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RS-24-081

10 CFR 50.90

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

Braidwood Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Subject: Application to Incorporate a Diurnal Curve to Braidwood Station Technical Specifications 3.7.9 for the Ultimate Heat Sink

References:

1. Summary of October 4, 2023, Presubmittal Meeting between the U.S. Nuclear Regulatory Commission and Constellation Energy Generation, LLC, Regarding Revising Technical Specification 3.7.9, "Ultimate Heat Sink (UHS)" (EPID L-2023-LRM-0067), dated January 3, 2024 (ML23363A094)

2. NRC Letter, "Braidwood Station, Units 1 and 2 - Issuance of Amendments Re: Ultimate Heat Sink Temperature Increase (CAC Nos. MF4671 and MF4672)," dated July 26, 2016 (ADAMS Access Number ML16133A438)

3. NRC Letter, "Braidwood Station, Units 1 and 2, - Issuance of Amendments Nos. 218 and 218 Re: Revision of Technical Specifications for the Ultimate Heat Sink (EPID L-2020-LLA-0159)," dated September 24, 2020 (ML20245E419)

4. NRC Letter, "Braidwood Station, Units 1 and 2 - Issuance of Amendment Nos. 235 and 235 Re: Revision of Technical Specifications for the Ultimate Heat Sink (EPID L-2024-LLA-0075)," dated September 10, 2024 (ML24164A003)

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Constellation Energy Generation, LLC (CEG) requests amendments to the Technical Specifications (TS) for Renewed Facility Operating License Nos. NPF-72 and NPF-77 for Braidwood Station, Units 1 and 2 (Braidwood).

The purposed amendment is to change Technical Specifications (TS) Surveillance Requirement (SR) 3.7.9.2 to support an Ultimate Heat Sink (UHS) TS temperature limit that would reflect the

diurnal effect that weather conditions have upon the UHS. A pre-submittal meeting was held in the fall of 2023 which discussed the use of this proposed approach (Reference 1).

Braidwood has little margin between the UHS temperature limit, which is the limit in the TS Surveillance Requirement SR, and the peak UHS temperatures that can occur during the summer months. Braidwood has previously increased the TS limit in 2014 from 100°F to the current limit of 102°F (Reference 2). During the 2020 summer months, hot weather and drought conditions to Northern Illinois area resulted in a sustained elevated UHS temperature which challenged the UHS temperature limit. A subsequent license amendment request (LAR) was submitted, reviewed, and approved by the NRC (Reference 3) to temporarily increase the UHS temperature limit as well as permanently change the completion time to be into Mode 3 within 12 hours when the UHS is inoperable. LARs for the temporary increases were also submitted and approved by the NRC for the summers since 2020 with the most recent approval in September 2024 (Reference 4).

The attached request is subdivided as follows:

- Attachment 1 provides a description and evaluation of the proposed changes.
- Attachment 2 provides the markup of the affected TS pages.
- Attachment 3 provides the markup of the affected TS Bases pages as information only.

CEG requests approval of the proposed license amendment request by June 1, 2025. Once approved, the Braidwood amendment shall be implemented within 30 days.

The proposed amendment has been reviewed and approved by the Braidwood Station Plant Operations Review Committee in accordance with the requirements of the CEG Quality Assurance Program.

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), CEG is notifying the State of Illinois of this application for license amendment by transmitting a copy of this letter and its attachments to the designated State Official.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this letter, please contact Brian Seawright at (779) 231-6151.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 20th day of December 2024.

Respectfully,

Steinman, Rebecca Lee

Digitally signed by Steinman, Rebecca Lee
Date: 2024.12.20 07:21:21 -06'00'

Rebecca L. Steinman
Senior Manager – Licensing
Constellation Energy Generation, LLC

Attachments:
1) Evaluation of Proposed Changes
2) Proposed Technical Specifications Changes (Mark-Up)
3) Proposed TS Bases Changes (Mark-Up)– For Information Only

cc: NRC Regional Administrator, Region III
NRC Senior Resident Inspector, Braidwood Station
Illinois Emergency Management Agency – Division of Nuclear Safety

Attachment 1
Evaluation of Proposed Changes

Subject: **Application to Incorporate a Diurnal Curve to Braidwood Station Technical Specifications 3.7.9 for the Ultimate Heat Sink**

1.0 SUMMARY DESCRIPTION

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Constellation Energy Generation, LLC (CEG) requests amendments to the Technical Specifications (TS) for Renewed Facility Operating License Nos. NPF-72 and NPF-77 for Braidwood Station, Units 1 and 2 (Braidwood).

Braidwood has little margin between the ultimate heat sink (UHS) temperature limit, which is the limit in the Technical Specification (TS) Surveillance Requirement (SR), and the peak UHS temperatures that can occur during the summer months. Braidwood has previously increased the TS limit in 2014 from 100°F to the current limit of 102°F (Reference 3). LARs for the temporary summer increases were also submitted and approved by the NRC with the most recent approval in September 2024 (Reference 6).

Past summer meteorological and atmospheric conditions have resulted in the TS UHS temperature limit being challenged. These conditions include elevated air temperatures, high humidity, and low wind speed. The UHS design analysis methodology is based on Regulatory Guide (RG) 1.27, Revision 2, "Ultimate Heat Sink for Nuclear Power Plants," and NUREG-0693, "Analysis of Ultimate Heat Sink Cooling Ponds," dated November 1980. The current UHS TS temperature limit does not reflect the diurnal effect that weather conditions have upon the allowable UHS temperature. Since the UHS heats up during the day and cools off during the night, the allowable UHS temperature is dependent upon the time of day when the design basis event occurs. Should the postulated event occur during the day, the allowable UHS temperature would be different (i.e., lower) than if the postulated event occurs at night.

This license amendment is being sought to allow the TS temperature limit of the cooling water supplied to the plant from the UHS to vary with the diurnal cycle and to reflect the effect (higher temperature) of more severe weather. Regulatory Position C.1.b of RG 1.27, Revision 2 states that the UHS temperature transient analysis should include diurnal variations where appropriate. The purpose of the UHS temperature limit is to ensure the initial temperature of the UHS during the design basis event will not result in the UHS exceeding the design limit for the cooling water supplied to the plant safety systems during the 30-day worst weather period. The UHS temperature limit varies with the diurnal cycle such that the most restrictive temperature occurring in the morning hours ensures that the maximum temperature of the cooling water supplied to the plant remains below the design limit of 104°F for the first 36 hours and below 106°F for the 30-day period following the event regardless of when the postulated event occurs. The current Braidwood TS uses the most restrictive temperature as the limit independent of the time of day. This results in an excessive reduction in available margin during severe meteorological conditions. The proposed license amendment will implement a UHS temperature limit versus time of day graph to follow the diurnal cycle temperature response.

If the UHS temperature exceeds the allowable temperature at a given time, Required Actions A.1 and A.2 of TS 3.7.9 would be entered concurrently, and both units are required to be in Mode 3 within 12 hours and Mode 5 within 36 hours.

2.0 DETAILED DESCRIPTION

2.1 Proposed Changes

The proposed change revises SR 3.7.9.2 to replace the verification of the current single average water temperature limit with a temperature versus time-of-day graph that is based on the UHS temperature diurnal cycle. The temperature versus time-of-day graph is incorporated as Figure 3.7.9-1 to the TS and is referenced by SR 3.7.9.2. Additionally, the proposed change increases the Frequency of SR 3.7.9.2 from 24 hours (Surveillance Frequency Control Program) to every hour when the UHS average temperature is greater than or equal to 100°F.

TS 3.7.9 Conditions are not altered by the proposed changes. If the average water temperature of the UHS exceeds the limits of proposed TS Figure 3.7.9-1, Condition A must be entered immediately. TS 3.7.9 Required Actions A.1 and A.2 would be entered concurrently, requiring entry into Mode 3 within 12 hours and entry into Mode 5 within 36 hours. Furthermore, the application of the TS does not change based on the TS SR 3.7.9 average water temperature limit (i.e. use of proposed diurnal curve or use of the existing single temperature value).

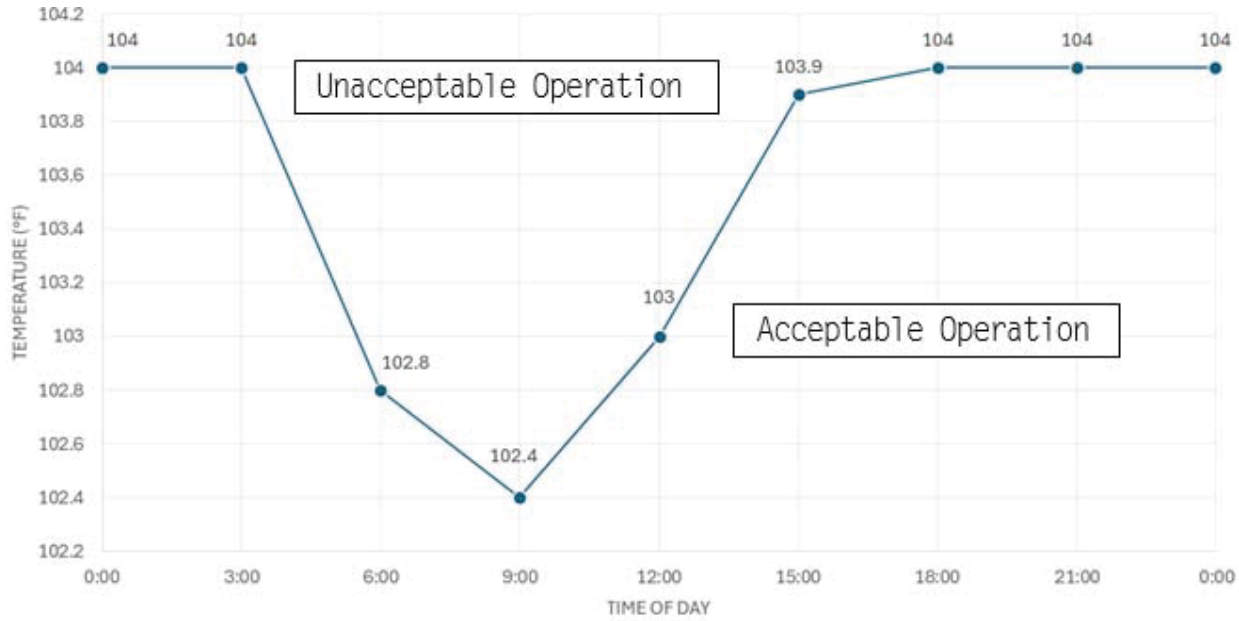
The current SR 3.7.9.2 states:

SR 3.7.9.2	Verify average water temperature of UHS is ≤ 102.8°F until September 30, 2024. After September 30, 2024, verify average water temperature of UHS is ≤ 102°F.	In accordance with the Surveillance Frequency Control Program

The proposed change to SR 3.7.9.2 states:

SR 3.7.9.2	Verify average water temperature of UHS is within the limits of Figure 3.7.9-1. ~~≤ 102.8°F until September 30, 2024. After September 30, 2024, verify average water temperature of UHS is ≤ 102°F.~~	Once per hour when average water temperature from UHS ≥ 100°F AND In accordance with the Surveillance Frequency Control Program

The proposed TS Figure 3.7.9-1 is:



TS Figure 3.7.9-1 (page 1 of 1)
Temperature of Average Water Temperature of UHS Versus Time of Day Requirements

Attachment 2 contains a markup of the proposed changes to TS 3.7.9. Attachment 3 provides the corresponding marked-up TS Bases pages. The TS Bases mark-up pages are being submitted for information only.

2.2 Background

The UHS consists of an excavated essential cooling pond integral with the main cooling pond (Braidwood Lake). The excavation is made such that the essential pond remains intact in the event of failure of the Category II retaining dikes impounding the main cooling pond. Under normal circumstances, the essential cooling pond is indistinguishable from the remainder of the Braidwood cooling pond as the main cooling pond water level is higher than the top elevation of the essential cooling pond. The essential cooling water intakes and discharges are arranged, however, to extract water from and return water to the cooling pond in that portion which would become the essential cooling pond, should failure of the Category II cooling pond retaining dikes occur. In accordance with the Braidwood UFSAR Section 9.2.5.1, the maximum operating level of the essential cooling pond is assumed to be 590 feet above mean sea level.

The main cooling pond has a storage volume of 22,300 acre-feet at the normal water elevation (approximately 595 feet). The essential cooling pond has an analyzed gross volume of 555.8 acre-feet at the 590 foot elevation. The design basis of the UHS assumes the dikes around the main cooling pond fail at the start of the event and none of the water volume above the 590 feet elevation is credited as a heat sink.

The volume of the UHS is sized to permit the safe shutdown and cooldown of both Braidwood Station units for a minimum 30-day period during a design basis accident (DBA) with no additional makeup water source. The UHS is designed to withstand the separate occurrence of either the safe shutdown earthquake (SSE) or the probable maximum flood on the cooling pond. The UHS provides a heat sink for process and operating heat from safety related components during a transient or accident, as well as during normal operation. The UHS dissipates residual heat after reactor shutdown and after an accident through the cooling components of the Essential Service Water (SX) System and the Component Cooling Water (CC) system, which are the principal systems at Braidwood Station that utilize the UHS to dissipate residual heat. The UHS provides the safety related source of water for the Auxiliary Feedwater (AF) system and can provide water for fire protection equipment. Non-essential service water pumps and circulating water pumps also take suction from the UHS during normal operation, however, operation for post-accident conditions is not considered since the non-essential service water and circulating water pumps are shut down before the UHS level reaches the minimum required water level for plant operation at 590 feet.

The suction lines for the SX system are located at the bottom of the Safety Category I Lake Screenhouse Forebay. The SX suction lines run to the auxiliary building where four SX pumps (two per unit) supply safety-related loads and components essential to safe shutdown of the plant. These include cubicle coolers, pump coolers, diesel engine coolers, CC heat exchangers, Reactor Containment Fan Coolers (RCFC) and chiller condensers. The CC system provides cooling water to the residual heat removal system, chemical and volume control system, reactor coolant system and process sampling system. Updated Final Safety Analysis Report (UFSAR) Figure 2.4-47, "Essential Cooling Pond," shows the layout of the SX supply and discharge piping along with the circulating water supply and discharge piping. Relevant elevations for the cooling pond are also included in this UFSAR figure.

3.0 TECHNICAL EVALUATION

3.1 UHS Structure and Evaluation

The UHS structure is comprised of the essential service cooling pond (ESCP) which is an excavated area located within the main cooling pond designed to provide sufficient volume to permit post-accident plant operation for a minimum 30-day period without requiring makeup water in accordance with RG 1.27 (Reference 1).

The main cooling pond is surrounded by a system of dikes and is excavated to elevation 590 feet. The ESCP is a 6-foot-deep pond, excavated to a bottom elevation of 584 feet, within the main cooling pond. The volume of the UHS is verified to be equal to or greater than the volume credited in the UHS temperature analysis by TS SR 3.7.9.3. As documented in the Braidwood Safety Evaluation Report (SER), NUREG-1002, Section 2.5.5.4, the ESCP was evaluated for stability (static and dynamic) and was found to be stable under static conditions and under the effects of an SSE.

An analysis of the UHS post-LOCA response provides the basis for the limiting TS UHS temperature curve. The post-accident UHS temperature profile has been evaluated for the impact on accident analyses and on the safety-related equipment performance during the event.

The new temperature limit curve (Figure 1) allows the UHS temperature to increase to a maximum of 104°F from hours 18:00 to 03:00 during normal plant operation. The increase of 2°F does not degrade the structural integrity of the materials used to construct the ESCP structure.

UHS Temperature Analysis

This calculation determines the thermal response of the UHS to a design basis event under worst case environmental conditions. In accordance with the Braidwood Design Basis, one unit is postulated to have a loss of coolant accident (LOCA), with loss of off-site power (LOOP), and the other unit is postulated to undergo normal shutdown. The dike around the Braidwood Lake is also assumed to have been breached and the UHS is available to support operation of the necessary equipment.

The Sargent & Lundy (S&L) LAKET-PC computer program is utilized to determine the combined impact of decay heat, SX flowrate, initial UHS temperature, and meteorological conditions on the UHS response following a DBA. This is the same computer model that was utilized to support the previously approved LAR to raise the UHS temperature limit in TS 3.7.9 to 102°F (Reference 3). The meteorological inputs previously used in supporting Unit 1 Amendment 189 and Unit 2 Amendment 189 (Reference 3) are also used to support this LAR in creation of the UHS temperature profile.

UHS Temperature Profile

The UHS temperature analysis determines the maximum allowable initial UHS temperature for 8 different start times, starting at 00:00, on a 3-hour frequency, for the design basis scenario with 3 SX pumps running.

The maximum allowed initial UHS temperature for each start time is determined based on the post-LOCA temperature profile that meets the following criteria:

- The peak UHS temperature is 104°F or below in the 36 hours following the DBA, as seen in Figure 3. This is an input to the UFSAR Chapter 6 accident analyses that use the RCFCs for heat removal (LOCA Mass and Energy Release and Containment Integrity, Main Steam Line Break Mass and Energy Release and Containment Integrity). The Main Steam Line Break (MSLB) accident is not the limiting accident for the UHS.
- The peak UHS temperature for the 30-day period following the LOCA is ≤ 106°F.

The above criteria support inputs to the containment integrity analyses and design equipment analyses.

The results of the UHS temperature analyses are shown in Figure 1, which is the same figure being proposed for incorporation into the TS (i.e., Proposed Figure 3.7.9-1).

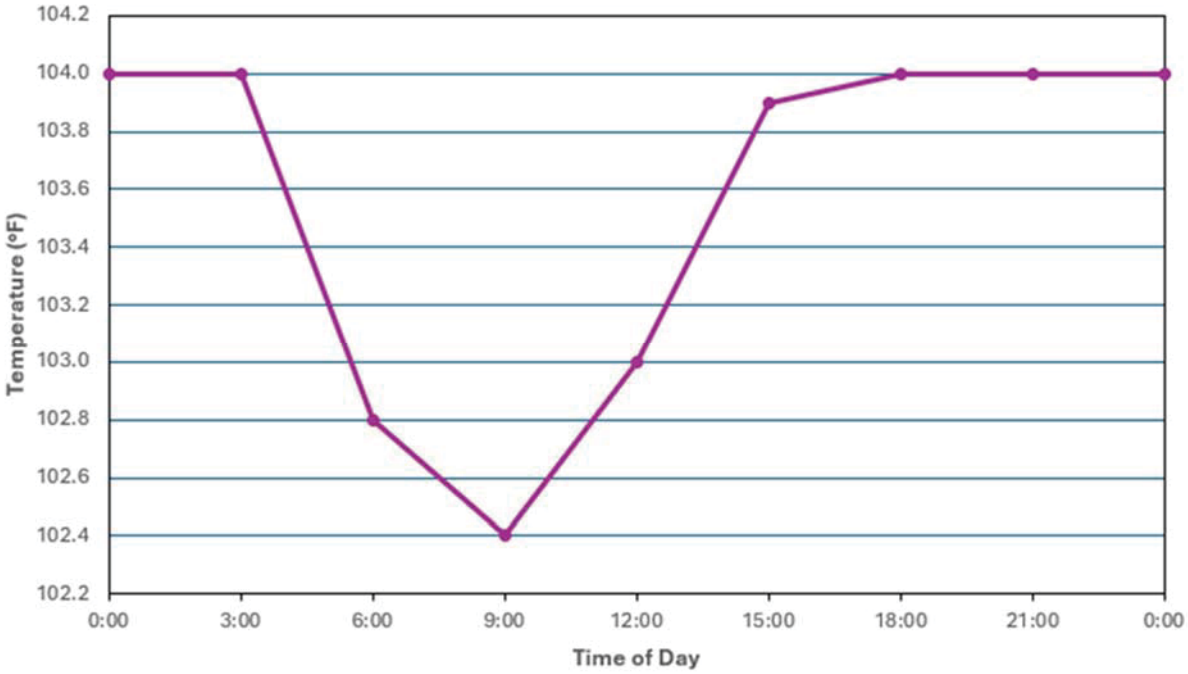


Figure 1
3-SX Pump Cases – Maximum Diurnal Initial UHS Temperature Allowable

Figure 2 shows the UHS temperature response to a DBA LOCA for each of the start times, every 3 hours in a 24-hour period, for the 33 days period post-accident, and Figure 3 shows an expanded view of the same response for initial 3 day period. The maximum allowable temperature for each start time is the initial temperature in the graph for that start time.

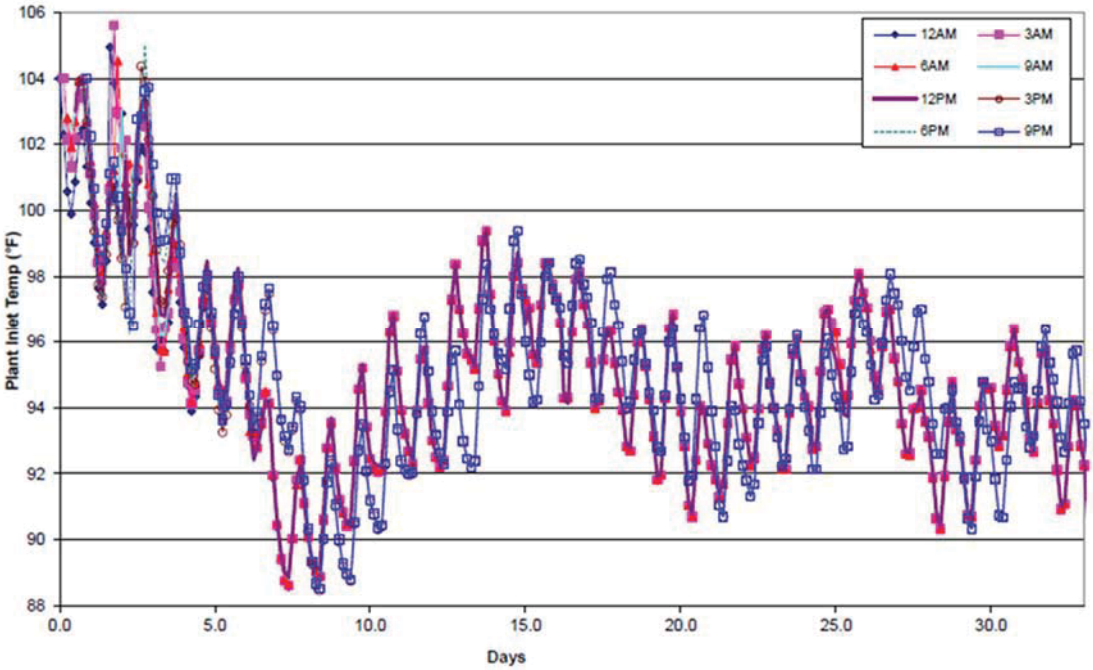


Figure 2
Maximum UHS Temperature – 3 SX Pumps – 33 Days

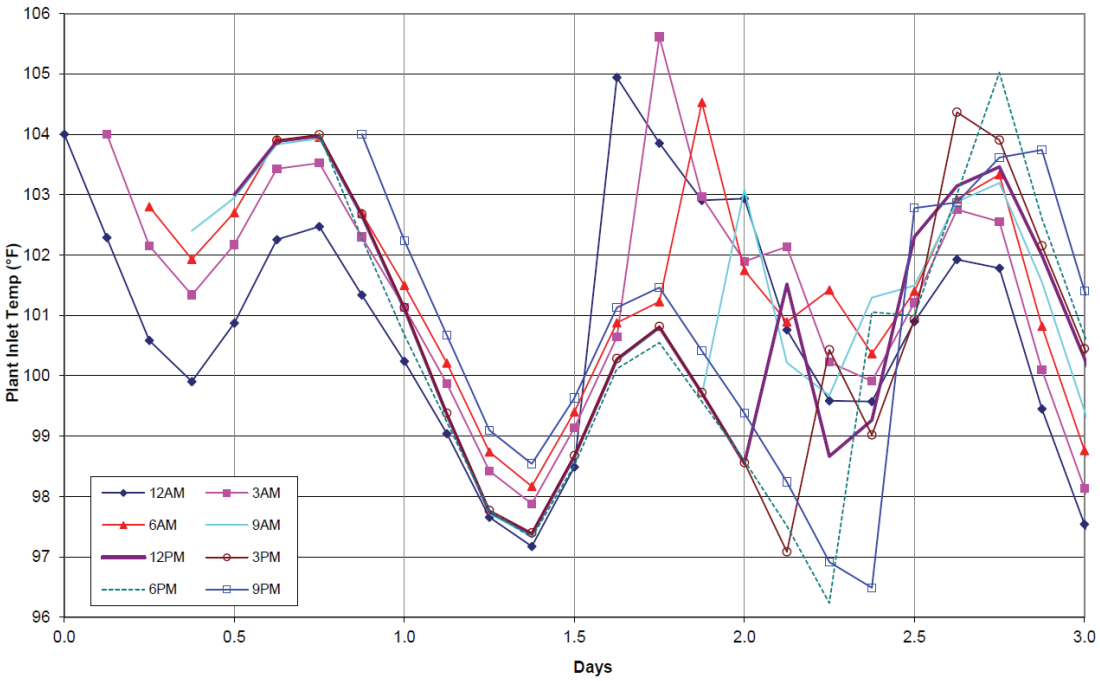


Figure 3
Maximum UHS Temperature – 3 SX Pumps – 3 Days

Piping Design Temperature Discussion

The implementation of the proposed TS limit curve for UHS temperature will result in normal operating temperatures that exceed design temperature for the SX Water System. The SX system piping is classified as ASME Section III, Class 3 except for the section of piping that is part of the containment pressure boundary at the containment penetrations. This piping is ASME Section III, Class 2.

The Construction Code for Braidwood Station is ASME Section III, 1974 Edition through the Summer 1975 Addenda. Section NC-3612.3 (for Class 2 piping) and ND-3612.3 (for Class 3 piping) provide criteria for temperature and pressure variations from design conditions. The impact of the higher UHS temperature limit on the impacted piping design temperature and pressure has been found to be within the allowances of the applicable ASME Code.

Equipment Heat Load

The heat load on the UHS is determined based on a unit undergoing a LOCA concurrent with a LOOP and the other unit going through a normal shutdown from maximum power. The proposed UHS temperature limit does not impact the UHS heat load as inputs to the limiting LOCA accident are not affected.

A separate project has the potential to impact the heat load on the UHS. Initial loading of Framatome fuel (GAIA) is scheduled for the fall 2025 refueling outage for Braidwood Unit 1 and spring 2026 refueling outage for Braidwood Unit 2 (Reference 2). Therefore, the new UHS temperature limit curve will be in effect at the time of the GAIA fuel transition. The potential change is due to the heat load to the residual heat removal (RHR) heat exchanger and the RCFCs following a Large Break LOCA (LBLOCA).

The GAIA fuel results in higher core stored energy. The impact of the higher energy on the containment pressure, temperature, and recirculation sump temperature following a LBLOCA has been evaluated in support of the GAIA LAR. Additional heat removal from the RHR heat exchanger and RCFCs is not credited in the calculation of the higher containment temperature, pressure, and recirculation sump water temperature. Therefore, the design basis heat load to the CC heat exchanger and RCFCs is not affected, ensuring no impact to the supporting analyses or conclusions of this LAR.

3.2 Equipment Evaluation

Design analyses for equipment operating post-accident were completed in support of the UHS LAR that increased the temperature limit to 102°F (Reference 3). These analyses use a post-accident UHS temperature of 106°F to envelope the post-LOCA UHS temperature. Therefore, these analyses remain bounding for the diurnal curve LAR.

The equipment addressed in the analyses is listed below:

Pump Room Cubicle Coolers

These coolers are supplied by the SX system:
- SX Pump Cubicle Coolers
- RHR Pump Cubicle Coolers
- Safety Injection (SI) Pump Cubicle Coolers
- Chemical and Volume Control System (CV) Pump Cubicle Coolers
- Spent Fuel Pit Pump Room Cubicle Cooler
- Diesel Driven (DD) AF Pump Room Cubicle Coolers
- Containment Spray (CS) Pump Room Cubicle Coolers

Lube Oil Coolers

These coolers are supplied by the SX system:
- SX Pump Oil Coolers
- SI Pump Oil Coolers
- DD AF pump Gear Oil Coolers
- CV Pump Gear Oil Coolers
- Motor Driven and DD AF Pump Oil Coolers
- DD AF Pump Right Angle Gear Lube Oil Coolers
- Centrifugal Charging Pump Oil Coolers

Engine Coolers

The evaluated equipment is:
- DD AF Pump Engine Closed Cycle Heat Exchanger
- Emergency Diesel Generator Jacket Water Coolers

Other Equipment

- Main Control Room Chiller Condenser

Component Cooling Heat Exchangers

The design basis analysis for the CC heat exchangers determine the minimum required performance for a number of operating scenarios which include normal plant operation, plant cooldown and post-LOCA operation.

The post-LOCA performance of the component cooling heat exchangers is evaluated with an SX temperature of 106°F. Therefore, this analysis remains bounding for the diurnal curve LAR.

3.3 Discussion of Higher UHS Temperature during Plant Operation

The proposed UHS temperature limit raises the maximum SX temperature to 104°F during normal plant operation. The impact of the higher temperature has been evaluated and is discussed below.

Component Cooling Heat Exchangers

Normal Plant Cooldown

The maximum heat load on the UHS consists of one unit undergoing post-LOCA cooldown concurrent with a LOOP, and the unaffected unit undergoing a safe non-accident shutdown and cooldown.

The current design basis cooldown analysis uses a Service Water (UHS) temperature of 104°F. The component cooling temperature is allowed to increase to 120°F during the cooldown. This analysis is not affected by the new diurnal curve limit with a maximum UHS temperature of 104°F. The UHS temperature will not be higher than 104°F for a duration of 36 hours. This 36-hour period bounds shutdown times to reach RHR entry conditions.

Normal Operation

The CC heat exchanger analysis for normal at power operation has been performed with the SX supply temperature of 104°F.

The CC heat exchanger outlet temperature (supply temperature to cooling loads) exceeds the normal operation maximum temperature of 105°F. Using conservative design fouling factors, the CC temperature reaches 108.5°F. A bounding CC temperature of 110°F has been evaluated for normal plant operation. The evaluated equipment includes:

- Spent Fuel Pool (SFP) Heat Exchanger
- Letdown Heat Exchanger
- Reactor Coolant Pumps
- Seal Water Heat Exchanger
- Waste Gas Compressor
- Sample Heat Exchanger
- Containment Penetration Cooling
- Residual Heat Removal Pump Seals
- Component Cooling Pumps

The evaluation concludes that the higher CC water temperature does not result in exceeding limiting temperatures for the affected equipment/systems. For the containment penetrations cooling, the temperature increase for the concrete surrounding the penetrations remains below limits for accidents or short-term periods. The SFP heat exchangers and the reactor coolant pumps are discussed separately.

SFP Cooling during Normal Plant Operation

The limiting SFP heat load is experienced during a refueling outage when the reactor fuel assemblies are offloaded. During normal operation, the impact of a temporary CC temperature increase up to 5°F on the SFP temperature is bounded by the design basis analyses. Based on historical data, limiting SX temperatures are experienced in the July to August period. Reactor core discharges are performed during times of lower SX temperatures in the Spring and Fall periods. The design basis SFP analyses are thus not impacted. Maximum expected SFP temperatures are bounded by the DBA event case.

Impact on TRM 3.9.a, Decay Time (For Information Only)

The core offload figures in Braidwood TRM 3.9.a are based on a CC supply temperature of 105°F to the SFP heat exchangers. The 105°F CC temperature is supported by a maximum SX temperature of 102°F. A limitation for using the TRM 3.9.a curves will be added to surveillance procedures supporting TRM 3.9.a to verify the SX temperature is below 102°F to ensure calculation is bounded.

SFP Cooling during the DBA Event

During a DBA event, the CC supply temperature is allowed to increase to 128°F. Design analyses for the SFP structure have evaluated a maximum bulk water temperature of 167°F. This temperature bounds the design basis calculated maximum temperature of 165.3°F. Based on the CC heat exchanger design analysis post-LOCA case, the maximum background heat load in the SFP is expected to result in a temperature difference of 19°F between the CC supply water and the bulk pool water temperature. Given a maximum CC supply temperature of 128°F for the non-LOCA unit, and the temperature difference, the maximum bulk water temperature is estimated at 147°F. This temperature is below the evaluated maximum temperature of 167°F.

This case bounds maximum bulk water temperature during normal operation with a maximum CC temperature of 110°F.

Reactor Coolant Pump/Motor

Normal Plant Operation

The normal operation CC supply temperature to the reactor coolant pump (RCP) is 105°F. CC supplies the thermal barrier heat exchanger and the lube oil heat exchanger for the RCP motor and pump bearings.

Typical RCP motor bearing temperatures during normal plant operation are approximately 130°F to 165°F which is significantly below the operational limit of 195°F. Even if the CC water temperature increases from 105°F to 110°F, and results directly in a 5°F increase in the RCP motor bearing temperature, the maximum bearing temperature during normal operation is bounded by the operational limit of 195°F.

Post-Accident Conditions

For DBA conditions, for the unit undergoing a normal shutdown while the opposite unit is experiencing a LOCA, the temperature of the CC water was allowed to increase to a maximum of 128°F as part of the Measurement Uncertainty Recapture implementation project and it is part of the Braidwood design basis. The evaluations have been completed for an SX temperature of 106°F. The results of this evaluation show the CC heat exchanger outlet temperature does not exceed the established limit of 128°F. Using a temperature of 106°F for this case is conservative because the UHS temperature profile, for the limiting case, shows the calculated temperature remains at 104°F or below for at least 36 hours into the event. This period is more than sufficient to take the Unit through the normal cooldown to the residual heat entry conditions.

For the LOCA Unit, the maximum CC heat exchanger temperature increases to 128°F due to the added heat load due to the ECCS Recirculation Phase. This increase does not have any impact on the RCPs because the Emergency Response Procedures have a step to stop all RCPs early in the event. In addition, the LBLOCA results in the isolation of the CC cooling water to the RCPs due to a Phase B isolation signal on a high containment pressure (20 psig).

3.4 Other Analyses

Diesel Driven AF Pump Operation during Loss of All AC Power

Sections 1.5 and 3.3 of Attachment 10.D, “An Evaluation of the AF System to the NRC Generic Short-Term and Long-Term Requirements”, to Section 10.4 of the Braidwood UFSAR document a recommendation from the NRC that Braidwood Station be capable of providing the required AF flow to the steam generators for at least 2 hours independent of any A-C power source. The station has committed to following this recommendation by crediting the diesel-driven AF pumps (1/2AF01PB) which can operate independent of offsite power and emergency diesel generator power.

In the event of a loss of all AC power, a diesel driven SX booster pump operates to provide cooling water to the diesel driven AF pump oil coolers and the engine jacket water cooler. The loss of all AC power is not coincident with a design basis accident, therefore, the initial conditions in the SX piping are not higher than the peak normal operating UHS temperature of 104°F. Due to the configuration of the discharge piping to the lake, there is insufficient booster pump head to maintain once-through flow to the lake during this event. Thus, flow recirculates through various components back to the diesel driven SX booster pump suction. This results in isolation of the cooling water heat sink and heat-up of the loop isolated from the lake.

This transient has been evaluated with a starting UHS temperature of 104°F. The maximum jacket water temperatures determined in the analysis occur 2 hours after a loss of power and are 202.1°F at Unit 1 and 199.9°F at Unit 2. The temperature at Unit 1 exceeds the jacket water high temperature trip setpoint of 202°F by 0.1°F. However, in a loss of all AC scenario, procedures are in place to establish an alternate path for the SX water supply to SX booster pumps. The alternate path will end SX recirculation sooner than 120 minutes after a loss of power. The action to realign the SX suction source is implemented using existing plant procedures. This action will begin 30 minutes after AF pump diesel engines automatically start

upon a loss of power. Walkthrough results showed that the action to align the alternate flow path can be completed in 32 minutes.

Therefore, the time from the loss of power to the realignment of the SX booster pump suction water source is 62 minutes. To provide margin, the jacket water temperatures have been evaluated 90 minutes after a loss of power. The results from the design analysis show temperatures of 198°F for Unit 1 and 197°F for Unit 2 at 90 minutes, which are below the jacket water high temperature trip setpoint of 202°F and are considered to be acceptable.

Thermal Barrier Rupture Analysis

The purpose of this calculation is to analyze the rupture of a tube inside an RCP thermal barrier heat exchanger to determine the impact of potentially severe water hammer. This analysis uses 110°F which is conservative for the maximum temperature during normal plant operation as input for Component Cooling water.

The scope of the calculation includes two scenarios. The first scenario is the rupture of a tube inside an RCP thermal barrier followed by the automatic closure of valve CC685 to isolate CC flow from all four RCP thermal barriers. The second scenario is the rupture of a tube inside an RCP thermal barrier followed by the manual closure of CC9438 after 3 minutes to isolate CC flow from all four RCP thermal barriers (with no credit for the automatic closure of CC685). An additional scenario is added as part of Revision 1 to the calculation that analyzes the manual closure of CC9438 after 10 minutes. The intended use of the calculation is to determine whether severe water hammer forces beyond the original design considerations would occur in the CC system following the rupture of a tube inside an RCP thermal barrier.

The results of the analysis show that the integrity of the affected piping is maintained with a bounding initial CC temperature of 110°F.

GL 96-06 Considerations

U.S. Nuclear Regulatory Commission Generic Letter 96-06 indicated concerns for possible water hammer events following either a LOCA or a MSLB concurrent with a LOOP. Under this scenario, the pumps that supply cooling water to the RCFCs and fans that supply air to RCFCs will temporarily lose power. Cooling water flow will stop due to the loss of pump head. Boiling may occur in RCFC tubes, causing steam bubbles to form in the RCFCs and pass into the attached SX piping, creating steam voids. As service water pumps restart and the water column accelerates, accumulated steam in the fan coolers tubes and piping will condense which could result in a water hammer when the void closes. Hydrodynamic loads introduced by such a water hammer event could potentially challenge the integrity and function of RCFC and associated cooling water system components, as well as pose a potential challenge to containment integrity.

The period of interest for the GL 96-06 concern is minutes after the event. The design analyses have been revised to include a starting SX temperature of 104°F. This is the maximum UHS normal operation temperature allowed by the new TS temperature limit curve. The resulting loads on the SX piping supports have been evaluated and found acceptable.

SX Supply to Auxiliary Feedwater

The SX system is the safety related back-up to the AF System. In the event of a Small Break Loss of Coolant Accident (SBLOCA) of size sufficiently small, AF to the Steam Generators may be necessary from the UHS, if the Condensate Storage Tank (CST) is assumed to be not available.

The design basis analysis for the UHS water temperature does consider the lost inventory to the AF system for determining the limiting diurnal curve. This is conservative as a SBLOCA is not the limiting scenario for heat load input to the UHS.

The maximum UHS temperature following a LOCA is < 106°F. This temperature is bounded by the temperature of 120°F that is assumed for the delivered AF temperature in the accident analyses.

Fire Protection

The source of water for the fire protection pumps is the Braidwood main cooling pond. The diurnal TS temperature limit could result in higher temperatures for the fire protection water. The 2°F increase (102°F to 104°F) is inconsequential to the function of the fire protection system.

The SX System can be used to supply the fire protection system, if necessary, upon loss of the fire protection pumps. In accordance with the Braidwood Safe Shutdown Analysis Section of the Fire Protection Report (Section 2.4.1.7, Assumptions), the postulated fire shall not be considered to occur simultaneously with other accidents, events, or phenomena such as design-basis accident except a LOOP. Therefore, the maximum temperature of the SX water supply to the fire protection system is 104°F.

Section 3.0 of the Fire Protection Report discusses sizing the cooling pond for the UHS demand and the fire protection demand. The UHS design basis analysis accounts for the volume of water due to the fire protection system demand.

Cooling for the CV Pump Lube Oil Cooler upon an Aux Building Flooding Event (Beyond DBA)

The fire protection system provides a source of alternate cooling water to the charging pumps oil coolers during a loss of all SX scenario (Beyond DBA), in accordance with plant operating procedures.

Due to the diurnal UHS TS temperature limit, the temperature of the FP water could be 104°F in place of the previous 102°F. This 2°F temperature increase does not adversely affect the lube oil cooler performance.

Non-Safety Related Loads

The non-essential service water pumps and the circulating water pumps will operate during at-power plant operation with a maximum Braidwood Lake temperature of 104°F. Operation of these pumps is not discussed for post-accident conditions with the UHS as the suction source because the non-essential service water and circulating water pumps are shut down before the UHS water elevation of 590 feet is reached.

Non-Essential Service Water System

The non-essential service water system pumps also take suction from the Braidwood main cooling pond. These pumps serve non-safety related plant loads on the balance of plant/secondary side of the plant. Main generator hydrogen coolers, main turbine lube oil coolers, bus duct cooling, and steam generator blowdown condenser are loads supplied by non-essential service water.

The operation of equipment cooled by the non-essential service water pumps and associated system is bounded by established temperature limitations for the equipment. Normal and abnormal operating procedures and annunciator response procedures specify these operational temperature limitations and provide direction for addressing elevated temperatures which include, if necessary, a plant power reduction to remain within the established limitations.

The increased cooling demand on the system will likely necessitate the operation of all three non-essential service water pumps to support the operation of both units at power. This operational need for the non-essential service water pumps applies for the existing UHS/lake temperature limit. In fact, Braidwood operated with three non-essential service water pumps during the hot weather conditions in July 2012. Pump net positive suction head available (NPSHA) is not significantly impacted by increasing the lake temperature limit.

Circulating Water System/Main Condenser

The circulating water pumps also take suction from the Braidwood main cooling pond and provide cooling for the main condensers on both units. The primary impact of operating this system at higher lake temperatures is a reduction in main condenser vacuum (increase in main turbine backpressure). Operational limitations for main turbine backpressure in existing procedures may require a reduction in turbine load to remain within these limits.

Reduced condenser vacuum/higher main turbine backpressure also impacts the load rejection capability of the steam dump system. The UFSAR Section 15.2.2 analysis for Loss of External Load does not credit the steam dump system.

3.5 Accident Analyses

LOCA Peak Clad Temperature Analyses

The current peak clad temperature (PCT) analysis follows the Full Spectrum LOCA (FSLOCA) methodology. The UHS temperature influences the calculated PCT only if the time of the peak

temperature occurs during the ECCS recirculation phase post-LOCA. Design analyses show that the calculated PCT does not occur during the ECCS Recirculation Phase.

Framatome Fuel Implementation

The UHS temperature potentially affects ECCS system fluid parameters only in the Recirculation Phase post-LOCA. The ECCS pumps take suction from the RWST during the ECCS Injection Phase.

The Framatome analyses are performed for a Realistic Large Break LOCA (RLBLOCA) and a SBLOCA.

RLBLOCA

The time of PCT for the RLBLOCA falls in the ECCS injection phase. The results of this analysis are not impacted by the proposed UHS limit.

SBLOCA

For cases that potentially extend into the post-LOCA recirculation phase, the results of the SBLOCA analyses for the break sizes with the greater time of PCT show significant margins from the limiting cases and from the 10 CFR 50.46 limit for PCT. The maximum containment recirculation water temperature increases by < 2°F due to the GAIA fuel (Reference 2). Based on the existing margin (> 300°F), the small increase in ECCS recirculation water temperature will not result in exceeding the limiting calculated PCT or the 10 CFR 50.46 PCT limit.

Post LOCA Boric Acid Precipitation Calculations

The design basis analysis assumes that the temperature of the ECCS cooling water is at a temperature of 212°F (Reference 5). During ECCS switchover operation post-LOCA, the SI and CV pumps are supplied with water from the discharge of the RHR pump after the sump water is cooled by the RHR heat exchanger. The calculated RHR pump heat exchanger outlet temperature in the design analysis is below 200°F. The CC heat exchanger has been evaluated to remove the required heat load that supports the assumptions in the calculation.

Framatome Fuel

The GAIA analyses assume the temperature of the ECCS cooling water is at a temperature of 212°F. The calculated RHR pump heat exchanger outlet temperature in the design basis analysis is below 200°F. Based on the small increase (< 2°F) in the recirculation water temperature, the RHR heat exchanger outlet temperature will remain below 212°F.

LOCA and Main Steam Line Break Containment Integrity Analyses

The Containment Integrity Analyses are not impacted by the proposed UHS temperature limit curve.

The UHS diurnal cycle temperature limit supports the design basis analyses for containment integrity as the calculated UHS temperature remains below 104°F for the first 36 hours post-accident. The following discussion is taken from the NRC Safety Evaluation Report (SER) for the 102°F temperature increase for TS 3.7.9 (Reference 3):

> *The licensee stated that the accident analysis temperature of 104°F is conservative because UHS temperature remains below 104°F for the first 36 hours into the event and increases to a maximum of 105.2°F for a period less than 6 hours from hour 36 to hour 42 post accident; and remains below 104°F after 42 hours. Based on the above, the NRC staff finds the licensee's analysis consistent with the guidance in RG 1.27 and SRP 6.2.2.*

The only changes are:

- The maximum temperature reached is 105.61°F (3 AM case) in place of 105.2°F. The additional 0.41°F is insignificant and does not change the conclusion of the disposition.
- Depending on the start time of the accident, the UHS temperature exceeds 104°F between 36 and 39 hours (12 AM 3 AM, and 6 AM cases) and at about 45 hours (3 PM and 6 PM cases) after the event for a brief period (3-6 hours). The maximum temperature is < 105.61°F, and 104°F is only exceeded one time for each of the cases.

UHS Temperature Increase after 36 hours (12 AM, 3 AM, and 6 AM Cases), after 45 hours (3 PM, 6 PM Cases)

In accordance with the UHS temperature analysis, the temperature for the limiting UHS peak temperature case (3 AM start) can be as high as 105.61°F by 36 hours post-LOCA. A review of the results of the containment integrity analysis indicates that the containment pressures and temperatures have been significantly reduced by 36 hours. Post 36 hours the containment pressure for both Braidwood Unit 1 and 2 is over 20 psi lower than the calculated peak and the containment atmosphere temperature is over 50°F lower when compared to the calculated containment peak temperature. Thus, while a 1.6°F increase in the UHS temperature could be postulated to increase the containment temperature by 1.6°F and possibly increase the pressure by < 2 psi based on using saturated steam conditions at 262.6°F (peak calculated temperature, between Unit 1 and Unit 2) and 264.2°F, the actual effect will be much lower due to the cooling provided by the containment fan coolers. Thus, the small increase of 1.6°F in the UHS temperature at approximately 36 hours into the event, for a short duration, will have no measurable effect on the LOCA results or conclusions. Therefore, the increase in the UHS temperature post 36 hours will not result in exceeding any design criteria related to post-LOCA containment requirements.

The discussion of the 3 AM case bounds the 12 AM and 6 AM cases, because it has the highest calculated temperature of the three cases. The 3 AM case also bounds the 3 PM and 6 PM cases because the containment temperature and pressure will be lower at 45 hours after the accident.

RCFC Performance Margin

The design basis analyses use the RCFC heat removal performance curve that is based on the SX temperature of 104°F. Considering the disposition of the short time excursion above 104°F, the results of the analyses are not impacted. In addition, margin exists in the RCFC heat removal curve.

The RCFC heat removal performance curve used in the accident analyses is based on 10% tube plugging level while the maximum actual tube plugging level range is 0.83% to 3%.

Main Steam Line Break Mass and Energy Releases Outside Containment (12 seconds AF Delay Analysis when SX Supplies AF Pump Suction)

The design basis analyses use a temperature of 104°F for the AF system. The normal water source for the AF pumps is the CST. The SX system is the safety-related water supply for the AF system. The proposed new diurnal curve for the temperature limit supports this design input and the results of the design basis analyses are not impacted.

The increase of the UHS temperature to 105.61°F following a LBLOCA does not apply to a MSLB scenario.

Non-LOCA Transient Analyses

Chapter 15 Accident Analyses model the AF System with the CST as the source of cooling water. The diurnal UHS TS temperature limit does not affect the temperature in the CST.

The Braidwood CST supply water to the AF pumps; the CSTs are non-seismic and non-safety related. The UFSAR states that the safety related source of water to the AF pumps is the SX system. Switchover to SX is done automatically. The current design basis analyses use a temperature of 104°F for the SX cooling water. The proposed change to the UHS temperature limit supports a maximum UHS temperature of 104°F for non-LOCA transients.

3.6 Operator Actions

In accordance with the Braidwood TS Bases B 3.7.9, the average water temperature of the UHS is measured at the discharge of an SX pump. The "average UHS temperature" is the average of the temperatures measured at the discharge of the running SX pumps on Units 1 and 2. Operators read and record the UHS temperature on a shiftly basis in accordance with station procedures. Each unit has an operator that monitors SX pump discharge temperature. The control room indication for cooling water temperature is readily available from the plant process computer at each of the unit’s computer consoles and main control board indications. Unit 1 and Unit 2 control room operators are both required to determine and record the SX pump temperature for the running SX trains for their respective units as part of their shiftly

surveillance. The control room operator is required to record and compare the average SX pump discharge temperature from both units to the limits in TS SR 3.7.9.2. Linear interpolation will be used to define the TS limit between identified points of the proposed TS Figure.

The UHS average temperature is the average of each unit's running SX pump discharge temperature and could result in both units entering the required actions at the same time should SX temperature exceed the TS limit. In accordance with the proposed change to the frequency for SR 3.7.9.2, operators will log the UHS average temperature hourly when the temperature reaches 100°F. In the event that TS SR 3.7.9.2 limits are exceeded, the action statements A.1 and A.2 will be entered with a completion time of 12 hours to be in Mode 3 and 36 hours to be in Mode 5 for both units as currently required.

As part of the proposed changes, the frequency for measuring the average water temperature of the UHS is increased to an hourly bases once the average water temperature is 100°F or greater. The once per hour frequency takes into consideration the diurnal UHS temperature variations. Based on the hourly temperature change during the period of the peak UHS temperatures in the summer of 2020, the UHS average water temperature is expected to increase less than 1°F in one hour. The lowest temperature of the proposed SR 3.7.9.2 limit is 102.4°F. Therefore, increasing monitoring to once per hour with the UHS temperature greater than or equal to 100°F will ensure the design basis temperature limits are not exceeded.

Beyond the proposed increased frequency to measure the UHS average water temperature at 100°F, no operator actions regarding temperature monitoring will change as a result of the proposed licensed amendment.

3.7 Temperature Measurement Uncertainty

To ensure the requested temperature limit is not exceeded, instrument uncertainty associated with the measurement of the UHS average water temperature is addressed in the CEG surveillance procedures that are used to demonstrate compliance with the TS limit.

In accordance with the Braidwood TS Bases B 3.7.9, the average water temperature of the UHS is measured at the discharge of an SX pump. The "average UHS temperature" is the average of the temperatures measured at the discharge of the running SX pumps on Units 1 and 2.

The surveillance procedure requires using a precision instrument to verify the UHS temperature when the temperature at the discharge of any operating SX pump exceeds 99°F. The difference between 99°F and the current SR limit of 102°F is 3°F, which is equal to the calculated instrument uncertainty associated with the installed instrumentation. The criterion to use the precision instrument is not changed with the new diurnal curve. However, there is a new requirement to log the monitored temperature more frequently when the temperature reaches 100°F as discussed in Section 3.6 above.

The alternate measurement of the UHS temperature is made using a handheld digital thermometer and a temperature probe that is inserted into existing spare thermowells that are located downstream of each SX pump strainer. The uncertainty of the precision thermometer is 0.07°F. The calculated uncertainty is valid for water temperatures in excess of 104°F.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements / Criteria

The regulatory requirements associated with the proposed change reflects 10 CFR 50.36, "Technical specifications." In accordance with 10 CFR 50.36, TS are required to include (1) safety limits, limiting safety system settings, and limiting control settings; (2) limiting conditions for operation; (3) surveillance requirements; (4) design features; and (5) administrative controls.

The proposed change revises SR 3.7.9.2 to replace the verification of the current single average water temperature limit with a temperature versus time-of-day graph that is based on the UHS temperature diurnal cycle. The temperature versus time-of-day graph is incorporated as Figure 3.7.9-1 to the TS and is referenced by SR 3.7.9.2. Additionally, the proposed change increases the Frequency of SR 3.7.9.2 from 24 hours (Surveillance Frequency Control Program) to every hour when the UHS average temperature is greater than or equal to 100°F.

4.2 Precedent

The NRC has approved a similar submittal for Lasalle County Station as indicated below. Precedent 1 incorporated the use of a diurnal curve for LaSalle County Station UHS TS temperature limit and increased monitoring of the cooling water temperature as a Condition B of the LCO. Precedent 2 moved the increase monitoring of the cooling water temperature requirement from Condition B to SR 3.7.3.1.

1. NRC Safety Evaluation Report, Lasalle County Station, Units 1 and 2, Issuance of Amendment Revision the Ultimate Heat Sink Temperature Limit (CAC Nos. ME9076 and ME9077), dated November 19, 2015 (ADAMS Accession No. ML15202A578)

2. NRC Safety Evaluation Report, Lasalle County Station, Units 1 and 2 – Issuance of Amendment Nos. 250 and 236 to Renewed Facility Operating Licenses Re: A License Amendment to Technical Specification 3.7.3, “Ultimate Heat Sink (UHS)” (EPID L-2020-LLA-0165), dated July 13, 2021 (Adams Accession No. ML21158A228)

4.3 No Significant Hazards Consideration

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit or early site permit," Constellation Energy Generation, LLC, (CEG) requests amendments to the Technical Specifications (TS) for Renewed Facility Operating License Nos. NPF-72 and NPF-77 for Braidwood Station, Units 1 and 2 (Braidwood).

The essential service cooling pond (ESCP) is the Ultimate Heat Sink (UHS) for Braidwood, Units 1 and 2. The ESCP is excavated and integral with the Braidwood main cooling pond. The volume of the ESCP is sized to permit the safe shutdown and cooldown of both Braidwood units for a 30-day period, including a design basis event with no additional makeup water source. The dike of the Braidwood main cooling pond is also assumed to have been breached, leaving only the UHS available to support operation of the necessary equipment. As discussed in the

Braidwood Station Updated Final Safety Analysis Report (UFSAR), the design basis event for the Braidwood Station UHS is a Loss of Coolant Accident (LOCA) coincident with a Loss of Offsite Power (LOOP) in one unit, in conjunction with a normal shutdown of the other unit. The UHS provides a heat sink for process and operating heat from safety-related components during the UHS design basis event. The evaluations and analyses performed to support the proposed license amendment demonstrate that the plant's safety related equipment will maintain its post-accident design function at the higher UHS temperature. Currently, Surveillance Requirement (SR) 3.7.9.2 verifies the cooling water temperature supplied to the plant from the ESCP is < 102°F. If the average water UHS temperature exceeds 102°F, the UHS must be declared inoperable in accordance with TS 3.7.9. Required Actions A.1 and A.2 of TS 3.7.9 are entered for both units to be placed in Mode 3 within 12 hours and Mode 5 within 36 hours.

The proposed change modifies the acceptance criterion in SR 3.7.9.2 from a fixed temperature limit to a variable limit based on time-of-day. If the indicated UHS temperature exceeds the time-of-day based limit, TS 3.7.9 Required Actions would be entered for both units to be placed in Mode 3 within 12 hours and in Mode 5 within 36 hours.

The proposed change will continue to ensure that the maximum temperature of the safety-related cooling water supplied to the plant during the UHS design basis event remains less than the design limit for Braidwood, Units 1 and 2. In addition, there are no adverse influences on risk associated with any other Design Basis Accident (DBA) and; therefore, a Probabilistic Risk Analysis (PRA) assessment is not required for this change.

According to 10 CFR 50.92, "Issuance of amendment," paragraph (c), a proposed amendment to an operating license involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not:

(1) Involve a significant increase in the probability or consequences of any accident previously evaluated; or

(2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or

(3) Involve a significant reduction in a margin of safety.

CEG has evaluated the proposed changes, using the criteria in 10 CFR 50.92, and has determined that the proposed changes do not involve a significant hazards consideration. The following information is provided to support a finding of no significant hazards consideration.

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

   Response: No.

   The proposed change makes no physical changes to the plant, nor does it alter any of the assumptions or conditions upon which the UHS is designed. These assumptions and conditions as described in the Braidwood UFSAR include failure of the main cooling pond dike, a LOOP and a DBA LOCA on one unit, and a normal shutdown of the other unit.

The accidents analyzed in the UFSAR are assumed to be initiated by the failure of plant structures, systems, or components (SSCs). An inoperable UHS is not an initiator of any analyzed events as described in the UFSAR. The impact on the structural integrity of the UHS due to a potential increase water temperature prior to and during the UHS design basis event has been evaluated and does not increase the probability of the failure of the main cooling pond dike. The proposed temperature limit for cooling water supplied to the plant from the ESCP could reduce the commercial capability of the Braidwood units; however, it does not result in an increase in the probability of occurrence for any of the events described in the UFSAR.

The basis provided in Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants," Revision 2, dated January 1976 (Reference 1), was employed for the temperature analysis of the Braidwood UHS to implement General Design Criteria 2, "Design bases for protection against natural phenomena," and 44, "Cooling water," of Appendix A to 10 CFR 50. The meteorological conditions chosen for the Braidwood UHS analysis utilized a critical period of the first 36 hours following a DBA, the worst 24 hours followed by the subsequent 30 calendar day period based on historical data. The Braidwood main cooling pond is conservatively assumed to be unavailable at the start of the event. The analysis shows that with an initial UHS temperature less than or equal to the proposed time-of-day-based limit, the required safety-related heat loads can be adequately cooled for 30 days while continuing to ensure safety-related cooling water temperature remains less than the design temperature for Braidwood, Units 1 and 2.

The SSCs credited to mitigate the consequences of postulated design basis accidents remain capable of performing their design basis function. The change in maximum UHS temperature has been evaluated using the UFSAR described methods to demonstrate that the UHS remains capable of removing the post-accident heat. The change in UHS temperature and resulting containment response following a postulated design basis accident has been demonstrated to not be impacted. Additionally, all the UHS supported equipment, credited in the accident analysis to mitigate an accident, has been shown to continue to perform their design function as described in the UFSAR.

Based on the above, it has been demonstrated that the change of the initial temperature limit for cooling water supplied to the plant from the ESCP to less than or equal to a temperature based on the time of day will not impede the ability of the equipment and components cooled by the UHS during a UHS design basis event to perform their safety functions.

There is no impact of this change on Braidwood safety analyses including the consequences of all postulated events since all required safety-related equipment continues to perform as designed. The effects of the proposed change on the ability of the UHS to assure that a 30-day supply of water is available considering losses due to evaporation, seepage, and firefighting have been considered. Sufficient inventory remains available to mitigate the design basis event for the Braidwood UHS for the required 30-day period.

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 accident from any accident previously evaluated?

   Response: No.

   The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated. The proposed change does not introduce any new modes of plant operation, change the design function of any SSC, change the mode of operation of any SSC, or change any actions required when the TS limit is exceeded. There are no new equipment failure modes or malfunctions created as affected SSCs continue to operate in the same manner as previously evaluated and have been evaluated to perform as designed at the increased UHS temperature and as assumed in the accident analysis. Additionally, accident initiators remain as described in the UFSAR and no new accident initiators are postulated as a result of the increase in UHS temperature.

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

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

   Response: No.

   The proposed change continues to ensure that the maximum temperature of the cooling water supplied to the plant SSCs during a UHS design basis event remains within the evaluated equipment limits and capabilities assumed in the accident analysis. The proposed change does not result in any changes to plant equipment function, including setpoints and actuations. All equipment will function as designed in the plant safety analysis without any physical modifications. The proposed change increases the SR Frequency of measuring the UHS average water temperature when near the TS limit. The proposed change does not alter any other limiting condition for operation, limiting safety system setting, or safety limit specified in the TS.

   The proposed change does not adversely impact the UHS inventory required to be available for the UFSAR described design basis accident involving the worst case 30-day period including losses for evaporation and seepage to support safe shutdown and cooldown of both Braidwood Station units. Additionally, the structural integrity of the UHS is not impacted and remains acceptable following the change, thereby ensuring that the assumptions for both UHS temperature and inventory remain valid.

   Therefore, since there is no adverse impact of this change on the Braidwood Station safety analysis, there is no reduction in the margin of safety of the plant.

Based on the above evaluation, CEG concludes that the proposed changes do 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 Conclusions

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

5.0 ENVIRONMENTAL CONSIDERATION

The proposed amendment would modify Braidwood TS 3.7.9, "Ultimate Heat Sink (UHS)," by changing the maximum allowable temperature of the UHS from a fixed limit of 102°F to allow the TS temperature limit of the cooling water supplied to the plant from the UHS to vary with the observed diurnal cycle. Approval of the proposed TS amendment could result in slight temperature increases to the UHS [cooling pond (sometimes referred to as cooling lake)] for normal plant operation during extreme weather conditions. However, Braidwood will continue to administratively control cooling pond discharge to the Kankakee River in accordance with the current National Pollutant Discharge Elimination System (NPDES) permit requirements. The proposed TS amendment would not result in higher temperature water being discharged to the Kankakee River.

NPDES Permit No. IL0048321 authorizes releases to the Braidwood cooling pond of wastewater streams as well as condenser cooling water, and the cooling pond blowdown is subject to wastewater discharge limitations specified in the NPDES permit. Accordingly, the cooling pond is defined as a wastewater "treatment works" (35 IAC 301.415), and as such it is excepted from the definition of "waters of the state" (35 IAC 301.440) as well as the definition of "waters of the United States" under the federal Clean Water Act (40 CFR 230.3(s)). As a result, the water inventory within the cooling pond is not subject to state water quality standards. The cooling pond is a managed ecosystem where Illinois Department of Natural Resources (IDNR) fish stocking and other human activities primarily influence species composition and population dynamics.

Braidwood has adopted an Extreme Heat Implementation Plan, which provides specific procedural guidance to plant personnel. This plan recognizes that under worst-case summer weather conditions, CEG may need to operate the plant at less than its rated maximum power output or take other operational actions necessary to maintain compliance with the Braidwood NPDES permit requirements for thermal discharge to the river and to protect plant equipment. CEG does not expect the proposed TS amendment to affect the ability to comply with the thermal limits of the NPDES permit.

The Braidwood Extreme Heat Implementation Plan anticipates potential fish loss in the cooling pond under the same unusual atmospheric conditions that the proposed TS amendment is intended to address, and it prescribes communication with the IDNR. In addition, CEG and IDNR meet annually at a minimum to discuss cooling pond and land management activities at Braidwood. The meetings include a review of fishery management and fish stocking activities at the Braidwood cooling pond.

CEG has evaluated the proposed amendment and has determined that 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 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. Regulatory Guide 1.27, Ultimate Heat Sink for Nuclear Power Plants, Revision 2, dated January 1976 (ADAMS Access Number ML003739969)

2. CEG Letter RS-24-044, “License Amendment to Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2, to transition to Framatome GAIA fuel and exemptions to 10 CFR 50.46 and 10 CFR 50 Appendix K,” dated May 28, 2024 (ADAMS Accession Number ML24149A126)

3. NRC Letter, “Braidwood Station, Units 1 and 2 - Issuance of Amendments Re: Ultimate Heat Sink Temperature Increase (CAC Nos. MF4671 and MF4672),” dated July 26, 2016 (ADAMS Access Number ML16133A438)

4. Engineering Change 641059, Revision 1, "Support Analyses for the License Amendment Request to Raise the Maximum Temperature for the UHS in TS LCO 3.7.9 Utilizing a Diurnal Temperature Profile"

5. Exelon Letter RS-02-065, “Hot Leg Switchover Confirmatory Analysis Supporting Uprated Power Operations at Byron and Braidwood Stations,” dated April 12, 2002 (ADAMS Accession Number ML021210065)

6. NRC Letter, “Braidwood Station, Units 1 and 2 - Issuance of Amendment Nos. 235 and 235 Re: Revision of Technical Specifications for the Ultimate Heat Sink (EPID L-2024-LLA-0075),” dated September 10, 2024 (ADAMS Accession Number ML24164A003)

Attachment 2

Proposed Technical Specifications Changes (Mark-Up)

Braidwood Station, Units 1 and 2

NRC Docket Nos. 50-456 and 50-457

TS Pages 3.7.9-1
TS Pages 3.7.9-2

3.7 PLANT SYSTEMS

3.7.9 Ultimate Heat Sink (UHS)

LCO 3.7.9 The UHS shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. UHS inoperable due to average water temperature.	A.1 Be in MODE 3. AND A.2 Be in MODE 5.	12 hours 36 hours
B. UHS inoperable for reasons other than Condition A.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.9.1	Verify water level of UHS is ≥ 590 ft Mean Sea Level (MSL).	In accordance with the Surveillance Frequency Control Program
SR 3.7.9.2	Verify average water temperature of UHS is ~~≤ 102.8°F until September 30, 2024. After September 30, 2024, verify average water temperature of UHS is ≤ 102°F.~~ within the limits of Figure 3.7.9-1.	Once per hour when average water temperature from UHS ≥ 100°F AND In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (cont.)

SURVEILLANCE		FREQUENCY
SR 3.7.9.3	Verify UHS contains a water volume of ≥ 555.8 acre-feet	In accordance with the Surveillance Frequency Control Program

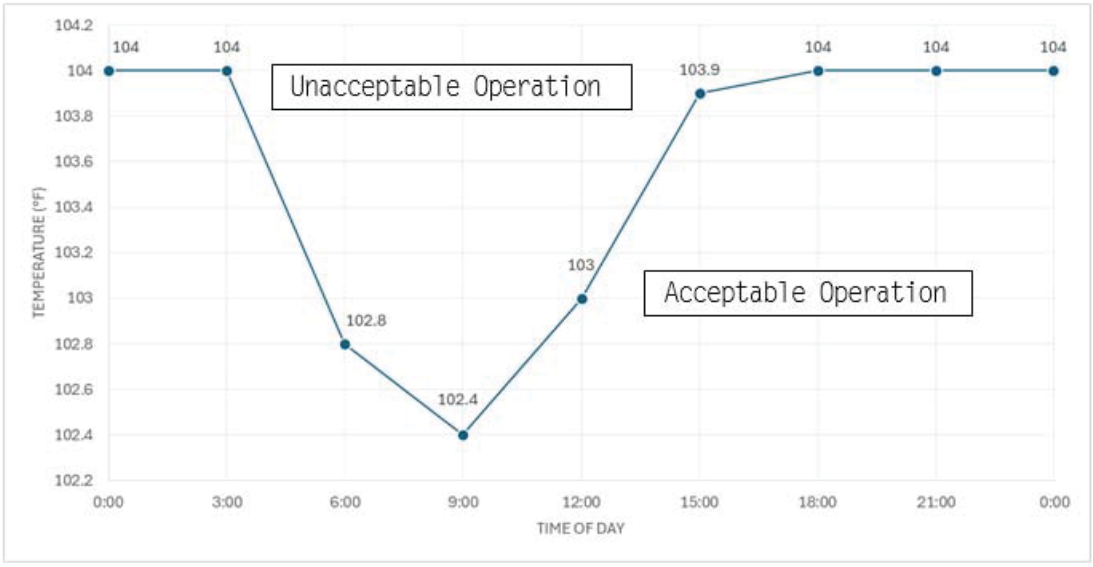


Figure 3.7.9-1 (page 1 of 1)
Temperature of Average Water Temperature of UHS Versus Time of Day Requirements

Attachment 3

Proposed TS Bases Changes (Mark-Up)

Braidwood Station, Units 1 and 2

NRC Docket Nos. 50-456 and 50-457

(For Information Only)

#

BASES

APPLICABLE SAFETY ANALYSES

Normal

when the Cold Leg Recirculation phase of Emergency Core Cooling is initiated

The UHS is the sink for heat removed from the reactor core following all accidents and anticipated operational occurrences in which the unit is cooled down and placed on Residual Heat Removal (RHR) operation. The UHS is also the ~~normal~~ heat sink for condenser cooling via the Circulating Water System. Unit operation at full power represents the UHS maximum heat load. Its maximum post accident heat load occurs ~~20 minutes~~ after a design basis Loss Of Coolant Accident (LOCA). Near this time, the unit switches from injection to recirculation and the containment cooling systems and RHR are required to remove the core decay heat.

The operating limits are based on conservative heat transfer analyses for the worst case LOCA. Reference 1 provides the details of the assumptions used in the analysis, which include worst expected meteorological conditions, conservative uncertainties when calculating decay heat, and worst case single failure (e.g., single failure of a manmade structure). The UHS is designed in accordance with Regulatory Guide 1.27 (Ref. 2), which requires a 30 day supply of cooling water in the UHS.

The UHS satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

be within the Acceptable Operation region defined in Figure 3.7.9-1

The UHS is required to be OPERABLE and is considered OPERABLE if it contains a sufficient volume of water at or below the maximum temperature that would allow the SX System to operate for at least 30 days following the design basis LOCA without the loss of Net Positive Suction Head (NPSH), and without exceeding the maximum design temperature of the equipment served by the SX System. To meet this condition, the UHS temperature should ~~not exceed 102°F (102.8°F until September 30, 2024)~~ and the level should not fall below 590 ft mean sea level during normal unit operation.

APPLICABILITY

In MODES 1, 2, 3, and 4, the UHS is required to support the OPERABILITY of the equipment serviced by the UHS and required to be OPERABLE in these MODES.

In MODE 5 or 6, the OPERABILITY requirements of the UHS are determined by the systems it supports.

BASES

ACTIONS

A.1 and A.2

If the UHS is inoperable due to average water temperature, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 12 hours and in MODE 5 within 36 hours.

B.1 and B.2

If the UHS is inoperable for reasons other than Condition A, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit 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 unit conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.7.9.1

This SR verifies that adequate long term (30 day) cooling can be maintained. The specified level also ensures that sufficient NPSH is available to operate the SX pumps. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. This SR verifies that the UHS water level is ≥ 590 ft mean sea level United States Geological Society datum.

within the Acceptable Operation region defined in Figure 3.7.9-1

SR 3.7.9.2

This SR verifies that the SX System is available to cool the CC System to at least its maximum design temperature with the maximum accident or normal design heat loads for 30 days following a Design Basis Accident. This SR verifies that the average water temperature of the UHS is ~~≤ 102°F (102.8°F until September 30, 2024)~~, as measured at the discharge of an SX pump. ~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

Insert: Proposed Text A

Proposed Text A:

Timing between the Surveillance Frequency is controlled under the Surveillance Frequency Control Program, unless the water temperature of the UHS is greater than or equal to 100°F. With water temperature of the UHS greater than or equal to 100°F, SR 3.7.9.2 is performed once per hour to monitor the water temperature of the UHS and verify the temperature is within the Acceptable Operation region defined in Figure 3.7.9-1 more frequently. The once per hour Frequency takes into consideration the diurnal UHS temperature variations and the increased monitoring frequency needed to ensure the design basis temperature limit is not exceeded.