meals ready to eat
MSL	mean sea level
MSVV	main steam valve vault
NEI	Nuclear Energy Institute
NPSH	net positive suction head
NRC	Nuclear Regulatory Commission
NSSS	nuclear steam supply system
NTTF	Near-Term Task Force
OBE	operating basis earthquake
PIC	post issuance change
PORV	power operated relief valve
PMF	probable maximum flood
PMP	probable maximum precipitation
PRA	probabilistic risk assessment
PWR	pressurized water reactor
PWROG	Pressurized Water Reactor Owners Group
PWST	primary water storage tank
QR	quality related
RCP	reactor coolant pump
RCS	reactor coolant system

RHR	residual heat removal
RRC	Regional Response Center
RWST	refueling water storage tank
RWT	raw water tank
SAFER	Strategic Alliance for FLEX Emergency Response
SAMG	severe accident management guideline
SBO	station blackout
SFP	spent fuel pool
SG	steam generator
SIP	safety injection pump
SIS	safety injection system
SPRA	seismic probabilistic risk assessment
SR	safety related
S/RVs	safety/relief valves
SSC	systems, structures and components
SSE	safe shutdown earthquake
TD	turbine-driven
TDH	total dynamic head
TSC	technical support center
TDAFWP	turbine driven auxiliary feedwater pump
TOAF	top of active fuel
TVA	Tennessee Valley Authority
TWST	tritiated water storage tank
UFSAR	updated final safety analysis report
UHS	ultimate heat sink

Attachment 1A
Sequence of Events Timeline
Non-Flood Event

Action Item	Elapsed Time from Event Initiation (T-0)	Action	New ELAP time constraint Y/N	Task Duration (hours)	Remarks / Applicability
	0	Event Starts	N	NA	Plant @100% power
	0	SBO	N	NA	1-ECA-0.0 (Reference 17)
1	Within 1 hour of T-0	Declare ELAP	N	Equal to or Less Than 1 hour from T-0	ELAP entry can be verified by control room staff and it is validated that the Emergency Diesel Generators (EDGs) are not available. This declaration needs to occur within 1 hour from T-0 to provide operators with guidance to perform ELAP actions.
2	0.5 hours	Align and place in service the 480v FLEX Diesel Generators (DGs)	Y	0.75 hours	This provides charging current to the 125v DC Vital Batteries and ensures 125v DC Vital Battery power (control) and through the Vital inverters 120v AC Vital Instrument Power (instrument indication).
3	1 hour	Verify 125v DC Vital Battery Chargers energized and supplying required load to the 125v DC Vital Batteries. **IF** not, **THEN** complete Extended Load Shed for any Vital Battery not being supplied its required load.	N	Complete within 1.5 hours of T-0 Minimum duration 0.5 hours.	Completed with 90 minutes (1.5 hours) from T-0. This ensures an 8 hour coping time for the 125v DC Vital Batteries. This ensures the 125v DC Vital Battery Chargers loading is less than the load limit on the chargers (ensures charging of the batteries).

Action Item	Elapsed Time from Event Initiation (T-0)	Action	New ELAP time constraint Y/N	Task Duration (hours)	Remarks / Applicability
4	0.5 hour	Damage Assessment and Flex Equipment Staging	Y	2 hours	Watts Bar is developing a post event damage assessment procedure. The damage assessment will evaluate and document the condition of plant systems, structures and components (SSCs) after an ELAP event. The assessment will be consistent with guidelines contained in supplement 5 of reference 16. FLEX equipment staging locations and access routes will be a priority for the damage assessment. This assessment will facilitate debris removal, if required, to support FLEX equipment staging.
5	1 hour	Stage and align Low Pressure (LP) FLEX pumps	Y	4.5 hours	Staged and aligned to take suction from the intake channel and discharge routed to the Essential Raw Cooling Water (ERCW) FLEX connections at the Intake Pumping Station (IPS). An alternate or additional raw water source could come from the CCW Cooling Tower basin supplying suction to a Dominator LP FLEX Pump with its discharge routed to FLEX (or B.5.b) connection at the 5th DG Building.

Action Item	Elapsed Time from Event Initiation (T-0)	Action	New ELAP time constraint Y/N	Task Duration (hours)	Remarks / Applicability
6	Within 1 hour of T-0	RCS Depressurization and Cooldown.	Y	3 hours	At rated RCS pressure a potential leakage rate of 21 GPM per RCP following the event is possible. RCS cooldown rate of 75 to 100° F/hr should be sustained until stabilized at ~ 300 PSIA SG pressure. Maintain RCS pressure greater than 250 psig to avoid Cold Leg Accumulator nitrogen injection into the RCS. Cooldown and depressurization should be stabilized within T-4 hours.
7	1.5 hours	Alignment of 6.9KV FLEX DGs (FESB), kirk-key transfer switches (EDG Bldg.), 6.9 KV Shutdown Boards, emergency feeder breakers and 480 V Shutdown Board Alignment	Y	2 hours	This is to ensure switching at the DG building and shutdown board rooms are complete, potential board loading is reduced and interlocks are cleared to allow the emergency feeder breakers to be used to safely power the 6.9 KV Shutdown Boards from the 6.9KV FLEX DGs.
8	3.5 hours	Energize the 6.9 KV Shutdown Boards with the 6.9KV FLEX DGs. Place the following components in service and restore RCS pressurizer level: • Component Cooling System (CCS) Pumps. • Safety Injection Pumps, as required to recover and maintain RCS pressurizer level.	Y	1.5 hour	Action initiated to support repowering installed pumps to restore RCS inventory.

Action Item	Elapsed Time from Event Initiation (T-0)	Action	New ELAP time constraint Y/N	Task Duration (hours)	Remarks / Applicability
Note: The MDAFWPs and the Auxiliary Air Compressors can be placed in service and serve as the secondary SG makeup source, if required.					
9	5.5 hours	Place the following equipment in service, if required. Verify 6.9KV FLEX DG loading between component starts. • Auxiliary Air Compressors • Motor Driven Auxiliary Feedwater Pumps (MDAFWP) • Spent Fuel Pool (SFP) Cooling Pump (Restore SFP cooling).	Y	2 hours	Action initiated, if required, to support repowering various installed pumps to provide indefinite coping capability.
10	7 hours	Stage and align the High Pressure (HP) FLEX Pumps with suction from Refueling Water Storage Tank (RWST) FLEX connections. {Alternate is from the Boric Acid Tank (BAT) FLEX connection for boration}.	Y	2.5 hours	The HP FLEX pump discharge can be routed to either Safety Injection Pumps discharge header's FLEX connection. RCS makeup is required to compensate for cooldown (shrinkage and boration). Hoses will remain isolated and pumps out of service until required.

Action Item	Elapsed Time from Event Initiation (T-0)	Action	New ELAP time constraint Y/N	Task Duration (hours)	Remarks / Applicability
11	7 hours	Stage and align the Intermediate Pressure (IP) FLEX pumps at the Auxiliary Feedwater Supply Tank (AFWST) for backup for SG makeup (backup to the TDAFWP (or) MDAFWPs).	Y	3 hours	Suction is aligned from the AFWST. The IP FLEX pump discharge can be routed to FLEX connections upstream of the TDAFWP Level Control Valves (LCV) (primary) or upstream of the MDAFWP LCVs (secondary). This is a contingency in case of loss of the normal SG makeup capabilities. Hoses will remain isolated and pumps out of service.
12	7 hours	Deploy hoses and spray nozzles as a contingency for SFP makeup.	Y	2 hours	Hoses will be routed from an Auxiliary Building el. 757 ERCW FLEX connection to the SFP area or from an el. 737 ERCW FLEX connection to the demineralized water FLEX connection on el. 737 to allow makeup to the SFP.
13	8 hours	Initiate fueling operations for diesel powered FLEX equipment.	Y	Continuous from initiation	This will need to be established within 8 hours. This is an assumption and will need to be assessed once all FLEX equipment has been purchased and specifications are known.

Action Item	Elapsed Time from Event Initiation (T-0)	Action	New ELAP time constraint Y/N	Task Duration (hours)	Remarks / Applicability
14	8 hours	Makeup to the AFWST will need to be evaluated. The AFWST provides approximately 10 hours for 2 unit operation. If the Condensate Storage Tanks survive the event an additional inventory of quality water will be available, allowing additional time for makeup to the AFWST.	Y	Continuous from initiation	Sources of makeup to the AFWST are identified and FLEX connections are provided to facilitate transfer of quality water. Alignment to the ERCW system an ultimate heat sink source via the LP FLEX pumps remains an option.
15	8 hours	Initiate portable lighting for MCR, Shutdown Board Room and FLEX equipment locations, as required.	Y	Continuous from initiation	This is not a time constraint. MCR and Shutdown Board Rooms are provided with battery backup lighting. Portable lighting for FLEX equipment staging locations could be required. Portable lighting will be available for internal and external service, if required.
16	8 hours	Monitor TDAFWP Room, Main Control Room (MCR), Shutdown Board Room, Vital Battery Board Room and SFP area ventilation needs.	Y	Continuous from initiation	If required, verify 6.9KV FLEX DG loading and restore selected heating, ventilation and air conditioning (HVAC) systems to service. (Reference 14)
17	8 hours	Evaluate, identify and address long term (within 72 hours) needs including: • Mobile water purification unit • Site diesel and gasoline fuel service.	Y	Continuous	

Attachment 1A
Sequence of Events Timeline
Flood Event

Action Item	Elapsed Time from Event Initiation T-0	Action	New ELAP time constraint Y/N	Task Duration (hours)	Remarks / Applicability
Note: An ELAP could occur at anytime during flood preparation or a flood event therefore FLEX equipment and strategies must be staged and ready for implementation if required. **Note:** The scenario described below assumes an ELAP event occurs post initial flood warning received from TVA's River System Operations and prior to a Stage 1 warning notification. This provides a 27 hour period before flood waters reach grade elevation. This flood preparation time period allows for initial use of the same strategy as a non-flood event for Steps 1-9 for stabilizing the plant and staging FLEX equipment for flood mitigation strategy.					
	0	Event Starts	NA	NA	Plant @100% power
	0	SBO	N	NA	1-ECA-0.0 (Reference 17)
1	Within 1 hour of T-0	Declare ELAP	N	Within 1 hour of T-0	ELAP entry can be verified by control room staff and it is validated that the Emergency Diesel Generators (EDGs) are not available. This declaration needs to occur within 1 hour from T-0 to provide operators with guidance to perform ELAP actions.

Action Item	Elapsed Time from Event Initiation T-0	Action	New ELAP time constraint Y/N	Task Duration (hours)	Remarks / Applicability
2	0.5 hours	Align and place in service the 480v FLEX Diesel Generators (DGs)	Y	0.75 hours	This provides charging current to the 125v DC Vital Batteries and ensures 125v DC Vital Battery power (control) and through the Vital inverters 120v AC Vital Instrument Power (instrument indication).
3	1 hour	Verify 125v DC Vital Battery Chargers energized and supplying required load to the 125v DC Vital Batteries. **IF** not, **THEN** complete Extended Load Shed for any Vital Battery not being supplied its required load.	N	Complete within 1.5 hours of T-0 Minimum duration 0.5 hours	Completed with 90 minutes (1.5 hours) from T-0. This ensures an 8 hour coping time for the 125v DC Vital Batteries. This ensures the 125v DC Vital Battery chargers loading is less than the load limit on the chargers (ensures charging of the batteries).
4	0.5 hour	Damage Assessment and Flex Equipment Staging	Y	2 hours	Watts Bar is developing a post event damage assessment procedure. The damage assessment will evaluate and document the condition of plant systems, structures and components (SSCs) after an ELAP event. The assessment will be consistent with guidelines contained in supplement 5 of reference 16. FLEX equipment staging locations and access routes will be a priority for the damage assessment. This assessment will facilitate debris removal, if required, to support FLEX equipment staging.

Action Item	Elapsed Time from Event Initiation T-0	Action	New ELAP time constraint Y/N	Task Duration (hours)	Remarks / Applicability
5	1 hour	Stage and align Low Pressure (LP) FLEX pumps (Dominator and Triton)	Y	4.5 hours	Staged and aligned to take suction from the intake channel and discharge routed to the Essential Raw Cooling Water (ERCW) FLEX connections at the Intake Pumping Station (IPS).
6	Within 1 hour of T-0	RCS Depressurization and Cooldown.	Y	3 hours	At rated RCS pressure a potential leakage rate of 21 GPM per RCP following the event is possible. RCS cooldown rate of 75 to 100° F/hr should be sustained until stabilized at ~ 300 PSIA SG pressure. Maintain RCS pressure greater than 250 psig to avoid Cold Leg Accumulator nitrogen injection into the RCS. Cooldown and depressurization should be stabilized within T-4 hours.
7	1.5 hours	Alignment of 6.9KV FLEX DGs (FESB), kirk-key transfer switches (EDG Bldg.), 6.9 KV Shutdown Boards, emergency feeder breakers and 480 V Shutdown Boards.	Y	2 hours	This is to ensure switching at the DG building and shutdown board rooms are complete, potential board loading is reduced and interlocks are cleared to allow the emergency feeder breakers to be used to safely power the 6.9 KV Shutdown Boards from the 6.9KV FLEX DGs.

Action Item	Elapsed Time from Event Initiation T-0	Action	New ELAP time constraint Y/N	Task Duration (hours)	Remarks / Applicability
8	3.5 hours	Energize the 6.9 KV Shutdown Boards with the 6.9KV FLEX DGs. Place the following components in service and restore RCS pressurizer level: • Component Cooling System (CCS) Pumps. • Safety Injection Pumps, as required to recover and maintain RCS pressurizer level.	Y	1.5 hour	Action initiated to support repowering installed pumps to restore RCS inventory.
Note: The MDAFWPs and Auxiliary Air Compressors can be placed in service and serve as the secondary SG makeup source, if required.					
9	5.5 hours	Place the following equipment in service, if required. Verify 6.9KV FLEX DG loading between component starts. • Auxiliary Air Compressors • Motor Driven Auxiliary Feedwater Pumps (MDAFWP). • Spent Fuel Pool (SFP) Cooling Pump (Restore SFP cooling).	Y	2 hours	Action initiated to support repowering various installed pumps to provide coping capability until flood waters reach plant grade and transition to FLEX mitigation strategy occurs.

Action Item	Elapsed Time from Event Initiation T-0	Action	New ELAP time constraint Y/N	Task Duration (hours)	Remarks / Applicability
10	5.5 hours	Stage and align the following LP FLEX Pumps. • A Dominator LP FLEX Pump at the CCW Cooling Tower basin. • A second set of Low Pressure (LP) FLEX Pumps (Dominator and Triton) staged on a pad just west of the 5th DG Building.	Y	2 hours	Stage a Dominator LP FLEX Pump with suction from the CCW Cooling Tower basin and discharge hoses routed to B.5.b connections at the 5th DG Building. Stage a second set of Low Pressure (LP) FLEX Pumps Aligned to take suction from the road just South of the 5th Diesel Building with discharge routed to the Essential Raw Cooling Water (ERCW) FLEX connections inside the 5th DG Building. Hoses will remain isolated and pumps out of service until required.
11	7 hours	Stage and align the High Pressure (HP) FLEX pumps (AB el. 692) with suction from the Refueling Water Storage Tank (RWST) FLEX connections (AB el. 692).	Y	2.5 hours	The HP FLEX pump discharge can be routed to either Safety Injection Pump discharge header's FLEX connection (B Train primary and A Train secondary). RCS makeup is required to compensate for cooldown (shrinkage and boration). Hoses will remain isolated and pumps out of service until required.

Action Item	Elapsed Time from Event Initiation T-0	Action	New ELAP time constraint Y/N	Task Duration (hours)	Remarks / Applicability
12	7 hours	Stage and align the Intermediate Pressure (IP) FLEX pumps AB el. 737 for makeup capability to the SGs.	Y	2.5 hours	Suction hoses are aligned from the AB el. 737 ERCW FLEX connections. The IP FLEX pumps discharge hoses can be routed to FLEX connection upstream of the TDAFWP Level Control Valves (LCVs) (SMSVV el. 729) (primary) or FLEX connections upstream of the MDAFWP LCVs (AB el. 737) (secondary). Hoses will remain isolated and pumps out of service until required.
13	7 hours	Deploy hoses and spray nozzles as a contingency for SFP makeup.	Y	2 hours	Hoses will be routed from an Auxiliary Building el. 757 ERCW FLEX connection to the SFP area or from an el. 737 ERCW FLEX connection to the SFP demineralized water FLEX connection on el. 737 to allow makeup to the SFP.
14	8 hours	Initiate fueling operations for diesel powered FLEX equipment.	Y	Continuous once initiated	This will need to be established within 8 hours. This is an assumption and will need to be assessed once all FLEX equipment has been purchased and specifications are known.

Action Item	Elapsed Time from Event Initiation T-0	Action	New ELAP time constraint Y/N	Task Duration (hours)	Remarks / Applicability
15	8 hours	Makeup to the AFWST will need to be evaluated. The AFWST provides approximately 10 hours for 2 unit operation. If the Condensate Storage Tanks survive the event an additional inventory of quality water will be available prior to the requirement to makeup to the AFWST.	Y	Continuous once initiated	Sources of makeup to the AFWST are identified and FLEX connections are provided to facilitate transfer of quality water. Alignment to the ERCW system an ultimate heat sink source via the LP FLEX pumps remains an option.
16	8 hours	Initiate portable lighting for MCR, Shutdown Board Room and FLEX equipment locations, as required.	Y	Continuous once initiated	This is not a time constraint. MCR and Shutdown Board Rooms are provided with battery backup lighting. Portable lighting for FLEX equipment staging locations could be required. Portable lighting will be available for internal and external service, if required.
17	8 hours	Monitor TDAFWP Room, Main Control Room (MCR), Shutdown Board Room, Vital Battery Board Room and SFP area ventilation needs.	Y	Continuous once initiated	If required, verify 6.9 KV DG loading and restore selected heating, ventilation and air conditioning (HVAC) systems to service. (Reference 14)
18	8 hours	Evaluate, identify and address long term (within 72 hours) needs including: • Mobile water purification unit • Site diesel and gasoline fuel service.	Y	Continuous	

Attachment 1B

NSSS Significant Reference Analysis Deviation Table

Item	Parameter of interest	WCAP value (WCAP-17601-P January 2013 Revision 1)	WCAP page	Plant applied value	Gap and discussion
There are no deviations.					

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.

Activity	Target Completion Date	Activity Status (Will be updated every 6 months)	Revised Target Completion Date
Submit 60 Day Status Report	**Oct 2012**	**Complete**	
Submit Overall Integrated Implementation Plan	**2/28/2013**	**Complete**	
6 Month Status Updates			
Update 1	**Aug 2013**	**Complete**	
Update 2	**Feb 2014**	**Complete**	
Update 3	**Aug 2014**	**Not Started**	
Update 4	**Feb 2015**	**Not Started**	
FLEX Strategy Evaluation	**June 2013**	**Complete**	
Walk-throughs or Demonstrations	**Sep 2014**	**Not Started**	
Perform Staffing Analysis	**June 2014**	**Not Started**	
Modifications			
Modifications Evaluation	**Apr 2013**	**Complete**	
Unit 1 N-1 Walkdown	**Apr 2013**	**Complete**	
Unit 1 Design Engineering	**Oct 2013**	**Complete**	
Unit 1 Implementation Outage	**Sep 2014**	**Not Started**	**May 2014**
Unit 2 Construction Walkdown	**Apr 2013**	**Complete**	
Unit 2 Design Engineering	**Oct 2013**	**In Progress**	**Feb 2014**
Unit 2 Implementation (Startup)	**Sep 2014**	**In Progress**	**Aug 2014**
Storage			
Storage Design Engineering		**Complete**	
Storage Implementation	**Sep 2014**	**In Progress**	**Aug 2014**
On-Site FLEX Equipment			
Purchase/Procure	**Dec 2013**	**In Progress**	**Feb 2014**
Off-Site FLEX Equipment			
Develop Strategies with RRC	**Dec 2013**	**In Progress**	**Jun 2014**
Identify Off-Site Delivery Stations (if necessary)	**Apr 2014**	**Complete**	
Procedures			
PWROG issues Functional Support Guidelines (FSG)	**Jun 2013**	**Complete**	
Create Watts Bar Functional Support Instructions (FSI)	**Jun 2014**	**In Progress**	**Apr 2014**
Create Maintenance Procedures	**Jun 2014**	**In Progress**	**Apr 2014**

Training			
Develop Training Plan	**Jan 2014**	**In Progress**	**Apr 2014**
Training Complete	**Sep 2014**	**Not Started**	**Jul 2014**
Unit 1 FLEX Implementation	**Sep 2014**	**In Progress**	**Aug 2014**
Unit 2 FLEX Implementation	**Sep 2014**	**In Progress**	**Aug 2014**
Full Site FLEX Implementation	**Sep 2014**	**In Progress**	**Aug 2014**
Submit Completion Report	**Oct 2014**	**Not Started**	**Aug 2014**

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT

LIST OF COMMITMENTS

1. TVA will provide justification regarding use of pre-staged diesel generators by February 28, 2014, to resolve Interim Staff Evaluation open item 3.2.4.8.A.