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10 CFR 50.90

RS-16-218

October 26, 2016

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

Braidwood Station, Unit 2
Renewed Facility Operating License No. NPF-77
NRC Docket No. STN 50-457

Subject: Response to Request for Additional Information License Amendment Request for a One-Time Extension of the Essential Service Water (SX) Train Completion Time to Support 2A SX Pump Repair

References:
1) Letter from D. M. Gullott (Exelon Generation Company, LLC) to U. S. Nuclear Regulatory Commission, "License Amendment Request for a One-Time Extension of the Essential Service Water (SX) Train Completion Time to Support 2A SX Pump Repair," dated September 30, 2016 (ML16274A474)

2) Email from J. Wiebe (NRC) to J. Bauer (Exelon Generation Company, LLC) Initial RAIs Related to the Braidwood Unit 2 SX Pump allowed Outage time Amendment Request, dated October 20, 2016

In Reference 1, Exelon Generation Company, LLC (EGC) requested an amendment to Technical Specification (TS) 3.7.8, "Essential Service Water (SX) System," of Renewed Facility Operating License No. NPF-77 for Braidwood Station Unit 2. The proposed amendment would modify TS 3.7.8 by adding a new Required Action A.2 that increases the Completion Time (CT) currently specified in Required Action A.1, "Restore unit-specific SX train to OPERABLE status," from 72 hours to 200 hours. This proposed change is a one-time change to support a planned 2A SX pump repair scheduled to be performed before January 23, 2017. The U. S. Nuclear Regulatory Commission (NRC) requested additional information related to its review of Reference 1 in Reference 2. Attachment 1 provides the requested information.

EGC has reviewed the information supporting a finding of no significant hazards consideration that was previously provided to the NRC in Attachment 1 of Reference 1. The additional information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration.

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), a copy of this letter and its attachments are being provided to the designated State of Illinois official.

There are no regulatory commitments contained in this letter.

Should you have any questions concerning this letter, please contact J. A. Bauer at (630) 657-2804.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 26th day of October 2016.

Respectfully,

David M. Gullott
Manager – Licensing
Exelon Generation Company, LLC

Attachments:
1. Responses to Request for Additional Information
2. Revised Technical Specification Pages for Braidwood Station
3. Revised Technical Specification Bases Pages for Braidwood Station (For Information Only)

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

ATTACHMENT 1

In Reference 1, Exelon Generation Company, LLC (EGC) requested an amendment to Technical Specification (TS) 3.7.8, "Essential Service Water (SX) System," of Renewed Facility Operating License No. NPF-77 for Braidwood Station Unit 2. The proposed amendment would modify TS 3.7.8 by adding a new Required Action A.2 that increases the Completion Time (CT) currently specified in Required Action A.1, "Restore unit-specific SX train to OPERABLE status," from 72 hours to 200 hours. This proposed change is a one-time change to support a planned 2A SX pump repair scheduled to be performed prior to January 23, 2017. The U. S. Nuclear Regulatory Commission (NRC) requested additional information related to its review of Reference 1 in Reference 2. The below information provides the requested information.

NRC RAIs

Regulatory Basis:

The guidelines of Regulatory Guide 1.177, "An Approach for Plant-Specific, Risk-Informed Decision making: Technical Specifications," Revision 1, dated May 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML100910008), state that the NRC staff desires to base its decisions on proposed Technical Specification changes from the results of traditional engineering evaluations, supported by insights (derived from the use of PRA methods) about the risk significance of the proposed changes. Decisions are expected to be reached in an integrated fashion, considering traditional engineering and risk information. One of the traditional engineering considerations is evaluating defense in depth. Defense in depth includes a reasonable balance in prevention of core damage, not having an over-reliance on programmatic activities, and having system redundancy and independence commensurate with the expected frequency of challenges to the system.

Braidwood was one of the sites with applicability to Generic Issue 130 and the corresponding Generic Letter 91-13 as noted in the September 30, 2016, submittal. The submittal did not address redundancy of the emergency service water system (SX) and prevention of core damage for the risk of an extended Loss of Offsite Power and failure of the 2B Emergency Diesel Generator (EDG). A fire in the Unit 2 Engineered Safety Feature (ESF) switchgear could also affect similar equipment losses. Loss of the 2B EDG with a LOOP would cause the immediate loss of SX to unit 2 and threaten loss of the 2A EDG due to lack of SX.

NRC RAI 1

The licensee is requested to supplement the application by addressing the scenario of an extended LOOP with failure of the 2B EDG. Include in your response as a minimum:

a) *All operator actions and response times needed,*
b) *How primary plant pressure and inventory will be controlled considering available electrical power and cooling to charging pumps and available cooling to letdown and the effect on 2A EDG,*
c) *How feed water is supplied to the steam generators considering available power and cooling to auxiliary feed water pumps,*
d) *RCP seal injection/cooling,*
e) *Available clean water inventory for SG feed for an extended LOOP, Discuss SG feed sources for LOOP that extends several days and/or the ability to use RHR for shutdown cooling.*
f) *How containment cooling is achieved*

g) *Are there analysis/calculations in place that demonstrate that the required SX flow from the unit crosstie can meet the SX needs of both units for the above scenario? Explain.*
h) *Are there procedures in place to mitigate the above described scenario? Explain.*

EGC Response:

Braidwood Station currently has Abnormal Operating Procedures (AOPs) that the plant staff uses to respond to a complete loss of SX on one unit. These AOPs utilize the SX System's redundancy and the cross-tie capability between the two units as described in Section 3.0 of Reference 1. The AOPs use the second (i.e., standby) 100% capacity SX pump from the opposite unit to provide the required SX flow to the unit that lost the capability of both SX pumps.

The proposed scenario (i.e., a LOOP event with single failure of the 2B EDG while in a TS Action Statement for the 2A SX pump) is outside the Braidwood Station Licensing Basis. Consistent with NRC Generic Letter (GL) 80-30, "Clarification of the Term "Operable" as It Applies to Single Failure Criterion for Safety Systems Required by TS (Generic Letter 80-30)," TS allow a temporary relaxation of the single failure criterion such that a single failure of a component need not be assumed during a design basis event while in a TS Required Action statement for a different component. However, as a prudent measure consistent with NRC Generic Letter 91-13, Braidwood has previously implemented the AOPs for a loss of SX on one unit that addresses this scenario. The details of the AOPs are provided below.

Note: there are no additions, deletions, or changes to these AOPs to support response to a loss of Unit 2 SX during the extended 2A SX train CT.

EGC Response to RAI-1a:

Operators enter 2BwEP-0, "Reactor Trip or Safety Injection Unit 2," to confirm automatic actions have occurred in response to the Unit 2 reactor trip following the Unit 2 LOOP.

Upon completion of 2BwEP-0 immediate actions, operators enter 2BwOA PRI-8, "Essential Service Water Malfunction Unit 2," due to the loss of Unit 2 SX flow, cued by annunciator 2-2-A2, SX PUMP DSCH HDR PRESS LOW. 2BwOA PRI-8 directs starting the standby Unit 1 SX pump and opening the 1SX005 and 2SX005 motor operated valves to supply Unit 2 SX loads from Unit 1 SX pumps. These actions are performed from the Main Control Room. Simulator training and recent simulator demonstrations have shown that SX crosstie between units is performed well within 5 minutes of the loss of SX to one unit. These actions will be pre-briefed to the operating crews during the extended CT.

The Braidwood Station UFSAR states that a lack of SX flow at the time an EDG starts will not prevent accomplishment of its safety function and that the EDGs were specified and designed to operate for 5 minutes without a supply of cooling water. In addition, an Engineering Evaluation has demonstrated the EDGs could operate for up to 22 minutes with a loss of SX flow to the engine cooler. Therefore, a Unit 2 EDG will be available to power its divisional loads during the SX cross-tie to Unit 1.

Under a LOOP scenario without a reactor trip, the operators would be provided guidance in accordance with 2BwOA ELEC-4, "Loss of Offsite Power, Unit 2," 2BwOA ELEC-3, "Loss of 4kV

Bus, Unit 2," and 2BwOA PRI-8. These procedures provide the necessary direction to respond to this event and complete the actions to crosstie SX to Unit 1.

EGC Response to RAI-1b:

Once the 2A EDG automatically starts and energizes ESF bus 241 within 10 seconds of the LOOP, bus 241 remains energized throughout the event. Two sets of pressurizer heaters and both pressurizer power operated relief valves (PORVs) and auxiliary spray remain available to control RCS pressure. Non-ESF bus 243 would be cross-tied with ESF bus 241 to provide power to the 2A and 2D pressurizer heaters.

The 2A Chemical and Volume Control System (CV) pump automatically starts following the LOOP and maintains RCS inventory in conjunction with CV letdown. The 2A Component Cooling System (CC) pump automatically starts following the LOOP to provide cooling to letdown flow. An Engineering Evaluation has demonstrated both the CV and CC systems could operate satisfactorily for at least 10 minutes with a loss of SX flow. Unit 2 SX flow can be restored from Unit 1 within this time period as described in the response to RAI-1a above.

EGC Response to RAI-1c:

The 2B Auxiliary Feedwater System (AF) pump provides feedwater flow to the steam generators. The 2B AF pump is a direct drive diesel engine equipped with an essential service water booster pump to provide cooling water for jacket water, lubrication oil, and room cooling in the event of a loss of both the 2A and 2B SX pumps (i.e., loss of SX on Unit 2). An Engineering Evaluation has shown that the 2B AF pump is capable of operating, with no AC power sources, for 2 hours with only its SX booster pump providing cooling flow (i.e., loss of SX flow). Unit 2 SX flow can be restored from Unit 1 well within this time period as described in the response to RAI-1a above.

EGC Response to RAI-1d:

The 2A CV pump provides reactor coolant pump (RCP) seal injection flow immediately when automatically started following the LOOP. The 2A CC pump provides RCP thermal barrier cooling immediately upon its automatic start following the LOOP. Therefore, the plant design will restore RCP seal injection and thermal barrier cooling soon after the LOOP event. An Engineering Evaluation has demonstrated both the CV and CC systems could operate satisfactorily for at least 10 minutes with a loss of SX flow. In the event that Unit 2 RCPs experience an extended loss of seal cooling, the pumps are designed with a seal assembly (i.e., shutdown seal (SDS)) with a ring that constricts around the No. 1 seal sleeve. This controls the shaft seal leakage and limits the loss of reactor coolant inventory through the seal package. Note that a normal LOOP is not expected to cause elevated seal temperatures which would actuate the SDS.

EGC Response to RAI-1e:

The Condensate Storage Tank (CST) provides a clean water inventory to perform RCS cooldown utilizing the AF system and the steam generator (SG) PORVs. The AF system and SG PORVs cool down the RCS to the Residual Heat Removal System (RH) shutdown cooling conditions (i.e., RCS temperature < 350°F, RCS pressure < 360 psig). RCS cooldown is initiated within 2 hours of CST level lowering to 70% during an RCS cooldown using the SG PORVs to ensure sufficient secondary inventory. Once the SX cross-tie to Unit 1 has been

established, the RH, CC, and SX systems remain available to support RH operation in the shutdown cooling mode.

EGC Response to RAI-1f:

Containment is cooled by the reactor containment fan coolers (RCFCs). One train of RCFCs (i.e., two fan coolers) will be capable of removing containment heat once the Unit 1 SX cross-tie is established in the first few minutes of the event as discussed in the response to RAI-1a. A Byron/Braidwood calculation addressing Station Blackout demonstrated that the containment parameters will remain below the EQ limits with a complete loss of SX cooling to the RCFCs for four hours. Although this analysis was performed pre-Power Uprate and pre-MUR Uprate, a postulated loss of SX event on Unit 2 would be significantly shorter than 4 hours; therefore, by engineering judgment, the results of the pre-Power Uprate analysis bound the loss of SX scenario.

EGC Response to RAI-1g:

Design analyses exist that demonstrate the SX system capability. The SX system for each unit consists of two separate and independent trains with 100% capacity to satisfy the normal or post-accident requirements associated with the unit. Typically, one 100% capacity SX pump in each unit operates to cool the unit's loads with the unit cross-tie valve closed. The scenario described requires one opposite unit SX train to be cross-tied to Unit 2 while the other Unit 1 SX train simultaneously supports normal Unit 1 operation. As described in UFSAR Section 9.2.1.2, the crosstie flowpath along with the opposite unit SX pump are capable of providing backup cooling in the event of a loss of all SX on one unit. As soon as the crosstie has been completed, the Unit 1 SX system supplies all required SX loads as identified in UFSAR Table 9.2-1 for Unit 1 and Unit 2.

EGC Response to RAI-1h:

The procedures for operator response to mitigate the loss of SX on Unit 2 are as follows:

2BwEP-0	"Reactor Trip or Safety Injection Unit 2." Confirms expected automatic actions have occurred following reactor trip. Directs entry to 2BwOA ELEC-3 to restore bus 242 from bus 142.
BwAR 2-2-A2	"SX PUMP DSCH HDR PRESS LOW." Cues 2BwOA PRI-8 entry.
2BwOA PRI-8	"Essential Service Water Malfunction Unit 2." Directs cooling U-2 SX loads using U-1 SX pumps.
2BwOA ELEC-3	"Loss of 4KV ESF Bus Unit 2." Directs restoring bus 242 from bus 142.
2BwOA ELEC-4	"Loss of Offsite Power, Unit 2." Provides actions to stabilize the plant following a loss of offsite power when a Safety Injection has not occurred.
2BwEP ES-0.1	"Reactor Trip Response." Directs initial control of reactivity, RCS inventory and pressure, secondary heat sink, and AC busses. Secures unnecessary plant equipment.

2BwEP ES-0.2 "Natural Circulation Cooldown Unit 2." Performs plant cooldown to mode 5 while controlling RCS temperature and pressure and core reactivity.

NRC RAI 2

Describe actions being taken during the extended allowed outage time to minimize the possibility of strainer fouling similar to that described in Licensee Event Report 2008-001-00, "2A Essential Service Water Train Inoperable due to Strainer Fouling from Bryozoa Deposition and Growth," dated December 8, 2008 (ADAMS Accession No. ML083450328). If no actions are necessary, explain why not.

EGC Response to RAI-2:

Following the 2008 event referenced above, Braidwood Station took action to reduce the likelihood and impact of future bryozoan events. The actions included design modifications to upgrade the SX strainer components to safety related and seismic category 1 (including ESF power), and implementing a Braidwood Lake Macrobiological Strategic Plan (i.e. CY-BR-120-4130). This program limits the macrobiological challenges at Braidwood Lake through monitoring and documenting the biological conditions in the lake, and taking intervention and mitigation actions prior to a significant impact on operation of the plant.

The Braidwood Lake Macrobiological Strategic Plan documents the behavior and growth patterns of the bryozoa species in Braidwood Lake. The bryozoan colonies found in Braidwood Lake grow in the summer months when the lake temperature is warm. Most bryozoan will begin to die in the Circulating Water (CW) forebays when water temperature decreases below 50-60°F. Bryozoan growth declines after mid-October and essentially stops and disintegrates over the winter.

Fundamental to the strategic plan are periodic CW forebay inspections and cleaning. The SX pumps take suction from the Ultimate Heat Sink via the CW forebay. The strategic plan requires that CW forebay inspection and cleaning be performed in the September/October timeframe. The forebay inspections are performed by divers who examine the forebay floor, walls and equipment, documenting the amount of sediment and macrobiological growth (including bryozoan). If the thickness of the bryozoan is 2" or greater, the forebay is cleaned in all the areas where accumulation is found. If less than 2" of bryozoan identified, the results are evaluated by Engineering to determine if cleaning is warranted and additional inspections are necessary. The most recent forebay inspections conducted in September / October 2016 on the Unit 1 A, B, and C forebays have identified less than 2" of bryozoan.

Based on the water temperature behavior of the bryozoan species and the recent inspection data, there is minimal risk of SX strainer fouling during the 2A SX pump repair window. No additional actions are necessary.

Regulatory Basis:

Another feature of defense in depth is avoiding over reliance on programmatic activities. The Braidwood fire PRA identified an ICCDP greater than 1.0E-06, but less than 1.0E-05, which may be deemed acceptable with effective compensatory measures implemented to reduce the sources of increased risk. Braidwood identified several compensatory actions to reduce the risk of fire leading to core damage. However, compensatory actions are considered programmatic.

NRC RAI 3

Discuss whether or not reliance on these compensatory actions pose an over reliance on programmatic activity.

EGC Response to RAI-3:

EGC describes compensatory actions to lessen the calculated increase in the core damage and large early release risk with the 2A SX pump out-of-service. EGC does not consider these actions an over-reliance on programmatic activities. The compensatory actions specified address elimination of elective maintenance, staff briefings, and plant walkdowns to ensure the plant configuration is consistent with the risk analysis. None of the compensatory actions are new or revised actions for the plant staff. These types of actions are not complex, controlled through plant procedures and programs, and are frequently performed. The fire related compensatory actions are focused on planned activities to prevent a fire event rather than emergent activities focused on mitigating a fire event; therefore, they are reliable and will be effectively executed.

NRC RAI 4

Clarify the applicability of the technical specification change by:

a. *Providing an expiration date for the proposed change.*
b. *Providing a discussion of whether or not repeated entry would be possible and if a cumulative limit for time in the condition should be identified.*

EGC Response to RAI-4:

EGC has modified the requested TS Note to indicate an expiration date of the proposed change and associated work. The modified TS page is included in Attachment 2. The TS Bases pages have been revised accordingly.

Because the proposed CT extension is a one-time change, there will be no repeated entry into the Required Action associated with the proposed CT extension. When the 2A SX train is declared inoperable in support of the 2A SX pump repair described in Reference 1 (RS-16-197) it will remain inoperable until the pump is repaired, tested and the 2A SX train is declared operable. Once the 2A SX train is declared operable, the proposed Note for Required Action A.1 and Required Action A.2 will no longer be applicable. This one-time entry is stated in the TS Notes as modified in Attachment 2.

NRC RAI 5

Provide a discussion/justification for categorizing the compensatory measures as regulatory commitments as opposed to a license condition or incorporating the compensatory measures into a TS requirement.

EGC Response to RAI-5:

Based on a teleconference between EGC and NRC on October 21, 2016, the compensatory measures included as Regulatory Commitments in Attachment 4 of Reference 1 have been

incorporated by reference in the revised TS pages included in Attachment 2, and are listed in the revised Bases pages included in Attachment 3. Please note that a typographical error was identified in compensatory measures detailed in Attachment 1 of Reference 1. The last bulleted item of compensatory measure No. 10 referred to Vital Instrument Buses 111 and 114. The correct instrument buses are 211 and 214. This error has been corrected in the compensatory measures listed in the TS Bases (as shown in Attachment 3) that will be referenced by the operators and used during the operating crew shift briefings.

Regulatory Basis:

NUREG-1764, "Guidance for the Review of Changes to Human Actions," (ADAMS Accession No. ML072640413) provides guidance for determining the level of human factors engineering review for human actions. In its initial review of the September 30, 2016, submittal, the NRC has made an initial determination that a Level-II review is appropriate. Based on this initial determination, the following additional information is needed to complete the review.

NRC RAI-6

Clarification of Operator Actions

a. *Identify any operator manual actions that will be added, deleted, or changed to support the proposed license amendment.*
b. *What cues are provided to personnel that manual action(s) is/are required?*
c. *What cues are provided to personnel that the proposed action(s) is/are no longer required?*
d. *What administrative controls exist to assure that, when the action(s) is/are no longer required, the plant configuration is put in the correct configuration for the plant status?*

EGC Response to RAI-6a:

The existing operating procedures and training include steps to support the operator actions necessary during the extended 2A SX CT. The PRA analysis supporting the extended CT does not credit or rely on new or modified operator actions beyond those actions contained in the existing procedures. There are no additions, deletions or changes to required operator actions since the existing procedures are not impacted by the extension of the CT. Consistent with the teleconference between EGC and NRC on October 21, 2016, since there are no changes to the operator actions, no response to 6.b, 6.c and 6.d is required.

NRC RAI-7

Staffing - Describe any changes to staffing or qualification needed to support the proposed license amendment, including compensatory measures identified in the submittal and mitigating actions required to address the scenario in RAI 1, above, including actions to use an opposite unit SX train to supply water.

EGC Response to RAI-7:

For the reasons described in the responses above (i.e., no changes required to existing procedures), there are no changes to staffing or personnel qualifications needed to support the proposed license amendment or associated compensatory actions.

NRC RAI-8

Procedures

a. *Please describe any changes to operating procedures needed to support the proposed license amendment, including compensatory measures identified in the submittal and mitigating actions required to address the scenario in RAI 1, above, including actions to use an opposite unit SX train to supply water.*

b. *If the Emergency Operating Procedures are affected, describe any changes that were required of the Control Room task analysis that was done as part of your Detailed Control Room Design Review. If no update to the task analysis was necessary, describe how task requirements to support the proposed amendment were developed.*

EGC Response to RAI-8:

As described in the responses above, there are no changes to operating procedures needed to support the proposed license amendment, including the associated compensatory and mitigating actions. No Emergency Operating Procedure changes were needed to support this proposed amendment.

NRC RAI-9

Human Action Verification

a. *Describe the process used to verify and validate the ability of your operators to accomplish the tasks required for the proposed LAR, including compensatory measures identified in the submittal and mitigating actions required to address the scenario in RAI 1, above, including actions to use an opposite unit SX train to supply water. In lieu of a description, you may provide the relevant administrative procedure(s) for verification and validation. Did the Validation include a representative sample of operators, and was it done with Technical Specification (TS) minimum staffing and nominal staffing?*

b. *What has been or will be done to assure that any new or changed human actions can be done within the time limits of the relevant scenario(s)? Include in your discussion the mitigating actions required to address the scenario in RAI 1, above, including actions to use an opposite unit SX train to supply water.*

EGC Response to RAI-9a:

The Braidwood License Operator Requalification Training (LORT) program is required to provide simulator training on the loss of SX every two years for all licensed operators. For example, Simulator Exercise Guide 1641, which includes the mitigating action of performing the cross-tie of SX to the opposite unit, was most recently trained in cycle 16-4 with all licensed operators between the dates of 06/14/16 and 07/15/16.

EGC Response to RAI-9b:

As described above, there are no new or changed human actions associated with the proposed license amendment, including the associated compensatory and mitigating actions.

NRC RAI-10

Training - Describe any changes to training and the simulator needed to support the proposed license amendment, including the compensatory measures identified in the submittal and mitigating actions required to address the scenario in RAI 1, above, including actions to use an opposite unit SX train to supply water.

EGC Response to RAI-10:

For the reasons described in the responses above, there are no required changes to training or the simulator needed to support the proposed license amendment including the associated compensatory and mitigating actions.

NRC RAI-11

Regulatory Basis:

NUREG-1764, Section 2.5, allows the NRC staff to add selected Level-I review criteria to a Level-II review, rather than elevating the entire review to Level-II. The NRC staff has determined that an operating experience review should be conducted because some of the manual actions presented are infrequently performed, are potentially risk important, and have the potential to affect the other unit. If there are likely errors identified in an operating experience review, reasonable preventative measures and/or mitigating measures should be taken.

Operating Experience – Provide the results of an operating experience review, including plant-specific condition reports, Licensee Event Reports, INPO reports, and other relevant sources. Include a brief description of any preventative or mitigating actions that are planned to minimize the effects of errors identified in the OER.

EGC Response to RAI-11:

An Operating Experience Review (OER) has been conducted, including a search of information from the Institute for Nuclear Power Operations (INPO), the INPO Consolidated Event System (ICES), event notifications, and internal EGC records. The OER searched relevant Operating Experience (OE) for SX system performance, SX pump repair, and the proposed compensatory actions. Experience from prior SX pump repairs has been incorporated into the maintenance planning and activities. Related to the scenario in RAI-1, the OER identified no OE specific to the actions identified in response to RAI-1. As stated in the response to RAI-3, the compensatory actions identified include an elimination of elective maintenance, staff briefings, and plant walkdowns. The compensatory actions are not complex, controlled through plant procedures and programs, and are frequently performed. As a result of the OER, no preventative or mitigating actions have been identified beyond those already identified as compensatory actions.

ATTACHMENT 1

REFERENCES

1. Letter from D. M. Gullott (Exelon Generation Company, LLC) to U. S. Nuclear Regulatory Commission, "License Amendment Request for a One-Time Extension of the Essential Service Water (SX) Train Completion Time to Support 2A SX Pump Repair," dated September 30, 2016 (ML16274A474)

2. Email from J. Wiebe (NRC) to J. Bauer (Exelon Generation Company, LLC) Initial RAIs Related to the Braidwood Unit 2 SX Pump allowed Outage time Amendment Request, dated October 20, 2016

ATTACHMENT 2

Proposed Technical Specification Pages for Braidwood Station

REVISED TS PAGES

3.7.8-1
3.7.8-2
3.7.8-3 (pagination change only)
3.7.8-4 (pagination change only)

3.7 PLANT SYSTEMS

3.7.8 Essential Service Water (SX) System

LCO 3.7.8 The following SX trains shall be OPERABLE:

a. Two unit-specific SX trains; and

b. One opposite-unit SX train for unit-specific support.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One unit-specific SX train inoperable.	----------NOTES---------- 1. Enter applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources-Operating," for Emergency Diesel Generator made inoperable by SX. 2. Enter applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops-MODE 4," for Residual Heat Removal loops made inoperable by SX. ----------	(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.1 --------NOTE-------- Not applicable to Unit 2 during repair of the 2A SX pump during the one-time Unit 2 planned SX System outage to be completed no later than January 23, 2017. ---------- Restore unit-specific SX train to OPERABLE status.	72 hours
	OR	
	A.2 --------NOTE-------- Applicable to Unit 2 during repair of the 2A SX pump during the one-time planned SX System outage to be completed no later than January 23, 2017. Allowance of the extended completion time is contingent on meeting the compensatory measures described in EGC submittal letter RS-16-197. ---------- Restore unit-specific SX train to OPERABLE status.	200 hours
B. Opposite-unit SX train inoperable.	B.1 Restore opposite-unit SX train to OPERABLE status.	7 days

(continued)

Deleted: ¶
72 hours

Deleted: A.1 --------NOTES--------¶
1. Enter applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources-

Deleted: Operating," for Emergency Diesel Generator made inoperable by SX.¶
¶
2. Enter applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops-MODE 4," for Residual Heat Removal loops made inoperable by SX.¶

Deleted: ----------¶
¶
Restore unit-specific SX train to OPERABLE status.

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.8.1	----------NOTE---------- Isolation of SX flow to individual components does not render the SX System inoperable. ---------- Verify each unit-specific SX manual, power operated, and automatic valve in the flow path servicing safety related equipment, that is not locked, sealed, or otherwise secured in position, is in the correct position.	In accordance with the Surveillance Frequency Control Program
SR 3.7.8.2	----------NOTE---------- Not required when opposite unit is in MODE 1, 2, 3, or 4. ---------- Operate the opposite-unit SX pump for ≥ 15 minutes.	In accordance with the Surveillance Frequency Control Program
SR 3.7.8.3	Cycle each opposite-unit SX crosstie valve that is not secured in the open position with power removed.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.7.8.4	Verify each unit-specific SX automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program
SR 3.7.8.5	Verify each unit-specific SX pump starts automatically on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program

ATTACHMENT 3

Proposed Technical Specification Bases Pages for Braidwood Station
(For Information Only)

(NOTE: Entire Section Included For Continuity)

RESIVED BASES PAGES

B3.7.8-1 (no change)
B3.7.8-2 (no change)
B3.7.8-3 (no change)
B3.7.8-4
B3.7.8-5
B3.7.8-6
B3.7.8-7
B3.7.8-8
B3.7.8-9 (page number change only)
B3.7.8-10 (page number change only)
B3.7.8-11

B 3.7 PLANT SYSTEMS

B 3.7.8 Essential Service Water (SX) System

BASES

BACKGROUND

The SX System provides a heat sink for the removal of process and operating heat from safety related components during a Design Basis Accident (DBA) or transient. During normal operation, and a normal shutdown, the SX System also provides this function for various safety related and nonsafety related components. The safety related function is covered by this LCO.

The unit-specific SX System consists of two separate, electrically independent, 100% capacity, safety related, cooling water trains. Each train consists of a 100% capacity pump, piping, valving, and instrumentation. The pumps and valves are remote and manually aligned, except in the unlikely event of a Loss Of Coolant Accident (LOCA). The pumps are automatically started upon receipt of a safety injection signal or an undervoltage on the ESF bus, and all essential valves are aligned to their post accident positions (Diesel Generator (DG) supply valves are opened once the DG has reached sufficient rpm). The SX System is the backup water supply to the Auxiliary Feedwater System.

The SX System includes provisions to crosstie the trains (unit-specific crosstie), as well as provisions to crosstie the units (opposite-unit crosstie). The opposite-unit crosstie valves (1SX005 and 2SX005) must both be open to accomplish the opposite-unit crosstie. The system is normally aligned with the unit-specific crosstie valves open and the opposite-unit crosstie valves closed.

Additional information about the design and operation of the SX System, along with a list of the components served, is presented in the UFSAR, Section 9.2.1 (Ref. 1). Some of the functions served by the SX System are the removal of decay heat from the reactor via the Component Cooling Water (CC) System, the removal of heat from containment via the reactor containment fan coolers, and cooling of the DGs.

BASES

APPLICABLE SAFETY ANALYSES

The design basis of the SX System is for one SX train, in conjunction with the CC System and a 100% capacity containment cooling system, to remove core decay heat following a design basis LOCA as discussed in the UFSAR, Section 6.2 (Ref. 2). This prevents the containment sump fluid from increasing in temperature during the recirculation phase following a LOCA and provides for a gradual reduction in the temperature of this fluid as it is supplied to the Reactor Coolant System by the Emergency Core Cooling System pumps. The SX System is designed to perform its function with a single failure of any active component, assuming the loss of offsite power.

The SX System, in conjunction with the CC System, also cools the unit from Residual Heat Removal (RHR) entry conditions, as discussed in the UFSAR, Section 5.4.7, (Ref. 3) to MODE 5 during normal and post accident operations. The time required for this evolution is a function of the number of CC and RHR System trains that are operating. One SX train is sufficient to remove decay heat during subsequent operations in MODES 5 and 6.

Generic Letter 91-13 (Ref. 4) included risk-based recommendations for enhancing the availability of SX Systems, in the case of a loss of all SX to a particular unit. Crediting the opposite-unit SX System with an opposite-unit pump and the opposite-unit crosstie valves, was a part of the response to this Generic Letter.

The unit-specific SX System satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii). The opposite-unit SX System satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

BASES

LCO

Two unit-specific SX trains are required to be OPERABLE to provide the required redundancy to ensure that the system functions to remove post accident heat loads, assuming that the worst case single active failure occurs coincident with the loss of offsite power.

A unit-specific SX train is considered OPERABLE during MODES 1, 2, 3, and 4 when:

a. The pump is OPERABLE; and

b. The associated piping, valves, and instrumentation and controls required to perform the safety related function are OPERABLE.

An opposite-unit SX train is considered OPERABLE during MODES 1, 2, 3, and 4 when:

a. An opposite-unit pump is capable of performing its required unit-specific function (manually start and supply SX to the flow path);

b. A flow path from the opposite unit is established, or capable of being established (including the opposite-unit crosstie valves 1SX005 and 2SX005); and

c. The associated piping, valves, and instrumentation and controls are capable of performing the crosstie function.

BASES

APPLICABILITY

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

While a specific unit is in MODES 1, 2, 3, or 4, the opposite-unit SX System must be available (independent of the opposite unit's MODE or condition) for unit-specific support. This minimizes the risk associated with loss of all unit-specific SX.

In MODES 5 and 6 the OPERABILITY requirements of the unit-specific SX System are determined by the systems it supports and there are no opposite-unit SX System requirements.

ACTIONS

A.1 and A.2

If one unit-specific SX train is inoperable, action must be taken to restore OPERABLE status. In this Condition, the remaining OPERABLE SX train is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure in the OPERABLE SX train could result in loss of the SX System function in the short term.

Deleted: within 72 hours

Deleted: The 72 hour Completion Time is based on the redundant capabilities afforded by the OPERABLE train, and the low probability of a DBA occurring during this time period.¶

Required Action A.1 requires restoring the unit-specific SX train to OPERABLE status within 72 hours. The 72 hour Completion Time is based on the redundant capabilities afforded by the OPERABLE train, and the low probability of a DBA occurring during this time period. Required Action A.1 is modified by a Note that indicates that this Required Action is not applicable to Unit 2 during the repair of the 2A SX pump during the one-time Unit 2 planned SX System outage to be completed no later than January 23, 2017.

Required Action A.2 requires restoring the unit-specific SX train to OPERABLE status within 200 hours. Required Action A.2 is modified by a Note that indicates that this Required Action is applicable to Unit 2 during repair of the 2A SX pump during the one-time planned SX System outage to be completed no later than January 23, 2017. Additionally, the note indicates that allowance of the extended completion time is contingent on meeting the compensatory measures described in EGC submittal letter RS-16-197 (Reference 5). This Completion Time is based upon a risk-informed assessment that concludes that the associated risk with the units in the specified configuration is acceptable.

BASES

ACTIONS (continued)

The compensatory measures described in RS-16-197 are as follows:

1. There will be no elective maintenance work on the remaining SX pumps, (1A, 1B, 2B) during the 2A SX extended CT. Additionally, this equipment will be protected for this one-time outage. This supports the maintenance assumptions in the risk analysis.

2. There will be no elective maintenance work on the emergency diesel generators (1A, 1B, 2A, 2B) during the 2A SX extended CT. Additionally, this equipment will be protected for this one-time outage. This supports the maintenance assumptions in the risk analysis and also supports mitigation of a loss of offsite power during the maintenance window.

3. There will be no elective maintenance work on the Unit 2 auxiliary feed pumps (2A, 2B). This equipment will be protected for the one-time outage. This supports the maintenance assumptions in the risk analysis.

4. There will be no elective maintenance on the 1/2SX16A/B (i.e., RCFC SX inlet valves) and 1/2SX27A/B (RCFC SX outlet valves) due to interlocks that could prevent use of the remaining SX pumps. This supports the maintenance assumptions in the risk analysis.

5. There will be no elective maintenance on the 211, 212, 213, or 214 instrument busses or their associated inverters and transformers. Additionally, this equipment will be protected for the one-time outage. This supports the maintenance assumptions in the risk analysis.

6. There will be no elective maintenance on the startup feedwater pump, 2FW02P.

7. There will be no elective maintenance activities on the Unit 2 Station Auxiliary Transformers.

8. The extended weather forecast will be examined to ensure severe weather conditions are not predicted prior to entry into the CT. In the event of an unforeseen severe weather condition due to rapidly changing conditions, such as severe high winds, a briefing with crew operators will be performed to reinforce operator actions and responses in the event of a loss of offsite

BASES

ACTIONS (continued)

power.

9. Fire Risk Management Actions (RMAs) applicable for the 2A SX pump will be completed per OP-AA-201-012-1001 "OPERATIONS ON-LINE FIRE RISK MANAGEMENT" (these actions protect against fire impacting key redundant equipment).

10. Operations will hold briefings on the following actions:

    - On a loss of all Reactor Coolant Pump (RCP) seal cooling, Operations trips RCPs in time to prevent damage to the Shutdown Seals relied on for extended loss of seal cooling events.
    - On a post-trip loss of AF, Operations initiates flow from either the motor-driven feedwater pump (2FW01PA) or the startup feedwater pump (2FW02P) to at least one SG prior to reaching dry SG conditions.
    - Operators manually throttle 0/2SX007 valves when the Residual Heat Removal (RHR) heat exchangers are used for ECCS recirculation.
    - On a loss of Unit 2 SX, Operations opens the 1/2SX005 valve(s) to crosstie SX between the units.
    - Operations refills the diesel-driven AF day tank from the 125K Fuel Oil Storage Tank in order to maintain operation of the diesel-driven AF pump.
    - On loss of Vital Instrument Bus (120 VAC) 211 or 214, Operations opens the AF flow control valves 2AF005A-D ("A" train) or 2AF005E-H ("B" train) by locally failing air to the valve operators, then Operations throttles 2AF013A-D ("A" train) or 2AF013E-H ("B" train) from the Main Control Room (MCR) to control SG levels.

11. Prior to entering the TS 3.7.8 Action Statement for repair of the 2A SX pump, an operating crew shift briefing and pre-job walkdowns will be conducted to reduce and manage transient combustibles and to alert the staff about the increased sensitivity to fires in the following fire zones during the extended 2A SX outage window. Operating crew shift briefings will continue to be conducted every shift throughout the duration of the CT period. Additionally, planned hot

BASES

ACTIONS (continued)

work activities in the following fire zones will be prohibited during the time within the extended 2A SX CT. In the event of an emergent issue requiring hot work in one of the listed zones, additional compensatory actions will be developed to minimize the risk of fire. The listed fire zones were identified based on risk significance in the FPRA results (generally zones with Division 2 equipment that impact SX). (The purpose of these walkdowns is to reduce the likelihood of fires in these zones by limiting transient combustibles, ensuring transients, if required to be present, are located away from fixed ignition sources and eliminating or isolating potential transient ignition sources, e.g., energized temporary equipment and associated cables).

Fire Zone(1)	Fire Zone Description
5.1-2	Division 22 ESF Switchgear Room
5.1-1	Division 12 ESF Switchgear Room
3.2-0	Auxiliary Building El. 439'-0"
11.4-0	Auxiliary Building General Area, El. 383'
11.6-2	Division 22 Containment Electrical Penetration Area, El. 426'
11.2C-2	Containment Spray Pump 2B Room
11.1B-0	Unit 2 Auxiliary Building Basement El. 330'
18.10D-2	Unit Auxiliary Transformer 241-2
18.10E-2	System Auxiliary Transformers 242-1/242-2

(1) For larger fire zones walkdowns may be focused on specific fire sensitive areas within the larger firezones'. Walkdowns are judged as not being required for areas with continuous operator occupation (e.g. MCR). Fire Risk Management Actions (RMAs) where they occur may address the need for walkdowns in some of these areas. ALARA principles apply when reviewing radiological areas such as RHR.

BASES

ACTIONS (continued)

Required Actions A.1 and A.2 have been modified by two Notes. The first Note indicates that the applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources-Operating," should be entered if an inoperable SX train results in an inoperable emergency diesel generator. The second Note indicates that the applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops-MODE 4," should be entered if an inoperable SX train results in an inoperable decay heat removal train. These are exceptions to LCO 3.0.6 and ensure the proper actions are taken for these components.

Deleted: is

B.1

If the opposite-unit SX train is not OPERABLE for unit-specific support, action must be taken to restore OPERABLE status within 7 days. In this Condition, if a complete loss of unit-specific SX were to occur, the SX System function would be lost. The 7 day Completion Time is based on the capabilities of the unit-specific SX System and the low probability of a DBA with a loss of all unit-specific SX occurring during this time period.

C.1 and C.2

If the unit-specific SX train or the opposite-unit SX train cannot be restored to OPERABLE status within the associated Completion Time, 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.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.8.1

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

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

This SR is modified by a Note indicating isolation of the SX components does not affect the OPERABILITY of the SX System. Isolation of components may render those components inoperable.

SR 3.7.8.2

This SR verifies that the opposite-unit SX pump can be run for ≥ 15 minutes. This SR does not require the opposite-unit pump to supply SX to the specific unit. SR 3.7.8.2 is modified by a note that only requires this surveillance to be performed when the opposite unit is in MODE 5 or 6 or has no fuel in the reactor vessel. If the opposite unit is in MODE 1, 2, 3, or 4, its SX System is normally operating. If the opposite unit is shut down, the credited SX pump may not be operating. Therefore, the Note requires the surveillance to be performed. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.8.3

This SR verifies proper operation of the opposite-unit SX crosstie valves (1SX005 and 2SX005). This Surveillance is not required if the opposite-unit SX crosstie valve is secured in the open position with power removed. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.7.8.4

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

SR 3.7.8.5

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

BASES

REFERENCES

1. UFSAR, Section 9.2.1.

2. UFSAR, Section 6.2.

3. UFSAR, Section 5.4.7.

4. Generic Letter 91-13.

5. RS-16-197, "License Amendment Request for One-Time Extension of the Essential Service Water (SX) Train Completion Time to Support 2A SX Pump Repair," dated September 30, 2016.