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RS-20-089

10 CFR 50.90

July 15, 2020

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: License Amendment to Braidwood Station, Units 1 and 2, Technical Specification 3.7.9, "Ultimate Heat Sink"

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Exelon Generation Company, LLC (EGC), is submitting a request for amendment to Renewed Facility Operating License Nos. NPF-72 and NPF-77 for Braidwood Station, Units 1 and 2 (Braidwood).

The proposed amendment is to change Technical Specifications (TS) Surveillance Requirement (SR) 3.7.9.2 to allow an Ultimate Heat Sink (UHS) temperature of ≤ 102.8°F between July 15 and September 30, 2020. This change will also permanently extend the completion time for the Required Action of both Braidwood Station, Units 1 and 2 to be placed in Mode 3 within 12 hours when the UHS is inoperable due to average water temperature.

Recent meteorological and atmospheric conditions have resulted in the TS UHS temperature being challenged. These conditions include elevated air temperatures, high humidity, and low wind speed. Specifically, July 4 through July 9, 2020 brought hot weather and drought conditions to the northern Illinois area resulting in sustained elevated UHS temperatures, leading to this license amendment request (LAR).

As described in Regulatory Guide (RG) 1.27, Revision 2, "Ultimate Heat Sink for Nuclear Power Plants," the predicted response of the UHS temperature to the design basis event is a function of the historical weather including the diurnal variations. This LAR is consistent with Braidwood Station's licensing basis (i.e., RG 1.27 Revision 2). The purpose of the UHS TS temperature limit is to restrict the initial UHS temperature such that the maximum UHS temperature (i.e., the temperature of the cooling water supplied to the plant safety systems from the UHS) experienced during the UHS design basis event would not exceed the design limit of the plant equipment cooled by the UHS.

The attached amendment request is subdivided as follows:

- Attachment 1 provides an evaluation of the proposed changes.
- Attachment 2 provides the current TS pages with the proposed changes indicated with markups.
- Attachment 3 provides the current TS Bases pages with the proposed changes indicated with markups. The TS bases pages are provided for information only and do not require NRC approval.

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), EGC 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.

EGC requests approval of the proposed license amendment by August 30, 2020 to support plant operation during northern Illinois' recent summer hot weather and drought conditions resulting in sustained elevated UHS temperatures. Once approved, the amendment will be implemented within 5 days.

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

There are no regulatory commitments contained in this letter. Should you have any questions concerning this letter, please contact Ms. Lisa Zurawski at (630) 657-2816.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 15th day of July 2020.

Respectfully,

Dwi Murray
Sr. Manager – Licensing
Exelon Generation Company, LLC

Attachments:
1. Evaluation of Proposed Changes
2. Mark-up of Proposed Technical Specification Page Change
3. Mark-up of Proposed Technical Specification Bases Pages Changes – For Information Only

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

Attachment 1
Evaluation of Proposed Changes

Subject: License Amendment to Braidwood Station, Units 1 and 2, Technical Specification 3.7.9, "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," Exelon Generation Company, LLC (EGC), is submitting a request for amendment to Renewed Facility Operating License Nos. NPF-72 and NPF-77 for Braidwood Station, Units 1 and 2 (Braidwood).

The proposed amendment is to change Technical Specifications (TS) Surveillance Requirement (SR) 3.7.9.2 to allow an Ultimate Heat Sink (UHS) temperature of ≤ 102.8°F between July 15 and September 30, 2020. This change will also permanently extend the completion time for the Required Action of both Braidwood Station Units 1 and 2 to be placed in Mode 3 within 12 hours when the UHS is inoperable due to average water temperature.

Recent 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. Specifically, July 4 through July 9, 2020 brought hot weather and drought conditions to the northern Illinois area resulting in sustained elevated UHS temperatures. 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.

This license amendment is being sought to allow the TS temperature limit of the cooling water supplied to the plant from the UHS to increase from ≤ 102°F to ≤ 102.8°F and increase the Required Actions Completion Time for the units to be placed in Mode 3 to within 12 hours. The impact of the maximum UHS temperature experienced during a Design Basis Accident (DBA) event has been evaluated consistent with the Braidwood Station current licensing basis. This includes Regulatory Position C.1.b of RG 1.27, Revision 2 which states that the UHS temperature transient analysis should include diurnal variations for the total of the critical time period, based on examination of regional climatological measurements that are demonstrated to be representative of the site. While the analysis has been performed to analyze the diurnal variations, the proposed TS limit for the UHS temperature is proposed to increase from ≤ 102°F to ≤ 102.8°F, independent of time of day. This is consistent with the existing TS.

Additionally, this license amendment will also increase the completion time for the requirement of both Braidwood units to be in Mode 3 if the UHS is inoperable due to average UHS water temperature from 6 hours to 12 hours. This change allows the natural diurnal cooling behavior of the lake to occur to restore the UHS temperature below the TS limit without having to perform an evolution to shutdown both Braidwood units and place each unit through an unnecessary thermal cycle.

The evaluations and analyses performed to support this proposed license amendment demonstrate that the plant's safety related equipment will maintain its design function at the higher UHS temperature. Therefore, the proposed change has no adverse impact on Braidwood Station plant safety.

This license amendment to change the UHS temperature limit is only being requested for the period from July 15, 2020 to September 30, 2020. EGC is performing detailed margin analyses and considering modifications to some equipment to increase margins. However, these analyses and modifications will not be completed in time to support potential impacts this summer (2020). Therefore, this UHS temperature limit change request is being submitted to

cover a limited period of time. Following completion of the margin analyses and modifications, EGC may submit a subsequent license amendment request and associated technical justification to permanently revise SR 3.7.9.2 UHS temperature.

2.0 DETAILED DESCRIPTION

2.1 Proposed Changes

The proposed changes to TS 3.7.9 are shown in Attachment 2 and are as follows:

The current TS SR 3.7.9.2 states:

> Verify average water temperature of UHS is ≤ 102°F.

The proposed TS SR 3.7.9.2 states:

> Verify average water temperature of UHS is ≤ 102°F. Verify average water temperature of the UHS is ≤ 102.8°F between July 15 and September 30, 2020.

The current TS 3.7.9 Actions states:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. UHS inoperable.	A.1 Be in MODE 3. AND A.2 Be in MODE 5.	6 hours 36 hours

The proposed TS 3.7.9 Actions states:

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

2.2 Background

The UHS consists of an excavated essential cooling pond integral with the main cooling pond. 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 DBA with no additional makeup water source. The UHS is designed to withstand the separate occurrence of either the safe shutdown earthquake 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 also provides a source of emergency makeup water for the spent fuel pool and can provide water for fire protection equipment. Non-Essential Service Water (WS) pumps and Circulating Water (CW) pumps also take suction from the UHS during normal operation, however, operation for post-accident conditions is not considered since the WS and CW pumps are shut down before the UHS level reaches the minimum required water level for plant operation at 590 feet.

The SX system takes suction from intake lines running from Safety Category I essential cooling pond to the auxiliary building where four SX pumps (two per unit) supply safety-related loads and components essential to safe shutdown. 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 figure.

The Braidwood limiting UHS DBA (i.e., that event that results in the maximum heat load on the UHS) is one unit undergoing post-Loss of Coolant Accident (LOCA) cooldown concurrent with a Loss of Offsite Power (LOOP), in conjunction with the other unaffected unit undergoing a safe non-accident shutdown. This scenario assumes the worst case single failure of the manmade structure (i.e., the Category II retaining dikes) that encloses the main cooling pond. This limiting DBA includes three sources of heat energy to be transferred by the SX system after a LOCA: containment heat removal via the RCFCs, containment heat and reactor residual heat removal via the containment sumps, and Engineered Safety Features (ESF) equipment heat loads (e.g., ESF equipment coolers and room coolers) and the Main Control Room chiller.

The thermal performance of the Braidwood Station UHS was originally developed based on the initial UHS temperature of 98°F and meteorological conditions from the summer of 1955 for highest temperature and summer of 1971 for highest evaporation. On June 13, 2000, the U.S. NRC issued an amendment to increase the allowable UHS temperature from 98°F to 100°F. Due to changes in meteorological conditions that resulted in the TS UHS temperature limit being challenged, EGC submitted a subsequent license amendment to increase the UHS allowable temperature to 102°F. On July 26, 2016, the U.S. NRC approved the increase of allowable TS UHS temperature from 100°F to 102°F.

The analysis of the Braidwood Station UHS to determine the TS limit for TS amendment 189 (ML16133A438) and the associated post-DBA UHS temperature was a multi-step process. The steps included determining the critical time periods unique to the Braidwood Station UHS, gathering updated meteorological data, and screening the meteorological data to determine the most limiting sets of data. This information was used in the UHS analysis to determine UHS temperature and evaporation response by analyzing the combined effects of the most limiting sets of meteorological data with the DBA heat loads. Once the limiting post-DBA UHS temperature responses were determined, they were used (1) as input into the safety analysis to ensure responses remained within analyzed limits and (2) to evaluate performance margins of equipment cooled by the SX and CC systems. The evaporation response was assessed against the existing design analysis to ensure response remained within limits.

3.0 TECHNICAL EVALUATION

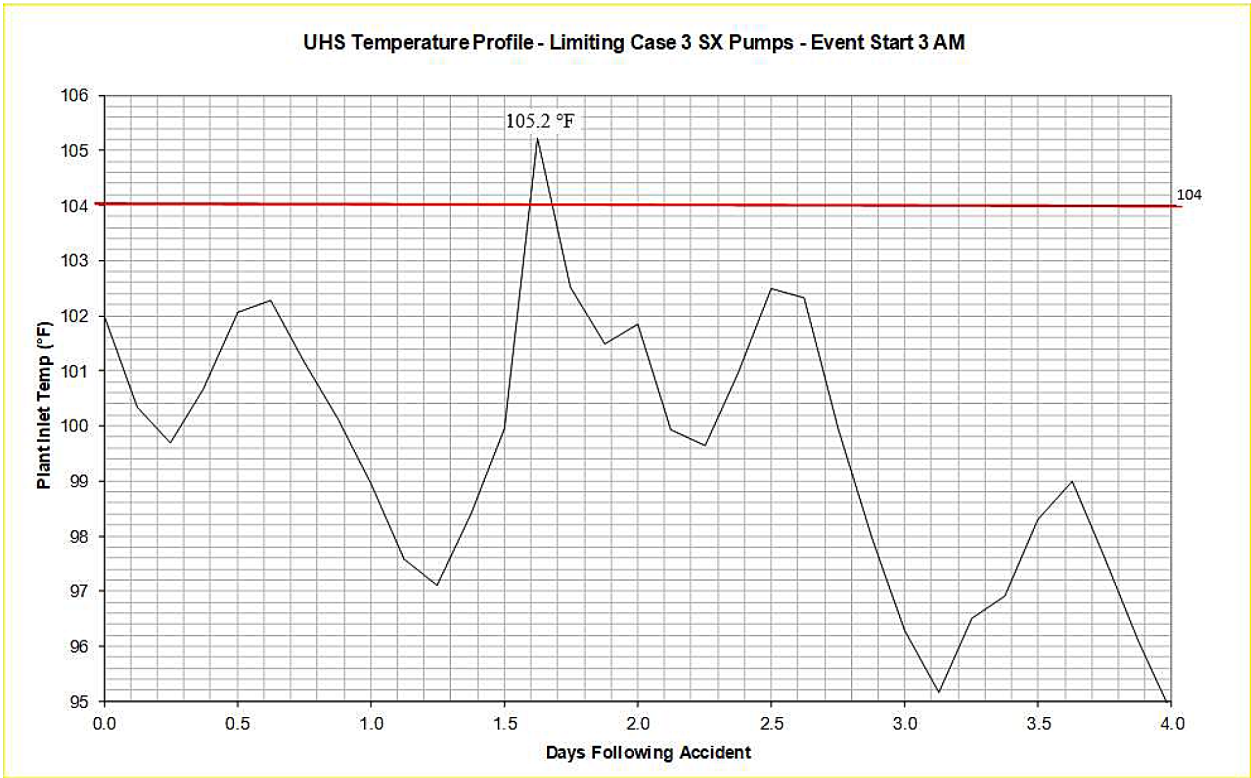
The UHS is the heat sink for heat removed from the reactor core following all accidents and anticipated operational occurrences in which the unit is cooled down and placed on Residual Heat Removal (RHR) operation. The operating limits are based on conservative heat transfer analyses for the worst case loss of coolant accident (LOCA). The UHS is designed in accordance with Regulatory Guide (RG) 1.27, "Ultimate Heat Sink for Nuclear Power Plants," Revision 2.

The current design basis analyses support an initial SX temperature of 102°F. This basis is documented and approved as part of the NRC's approval of TS amendments 189 (ML16209A218). An evaluation has been completed that supports a 0.8°F increase in SX temperature on accident analyses and containment response and analyses of the components served by SX. The current UHS analysis of record that was approved as part of the TS change to 102°F calculated the highest resulting UHS temperature following the design basis event would be 105.2°F. Therefore, EGC has concluded that an increase of an additional 0.8°F in initial UHS temperature would conservatively result in a corresponding increase in the highest calculated UHS temperature of 106°F. The discussion below provides the evaluation of the 106°F peak post-accident temperature on the containment heat removal via the RCFCs, containment heat and reactor residual heat removal via the containment sumps, and Engineered Safety Features (ESF) equipment heat loads (e.g., ESF equipment coolers and room coolers). This evaluation does not take credit for the additional known gross volume in the UHS of approximately 40 acre-feet (597.9 vs 555.8) from the latest surveillance.

The UHS supplies water to the SX system, UHS and SX for certain circumstances can be used interchangeablly in this document. The following evaluation demonstrates that there is no increase in risk as a result of the proposed temperature increase as discussed below.

3.1 UHS Temperature Profile

As discussed in the basis for TS amendments 189, EGC determined that with UHS starting at a temperature of 102°F, the highest UHS temperature during a worst case LOCA would be 105.2°F. The figure below shows the temperature response for this worst case LOCA at a start time of 0300. In support of TS amendment 189, EGC used 106°F to analyze the post-accident performance of the equipment served by SX except for the Reactor Containment Fan Coolers (RCFC) which used 104°F.



EGC has evaluated the impact of this initial UHS temperature increase on the safety related component and accident analyses as discussed below.

3.2 Equipment Supported by SX

The Essential Service Water System (SX) supplies the safety related loads and components required for safe shutdown. These include cubicle coolers, pump coolers, diesel engines coolers, containment coolers, Component Cooling (CC) water heat exchangers and Main Control Room chiller condenser.

The post-accident performance of the equipment served by SX has been analyzed for a supply SX temperature of 106°F. These analyses use design fouling values and tube plugging limiting criteria. Actual tube plugging is lower than analyzed and fouling values are lower in Summer months due to higher SX flows through the cooling equipment. These margins remain during the period of the requested higher SX temperature limit of 102.8°F.

The table below demonstrates the resulting maximum UHS temperature as a result of the DBA starting at different times of day. Due to the diurnal behavior of the UHS and the transient time for cooling, the amount of heat dissipated and thus the maximum UHS temperature during a DBA event is dependent on event initiation time. The table below shows that with an event starting at 0300, the maximum calculated UHS temperature is 105.2°F. This represents a margin of 0.8°F to the currently analyzed equipment limit of 106°F. In order to maintain this margin and the maximum calculated post-accident temperature, the initial UHS temperature is limited to 102.8°F. As shown, an event starting at other times results in lower maximum UHS temperature and would support a higher initial UHS temperature.

Based on the starting temperature of 102.8°F, it is concluded by Engineering Judgment that the maximum UHS temperature will not be higher than 106°F. In fact, the highest UHS temperature will be limited by an UHS volume that is greater than analyzed (597.9 vs 555.8 acre-ft). Sensitivity analyses performed in support of TS amendment 189 (ML16209A218) show the additional volume results in a reduction of 0.7°F in the peak calculated temperature.

DBA - 3 SX pumps Running at the Start of the event

Time of Day	**DBA Max UHS Temp** (°F)	**Max Calculated UHS Temp** (°F)	**UHS Temp margin**	**UHS Temp Limit**
Midnight	106	104.5	1.5	103.5
03:00	106	105.2 (DB Limiting Case)	0.8	102.8
06:00	106	104.4	1.6	103.6
09:00	106	103.6	2.4	104.4
12:00	106	103.3	2.7	104.7
15:00	106	104	2	104
18:00	106	104.7	1.3	103.3
21:00	106	103.4	2.6	104.6

(Calculation ATD-0109 Revision 4, including 4A and 4B)

Based on the above, all equipment served by SX remains operable with the elevated SX temperature. The UHS temperature of 102.8°F supports the current design analyses.

The Reactor Containment Fan Coolers are addressed in the Accident Analyses section.

3.3 Impact on Accident Analyses

3.3.1 Containment Integrity (UFSAR Chapter 6)

The SX system supplies the Reactor Containment Fan Coolers (RCFCs) post-accident. Two trains of containment cooling, each of sufficient capacity to supply 100% of the design cooling requirement, are provided. Each train consisting of two RCFCs is supplied with cooling water from a separate train of SX and is powered from a separate ESF bus. During all operating conditions, air is drawn from the upper volume of the containment approximately 50 feet above the operating floor by a return air riser (one riser for each RCFC unit). The return air is then routed through the SX cooling coils, the Chilled Water (WO) cooling coils, and the fan and discharge duct (one for each RCFC unit). The RCFC discharges directly into the lower containment volume. The WO chiller unit condensers are served by the SX return from the RCFC SX cooling coils. Upon receipt of an ESF signal, the WO condensers are automatically isolated from SX. In post-accident operation following an actuation signal, the RCFC fans are designed to start automatically in slow speed if not already running. If running in high (normal) speed, the fans automatically shift to slow speed. The fans are operated at the lower speed during accident conditions to prevent adverse fan conditions from the higher mass atmosphere. The temperature of the SX is an

important factor in the heat removal capability of the fan units. The heat removal for the RCFCs is an input to the Accident Analyses.

These analyses use RCFC heat removal performance for an SX temperature of 104°F. This is acceptable because the SX temperature remains below 104°F for a period longer than the time of the calculated peak Containment pressure and temperature. This analysis and conclusion do not change with an initial UHS temperature of 102.8°F because the peak Containment temperature and pressure occur early in the accident well before the UHS post-accident temperature increases above the RCFC analyzed temperature of 104°F. This justification was approved by the NRC in TS amendments 189 (ML16209A218) and is described in more detail below.

The calculated UHS temperature profile shows the temperature initially decreases and remains below the starting temperature until about 36 hours after the event. A small excursion (< 0.5°F) above the initial temperature occurs at about 12 hours. By Engineering Judgment, the same profile is expected for a starting UHS temperature of 102.8°F with the temperature remaining below 104°F for at least 24 hours. The containment pressures and temperatures have been significantly reduced from the calculated peak value at 24 hours after the event. At 24 hours, the containment pressure is approximately 30 psi lower than the calculated peak (about 10 psig vs Limiting Pressure U-1 42.1 psig) and the containment temperature is approximately 80°F lower than the calculated peak (180°F vs 260°F). Similar margins are available for the Containment Sump water temperature. Therefore, the increase in the UHS temperature above 104°F post 24 hours will not result in exceeding any design criteria related to post-LOCA containment requirements. In addition, the heat removal curve used for the RCFCs is conservative because it is based on a tube plugging level of 10% while the actual tube plugging is < 2%.

For the Main Steamline Break accidents inside Containment, the calculated temperature is nearly 100°F lower at 24 hours after the event. The LOCA event is bounding for peak calculated pressure.

The current analysis of record for Braidwood Units 1 and 2 were reviewed and it was concluded that a 0.8°F increase in the UHS water temperature (from 102°F to 102.8°F) will have no or negligible impact on the large break loss of coolant accident (LBLOCA), small break loss of coolant (SBLOCA), long term core cooling (LTC) and non-LOCA analyses.

The LOCA analyses (and some non-LOCA transients) assume the minimum and/or the maximum water temperature of the Emergency Core Cooling System (ECCS) and the maximum cooling capacity of the reactor containment fan coolers (RCFC). Both of these assumptions can be potentially impacted by the assumption of the SX temperature. These impacts are addressed below.

3.3.2 Peak Clad Temperature Analyses

Large Break LOCA (LBLOCA)

In the event of a LBLOCA, the ECCS water is initially drawn from the refueling water storage tank (RWST). When the RWST empties (or nearly empties) the pumps are realigned to the Containment sump, i.e., cold leg recirculation. Assuming no single failure and full runout flow from all the pumps, the earliest time the RWST can empty is in excess of 10 minutes.

The current licensing basis peak clad temperature (PCT) is 2025°F for Unit 1 and 2047°F for Unit 2, including all penalties and benefits (UFSAR Table 15.6-15). UFSAR Table 15.6-1a show the limiting PCT occurs at 102 seconds for Braidwood Unit 1 and 96 seconds for Braidwood Unit 2. Therefore, the PCT related transient is over while the ECCS is drawing suction from the RWST. Since SX temperature has no effect on the RWST water temperature, an increase in SX temperature of 0.8°F will not impact the calculated PCT.

During the long term, when the ECCS water is drawing suction from the sump, the SX temperature can have an effect on the peak clad temperatures. However, at this point in the transient, the peak clad temperatures are significantly lower, and a 0.8°F variance in SX temperature will not result in the clad temperatures challenging the calculated peaks.

Furthermore, it is conservative to minimize the containment pressure when evaluating overall ECCS performance as described in NUREG-0800, Section 6.2.1.5, "Minimum Containment Pressure Analysis for Emergency Core Cooling System Performance Capability Studies." Lower containment pressure results in a lower reflood rate and hence a higher PCT. To minimize containment pressure, maximum RCFC heat removal capacity is assumed in the LBLOCA analysis. The maximum RCFC heat removal capacity is based on an SX temperature of 32°F (UFSAR, Table 6.2-54). Therefore, raising the SX temperatures to 102.8°F does not impact this analysis. Based on the above, an increase in SX temperature of 0.8°F will have little or no detrimental impact on the outcome of the LBLOCA PCT.

Small Break LOCA (SBLOCA)
The calculated peak clad temperature for a SBLOCA is 1749°F for Unit 1 and 1755°F for Unit 2 (UFSAR Table 15.6-15).

The NOTRUMP Evaluation Model which is used for the SBLOCA analysis does not explicitly model the UHS; therefore, this change does not directly impact the SBLOCA analyses (UFSAR 15.6.5.2.2).

Auxiliary Feedwater (AF) is modeled in the SBLOCA analysis with a temperature of 125°F. The SX system is the safety related backup to the AF system. Based on the results of the UHS temperature analysis, the AF temperature could reach a maximum of 106°F (105.2 + 0.8). This maximum temperature is bounded by the temperature used in the SBLOCA analysis.

The temperature of the safety injection water in the SBLOCA analysis is assumed to be at 120°F, based on the RWST as the source. The UHS temperature change does not impact the RWST.

The temperature of the recirculation water is taken as 212°F. Design analyses that were completed in support of the TS amendments 189 (ML16209A218) have calculated the RHR heat exchanger discharge temperature to be below 212°F. The CC Heat Exchanger has been evaluated and has been found to be able to remove the required heat load that supports the assumptions of the calculation with an SX supply temperature of 106°F. Thus, the assumption of the SBLOCA analysis for the recirculation water temperature of 212°F is validated.

Based on the above, a 0.8°F increase in SX temperature will have no detrimental impact on the outcome of the SBLOCA PCT.

Non-LOCA Analyses
For three non-LOCA events, main steam line break (MSLB), feed line break (FLB) and steam generator tube rupture (SGTR), the ECCS is modeled and assumed to operate. For these events the transient is terminated well before the RWST is drained down since only the charging and the safety injection pumps actuate during these events. Therefore, a 0.8°F increase in SX temperature will have no detrimental impact on the outcome of the MSLB and the SGTR results.

3.3.3 Long Term Core Cooling and Hot Leg Switchover Analysis

The Component Cooling Heat Exchangers have been evaluated and have been found to be able to remove the required heat load that supports the assumptions of the Containment Analysis with an SX supply temperature of 106°F. The Hot Leg Switchover analysis for Braidwood Station has determined that switchover must occur at 6 hours after the event. The SX temperature at 6 hours is below the temperature at the start of the event. The existing design analysis remain acceptable with a maximum UHS starting temperature of 102.8°F.

3.3.4 CC System to RCPs

The maximum CC temperature to the Reactor Coolant Pumps (RCP) is 105°F during normal plant operation. This temperature limit is raised to 120°F for a short period (3 hours) when the Residual Heat Removal system is first used during RCS cooldown. The postulated increase in CC temperature of 0.8°F is found acceptable by Engineering Judgement. This is based on the small increase and the short duration considering the diurnal cycle of the UHS temperature profile.

3.3.5 Other Analyses

Other considerations, such as the impact of increasing the UHS temperature to 102.8°F on Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions," and Station Blackout (SBO), were also evaluated.

- GL 96-06

The period of interest for the GL 96-06 concern of water hammer is the first few minutes post-accident, while the pumps and fans are restarting following load shed. The analysis of record reviewed the impact with an increase in SX temperature from 100°F to 102°F and determined that a slight increase in fluid temperature will not result in significant changes to the amount of voiding and thus negligible impacts to void collapse and the existing results of this analysis. The additional degree from an initial SX temperature of 102.8°F does not change the conclusion of the analysis. This qualitative assessment is supported by the results of the evaluation that was completed for a fluid temperature of 105°F (Reference 2).

- Diesel Driven AF Pump Operation during Loss of All AC Power

In the event of a loss of all AC power (i.e., Station Blackout or SBO), a diesel driven SX booster pump operates to provide cooling water to the diesel driven AF pump and engine cooler. 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 sinks and heat-up of the isolated SX loop during the SBO coping period.

Design analysis evaluates this transient and concludes that AF diesel engine jacket water temperature will not exceed the engine trip setpoint in 2 hours. The calculation evaluates a maximum UHS temperatures of 102°F. The analysis used a plugging level of 5 tubes for the 102°F case. The analysis also determined that the allowed tube plugging decreases by two (2) tubes for each °F increase in the SX temperature.

The actual numbers of tubes that are plugged for the heat exchangers (1/2SX01K) is zero (0) for Unit 1 and one (1) for Unit 2. The actual plugging level supports a maximum SX temperature of 104°F. Therefore, raising the SX temperature of 102.8°F is acceptable.

3.4 Extension of Completion Time

In addition to the proposed change to increase allowable TS limit for the UHS temperature from ≤ 102°F to ≤ 102.8°F, this LAR would also increase the Required Action Completion Time for both Braidwood units to be in Mode 3 from 6 hours to 12, if the UHS is inoperable due to average UHS water temperature. This proposed change would allow the natural diurnal cooling behavior of the lake to occur in restoring the UHS temperature below the TS limit without having to shutdown both Braidwood units and place each unit through an unnecessary thermal cycle evolution. The proposed change only affects the TS CT and does not involve a change to the design or method of operation of the UHS. This additional 6 hours does not result in any reasonable impact of safety. The possibility of the DBA LOCA coupled with the failure of the manmade structure surrounding the UHS during a 12 hour Completion Time is not measurably increased from the same event occurring during the current 6 hour Completion Time. The 12 hour Completion Time to reach Mode 3 is consistent with other plants with cooling lakes affected by diurnal variations.

4.0 REGULATORY EVALUATION

4.1 APPLICABLE REGULATORY REQUIREMENTS/CRITERIA

10 CFR 50.36, "Technical Specifications," paragraph (c)(2)(i) states that limiting conditions for operation are the lowest functional capability or performance level of equipment required for safe operation of the facility, and when a limiting condition for operation is not met, the licensee shall shut down the reactor or follow any remedial actions permitted by the TS until the condition can be met. The proposed change to extend TS Completion Time to allow the natural diurnal cooling behavior of the lake for restoring UHS temperature below the TS limit is consistent with the requirement to follow remedial action to restore the limiting condition for operation.

The design of the UHS satisfies the requirements of 10 CFR 50.36(c)(2)(ii), Criterion 3. This criterion states the following:

> (ii) A Technical Specification Limiting Condition for Operation (TS LCO) of a nuclear reactor must be established for each item meeting one or more of the following criteria:
>
> Criterion 3. A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that

either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

The proposed change does not change the design function or purpose of the UHS, therefore, Criterion 3 of 10 CFR 50.36(c)(2)(ii) continues to be met.

General Design Criteria 2, "Design bases for protection against natural phenomena," and General Design Criteria 44, "Cooling water," of Appendix A to 10 CFR Part 50, "General Design Criteria for Nuclear Power Plants," provides design considerations for the UHS. RG 1.27, "Ultimate Heat Sink for Nuclear Power Plants," Revision 2, dated January 1976, provides an acceptable approach for satisfying these criteria. The basis provided in RG 1.27, Revision 2, was employed for the temperature analysis of the Braidwood Station UHS.

General Design Criteria 5, “Sharing of structures, systems and components,” of Appendix A to 10 CFR Part 50 also provides design criteria applicable to the UHS, a shared system between Braidwood Station Units 1 and 2. The proposed change, including the re-analysis of the UHS DBA, was evaluated consistent with the existing methodology which considers a DBA event (i.e., a LOCA with LOOP) along with the safe non-accident shutdown and cooldown of the opposite unit. Therefore, GDC 5 criteria continue to be met by the reanalysis of the UHS DBA at the elevated initial UHS temperature of 102.8°F.

The proposed changes continue to ensure that the plant's safety related equipment will maintain its design function at the higher UHS temperature. Therefore, there is no adverse impact of this change on Braidwood Station plant safety.

4.2 NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Exelon Generation Company, LLC (EGC) is requesting a change to the Technical Specifications (TS) of Renewed Facility Operating License Nos. NPF-72 and NPF-77 for Braidwood Station, Units 1 and 2.

The Ultimate Heat Sink (UHS) for Braidwood Station, Units 1 and 2 provides a heat sink for processing and operating heat from safety related components during a transient or accident, as well as during normal operation. This is done by utilizing the Essential Service Water (SX) System and the Component Cooling Water (CC) system. The UHS consists of an excavated essential cooling pond integral with the main cooling pond. The volume of the excavated essential cooling pond is sized to permit the safe shutdown and cooldown of both Braidwood Station units for a 30 day period, including a design basis event with no additional makeup water source. 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 proposed change modifies the acceptance criterion in TS Surveillance Requirement (SR) 3.7.9.2. The current TS SR 3.7.9.2 states: "Verify average water temperature of UHS is $\leq$102°F." The proposed TS SR 3.7.9.2 states: "Verify average water temperature of UHS is $\leq$ 102°F. Verify average water temperature of the UHS is $\leq$ 102.8°F between July 15, 2020 and September 30, 2020." The proposed change also increases the completion time for the

requirement of both Braidwood units to be in Mode 3 if the UHS is inoperable due to average UHS water temperature from 6 hours to 12.

The evaluations and analyses performed to support the proposed license amendment demonstrate that the plant's safety related equipment will maintain its design function at the higher UHS temperature.

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 an accident previously evaluated;
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.

In support of this determination, an evaluation of each of the three criteria set forth in 10 CFR 50.92 is provided below:

1. Does the Proposed Change Involve a Significant Increase in the Probability or Consequences of an Accident Previously Evaluated?

   Response: No

The likelihood of a malfunction of any systems, structures or components (SSCs) supported by the Ultimate Heat Sink (UHS) is not significantly increased by increasing the allowable UHS temperature from ≤ 102°F to ≤ 102.8°F or extending the time for both Unit 1 and Unit 2 to be placed in Mode 3 to 12 hours. 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 proposed change does not make any physical changes to any plant SSCs, nor does it alter any of the assumptions or conditions upon which the UHS is designed. The UHS is not an initiator of any analyzed accident. All equipment supported by the UHS has been evaluated to demonstrate that their performance and operation remains as described in the UFSAR with no increase in probability of failure or malfunction.

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 normal operating and 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.

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 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, or change the mode of operation of any SSC. 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 does not alter a limiting condition for operation, limiting safety system setting, or safety limit specified in the Technical Specifications.

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 proposed change on the Braidwood Station safety analysis, there is no reduction in the margin of safety of the plant.

4.3 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

EGC has evaluated this proposed operating license amendment consistent with the criteria for identification of licensing and regulatory actions requiring environmental assessment in accordance with 10 CFR 51.21, "Criteria for and identification of licensing and regulatory actions requiring environmental assessments." EGC has determined that this proposed change meets the criteria for a categorical exclusion set forth in paragraph (c)(9) of 10 CFR 51.22, "Criterion or categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," and as such, has determined that no irreversible consequences exist in accordance with paragraph (b) of 10 CFR 50.92, "Issuance of amendment." This determination is based on the fact that this change is being proposed as an amendment to the license issued pursuant to 10 CFR 50, "Domestic Licensing of Production and Utilization Facilities," which changes a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, "Standards for Protection Against Radiation," or which changes an inspection or a surveillance requirement, and the amendment meets the following specific criteria:

(i) The amendment involves no significant hazards consideration.

As demonstrated in Section 4.2, "No Significant Hazards Consideration," the proposed change does not involve any significant hazards consideration.

(ii) There is no significant change in the types or significant increase in the amounts of any effluent that may be released offsite.

The proposed change does not result in an increase in power level, does not increase the production nor alter the flow path or method of disposal of radioactive waste or byproducts. The proposed change continues to ensure that the plant's safety related equipment will maintain its design function at the higher UHS temperature. Therefore, there is no impact of this change on Braidwood Station safety analyses including the consequences of such events.

Based on the above evaluation, the proposed change will not result in a significant change in the types or significant increase in the amounts of any effluent released offsite.

(iii) There is no significant increase in individual or cumulative occupational radiation exposure.

There is no net increase in individual or cumulative occupational radiation exposure due to the proposed change. The proposed action will not change the level of controls or methodology used for processing of radioactive effluents or handling of solid radioactive waste, nor will the proposed action result in any change in the normal radiation levels within the plant.

Based on the above information, there will be no increase in individual or cumulative occupational radiation exposure resulting from this change.

6.0 REFERENCES

1. NRC Safety Evaluation Report, Braidwood Station Units 1 and 2 – Issuance of Amendments RE: Ultimate Heat Sink Temperature Increase, dated July 26, 2016. (ADAMS ACCESS ML16133A438)

2. Engineering Change (EC) Evaluation 396478 Revision 0, "Support Analyses for the License Amendment Request to Raise the Maximum UHS Temperature for the UHS in TS LCO 3.7.9."

3. WCAP-10325-P-A, "Westinghouse LOCA Mass and Energy Release Model for Containment Design March 1979 Version," dated May, 1983

ATTACHMENT 2

BRAIDWOOD STATION
UNITS 1 and 2

Renewed Facility Operting License Nos. NPF-72 and NPF-77

Docket Nos. STN-50-456 and STN-50-457

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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 °F. Verify average water temperature of the UHS is ≤ 102.8 °F between July 15, 2020 and September 30, 2020.	In accordance with the Surveillance Frequency Control Program

ATTACHMENT 3

BRAIDWOOD STATION
UNITS 1 and 2

Renewed Facility Operting License Nos. NPF-72 and NPF-77

Docket Nos. STN-50-456 and STN-50-457

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BASES

APPLICABLE SAFETY ANALYSES

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

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 between July 15th and September 30, 2020) 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 $\geq$ 590 ft mean sea level United States Geological Society datum.

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 $\leq$ 102°F (102.8°F between July 15th and September 30, 2020), as measured at the discharge of an SX pump. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.