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10 CFR 50.90
10 CFR 50.59(c)(2)(ii)

January 31, 2012

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

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

Byron Station, Units 1 and 2
Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

Subject: License Amendment Request for the use of an Auxiliary Feedwater Cross-tie Between Units

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 an amendment to Facility Operating License Nos. NPF-72 and NPF-77 for Braidwood Station, Units 1 and 2, and Facility Operating License Nos. NPF-37 and NPF-66 for Byron Station, Units 1 and 2. The proposed change would revise the Updated Final Safety Analysis Report (UFSAR) to describe the use of an Auxiliary Feedwater (AF) cross-tie. Associated Technical Specification (TS) Bases changes are included for information. Specifically, this change adds information to the UFSAR and the TS 3.7.5, "AF System" Bases describing the design and shared operation of cross-tie piping between the discharges of the Unit 1 and Unit 2 Train A motor-driven AF pumps.

EGC is requesting this amendment in accordance with the provisions of 10 CFR 50.90 and 10 CFR 50.59, "Changes, tests and experiments," paragraph (c)(2)(ii). The operation and use of the AF Train A unit cross-tie results in more than a minimal increase in the likelihood of occurrence of a malfunction of a Structure, System or Component (SSC) that is important to safety, previously evaluated in the UFSAR. NRC approval is requested for the use of the cross-tie since this function for the AF system has not previously been licensed to meet 10 CFR 50, Appendix A, General Design Criterion 5, "Sharing of structures, systems, and components" as a shared system. This proposed use of the AF Train A unit cross-tie would improve safety and the emergency response procedures for a beyond design basis total loss of secondary heat sink by providing greater assurance of achieving Reactor Coolant System conditions that allow the Residual Heat Removal System to be used for shutdown cooling.

The attached request is subdivided as follows:

- Attachment 1 provides an evaluation of the proposed change
- Attachment 2 includes the marked-up UFSAR consistent with the proposed change
- Attachment 3 includes example actions for use of the cross-tie that are applicable to an emergency procedure for a total loss of secondary heat sink

- Attachment 4 includes the marked-up TS Bases changes for both Braidwood and Byron Stations, respectively, for information only. These TS Bases changes will be made in accordance with the TS Bases Control Program following NRC approval.
- Attachment 5 includes a figure of the AF system

Approval of this amendment application is requested by August 1, 2012. The compressed schedule for approval is requested based upon the improvements to safety and reduced baseline probabilistic risk for station operation provided by the AF Train A unit cross-tie. NRC approval will allow the use of the cross-tie to be included in plant procedures and incorporated into operator training programs. Approval eliminates the need to exit procedures and plant licensing basis under the provisions of 10 CFR 50.54(x) in order to utilize the benefits of the cross-tie. Once approved, the amendment will be implemented within 30 days.

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

EGC is notifying the State of Illinois of this application for a change to the UFSAR by sending a copy of this letter and its attachments to the designated State Official in accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b).

There are no regulatory commitments contained within this letter. Should you have any questions concerning this letter, please contact Richard McIntosh at (630) 657-2816.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 31[th] day of January 2012.

Respectfully,

David M. Gullott
Manager - Licensing

Attachments:

1. Evaluation of Proposed Change
2. Markup / Annotated Pages of UFSAR
3. Actions on the Use of the Cross-tie in Response to a Total Loss of Secondary Heat Sink
4. TS Bases Changes (For Information)
5. Figure: Auxiliary Feedwater System

cc: NRC Regional Administrator, Region III
NRC Senior Resident Inspector, Braidwood Station
NRC Senior Resident Inspector, Byron Station
NRC Project Manager, NRR – Braidwood and Byron Stations
Illinois Emergency Management Agency – Division of Nuclear Safety

ATTACHMENT 1
Evaluation of Proposed Change

1.0 SUMMARY DESCRIPTION

This evaluation supports a request to amend Facility Operating License Nos. NPF-72 and NPF-77 for Braidwood Station, Units 1 and 2, and Facility Operating License Nos. NPF-37 and NPF-66 for Byron Station, Units 1 and 2.

The proposed change would revise the Updated Final Safety Analysis Report (UFSAR) to describe the use of an Auxiliary Feedwater (AF) cross-tie. Associated Technical Specification (TS) Bases changes are included for information. Specifically, this change adds information to the UFSAR and the TS 3.7.5, "AF System" Bases describing the design and shared operation of cross-tie piping between the discharges of the Unit 1 and Unit 2 Train A motor-driven AF pumps. Exelon Generation Company, LLC (EGC) is requesting this amendment in accordance with the provisions of 10 CFR 50.90 and 10 CFR 50.59(c)(2)(ii). NRC approval is required for the use of the AF Train A unit cross-tie since this function for the AF system has not previously been licensed to meet 10 CFR 50, Appendix A, General Design Criterion (GDC) 5, "Sharing of structures, systems, and components," as a shared system.

Approval of this amendment application is requested by August 1, 2012. The compressed schedule for approval is requested based upon the improvements to safety and reduced baseline probabilistic risk for station operation provided by the AF Train A unit cross-tie. NRC approval will allow the use of the cross-tie to be included in plant procedures and incorporated into operator training programs. Approval eliminates the need to exit procedures and plant licensing basis under the provisions of 10 CFR 50.54(x) in order to utilize the benefits of the cross-tie. Once approved, the amendment will be implemented within 30 days.

2.0 DETAILED DESCRIPTION

The AF Train A unit cross-tie piping and components were installed to improve safety and the emergency response procedures, by providing additional emergency beyond design basis operating flexibility that can help to maintain natural circulation and water level in the Steam Generators (SGs). The AF Train A unit cross-tie is normally isolated with two manual locked closed isolation valves. During the response to a beyond design basis loss of secondary heat sink, if the minimum AF flow to the SGs cannot be restored using the accident unit's dedicated AF trains, the AF Train A unit cross-tie may be placed into service. This requires the non-accident unit's AF Train A pump be started and the AF Train A unit cross-tie isolation valves to be locally unlocked and opened. This proposed use of the AF Train A unit cross-tie provides greater assurance of achieving Reactor Coolant System (RCS) conditions that allow the Residual Heat Removal (RH) system to be used for shutdown cooling.

Example actions that use the AF Train A unit cross-tie at Braidwood Station, Unit 1, are provided in Attachment 3 and are typical for both units at each station. A figure showing the AF system with the AF Train A unit cross-tie piping and components is provided in Attachment 5.

2.1 PROPOSED CHANGES TO THE UFSAR

Pages from the UFSAR showing the proposed markups are provided in Attachment 2.

1. UFSAR Section 3.1.2.1.5, Evaluation Against Criterion 5 – Sharing of structures, systems, and components, currently states:

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

An evaluation against GDC 5 is provided in UFSAR Section 3.1.2.1.5 that describes SSCs important to safety that are shared by the two units. The proposed change adds the following discussion to UFSAR Section 3.1.2.1.5 to reflect the capability to share the AF system between the two units:

> In the event of a beyond design basis loss of all Auxiliary Feedwater (AF) on one unit, AF may be provided by the other unit via the Train A unit cross-tie connection. When the Train A unit cross-tie is operated in support of the accident unit, the motor-driven AF pump would not be available to perform its UFSAR described design basis function for the non-accident unit. If necessary, an orderly shutdown and cooldown of the non-accident unit could be accomplished using the main feedwater (FW) system. The diesel driven AF pump on the non-accident unit must be confirmed operable prior to use of the AF Train A unit cross-tie. If required, the redundant diesel-driven AF pump could also support shutdown and cooldown of the non-accident unit if the non-safety related FW system is unavailable.

2. UFSAR Section 3.1.2.4.5, Evaluation Against Criterion 34 – Residual Heat Removal, currently states:

> "A system to remove residual heat shall be provided. The system safety function shall be to transfer fission product decay heat and other residual heat from the reactor core at a rate such that specified acceptable fuel design limits and the design conditions of the reactor coolant pressure boundary are not exceeded.
>
> Suitable redundancy in components and features, and suitable interconnections, leak detection, and isolation capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished assuming a single failure."

An evaluation against GDC 34 is provided in UFSAR Section 3.1.2.4.5. The proposed change adds the following discussion to UFSAR Section 3.1.2.4.5:

> The AF system automatically supplies feedwater to the steam generators (SGs) to remove decay heat from the Reactor Coolant System upon loss of normal feedwater supply. The AF system consists of a motor driven AF pump and diesel driven AF pump configured into two trains. Each pump provides 100% capacity to the SGs, as assumed in the accident analysis. One pump at full flow conditions is sufficient to remove decay heat and cool the unit to RH entry conditions. The AF system is capable of supplying, but does not normally supply, feedwater to the SGs during normal unit startup, shutdown, and hot standby conditions. The AF system is designed with suitable redundancy to offset the consequences of any single failure, with one exception during AF

Train A unit cross-tie use. A normally isolated cross-tie between the discharges of both units' AF Train A pumps is available for emergency response to a beyond design basis total loss of secondary heat sink on one unit. With the Train A unit cross-tie in use, the AF Train A is not available to the non-accident unit. The diesel driven AF pump on the non-accident unit must be confirmed operable prior to use of the AF Train A unit cross-tie. The Technical Specifications limit operation with one train of AF inoperable. Use of the Train A unit cross-tie results in a temporary relaxation of the single failure criterion for the non-accident unit, which, consistent with overall system reliability considerations, provides a limited time to support the accident unit emergency response, and return the AF Train A to an operable status. Otherwise, a plant shutdown is required.

2.2 ASSOCIATED CHANGES TO THE TS BASES SECTION 3.7.5, AF SYSTEM (FOR INFORMATION)

The associated TS Bases changes for Braidwood and Byron Stations, respectively, are provided in Attachment 4. These TS Bases changes are provided for information and the changes to the TS Bases will be made to implement the proposed UFSAR changes following NRC approval in accordance with the Braidwood and Byron Station TS Bases Control Programs. The markups of TS Bases pages in Attachment 4 show what the TS Bases currently state.

1. The proposed change adds the following additional information to the BACKGROUND of TS Bases Section 3.7.5:

    There is also an AF Train A unit cross-tie downstream of the motor driven AF pump at each unit that is normally isolated. Use of the AF Train A unit cross-tie, however, is incompatible with an OPERABLE motor driven AF pump on either unit and its use is limited to an emergency response for a beyond design basis event that involves a total loss of secondary heat sink.

2. The proposed change adds the following additional information to the LCO of TS Bases Section 3.7.5:

    The motor-driven AF pump is not OPERABLE if the AF Train A unit cross-tie is unisolated, (i.e., both isolation valves open). The use of the AF Train A unit cross-tie is for an emergency response to a total loss of secondary heat sink on the accident unit. Use of the AF Train A unit cross-tie results in a temporary relaxation of the single failure criterion for the non-accident unit, which, consistent with overall system reliability considerations, provides a limited time to support the emergency response on the accident unit, and return the AF Train A to an OPERABLE status. Otherwise, a plant shutdown is required. The diesel driven AF pump on the non-accident unit must be confirmed OPERABLE prior to use of the AF Train A unit cross-tie.

2.3 SYSTEM INFORMATION

The design basis safety function of the AF system is to remove decay heat and prevent core damage in the event of loss of normal feedwater or secondary side piping or component failure. During such transients, AF maintains SG water levels to ensure sufficient heat transfer area for removal of decay heat. AF also serves as a backup system for supplying feedwater to the secondary side of the SGs when the normal feedwater system is unavailable thus maintaining the heat sink capabilities of the SGs.

In Modes 1, 2, and 3, AF features are required to be operable to ensure that the SGs can remain the heat sink for the reactor. In Modes 4, 5, and 6, the SGs are not normally used for heat removal, and the AF system is not required.

The AF system is not used for normal startup and shutdown of the unit, or for normal operation. A simplified figure of the AF system is provided in Attachment 5.

Major components include two AF pumps (one electric motor-driven and one diesel driven); associated pump suction and discharge supply valves; and pump run-out protection orifices.

The AF system (for both Units 1 and 2) consists of a motor-driven AF pump and a diesel driven AF pump configured in two trains. Each pump provides 100 percent of the required AF capacity to the four SGs necessary to remove a conservative, core residual heat load, based on long-term operation at power. The pumps are equipped with recirculation lines to prevent pump operation against a closed system. The flow limiting orifices in each AF supply line to the SGs provide pump run out protection and minimum required flow to the unfaulted SGs in the event of a line break or faulted SG. The AF system employs no common valving or other common components capable of spurious mechanical motion.

The Train A motor-driven AF pump is powered from an independent Class 1E power supply. The Train B diesel driven AF pump is supported by a diesel engine, an independent battery system, an essential service water booster pump, and a fuel oil day tank. Thus, the requirement for diversity in motive power sources for the AF system are met.

The AF system pumps are started on either low-low SG level, a safety injection signal, or a loss of power to the reactor coolant pumps. The AF Train A also automatically starts on an undervoltage signal from the Division 1 ESF bus. The Anticipated Transient Without Scram (ATWS) Mitigation System trips the main turbine and initiates the AF system whenever three-out-of-four SG levels are greater than 3% below the Reactor Protection System (RPS) low-low-setpoint, and the Turbine Impulse pressure is greater than 30% of nominal full power.

There are two sources of cooling water for the AF system. The AF pumps normally take suction from the Condensate Storage Tank (CST) and pump flow to the SG secondary side via separate and independent connections to the feedwater piping outside containment. If the CST is not available, the Essential Service Water System (SX) serves as the credited safety related supply to the AF pumps.

The condensate storage facility consists of two tanks, with associated pumps and valves, to serve both Units 1 and 2. The tanks at Byron have a capacity of 500,000 gallons each. The tanks at Braidwood have a capacity of 650,000 gallons each. For both Byron and Braidwood, the CSTs have a TS minimum requirement of 212,000 gallons (useable volume), and are required to be operable in Modes 1, 2, and 3. This volume is sufficient to maintain the RCS in MODE 3 at normal operating pressure and temperature for 2 hours, followed by a cooldown to RH entry conditions at 50°F/hour, followed by a period not longer than one-hour to allow warmup of the RH pumps prior to placing the RH system into service in shutdown cooling mode.

When pressure in the supply line to the AF pumps is low and there is an actuation demand for AF, water supply to the pumps is automatically switched over to SX. At Byron, SX inventory for AF is obtained from the SX cooling tower basins. Normal makeup to the SX cooling tower basins is from the circulating water makeup pumps, while safety-related makeup is provided from two independent SX makeup pumps. A backup makeup water source is provided by two deep well pumps. The stored inventory of the SX cooling tower basins plus one of the sources of makeup water provides a sufficient supply of cooling water to support AF cooling. At Braidwood, the SX is provided by a cooling lake which provides an essentially unlimited backup AF supply. Thus, a backup supply of cooling water is available for both stations and a reasonable assurance that sufficient cooling water inventory exists.

2.4 CROSS-TIE INSTALLATION

The addition of the AF Train A unit cross-tie between the 1A and 2A AF trains provides a measurable benefit in improving nuclear safety at Byron and Braidwood stations. The ability to use the AF Train A unit cross-tie is an improvement in safety for the accident unit that experiences a beyond design basis event involving a total loss of secondary heat sink. This modification provides additional capability to supply feedwater to the SGs, and it may avoid relying heavily upon use of pressurizer power-operated relief valves (PORVs) and reactor head vents during a bleed and feed attempt to lower the pressure during such an emergency. This ensures the integrity of the RCS and reduces the impact of radiological consequences on the accident unit.

EGC installed the AF Train A unit cross-tie piping modifications in 2009 and 2010. The new piping modification provides the capability to tie the AF Train A pump discharge from one unit to the other unit, between two isolation valves. The AF Train A unit cross-tie piping is 6-inch diameter piping that is equivalent to the existing AF Train A pump discharge piping diameter. A simplified figure of the AF system is provided in Attachment 5. The AF Train A unit cross-tie line is located at the discharge of both unit's AF motor-driven pumps, 1AF01PA (Unit 1) and 2AF01PA (Unit 2), in the Auxiliary Building. The AF Train A unit cross-tie is normally isolated with the two manual closed and locked isolation valves 1AF036 (Unit 1) and 2AF036 (Unit 2). AF Train A unit cross-tie piping is also maintained filled and vented between these two manual isolation valves.

The new piping for the cross-tie was tested for leakage (VT-2) when the modifications were installed.

The AF Train A unit cross-tie can deliver water to the accident unit's SGs, and recirculation flow returns to the non-accident unit's CST through the non-accident unit's AF022A valve, or to the SX return header through the non-accident unit's AF024 valve, depending on the water source. The accident unit's AF Train A pump recirculation is isolated for AF Train A cross-tie operation. This arrangement ensures a recirculation flow path for any running AF pump on the non-accident unit.

The operation of the AF Train A cross-tie on the discharge of the AF Train A pump is not impacted from where the suction is coming, (i.e., either CST or SX). However, when the CST is used, the Emergency Operating Procedure (EOP) involving the AF Train A cross-tie will locally unlock and close the accident unit's AF pump recirculation isolation valve (AF009A) that flows back to the CST. The EOP will then also locally open CST crosstie valve 0CD117. The CST crosstie is an existing design feature that is consistent with current EOPs. Refer to Attachment 3, example steps 6.g and 6.h. These steps perform two important functions. Closing the accident unit AF009A valve will prevent an additional recirculation flow path of non-accident unit AF flow from returning to the accident unit CST. The non-accident AF pump is still protected with its own recirculation flowpath. Second, opening valve 0CD117 allows sharing of both the Unit 1 and Unit 2 CSTs. Opening the CST cross-tie isolation valve ensures the minimum required volume will remain available for the non-accident unit should it be required. The existing TS 3.7.6, "Condensate Storage Tank," will be applicable if CST level drops below a level that ensures the required usable volume of approximately 212,000 gallons in Modes 1, 2, and 3. If entry into TS LCO 3.7.6 is required, it will occur simultaneously for both units. The required action is to verify the operability of the backup water supply (SX) within 4 hours and restore the CST level within 7 days. If the CST is unavailable and SX must be relied upon as the suction source, the requirements of TS 3.7.9, "Ultimate Heat Sink," ensure a sufficient volume of water is available. In addition, the resultant increase in SX flow on the non-accident unit's SX pump due to the additional load of supplying the accident unit's AF pump (approximately 990 gpm) is within the capacity of an SX pump.

EGC evaluated this piping modification under 10 CFR 50.59 and installed the change without prior NRC approval. In June 2011, the operation of the AF Train A unit cross-tie was reviewed during an NRC inspection. The review concluded that the operation of the AF Train A unit cross-tie resulted in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system or component important to safety previously evaluated in the UFSAR. 10 CFR 50.59 requires, in part that for this type of change a license amendment is required. NRC Inspection Reports document a non-cited violation for the Braidwood and Byron Stations related to not receiving prior NRC approval, (References 2 and 3).

3.0 TECHNICAL EVALUATION

The availability of the AF Train A unit cross-tie is intended to help improve safety by restoring the normal secondary heat sink with a supply of water to the SGs. Without the cross-tie available, the EOPs direct operators to initiate bleed and feed to cope with the beyond design basis event involving the loss of secondary heat sink and a loss of heat transfer causing RCS temperature and pressure to rise. That bleed and feed strategy requires operators to initiate Safety Injection to inject into the RCS and then bleed reactor coolant out of the RCS by opening pressurizer Power-Operated Relief Valves (PORVs) or reactor head vents. The bleed and feed strategy essentially uses a controlled LOCA that introduce fission products into the Pressurizer Relief Tank or the containment atmosphere.

The AF Train A unit cross-tie can be initiated before more severe conditions develop in the RCS that necessitate a bleed and feed strategy, thereby reducing the potential for fuel damage. By utilizing the SGs per their design to transfer heat from the RCS to the secondary, non-contaminated system, the AF Train A unit cross-tie can re-fill the SGs, which will help maintain the integrity of SG tubing and the RCS, helping to keep fission products contained in RCS. Therefore, use of the AF Train A unit cross-tie allows for injection into the SGs, which protects the SG tubes from creep rupture, and scrubs fission products entering the SGs via tube leakage, while providing a heat sink for the RCS. Considering these safety improvements, the AF Train A unit cross-tie is evaluated to reduce the overall unit baseline core damage frequency.

Either of the two AF trains, supplying the four SGs, provides sufficient feedwater to cool the unit down safely to the temperature at which the RH system can be utilized for shutdown cooling. The events which impose safety-related performance requirements on the design of the AF system include the following: loss of main feedwater transient, secondary system pipe breaks, loss of all a-c power, loss-of-coolant accident (LOCA), and cooldown (after expected transients, accidents, and other scenarios).

Operation of the AF Train A unit cross-tie affects only the A Train associated with the motor-driven AF pumps. The AF Train A piping is safety related and seismically qualified. The redundant diesel-driven B Train flow path is not affected because none of the added piping and components of the AF Train A unit cross-tie are connected to the B Train of AF and appropriate physical separation is maintained to preclude any adverse interactions with the redundant AF train. In addition, added cross-tie piping and valves will not create any adverse interactions with any AF control devices nor are any new AF failure modes introduced. Failure of the AF Train A unit cross-tie piping during design basis accidents and transients does not impact the ability of the AF system to perform its function because the piping is isolated from the normal system flowpath.

The criteria for AF system design basis conditions (UFSAR Table 10.4-5) and the summary of assumptions used in AF system design verification analyses (UFSAR Table 10.4-6) are not changed.

The AF system is designed to provide adequate feedwater to the unfaulted SGs in response to accidents/transients described in the UFSAR, considering a worse case single failure. The limiting accident considered in the AF failure modes-effects analysis is a break of a main feedwater line in close proximity to a SG, as documented in UFSAR Table 10.4-4. Failure of AF pumps, control valves, stop valves, feedwater lines, power supplies, and gate valves are evaluated in the failure analysis.

The AF Train A unit cross-tie does not add any active components subject to failure that would impact the failure modes-effects analysis or radiological consequences. The redundant diesel driven AF pump flow path will not be affected because none of the added piping is connected to the B Train of AF and appropriate separation is maintained to preclude any adverse interactions with the redundant AF train. Therefore, the previously evaluated radiological consequences will not be affected.

During normal operation and design basis events, the AF Train A unit crosstie remains isolated with at least one locked and closed valve. These valves are normally in a locked closed position and administratively controlled by procedures to ensure safety functions are fulfilled. Therefore, these added system interfaces will not result in an increase in the frequency of an accident previously evaluated in the UFSAR, because an accident is not initiated nor are any new failure modes introduced.

With the AF Train A unit cross-tie isolation valves in the normally locked closed position, the proposed piping configuration changes will have a negligible impact on the hydraulics of the AF system. Therefore, the required design basis flow to the SGs following an accident, as documented in UFSAR Table 10.4-8, is not impacted by this change.

During AF Train A unit cross-tie operation, the flow of AF through the additional short section of piping and valves was evaluated and determined to have a minor impact on the hydraulics of the AF system. The EOP will direct isolation of the accident unit recirculation flow path, however, if the recirculation flow path to the CST remains open on the unit with the accident, there may be a minor reduction in AF flow to the SGs. However, since this is a condition that exceeds postulated design basis events, the design basis flow to the SGs defined in Table 10.4-8 are not applicable. In addition, AF pump runout is not an issue based on the use of existing system flow restriction orifices and based on existing operating procedures. Consequently, the motor-driven AF pump will not be adversely affected by the AF Train A unit cross-tie use.

Since the motor-driven AF pump will be operated hydraulically consistent with its current design, the imposed electrical loads on the pumps will be within current design limits.

With a loss of offsite power on a unit, the emergency diesel generators continue to provide electrical power to the motor-driven AF pump during design basis accidents and natural phenomena scenarios.

Although manual operator actions will be needed to align the motor-driven AF pump for cross-tie flow, this is not a permanent substitution of a manual action for an automatic function, since the AF Train A unit cross-tie is only used during an event that is more severe than postulated design basis conditions.

The inventory of the CST will be depleted when the AF Train A unit cross-tie is in operation. The CST crosstie isolation valve will be opened, which allows sharing of both the Unit 1 and Unit 2 CSTs. Opening the CST cross-tie isolation valve ensures the minimum required volume will remain available for the non-accident unit should it be required. The existing TS 3.7.6 for CST level will be applicable if CST level drops below a level that ensures the required useable volume of approximately 212,000 gallons in Modes 1, 2, and 3. The required action to verify the backup water supply (SX) is within 4 hours, with restoration of the CST level within 7 days. There are no expected conditions brought about by use of the AF Train A cross-tie that would prevent these actions from being met. If the CST is unavailable and SX must be relied upon as the suction source, the requirements of TS 3.7.9, "Ultimate Heat Sink," ensure a sufficient volume of water is available. In addition, the resultant increase in SX flow on the non-accident unit's SX pump due to the additional load of supplying the accident unit's AF pump (approximately 990 gpm) is within the capacity of an SX pump.

The AF Train A unit cross-tie line is not credited to mitigate the consequences of design basis accidents. There is no change to the radiological consequences because the non-accident unit will still be operating within the existing LCO.

The use of the AF Train A unit cross-tie allows for injection into the SGs, which protects the SG tubes from creep rupture, and scrubs fission products entering the SGs via tube leakage, while providing a heat sink for the RCS. Because the AF Train A unit cross-tie operation can be initiated to fill SGs before more severe conditions develop in the RCS that necessitate a bleed and feed strategy, this proposal reduces the potential for fuel damage. With the ability to operate the AF Train A unit cross-tie the operators may be able to avoid initiation of bleed and feed evolutions.

The ability to use the AF Train A unit cross-tie results in a reduction in operator actions required for safe shutdown of a unit experiencing a beyond design basis total loss of secondary heat sink, if the bleed and feed evolutions can be avoided. The reduction in operator actions is a reduced potential for human error. Therefore, the potential for operator error is not increased by the proposed change. In addition, there is no impact to operator actions required for the ability to isolate a faulted SG.

The AF Train A unit cross-tie piping and components are classified and designed in accordance with the UFSAR requirements and applicable referenced ASME code requirements for the design of the AF system piping. The piping is evaluated using moderate energy pipe break location methodologies as described in the UFSAR. The affected pipe supports were analyzed in accordance with the structural design requirements as described in the UFSAR. The new valves are seismically qualified in accordance with the existing UFSAR described methodology.

3.1 PROCEDURES

The AF Train A unit cross-tie piping and components have been installed, and the manual isolation valves are normally in a locked closed position and administratively controlled by procedures. There is one anticipated evolution where both the AF Train A unit cross-tie isolation valves will be opened, that is to support a beyond design basis accident on one unit.

The approval of this request will permit implementation of the proposed UFSAR changes. The associated TS Bases changes clarify existing TS LCO requirements and the applicability of the Condition for an inoperable train of AF on one unit when using the cross-tie. The approval of this request also allows EOPs for the Braidwood and Byron stations for a loss of secondary heat sink to be changed to reflect the example that has been provided in Attachment 3, for use of the AF Train A cross-tie piping and components. Although specific EOP content or the changes that will be implemented upon approval of the amendment have been provided as an example in Attachment 3, the specific steps of the EOP provided with this proposal are for information only, and may be modified upon final development and implementation. The implementation of approval for this proposal will require EOP changes to use the AF Train A unit cross-tie.

Braidwood and Byron Stations utilize procedures that track the actions that are taken in the event any TS Limiting Condition for Operation (LCO) is not met. These procedures assist in complying with the TS by providing documentation that the unit is maintained in the required mode of operation for safe operation until the LCO is restored. If the AF Train A unit cross-tie must be placed into use, the AF motor-driven pump, Train A, is considered inoperable on the non-accident unit, and the associated action of the TS would be entered.

3.2 RISK ASSESSMENT

Although this is not a risk informed license amendment request, the risk benefit was quantified by evaluating the current internal events Probabilistic Risk Assessment (PRA) model for Byron and Braidwood, with the AF Train A unit cross-tie available and with it disabled.

The benefit from implementation of the AF Train A unit cross-tie capability was modeled under this configuration and the results compared to the base Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) results for the current model. This information is summarized in the table provided below.

CDF and LERF Benefits from AF Train A Unit Cross-Tie				
Station	Unit 1		Unit 2	
	CDF Reduction	LERF Reduction	CDF Reduction	LERF Reduction
Byron	4%	1%	6%	12%
Braidwood	4%	2%	6%	12%

As shown, there is a significant reduction in risk for all four units.

4.0 REGULATORY EVALUATION

4.1 APPLICABLE REGULATORY REQUIREMENTS/CRITERIA

Apart from the UFSAR changes proposed, there is no impact to the applicable regulatory requirements for the AF system. The following 10 CFR 50, Appendix A, GDC are applicable to the Byron Units 1 and 2 and Braidwood Units 1 and 2 AF systems:

- GDC 2 - Design Bases for Protection Against Natural Phenomena
- GDC 4 - Environmental and Missile Design Bases
- GDC 5 - Sharing of structures, systems, and components
- GDC 19 - Control Room
- GDC 34 - Residual Heat Removal
- GDC 44 - Cooling Water
- GDC 45 - Inspection of Cooling Water System
- GDC 46 - Testing of Cooling Water System

The AF system was designed to meet the requirements of these GDC with respect to protection against natural phenomena, missiles, environmental effects, shared systems, operational capability from the control room, decay heat and cooling water capability, inservice inspection and functional testing. The AF system is designed consistent with guidelines of Regulatory Guide 1.29, "Seismic Design Criteria," and the Branch Technical Position (BTP) ASB 10-1, "Design Guidelines for Auxiliary

Feedwater System Pump Drive and Power Supply Diversity for Pressurized Water Reactors," and RSB 5-1, "Design Requirements of the Residual Heat Removal System," concerning seismic classification, power diversity, and design of decay heat removal systems. The AF system also meets recommendations of NUREG-0611, "Generic Evaluation of Feedwater Transients and Small Break Loss-of-Coolant Accidents in Westinghouse-Designed Operating Plants," concerning generic improvements to the AF design, procedures, and TS and AF system reliability.

This change proposes additional information necessary to define AF system compliance with GDC 5, and 34, which reflects the use of the shared AF system function of the AF Train A unit cross-tie piping. The AF system is designed with suitable redundancy to offset the consequences of any single failure, with the exception to allow AF Train A unit cross-tie use during a beyond design bases event. Use of the AF Train A unit cross-tie results in a temporary relaxation of the single failure criterion for the non-accident unit, which, consistent with overall system reliability considerations, provides a limited time to support the accident unit emergency response during a beyond design basis event, and return the AF Train A to an Operable status. Otherwise, a plant shutdown is required.

The proposed change continues to meet GDC 5 because in the event of an accident on one unit, an orderly shutdown and cooldown of the other unit is not impaired by the sharing. This is due to the fact that the AF system is not used to perform orderly/controlled shutdown of a unit. Therefore, GDC 5 conditions are met with the sharing of the AF Train A between units. The use of the AF Train A unit cross-tie is predicated upon the operability of the diesel driven AF pump.

The diesel driven AF pump functions independently of any onsite or offsite a-c power, and is thus not affected by a loss of offsite power. The exception to single failure criterion necessary for AF Train A unit cross-tie use is recognized in the proposed change to the UFSAR in response to GDC 34. However, existing TS are not changed and continue to ensure that the non-accident unit enters TS 3.7.5 Condition A for one inoperable AF Train. This TS condition allows the unit to operate with relaxed single failure criterion for 72 hours. This approach is consistent with GL 80-30 and NRC Inspection Manual Part 9900 which conclude that TS allow continued operation with only one train of a two train safety system operable. In these cases, the GDC continues to be met because the system design provides the necessary redundancy and the TS permit continued operation for a specified time.

EGC has evaluated the impact of the AF cross-tie against GDC 44, “Cooling Water,” and concluded that the SX system functions are maintained in accordance with this GDC. The SX supply to the AF system has been analyzed and does not impact the safety function of the SX system or the Ultimate Heat Sink. For the non-accident unit, the AF Train B will remain operable during cross-tie operation. In this condition, the SX supply to the AF Train B remains capable of withstanding a single failure since SX remains capable of supplying cooling water to AF via two independent SX trains. Therefore, the AF Train B is able to perform its safety function assuming a single failure on the SX system. Furthermore, the resultant increase in SX flow on the non-accident unit's SX pump due to the additional load of supplying the accident unit's AF pump (approximately 990 gpm) is within the capacity of an SX pump. The impact of the cross-tie on the AF system's ability to withstand a single failure is addressed in the GDC 34 discussion above.

10 CFR 50.36 (c)(2)(ii), stipulates that a TS limiting condition for operation must be established for each item meeting one or more of the following criteria.

1. Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.
2. A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of, or presents a challenge to the integrity of a fission product barrier.
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.
4. A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.

The AF system satisfies the Criterion 3 of 10 CFR 50.36(c)(2)(ii). However, no change to TS are proposed that would modify the manner in which the AF system continues to meet this regulation.

4.2 NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

Exelon Generation Company, LLC (EGC) has evaluated the proposed changes to the Technical Specifications (TS) using the criteria in 10 CFR 50.92 and has determined that the proposed changes do not involve a significant hazards consideration.

Description of Amendment Request:

The proposed changes request an amendment to Facility Operating License Nos. NPF-72 and NPF-77 for Braidwood Station, Units 1 and 2, and Facility Operating License Nos. NPF-37 and NPF-66 for Byron Station, Units 1 and 2.

The proposed change would revise the Operating License(s) to add information to the Updated Final Safety Analysis Report (UFSAR) and Technical Specification (TS) Bases describing the use of an Auxiliary Feedwater (AF) Train A unit cross-tie between units during emergency response to a beyond design basis total loss of secondary heat sink. Specifically, this change adds information to the UFSAR and the TS 3.7.5, "AF System" Bases describing the design and shared operation of AF Train A unit cross-tie piping between the discharges of the Unit 1 and Unit 2 Train A motor-driven AF pumps. EGC is requesting this amendment in accordance with the provisions of 10 CFR 50.90 and 10 CFR 50.59(c)(2)(ii). NRC approval is required for the use of the AF Train A unit cross-tie since this shared function between units for the AF system has not previously been licensed to meet 10 CFR 50, Appendix A, General Design Criteria (GDC) 5, "Sharing of structures, systems, and components," as a shared system.

Basis for proposed no significant hazards determination:

As required by 10 CFR 50.91(a), the EGC analysis of the issue of no significant hazards consideration is presented below:

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

   Response: No

   The AF system is normally in standby and a failure of the AF system during normal operations or emergency operations cannot initiate any of the accidents previously evaluated. The use of the AF Train A unit cross-tie does not interface with the reactor coolant system, containment, or engineered safeguards features in such a way as to be a precursor or initiator for an accident previously evaluated. The AF system is capable of performing the safety-related functions required to mitigate the effects of design basis accidents. Conditions which impose safety-related performance requirements on the design of the AF system include the following: loss of main feedwater transient, secondary system pipe breaks, loss of all a-c power, loss-of-coolant accident (LOCA), and cooldown (after expected transients, accidents, and other scenarios). For the non-accident unit, controls ensure compliance with existing TS conditions that ensure one train remains operable and the condition exists for a limited time. The AF system will continue to be used in compliance with the existing conditions in the TS. Since the AF system is assured of performing its intended design function in mitigating the effects of design basis accidents, the consequences of accidents previously evaluated in the UFSAR will not be increased. 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

   Failures of the AF system cannot initiate an accident. The proposed use of an AF Train A unit cross-tie will not interface with the reactor coolant system, containment, or engineered safeguards features. Failure modes and effects described in the UFSAR are not impacted. The electrical power supplies and AF system pumps will be maintained in design basis train alignments. Use of an AF Train A unit cross-tie will have no impact on the range of initiating events previously assessed. Thus, the accident analysis presented in the UFSAR is not impacted. The change is consistent with the safety analysis assumptions. Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

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

   Response: No

   The margin of safety is not reduced. Results of the existing UFSAR accident analysis are not impacted, and therefore the safety margins are not impacted. The proposed change will not reduce a margin of safety because the non-accident unit will be operated within existing TS conditions. For the non-accident unit, controls ensure compliance with existing TS conditions that ensure one train remains operable and the condition exists for a limited time. The AF Train A unit cross-tie is not a credited flow path in design basis or needed to meet a safety function. The AF Train A unit cross-tie is an additional strategy made available if a total loss of secondary heat sink should occur. The AF Train A unit cross-tie would be initiated if the feed flow to at least one SG cannot be verified during the event, and an appropriate SG level cannot be maintained to regain secondary heat sink. As such, the AF Train A unit cross-tie is an improvement in emergency procedures for a total loss of heat sink, and this improves probabilistic risk assessment. The proposed change, therefore, does not involve a reduction in a margin of safety.

Based on the above evaluation, EGC concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92, paragraph (c), and accordingly, a finding of no significant hazards consideration is justified.

4.3 CONCLUSION

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by the operation of Byron and Braidwood Units 1 and 2 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 the health and safety of the public.

5.0 ENVIRONMENTAL CONSIDERATION

EGC has evaluated the proposed amendment for environmental considerations, consistent with 10 CFR 51.21, "Criteria for and identification of licensing and regulatory actions requiring environmental assessments." The review results in the determination that the proposed change will modify a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in paragraph (c)(9) of 10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review." Therefore, in accordance with 10 CFR 51.22(b), no environmental impact statement or environmental assessment needs to be prepared in connection with the proposed amendment.

6.0 REFERENCES

1. Braidwood Station and Byron Station Updated Final Safety Analysis Report (UFSAR), Revision 13.

2. Letter from NRC to M. J. Pacilio, "Byron Station Units 1 and 2 NRC Integrated Inspection Report 05000454/2011004; 05000455/2011004," dated November 3, 2011

3. Letter from NRC to M. J. Pacilio, "Braidwood Station, Units 1 and 2, NRC Integrated Inspection Report 05000456/2011004; 05000457/2011004," dated November 9, 2011

ATTACHMENT 2

Braidwood Station, Units 1 and 2
Byron Station, Units 1 and 2

Facility Operating License Nos.: NPF-72, NPF-77, NPF-37 and NPF-66

Docket Nos.: 50-456, 50-457, 50-454 and 50-455

Markup / Annotated Pages of UFSAR

ATTACHMENT 2

Markup / Annotated Pages of UFSAR

3.1.2.1.4 Evaluation Against Criterion 4 - Environmental and Missile Design Bases

"Structures, systems and components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing and postulated accidents, including loss of coolant accidents. These structures, systems, and components shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit."

RESPONSE

Safety-related systems, components, and structures in this plant are designed to accommodate all normal or routine environmental conditions as well as those associated with postulated accidents (where appropriate). The design includes provisions to protect (by physical separation, barriers, or appropriate restraints) safety-related items from dynamic effects resulting from component failures, and specific credible external events and conditions.

The design criteria for these systems, components, and structures are discussed in the remainder of this chapter.

3.1.2.1.5 Evaluation Against Criterion 5 - Sharing of Structures, Systems, and Components

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

RESPONSE

Those systems, structures, and components important to safety shared by the two units are the ultimate heat sinks and the associated Byron makeup water systems; various heating, ventilating, and air conditioning systems within the shared auxiliary and fuel handling building; and a component cooling heat exchanger which can be valved to serve one unit or the other. These shared systems, structures, and components are more fully described elsewhere in this report. No safety-related systems, structures, or components are shared unless such sharing has been evaluated to ensure that there will be no significant adverse impact on safety functions.

In the event of a beyond design basis loss of all Auxiliary Feedwater (AF) on one unit, AF may be provided by the other unit via the Train A unit cross-tie connection. When the Train A unit cross-tie is operated in support of the accident unit, the motor-driven AF pump would not be available to perform its UFSAR described design basis function for the non-accident unit. If necessary, an orderly shutdown and cooldown of the non-accident unit could be accomplished using the main feedwater (FW) system. The diesel driven AF pump on the non-accident unit must be confirmed operable prior to use of the AF Train A unit cross-tie. If required, the redundant diesel-driven AF pump could also support shutdown and cooldown of the non-accident unit if the non-safety related FW system is unavailable.

No changes this page –
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The material properties surveillance program includes not only the conventional tensile and impact tests, but also fracture mechanics specimens. The observed shifts in RT_{NDT} of the core region materials with irradiation will be used to confirm the allowable limits calculated for all operational transients.

See the appropriate sections in Chapter 5.0 for further details on inspection and surveillance requirements.

3.1.2.4.4 Evaluation Against Criterion 33 - Reactor Coolant Makeup

"A system to supply reactor coolant makeup for protection against small breaks in the reactor coolant pressure boundary shall be provided. The system safety function shall be to assure that specified acceptable fuel design limits are not exceeded as a result of reactor coolant loss due to leakage from the reactor coolant pressure boundary and rupture of small piping or other small components which are part of the boundary. The system shall be designed to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished using the piping, pumps, and valves used to maintain coolant inventory during normal reactor operation."

RESPONSE

The chemical and volume control system provides a means of reactor coolant makeup to ensure appropriate makeup supply for small breaks as described in Subsection 9.3.4 and adjustment of the boric acid concentration. Makeup is added automatically if the level in the volume control tank falls below the preset level. The high-pressure centrifugal charging pumps provided are capable of supplying the required makeup and reactor coolant seal injection flow when power is available from either onsite or offsite electric power systems. These pumps also serve as high-head safety injection pumps. Functional reliability is assured by provision of standby components assuring a safe response to probable modes of failure. Details of system design are included in Section 6.3, with details of the electric power system included in Chapter 8.0.

3.1.2.4.5 Evaluation Against Criterion 34 - Residual Heat Removal

"A system to remove residual heat shall be provided. The system safety function shall be to transfer fission product decay heat and other residual heat from the reactor core at a rate such that specified acceptable fuel design limits and the design conditions of the reactor coolant pressure boundary are not exceeded.

ATTACHMENT 2

Markup / Annotated Pages of UFSAR

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

RESPONSE

The residual heat removal (RHR) system in conjunction with the steam and power conversion system, is designed to transfer the fission production decay heat and other residual heat from the reactor core within acceptable limits. The crossover from the steam and power conversion system to the residual heat removal system occurs at approximately 350°F and 360 psig.

Suitable redundancy at temperatures below approximately 350°F is accomplished with the two residual heat removal pumps (located in separate compartments with means available for draining and monitoring of leakage); the two heat exchangers; and the associated piping; cabling, and electric power sources. The residual heat removal system is capable of operating on either onsite or offsite electrical power.

Suitable redundancy at temperatures above approximately 350°F is provided by the four steam generators and attendant piping. Details of the system designs are given in Sections 5.4 and 9.2 and Chapter 10.0.

3.1.2.4.6 Evaluation Against Criterion 35 - Emergency Core Cooling

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RESPONSE

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The AF system automatically supplies feedwater to the steam generators (SGs) to remove decay heat from the Reactor Coolant System upon loss of normal feedwater supply. The AF system consists of a motor driven AF pump and diesel driven AF pump configured into two trains. Each pump provides 100% capacity to the SGs, as assumed in the accident analysis. One pump at full flow conditions is sufficient to remove decay heat and cool the unit to RH entry conditions. The AF system is capable of supplying, but does not normally supply, feedwater to the SGs during normal unit startup, shutdown, and hot standby conditions. The AF system is designed with suitable redundancy to offset the consequences of any single failure, with one exception during AF Train A unit cross-tie use. A normally isolated cross-tie between the discharges of both units' AF Train A pumps is available for emergency response to a beyond design basis total loss of secondary heat sink on one unit. With the Train A unit cross-tie in use, the AF Train A is not available to the non-accident unit. The diesel driven AF pump on the non-accident unit must be confirmed operable prior to use of the AF Train A unit cross-tie. The Technical Specifications limit operation with one train of AF inoperable. Use of the Train A unit cross-tie results in a temporary relaxation of the single failure criterion for the non-accident unit, which, consistent with overall system reliability considerations, provides a limited time to support the accident unit emergency response, and return the AF Train A to an operable status. Otherwise, a plant shutdown is required.

No changes this page –
For Information Only

Cooldown

The cooldown function performed by the auxiliary feedwater system is a partial one since the reactor coolant system is reduced from normal zero load temperature to a hot leg temperature of approximately 350°F. The latter is the maximum temperature recommended for placing the residual heat removal system (RHRS) into service. The RHR system completes the cooldown to cold shutdown conditions.

Cooldown may be required following expected transients, following an accident such as a main feedline break, or during a normal cooldown prior to refueling or performing reactor plant maintenance. If the reactor is tripped following extended operation at rated power level, the AFWS is capable of delivering sufficient AFW to remove decay heat and reactor coolant pump (RCP) heat following reactor trip while maintaining the steam generator (SG) water level. Following transients or accidents, the recommended cooldown rate is consistent with expected needs and at the same time does not impose additional requirements on the capacities of the auxiliary feedwater pumps, considering a single failure. In any event, the process consists of being able to dissipate plant sensible heat in addition to the decay heat produced by the reactor core.

Descriptions of the analyses of the design and supporting assumptions are provided in Subsection 10.4.9.3.2.

10.4.9.2 System Description

The auxiliary feedwater system consists of two subsystems. One subsystem utilizes an electric-motor-driven pump, which is powered from one of the emergency onsite power systems supplied from a diesel generator; the other utilizes a pump that is directly powered by a diesel engine through a gear increaser. Each of the two subsystems can deliver feedwater to all four steam generators. The system has been designed to provide adequate feedwater to the unfaulted steam generators in the event of a main feedwater or steamline break coupled with a single active or passive failure in the auxiliary feedwater system, as shown in Table 10.4-4. Equipment redundancy, flow paths, safety class and quality group boundaries, major line sizes, and system operation are illustrated on the system diagram, Drawing M-37.

For this page, this shows the UFSAR as it currently exists. There are no new changes to this page that are proposed so this page is for information only.

The auxiliary feedwater systems are not utilized for normal startup and shutdown of the units. They are, therefore, classified as moderate-energy systems.

A crosstie line off the discharge piping of the motor-driven auxiliary feedwater pumps, from one unit to the other, provides additional beyond-design-basis emergency operating flexibility and risk enhancement. The AF crosstie line between the units contains two manual isolation valves that are locked closed during normal plant operation. AF crosstie operation is not credited in any design bases event response.

ATTACHMENT 3

Braidwood Station, Units 1 and 2
Byron Station, Units 1 and 2

Facility Operating License Nos.: NPF-72, NPF-77, NPF-37 and NPF-66

Docket Nos. 50-456, 50-457, 50-454 and 50-455

Actions on the Use of the Cross-tie in Response to a Total Loss of Secondary Heat Sink

The steps shown in this attachment are an example of content applicable to Braidwood Station, Unit 1, and are typical for both units at each station.

ATTACHMENT 3

Actions on the Use of the Cross-tie in Response to a Total Loss of Secondary Heat Sink

A. PURPOSE

This procedure provides actions to respond to a loss of secondary heat sink in all steam generators.

B. SYMPTOMS OR ENTRY CONDITIONS

This procedure is entered from:

- 1BwEP-0, REACTOR TRIP OR SAFETY INJECTION, Step 15, when minimum AF flow is not verified AND narrow range level in all SGs is less than 10% (31% ADVERSE CNMT).
- 1BwST-3, HEAT SINK, Critical Safety Function Status Tree on a RED condition.

ATTACHMENT 3

Actions on the Use of the Cross-tie in Response to a Total Loss of Secondary Heat Sink

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

```
****************************************
*                 NOTE                 *
*  The following step will make the 2A *
*  AF pump and the Unit 2 CST          *
*  inoperable.                         *
****************************************
```

6 CROSSTIE A-TRAIN AF FROM OPPOSITE UNIT:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
a. Check **Unit 2** - IN MODE 1-3	a. IF **Unit 2A** AF pump is available, THEN perform the following: 1) Locally energize **Unit 2A** AF pump Aux Oil pump breaker: • MCC 231X3 A1 2) GO TO Step 6c. IF **Unit 2A** AF pump is NOT available, THEN GO TO Step 7 (Page 11).
b. Check **Unit 2** AF pumps - BOTH OPERABLE	b. GO TO Step 7 (Page 11).
c. Close the following **Unit 2** Train A AF Isol valves: • 2AF013A • 2AF013B • 2AF013C • 2AF013D	c. Locally isolate AF flow: 1) Dispatch an operator to fail **Unit 2** Train A AF flow control valves by isolating air to the valve operators. 2) Locally close 2AF005A thru D (364' P10).
d. Locally unlock and open Train A AF unit crosstie isol valves: • 1AF036 (383' M18) (F2 key) • 2AF036 (383' M18) (F2 key)	d. IF both crosstie valves cannot be opened, THEN GO TO Step 7 (Page 11)

Step continued on next page

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
Step 6	(continued)	
	e. Start **Unit 2A** AF pump	
	f. Check total feed to flow to Unit 1 SGs - GREATER THEN 500 GPM	f. If any feed flow to at least one SG is verified, THEN perform the following: 1) Maintain feed flow to restore narrow range level to greater than 10% (31% ADVERSE CNMT). 2) WHEN narrow range level is greater than 10% (31% ADVERSE CNMT), THEN **RETURN TO** procedure and step in effect. 3) **GO TO** Step 7 (Next Page). IF feed flow is NOT verified, THEN **GO TO** 7 (Next Page).
	g. Locally unlock and close 1A AF pump recirc isol valve: • 1AF009A (383' M18) (1U4 key)	
	h. Locally open CST crosstie valve: • 0CD117 (U-2 CST valve pit) (G-0 key)	
	i. **RETURN TO** procedure and step in effect	

ATTACHMENT 4

Braidwood and Byron Stations, Units 1 and 2

Facility Operating License Nos.: NPF-72, NPF-77, NPF-37, and NPF-66

Docket Nos.: 50-456, 50-457, 50-454, and 50-455

Technical Specifications Bases Changes

All TS Bases Pages are Included
for Information Only

ATTACHMENT 4

Technical Specifications Bases Changes

B 3.7 PLANT SYSTEMS

B 3.7.5 Auxiliary Feedwater (AF) System

BASES

BACKGROUND

The AF System automatically supplies feedwater to the Steam Generators (SGs) to remove decay heat from the Reactor Coolant System upon the loss of normal feedwater supply. The AF pumps normally take suction from the condensate storage tank (CST) (LCO 3.7.6) and pump to the steam generator secondary side via separate and independent connections to the feedwater piping outside containment. If the CST is not available, AF can be supplied by the Essential Service Water System. The steam generators function as a heat sink for core decay heat. The heat load is dissipated by releasing steam to the atmosphere from the steam generators via the Main Steam Safety Valves (MSSVs) (LCO 3.7.1) or SG Power Operated Relief Valves (PORVs) (LCO 3.7.4). If the main condenser is available, steam may be released via the steam dump valves and recirculated to the CST.

The AF System consists of a motor driven AF pump and a diesel driven pump configured into two trains. Each pump provides 100% of the required AF capacity to the steam generators, as assumed in the accident analysis. The pumps are equipped with independent recirculation lines to prevent pump operation against a closed system. The motor driven AF pump is powered from an independent Class 1E power supply and feeds four steam generators. The diesel driven AF pump is powered from an independent diesel and also feeds four steam generators. The diesel driven AF pump is supported by a diesel engine, an independent battery system, an essential service water booster pump, and a fuel oil day tank. Thus, the requirement for diversity in motive power sources for the AF System is met.

There is also an AF Train A unit cross-tie downstream of the motor driven AF pump at each unit that is normally isolated. Use of the AF Train A unit cross-tie, however, is incompatible with an OPERABLE motor driven AF pump on either unit and its use is limited to an emergency response for a beyond design basis event that involves a total loss of secondary heat sink.

The AF System is capable of supplying, but does not normally supply, feedwater to the steam generators during normal unit startup, shutdown, and hot standby conditions.

One pump at full flow is sufficient to remove decay heat and cool the unit to Residual Heat Removal (RHR) entry conditions.

No changes on this page
- For Information Only -

BASES

BACKGROUND (continued)

The AF System is designed to supply sufficient water to the steam generator(s) to remove decay heat with steam generator pressure at the setpoint of the MSSVs. Subsequently, the AF System supplies sufficient water to cool the unit to RHR entry conditions, with steam released through the SG PORVs.

The AF System actuates automatically on low-2 steam generator water level, Safety Injection and Undervoltage (UV) on the Reactor Coolant Pump buses. The motor driven AF pump also actuates on an UV on bus 141(241).

The AF System is discussed in the UFSAR, Section 10.4.9 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The AF System mitigates the consequences of any event with loss of normal feedwater.

The design basis of the AF System is to supply water to the steam generator to remove decay heat and other residual heat by delivering at least the minimum required flow rate to the steam generators at pressures corresponding to the maximum steam pressure inside an intact steam generator during the long term cooling portion of the design basis accident (i.e., after steam line isolation occurs). This maximum steam pressure is 1250 psia (Ref. 2).

In addition, the AF System must supply enough makeup water to replace steam generator secondary inventory lost as the unit cools to MODE 4 conditions. Sufficient AF flow must also be available to account for flow losses such as pump recirculation and line breaks.

The limiting Design Basis Accidents (DBAs) and transients for the AF System are as follows:

a. Feedwater Line Break (FWLB); and

b. Loss of normal feedwater.

ATTACHMENT 4

Technical Specifications Bases Changes

No changes on this page
- For Information Only -

BASES

APPLICABLE SAFETY ANALYSES (continued)

In addition, the minimum available AF flow and system characteristics are serious considerations in the analysis of a small break Loss Of Coolant Accident (LOCA) and loss of offsite power (Ref. 3).

The AF System design is such that it can perform its function following an FWLB between the main feedwater isolation valves and containment, combined with a loss of offsite power following turbine trip, and a single active failure of one AF pump. The AF lines to the SGs are orificed such that sufficient flow is delivered to the non faulted SGs. Reactor trip is assumed to occur when the faulted SG reaches the low-low level setpoint. Sufficient flow would be delivered to the intact steam generators by the other AF pump.

During the loss of all AC power events, the Engineered Safety Feature Actuation System (ESFAS) automatically actuates the AF diesel driven pump and associated controls to ensure an adequate supply to the steam generators during loss of power. Valves which can be manually controlled are provided for each AF line to control the AF flow to each steam generator during loss of all AC power events.

The AF System satisfies the requirements of Criterion 3 of 10 CFR 50.36(c)(2)(ii).

BASES

LCO

This LCO provides assurance that the AF System will perform its design safety function to mitigate the consequences of accidents that could result in overpressurization of the reactor coolant pressure boundary. Two independent AF pumps in two diverse trains are required to be OPERABLE to ensure the availability of RHR capability for all events accompanied by a loss of offsite power and a single failure. This is accomplished by powering one of the pumps from the emergency buses. The second AF pump is powered by a different means, a diesel engine.

The AF System is configured into two trains. The AF System is considered OPERABLE when the components and flow paths required to provide redundant AF flow to the steam generators are OPERABLE. This requires that the motor driven AF pump and the diesel driven AF pump be OPERABLE and capable of supplying AF to each steam generator. The associated piping, valves, instrumentation, and controls in the required flow paths to perform the safety related function are also required to be OPERABLE.

The motor-driven AF pump is not OPERABLE if the AF Train A unit cross-tie is unisolated, (i.e., both isolation valves open). The use of the AF Train A unit cross-tie is for an emergency response to a total loss of secondary heat sink on the accident unit. Use of the AF Train A unit cross-tie results in a temporary relaxation of the single failure criterion for the non-accident unit, which, consistent with overall system reliability considerations, provides a limited time to support the emergency response on the accident unit, and return the AF Train A to an OPERABLE status. Otherwise, a plant shutdown is required. The diesel driven AF pump on the non-accident unit must be confirmed OPERABLE prior to use of the AF Train A unit cross-tie.

APPLICABILITY

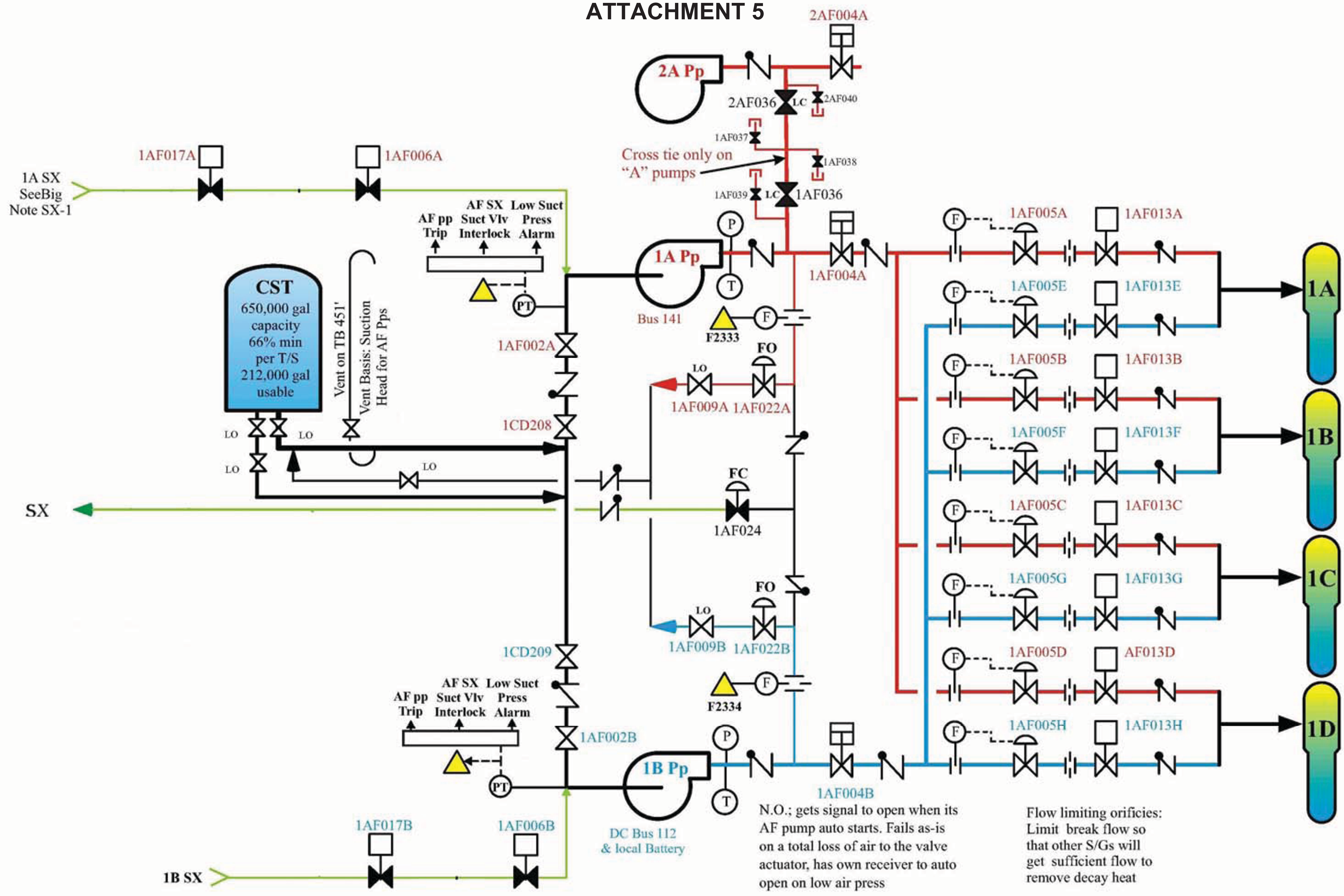
In MODES 1, 2, and 3, the AF System is required to be OPERABLE in the event that it is called upon to function when feedwater is lost.

In MODE 4, 5, or 6, the steam generators are not normally used for heat removal, and the AF System is not required.

ATTACHMENT 5

FIGURE:
AUXILIARY FEEDWATER SYSTEM

ATTACHMENT 5



AUXILIARY FEEDWATER