



Watts Bar Nuclear Plant (WBN)

Proposed License Approach Regarding a Change for the WBN Units 1 & 2 Technical Specification (TS) 3.3.2 Table 1 Function 6.e “Auxiliary Feedwater Auto - Start from Loss of Main Feedwater Pumps”

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May 27, 2020

# Agenda

- Opening Remarks
- Regulatory Background
- Need for Change
- Proposed design change
- Approach for TS change
- Closing Remarks

# Opening Remarks

- Purpose of the meeting is to discuss a proposed WBN Units 1& 2 Technical Specification (TS) 3.3.2 Table 1 Function 6.e “Auxiliary Feedwater Auto - Start from Loss of Main Feedwater Pumps.”
- Proposed TS change will allow the use of the standby main feedwater pump as the normal means for starting up and shutting down the plant.
- Due to the regulatory background of this proposed change, TVA is seeking early NRC engagement and feedback on the proposed TS change.
- Formal pre-submittal meeting planned for August 2020



# Regulatory Background

- WBN Technical Specification 3.3.2 Table 1 Function 6.e, Trip of all Turbine Driven Main Feedwater Pumps, for Auxiliary Feedwater (AFW) auto-start function
  - Is an anticipatory function that provides early actuation of the AFW system to mitigate the consequences of a loss of normal feedwater
  - The anticipatory AFW auto-start circuits associated with the turbine driven main feedwater pumps do not meet the code requirements specified in 10 CFR50.55a(h)(2).
    - > The pressure switches and relays that make up these circuits are not single failure proof, nor are they seismically qualified.
    - > These circuits are not part of the primary success path for postulated accident mitigation and are not credited in the accident analysis.
- The design basis events, which impose AFW safety function requirements, assume AFW auto-start on either low-low SG level (TS 3.3.2 Table 1 Function 6.b), safety injection (TS 3.3.2 Table 1 Function 6.c) or a Loss of Offsite Power (TS 3.3.2 Table 1 Function 6.d) signal. These engineered safety feature actuation system (ESFAS) meet all requirements for reliable power supplies, separation, redundancy, testability, seismic and environmental qualifications as specified in 10 CFR 50.55a(h)(2), Protection Systems.

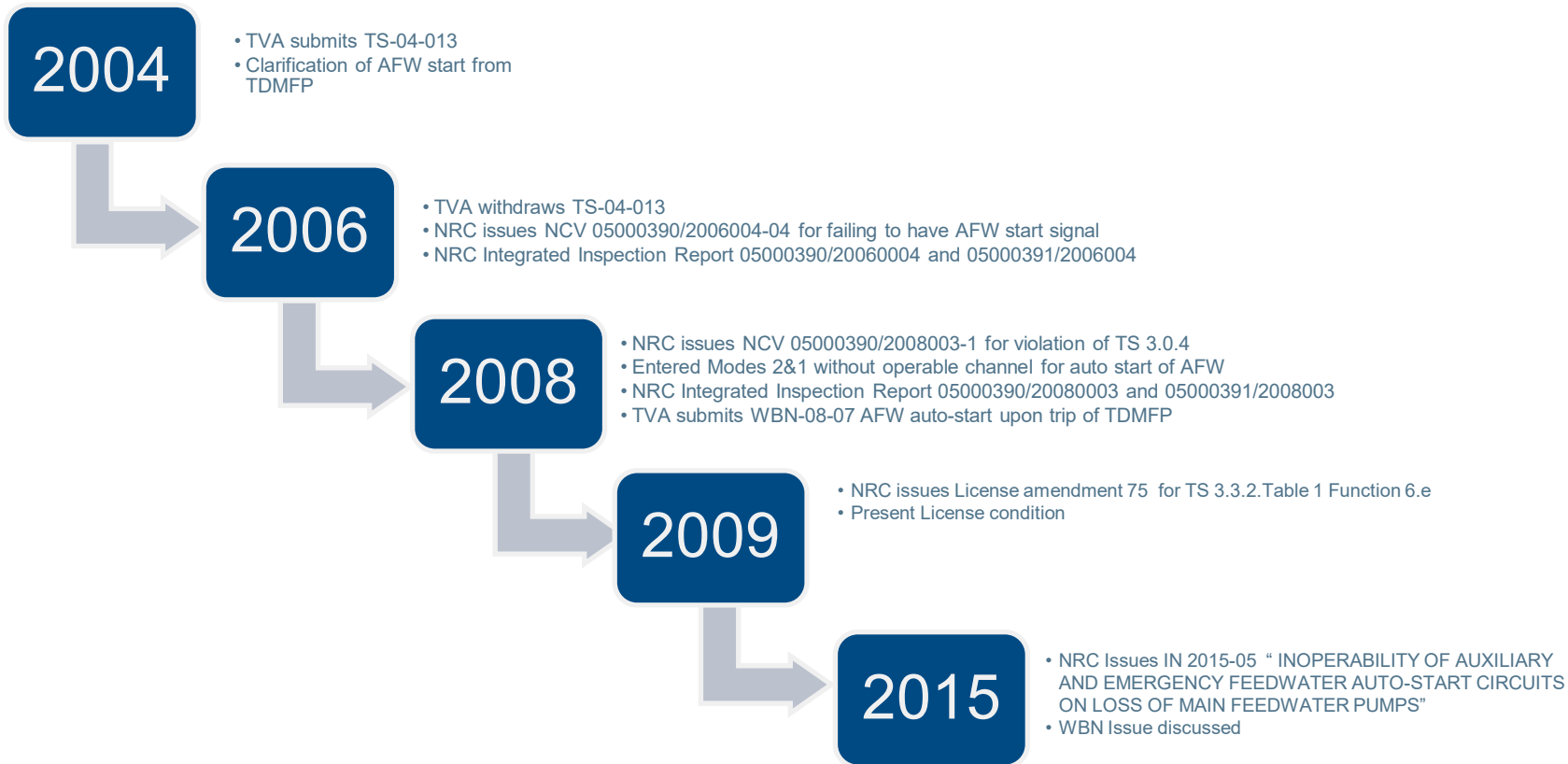
# Regulatory Background

- The WBN main feedwater system is designed to supply a sufficient quantity of feedwater to the steam generator secondary side during plant normal operating conditions.
- The WBN main feedwater system consists of two turbine driven main feed pumps (TDMFPs) arranged in parallel with a single standby main feed pump (SBMFP), two injection water pumps, three (parallel string) high-pressure FW heaters, and associated piping and instrumentation.
- The TDMFPs are variable speed feed pumps with each pump can provide up to 67% capacity
- The two TDMFPs variable speed main feedwater pumps are capable of delivering feedwater to the four steam generators under all expected operating conditions.
- The electric motor-driven SBMFP can provide approximately 15% to 18% capacity
- During certain times of the year, to improve plant efficiency, the standby main feedwater pump is used to supplement MFP flow at high plant loads.
- The SBMFP will automatically start if one of the TDMFPs trip above 67% power.

# Regulatory Background

- ▶ The electric motor driven SBMFP does not interface with the MFP Trip for AFW Auto-Start Logic
- ▶ The original design basis for Watts Bar allowed the electric motor driven SBMFP to be used for normal plant startup and shutdown (up to 15% thermal power) while a TDMFP(s) were being placed or removed from service.
- ▶ NUREG 0847, Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant Units 1 and 2 Docket Nos. 50-390 and 50-391, dated June 1982 (ADAMS ML072060490), Section 10.4.7:
  - *The use of the standby feedwater pump is the normal means for starting up and shutting down the plant. This pump is also automatically activated in the event of the loss of one main feedwater pump. This is accompanied by an automatic turbine runback to 85 percent of load if the power level is above 80 percent of full power. Should main feedwater flow continue to decrease, the auxiliary feedwater system will automatically activate when the low-low steam generator level is reached. The auxiliary feedwater system (see Section 10.4.9) automatically provides flow to the steam generators for decay heat removal upon the loss of normal feedwater supply.*

# Regulatory Background



# Regulatory Background

- NRC documented concerns on the use of the SBMFP for reactor startup beginning in 2006 since the SBMFP does not interface to the auxiliary feedwater water (AFW) automatic start logic.
- Due to the non-compliance issues addressed in NRC Inspection Reports 2006-004 and 2008-003, TVA submitted TS Change 08-07 “AFW Auto-start Upon Trip of the Turbine Driven Main Feedwater Pumps”
- TS change 08-07 denoted that the SBMFP pump was originally designed to provide feed flow during startup and shutdown conditions below 15% rated thermal power (RTP) and to accommodate loss of one TDMFP above 67% RTP. Due to the non-compliance issues addressed in NRC Inspection Reports 2006-004 and 2008-003, the AFW motor driven pumps and the TDMFPs would be used for normal plant startup and shutdown in compliance with the proposed change.
- The AFW motor driven pumps and the TDMFPs are used for normal plant startup and shutdown in compliance with TS 3.3.2 Table 1 Function 6.e



# Need for Change

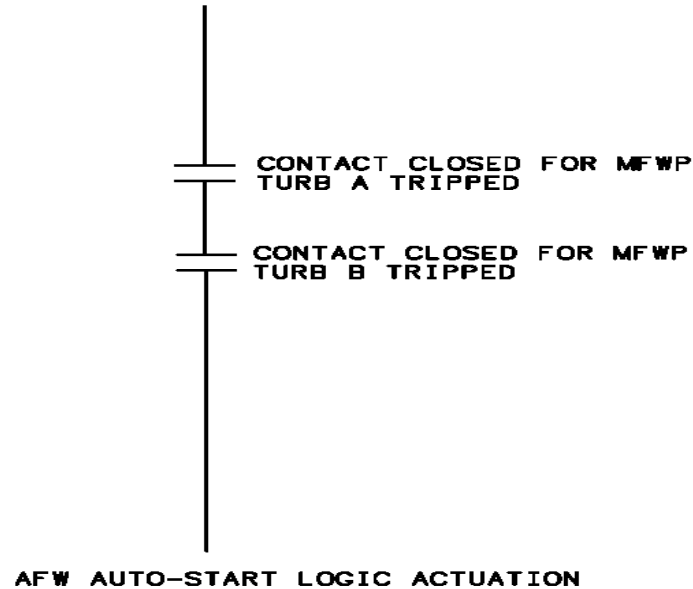
- Presently, the AFW motor driven pumps and the TDMFPs are used for normal plant startup and shutdown in compliance with TS 3.3.2 Table 1 Function 6.e
  - During startup, with the use of the AFW motor driven pumps, steam generator water level and feedwater control at low reactor thermal power (2-3%) power can be challenging
  - feedwater swings affect temperature and power which is not ideal at low powers with tight control bands
- A TDMFP is placed in service at low reactor thermal power (~4%). However, it is ideal for a steam driven pump, which impacts reactivity, to be placed in service at a higher reactor thermal power (>5% Mode 1).
- With the use of the SBMFP for startup activities
  - SBFMP would be placed in service to control steam generator level from Mode 3 to Mode 1 ~15% power.
  - At ~15% reactor thermal power, a TDMFP would be placed in service in Mode 1 to control steam generator water levels
  - Once the TDMFP is operating, the SBMFP would be removed from service.
- The use of the SBMFP during start up activities would simplify startup activities with the elimination of the need to swap between AFW level control valves and Main Feedwater bypass valves in mode 2 (2-3% RTP).

# Design Approach

- Revise the AFW Auto-start Logic
  - The addition of SBMFP power supply breaker contact interface to the AFW Auto-start Logic
  - The breaker contact will close when breaker is open.
  - This will make the AFW auto-start logic initiate from the trip of all MFW pumps both TDMFPs and the SBMFP
  - The SBMFP trip channel will be provided with a manual “trip enable” switch that allows the operations staff to enable the trip when the SBMFP is the only supply of feedwater to the steam generators. When one or more TDMFPs are supplying feedwater to the steam generators, the SBMFP “trip enable” switch will be taken to the bypass position, which places that channel in the tripped position effectively removing the trip from the circuitry.
- The revised circuitry will remain as an anticipatory AFW auto-start function and will not be credited in the WBN accident analyses.

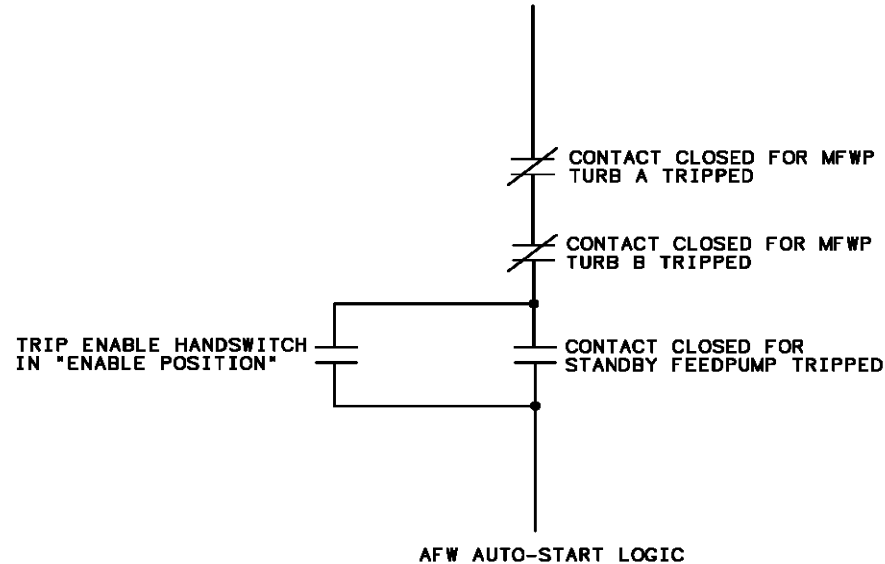
# Design Approach

## Existing AFW Auto-Start initiation Logic



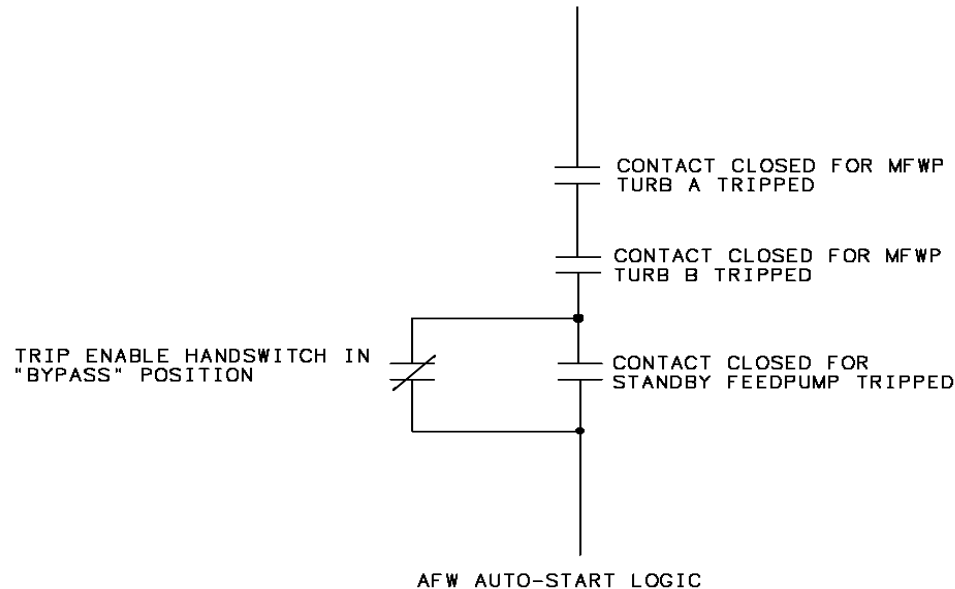
# Design Approach

Conceptual approach for AFW auto-start initiation logic when the SBMFP is the only main feedwater supply to steam generators



# Design Approach

Conceptual approach for AFW auto-start initiation logic when a turbine driven main feedwater pump(s) is supplying main feedwater to steam generators





# Approach to TS Change

- TS 3.3.2 Table 1 Function 6.e would be revised to denote the AFW Automatic start will include:
  - The Trip of all Main Feedwater Pumps
    - » The trip of both Turbine Driven Main Feedwater Pumps
    - » And
    - » The trip of the Electric Motor Driven Standby Main Feedwater Pump
- The applicability of the SBMFP trip channel would be Mode 1 and 2, when the SBMFP is the only supply of feedwater to the steam generators.
- A new TS 3.3.2 condition will be added to address inoperability of the SBMFP trip function.
- With this approach, the use of the SBMFP for startup and shutdown activities would be in compliance to TS 3.3.2 Table 1 Function 6.e

# License Amendment Request Schedule

- Pre-Submittal Meeting with the NRC – August 2020
- Submittal to the NRC – September 2020

