AFW

3.0 Objectives
- 3.1 State the purposes of the auxiliary feedwater system (AFW)
- 3.2 List all suction sources for the AFW pumps and state when each source would be used.
- 3.3 List the automatic start signals for the AFW pumps
- 3.4 Explain how the operation of the AFW system helps promote natural circulation.

4.0 Presentation
- 4.1 AFW System Purposes
  - 4.1.1 The AFW system is designed to automatically maintain the plant in a hot standby condition for a minimum of 4 hours with sufficient water inventory remaining to allow for the manually controlled cooldown of the RCS to the pressure and temperature required for DHR during a loss of Offsite power event.
  - 4.1.2 To provide decay heat removal in the event all main feed water is lost.
  - 4.1.3 To provide decay heat removal during small break loss of coolant accidents.
  - 4.1.4 To provide a heat sink for natural circulation events.
- 4.2 AFW Start Signals
  - 4.2.1 ESFAS
    - 4.2.1.1 Low RCS Pressure
    - 4.2.1.2 Low OTSG Pressure
    - 4.2.1.3 High Containment Pressure
  - 4.2.2 Low OTSG Level - 1 ft.
  - 4.2.3 Loss of both MFPs
- 4.3 Basic Flow Path Description
  - 4.3.1 DWST
  - 4.3.2 AFW Pump Suction
  - 4.3.3 Motor Driven Pumps
    - 4.3.3.1 Pump 1A supplies "A" OTSG
    - 4.3.3.2 Pump 2B supplies "B" OTSG
    - 4.3.3.3 Motor driven pumps are 50% capacity pumps
  - 4.3.4 Turbine Driven Pump
    - 4.3.4.1 Capable of suppling both OTSGs
    - 4.3.4.2 100% Capacity Pump
- 4.4 Detailed Description
  - 4.4.1 Demineralized Water Storage Tank
    - 4.4.1.1 Seismic Tank
    - 4.4.1.2 Tank Capacity of 460,000 gallons
    - 4.4.1.3 330,000 gallons dedicated to AFW system
      - 4.4.1.3.1 280,000 gallons of water would allow the unit to be maintained at hot standby for 24 hours (FSAR has a four hour requirement)
      - 4.4.1.3.2 50,000 gallons required for cooldown to 305 degrees (DHR Initiation)
    - 4.4.1.4 130,000 gallons for plant DWST demands
      - 4.4.1.4.1 Taps for plant demin water above 330,000 gallon level
      - 4.4.1.4.2 Demin water uses:

A-20

4.4.1.4.2.1 RCS Dilution
4.4.1.4.2.2 CCW surge tank
4.4.1.4.2.3 SDC surge tank

4.4.2 Condensate Storage Tank Supply
4.4.2.1 Manual backup to DWST
4.4.2.2 Operator would have to manually open V-73C and V-74C
4.4.2.3 NO AUTOMATIC SWITCHOVER

4.4.3 Emergency Service Water Supply
4.4.3.1 Not Shown on drawing
4.4.3.2 Second Choice of backup supply
4.4.3.3 Not feedwater quality

4.4.4 Motor Driven Pumps
4.4.4.1 4160 Vac
4.4.4.2 900 hp
4.4.4.3 Vital Powered
4.4.4.4 10 stage pump
4.4.4.5 600 gpm capacity @ 1431 psig
4.4.4.6 Recirculation flow control valve
4.4.4.6.1 Recirc back to DWST
4.4.4.6.2 Fully open at zero flow
4.4.4.6.3 Closed at > 150 gpm
4.4.4.6.4 valve position is linear between two limits

4.4.5 Turbine Driven pump
4.4.5.1 Steam supplied from both OTSGs
4.4.5.2 Turbine rated to supply flow at steam pressures between 1260 and 50 psig
4.4.5.3 Governor controls speed at 3800 rpm
4.4.5.4 Overspeed trip of turbine = 112%
4.4.5.5 six stage pump
4.4.5.6 1200 gpm capacity

4.4.6 Level Control valves
4.4.6.1 Control Level at 6 ft. if: - Loss of RCP
4.4.6.1.1 Low level start signal
4.4.6.1.2 Loss of both MFP start signal -2FT
4.4.6.2 No Level control if started by ESFAS
4.4.6.3 Closed by FOGG

4.4.7 Motor Operated Isolation Valves
4.4.7.1 Open on any start signal
4.4.7.2 Closed by FOGG

4.4.8 Steam Supply
4.4.8.1 Redundant supply from both steam generators
4.4.8.2 Affected SG valve closes on low SG pressure
4.4.8.3 CV 2872 - closes on low downstream pressure
4.4.8.4 CV 7938 - opens on any start signal
4.4.8.5 CV 434 - maintenance isolation

4.4.9 Natural Circulation Operations
4.4.9.1 Heat Sink - core's decay heat
4.4.9.2 Heat Source - OTSG Level
4.4.9.3 Elevation difference - plant design
4.4.9.4 Heat removal - MAD or safety valves
4.4.9.5 OTSG level control - AFW system

4.4.10 Loss of MFW operations
4.4.10.1 Reactor Trips

4.4.10.1.1 High RCS Pressure
4.4.10.1.2 ARTS - Loss of Feedwater
4.4.10.2 Auto start on loss of MFPs
4.4.10.3 LCVs control level at ~~6~~ 2 ft.
4.4.11 Accident Operations
4.4.11.1 Start signal from ESFAS
4.4.11.2 Level not controlled - operator must override
4.4.11.3 Must operate to supplement HPI flow
4.4.11.3.1 Operator can feed and bleed if AFW fails
4.4.11.3.2 Not required for large LOCA

5.0 PRA Insights
5.1 Core Melt Frequency contribution of 53%
5.2 Loss of MFW sequence
5.2.1 Loss of MFW
5.2.2 AFW Fails
5.2.3 RCS heats up
5.2.4 Pressurizer Insurge
5.2.5 RCS Pressure Increase
5.2.6 PORV Lifts and fails
5.3 Small Break LOCA Sequence
5.3.1 Small break LOCA occurs
5.3.2 AFW Fails
5.3.3 HPI flow insufficient for core cooling
5.3.4 Core heats up
5.3.5 Operator does not initiate feed and bleed

6.0 Summary
6.1 Review objectives with class
6.2 Video tour of system