Dominion Energy

Pre-Submittal Meeting
License Amendment Request for Moderator Temperature Coefficient Analytical Verification

Dominion Energy

Agenda

- Purpose
- Technical Basis Summary
- Analytical Verification Process
- Application Criteria for Analytical Verification
- Proposed Changes
- Additional Technical Justification for Changes
- Conclusions
- Schedule
- Acronyms

Purpose

- Dominion Energy will request approval to change the Millstone Unit 3, North Anna Units 1 & 2, and V.C. Summer Unit 1 Technical Specifications to allow for the analytical verification of BOC and EOC MTC limits in lieu of measurements under certain conditions.
- Submittal Package will include:
  - Technical Basis for the change
  - Description of the Analytical Verification processes
  - Marked up TS pages
  - Example TS Bases changes (for information only)
  - FSAR/UFSAR language additions (for information only)

Technical Basis Summary

- Based on Measured versus Predicted (M-P) comparisons from ~100 startups across the Dominion Energy fleet, when the overall measurement uncertainty is small (e.g. at BOC startup conditions), the comparisons show that the predicted tools (CMS5 or ANC9) predict MTC within $\pm$2 pcm/°F at all expected conditions.
- This value was bounding for the entire data set.
- The Nuclear Reliability Factor (NRF) of the predicted tools is also $\pm$2 pcm/°F, therefore using the NRF is an appropriate uncertainty factor.

Technical Basis Summary (cont.)

- Analytical Verification (AV) compares predicted MTC values that have been augmented for measurement uncertainty factors to confirm the reload core is operating within the MTC TS/COLR limits.
- With high confidence that the calculated values from neutronics codes are accurate predictions of how the plant is behaving, an unnecessary plant manipulation can be avoided by confirming the MTC remains within all required limits through AV.

Analytical Verification Process

- AV involves adding an appropriate uncertainty (± 2.0 pcm/°F) to the most limiting calculated value for BOC or EOC, and confirming the value remains within required limits throughout the entire core life.
- Additional operational penalties are added to the margin assessment for the EOC surveillance to account for uncertainty associated with the data and evolution for EOC measurement.

Analytical Verification Process (cont.)

Steps for BOC AV

- Confirm application criteria for AV of MTC are met.
- Apply appropriate uncertainty factor to most limiting case (e.g. add +2 pcm/°F to most positive MTC value).
- Determine if positive margin exists between the predicted value and TS/COLR limit.
- If yes, TS surveillance is SAT. If no, perform measurement.

Analytical Verification Process (cont.)

Steps for EOC AV

- Confirm application criteria for AV of MTC are met.
- Apply appropriate uncertainty factor to most limiting case (e.g. add -2 pcm/°F to most negative MTC value).
- Apply additional penalties based on the difference in cycle operation from the predicted model for the following:
  - Core Leakage
  - Core Average Burnup
  - Hot Full Power AFD
- Determine if positive margin exists between the predicted value and TS/COLR limit.
- If yes, TS surveillance is SAT. If no, perform measurement (and for all further surveillances after 300 ppm).

Application Criteria for Analytical Verification

The following must be all true to use for either BOC or EOC surveillance:

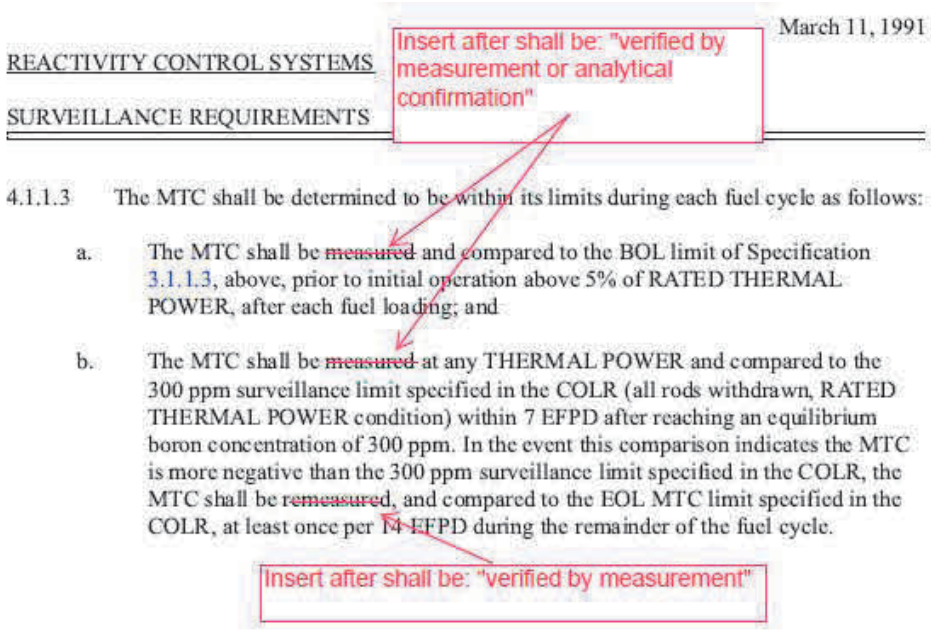
- The calculated MTC must remain within required limits after application of an appropriate uncertainty value (± 2.0 pcm/°F) for the entire core life.
- None of the following were implemented for that cycle:
  - Significant fuel design change (procedurally controlled)
  - Power increase
  - Plant modification that may have significantly altered core reactivity or nuclear, thermal, or hydraulic performance
  - Neutronics code used for core design/safety analysis that has not been previous evaluated for AV

Additional Criterion for BOC only:

- Following initial criticality, the measured critical conditions are within 500 pcm of the predicted critical conditions.

Proposed Changes

- For MPS3 and VCS, change TS 4.1.1.3.a/b to read: “The MTC shall be verified by measurement or analytical confirmation…”
- Additional requirement for TS 4.1.1.3.b that if the 300 ppm surveillance is not met, measurement will be performed.



March 11, 1991

REACTIVITY CONTROL SYSTEMS

SURVEILLANCE REQUIREMENTS

Insert after shall be: "verified by measurement or analytical confirmation"

4.1.1.3 The MTC shall be determined to be within its limits during each fuel cycle as follows:

a. The MTC shall be ~~measured~~ and compared to the BOL limit of Specification 3.1.1.3, above, prior to initial operation above 5% of RATED THERMAL POWER, after each fuel loading; and

b. The MTC shall be ~~measured~~ at any THERMAL POWER and compared to the 300 ppm surveillance limit specified in the COLR (all rods withdrawn, RATED THERMAL POWER condition) within 7 EFPD after reaching an equilibrium boron concentration of 300 ppm. In the event this comparison indicates the MTC is more negative than the 300 ppm surveillance limit specified in the COLR, the MTC shall be ~~remeasured~~, and compared to the EOL MTC limit specified in the COLR, at least once per 14 EFPD during the remainder of the fuel cycle.

Insert after shall be: "verified by measurement"

Dominion Energy

Proposed Changes (cont.)

- For NAPS, change TS SR 3.1.3.1 and 3.1.3.2 to read: “Verify MTC is within upper/lower limit by measurement or analytical confirmation.”
- TS SR 3.1.3.2 has additional change to Note 2: “If the MTC is more negative than the 300 ppm Surveillance limit…shall be repeated once per 14 EFPD during the remainder of the fuel cycle by measurement.”

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.3.1	Verify MTC is within upper limit.	Once prior to entering MODE 1 after each refueling

Insert after limit: "by measurement or analytical confirmation."

SR 3.1.3.2	----------NOTES---------- 1. Not required to be performed until 7 effective full power days (EFPD) after reaching the equivalent of an equilibrium RTP all rods out (ARO) boron concentration of 300 ppm 2. If the MTC is more negative than the 300 ppm Surveillance limit (not LCO limit) specified in the COLR, SR 3.1.3.2 shall be repeated once per 14 EFPD during the remainder of the fuel cycle. 3. SR 3.1.3.2 need not be repeated if the MTC measured at the equivalent of equilibrium RTP-ARO boron concentration of ≤ 60 ppm is less negative than the 60 ppm Surveillance limit specified in the COLR. ----------	
	Verify MTC is within lower limit.	Once each cycle

Insert after cycle: "by measurement."

Insert after limit: "by measurement or analytical confirmation."

Dominion Energy

Proposed Changes (cont.)

- VCS will remove reference to WCAP-13749-P-A (“Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient”) in TS 6.9.1.11.
- TS Bases will be revised for MPS3, VCS and NAPS to explain the AV process.
- Specific criteria that must be met in order to use AV will be procedurally controlled and described in the FSAR.
- TS Bases will reference the FSAR section containing criteria.

Dominion Energy

Additional Technical Justification for Changes

- Based on historical data, Dominion Energy has confidence that the neutronics codes being used are accurate and there is little value gained for measuring MTC if no significant changes were made from the previous cycle.
- MTC is indirectly verified every cycle (regardless of process for verifying TS surveillances) through measurement of critical boron concentration and performance of flux maps during power ascension and throughout the operating cycle.
- GDC 11 and GDC 28, as well as NUREG-0800, do not explicitly require measurement, and their requirements are still met by application of the appropriate uncertainty (and penalties for EOC), ensuring MTC remains within required limits.

Conclusions

- Dominion Energy is submitting a LAR to allow for use of AV to satisfy MTC TS surveillances for MPS3, VCS, and NAPS.

- AV will only be used if specific criteria are met, otherwise measurements will be performed. This criteria will be procedurally controlled and described in the FSAR.

- Use of AV will prevent unnecessary plant manipulations at BOC and EOC, which will reduce the risk of equipment malfunction or human performance error while still remaining in compliance with the applicable regulations.

Schedule

- NRC Pre-Submittal Meeting on 08/06/2024
- LAR Submittal to the NRC expected by end of January 2025
- NRC Approval requested by end of January 2026

Acronyms

AV	Analytical Verification
BOC	Beginning of Cycle
COLR	Core Operating Limits Report
EFPD	Effective Full Power Day
EOC	End of Cycle
LAR	License Amendment Request
M-P	Measured versus Predicted
MPS3	Millstone Power Station Unit 3
MTC	Moderator Temperature Coefficient
NAPS	North Anna Power Station
NRC	Nuclear Regulatory Commission
NRF	Nuclear Reliability Factor
PCM	Per Cent Mille
SR	Surveillance Requirement
TS	Technical Specifications
VCS	V.C. Summer