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

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

Watts Bar Nuclear Plant, Unit 2
Facility Operating License No. NPF-96
NRC Docket No. 50-391

Subject: **Application to Modify Watts Bar Nuclear Plant Unit 2 Technical Specifications 3.7.8 to Extend the Completion Time for an Inoperable Essential Raw Cooling Water Train on a One-Time Basis (WBN-TS-18-07)**

References:

1. TVA Letter to NRC, CNL-18-119, “Application to Revise Watts Bar Nuclear Plant, Units 1 and 2, Technical Specifications 3.8.1, 3.8.7, 3.8.8, and 3.8.9, Regarding Electrical Power Systems (WBN-TS-18-08),” dated November 26, 2018 (ML18345A085)

2. TVA Letter to NRC, CNL-18-118, “Application to Revise Technical Specifications Regarding DC Electrical Systems TSTF-500, Revision 2, “DC Electrical Rewrite - Update to TSTF 360” (WBN-TS-18-09), “ dated November 29, 2018 (ML18334A389)

In accordance with the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) 50.90, "Application for amendment of license, construction permit, or early site permit," Tennessee Valley Authority (TVA) is submitting a request for an amendment to the Technical Specifications (TS) for Watts Bar Nuclear Plant (WBN) Unit 2.

The proposed amendment revises the WBN Unit 2 TS 3.7.8, “Essential Raw Cooling Water (ERCW),” on a one-time basis to support performance of maintenance on 6.9 kiloVolt (kV) Shutdown Board (SDBD) 1A-A and associated 480 Volt (V) boards and motor control centers. The proposed changes will allow greater operational flexibility for two-unit operation at WBN. Because WBN Unit 2 is operational, current limitations for the alternating current (AC) electrical power system and associated boards will restrict maintenance with one unit operating. A longer completion time under certain plant conditions will allow the necessary flexibility to perform the maintenance with one unit defueled, while minimizing risk to the operating unit. Without this proposed change, a dual unit outage would be required to perform the electrical board maintenance activities.

In addition to this proposed license amendment, other changes will be required to facilitate electrical board maintenance. In Reference 1, TVA submitted a license amendment request (LAR) to extend the completion times associated with alternating current (AC) power sources and AC electrical distribution subsystems. In Reference 2, TVA submitted an LAR to adopt Technical Specification Task Force (TSTF) Traveler TSTF-500, Revision 2, "DC Electrical Rewrite - Update to TSTF-360." The requested changes within this LAR do not rely on the approval of the proposed changes contained in References 1 and 2.

Enclosure 1 provides a description and assessment of the proposed change, including technical analyses, regulatory analyses, and environmental considerations. Enclosure 2 provides a simplified drawing of the WBN ERCW System. Enclosure 3 provides markups of the existing TS and Bases pages to show the proposed changes. Enclosure 4 provides revised (clean) TS and Bases pages. The changes to the TS Bases are provided for information only. Enclosure 5 provides a tabular listing of the major equipment that will be out of service during the planned maintenance on 6.9 kV SDBD 1A-A and associated 480 V boards and motor control centers. Included in the table is the associated equipment that will be protected during the electrical board maintenance. New regulatory commitments associated with this submittal are provided in Enclosure 6.

The WBN Plant Operations Review Committee has reviewed this proposed change and determined that operation of WBN Units 1 and 2 in accordance with the proposed change will not endanger the health and safety of the public.

TVA has determined that there are no significant hazard considerations associated with the proposed change and that the change qualifies for a categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9). Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and the enclosures to the Tennessee Department of Environment and Conservation.

TVA requests approval of the proposed license amendment within one year from the date of this submittal with implementation of the amendment prior to commencement of the WBN Unit 1 spring 2020 refueling outage.

Please address any questions regarding this request to Michael A. Brown at 423-751-3275.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 7th day of February 2019.

Respectfully,

E. K. Henderson
Director, Nuclear Regulatory Affairs

Enclosures

cc: See Page 3
Enclosures:

1. Description and Assessment of Proposed Change
2. Simplified Drawing of the WBN Essential Raw Cooling Water System
3. Markups of Technical Specification and Bases Changes
4. Clean Technical Specification and Bases Changes
5. Equipment Out of Service / Protected Equipment
6. Regulatory Commitments

cc (Enclosures):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Watts Bar Nuclear Plant
NRC Project Manager – Watts Bar Nuclear Plant
Director, Division of Radiological Health - Tennessee State Department of Environment and Conservation

Enclosure 1

Description and Assessment of Proposed Change

Subject: **Application to Modify Watts Bar Nuclear Plant Unit 2 Technical Specifications 3.7.8 to Extend the Completion Time for an Inoperable Essential Raw Cooling Water Train on a One-Time Basis (WBN-TS-18-07)**

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1.0 SUMMARY DESCRIPTION

In accordance with the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) 50.90, "Application for amendment of license, construction permit, or early site permit," Tennessee Valley Authority (TVA) is requesting a license amendment to the Watts Bar Nuclear Plant (WBN) Unit 2 Technical Specifications (TS) 3.7.8, "Essential Raw Cooling Water (ERCW) System," to extend the allowed Completion Time on a one-time basis to restore one ERCW System train to operable status from 72 hours to seven days. This change is needed to facilitate maintenance of 6.9 kilovolt (kV) shutdown board (SDBD) 1A-A and associated 480 Volt (V) boards and motor control centers (MCCs) without requiring a dual unit shutdown.

2.0 DETAILED DESCRIPTION

2.1 NEED FOR PROPOSED CHANGE

The ERCW System supports both WBN Unit 1 and Unit 2 and consists of a two-train system (Train A and Train B) with each train having the capability to provide the maximum required cooling water requirement for both units under any credible plant condition. The ERCW System has a total of eight pumps (four pumps per Train A and four pumps per Train B), two traveling water screens per train (four total), two screen wash pumps per train (four total), and two supply strainers per train (four total) located within the ERCW pumping station. The ERCW pumps are powered from four 6.9 kV SDBDs with two pumps aligned to each 6.9 kV SDBD.

When either WBN unit is operating in Modes 1, 2, 3, and 4, TS 3.7.8 requires two ERCW pumps in each train to be operable, with no more than one ERCW pump powered from each 6.9 kV SDBD. Therefore, four 6.9 kV SDBDs are required to be operable to meet TS 3.7.8.

The requested change is needed because taking one 6.9 kV SDBD out of service to perform maintenance renders one ERCW System train inoperable, affecting both WBN units. In this condition, TS 3.7.8 allows 72 hours to return the ERCW train to an operable status. However, 72 hours is not adequate to safely inspect and perform maintenance on a SDBD. Therefore, an extension of the completion time from 72 hours to seven days to restore an ERCW System train to operable status is needed to facilitate safe inspection of a set of electrical boards, and perform required maintenance without having to shut down both units.

As indicated in Table 1 below, the timeline to safely complete the required maintenance and restore the electrical boards is approximately 105 hours. The 7-day completion time provides margin for unanticipated repair activities.

Table 1 - Shutdown Board Maintenance Activities and Durations

Activity	Duration
Install clearance	6 hours
Ground installation	4.5 hours
Breaker compartment Inspections	42 hours
Circuit breaker interface inspections and adjustments	34 hours
Bus inspections and tests	8 hours
Ground removal	4.5 hours
Release clearance	6 hours
Total	105 hours

The proposed completion time to restore an inoperable ERCW train while performing planned maintenance on a single set of electrical boards applies under conditions that allow the single operable pump in the affected train to provide adequate ERCW flow for its essential safety functions. The prerequisite ERCW train valve alignments discussed in Section 3.2.8 of this enclosure were analyzed to ensure safe plant operation during the extended completion time for the maintenance.

2.2 PROPOSED CHANGE

A one-time change to WBN Unit 2 TS 3.7.8 is proposed that extends the completion time for restoring an inoperable ERCW System train to operable status for planned maintenance on 6.9 kV SDBD 1A-A and associated 480 V boards and MCCs, when WBN Unit 1 is defueled and ultimate heat sink (UHS) temperature is less than or equal to (≤) 71ºF. The proposed changes are reflected in Enclosures 3 and 4 to this submittal and are summarized below:

- New TS 3.7.8 Condition A applies when one ERCW train is inoperable. The new Condition is modified by the four notes below. All four notes are required to be met in order to use new Condition A.
  1. Only applicable during the Unit 1 spring 2020 outage (U1R16), but no later than May 1, 2020.
  2. Only applicable when Unit 1 is defueled.
  3. Only applicable when UHS temperature is ≤ 71 ºF.
  4. Only applicable during planned maintenance on 6.9 kV SDBD 1A-A and associated 480 V boards and MCCs.
- Required Action A.1 for the proposed Condition A of WBN Unit 1 TS 3.7.8 specifies restoration of the affected ERCW train to operable status with a completion time of seven days. This required action is modified by two notes that require entry into applicable Conditions and Required Actions of Limiting Condition for Operation (LCO) 3.8.1, “AC Sources - Operating,” for the inoperable emergency diesel generator (EDG) and LCO 3.4.6, “RCS Loops - MODE 4,” for Residual Heat Removal (RHR) loops made inoperable by the ERCW system condition during shutdown board maintenance. These notes are an exception to LCO 3.0.6 and ensure the proper actions are taken for the affected components in these systems.

- Required action A.2 specifies that the UHS temperature be verified to be ≤ 71ºF within one hour and once every 12 hours thereafter. If the UHS temperature is found to be greater than 71ºF, then the analytical assumptions for justifying the extended completion time for Condition A are no longer met and Condition B is entered for an inoperable ERCW train for reasons other than Condition A. The frequency of 12 hours is consistent with the frequency for other site shiftly surveillances and is appropriate because the temperature of the Tennessee River does not fluctuate significantly over a 12-hour period.
- Condition A (re-sequenced as Condition B) is changed to apply for reasons other than new Condition A.
- Condition B (re-sequenced as Condition C) is changed to also apply when Required Action A.1 and associated Completion Time are not met. Therefore, when an ERCW train is inoperable for maintenance on 6.9 kV SDBD 1A-A (and associated 480 V boards and MCCs) and is not restored to an operable status in seven days, the unit is required to be placed in Mode 3 in 6 hours and Mode 5 in 36 hours.

In addition to this proposed license amendment, other TS changes will be required to facilitate electrical board maintenance through separate license amendment requests (LAR). Specifically, in Reference 1, TVA submitted an LAR to extend the completion times associated with alternating current (AC) power sources and AC electrical distribution subsystems. In Reference 2, TVA submitted an LAR to adopt Technical Specification Task Force (TSTF) Traveler TSTF-500, Revision 2, "DC Electrical Rewrite - Update to TSTF-360." The requested changes within this LAR do not rely on the approval of the proposed changes contained in References 1 and 2.

2.3 CONDITION INTENDED TO RESOLVE

The proposed changes will allow greater operational flexibility for two-unit operation at WBN. Because WBN Unit 2 is now operational, current limitations for the associated electrical boards will restrict maintenance with one unit operating. Longer completion times for certain conditions will allow the necessary flexibility, while minimizing risk to the operating unit. Without this proposed change, a dual unit outage would be required to perform electrical board maintenance.

3.0 TECHNICAL EVALUATION

3.1 SYSTEM DESCRIPTIONS

3.1.1 UHS

The UHS provides a heat sink for processing and operating heat from safety-related components during a transient or accident, as well as during normal operation. The ERCW System and the Component Cooling System (CCS) remove operating heat to the UHS.

The UHS is comprised of a single water source (i.e., the Tennessee River) including the complex of TVA-controlled dams upstream of the plant intake, TVA's Chickamauga Dam (the nearest downstream dam), and the plant intake channel.

In accordance with TS 3.7.9, “Ultimate Heat Sink (UHS),” the UHS shall be operable in Modes 1, 2, 3, and 4 with a TS Surveillance Requirement to verify average ERCW supply header water temperature is less than or equal to 85ºF. If the UHS function is not satisfied, unit shutdown is required.

3.1.2 ERCW System

The ERCW System is a shared system between the WBN units. The ERCW System is a two-train system with each train having the capability to provide the maximum required cooling water requirement for both units under any credible plant condition. The ERCW System trains are redundant and are sufficiently independent to ensure the availability of at least one train at any time. A simplified diagram of the ERCW System is provided in Enclosure 2

The safety-related portion of the ERCW system is designed such that total loss of either train or the loss of offsite power and an entire plant shutdown power train will not prevent safe shutdown of either unit under any credible condition. Sufficient pump capacity is provided for design cooling water flows under all conditions. The ERCW System arrangement ensures a loss of a complete header can be isolated in a manner that does not jeopardize plant safety.

The ERCW system consists of eight 50 percent (%) ERCW pumps, four traveling water screens, four screen wash pumps, four strainers located in the main intake pumping station, and associated piping and valves.

The ERCW system draws water directly from the Tennessee River (Chickamauga Reservoir).

The eight ERCW pumps are mounted on the intake pumping station (IPS) at elevation (El) 741.0 feet (ft), which is above the probable maximum flood level. The IPS provides direct communication with the main river channel for all reservoir levels including loss of the downstream dam. The IPS is designed to retain full functional capability of the ERCW system water intakes for floods up to and including the design basis flood. To assure operation during these conditions, the ERCW pumps, traveling screen motors, screen wash pumps, valve operators and controls are in the IPS on El 741.0 ft.

Water for the ERCW system enters two separate sump areas of the pumping station through four traveling water screens, two for each sump, and two diver protection barriers, one for each sump. Four ERCW pumping units, on the same plant train, take suction from one of the sumps, and four more on the opposite plant train take suction from the other sump. One set of pumps and associated equipment is designated Train A, and the other Train B. Each set of four pumps discharges into a common manifold, from which two separate headers (1A and 2A for Train A, 1B and 2B for Train B), each with its own automatic backwashing strainer, supply water to the various system loads. Two ERCW headers associated with the same ERCW train (i.e., 1A and 2A, or 1B and 2B) may be cross-connected to provide greater flexibility (e.g., for strainer maintenance).

The ERCW System supplies cooling water to the following components:

- CCS heat exchangers (HXs)
- Containment Spray System HXs
- EDG HXs
- Emergency makeup for CCS
- Control Building air conditioning water chillers
- Auxiliary Building ventilation coolers (for engineered safeguard features [ESF] equipment)
- Containment ventilation coolers
- Auxiliary Control Air System (ACAS) compressors
- Reactor coolant pump (RCP) motor coolers
- Control rod drive mechanism (CRDM) ventilation coolers
- SDBD room air conditioning water chillers
- Instrument room chillers
- Auxiliary Feedwater (AFW) System*
- Backup cooling water to the component cooling pump (CCP) 2A-A lube and gear oil cooler via the CCP 2A-A room cooler

  * Not a cooling load. ERCW discharge provides a safety-related source for AFW System when the preferred supply from the condensate storage tank is unavailable.

The alignment of ERCW headers and system loads is as follows:

- Containment spray HXs 1A, 1B, 2A, and 2B are supplied from ERCW headers 1A, 1B, 2A, and 2B, respectively.
- The normal supply for both Train A EDGs is from header 1A, although a backup source from header 2B is also provided. The normal supply for both Train B EDGs is from header 1B with a backup supply from header 2A.
- The normal supply for CCS HXs A, B, and C is from ERCW header 2A, 2A, and 2B, respectively. Interconnections between headers 1B and 2A, and between headers 1A and 2B permit alternate supplies.
- Each ERCW header provides cooling water to the following: main control room and control building electrical board room air-conditioning chillers, Auxiliary Building ventilation coolers for ESF equipment, containment ventilation coolers, RCP motor air coolers, CRDM ventilation coolers, and containment instrument room air conditioning water.
- Headers 1A and 1B provide a normal and backup source of cooling water for the station air compressors. There is one compressor on header 1A and one on header 2B for the ACAS air compressors.
- When the normal supply of water is not available from the condensate storage tank, ERCW discharge headers A and B automatically provide an emergency water supply to the motor-driven AFW pumps.
- Connections are available in the Train A ERCW supply and return headers for the lower compartment coolers that allow chilled water from a non-safety related chiller to be used to provide additional cooling of the Reactor Building during outages.

- Two RCP motor air coolers are supplied from ERCW header 1A for Unit 1, header 2A for Unit 2; and two RCP motor air coolers are supplied from ERCW header 1B for Unit 1 and header 2B for Unit 2.

The supply headers are fitted with isolation valves, such that a critical crack in either header can be isolated, ensuring uninterrupted operation of the other header.

The operation of two ERCW pumps on the same train is sufficient to supply cooling water requirements for a two-unit cooldown, refueling or post-accident operation, and two ERCW pumps per train will operate during the hypothetical combined accident and loss of normal power, if all four diesel generators are in operation. In an accident, the safety injection signal automatically starts two ERCW pumps on each train, thereby providing full redundancy.

The ERCW system receives power from either the offsite power sources or the onsite emergency power sources. The EDGs are used to supply power for the ERCW pumps and motor operated valves during a loss of offsite power (LOOP). Two ERCW pumps are supplied power from each 6.9 kV SDBD and are interlocked such that only one ERCW pump automatically starts on restoration of power to the SDBD by the EDG. On a LOOP, one EDG supplies power to each 6.9 kV SDBD.

Table 2 below shows the relationship between 6.9kV SDBDs, associated EDGs, and supported ERCW System pumps.

Table 2 - 6.9 kV Shutdown Board / ERCW Pump Alignment

6.9KV SDBD	EDG	ERCW Pump
1A-A	1A-A	A-A C-A
1B-B	1B-B	E-B G-B
2A-A	2A-A	B-A D-A
2B-B	2B-B	F-B H-B

The availability of water for the design basis condition on the ERCW system is based on one unit being in a loss of coolant accident (LOCA) and the other unit in hot standby and the following events occurring simultaneously:

- LOOP,
- Loss of downstream dam, and
- Loss of an emergency power train.

The ERCW System has eight pumps (four pumps per train). However, minimum combined safety requirements for the two units are met with two ERCW pumps on the same train.

During a LOOP event, only four pumps (two pumps per train) may be loaded onto the four EDGs (one per EDG). When both trains of ERCW are available, the four ERCW pumps are able to supply required loads for design basis events to support both units. When various events occur with a LOOP, and combined with a complete loss of one train of emergency power, then two ERCW pumps are normally available. The two ERCW pumps are able to support the accident unit, the non-accident unit and the spent fuel pool heat loads for the design basis event, except as described below:

If an accident occurs on one unit, the second unit can be brought to Mode 3 (Hot Standby). The non-accident unit will be maintained in Mode 3 until the accident unit can be stabilized and the core decay heat in the non-accident is within the capability of the RHR System. Two ERCW pumps are sufficient to cope with the accident unit and bring the non-accident unit to Cold Shutdown within 72 hours. There is one scenario where two ERCW pumps do not have sufficient capacity to cope with both the accident and non-accident units. This scenario is described as follows:

- The non-accident unit has been shutdown within the previous 48 hours and is being cooled by RHR in either Mode 4 or Mode 5,
- The accident unit is in LOCA-RECIRC mode of operation,
- LOOP, and
- Loss of one train of emergency power.

For the above scenario, a third ERCW pump is required. Loading calculations indicate that the EDG associated with the non-accident unit has the capacity to support a second ERCW pump (approximately 805 horsepower). Manual bypass switches on the SDBDs allow the interlocks, which prevent more than one ERCW pump to be loaded onto an EDG, to be over-ridden. The third ERCW pump must be manually started prior to placing the accident unit in LOCA-RECIRC mode.

For these reasons, one of the following restrictions of TS 3.7.17, “ERCW - Shutdown,” is imposed on the ERCW System following the shutdown of a unit:

- A third ERCW pump must be available on each train of ERCW, or
- The shutdown unit must remain in Mode 3 for 48 hours prior to establishing RHR cooling.

<u>ERCW Train Operability</u>

WBN Units 1 and 2 TS 3.7.8 requires two independent ERCW trains to be operable in Modes 1, 2, 3, and 4 to provide the required redundancy to ensure that the system functions to remove post-accident heat loads, assuming that the worst case single active failure occurs coincident with a LOOP event. An ERCW train is operable when two pumps, aligned to separate SDBDs, are operable and the associated piping, valves, HX, and instrumentation and controls required to perform the safety-related function are operable.

Additionally, a third ERCW pump is required to be available on each ERCW train in Modes 4 and 5 during the first 48 hours after a reactor shutdown. This requirement addresses the potential increased heat loads that may exist immediately after a unit is shut down, concurrent with a LOCA on the operating unit, an assumed LOOP, and a single failure that affects both 6.9 kV SDBDs in one power train. An ERCW train is considered operable during the first 48 hours after shutdown with a UHS temperature not exceeding 85ºF, two pumps per train, aligned to separate SDBDs, and one additional Train A pump and one additional Train B pump are capable of being aligned to their respective 6.9 kV SDBD and manually placed in service.

The ERCW System trains are independent of each other. Within each train there are various crosstie supply headers. Two ERCW headers associated with the same ERCW train (i.e., 1A and 2A, or 1B and 2B) may be cross-connected to provide greater flexibility (e.g., for strainer maintenance).

3.2 EVALUATION

3.2.1 Overview

TVA is requesting approval for a one-time use change to WBN Unit 2 TS 3.7.8 to extend the completion time for restoring an inoperable ERCW System train from 72 hours to seven days. This extension would only be applicable during the WBN Unit 1 spring 2020 refueling outage (U1R16) for planned maintenance on the 6.9 kV SDBD 1-A-A, when WBN Unit 1 has been shutdown for at least 100 hours and is defueled, and UHS temperature ≤ 71ºF. This will allow the performance of planned maintenance on 6.9 kV SDBD 1A-A (1-BD-211-A), including associated 480 V boards and MCCs. The affected 480 V boards and MCCs are:

- 1-BD-212-A1-A, “480 V Shutdown Board 1A1-A”
- 1-BD-212-A2-A, “480 V Shutdown Board 1A2-A”
- 1-MCC-213-A1-A, “RMOV Board 1A1-A”
- 1-MCC-213-A2-A, “RMOV Board 1A2-A”
- 1-MCC-214-A1-A, “C&A Vent Board 1A1-A”
- 1-MCC-214-A2-A, “C&A Vent Board 1A2-A”
- 1-MCC-215-A1-A, “Diesel Aux Board 1A1-A”
- 1-MCC-215-A2-A, “Diesel Aux Board 1A2-A”
- 1-MCC-232-A-A, “Reactor Vent Board 1A-A”

The planned maintenance requires the removal of two ERCW pumps from service (both powered from 6.9 kV SDBD 1A-A). Removing the ERCW pumps from service to support the planned maintenance leaves one available ERCW pump in Train A. The UHS temperature limit of ≤ 71ºF and the requirement for WBN Unit 1 to be shutdown for more than 100 hours and in a defueled condition, significantly reduces the cooling water demands on the ERCW System and CCS to allow the performance of planned maintenance on 6.9 kV SDBD 1A-A and associated 480 V boards and MCCs. Furthermore, in accordance with WBN Unit 1 TS 3.9.10, “Decay Time,” WBN Unit 1 will be subcritical for at least 100 hours prior to entering the new WBN Unit 1 TS 3.7.8, Condition A.

3.2.2 Risk Insights

Although this license amendment request is not a risk-informed submittal, the risk impacts of the proposed SDBD maintenance lineup were evaluated for WBN Unit 2 for a duration of seven days.

The bounding estimates of the risk associated with the SDBD maintenance evolution were determined to be very small.

3.2.3 Equipment Protection

With equipment or components out of service, TVA employs a graded approach to defense-in-depth (DID) and protected equipment strategies based on the operating status of the affected unit and a unit in an outage. Because ERCW is a shared system, the DID strategies addresses both the outage unit and the operating unit.

For the outage unit, at least once every 24 hours, procedures direct control room operators to complete a DID assessment. The DID assessment provides instructions for verifying the status and availability of components required to maintain key safety functions (reactivity control, decay heat removal, containment, RCS inventory, power availability, and spent fuel cooling/Inventory). The assessment includes guidance to ensure protected equipment/systems are identified and protected. Work is screened to ensure that protected components or systems are not jeopardized. Protected components or systems are identified on shift turnover checklist and reviewed during shift turnover meetings and pre-job briefings, as well as through the use of physical or administrative barriers to prevent entry into a given area. WBN procedures define the requirements for physical barriers, which may consist or roped off areas, posting signs, and/or placing cover devices with a DID tag attached to a doorknob or breaker compartment handle. When Operations determines that additional barriers are needed, placement of DID placards and tags is documented and maintained.

For the operating unit, fleet procedures define the work management process that includes the assessment of plant risk, maximizing plant reliability. WBN procedures define the requirements for physical barriers, which may consist of roped off areas, posting signs, and/or placing cover devices with a DID tag attached to a doorknob or breaker compartment handle. When Operations determines that additional barriers are needed, placement of DID placards and tags is documented and maintained.

Enclosure 6 to this submittal contains a tabular listing of the equipment that will be out of service during the SDBD maintenance. For each item in the table, the corresponding equipment that will be protected for that out of service item during the maintenance is also provided.

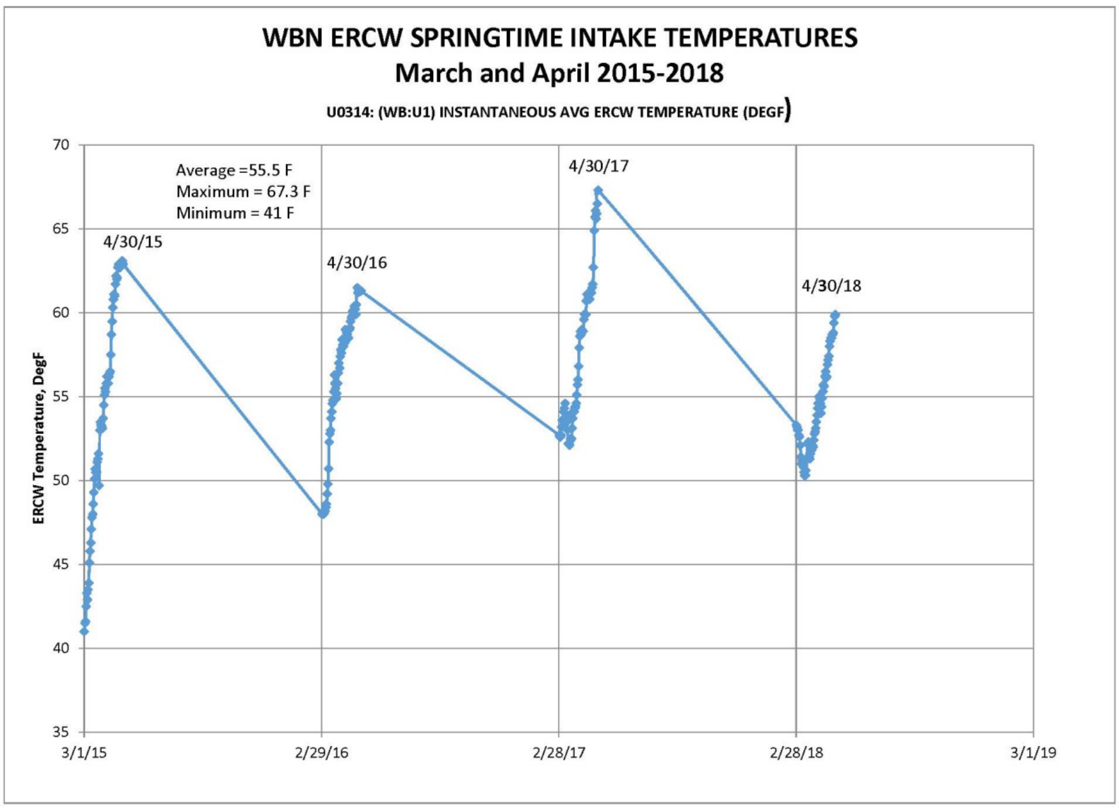
3.2.4 Evaluation Method and Approach

A comprehensive and scenario-specific thermal hydraulic analysis was developed to determine the ERCW and CCS alignments required to support the proposed completion time for restoring an inoperable ERCW train. The prerequisite ERCW train valve alignments were analyzed to ensure safe plant operation during the extended completion time for electrical board maintenance. The analysis was conducted in accordance with the following approach and methodology.

The ERCW System and CCS are shared systems supporting dual-unit operation. Four 6.9 kV SDBDs power the safety-related equipment on both units. The 6.9 kV SDBDs are required to support the shared ERCW and CCS safety functions. At the current design basis UHS temperature of 85ºF supplying the ERCW System, a dual-unit outage is required to perform periodic maintenance on the boards. However, the required ERCW cooling water flow to the essential components is lower at reduced ERCW temperatures and the UHS temperature is historically lower than 85ºF during springtime refueling outages.

As indicated in Figure 1 below, a review of the past four years of plant data has shown that the ERCW temperature throughout the months of March and April does not exceed 71ºF and only exceeded 65ºF for a few days in 2017 with a maximum value of 67.3ºF and overall average of 55.5ºF.

Figure 1 - WBN ERCW Intake Temperature History



The analysis determined the available ERCW flow to each ESF component when 6.9 kV SDBD 1A-A is out of service, and then determined the maximum allowable ERCW temperature at the respective available flow rate for each essential component to transfer its design basis heat load. The limiting ERCW component temperature was then compared to the historical springtime Tennessee River temperature data to demonstrate the available UHS margin, allowing one 6.9 kV SDBD to be removed from service for up to seven days during a spring refueling outage.

Initial Conditions

- WBN Unit 2 operating at 100 percent of rated thermal power,
- WBN Unit 1 in a defueled condition more than 100 hours after shutdown,
- Unnecessary WBN Unit 1 ERCW loads are isolated from the ERCW System, leaving the spent fuel pool as the remaining WBN Unit 1 ERCW load, and
- UHS temperature is ≤ 71ºF.

Scenario

A design basis LOCA is postulated to occur on WBN Unit 2 during the WBN Unit 1 spring refueling outage after 6.9 kV SDBD 1A-A is removed from service for planned maintenance. Concurrent with the LOCA, a LOOP and a worst case single active failure of Train B (SDBDs and EDGs 1B-B and 2B-B) is assumed, leaving 6.9kV SDBD 2A-A and associated EDG 2A-A to supply power to the ESFs and components.

There are three major steps in the analysis. First, the flow-balanced and benchmarked hydraulic model of the ERCW System is configured for the LOCA unit (WBN Unit 2) with non-essential WBN Unit 1 ERCW loads isolated. This step determines the ERCW flow rate available to each ESF component. The flow rates are compared to the design basis flow rates required at the design basis UHS temperature and components predicted to receive less than design basis flow are identified.

Next, component-specific thermal analyses are performed to determine the reduced ERCW temperature required to transfer the component-specific design basis heat load, with margin at the reduced available ERCW flow. Three different types of thermal analysis are applied, consistent with the component type. The shell and tube heat exchangers are modeled with PROTO-HX software, the board room chillers are modeled with energy balance spreadsheet models, and the finned-tube air coils are modeled with PROTO-HX Air Coil software.

Finally, a composite PROTO-FLO/PROTO-HX thermal model of the ERCW and CCS is utilized to evaluate the overall performance of both systems, showing that the design basis heat loads are transferred with margin and that outlet temperature limits are not exceeded. This step determines the overall limiting condition for the maximum ERCW temperature allowed throughout the proposed TS completion time extension.

3.2.5 Available ERCW Flow

For the planned maintenance on 6.9 kV SDBD 1A-A, a LOOP and loss of Train B (LOTB) are assumed, leaving 6.9 kV SDBD 2A-A and EDG 2A-A to supply power to the ESF systems and components.

For this scenario, ERCW Train A is available with ERCW pump B-A or D-A (depending on which pump is pre-selected). Therefore, prior to removing 6.9 kV SDBD 1A-A from service, non-essential WBN Unit 1 loads on the ERCW System are isolated.

Diesel loading limits normally preclude operation of two ERCW pumps from one EDG in combination with a motor-driven AFW pump. With the motor-driven AFW pump required to remain in service for the WBN Unit 2, a second ERCW pump cannot be powered from 6.9 kV SDBD and EDG 2A-A. Considering the LOTB and the 6.9 kV SDBD 1A-A out of service, no CCS cooling water will be supplied to the CCS 1A HX. Therefore, spent fuel pool (SFP) cooling is required to be transferred to SFP HX B prior to taking 6.9 kV SDBD 1A-A out of service to preclude a temporary loss of SFP cooling.

The non-essential WBN Unit 1 loads on ERCW Train A with WBN Unit 1 in the defueled condition include the control rod drive coolers, the containment lower compartment ventilation coolers, RCPs 1-1 and 1-3, and the containment upper compartment coolers. These loads will be isolated when 6.9 kV SDBD 1A-A is removed from service.

The flow balanced and benchmarked ERCW hydraulic model, developed with PROTO-FLO software, formed the starting point for the ERCW available flow determination. The model was benchmarked against plant test data to ensure that it accurately predicts the actual ERCW flows to the ESF components. This model represents the normal full power configuration of the ERCW System with four ERCW pumps available and the ERCW cooled components in service. For the WBN Unit 2 design basis LOCA with WBN Unit 1 defueled and 6.9 kV SDBD 1A-A out of service, the base model was reconfigured as follows:

- ERCW pumps, except pump B-A, were isolated,
- The WBN Unit 2 ERCW containment isolation valves were closed,
- The CCS HX ERCW discharge valves were set to their post-LOCA positions, and
- The valves in the ERCW supply lines to the non-essential WBN Unit 1 loads were closed.

The ERCW System provides the cooling water to the station air compressors (SACs), which are not safety-related. Each train of ERCW has a supply line to the SAC, with a single four-inch isolation valve that is normally throttled open in the base model. For this scenario, it is assumed that the non-seismic portion of the ERCW piping supplying the SACs in the Turbine Building fails and discharges ERCW flow through each four-inch diameter pipe. Although the low pressure and high flow control system logic would normally isolate motor operated valves in these lines, neither of these valves would be powered and consequently, fail as-is. Assuming both valves open provides a conservative loss of ERCW flow in excess of the 350-gpm flow switch setpoint. Finally, a 100 gallon per minute (gpm) constant leakage flow is incorporated at the ERCW pump discharge header to account for unidentified system leakage.

The resulting ERCW model alignment was saved as “Case 1A-A,” representing the long-term LOCA-RECIRC phase of the accident scenario, for which the ERCW and CCS heat loads are bounding.

The ERCW hydraulic model was executed and the available Train A component flow rates were exported to a spreadsheet (which reduced these flow rates by ten percent) and then compared the reduced flows to the 85ºF UHS design basis flow requirements and computed the associated flow margins. The results of this step of the analysis are

presented in Table 3. The components identified with negative flow margin are those components where an ERCW temperature lower than 85ºF is required to transfer the specific design basis heat load for that component. These "limiting" components and available ERCW flow rates were input to the subsequent thermal analysis step to determine the reduced ERCW temperature limit required to the proposed extended completion time.

Table 3 - Available ERCW Flows for 6.9 kV SDBD 1A-A Out of Service with Loss of Train B[1]

Component	Design Basis Required Flow (gpm)	Case 1A-A Available Flow (gpm)	90% Case 1A-A Available Flow (gpm)	Percent of Design Basis Required Flow
EDG HX 2A1	450.0	455.27	409.74	-8.9%
EDG HX 2A2	450.0	466.11	419.50	-6.8%
CCS HX B Unit 2 LOCA	3000.0	5640.47	5076.42	69.2%
2A Containment Spray HX	5200.0	4304.72	3874.25	-25.5%
A Shutdown Board Room Chiller	560.0	546.79	492.11	-12.1%
A Electrical Board Room A/C Chiller A-A	288.0	297.38	267.64	-7.1%
A Auxiliary Control Air	3.5	10.64	9.58	173.6%
1A CCP Room Cooler	25.0	28.54	25.69	2.7%
2A CCP Room Cooler	25.0	33.01	29.70	18.8%
1A Safety Injection (SI) Pump Room Cooler	22.0	28.54	25.68	16.7%
2A SI Pump Room Cooler	22.0	35.45	31.90	45.0%
1A Containment Spray Pump (CSP) Room Cooler	28.0	33.29	29.96	7.0%
2A CSP Room Cooler	28.0	35.96	32.36	15.6%
1A RHR Pump Room Cooler	19.0	22.53	20.28	6.7%
2A RHR Pump Room Cooler	19.0	23.56	21.20	11.6%
2A Emergency Gas Treatment System Room Cooler	10.0	16.52	14.87	48.7%
1A Spent Fuel Pool/Thermal Barrier Booster Pump Space Cooler	29.0	30.64	27.57	-4.9%
1A CCS/AFW Pump Cooler	102.0	112.54	101.29	-0.7%
2A AFW/Boric Acid Tank Pump Space Cooler	60.0	63.28	56.95	-5.1%
1A El 737 Penetration Room Cooler	12.0	17.14	15.42	28.5%
2A El 737 Penetration Room Cooler	12.0	34.01	30.61	155.1%
1A El 713 Penetration Room Cooler	11.0	15.14	13.62	23.8%
2A El 713 Penetration Room Cooler	11.0	17.48	15.73	43.0%
1A El 692 Penetration Room Cooler	12.0	16.56	14.90	24.2%
2A El 692 Penetration Room Cooler	12.0	15.82	14.24	18.7%
1A Pipe Chase Cooler	15.0	20.43	18.39	22.6%
2A Pipe Chase Cooler	15.0	21.68	19.51	30.1%
2A ERCW Strainer Backwash	450.0	356.39	320.75	-28.7%
2A IIRC Flow Out Broken Pipe	-	32.26	29.03	-

Note 1: The table excludes equipment flow paths that do not receive flow for the analyzed case. The excluded flow paths include those that are isolated and will not operate without power from Train 1A-A, pre-alignment equipment isolation requirements, and equipment that isolates following a WBN Unit 2 accident.

3.2.6 Limiting ERCW Temperature Determination

Previously developed and benchmarked design basis thermal models were applied in this evaluation step. Three methods were employed, depending on the component type, as described below. The overall approach for this analysis is to credit reduced ERCW temperature to compensate for reduced available ERCW cooling water flow. For each limiting component, the heat transfer rate was analyzed, iteratively, at the reduced available flow rate from the previous ERCW hydraulic analysis with reduced ERCW temperatures, until the predicted heat transfer rate exceeded the respective design basis heat load. After the individual component ERCW temperatures were determined, a thermal model of the CCS was developed to evaluate the CCS performance when supplied with reduced ERCW flow at the limiting allowable ERCW temperature.

3.2.5.1 Shell and Tube HX Models

EDG Jacket Water HXs

The EDG 2-A-A jacket water HXs are being replaced with higher capacity units that require thirty percent less ERCW cooling water flow (450 gpm versus 650 gpm at 88ºF versus 85ºF) and are sized to transfer the design basis EDG heat load under fully fouled conditions with ten percent of the tubes plugged. In support of this change, the new HX was modeled with the PROTO-HX software and the model was benchmarked against the vendor's design performance specification datasheet. The model was extrapolated for the reduced ERCW flow rate available to determine the ERCW temperature required to transfer the design basis heat load with margin.

Enclosure 6 to this letter includes a commitment to replace the EDG 2A-A diesel jacket water HXs with high capacity HXs prior to entering the one-time extended completion time for an inoperable ERCW train due to planned maintenance on 6.9 kV Shutdown Board 1A-A.

Containment Spray System HX

The benchmarked PROTO-HX model for the LOCA analysis conditions of 158.2ºF tube side inlet, 88ºF shell inlet, design fouling and five-percent plugged tubes was executed to determine the benchmark duty of 81,294,921 Btu/hr. Applying the model and extrapolating the ERCW shell side flow to the reduced available ERCW flow rate yielded the ERCW temperature required to transfer the design basis LOCA-RECIRC heat load with margin, considering fully fouled conditions with 5 percent plugged tubes.

3.2.5.2 Air Coil Room Cooler Models

Models of the air coil (finned tube) HXs were previously developed with the PROTO-HX Air Coil software application and benchmarked to vendor data. Specifically, models were available for 12 different coils. The air coil models include the following:

- CCS-AFW pump room cooler
- CCS-SFP room cooler
- CCP room cooler

- CSS pump room cooler
- Emergency Gas Treatment System (EGTS) room cooler
- AFW-Boric Acid Tank Pump Room Cooler
- Penetration room cooler Elevation (EL) 692
- Penetration room cooler El 713
- Penetration room cooler El 737
- Pipe chase cooler
- RHR Room Cooler
- Safety Injection System pump room cooler

These models were extrapolated for a range of ERCW temperatures to produce trend curves of ERCW flow rate versus temperature. These data were interpolated in this analysis to determine the specific ERCW temperature required to transfer the respective design basis heat load at the available ERCW flow rate for each negative flow margin ESF room cooler.

3.2.5.3 Energy Balance Chiller Models

Water chillers are employed for cooling the shutdown board room, electric board room (EBR), and main control room (MCR). These are package refrigeration units, which incorporate ERCW cooled condensers. Spreadsheet models were previously developed to solve the energy balance equations in accordance with a method presented in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Fundamentals Handbook. The method maintains the design evaporator capacity for varying condenser performance resulting from reduced ERCW cooling water flow rates and reduced ERCW temperatures. Iteratively solving these equations for the predicted available ERCW flow rates yielded the required ERCW temperature for each chiller unit.

3.2.5.4 CCS Thermal Model

The purpose of this model is to demonstrate that the available ERCW flow rate and limiting temperature conditions provide adequate cooling for the Containment Spray System (CSS) HX and for the CCS, such that the WBN Unit 2 LOCA and WBN Units 1 and 2 CCS heat loads are transferred with margin. This model also allows evaluation of the ERCW and CCS outlet temperatures, which must be maintained lower than the associated piping system thermal stress analysis limits.

The PROTO-FLO software features an option to incorporate HXs modeled with the companion PROTO-HX application. The composite PROTO-FLO model then determines each HX performance considering the flow rates and temperatures on both sides of the respective HX. The option is also provided to simulate a fixed heat load and flow rate.

For this analysis, the ERCW flow rates on the shell side of the CSS HX and the tube side of the CCS HX are known from the preceding hydraulic analysis and the design basis CCS flow rates through the CCS cooled components are known. Thus, a heat balance network model was developed using a pump curve defined as the minimum design basis pump performance that represents the Inservice Test minimum performance criterion and is conservative relative to current performance. In addition, the heat balance network model used control valves to model the ERCW flow loop through the CSS and CCS HXs and the CCS flow loop through the CCS HX and the active HXs cooled by the CCS.

This model incorporates the benchmarked PROTO-HX models of the CSS HX, CCS HX, RHR HX, and the SFP HX. Other CCS heat loads and associated CCS flow rates, which are essentially constant, are combined into one fixed heat load and flow rate. Inputs to this model include the following:

- ERCW flow to the CSS HX
- ERCW flow to the CCS HX
- ERCW supply temperature
- LOCA-RECIRC heat load on the CSS HX
- LOCA-RECIRC het load on the RHR HX
- SFP heat load on the SFP HX
- Other fixed heat load on the CCS

Heat transfer to ERCW is maximized assuming zero fouling, zero tubes plugged and design maximum fixed heat loads. The SFP temperature is allowed to increase from the maximum normal temperature of 127ºF to the design maximum value of 159.24ºF (precluding pool boiling), as necessary, to transfer the specified SFP heat load.

<u>CCS Heat Loads</u>

Review of the CCS heat load calculation for the case of a WBN Unit 2 LOCA, LOOP, and LOTB with WBN Unit 1 in a defueled condition revealed two WBN Unit 1 heat loads that are eliminated when 6.9 kV SDBD 1A-A is out of service. With no power to the CCP, the CCP oil cooler heat load is eliminated. In addition, with no power to the other pumps served by the seal water HX, that load is eliminated. Therefore, the remaining load on the CCS for WBN Unit 1 is the Spent Fuel Pool Cooling System (SFPCS) HX.

For WBN Unit 2, the CCS heat load in the LOCA-RECIRC phase bounds the heat load in the LOCA-SI phase of the accident due to the operation of the RHR HX in the LOCA-RECIRC phase. The seal water HX is also a significant load in the LOCA-RECIRC phase. Therefore, the CCS thermal model incorporates the WBN Unit 2 RHR HX, the seal water HX, and a fixed heat load representing the combined heat loads of the four ESF pump coolers.

Outlet Temperature Limits

The system Operating Modes calculations establish the piping temperature limits, which are input to the associated system thermal stress analyses. The Operating Modes calculations were reviewed and the applicable temperature limits are summarized in the Table 4.

Table 4 - ERCW System and CCS Piping Temperature Limits

System	Location	Maximum Pipe Temperature, ºF
ERCW	ERCW Outlet of CCS HX	122
	ERCW Outlet of CSS HX	130
CCS	CCS Outlet of CCS HX	104
	CCS Outlet of RHR HX	146
	CCS Outlet of SFP HX	128

CCS Outlet Temperature and Available Heat Transfer Capacities

For the maximum allowable ERCW temperature and available flow rate to the tube side of the CCS HX, the CCS thermal model determines the shell side CCS outlet temperature for the shell side CCS flow equal to the sum of the required CCS flow rates to the CCS heat loads. No heat loads exist for the LOCA unit non-regenerative letdown HX or the waste gas compressor, but the CCS flows to these components are not isolated. These unheated flow streams are maintained in the model, because they tend to conservatively increase the CCS temperature. The shell side CCS inlet temperature is the mass averaged temperature of the discharges from the heat exchangers cooled by the CCS, including the two unheated flow streams.

This model was initially executed with the ERCW supply temperature determined in the preceding step for the limiting component and with the SFP temperature at its maximum value with one loop of SFP cooling in service (159.24ºF). When the model predicted outlet temperatures exceeding pipe stress thermal limits and SFP HX duty lower than design maximum heat load, the model was iterated with reduced ERCW supply temperatures and increased SFP temperatures, until the outlet pipe temperature limits were met and the SFP HX duty exceeded the design maximum target. This evaluation produced the overall maximum allowable ERCW temperature for the proposed system alignment and extended completion time to support planned SDBD maintenance.

3.2.3.5 Summary of Results

The ERCW temperature limit, as determined by this analysis, is 71ºF, based on the maximum outlet temperature limit of 130ºF for the ERCW discharge from the containment spray HX. Table 5 lists the allowable temperatures for the other components receiving less than their respective design flow rates and shows the associated margins. This table also lists predicted heat transfer capacities compared to the conservative design values selected as the acceptance criteria.

Table 5 - Components Receiving Less Than Design Flow Rates

	Unit 2 LOCA-RECIRC, LOOP, LOTB Unit 1 Refueling >48 hrs Post-SD 1A-A 6.9 kV SDBD Out of Service		
Parameter	**Predicted**	**Design Maximum**	**Margin**
Maximum Allowable ERCW Inlet Temperature, °F	71	65 **	8%
CCS HX Outlet Temperature, °F	96.19	104	8%
CCS HX Outlet ERCW Temperature, °F	118.18	122	3%
CSS HX Outlet ERCW Temperature, °F	129.42	130	0.45%
SFP Temperature, °F	159.24	≤ 159.24	0%
SFP HX Outlet CCS Temperature, °F	121.86	128	5%
RHR HX Outlet CCS Temperature, °F	128.29	146	14%
B-CCS HX Duty, Btu/hr	118,480,735	106,183,506	12%
RHR HX Duty, Btu/hr	79,195,543	54,800,000	45%
SFP HX Duty, Btu/hr	38,058,810	32,420,000	17%
CSS HX Duty, Btu/hr	112,961,147	81,294,921	39%

** Estimated seasonal maximum based on ERCW average temperatures for March and April of 2015 through 2018

3.2.7 Analysis Assumptions and Conservatism

The following assumptions and conservatisms are utilized:

- Minimum ERCW pump performance is assumed by specifying a lower bounding head versus flow curve relative to the vendor pump curves. The lower bounding curve under predicts the vendor's witness test performance curves for the eight pumps by five to nine percent. This ensures that the actual ERCW flow rates supplied in this accident scenario will conservatively bound the analysis predicted flow rates.
- The flow values determined in the ERCW hydraulic analysis are reduced by ten percent to account for the measurement and analysis uncertainties.
- Maximum heat transfer to the CCS is assumed in order to maximize the CCS HX ERCW outlet temperature. This is accomplished by specifying zero fouling inside and outside of the HX tubes and zero plugged tubes in the respective PROTO-HX models.
- The ERCW System Train B fails in its entirety. No credit is taken for the WBN Unit 1 Train B equipment, even though the WBN Unit 1 Train B EDG and SDBD are likely to be available. This is a conservative assumption that maximizes the demand on ERCW Train A.

- The 6.9kV SDBD 1A-A is not removed from service until WBN Unit 1 is in a defueled condition, to ensure that ERCW flow and heat transfer margins are preserved for a design basis accident (DBA) on WBN Unit 2.
- The SFP heat load is maximized by assuming that the full core offload for WBN Unit 1 occurs at 100 hours after shutdown. This is conservative, because the earliest time defueling can begin per TS 3.9.10 is 100 hours, and 6.9kV SDBD 1A-A outage cannot begin until the full core has been offloaded. Therefore, the maintenance on 6.9kV SDBD 1A-A does not begin until WBN Unit 1 has been shut down for at least 100 hours.
- All WBN Unit 1 non-essential cooling loads are isolated prior to and in preparation for removal of the SDBD from service. This ensures that ERCW flow and heat transfer margins are preserved for a DBA on WBN Unit 2.
- The SFP is initially at the maximum normal temperature of 127°F, which maximizes the heat load on the CCS and ERCW System and minimizes the time for SFP heat-up.
- The SFP heats up following initial loss of cooling to a temperature ≤159.24ºF. As the SFP temperature increases, the heat transfer to the CCS increases until the SFP decay heat load is matched. This temperature is the design maximum SFP temperature.
- For the 1A-A SDBD maintenance, SFP cooling will be transferred from the A SFPHX to the B SFPHX. For this scenario, only one CCS pump supplying the WBN Unit 2 A CCS train is available due to loss of the redundant power supplies to the C-S CCS pump (LOTB and loss of SDBD 1A-A).
- ERCW flow to AFW is isolated for this analysis. This is conservative, as the AFW pumps take suction from the ERCW discharge headers. Flow to the AFW pumps would reduce the ERCW discharge flow and the backpressure in the discharge headers, resulting in higher available flow rates to ERCW loads. Also, the ERCW discharge header flow rate and elevation relative to the WBN Unit 2 AFW pump elevation ensure more than adequate suction head and flow is available to supply the AFW pumps.
- The SFP heat load is the beyond design basis 100-hour full core offload maximum of 50,215,000 Btu/hr. This conservatively maximizes the load on the CCS HX and maximizes the ERCW cooling flow required.
- The SFP heat load, for analysis purposes, is the design basis 100-hour full core offload maximum of 32,420,000 Btu/hr. This is conservative, because the actual heat load would be less following the minimum decay time required by TS 3.9.10 before defueling can begin (100 hours), plus the time required before maintenance on 6.9 kV SDBD 1A-A can begin (approximately 40 hours to defuel WBN Unit 1). This is the SFP heat load used to establish the design maximum pool temperature of 159.24ºF. This heat load is applied as the minimum acceptance criterion where the predicted SFP heat exchanger duty is compared to demonstrate the available heat transfer margin.

- The maximum RHR HX duty of 54,800,000 Btu/hr (LOCA-RECIRC mode) and design CCS flow rate of 5000 gpm are the acceptance criteria for the LOCA unit (WBN Unit 2). The predicted RHR duty under the postulated conditions is compared to this criterion to demonstrate the available heat transfer margin.
- The non-seismic portion of the ERCW piping supplying the SACs in the Turbine Building fails and discharges ERCW flow through each four-inch diameter pipe. The low pressure and high flow control system logic would normally isolate motor operated valves in these lines. However, for this scenario, neither of these valves will be powered and will fail as-is. Assuming both valves open provides a conservative loss of ERCW flow in excess of the 350-gpm flow switch setpoint.
- To account for unidentified valve and component leakage, 100 gpm of ERCW flow is discharged directly from the system. This results in a conservative loss of ERCW flow, which is in excess of system leakage under normal operating conditions.
- ERCW discharge flow is directed over the hydraulic gradient, rather than to the cooling tower basin. This increases the discharge flow resistance and conservatively reduces the flow available to the essential components.
- The CCS supplies to the WBN Unit 1 RHR HX and the non-regenerative letdown HX are isolated. With WBN Unit 1 defueled, there are no heat loads on these HX, preserving CCS flow for mitigation of a LOCA on WBN Unit 2.

3.2.8 Special System Alignments

- Prior to removing the 6.9 kV SDBD 1A-A from service, CCS 2A-train flow is aligned to the SFPCS HX B to compensate for a loss of SFP cooling due to failure of emergency Train-B power to CCS pump C-S, as well as loss of Train-A power to that pump and to the CCS pump A-A when 6.9 kV SDBD 1A-A is out of service.
- WBN Unit 1 non-essential ERCW loads, including the upper compartment ventilation coolers (UCVCs), lower compartment ventilation coolers (LCVCs), control rod drive (CRD) coolers, and RCP motor coolers, are isolated prior to and in preparation for removal of the SDBD from service. These are non-essential loads with the unit in a defueled condition.
- Isolate ERCW flow to the CCS A HX, as the CCS A HX will have no CCS pump flow available with LOTB and 6.9 kV SDBD 1A-A out of service.
- Isolate the WBN Unit 1A EDG jacket water HXs to maximize flow available to the ERCW Train 2B components.

Enclosure 6 to this letter includes a commitment to revise or develop a Standard Operating Instruction (SOI) to establish the ERCW equipment lineup necessary to support ERCW Train A operation using one ERCW pump powered from 6.9 kV SDBD 2A-A with WBN Unit 1 in a defueled condition and WBN Unit 2 in Mode 1, 2, 3, or 4. The SOI will be issued prior to performing maintenance activities on 6.9 kV Shutdown Board 1A-A during the WBN Unit 1 spring 2020 Outage.

3.3 CONCLUSION

This evaluation demonstrates that one ERCW pump operating at minimum performance in Train A will supply adequate cooling water flow to all essential components on Unit 2 during a postulated LOCA, as well as Unit 1 after entering a defueled condition, when the UHS temperature is limited to less than or equal to 71ºF.

Therefore, in addition to the capability of ERCW Train B to perform the ERCW safety functions, when the ERCW System is aligned to the assumed configuration for planned maintenance and the UHS temperature satisfies the maximum temperature limit, ERCW Train A would provide redundant capability with one ERCW pump. With this additional capability, the ERCW System safety function could be satisfied considering a single failure that disables ERCW Train B.

On this basis, a one-time change of the TS 3.7.8 completion time for restoration of an inoperable ERCW Train from 72 hours to seven days is acceptable.

4.0 REGULATORY ANALYSIS

4.1 APPLICABLE REGULATORY REQUIREMENT CRITERIA

The Nuclear Regulatory Commission (NRC) regulatory requirements related to the content of the TSs are contained in 10 CFR 50.36. The TS requirements in 10 CFR 50.36 include the following categories:

(1) safety limits, limiting safety systems settings, and control settings; (2) LCO; (3) surveillance requirements; (4) design features; and (5) administrative controls. As stated in 10 CFR 50.59(c)(1)(i), a licensee is required to submit a license amendment pursuant to 10 CFR 50.90 if a change to the TSs is required. Furthermore, the requirements of 10 CFR 50.59 necessitate that the NRC approve the TS changes before they are implemented. TVA's submittal meets the requirements of 10 CFR 50.59(c)(1)(i) and 10 CFR 50.90.

General Design Criteria

The Watts Bar Nuclear Power plant was designed to meet the intent of the "Proposed General Design Criteria for Nuclear Power Plant Construction Permits" published in July, 1967. The Watts Bar construction permit was issued in January 1973. The UFSAR, however, addresses the NRC General Design Criteria (GDC) published as Appendix A to 10 CFR 50 in July 1971, including Criterion 4 as amended October 27, 1987.

Each criterion listed below is followed by a discussion of the design features and procedures that meet the intent of the criteria. Any exception to the 1971 GDC resulting from the earlier commitments is identified in the discussion of the corresponding criterion.

Criterion 2, "Design Bases for Protection Against Natural Phenomena"

Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety function. The design bases for these structures, systems, and components shall reflect:

1. Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated,

2. Appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena, and

3. The importance of the safety functions to be performed.

Compliance

The structures, systems, and components important to safety are designed to either withstand the effects of natural phenomena without loss of capability to perform their safety functions, or to fail in the safest condition. Those structures, systems, and components vital to the shutdown capability of the reactor are designed to withstand the maximum probable natural phenomenon expected at the site, determined from recorded data for the site vicinity, with appropriate margin to account for uncertainties in historical data. Appropriate combinations of normal, accident, and natural phenomena structural loadings are considered in the plant design.

The nature and magnitudes of the natural phenomena considered in the design of the plant are discussed in WBN UFSAR Sections 2.3, 2.4, and 2.5. Sections 3.2 through 3.10 discuss the design of the plant in relationship to natural events. Seismic and safety classifications, as well as other pertinent standards and information, are given in the sections discussing individual structures and components.

This proposed LAR has no effect on WBN's compliance with Criterion 2 as described above.

Criterion 5, "Sharing of Structures, Systems, and Components"

Structures, systems, and components important to safety shall not be shared among nuclear power units unless it is shown that such sharing will not impair significantly their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units.

Compliance

The structures important to safety that are shared are the Auxiliary Building, Control Building, Diesel Generator Building, and the intake pumping station. Shared safety- related systems include the essential raw cooling water, component cooling water, fire protection, spent fuel cooling, fuel oil storage tanks, preferred and emergency

electric power, chemical and volume control, radioactive waste, emergency gas treatment system, and Control and Auxiliary Building ventilation systems. The vital dc power system is shared to the extent that a few loads (e.g., the vital inverters) in one nuclear unit are energized by the dc power channels assigned primarily to power loads of the other unit. In no case does the sharing inhibit the safe shutdown of one unit while the other unit is experiencing an accident. All shared systems are sized for all credible initial combinations of normal and accident states for the two units, with appropriate isolation to prevent an accident condition in one unit from carrying into the other. For systems that are shared and have interface points, a means is provided for isolating and protecting the portions required for WBN Unit 1 operation and safe shutdown from the balance of the WBN Unit 2 systems, which are not necessary or desirable for the operation, and/or safe shutdown of WBN Unit 1.

If the designated equipment configuration is revised to allow system testing or modification, appropriate action will be taken to ensure that the required system availability for accident mitigation is maintained.

This proposed LAR has no effect on WBN's compliance with Criterion 5 as described above.

Criterion 44, "Cooling Water"

A system to transfer heat from structures, systems, and components important to safety, to an ultimate heat sink shall be provided. The system safety function shall be to transfer the combined heat load of these structures, systems, and components under normal operating and accident conditions.

Suitable redundancy in components and features, and suitable interconnections, leak detection, and isolation capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure.

Compliance

A Seismic Category I CCS is provided to transfer heat from the reactor coolant system reactor support equipment and engineered safety equipment to a Seismic Category I ERCW system. The CCS serves as an intermediate system and thus a barrier between potentially or normally radioactive fluids and the river water which flows in the ERCW system. The CCS consists of two independent engineered safety subsystems, each of which is capable of serving all necessary loads under normal or accident conditions.

In addition to serving as the heat sink for the CCS, the ERCW system is also used as heat sink for the containment through use of the containment spray HXs, and engineered safety equipment through use of compartment and space coolers. The ERCW system consists of two independent trains, each of which is capable of providing all necessary heat sink requirements. The ERCW system transfers heat to the ultimate heat sink.

This proposed LAR has no effect on WBN's compliance with Criterion 44 as described above.

Criterion 45, "Inspection of Cooling Water System"

The cooling water system shall be designed to permit appropriate periodic inspection of important components, such as HXs and piping, to assure the integrity and capability of the system.

Compliance

The integrity and capability of the component cooling water system and essential raw cooling water system will be monitored during normal operation by the Surveillance Instruction Program. Nonsafety-related systems may be isolated temporarily for inspection. All major components will be visually inspected on a periodic basis.

The component cooling and ERCW pumps are arranged such that any pump may be isolated for inspection and maintenance while maintaining full plant operational capabilities.

This proposed LAR has no effect on WBN's compliance with Criterion 45 as described above.

Criterion 46, "Testing of Cooling Water System"

The cooling water system shall be designed to permit appropriate periodic pressure and functional testing to assure (1) the structural and leaktight integrity of its components, (2) the operability and the performance of the active components of the system, and (3) the operability of the system as a whole and under conditions as close to design as practical, the performance of the full operational sequence that brings the system into operation for reactor shutdown and for LOCAs, including operation of applicable portions of the protection system and the transfer between normal and emergency power sources.

Compliance

The cooling water systems are pressurized during plant operations; thus, the structural and leaktight integrity of each system and the operability and performance of their active components are continuously demonstrated. In addition, normally idle portions of the piping system and idle components are tested during plant shutdown. The emergency functions of the systems are periodically tested out to the final actuated device in accordance with the technical specifications.

This proposed LAR has no effect on WBN's compliance with Criterion 46 as described above.

4.2 PRECEDENT

In Reference 3, the NRC approved a request for the Sequoyah Nuclear Plant Units 1 and 2 to add a new Condition A to TS 3.7.8, "Essential Raw Cooling Water (ERCW)

System," to extend the allowed completion time to restore ERCW System train to operable status from 72 hours to seven days for planned maintenance when the opposite unit is defueled or in Mode 6 following defuel under certain restrictions.

4.3 NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The proposed change adds a one-time use Condition A to Technical Specification (TS) 3.7.8, "Essential Raw Cooling Water (ERCW) System," for Watts Bar Nuclear Plant (WBN) Unit 2. The proposed change will extend the allowed completion time to restore ERCW System train to operable status from 72 hours to seven days for planned maintenance when Unit 1 is defueled and ultimate heat sink (UHS) Temperature is less than or equal to 71 degrees Fahrenheit (ºF). This change is needed to support required maintenance on the safety-related 6.9 kilovolt (kV) shutdown boards and associated 480 V boards and motor control centers.

Tennessee Valley Authority (TVA) has evaluated the proposed changes to the TS using the criteria in Section 50.92 to Title 10 of the Code of Federal Regulations (10 CFR) and has determined that the proposed changes do not involve a significant hazards consideration. As required by 10 CFR 50.91(a), the TVA analysis of the issue of no significant hazards consideration is presented below:

1. Does the proposed change involve a significant increase in the probability or consequences of any accident previously evaluated?

   Response: No

   The proposed change adds a one-time use new Condition A to TS 3.7.8 for WBN Unit 2. The proposed change will extend the allowed completion time to restore ERCW System train to operable status from 72 hours to seven days for planned maintenance when Unit 1 is defueled and UHS Temperature is less than or equal to 71ºF. This change does not result in any physical changes to plant safety-related structures, systems, or components (SSCs). The UHS and associated ERCW system function is to remove plant system heat loads during normal and accident conditions. As such, the UHS and ERCW system are not design basis accident initiators, but instead perform accident mitigation functions by serving as the heat sink for safety-related equipment to ensure the conditions and assumptions credited in the accident analyses are preserved. During operation under the proposed change with one ERCW train inoperable, the other ERCW train will continue to perform the design function of the ERCW system. Therefore, the proposed change does not involve a significant increase in the probability of an accident previously evaluated.

   Accordingly, as demonstrated by TVA design heat transfer and flow modeling calculations, operation with one ERCW System inoperable for seven days for planned maintenance when WBN Unit 1 is defueled, the fuel cladding, Reactor Coolant System (RCS) pressure boundary, and containment integrity limits are not challenged during worst-case post-accident conditions. Accordingly, the conclusions of the accident analyses will remain as previously evaluated such that there will be no significant increase in the post-accident dose consequences.

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any previously evaluated?

   Response: No

   The proposed change does not involve any physical changes to plant safety related SSCs or alter the modes of plant operation in a manner that is outside the bounds of the current UHS and ERCW system design heat transfer and flow modeling analyses. The proposed change adds a one-time use new Condition A to TS 3.7.8, which would extend the allowed completion time to restore ERCW System train to operable status from 72 hours to seven days for planned maintenance when Unit 1 is defueled and UHS Temperature is less than or equal to 71ºF. Therefore, although the specified ERCW System alignments result in reduced heat transfer flow capability, the plant's overall ability to reject heat to the UHS during normal operation, normal shutdown, and hypothetical worst-case accident conditions will not be significantly affected by this proposed change. Because the safety and design requirements continue to be met and the integrity of the RCS pressure boundary is not challenged, no new credible failure mechanisms, malfunctions, or accident initiators are created, and there will be no effect on the accident mitigating systems in a manner that would significantly degrade the plant's response to an accident.

   Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed change involve a significant reduction in the margin of safety?

   Response: No

   The proposed change adds a one-time use new Condition A to TS 3.7.8, which would extend the allowed completion time to restore ERCW System train to operable status from 72 hours to seven days for planned maintenance when Unit 1 is defueled and UHS Temperature is less than or equal to 71ºF. As demonstrated by TVA design basis heat transfer and flow modeling calculations, the design limits for fuel cladding, RCS pressure boundary, and containment integrity are not exceeded under both normal and post-accident conditions. As required, these calculations include evaluation of the worst-case combination of meteorology and operational parameters, and establish adequate margins to account for measurement and instrument uncertainties. While operating margins have been reduced by the proposed change in order to support necessary maintenance activities, the current limiting design basis accidents remain applicable and the analyses conclusions remain bounding such that the accident safety margins are maintained. Accordingly, the proposed change will not significantly degrade the margin of safety of any SSCs that rely on the UHS and ERCW System for heat removal to perform their safety related functions.

   Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, TVA concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92 (c), and accordingly, a finding of “no significant hazards consideration” is justified.

Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission’s regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

4.0 ENVIRONMENTAL CONSIDERATION

The proposed TS change would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR Part 20, and would change an inspection or surveillance requirement. However, the proposed change does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed TS change meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed TS change.

5.0 REFERENCES

1. TVA Letter to NRC, CNL-18-119, “Application to Revise Watts Bar Nuclear Plant, Units 1 and 2, Technical Specifications 3.8.1, 3.8.7, 3.8.8, and 3.8.9, Regarding Electrical Power Systems (WBN-TS-18-08),” dated November 26, 2018 (ML18345A085)

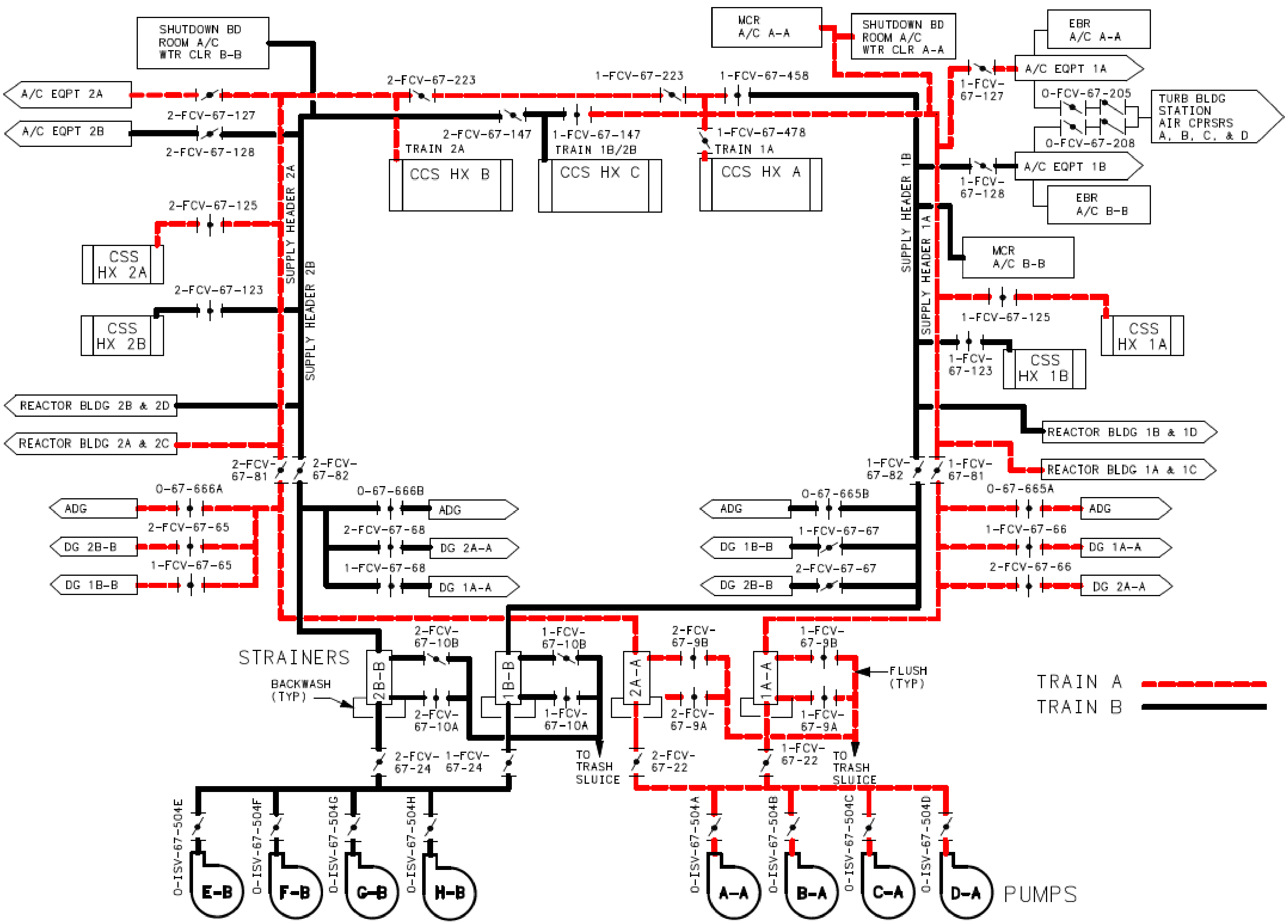
2. TVA Letter to NRC, CNL-18-118, “Application to Revise Technical Specifications Regarding DC Electrical Systems TSTF-500, Revision 2, “DC Electrical Rewrite - Update to TSTF 360” (WBN-TS-18-09),“ dated November 29, 2018 (ML18334A389)

3. NRC letter to TVA, "Sequoyah Nuclear Plant, Units 1 and 2 - Issuance of Amendments to Revise Technical Specification for Essential Raw Cooling Water System Allowed Completion Time (CAC Nos. MF7450 and MF7451)," dated September 29, 2016 (ML16225A276)

Enclosure 2

Simplified Drawing of the WBN Essential Raw Cooling Water System

Simplified Drawing of the WBN Essential Raw Cooling Water System



Enclosure 3

Markups of Technical Specification and Bases Changes

3.7 PLANT SYSTEMS

3.7.8 Essential Raw Cooling Water (ERCW) System

LCO 3.7.8 Two ERCW trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
-----------------NOTES--------------- 1. Only applicable during the Unit 1 spring 2020 outage (U1R16) but no later than May 1, 2020. 2. Only applicable when Unit 1 is defueled. 3. Only applicable when Ultimate Heat Sink (UHS) temperature is ≤ 71 °F. 4. Only applicable during planned maintenance on 6.9 kV shutdown board 1A-A and associated 480 V boards and motor control centers. ---	A.1	------------NOTES----------- 1. Enter applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources - Operating," for diesel generator made inoperable by ERCW. 2. Enter applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops - MODE 4," for residual heat removal loops made inoperable by ERCW. -----------------------------------	
A. One ERCW train inoperable.		Restore ERCW train to OPERABLE status.	7 days
	AND		
	A.2	Verify UHS temperature is ≤ 71 °F.	1 hour AND Once every 12 hours thereafter

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
BA. One ERCW train inoperable for reasons other than Condition A.	BA.1 ------------NOTES----------- 1. Enter applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources- Operating," for diesel generator made inoperable by ERCW. 2. Enter applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops-MODE 4," for residual heat removal loops made inoperable by ERCW. ---------------------------------- Restore ERCW train to OPERABLE status.	72 hours
CB. Required Action A.1 and associated Completion Time not met. OR Required Action and associated Completion Time of Condition AB not met.	CB.1 Be in MODE 3. AND CB.2 Be in MODE 5.	6 hours 36 hours

BASES (continued)

APPLICABILITY

In MODES 1, 2, 3, and 4, the ERCW System is a normally operating system that is required to support the OPERABILITY of the equipment serviced by the ERCW System and required to be OPERABLE in these MODES.

In MODES 5 and 6, the OPERABILITY requirements of the ERCW System are determined by the systems it supports.

ACTIONS

A.1 and A.2

Condition A is modified by four notes that limit the conditions and parameters that allow entry into Condition A. The first note limits the applicability of Condition A to the time period when Unit 1 is in a refueling outage in spring 2020, but no later than May 1, 2020. The second note limits the applicability of Condition A to the time period when Unit 1 is defueled. The third note requires a temperature limitation on UHS Temperature. The fourth note states that Condition A is only applicable during planned maintenance on 6.9 kV shutdown board 1A-A (1-BD-211-A) and associated 480 V boards and motor control centers (i.e., 1-BD-212-A1-A, 1-BD-212-A2-A, 1-MCC-213-A1-A, 1-MCC-213-A2-A, 1-MCC-214-A1-A, 1-MCC-214-A2-A,1-MCC-215-A1-A, 1-MCC-215-A2-A,and 1-MCC-232-A-A). This will allow the plant configuration to be aligned (i.e., cross-ties exist and isolation of loads to facilitate maintenance and modification activities) to minimize the heat load on the ERCW system to ensure ERCW continues to meet its design function.

The 7 day completion time is acceptable based on the following:

- Low probability of a DBA occurring during that time.
- Heat load on the ERCW System is substantially lower than assumed for the DBA with the opposite unit defueled.
- Redundant capabilities afforded by the OPERABLE train.

If one ERCW system train is inoperable for planned maintenance, action must be taken to restore to an OPERABLE status within 7 days. In this Condition, the remaining OPERABLE ERCW system train is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure in the OPERABLE ERCW system train could result in loss of ERCW system function.

Required Action A.1 is modified by two Notes. The first Note indicates that the applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources - Operating," should be entered if an inoperable ERCW system train results in an inoperable diesel generator. The second Note indicates

(continued)

ACTIONS

A.1 and A.2 (continued)

that the applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops - MODE 4," should be entered if an inoperable ERCW system train results in an inoperable residual heat removal loop. This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

Required Action A.2 ensures the credited UHS temperature limit is maintained. If the credited UHS temperature is not maintained, the analytical assumptions for relying on ERCW Train A as a defense-in-depth measure during the extended Completion Time for Required Action A.1 are no longer met and Condition B is entered for an inoperable ERCW train for reasons other than Condition A.

B~~A~~.1

If one ERCW train is inoperable for reasons other than Condition A, action must be taken to restore OPERABLE status within 72 hours. In this Condition, the remaining OPERABLE ERCW train is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure in the OPERABLE ERCW train could result in loss of ERCW System function. Required Action B~~A~~.1 is modified by two Notes. The first Note indicates that the applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources - Operating," should be entered if an inoperable ERCW train results in an inoperable diesel generator. The second Note indicates that the applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops - MODE 4," should be entered if an inoperable ERCW train results in an inoperable decay heat removal train. This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components. The 72 hour Completion Time is based on the redundant capabilities afforded by the OPERABLE train, and the low probability of a DBA occurring during this time period.

C~~B~~.1 and C~~B~~.2

If the ERCW train cannot be restored to OPERABLE status within the associated Completion Time, the plant must be placed in a MODE in which the LCO does not apply. To achieve this status, the plant must be placed in at least MODE 3 within 6 hours and in MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

Enclosure 4

Clean Technical Specification and Bases Changes

3.7 PLANT SYSTEMS

3.7.8 Essential Raw Cooling Water (ERCW) System

LCO 3.7.8 Two ERCW trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
-----------------NOTES--------------- 1. Only applicable during the Unit 1 spring 2020 outage (U1R16) but no later than May 1, 2020. 2. Only applicable when Unit 1 is defueled. 3. Only applicable when Ultimate Heat Sink (UHS) temperature is ≤ 71 ºF. 4. Only applicable during planned maintenance on 6.9 kV shutdown board 1A-A and associated 480 V boards and motor control centers. -- B. One ERCW train inoperable.	A.1	------------NOTES----------- 1. Enter applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources - Operating," for diesel generator made inoperable by ERCW. 2. Enter applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops - MODE 4," for residual heat removal loops made inoperable by ERCW. --------------------------------- Restore ERCW train to OPERABLE status.	 7 days
	AND		
	A.2	Verify UHS temperature is ≤ 71 ºF.	1 hour AND Once every 12 hours thereafter

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. One ERCW train inoperable for reasons other than Condition A.	B.1	------------NOTES----------- 1. Enter applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources- Operating," for diesel generator made inoperable by ERCW. 2. Enter applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops-MODE 4," for residual heat removal loops made inoperable by ERCW. --------------------------------- Restore ERCW train to OPERABLE status.	72 hours
C. Required Action A.1 and associated Completion Time not met. <u>OR</u> Required Action and associated Completion Time of Condition B not met.	C.1	Be in MODE 3.	6 hours
	<u>AND</u>		
	C.2	Be in MODE 5.	36 hours

BASES (continued)

APPLICABILITY

In MODES 1, 2, 3, and 4, the ERCW System is a normally operating system that is required to support the OPERABILITY of the equipment serviced by the ERCW System and required to be OPERABLE in these MODES.

In MODES 5 and 6, the OPERABILITY requirements of the ERCW System are determined by the systems it supports.

ACTIONS

A.1 and A.2

Condition A is modified by four notes that limit the conditions and parameters that allow entry into Condition A. The first note limits the applicability of Condition A to the time period when Unit 1 is in a refueling outage in spring 2020, but no later than May 1, 2020. The second note limits the applicability of Condition A to the time period when Unit 1 is defueled. The third note requires a temperature limitation on UHS Temperature. The fourth note states that Condition A is only applicable during planned maintenance on 6.9 kV shutdown board 1A-A (1-BD-211-A) and associated 480 V boards and motor control centers (i.e., 1-BD-212-A1-A, 1-BD-212-A2-A, 1-MCC-213-A1-A, 1-MCC-213-A2-A, 1-MCC-214-A1-A, 1-MCC-214-A2-A,1-MCC-215-A1-A, 1-MCC-215-A2-A,and 1-MCC-232-A-A). This will allow the plant configuration to be aligned (i.e., cross-ties exist and isolation of loads to facilitate maintenance and modification activities) to minimize the heat load on the ERCW system to ensure ERCW continues to meet its design function.

The 7 day completion time is acceptable based on the following:

- Low probability of a DBA occurring during that time.
- Heat load on the ERCW System is substantially lower than assumed for the DBA with the opposite unit defueled.
- Redundant capabilities afforded by the OPERABLE train.

If one ERCW system train is inoperable for planned maintenance, action must be taken to restore to an OPERABLE status within 7 days. In this Condition, the remaining OPERABLE ERCW system train is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure in the OPERABLE ERCW system train could result in loss of ERCW system function.

Required Action A.1 is modified by two Notes. The first Note indicates that the applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources - Operating," should be entered if an inoperable ERCW system train results in an inoperable diesel generator. The second Note indicates

ACTIONS

A.1 and A.2 (continued)

that the applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops - MODE 4," should be entered if an inoperable ERCW system train results in an inoperable residual heat removal loop. This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

Required Action A.2 ensures the credited UHS temperature limit is maintained. If the credited UHS temperature is not maintained, the analytical assumptions for relying on ERCW Train A as a defense-in-depth measure during the extended Completion Time for Required Action A.1 are no longer met and Condition B is entered for an inoperable ERCW train for reasons other than Condition A.

B.1

If one ERCW train is inoperable for reasons other than Condition A, action must be taken to restore OPERABLE status within 72 hours. In this Condition, the remaining OPERABLE ERCW train is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure in the OPERABLE ERCW train could result in loss of ERCW System function. Required Action B.1 is modified by two Notes. The first Note indicates that the applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources - Operating," should be entered if an inoperable ERCW train results in an inoperable diesel generator. The second Note indicates that the applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops - MODE 4," should be entered if an inoperable ERCW train results in an inoperable decay heat removal train. This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components. The 72 hour Completion Time is based on the redundant capabilities afforded by the OPERABLE train, and the low probability of a DBA occurring during this time period.

C.1 and C.2

If the ERCW train cannot be restored to OPERABLE status within the associated Completion Time, the plant must be placed in a MODE in which the LCO does not apply. To achieve this status, the plant must be placed in at least MODE 3 within 6 hours and in MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

(continued)

Enclosure 5

Equipment Out of Service / Protected Equipment

Equipment Out of Service for Train 1A	Protected Equipment for Defense In Depth	Comments
6.9 kV Shutdown Board (SDBD) 1A-A	6.9 kV SDBD 1B-B 6.9 kV SDBD 2A-A 6.9 kV SDBD 2B-B Switchyard - including Common Station Service Transformers C and D Emergency Diesel Generator (EDG) 1B-B EDG 2A-A EDG 2B-B	None
480V SDBD 1A1-A 480V SDBD 1A2-A	480V SDBD 2A1-A 480V SDBD 2A2-A 480V SDBD 1B1-B 480V SDBD 1B2-B 480V SDBD 2B1-B 480V SDBD 2B2-B	None
480V Reactor Motor-Operated Valve (RMOV) Board 1A1-A 480V RMOV Board 1A2-A	480V RMOV Board 2A1-A 480V RMOV Board 2A2-A 480V RMOV Board 1B1-B 480V RMOV Board 1B2-B 480V RMOV Board 2B1-B 480V RMOV Board 2B2-B	None
EDG 1A-A 480 V Diesel Auxiliary Board 1A1-A 480 V Diesel Auxiliary Board 1A2-A 125 V EDG 1A-A battery EDG 1A-A battery chargers	EDG 1B-B EDG 2A-A EDG 2B-B 480 V Diesel Auxiliary Board 1A1-A 480 V Diesel Auxiliary Board 1A2-A 480 V Diesel Auxiliary Board 1A1-A 480 V Diesel Auxiliary Board 1A2-A 480 V Diesel Auxiliary Board 1A1-A 480 V Diesel Auxiliary Board 1A2-A 125 V EDG 2A-A battery 125 V EDG 1B-B battery 125 V EDG 2B-B battery EDG 1B-B battery chargers EDG 2A-A battery chargers EDG 2B-B battery chargers	None
480 V Control and Auxiliary Building (C&A) Vent Board 1A1-A	480 V C&A Vent Board 2A1-A 480 V C&A Vent Board 1B1-B 480 V C&A Vent Board 2B1-B	None
480 V Reactor Vent Board 1A-A	None / see comments	The 480 V Reactor Vent Boards do not perform a safety function.

Enclosure 5

Equipment Out of Service / Protected Equipment

Equipment Out of Service for Train 1A	Protected Equipment for Defense In Depth	Comments
480 V C&A Vent Board 1A2-A	None / see comments	480 V C&A Vent Board 1A2-A does not perform a safety function.
125 V DC Vital Battery Charger I AND Normal Feeder for 125 V Vital Battery Charger I, Normal Feeder for Vital Inverter 1-I, 2-I, 0-I	125 V DC Vital Battery Charger II 125 V DC Vital Battery Charger III 125 V DC Vital Battery Charger IV 125 V DC Vital Battery Charger 7/9-S 125 V DC Vital Battery I 125 V DC Vital Battery II 125 V DC Vital Battery III 125 V DC Vital Battery IV 120 V AC Vital Inverter 0-I 120 V AC Vital Inverter 0-II 120 V AC Vital Inverter 0-III 120 V AC Vital Inverter 0-IV 120 V AC Vital Inverter 1-I 120 V AC Vital Inverter 1-II 120 V AC Vital Inverter 1-III 120 V AC Vital Inverter 1-IV 120 V AC Vital Inverter 2-I 120 V AC Vital Inverter 2-II 120 V AC Vital Inverter 2-III 120 V AC Vital Inverter 2-IV	The 125 V DC Vital Battery Charger 6/8-S (which supplies 125 V DC Vital Battery I during board maintenance) will be inoperable (because it is cross-train).
ERCW Pump A-A ERCW Pump C-A ERCW Strainer 1A-A ERCW Train 1A: traveling screens / screen wash pumps	ERCW Pump B-A ERCW Pump D-A ERCW Pump G-B ERCW Pump E-B ERCW Pump H-B ERCW Pump F-B ERCW Strainer 1B-B ERCW Strainer 2A-A ERCW Strainer 2B-B ERCW Train 1B: traveling screens / screen wash pumps ERCW Train 2A: traveling screens / screen wash pumps ERCW Train 2B: traveling screens / screen wash pumps (All ERCW Train B equipment required for Unit 2 power operations)	None

Note: For the case of performing maintenance on Power Train 1A, this list illustrates the electrical boards and major multiple-system components that will be protected as a "Defense In Depth" strategy. With the exception of major ERCW components, equipment that supports single-system components is not included in the list. The TVA approach of physical barricading "protected equipment" is usually limited to the switchyard and to individual switchgear or individual motor control centers. Therefore, physical barricades would not be placed around ERCW equipment located at the Intake Pumping Station.

Enclosure 6

Regulatory Commitments

Commitment	Due Date/Event
TVA will replace the WBN diesel jacket water heat exchangers for emergency diesel generator 2A-A with high capacity heat exchangers.	Prior to entering the one-time extended completion time (seven days) for an inoperable Essential Raw Cooling Water (ERCW) train due to planned maintenance on 6.9 kV Shutdown Board 1A-A.
TVA will revise or develop a Standard Operating Instruction (SOI) to establish the ERCW equipment lineup necessary to support ERCW Train A operation using one ERCW pump powered from 6.9 kV Shutdown Board 2A-A with WBN Unit 1 in a defueled condition and WBN Unit 2 in Mode 1, 2, 3, or 4.	Prior to performing maintenance activities on 6.9 kV Shutdown Board 1A-A during the WBN Unit 1 spring 2020 Outage.