Duke Energy / NRC Pre-submittal Meeting

License Amendment Request for Revision 1 of DPC-NE-1007-P, Conditional Exemption of the End-of-Cycle (EOC) Moderator Temperature Coefficient (MTC) Measurement Methodology

Presenter:

David Bortz

Catawba and McGuire Nuclear Stations

August 30, 2021

Participants

- Dave Bortz (Safety Analysis Models)
- Mike Blom (Director Fuel Management and Design)
- Jeff Abbott (Manager Safety Analysis Models)
- Art Zaremba (Fleet Licensing Manager)

Outline

- Overview of DPC-NE-1007-P
- EOC MTC Measurement
- Summary of Changes
- Motivation for Changes
- Methodology Revisions
- Schedule

Overview of DPC-NE-1007-P

- Describes the methodology to conditionally exempt the performance of the EOC MTC measurement at CNS and MNS
- Technical Specification SR 3.1.3.2 requires verification of the MTC within 7 effective full power days of reaching the equivalent of an equilibrium core boron concentration of 300 ppm at RTP conditions
- Conditional Exemption based on:
  - Core performance criteria being satisfied to demonstrate the reactor core is operating as designed
  - Calculation of the EOC 300 ppm RTP MTC accounting for uncertainty and differences between predicted and actual core performance
  - Verification the calculated MTC is within the SR 3.1.3.2 limit
- If any single core performance criterion is not met, an EOC MTC measurement is required

EOC MTC Measurement

- Required by SR 3.1.3.2
- Measurement is an infrequent plant evolution
- Plant systems operated in a mode or condition not typical of steady state operation
- Introduces a reactivity transient
- Difficult to accurately perform
- Loss in plant availability (decrease in thermal efficiency during the test)
- Potential for a reactivity event due to a human performance error or unanticipated equipment issue

Summary of Changes

- Remove the incore tilt performance criterion
- Modify the power distribution performance criterion to prevent a false positive failure
- Add an alternative method for determining the most-negative MTC safety analysis limit
- No Technical Specification changes required

Motivation for Methodology Changes

- Prevent the unnecessary performance of an infrequent plant evolution, reactivity transient and loss of plant efficiency
- Eliminate a condition where an indeterminate instrument issue causes the power distribution performance criteria to be exceeded
- Increase margin to the safety analysis most-negative MTC limit to accommodate the introduction of advanced fuel designs and fuel management strategies

Incore Tilt Methodology Revision

- Remove the incore tilt criterion based on experience with using the method
  - Frequently challenged
  - Responsible for all exemption failures
  - Negligibly impacts the magnitude of the MTC
  - Power distribution reaction rate criterion available to demonstrate core is operating as designed
- Incore tilts are not uncommon. Can results from:
  - differences in loop flows and inlet temperatures
  - Asbuilt fuel and burnable absorber fabrication
  - Intentional

Power Distribution Methodology Revision

- Modify the performance criteria to remove the single failure criterion
- Current criteria is +/- 10% assembly average reaction rate error and remains unchanged
- Any single location with a reaction rate error greater than 10% absolute results in a failure of the criterion
- New criterion requires multiple failures
- Eliminates the condition where a measurement due to an indeterminate instrument issue causes a false positive (criteria exceeded)

SA MTC Limit Methodology Revision

- Add an alternate approach for calculating the EOC most negative MTC Safety Analysis limit
- Removes unnecessary conservatism in the method
- Current method is deterministic
- New method statistically combines parameters used to calculate the limit
- Methodology revision increases analysis margin to support higher burnup fuel designs and potential two-year fuel management strategies

Schedule

- Expected submittal – September 2021
- One year review and approval from NRC acceptance