Byron and Braidwood Stations
Auxiliary Feedwater System - Unit Cross-tie
License Amendment Request

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Agenda

- Introductions and Opening Remarks
- Meeting Purpose
- Auxiliary Feedwater (AF) System Licensing and Design Basis
- AF System Cross-tie Function and Operation
- AF System Cross-tie Chronology
- License Amendment Request
  - Overview
  - Existing Technical Specification (TS)
  - Proposed TS Changes
  - TS Requirements
  - Proposed Updated Final Safety Analysis Report (UFSAR) Changes
- Summary and Conclusions

Meeting Purpose

- Outline the key attributes of a proposed License Amendment Request (LAR) to utilize the installed opposite unit's AF pump and cross-tie valves at Byron and Braidwood Stations

- Engage the NRC in an open and transparent dialog regarding the proposed approach to identify technical and regulatory areas of concern that warrant additional discussion such that they may be satisfactorily addressed in the LAR prior to submittal

- Obtain NRC feedback on the proposed changes and provide clarification on NRC questions

AF System Licensing and Design Basis

- Design Basis Safety Function is to supply feedwater to the Steam Generators (SG) to remove decay heat from the Reactor Coolant System (RCS)
  - The limiting Design Basis Accidents and transients associated with the AF System are the feedwater line break and loss of normal feedwater events

- Each unit contains two independent, 100% capacity trains capable of supplying feedwater to all four SGs
  - 'A' train consists of a motor-driven pump with power supplied by a Class 1E source
  - 'B' train consists of a diesel-driven pump with power supplied by an independent diesel generator
  - One pump at full capacity is sufficient to remove decay heat and cool the RCS to Residual Heat Removal (RHR) entry conditions

- Design redundancy conforms to the GDC 34, "Residual heat removal," requirement to be capable of performing safety function under accident conditions assuming a single active failure

- Existing AF System TS Limiting Condition for Operation (LCO) meets the requirements of 10 CFR 50.36(c)(2)(ii), Criterion 3 for a system that is part of the primary success path which functions to mitigate a design basis accident or transient

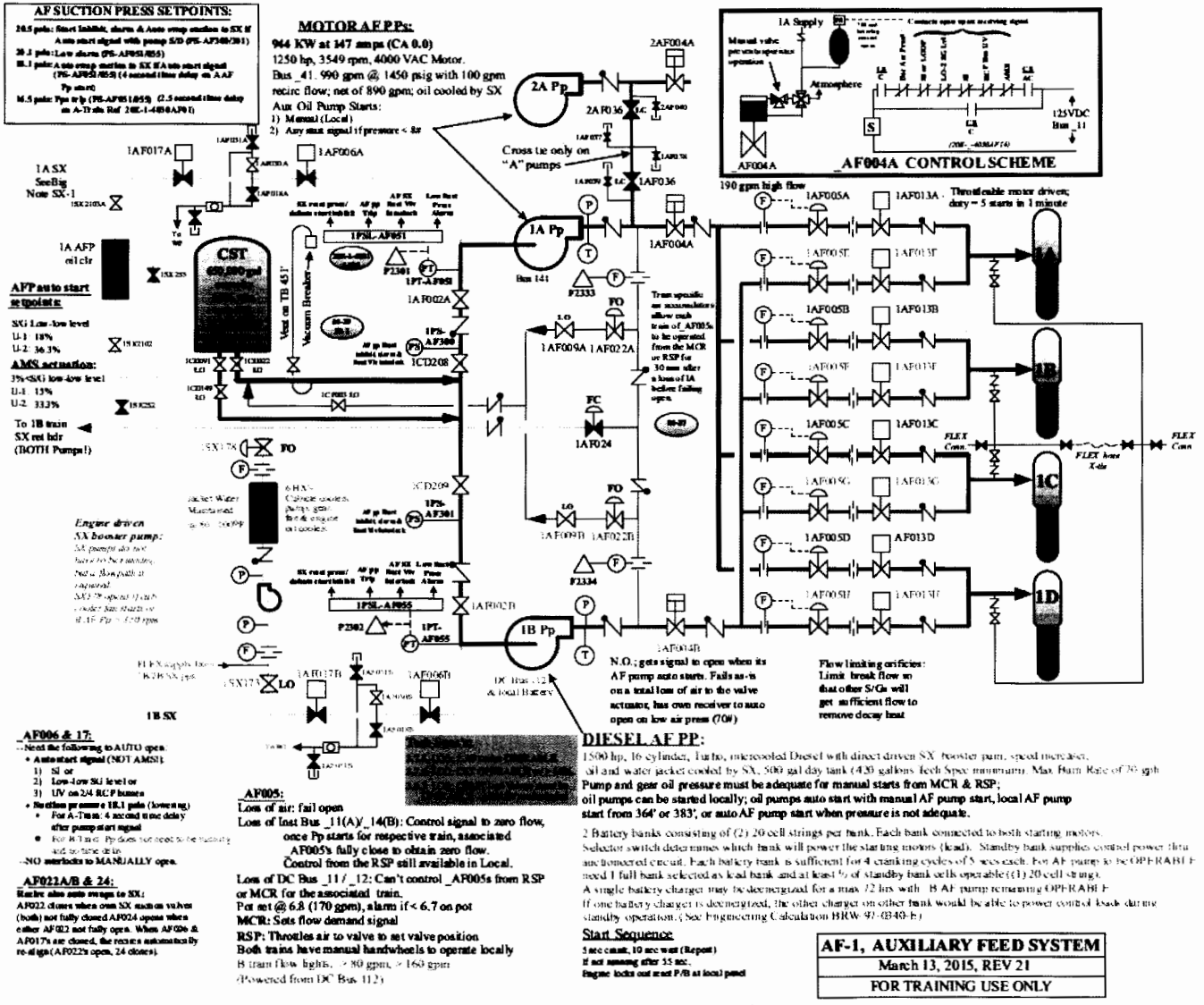
AF System Cross-tie Function and Operation

- AF Cross-tie connects the discharge lines of the Unit 1 and Unit 2 AF 'A' train pumps
  - Approximately 17 feet of Seismic Category I, 6" pipe
  - Normally isolated by two closed, locked manual valves (safety related)
  - Flow analysis demonstrates small hydraulic loss through cross-tie
  - Same ASME Section III, Class 3 standards as the AF System

- Cross-tie does not support or accomplish any AF System safety function, design basis function, or normal operating function

- Provides an improvement in safety for a unit experiencing a beyond design basis loss of heat sink (i.e., loss of all unit specific normal feedwater and both trains of safety related AF)
  - Existing Emergency Operation Procedures (EOPs) require pressurizer power operated relief valves (PORVs) and Reactor Head Vents to be opened as part of the RCS feed and bleed strategy
  - Feed and bleed strategy challenges integrity of RCS and creates potential radiological consequences
  - Use of AF System Cross-tie provides an additional capability to supply feedwater to the SG, thereby reducing the potential of a total loss of heat sink and need to invoke RCS feed and bleed strategy

AF System Cross-tie Function and Operation



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AF System Cross-tie Chronology

- AF System Cross-tie was installed at Byron and Braidwood Stations in 2009 and 2010 at a cost exceeding $1 million per station
  - Installation and subsequent EOP changes were performed in accordance with 10 CFR 50.59

- In 2011, the NRC issued a Severity Level IV Non-cited Violation of 10 CFR 50.59 for failure to obtain NRC approval prior to proceduralizing the AF System Cross-tie
  - Inspectors concluded that use of the cross-tie resulted in a more than minimal increase in the likelihood of a malfunction of equipment important to safety
  - The NRC Inspection Report noted that Exelon planned to submit a LAR as a corrective action
  - Procedural guidance was removed in response to the NRC violation
  - Currently, operators have no guidance on use of the AF System Cross-tie

- LAR was submitted in January 2012 requesting approval for use of the AF System Cross-tie
  - Additional information was provided to the NRC in February 2013
  - Exelon withdrew the LAR in June 2015 due to NRC concerns regarding compliance with GDC 5, "Sharing of structures, systems, and components," not addressing the cross-tie in the TS, and not having an updated Failure Modes – Effects Analysis (FMEA)
  - Exelon plans to resubmit the LAR in Fall 2015

License Amendment Request – Overview

- NRC approval is requested since the AF System has not been previously licensed as a system shared between Unit 1 and Unit 2
  - Seeking NRC approval for the non-accident unit to donate its 'A' Train AF pump to the beyond design basis accident unit - providing additional defense in depth
  - Not requesting approval to use the AF System cross-tie to mitigate a design basis accident, (e.g., a loss of heat sink event) on the accident unit since the subject event is beyond the design basis requirements (i.e., not an accident or transient described in UFSAR Chapter 6, "Engineered Safety Features," or Chapter 15, "Accident Analysis")

- Cross-tie does not support any AF System safety function to mitigate a design basis accident or transient; therefore, the AF System TS LCO does not need to be revised

- AF Cross-tie use involves opening both manual isolation valves and starting the opposite (i.e., non-accident) unit's 'A' pump
  - In this configuration, the 'A' pump is not operable for the non-accident unit
  - Donated pump discharge remains isolated from the non-accident unit's steam generators

License Amendment Request – Overview

- Technical Specifications
  - TS 3.7.5, "Auxiliary Feedwater (AF) System," Condition C will be revised to acknowledge the opposite unit's motor-driven AF pump and cross-tie valves when both AF pumps are inoperable
  - A new Surveillance Requirement (SR) 3.7.5.9 is added to cycle the cross-tie valves to verify operability
  - Based on current Calvert Cliffs AF TS and system design with cross-tie used for beyond design basis function

- UFSAR
  - Section 3.1, "Conformance with NRC General Design Criteria," will be revised to describe how unit/plant design continues to meet GDC 5 and GDC 34
  - Section 10.4.9, "Auxiliary Feedwater System," will be revised to describe the AF Cross-tie components and operation
  - Table 10.4-4, "Auxiliary Feedwater System Failure Modes – Effects Analysis," will be revised to add details supporting the cross-tie

License Amendment Request – Existing TS

3.7 PLANT SYSTEMS

3.7.5 Auxiliary Feedwater (AF) System

LCO 3.7.5 Two AF trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

---NOTE---
LCO 3.0.4.b is not applicable when entering MODE 1.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One AF train inoperable.	A.1	Restore AF train to OPERABLE status.	72 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1	Be in MODE 3.	6 hours
	AND		
	B.2	Be in MODE 4.	12 hours
C. Two AF trains inoperable.	C.1	---NOTE--- LCO 3.0.3 and all other LCO Required Actions requiring MODE changes are suspended until one AF train is restored to OPERABLE status. --- Initiate action to restore one AF train to OPERABLE status.	Immediately

License Amendment Request – Proposed TS Changes

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Two AF trains inoperable.	----------NOTE---------- LCO 3.0.3 and all other LCO Required Actions requiring MODE changes are suspended until one AF train is restored to OPERABLE status. ----------	
	C.1 Initiate action to restore one AF train to OPERABLE status.	Immediately
	AND	
	C.2.1 Verify the opposite unit's motor driven AF pump is OPERABLE.	1 hour
	OR	
	C.2.2 Initiate action to restore the opposite unit's motor driven AF pump to OPERABLE status.	Immediately
	AND	
	C.3.1 Verify the cross-tie valves to the opposite unit are OPERABLE.	1 hour
	OR	
	C.3.2 Initiate action to restore the cross-tie valves to the opposite unit to OPERABLE status.	Immediately

License Amendment Request – TS Requirements

- TS 3.7.5 LCO for the AF System requires both trains to be OPERABLE during Modes 1, 2, and 3
  - Condition A allows operation for 72 hours with one train inoperable
  - Constitutes a "temporary relaxation" of the single failure criterion (GL 80-30)
- To ensure compliance with TS 3.7.5 Condition A, 'A' AF Train to be declared inoperable and the 'B' AF Train ensured OPERABLE during Cross-tie use
- TS LCO 3.0.2 Bases establishes requirements when a TS LCO is not met
  - Intentionally not meeting an LCO and relying on the TS Conditions is allowed for reasons that include, but are not limited to, performance of Surveillances, preventive maintenance, corrective maintenance, or investigation of operational problems
  - Entering TS Conditions for these reasons must be done in a manner that does not compromise safety
- Entry into TS 3.7.5 Condition A on the non-accident unit to support AF System Cross-tie operation is consistent with the TS
  - Intentional entry in this manner is not restricted by TS LCO 3.0.2
  - Safety is not compromised since one AF Train remains operable and capable of performing AF System safety function
  - TS 3.7.5 Conditions and Bases are complied with throughout operation with the AF System Cross-tie open

License Amendment Request – Proposed UFSAR Changes

- AF System UFSAR Section 10.4.9 revised to describe the cross-tie design and function

- AF System Failure Modes – Effects Analysis (FMEA) documented in UFSAR Table 10.4-4
  - Updated FMEA conducted to ensure that a condition associated with the beyond design basis unit will not propagate to the non-accident unit when cross-tied

- UFSAR Section 3.1 describes AF System conformance with the GDCs
  - Continues to conform with GDC 34, "Residual heat removal"
    - Design includes redundant, full capacity AF System trains, with diverse power supplies – each capable of independently performing the AF System safety function
    - Design capable of withstanding a single failure
  - Will revise discussion addressing GDC 5, "Sharing of structures, systems, and components," to include the AF System
    - AF System safety function is not impaired since the 'B' AF Train is operable and capable of independently performing the safety function
    - Non-accident unit remains capable of an orderly shutdown and cooldown

Summary and Conclusions

- Utilization of the AF Cross-tie improves overall plant safety by providing additional operational flexibility to reduce the potential for beyond design basis loss of heat sink events
  - Maximum benefit is derived with operator training and procedure implementation
  - Probabilistic Risk Assessment of safety to the general public is improved through this station initiative

- AF System design and sharing of 'A' Train between units conform with all GDC requirements
  - Design remains capable of withstanding a single failure
  - Design meets all requirements for sharing among units

- Unit donating 'A' Train complies with TS to ensure no loss of safety function and limited time in TS 3.7.5 Condition A
  - Intentional entry into this TS Condition is consistent with TS 3.0.2 Bases discussion
  - Operation of a system, structure or component in accordance with a TS LCO does not create a non-compliance with the GDCs

Questions ?