TVA TENNESSEE VALLEY AUTHORITY

1101 Market Street, Chattanooga, Tennessee 37402

CNL-21-062

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10 CFR 50.90

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

Watts Bar Nuclear Plant, Units 1 and 2
Facility Operating Licenses Nos. NPF-90 and NPF-96
NRC Docket Nos. 50-390 and 50-391

Subject: Application to Modify Watts Bar Nuclear Plant Units 1 and 2 Technical Specification 3.7.8 to Support Shutdown Board Cleaning (WBN-TS-19-019)

Reference: NRC letter to TVA, "Watts Bar Nuclear Plant, Unit 2- Issuance of Amendment No. 35 Regarding One-Time Extension of Completion Time for Technical Specification 3.7.8 for Inoperable Essential Raw Cooling Water Train (EPID L-2019-LLA-0020)," dated February 24, 2020 (ML20024F835)

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 Facility Operating License Nos. NPF-90 and NPF-96 for the Watts Bar Nuclear Plant (WBN), Units 1 and 2, respectively.

In the referenced letter, the Nuclear Regulatory Commission (NRC) approved a revision to WBN Unit 2, Technical Specification (TS) 3.7.8, "Essential Raw Cooling Water (ERCW) System," to extend the allowed Completion Time to restore one ERCW system train to operable status from 72 hours to seven days, on a one-time basis, to support maintenance on the WBN Unit 1 6.9 kiloVolt (kV) Shutdown Board (SDBD) 1A-A and associated 480 Volt (V) boards and motor control centers (MCC).

Similarly, the proposed amendment revises WBN Units 1 and 2 TS 3.7.8 to support future maintenance on the WBN Units 1 and 2 SDBDs and associated 480 V boards and MCCs on a permanent basis. Similar to the existing WBN Unit 2 TS 3.7.8, the proposed amendment adds a new Condition A to WBN Unit 1 TS 3.7.8 to extend the allowed Completion Time to restore one ERCW system train to operable status from 72 hours to seven days, to support maintenance on the WBN Unit 2 6.9 kV SDBDs. To support SDBD maintenance for both fall and spring outages, a bounding ultimate heat sink (UHS) temperature of ≤ 78°F has been established in WBN Units 1 and 2 TS 3.7.8, Condition A. The enclosure to this submittal provides the basis for the bounding UHS temperature.

The enclosure to this submittal provides a description and technical evaluation of the proposed change, a regulatory evaluation, and a discussion of environmental considerations. Attachment 1 to the enclosure provides the existing WBN Units 1 and 2 TS pages marked to show the proposed changes. Attachment 2 to the enclosure provides the existing WBN Units 1 and 2 TS pages retyped to show the proposed changes. Attachment 3 provides the existing Unit 1 TS Bases page marked to show the proposed changes. Changes to the existing TS Bases are provided for information only and will be implemented under the Technical Specification Bases Control Program. Attachment 4 to the enclosure provides a proposed markup to the WBN dual-unit Updated Final Safety Analysis Report (UFSAR) to reflect the ERCW configuration to support maintenance on the WBN Units 1 and 2 SDBDs and associated 480 V boards and MCCs. The proposed UFSAR markups are being provided for information only.

TVA has determined that there are no significant hazards considerations associated with the proposed changes and that the TS changes qualify for a categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9). In accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and enclosure to the Tennessee State Department of Environment and Conservation.

TVA requests approval of the proposed license amendment within one year from the date of this submittal with implementation within 30 days of issuance of the amendment.

There are no new regulatory commitments associated with this submittal. Please address any questions regarding this request to Kimberly D. Hulvey, Senior Manager, Fleet Licensing, at (423) 751-3275.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 29th day of September 2021.

Respectfully,

James T. Polickoski
Director, Nuclear Regulatory Affairs

Enclosure: Evaluation of Proposed Change

cc (Enclosure):

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

Evaluation of Proposed Change

Subject: **Application to Modify Watts Bar Nuclear Plant Units 1 and 2 Technical Specification 3.7.8 to Support Shutdown Board Cleaning (WBN-TS-19-019)**

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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 Facility Operating License Nos. NPF-90 and NPF-96 for the Watts Bar Nuclear Plant (WBN), Units 1 and 2.

In Reference 1, the Nuclear Regulatory Commission (NRC) approved a revision to WBN Unit 2, Technical Specification (TS) 3.7.8, "Essential Raw Cooling Water (ERCW) System," to extend the allowed Completion Time to restore one ERCW system train to operable status from 72 hours to seven days, on a one-time basis, to support maintenance on the WBN Unit 1 6.9 kiloVolt (kV) Shutdown Board (SDBD) 1A-A and associated 480 Volt (V) boards and motor control centers (MCCs). As indicated in Note 1 to the existing WBN Unit 2 TS 3.7.8, Condition A, the extended completion time of seven days only applied during the WBN Unit 1 spring 2020 outage.

Therefore, the proposed amendment revises WBN Units 1 and 2 TS 3.7.8 to support future maintenance on the WBN Units 1 and 2 SDBDs and associated 480 V boards and MCCs, on a permanent basis, without requiring a dual-unit shutdown.

2.0 DETAILED DESCRIPTION

2.1 DESCRIPTION OF THE PROPOSED CHANGE

The proposed changes are summarized below:

- Similar to the existing WBN Unit 2 TS 3.7.8, the proposed amendment adds a new Condition A to WBN Unit 1 TS 3.7.8 to extend the allowed Completion Time to restore one ERCW system train to operable status from 72 hours to seven days, to support maintenance on the WBN Unit 2 6.9 kV SDBDs and associated 480 V boards and MCCs when WBN Unit 2 is defueled.
- To support SDBD maintenance for both fall and spring outages, a bounding ultimate heat sink (UHS) temperature of less than or equal to (≤) 78°F has been established in WBN Units 1 and 2 TS 3.7.8, Condition A. Section 3.2 of this enclosure provides the basis for the bounding UHS temperature.
- The notes for the existing WBN Unit 2 TS 3.7.8, Condition A, and the new WBN Unit 1 TS 3.7.8, Condition A, indicate that the WBN Units 1 and 2 TS 3.7.8, Condition A only applies when (1) the opposite unit is defueled and (2) during planned maintenance on the opposite unit's 6.9 kV SDBDs and associated 480 V boards and MCCs.
- Similar to the existing WBN Unit 2 TS 3.7.8, Condition B, the existing WBN Unit 1 TS 3.7.8, Condition A is renumbered as Condition B and is changed to apply for reasons other than new Condition A.
- WBN Unit 2 TS 3.7.8, Condition C is revised to change "Required Action A.1 and associated Completion Time not met," to "Required Action and associated Completion Time of Condition A not met." This is an administrative change to reflect that Condition C applies to both Required Actions A.1 and A.2.

- Similar to the existing WBN Unit 2 TS 3.7.8, Condition C, the existing WBN Unit 1 TS 3.7.8, Condition B is renumbered as Condition C and is changed to also apply when the Completion Time of Condition A is not met.

Attachment 1 to this enclosure provides the existing WBN Units 1 and 2 TS pages marked up to show the proposed changes. Attachment 2 to this enclosure provides the existing WBN Units 1 and 2 TS pages retyped to show the proposed changes. Attachment 3 provides the existing Unit 1 TS Bases page marked to show the proposed changes. Attachment 4 to the enclosure provides a proposed markup to the WBN dual-unit Updated Final Safety Analysis Report (UFSAR) to reflect the ERCW configuration to support maintenance on the WBN Units 1 and 2 SDBDs and associated 480 V boards and MCCs. Changes to the existing TS Bases and UFSAR are provided for information only and will be implemented under the Technical Specification Bases Control Program and UFSAR change control process, respectively.

2.2 CONDITION INTENDED TO RESOLVE

As previously noted in Reference 1, the NRC approved a revision to WBN Unit 2 TS 3.7.8, to extend the allowed Completion Time to restore one ERCW system train to operable status from 72 hours to seven days, on a one-time basis, to support maintenance on the WBN Unit 1 6.9 kV SDBD 1A-A and associated 480 V boards and MCCs. The proposed change will allow greater operational flexibility, while maintaining an adequate margin of safety for two-unit operation at WBN in order to support future maintenance on the WBN Units 1 and 2 6.9 kV SDBDs and associated 480 V boards and MCCs.

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, WBN Units 1 and 2 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 WBN Units 1 and 2 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, WBN Units 1 and 2 TS 3.7.8 allows 72 hours to return the ERCW train to an operable status. However, 72 hours is not an adequate amount of time to safely inspect and perform maintenance on a SDBD and associated 480 V boards and MCCs. 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 noted in Table 1 of Enclosure 1 to Reference 2, the timeline to safely complete the required maintenance and restore the electrical boards is approximately 105 hours. Therefore, the proposed seven-day (168 hours) completion time provides margin for

unanticipated repair activities.

2.3 JUSTIFICATION FOR PROPOSED TS CHANGES

If UHS temperature exceeds 78ºF while in Condition A of TS 3.7.8, further operation in Condition A will be limited to 24 hours after entry into Condition A greater than or equal to (≥) 48 hours, but cannot exceed seven days. The proposed change to WBN Units 1 and 2 TS 3.7.8, which relies on the availability of an ERCW train with only one ERCW pump under specified conditions as a compensatory measure, is similar to WBN Units 1 and 2 TS 3.8.1, Condition B for the extended outage time allowed for an inoperable diesel generator that also relies on the availability of a compensatory measure. Specifically, while performing planned maintenance on a 6.9 kV SDBD and associated 480 V boards and MCC, TS 3.7.8, Condition A requires the inoperable ERCW train to be restored to an operable status within seven days and the verification that UHS temperature is ≤ 78ºF within one hour and once every 12 hours thereafter. The allowance of seven days to restore the inoperable ERCW train to an operable status is predicated on the availability of the inoperable ERCW train, with one pump remaining, to perform the safety function under specified conditions (i.e., the opposite unit is defueled, during planned maintenance on a 6.9 kV SDBD and associated 480 V boards and MCCs, and UHS temperature ≤ 78 ºF). These specified conditions ensure the ERCW train with one ERCW pump remaining has sufficient heat removal capacity to mitigate a design basis event on the operating unit and meet the additional heat removal requirements for the unit in a defueled condition, as well as provide adequate cooling for the spent fuel pool.

If UHS temperature exceeds 78ºF after 48 hours of continuous ERCW train inoperability, then the specified conditions for crediting the availability of the inoperable ERCW train are no longer met and action must be taken to restore the ERCW train to an operable status within 24 hours. Otherwise, the unit must enter WBN Unit 2 TS 3.7.8, Condition C, which requires the unit to be in Mode 3 within six hours and Mode 5 within 36 hours. If UHS temperature is discovered to be > 78ºF, prior to 48 hours of continuous operation in Condition A, then the 24-hour Completion Time to restore the inoperable ERCW train to operable status starts after 48 hours of continuous operation in Condition A. However, the proposed change to WBN Unit 2 TS 3.7.8 does not allow continued operation in Condition A for greater than seven days.

In Sections 2.2 and 3.0 of Reference 1, the NRC evaluated the above similar TS changes for the existing WBN Unit 2, TS Section 3.7.8 and determined they were acceptable. The key difference between the TS changes in Reference 1 and those proposed in this LAR is the change in the UHS temperature from 71ºF to 78ºF. The basis for the increase in the UHS temperature is provided in Section 3.2 to this enclosure.

3.0 TECHNICAL EVALUATION

3.1 SYSTEM DESCRIPTION

A description of the UHS and ERCW systems is provided in Section 3.1 of Enclosure 1 to Reference 2. The ERCW is also described in Section 2.1 to Reference 1. A simplified diagram of the ERCW system is provided in Enclosure 2 to Reference 2.

3.2 TECHNICAL ANALYSIS

3.2.1 OVERVIEW

TVA is requesting approval for a permanent change to WBN Units 1 and 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 when a unit is defueled and UHS temperature ≤ 78ºF. This will allow the performance of planned maintenance on a 6.9 kV SDBD (1A-A, 2A-A, 1B-B, or 2B-B), including the associated 480 V boards (1A1-A, 1A2-A, 1B1-B, 1B2-B, 2A1-A, 2A2-A, 2B1-B, and 2B2-B) and MCCs (1A1-A, 1A2-A, 1B1-B, 1B2-B, 2A1-A, 2A2-A, 2B1-B, and 2B2-B). Section 3.1 and Tables 1 through 4 of Reference 3 provide a description of the WBN electrical power distribution system. Enclosure 2 of Reference 3 provides a simplified drawing of the WBN air conditioning electrical distribution system and a figure indicating the WBN Units 1 and 2 safety-related load distribution across the shared 6.9 kV SDBDs and associated 480 V boards.

The planned maintenance requires the removal of two ERCW pumps from service (both powered from a 6.9 kV SDBD). Removing the ERCW pumps from service to support the planned maintenance leaves two available ERCW pumps in the affected train. However, Emergency Diesel Generator (EDG) capacity and load sequencing support only one ERCW pump per EDG. A specific ERCW pump is preselected by the operators for automatic sequencing onto each EDG. Consequently, with a SDBD out of service and the postulated loss of the opposite train of emergency power, only one ERCW pump is automatically available. The UHS temperature limit of ≤ 78ºF and the requirement for the outage unit to be in a defueled condition, significantly reduces the cooling water demands on the ERCW system and component cooling system (CCS) to allow the performance of planned maintenance on a 6.9 kV SDBD and associated 480 V boards and MCCs. Furthermore, in accordance with WBN Units 1 and 2 TS 3.9.10, “Decay Time,” the shutdown unit will be subcritical for at least 100 hours prior to entering the operating unit TS 3.7.8, Condition A.

3.2.2 RISK INSIGHTS

Although this LAR request is not a risk-informed submittal, the risk impacts of the proposed SDBD maintenance lineup were evaluated 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 address 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 checklists 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 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, the 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, the placement of DID placards and tags is documented and maintained.

Enclosure 5 to Reference 2 contains a tabular listing of the equipment that will be out of service during the planned maintenance on 6.9 kV SDBD 1A-A and associated 480 V boards and MCCs. For each item in Enclosure 5 to Reference 2, the corresponding equipment that will be protected for that out of service item during the maintenance is also provided. Similar corresponding equipment would be protected for maintenance of the other SDBDs (2A-A, 1B-B, or 2B-B).

3.2.4 EVALUATION METHOD AND APPROACH

A comprehensive and scenario-specific thermal hydraulic analysis was developed to determine the ERCW, CCS and Spent Fuel Pool Cooling System (SFPCS) 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, CCS, and SFPCS systems 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, CCS, and SFPCS safety functions. At the current design basis and WBN TS UHS temperature limit 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 spring and fall refueling outages.

As indicated in Figure 1 below, a review of the past six years of plant data has shown that the ERCW spring and fall seasonal maximum temperatures remain well below the allowable limit of 78ºF. Additionally, during any outage where a SDBD is removed from service, TVA monitors the river temperature on a daily basis. In the unlikely event the UHS temperature exceeds 78ºF during the performance of the planned maintenance, TVA would take the appropriate actions in accordance with WBN Units 1 and 2 TS 3.7.8.

Figure 1 - WBN ERCW Intake Temperature History

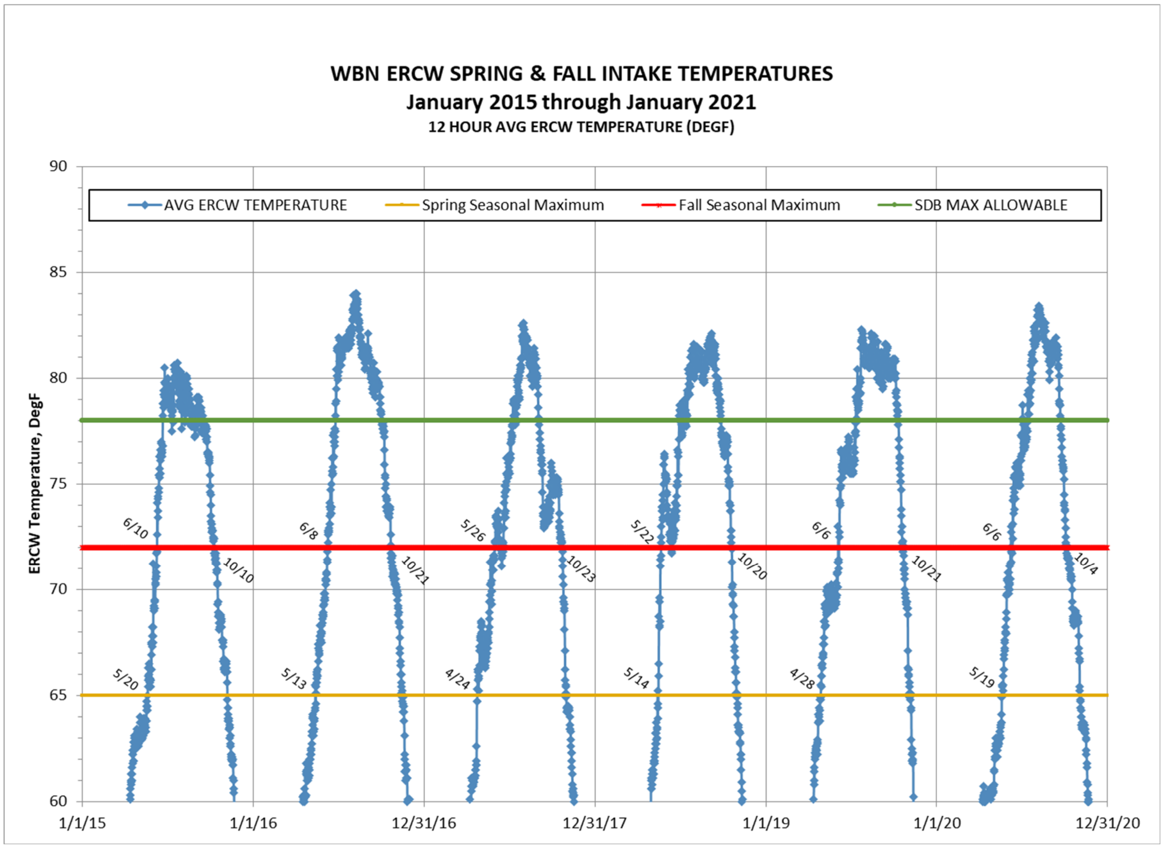


Figure 2 provides a further breakdown of Figure 1 and represents the spring seasonal temperature history relative to the proposed SDBD cleaning maximum ERCW temperature analytical limit of 78°F. WBN spring refueling outages typically end in mid-May when ERCW temperature is generally less than 65°F.

Figure 2 - WBN ERCW Spring Intake Temperature History

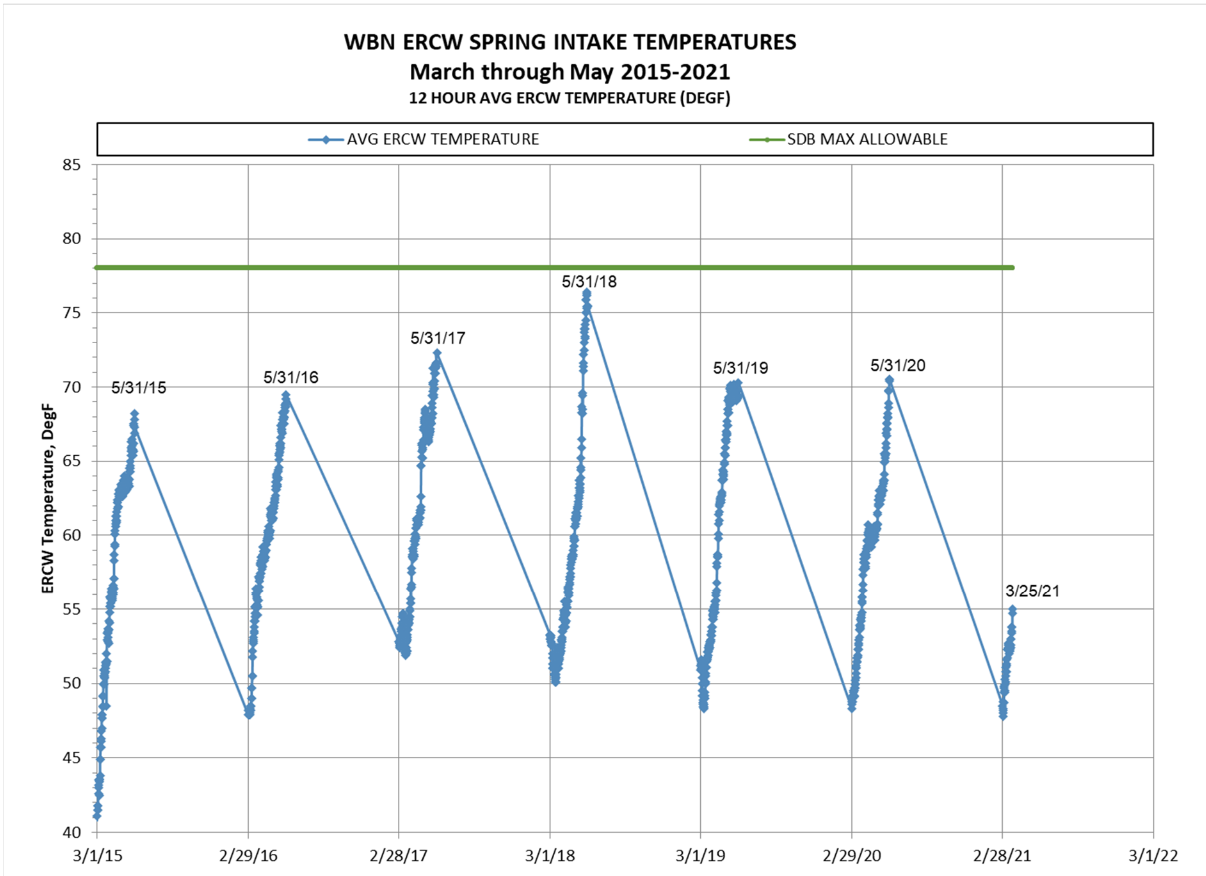
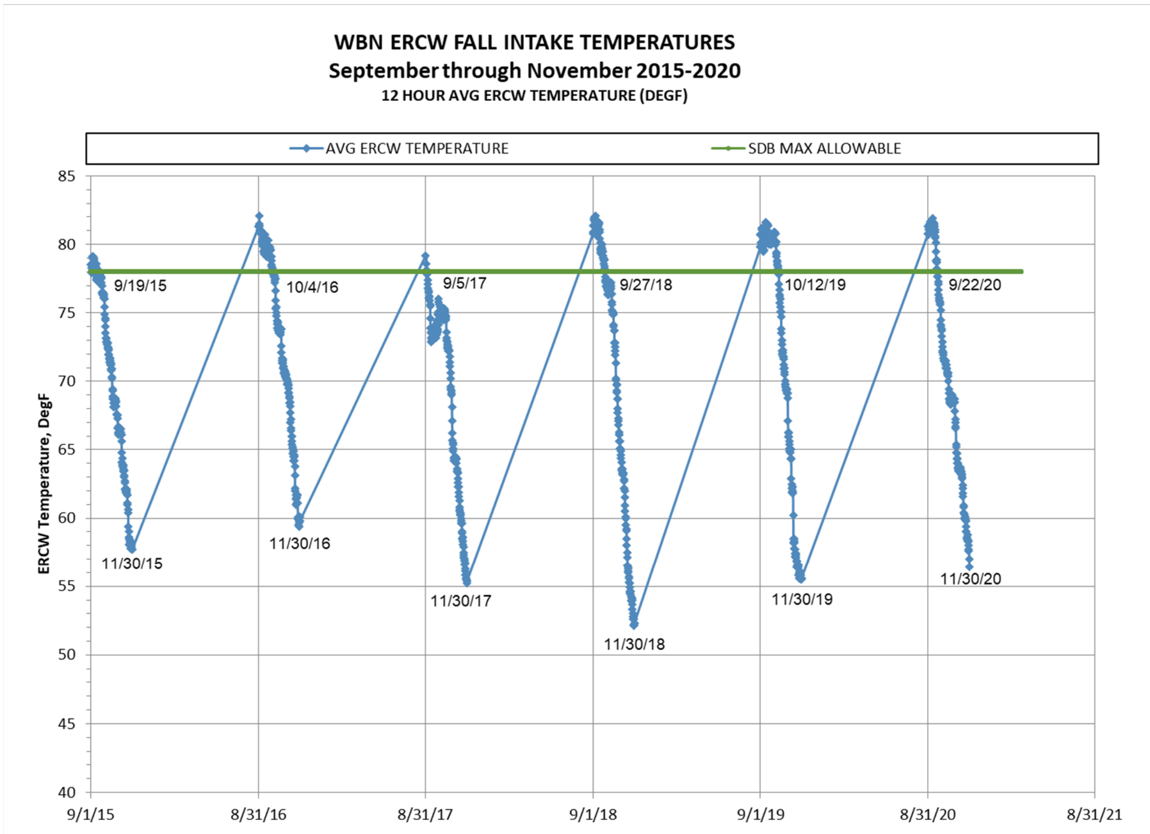


Figure 3 provides a further breakdown of Figure 1 and represents the fall seasonal temperature history relative to the proposed SDBD cleaning maximum ERCW temperature analytical limit of 78°F. The UHS temperatures that exceed 78°F generally occur between the end of August to early September. However, the scheduled fall outages generally commence in mid to late October when UHS temperature is typically below 78°F.

Figure 3 - WBN ERCW Fall Intake Temperature History



The thermal hydraulic analysis determined the available ERCW flow to each engineered safety feature (ESF) component when each 6.9 kV SDBD 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 spring and fall seasonal maximum 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 either a spring or fall refueling outage.

<u>Initial Conditions</u>

- One WBN unit is operating at 100 percent of rated thermal power,
- The opposite WBN unit is in a defueled condition more than 100 hours after shutdown,
- Unnecessary ERCW loads on the Shutdown (SD) unit are isolated from the ERCW System, leaving the spent fuel pool as the remaining ERCW load, and
- UHS temperature is ≤ 78ºF.

Scenario

A design basis loss of cooling accident (LOCA) is postulated to occur on the WBN operating unit during the spring or fall refueling outage on the shutdown unit after one 6.9 kV SDBD is removed from service for planned maintenance. Concurrent with the LOCA, a loss of offsite power (LOOP) and a worst case single active failure of the emergency power train (SDBDs and EDGs) opposite to the train supplying the out of service SDBD is assumed, leaving one 6.9 kV SDBD and associated EDG to supply power to the ESFs and components. Due to EDG capacity and load sequencing limits, only one of the two ERCW pumps remaining available is automatically powered from the EDG.

There are three major steps in the analysis. First, component-specific thermal analyses are performed to determine the reduced ERCW temperature required to transfer the component-specific design basis heat load as a function of available ERCW flow. Three different types of thermal analysis are applied, consistent with the component type. The shell and tube heat exchangers (HX) are modeled with PROTO-HX software, the electric board room chillers are modeled with energy balance spreadsheet models, and the finned-tube air coils are modeled with PROTO-HX Air Coil software. These analyses produce curves of required ERCW flow rate versus ERCW temperature for each component.

Next, the flow-balanced and benchmarked hydraulic model of the ERCW system is configured for the LOCA unit with non-essential 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 along with the associated maximum ERCW temperature obtained in the preceding step.

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

Four analysis scenarios are developed consistent with each of the four SDBDs being alternately removed from service for maintenance during spring and fall refueling outages. In each case, ERCW flow demand is maximized with the LOCA unit containment spray system (CSS) heat exchanger in service and CCS flow demand is maximized with the residual heat removal (RHR) heat exchanger in Shutdown Cooling Mode. Note that all special system alignments required by this analysis are in place prior to board outage and do not involve additional operator burden. The four cases are summarized as follows:

- Case 2F1AA - Unit 2 LOCA, LOOP, loss of Train B (LOTB) and Unit 1 cold shutdown (CSD) >48 hrs with 1A-A SDBD out of service (OOS)
- Case 1F2AA - Unit 1 LOCA, LOOP, LOTB and Unit 2 CSD >48 hrs with 2A-A SDBD OOS
- Case 2D1BB - Unit 2 LOCA, LOOP, loss of Train A (LOTA) and Unit 1 CSD>48 hrs with 1B-B SDBD OOS
- Case 1D2BB - Unit 1 LOCA, LOOP, LOTA and Unit 2 CSD >48 hrs with 2B-B SDBD OOS

As an example, for the planned maintenance on 6.9 kV SDBD 1A-A, a LOOP and 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 auxiliary feedwater (AFW) pump. With the motor-driven AFW pump required to remain in service for WBN Unit 2, a second ERCW pump cannot be powered from the 2A-A 6.9 kV SDBD and EDG. 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 D-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 SACs, 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 gallon per minute (gpm) flow switch setpoint. Finally, a 100 gpm constant leakage flow is incorporated at the ERCW pump discharge header to account for unidentified system leakage.

The ERCW hydraulic model was executed and the available Train A component flow rates were reduced by five percent for conservatism and then compared to the 85ºF UHS design basis flow requirements to compute the associated flow margins. The results of this step of the analysis are presented in Table 1. The components identified with negative flow margin

are those components where an ERCW temperature lower than 85ºF may be 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 for the proposed extended completion time. The CCS HXs are listed as zero gpm required because they are evaluated separately in Sections 3.2.6.5 and 3.2.6.6 of this enclosure.

A similar approach, considering the specific equipment credited in service and the equipment required to be isolated, is applied for each of the other three cases with the results listed in Tables 2, 3, and 4.

Table 1 - 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 2F1AA Available Flow (gpm)	95% Case 2F1AA Available Flow (gpm)	Margin % of Design Basis
SWP PRELUBE 1A/ 2A	20	47.5	45.17	125.8%
DG HX 2A1	450	472.9	449.23	-0.2%
DG HX 2A2	450	484.1	459.89	2.2%
CCS HX B	0	5081.2	4827.10	N/A
2A CONTAINMENT SPRAY HX	5200	5583.1	5303.93	2.0%
A SDBR CHILLER	560	592.4	562.77	0.5%
A EBR A/C Chiller A-A	260	315.0	299.23	15.1%
A ACA	3.5	22.8	21.62	517.7%
1A CCP RM CLR	25	30.4	28.92	15.7%
2A CCP RM CLR	25	33.0	31.33	25.3%
1A SIP RM CLR	22	27.8	26.46	20.3%
2A SIP RM CLR	22	35.1	33.33	51.5%
1A CSP RM CLR	28	32.7	31.11	11.1%
2A CSP RM CLR	28	36.0	34.18	22.1%
1A RHR PMP RM CLR	19	23.8	22.61	19.0%
2A RHR PMP RM CLR	19	23.5	22.36	17.7%
2A EGTS Room Cooler	10	13.6	12.88	28.8%
1A SFP / TBBP SP COOLER	29	36.2	34.40	18.6%
1A CCS / AFW Pump CLR	102	127.4	120.99	18.6%
2A AFW / BATP SPACE COOLER	60	68.0	64.57	7.6%
1A 737 Penetration Rm Clr	12	18.7	17.73	47.7%
2A 737 Penetration Rm Clr	12	31.3	29.78	148.2%
1A 713 Penetration Rm Clr	11	15.9	15.15	37.7%
2A 713 Penetration Rm Clr	11	14.9	14.17	28.8%
1A 692 Penetration Rm Clr	12	18.2	17.27	43.9%
2A 692 Penetration Rm Clr	12	18.1	17.23	43.5%
1A Pipe Chase Cooler	15	21.3	20.27	35.1%
2A Pipe Chase Cooler	15	20.9	19.83	32.2%

Note 1: Tables 1 through 4 exclude 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 the out-of-service train, pre-alignment equipment isolation requirements, and equipment that isolates following an accident in the pertinent unit.

Table 2 - Available ERCW Flows for 6.9 kV SDBD 2A-A Out of Service with Loss of Train B[1]

Component	Design Basis Required Flow (gpm)	Case 1F2AA Available Flow (gpm)	95% Case 1F2AA Available Flow (gpm)	Margin % of Design Basis
ACAS C-S	16.8	18.8	17.82	6.1%
SWP PRELUBE 1A/ 2A	20	50.6	48.06	140.3%
DG HX 1A1	450	494.7	469.97	4.4%
DG HX 1A2	450	501.9	476.81	6.0%
CCS HX A	0	4820.0	4578.97	N/A
1A CONTAINMENT SPRAY HX	5200	5216.3	4955.51	-4.7%
A MCR A/C Chiller	240	315.4	299.65	24.9%
1A CCP RM CLR	25	31.0	29.46	17.8%
2A CCP RM CLR	25	41.8	39.68	58.7%
1A SIP RM CLR	22	28.5	27.11	23.2%
2A SIP RM CLR	22	44.4	42.19	91.8%
1A CSP RM CLR	28	33.6	31.89	13.9%
2A CSP RM CLR	28	45.6	43.35	54.8%
1A RHR PMP RM CLR	19	24.4	23.18	22.0%
2A RHR PMP RM CLR	19	29.9	28.38	49.3%
2A EGTS Room Cooler	10	17.2	16.31	63.1%
1A SFP / TBBP SP COOLER	29	37.7	35.81	23.5%
1A CCS / AFW Pump CLR	102	131.2	124.66	22.2%
2A AFW / BATP SPACE COOLER	60	86.1	81.76	36.3%
1A 737 Penetration Rm Clr	12	18.6	17.63	46.9%
2A 737 Penetration Rm Clr	12	39.8	37.77	214.7%
1A 713 Penetration Rm Clr	11	16.2	15.36	39.6%
2A 713 Penetration Rm Clr	11	18.9	17.93	63.0%
1A 692 Penetration Rm Clr	12	18.6	17.67	47.2%
2A 692 Penetration Rm Clr	12	22.9	21.79	81.6%
1A Pipe Chase Cooler	15	21.8	20.66	37.8%
2A Pipe Chase Cooler	15	26.4	25.09	67.3%

Note 1: Tables 1 through 4 exclude 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 the out-of-service train, pre-alignment equipment isolation requirements, and equipment that isolates following an accident in the pertinent unit.

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

Component	Design Basis Required Flow (gpm)	Case 2D1BB Available Flow (gpm)	95% Case 2D1BB Available Flow (gpm)	Margin % of Design Basis
B-B Aux Control Air	3.5	18.2	17.33	395.1%
SWP PRELUBE 1A/ 2A	20	17.7	16.80	-16.0%
DG HX 2B1	450	437.3	415.48	-7.7%
DG HX 2B2	450	448.8	426.38	-5.2%
C CCS HX Flow	0	6413.1	6092.46	N/A
2B CONTAINMENT SPRAY HX	5200	4455.1	4232.39	-18.6%
B EBR A/C Chiller	260	269.8	256.32	-1.4%
1B CCP RM CLR	25	29.9	28.44	13.7%
2B CCP RM CLR	25	24.2	22.96	-8.2%
1B SIP RM CLR	22	33.1	31.45	42.9%
2B SIP RM CLR	22	26.1	24.78	12.6%
1B CSP RM CLR	28	36.0	34.16	22.0%
2B CSP RM CLR	28	30.4	28.91	3.2%
1B RHR Pump Room Cooler	19	25.4	24.18	27.2%
2B RHRP RM CLR	19	19.5	18.55	-2.4%
2B EGTS Rm Clr	10	8.6	8.16	-18.4%
1B SF and TBB Pump Space Clr	29	31.4	29.82	2.8%
1B CCS + AFW Pump Sp Clr	102	110.7	105.19	3.1%
2B BAT and AFW Pump Sp Clr	60	53.4	50.71	-15.5%
1B 737 Penetration Rm Clr	12	18.5	17.54	46.2%
2B 737 Pen Room	12	20.7	19.68	64.0%
1B 713 Penetration Rm Clr	11	15.8	14.99	36.3%
2B 713 Pen Room	11	12.5	11.84	7.7%
1B 692 Penetration Rm Clr	12	16.9	16.01	33.4%
2B 692 Penetration Rm Clr	12	24.4	23.20	93.4%
1B Pipe Chase Cooler	15	29.1	27.62	84.1%
2B Pipe Chase Cooler	15	16.2	15.35	2.3%

Note 1: Tables 1 through 4 exclude 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 the out-of-service train, pre-alignment equipment isolation requirements, and equipment that isolates following an accident in the pertinent unit.

Table 4 - Available ERCW Flows for 6.9 kV SDBD 2B-B Out of Service with Loss of Train A[1]

Component	Design Basis Required Flow (gpm)	Case 1D2BB Available Flow (gpm)	95% Case 1D2BB Available Flow (gpm)	Margin % of Design Basis
ACAS C-S	16.8	15.0	14.26	-15.1%
SWP PRELUBE 1A/ 2A	20	17.8	16.91	-15.5%
DG HX 1B1	450	395.8	375.97	-16.5%
DG HX 1B2	450	392.1	372.47	-17.2%
C CCS HX Flow	0	6511.0	6185.45	N/A
1B CONTAINMENT SPRAY HX	5200	4622.9	4391.76	-15.5%
B MCR A/C Chiller Discharge	240	265.9	252.61	5.3%
B SDBR CHILLER	560	487.9	463.50	-17.2%
1B CCP RM CLR	25	26.1	24.76	-1.0%
2B CCP RM CLR	25	24.6	23.35	-6.6%
1B SIP RM CLR	22	28.8	27.34	24.3%
2B SIP RM CLR	22	26.5	25.20	14.6%
1B CSP RM CLR	28	31.2	29.68	6.0%
2B CSP RM CLR	28	30.9	29.40	5.0%
1B RHR Pump Room Cooler	19	22.1	21.01	10.6%
2B RHRP RM CLR	19	19.9	18.86	-0.7%
2B EGTS Rm Clr	10	8.9	8.42	-15.8%
1B SF and TBB Pump Space Clr	29	27.1	25.79	-11.1%
1B CCS + AFW Pump Sp Clr	102	96.4	91.61	-10.2%
2B BAT and AFW Pump Sp Clr	60	54.3	51.57	-14.0%
1B 737 Penetration Rm Clr	12	15.5	14.70	22.5%
2B 737 Pen Room	12	21.1	20.01	66.8%
1B 713 Penetration Rm Clr	11	13.4	12.78	16.2%
2B 713 Pen Room	11	12.7	12.05	9.5%
1B 692 Penetration Rm Clr	12	14.6	13.82	15.2%
2B 692 Penetration Rm Clr	12	24.8	23.60	96.6%
1B Pipe Chase Cooler	15	25.0	23.71	58.0%
2B Pipe Chase Cooler	15	16.4	15.61	4.0%

Note 1: Tables 1 through 4 exclude 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 the out-of-service train, pre-alignment equipment isolation requirements, and equipment that isolates following an accident in the pertinent unit.

3.2.6 Limiting ERCW Temperature Determination

Previously developed and benchmarked design basis thermal models were applied in this evaluation step. Three methods (Sections 3.2.6.1 through 3.2.6.3) 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 parametrically to produce correlations of ERCW temperature versus ERCW flow rate required to transfer the respective component design basis heat load. These correlations were then used to determine the maximum allowable ERCW temperature for each component at the previously determined available ERCW flow rates. 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.

3.2.6.1 Shell and Tube HX Models

<u>EDG Jacket Water HXs</u>

The EDG jacket water HXs have been 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 evaluated for the reduced ERCW flow rate available to determine the ERCW temperature required to transfer the design basis heat load considering design basis fouling and tube plugging. The component performance with zero fouling and zero plugged tubes was then evaluated to determine the allowable ERCW temperature at reduced flow without exceeding the ERCW outlet piping thermal stress temperature limit of 120°F.

<u>Containment Spray System HX</u>

The benchmarked PROTO-HX model for the LOCA analysis conditions of 164.8ºF tube side inlet, 88ºF shell inlet, design fouling and ten percent plugged tubes was executed to determine the benchmark duty of 87,323,731 Btu/hr. The model was evaluated for the reduced ERCW flow rate available to determine the ERCW temperature required to transfer this benchmark heat load considering design basis fouling and tube plugging. The component performance with zero fouling and zero plugged tubes was then evaluated to determine the allowable ERCW outlet temperature at reduced flow without exceeding the ERCW outlet piping thermal stress temperature limit of 130°F.

3.2.6.2 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
- Centrifugal charging pump (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 ft
- Penetration room cooler El 713 ft
- Penetration room cooler El 737 ft
- Pipe chase cooler
- RHR Room Cooler
- Safety Injection System pump room cooler

These models were evaluated for a range of ERCW temperatures to produce correlation curves of ERCW flow rate versus temperature. These correlations were used 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.

3.2.6.3 ENERGY BALANCE CHILLER MODELS

Water chillers are employed for cooling the shutdown board room (SDBR), electric board room (EBR), and main control room (MCR). These are packaged 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. As replacements with increased cooling capacity are planned, or in process, for the SDBR and MCR chillers (References 4, 5, and 6), both the old and new chiller units are evaluated, and the limiting unit is used in each case.

3.2.6.4 COMPONENT SPECIFIC ERCW TEMPERATURE LIMITS

The ERCW available flow results for the two LOTB SDBD cases presented in Tables 1 and 2 were compared and the minimum available flow was selected for each component. These bounding minimum flow rates were then used to determine the allowable maximum ERCW temperature for each component as summarized in Table 5. Likewise, the results in Tables 3 and 4 were compared for the LOTA cases and the limiting component ERCW temperatures are summarized in Table 6.

Table 5 – Component-Specific ERCW Temperature Limits with Loss of Train B

Unit 1 or Unit 2 LOCA, LOTB and Alternate Unit A-A SDB Unavailable			
Component	**Design Minimum ERCW Flow Rate (gpm)**	**Available ERCW Flow Rate (gpm)**	**Maximum Allowable ERCW Temperature (°F)**
ACAS C-S	17	18	85
SWP PRELUBE 1A/ 2A	20	45	85
DG HX 1A1 or 2A1	450	449	89.7
DG HX 1A2 or 2A2	450	460	90.4
CCS HX A or B	0	4579	78 [1]
1A or 2A CONTAINMENT SPRAY HX	5200	4956	78 [1]
A MCR A/C Chiller	240	300	85.0
A SDBR CHILLER	560	563	87.4
A EBR A/C Chiller A-A	260	299	88
A ACA	3.5	22	85
1A CCP RM CLR	25	29	88
2A CCP RM CLR	25	31	88
1A SIP RM CLR	22	26	88
2A SIP RM CLR	22	33	88
1A CSP RM CLR	28	31	88
2A CSP RM CLR	28	34	88
1A RHR PMP RM CLR	19	23	88
2A RHR PMP RM CLR	19	22	88
2A EGTS Room Cooler	10	13	88
1A SFP / TBBP SP COOLER	29	34	88
1A CCS / AFW Pump CLR	102	121	88
2A AFW / BATP SPACE COOLER	60	65	88
1A 737 Penetration Rm Clr	12	18	88
2A 737 Penetration Rm Clr	12	30	88
1A 713 Penetration Rm Clr	11	15	88
2A 713 Penetration Rm Clr	11	14	88
1A 692 Penetration Rm Clr	12	17	88
2A 692 Penetration Rm Clr	12	17	88
1A Pipe Chase Cooler	15	20	88
2A Pipe Chase Cooler	15	20	88

Note 1: These limits are determined by the subsequent component cooling system (CCS) thermal model.

Table 6 – Component-Specific ERCW Temperature Limits with Loss of Train A

Unit 1 or Unit 2 LOCA, LOTA And Alternate Unit B-B SDB Unavailable			
Component	**Design Minimum ERCW Flow Rate (gpm)**	**Available ERCW Flow Rate (gpm)**	**Maximum Allowable ERCW Temperature (°F)**
ACAS C-S	17	14	85
SWP PRELUBE 1A/ 2A	20	17	85
DG HX 1B1 or 2B1	450	376	83.8
DG HX 1B2 or 2B2	450	372	83.5
C CCS HX Flow	0	6092	78 [1]
1B / 2B CONTAINMENT SPRAY HX	5200	4232	78 [1]
B MCR A/C Chiller Discharge	240	253	82.8
B SDBR CHILLER	560	464	85.5
B EBR A/C Chiller	260	256	85
B-B Aux Control Air	3.5	17	85
1B CCP RM CLR	25	25	87
2B CCP RM CLR	25	23	87
1B SIP RM CLR	22	27	88
2B SIP RM CLR	22	25	88
1B CSP RM CLR	28	30	88
2B CSP RM CLR	28	29	88
1B RHR Pump Room Cooler	19	21	88
2B RHRP RM CLR	19	19	88
2B EGTS Rm Clr	10	8	88
1B SF and TBB Pump Space Clr	29	26	88
1B CCS + AFW Pump Sp Clr	102	92	88
2B BAT and AFW Pump Sp Clr	60	51	88
1B 737 Penetration Rm Clr	12	15	88
2B 737 Pen Room	12	20	88
1B 713 Penetration Rm Clr	11	13	88
2B 713 Pen Room	11	12	88
1B 692 Penetration Rm Clr	12	14	88
2B 692 Penetration Rm Clr	12	23	88
1B Pipe Chase Cooler	15	24	88
2B Pipe Chase Cooler	15	15	88

Note 1: These limits are determined by the subsequent CCS thermal model.

3.2.6.5 CCS THERMAL MODEL FOR LOTB

The purpose of this model is to demonstrate that the available ERCW flow rate and limiting temperature conditions provide adequate cooling for the CSS heat exchanger (HX) and for the CCS, such that the WBN LOCA and 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 CCS flow rates through the CCS cooled components are known. Thus, a heat balance network model was developed using control valves to model the known flows from the ERCW flow loop through the CSS and CCS HXs and the known flows in 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 CCS HX
- LOCA-RECIRC heat load on the RHR HX
- SFP heat load on the SFP HX
- Other fixed heat loads on the CCS

To evaluate fluid temperature versus piping design temperature, heat transfer to ERCW is maximized by 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, as necessary, to conservatively maximize 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 LOT with WBN Unit 1 in a defueled condition revealed one WBN Unit 1 heat load that is eliminated with one 6.9 kV SDBD out of service. With no power to the CCP, the CCP oil cooler heat load is eliminated. Therefore, the remaining loads on the CCS for WBN Unit 1 are the spent fuel pool cooling system (SFPCS) HX and seal water HX. The same conclusions were reached in review of the opposite case of a WBN Unit 1 LOCA with WBN Unit 2 defueled.

For WBN, 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 LOCA unit 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 Table 7.

Table 7 - 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 load exists for the LOCA unit non-regenerative letdown HX, but the CCS flow to this component is not isolated. This unheated flow stream is maintained in the model, because it tends 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 unheated flow stream.

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 that exceeded pipe stress thermal limits, the model was iterated with reduced ERCW supply temperatures, until the outlet pipe temperature limits were met. This evaluation produced the overall maximum allowable ERCW temperature for the proposed system alignment and extended completion time to support planned SDBD maintenance. The results for a design basis LOCA on either WBN Unit 1 or 2, LOTB with the alternate unit 1/2A-A SDBD out of service are presented in Table 8.

Table 8 – Maximum Allowable ERCW Temperature for 1/2A-A SDBD Cleaning and LOTB

	Unit 1/2 LOCA-RECIRC, LOOP, LOTB Unit 1/2 Refueling >48 hrs Post-SD 1/2 A-A 6.9 kV SDBD Out of Service		
Parameter	Maximum Allowable	Seasonal Maximum[1]	Margin
Spring Seasonal ERCW Inlet Temperature, °F	78	65	17%
Fall Seasonal ERCW Inlet Temperature, °F	78	72	8%
	Predicted	Design Maximum	Margin
CCS HX Outlet Temperature, °F	102.6	104	1%
CCS HX Outlet ERCW Temperature, °F	121.1	122	1%
CSS HX Outlet ERCW Temperature, °F	124.5	130	4%
SFP HX Outlet CCS Temperature, °F	125.8	128	2%
RHR HX Outlet CCS Temperature, °F	127.7	146	13%
Parameter	Predicted	Design Minimum	Margin
A Train -CCS HX Duty, Btu/hr	97,653,622	88,764,506	10%
RHR HX Duty, Btu/hr	61,809,383	54,800,000	13%
SFP HX Duty, Btu/hr	34,265,838	32,420,000	6%
CSS HX Duty, Btu/hr	114,802,818	87,323,731	31%

Note 1: Estimated spring seasonal maximum = 65°F and estimated fall seasonal maximum = 72°F based on ERCW average temperatures for January 2015 through January 2021

3.2.6.6 CCS Thermal Model for LOTA

The CCS thermal model for LOTA is essentially the same as previously described for LOTB. The results for a design basis LOCA on either WBN Unit 1 or 2, LOTA with the alternate unit 1/2B-B SDBD out of service are presented in Table 9.

Table 9 – Maximum Allowable ERCW Temperature for 1/2B-B SDBD Cleaning and LOTA

	Unit 1/2 LOCA-RECIRC, LOOP, LOTA Unit 1/2 Refueling >48 hrs Post-SD 1/2 B-B 6.9 kV SDBD Out of Service		
Parameter	Maximum Allowable	Seasonal Maximum[1]	Margin
Spring Seasonal ERCW Inlet Temperature, °F	78	65	17%
Fall Seasonal ERCW Inlet Temperature, °F	78	72	8%
Parameter	Predicted	Design Maximum	Margin
CCS HX C Outlet CCS Temperature, °F	94.1	104	10%
CCS HX C Outlet ERCW Temperature, °F	115.0	122	6%
CSS HX Outlet ERCW Temperature, °F	129.2	130	1%
SFP HX Outlet CCS Temperature, °F	117.9	128	8%
RHR HX Outlet CCS Temperature, °F	123.5	146	15%
Parameter	Predicted	Design Minimum	Margin
Train B-CCS HX Duty, Btu/hr	111,685,151	88,764,506	26%
RHR HX Duty, Btu/hr	68,661,256	54,800,000	25%
SFP HX Duty, Btu/hr	41,483,112	32,420,000	28%
CSS HX Duty, Btu/hr	108,133,855	87,323,731	24%

Note 1: Estimated spring seasonal maximum = 65°F and estimated fall seasonal maximum = 72°F based on ERCW average temperatures for January 2015 through January 2021

3.2.6.7 Summary of Results

The ERCW temperature limit for LOTB cases, as determined by this analysis, is 78ºF, based on the maximum outlet temperature limits of 104ºF (CCS) and 122ºF for the ERCW discharge from the CCS HX. Table 8 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.

The ERCW temperature limit for LOTA cases, as determined by this analysis, is also 78ºF, based on the maximum outlet temperature limit of 130ºF for the ERCW discharge from the containment spray HX. Table 9 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.

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.
- To improve ERCW flow margin, the component cooling system (CCS) train B heat exchanger post accident flow control valve will be replaced and relocated to improve flow balance between the two ERCW discharge headers. This modification is scheduled for WBN U1R17 (fall 2021).
- The flow values determined in the ERCW hydraulic analysis are reduced by five percent to account for 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.
- On loss of train, the respective ERCW system train fails in its entirety. No credit is taken for the refueling unit equipment, even though the respective refueling unit EDG and SDBD are likely to be available. This is a conservative assumption that maximizes the demand on the remaining ERCW train.
- The respective 6.9 kV SDBD is not removed from service until shutdown/refueling unit is in a defueled condition, to ensure that ERCW flow and heat transfer margins are preserved for a design basis accident (DBA) on the operating unit.
- The SFP heat load is maximized by assuming that the full core offload for the refueling unit occurs at 100 hours after shutdown. This is conservative, because the earliest time defueling can begin per WBN Units 1 and 2 TS 3.9.10 is 100 hours, and the 6.9 kV SDBD outage cannot begin until the full core has been offloaded. Therefore, the maintenance on a 6.9 kV SDBD does not begin until the refueling unit has been shut down for at least 100 hours.
- All WBN refueling unit 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 the operating unit.
- 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, and is conservatively assumed to maximize CCS HX ERCW outlet temperature.
- For 1A-A and 2B-B SDBD maintenance, SFP cooling will be transferred from the A SFPHX to the B SFPHX. For these scenarios, only one CCS pump supplying the WBN Unit 2 A and Unit 1 B CCS trains, respectively, is available due to loss of the redundant power supplies to the C-S CCS pump.

- 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 AFW pump elevation ensure more than adequate suction head and flow is available to supply the AFW pumps.
- 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 WBN Units 1 and 2 TS 3.9.10 before defueling can begin (100 hours), plus the time required before maintenance on a 6.9 kV SDBD can begin (approximately 40 hours to defuel a WBN unit). 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 (the operating unit). 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 refueling unit RHR HX and the non-regenerative letdown HX are isolated. With the shutdown unit defueled, there are no heat loads on these HXs, preserving CCS flow for mitigation of a LOCA on the operating unit.

3.2.8 SYSTEM ALIGNMENTS

The proposed UFSAR update in Attachment 4 to this enclosure describes the component configurations needed to support the specific system alignments necessary for removing a specific SDBD from service.

3.2.8.1 General SYSTEM ALIGNMENTS

- The 6.9 kV SDBD selected for maintenance shall not be removed from service until the shutdown unit is in a refueling outage with the fuel removed from the vessel.
- All shutdown unit, non-essential cooling loads including the containment upper compartment coolers (UCCs), lower compartment coolers (LCCs), control rod drive (CRD) coolers, and reactor coolant pump (RCP) motor coolers, must be isolated prior to and in preparation for removal of the SDB from service. This does not include normal power available loads that would not exist for loss of normal power, will not affect LOCA/LOT flow, and will not add heat to available cooling water.
- The results of this analysis determined that the UHS temperature must be less than or equal to 78°F throughout any single 6.9 kV SDBD outage (1A-A, 2A-A, 1B-B, or 2B-B).

3.2.8.2 SPECIFIC SYSTEM ALIGNMENTS

The proposed change to the WBN UFSAR in Attachment 4 to this enclosure identifies the component configuration required to meet the design function of a single ERCW loop with one operating ERCW pump and one 6.9 kV SDBD out of service.

3.3 CONCLUSION

This evaluation demonstrates that one ERCW pump operating at minimum performance will supply adequate cooling water flow to all essential components on the operating unit following a postulated design basis LOCA, as well as the shutdown unit after entering a defueled condition, when the UHS temperature is limited to ≤ 78ºF.

Therefore, in addition to the capability of ERCW Train A or 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 or B would provide redundant capability with one ERCW pump. With this additional capability, the ERCW system safety functions could be satisfied considering a single failure that disables one ERCW Train concurrent with one 6.9 kV SDBD out of service for maintenance cleaning.

On this basis, a permanent 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 EVALUATION

4.1 APPLICABLE REGULATORY REQUIREMENTS AND CRITERIA

General Design Criteria

WBN Units 1 and 2 were designed to meet the intent of the "Proposed General Design Criteria for Nuclear Power Plant Construction Permits" published in July 1967. The WBN construction permit was issued in January 1973. The dual-unit updated final safety analysis report (UFSAR), however, addresses the NRC GDC published as Appendix A to 10 CFR 50 in July 1971. Conformance with the GDCs is described in Section 3.1.2 of the UFSAR.

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.

<u>Compliance</u>

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 direct current (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 unit operation and safe shutdown.

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 18 - Inspection and Testing of Electric Power Systems.* Electric Power Systems important to safety shall be designed to permit appropriate periodic inspection and testing of important areas and features, such as wiring, insulation, connections, and switchboards, to assess the continuity of the systems and the condition of their components. The systems shall be designed with a capability to test periodically (1) the operability and functional performance of the components of the systems, such as onsite power sources, relays, switches, and buses, and (2) the operability of the systems as a whole and, under conditions as close to design as practical, the full operation sequence that brings the systems into operation, including operation of applicable portions of the protection system, and the transfer of power among the nuclear power unit, the offsite power system and the onsite power system.

<u>Compliance</u>

In addition to continuous surveillance by visual and audible alarms for any abnormal condition, the onsite power system is designed to permit inspection and checking of wiring, insulation, connections, and switchboards to the extent that personnel safety is not jeopardized, equipment not damaged, and the plant not exposed to accidental tripping. Approval of this LAR is one part of the activities needed to permit maintenance on the 6.9 kV shutdown boards while maintaining personnel safety, preventing equipment damage, and minimizing exposure of the plant to accidental tripping. The proposed changes in this LAR will ensure continued compliance with Criterion 18.

> *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 7, 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.

As previously noted, in Reference 1, NRC approved a revision to WBN Unit 2, TS 3.7.8 to extend the allowed Completion Time to restore one ERCW system train to operable status from 72 hours to seven days, on a one-time basis, to support maintenance on the WBN Unit 1 6.9 kV SDBD 1A-A and associated 480 V boards and MCCs.

4.3 NO SIGNIFICANT HAZARDS CONSIDERATION

The proposed change revises the Watts Bar Nuclear Plant (WBN), Units 1 and 2 Technical Specification (TS) 3.7.8, "Essential Raw Cooling Water (ERCW) System," to support future maintenance on the WBN Units 1 and 2 6.9 kilovolt (kV) shutdown boards (SDBD) and associated 480 V boards and motor control centers (MCC) on a permanent basis. Similar to the existing one-time change to WBN Unit 2 TS 3.7.8, the proposed amendment adds a new Condition A to WBN Unit 1 TS 3.7.8 to extend the allowed Completion Time to restore one ERCW system train to operable status from 72 hours to seven days, to support maintenance on the WBN Unit 2 6.9 kV SDBDs. To support SDBD maintenance for both fall and spring outages, a bounding ultimate heat sink (UHS) temperature of less than or equal to (≤) 78°F has been established in WBN Units 1 and 2 TS 3.7.8, Condition A.

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 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 a unit 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 would extend the allowed completion time to restore ERCW system train to operable status from 72 hours to seven days for planned maintenance when a unit is defueled and UHS Temperature is ≤ 78ºF. 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

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.

4.4 CONCLUSION

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.

5.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any radioactive effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment 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 amendment.

6.0 REFERENCES

1. NRC letter to TVA, “Watts Bar Nuclear Plant, Unit 2- Issuance of Amendment No. 35 Regarding One-Time Extension of Completion Time for Technical Specification 3.7.8 for Inoperable Essential Raw Cooling Water Train (EPID L-2019-LLA-0020),” dated February 24, 2020 (ML20024F835)
2. TVA letter to NRC, CNL-19-014, “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),” dated February 7, 2019 (ML19038A483)
3. 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 (ML18331A134)
4. TVA letter to NRC, CNL-20-012, “Application to Modify the Watts Bar Nuclear Plant Unit 1 and Unit 2 Technical Specifications for Main Control Room Chiller Completion Time Extension (WBN-TS-18-16),” dated May 19, 2020 (ML20140A342)
5. TVA letter to NRC, CNL-20-091, “Response to Request for Additional Information Regarding Application to Modify the Watts Bar Nuclear Plant Unit 1 and Unit 2 Technical Specifications for Main Control Room Chiller Completion Time Extension (WBN-TS-18-16) (EPID L-2020-LLA-0114),” dated December 16, 2020 (ML20351A424)
6. NRC letter to TVA, “Watts Bar Nuclear Plant, Units 1 and 2 - Issuance of Amendment Nos. 145 and 51 for One-Time Change to Technical Specification 3.7.11 to Extend the Completion Time for Main Control Room Chiller Modifications (EPID L-2020-LLA-0114),” dated May 5, 2021 (ML21078A484)
7. 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

Attachment 1

Proposed TS Changes (Markups) for WBN Units 1 and 2

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 when Unit 2 is defueled. 2. Only applicable during planned maintenance of a Unit 2 6.9kV shutdown board and the associated 480V boards and motor control centers. -- A. 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 <u>AND</u> 24 hours from discovery of Condition A entry ≥ 48 hours concurrent with UHS temperature > 78°F.
	<u>AND</u>		
			(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2 Verify UHS temperature is ≤ 78°F.	1 hour AND Once every 12 hours thereafter.
~~A~~B. One ERCW train inoperable for reasons other than Condition A~~, other than for Condition C~~.	~~A~~B.1 ------------------NOTES------------ 1. Enter applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources- Operating," for emergency 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 OPERABLE status.	 72 hours
~~B~~C. Required Action and associated Completion Time of Condition A not met. OR Required Action and associated Completion Time of Condition B not met.	~~B~~C.1 Be in MODE 3. AND ~~B~~C.2 Be in MODE 5.	6 hours 36 hours

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 31, 2020.~~ ~~2.~~ Only applicable when Unit 1 is defueled. ~~3~~2. Only applicable during planned maintenance of a Unit 1 ~~n~~ 6.9 kV shutdown board and the ~~1 A-A and~~ associated 480 V boards and motor control centers. --- A. 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. AND	7 days AND 24 hours from discovery of Condition A entry ≥ 48 hours concurrent with UHS temperature > 7~~1~~8 °F

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. (continued)	A.2	Verify UHS temperature is ≤ 7~~1~~8° F.	1 hour <u>AND</u> Once every 12 hours thereafter
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 OEPRABLE status.	 72 hours
C. Required Action ~~A.1~~ and associated Completion Time of Condition A not met. <u>OR</u> Required Action and associated Completion Time of Condition B not met.	C.1 <u>AND</u> C.2	Be in MODE 3. Be in MODE 5.	6 hours 36 hours

Enclosure

Attachment 2

Proposed TS Changes (Final Typed) for WBN Units 1 and 2

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 when Unit 2 is defueled. 2. Only applicable during planned maintenance of a Unit 2 6.9kV shutdown board and the associated 480V boards and motor control centers. --- A. 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. <u>AND</u>	7 days <u>AND</u> 24 hours from discovery of Condition A entry ≥ 48 hours concurrent with UHS temperature > 78°F. (continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2 Verify UHS temperature is ≤ 78°F.	1 hour AND Once every 12 hours thereafter.
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 emergency 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 OPERABLE status.	 72 hours
C. Required Action and associated Completion Time of Condition A not met. OR Required Action and associated Completion Time of Condition B not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 5.	6 hours 36 hours

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 when Unit 1 is defueled. 2. Only applicable during planned maintenance of a Unit 1 6.9 kV shutdown board and the associated 480 V boards and motor control centers. -- A. 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 24 hours from discovery of Condition A entry ≥ 48 hours concurrent with UHS temperature > 78 °F
	AND		

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. (continued)	A.2	Verify UHS temperature is ≤ 78° F.	1 hour AND Once every 12 hours thereafter
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 OEPRABLE status.	72 hours
C. Required Action and associated Completion Time of Condition A not met. OR Required Action and associated Completion Time of Condition B not met.	C.1 AND C.2	Be in MODE 3. Be in MODE 5.	6 hours 36 hours

Enclosure

Attachment 3

Proposed TS Bases Changes (Mark-Ups) for WBN Units 1 and 2
(For Information Only)

ACTIONS

A.1 and A.2

Condition A is modified by two 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 2 is defueled. The second note states that Condition A is only applicable during planned maintenance of a Unit 2 6.9 kV shutdown board and associated 480 V boards and motor control centers (MCC). In order to credit the temperature limit noted in A.2, the effected ERCW train must be aligned in accordance with UFSAR Section 9.2.1.3. 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. During this period, with the planned maintenance of a Unit 2 6.9 kV shutdown board and the associated 480V boards and motor control centers, entering Condition A will only require the EDG associated with the shutdown board being removed from service to be inoperable. In this condition, the remaining EDGs will have sufficient ERCW flow with this arrangement.

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 the ERCW train 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.

If UHS temperature exceeds 78 ºF sometime after 48 hours of continuous ERCW train inoperability, then action must be taken to restore the ERCW train to an OPERABLE status within 24 hours. The 24 hour Completion Time allows for an exception to the normal “time zero” for beginning the allowed outage time “clock.” The 24 hour Completion Time only begins ≥ 48 hours after an ERCW train is made inoperable for planned maintenance on a Unit 2 6.9 kV shutdown board (and associated 480 V boards and MCCs) and the UHS temperature is > 78 ºF.

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 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

BASES

ACTIONS

A.1 and A.2 (continued)

credited UHS temperature limit is maintained. If the credited UHS temperature is not maintained, the analytical assumptions for relying on the effected ERCW Train, for both units, as a defense-in-depth measure during the extended Completion Time for Required Action A.1 are no longer met.

ACTIONS

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 ~~A~~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 emergency 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.

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

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.8.1

This SR is modified by a Note indicating that the isolation of the ERCW System components or systems may render those components inoperable, but does not affect the OPERABILITY of the ERCW System.

Verifying the correct alignment for manual, power operated, and automatic valves in the ERCW System flow path provides assurance that the proper flow paths exist for ERCW System operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since they are verified to be in the correct position prior to being locked, sealed, or secured. This SR does not require any testing or valve manipulation; rather, it involves verification that those valves capable of being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.7.8.2

This SR verifies proper automatic operation of the ERCW System valves on an actual or simulated actuation signal. The ERCW System is a normally operating system that cannot be fully actuated as part of normal testing. This Surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative control. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.7.8.3

This SR verifies proper automatic operation of the ERCW pumps on an actual or simulated actuation signal. The ERCW System is a normally operating system that cannot be fully actuated as part of normal testing during normal operation. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. Watts Bar FSAR, Section 9.2.1, "Essential Raw Cooling Water."
2. Watts Bar FSAR, Section 5.5.7, "Residual Heat Removal System."

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 two~~three~~ 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 31, 2020. The second note~~ limits the applicability of Condition A to the time period when Unit 1 is defueled. The second ~~third~~ note states that Condition A is only applicable during planned maintenance of a Unit 1~~n~~ 6.9 kV shutdown board ~~1A-A (1-BD-211-A)~~ and associated 480 V boards and motor control centers (MCC) ~~(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)~~. In order to credit the temperature limit noted in A.2, the effected ERCW train must be aligned in accordance with UFSAR Section 9.2.1.3. 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. During this period, with the planned maintenance of a Unit 2 6.9 kV shutdown board and the associated 480V boards and motor control centers, entering Condition A will only require the EDG associated with the shutdown board being removed from service to be inoperable. In this condition, the remaining EDGs will have sufficient ERCW flow with this arrangement.

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 the ERCW train 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.

If UHS temperature exceeds 7~~1~~8 ºF sometime after 48 hours of continuous ERCW train inoperability, then action must be taken to restore the ERCW train to an OPERABLE status within 24 hours. The 24 hour Completion

(continued)

BASES (continued)

ACTIONS

A.1 and A.2 (continued)

Time allows for an exception to the normal “time zero” for beginning the allowed outage time “clock.” The 24 hour Completion Time only begins ≥ 48 hours after an ERCW train is made inoperable for planned maintenance on a Unit 1 6.9 kV shutdown board ~~1A-A~~ (and associated 480 V boards and MCCs) and the UHS temperature is > 7~~1~~8 ºF.

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 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.

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.

(continued)

BASES (continued)

ACTIONS (continued)

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.

SURVEILLANCE REQUIREMENTS

SR 3.7.8.1

This SR is modified by a Note indicating that the isolation of the ERCW flow to individual components may render those components inoperable, but does not affect the OPERABILITY of the ERCW System.

Verifying the correct alignment for manual, power operated, and automatic valves in the ERCW System flow path provides assurance that the proper flow paths exist for ERCW System operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since they are verified to be in the correct position prior to being locked, sealed, or secured. This SR does not require any testing or valve manipulation; rather, it involves verification that those valves capable of being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.7.8.2

This SR verifies proper automatic operation of the ERCW System valves on an actual or simulated actuation signal. The ERCW System is a normally operating system that cannot be fully actuated as part of normal testing. This Surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative control. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

(continued)

Enclosure

Attachment 4

Proposed WBN dual-unit Updated Final Safety Analysis Report Mark-up Pages
(For Information Only)

4. In the event of blockage of the non-qualified, normal discharge path, the alternative discharge path would be functional. In this event, the discharge water would flow through the ERCW standpipes and out of the ERCW overflow box. The ERCW overflow box is located in Area 2 which is described in Section 2.4.2.3. The flow from the overflow box will drain along the road, then across the perimeter road, flow west through a swale and across the low point in the access road. If the normal discharge path is blocked, no change in valve alignment or operator action is necessary to activate the alternate path. The alternate path is seismically qualified up to and including the ERCW overflow box. If the alternate path was in use and the non-qualified piping became blocked, the discharge water would flow out of the overflow box and drain away from the plant. Even with the maximum flow out of the overflow box, the water would not build up to reach the elevation of any of the entrances to safety-related buildings. For purposes of maintenance to the cooling towers, a valve is provided in each of the normal discharge headers so that the ERCW flow can be terminated to the cooling towers and diverted to the holding pond via the alternate discharge path.

Cooling water is supplied in an open cycle cooling mode to the various heat exchangers served by the ERCW pumps during all modes of plant operation. With normal offsite power sources available, water is normally supplied to both units by operating up to two ERCW pumps per train. More than 2 pumps may be operated during pump changeover, etc. The ERCW system provides the required flow necessary to dissipate the heat loads imposed under the design basis operating mode combination, i.e., one unit in LOCA and the other unit in hot standby, based on a maximum river temperature. The ERCW system is also capable of supporting a cooldown of the non-accident unit in accordance with GDC 5. Maximum ERCW supply temperature is 85°F and is consistent with the recommendations in Regulatory Guide 1.27. Minimum river temperature is 35°F.

ERCW is a versatile system capable of providing sufficient flow and heat removal for a variety of conditions in each unit. As examples,

1. During normal operations, the ERCW system can supply the highest flow / decay heat demand of one unit in Startup and the other in Hot Shutdown with a flow requirement of approximately 26,250 gpm and remove a heat demand of 241 MBtu/hr.

2. Under design basis accident conditions with offsite power available, the ERCW system can supply the highest flow / decay heat demand with one unit in Startup and the other in LOCA Recirculation with a flow requirement of approximately 32,750 gpm and remove a heat demand of 446 MBtu/hr.

3. Under design basis accident conditions with a LOOP coupled with a Loss of Train A, ERCW Train B can supply the highest flow / decay heat demand of one unit in Hot Shutdown and the other in LOCA-Recirculation with a flow requirement of approximately 21,850 gpm and remove a decay heat demand of 316 MBtu/hr.

4. Under design basis accident conditions with a LOOP coupled with a Loss of Train B, ERCW Train A can supply the highest flow / decay heat demand of one unit in Hot Shutdown and the other in LOCA-Recirculation with a flow requirement of approximately 22,400 gpm and remove a decay heat demand of 320 MBtu/hr.

Insert 1 (pages 1 and 2)

5. Under design basis accident conditions with one unit in Mode 6 for more than 100 hours and one 6.9 kV Shutdown Board out of service, a single ERCW pump can supply the highest flow / decay heat demand of one unit in Cold Shutdown and the other in LOCA-Recirculation with the Ultimate Heat Sink temperature ≤ 78°F.

The following list identifies the component configuration required to meet the Design Function of a single ERCW Loop with one operating ERCW pump and one 6.9kV Shutdown Board Out of Service:

For Unit 1 Train A One Pump Operation with 2A-A SDB Out of Service:

ERCW flow is isolated to the following components:

- 2A-A Diesel Generator Heat Exchangers;
- Unit 2 Containment Spray Heat Exchanger 2A;
- Component Cooling System B Heat Exchanger,
- ERCW Strainer 2A-A
- Lower Containment Vent Cooler 2A, Control Rod Drive Vent Cooler 2A, and Reactor Coolant Pump 2-1 Motor Cooler;
- Lower Containment Vent Cooler 2C, Control Rod Drive Vent Cooler 2C, and Reactor Coolant Pump 2-3 Motor Cooler;
- Upper Containment Vent Cooler 2A;
- Upper Containment Vent Cooler 2C;
- Shutdown Board Room Water Chiller A-A
- Electric Board Room Water Chiller A-A, and
- Incore Instrumentation Room Water Chiller 2A.

The following components are in service:

- Train A ERCW Pump A-A or C-A,
- Auxiliary Control Air System C-S, and
- Train A ERCW 24-inch strainer discharge crosstie.

For Unit 1 Train B One Pump Operation with 2B-B SDB Out of Service:

ERCW flow is isolated to the following components:

- 2B-B Diesel Generator Heat Exchangers;
- Unit 2 Containment Spray Heat Exchanger 2B;
- ERCW Strainer 2B-B
- Lower Containment Ventilation Cooler 2B, Control Rod Drive Vent Cooler 2B, and Reactor Coolant Pump 2-2 Motor Cooler;
- Lower Containment Ventilation Coolers 2D, Control Rod Drive Vent Cooler 2D, and Reactor Coolant Pump 2-4 Motor Cooler;
- Upper Containment Ventilation Coolers 2B;
- Upper Containment Ventilation Coolers 2D;
- Electric Board Room Water Chiller B-B,
- Incore Instrumentation Room Water Cooler 2B, and
- Auxiliary Control Air System B.

The following components are in service:

- Train B ERCW Pump E-B or G-B,

- Train B ERCW 24-inch strainer discharge crosstie, and
- Auxiliary Control Air System C-S.

For Unit 2 Train A One Pump Operation with 1A-A SDB Out of Service:

ERCW flow is isolated to the following components:

- 1A-A Diesel Generator Heat Exchangers;
- Unit 1 Containment Spray Heat Exchanger 1A;
- Component Cooling System A Heat Exchanger,
- ERCW Strainer 1A-A
- Lower Containment Vent Cooler 1A, Control Rod Drive Vent Cooler 1A, and Reactor Coolant Pump 1-1 Motor Cooler;
- Lower Containment Vent Cooler 1C, Control Rod Drive Vent Cooler 1C, and Reactor Coolant Pump 1-3 Motor Cooler;
- Upper Containment Ventilation Coolers 1A;
- Upper Containment Ventilation Coolers 1C;
- Main Control Room Water Chiller A-A, and
- Incore Instrumentation Room Water Cooler 1A.

The following components are in service:

- Train A ERCW Pump B-A or D-A, and
- Train A ERCW 24-inch strainer discharge crosstie.

For Unit 2 Train B One Pump Operation with 1B-B SDB Out of Service:

ERCW flow is isolated to the following components:

- 1B-B Diesel Generator Heat Exchangers;
- Unit 1 Containment Spray Heat Exchanger 1B;
- ERCW Strainer 1B-B,
- Lower Containment Ventilation Cooler 1B, Control Rod Drive Vent Cooler 1B, and Reactor Coolant Pump 1-2 Motor Cooler;
- Lower Containment Ventilation Coolers 1D, Control Rod Drive Vent Cooler 1D, and Reactor Coolant Pump 1-4 Motor Cooler;
- Upper Containment Ventilation Coolers 1B;
- Upper Containment Ventilation Coolers 1D;
- Main Control Room Water Chiller B-B,
- Shutdown Board Room Water Chiller B-B, and
- Incore Instrumentation Room Water Cooler 1B.

The following components are in service:

- Train B ERCW Pump F-B or H-B, and
- Train B ERCW 24-inch strainer discharge crosstie.