Nuclear Operating Company

NRC meeting for proposed South Texas Project Moderator Temperature Coefficient Tech Spec change

July 26, 2021

Introductions / Opening Remarks

- STP / PWROG
- NRC

Meeting Objective

Discuss Moderator Temperature Coefficient (MTC) verification approach details and provide additional information in support of the proposed change to the STP MTC Technical Specification

Verification of the BOL and EOL Tech Spec Surveillances

- Historically, a measurement has been used to satisfy both the beginning of life (BOL) and end of life (EOL) moderator temperature coefficient (MTC) TS Surveillances
- Therefore, the TS BOL and EOL Surveillances state “measure”
- The precedent for verifying the EOL MTC TS Surveillance was implemented via WCAP-13749
- The reason for the LAR is to allow both the BOL and EOL TS Surveillances to be performed via a verification, as well as a measurement, if required
- The BOL and EOL TS Surveillance verification procedure is not a method of evaluation in accordance with 10CFR50.59 because it is not used to establish the design basis or in the safety analyses

Verification of the BOL and EOL Tech Spec Surveillances

- Current NRC approved codes have demonstrated the capability to accurately predict MTC values and can be used in place of BOL and EOL TS Surveillance measurements
- NRC approved code predictions are integral and necessary to confirm the TS MTC at both BOL and EOL

Current MTC Measurements Utilize NRC Approved Code Predictions

- The MTC is inferred by measuring the isothermal temperature coefficient (ITC) and subtracting the NRC approved code predicted doppler temperature coefficient
- The MTC is not measured at the most limiting conditions for accident scenarios
  - Confirmation of the analysis of record results therefore rely on code predictions of core reactivity feedback
- All MTC predictions used in the safety analysis confirmation are completed with an NRC approved neutronics code package capable of predicting the MTC

MTC Measurement

- The MTC measurement does not detect or determine any core anomaly, since it is a global core parameter
- The predictive performance of the NRC approved core neutronics codes are validated each cycle through more frequently performed TS Surveillances for core reactivity and power distribution
- Measured to predicted critical boron concentrations, radial power distribution, axial power distribution, and the measured vessel average temperature ensure the actual MTC remains in compliance with the TS BOL and EOL limits

MTC Measurement

- Measurement of BOL MTC extends the amount of time the core remains close to least negative MTC limit. The core is rarely required to be critical at high boron concentration resulting in less negative MTCs.
- The measurement extends the amount of time the core remains below the point of adding nuclear heat
- Extending the amount of time below the point of adding nuclear heat and at a least negative MTC limits the core feedback mechanisms available to mitigate a transient
- The measurement of the EOL MTC (typically at 300 ppm) requires focused manual operator action to control Tavg at power and results in changes to the axial power distribution

Least Negative MTC (Beginning of Life)

- The MTC is primarily impacted by boron concentration with a secondary impact of neutron leakage dictated by the core power distribution
- The boron concentration is confirmed to determine the core reactivity during startup activities and throughout the core life to confirm the Core Reactivity TS Surveillance
- The core power distribution is measured multiple times during startup activities and throughout the core life to confirm the TS core peaking factor limits are met

Most Negative MTC (End of Life)

- The boron concentration for the EOL MTC TS Surveillance confirmation is fixed to a specific boron concentration, thereby making power distribution and burnup of the core the primary MTC impacts
- The core reactivity is a measurement of core burnup characteristics and is compared to the predicted core reactivity periodically in accordance with Core Reactivity TS surveillance
- The core power distribution is monitored throughout the core life to confirm various TS:
  - Heat Flux Hot Channel Factor
  - Nuclear Enthalpy Rise Hot Channel Factor
  - Axial Flux Difference
  - Quadrant Power Tilt Ratio

MTC Verification Procedure Uncertainties

- The minimum applied uncertainty for the BOL TS MTC verification is 1.5 pcm/^{o}F
  - Any NRC approved neutronics package that is used to verify the BOL or EOL TS MTC must have an uncertainty less than or equal to 1.5 pcm/^{o}F based on previous fleet plant measurements at BOL or use the larger calculated MTC uncertainty for that specific code package
- The minimum applied uncertainty for the EOL TS MTC verification is 2.0 pcm/^{o}F
  - Any additional uncertainty applied is based on plant measurements of the core power distribution and core reactivity that are performed near the time in core life when the EOL TS MTC is verified, and would only be used to increase the 2.0 pcm/^{o}F uncertainty

Summary and Conclusions

- The current TS BOL and EOL Surveillances state “measure” because that is how it was previously performed
- The precedent for verifying the EOL MTC TS Surveillance was implemented via WCAP-13749
- The reason for the LAR is to allow both the BOL and EOL TS Surveillances to be performed via verification, as well as measurement, if required
- The BOL and EOL TS Surveillance verification procedure is not a method of evaluation in accordance with 10CFR50.59 because it is not used to establish the design basis or in the safety analyses
- 10CFR50.36(c)(3), Surveillance requirements, continues to be satisfied because the BOL and EOL MTC TS Surveillances will continue to ensure that the LCO limits are met via verification

Questions?