Proposed Change to the PWR ECCS Mode 4 Requirements

Introduction

- The PWR licensing basis for Mode 4 accident and transient mitigation is unclear.
- The current TS Bases are contradictory regarding the events assumed to occur in Mode 4 and the required mitigating systems.
- The PWR and TSTF are pursuing a project to establish a consistent licensing basis for Mode 4 accidents and transients, similar to the change made for BWRs in TSTF-542, “Reactor Pressure Vessel Water Inventory Control,” and TSTF-582, “RPV WIC Enhancements.”

Mode 4

- Mode 4 (hot shutdown), is defined in the TS as subcritical, all reactor vessel head closure bolts fully tensioned, RCS Temperature > [200] °F and < [350] °F. This temperature range is consistent with an RCS pressure ≤ 400 psig (< 20% of the ASME Code design pressure).
- Some TS Bases state that DBAs can occur in Mode 4, while others state they cannot occur.
- SRP Chapter 15 events applicable to a PWR were reviewed to determine which could reasonably occur in Mode 4.
  - Most events were not credible because of the low RCS pressure.
  - Most of the remaining events are adequately addressed by existing TS that are not being considered for revision.

Emergency Core Cooling System

- The most operationally impactful Mode 4 TS is TS 3.5.3, "ECCS – Shutdown," which requires one train of ECCS to be operable.
  - The requirement for a low pressure ECCS subsystem to be operable limits the ability to use both trains of the RHR system for a plant cooldown.
- The Bases for TS 3.5.3 states that the "ECCS – Operating" Bases apply, but then make contrary statements regarding the plant conditions, automatic systems, single failure, etc.
- A loss of reactor coolant system inventory from a small pipe break or inadvertent opening of a valve in Mode 4 is credible, but a double-guillotine large-break LOCA is not.
  - There is no accident analysis for a LOCA initiated in Mode 4.

Proposed Approach

- Similar to the change made to the BWR TS in TSTF-542, the PWR is pursuing a revision to TS 3.5.3 to rename it "Reactor Coolant System Water Inventory Control," and to revise the requirements to ensure equipment is available to respond to a loss of inventory in Mode 4.
  - A single ECCS subsystem (high pressure or low pressure) capable of being powered by emergency power.
  - A single failure is not assumed (as in the current TS 3.5.3).
  - Manual starting of the ECCS pump, and alignment of the water source can be performed from the control room using procedurally controlled actions (similar to some current TS 3.5.3 requirements).

Proposed Approach

- As was done in TSTF-542, this change is not establishing a new DBA analysis, but will ensure that appropriate equipment is available to respond to credible events.
- As a follow-on activity, the PWROG will examine all of the TS with Mode 4 applicability and propose TS and/or Bases changes as needed to establish a consistent licensing basis.
- This project will start in late 2024 or 2025.