Brunswick Implementation of TSTF-564

NRC Conference Call – February 5, 2020

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TSTF-564 Overview

- Currently TS 2.1.1.2 Safety Limit (SL) MCPR ensures that 99.9% of fuel rods are not susceptible to boiling transition
  - Separate limits for two-loop operation (TLO) and single-loop operation (SLO).
  - Further referred to as the $MCPR_{99.9\%}$
- TSTF-564 redefines the SLMCPR as a cycle-independent MCPR value dependent on the 95/95 statistics of the fuel assembly critical power correlation database
  - Further referred to as the $MCPR_{95/95}$
- $MCPR_{99.9\%}$, which is dependent on the cycle-specific power distribution, will be documented in the COLR as required in TS 5.6.5.a.2 and will be used in the determination of operating limit MCPR for LCO 3.2.2

TSTF-564 Background

- TSTF-564 Rev. 0 submitted to the NRC in August 2017
- Rev. 1 was submitted in May 2018 along with responses to requests for additional information (RAI)
  - RAI #1 response expanded the applicability of the methodology to all fuel vendors (e.g., Framatome)
- Final SE issued November 2018 upon receipt of Rev. 2 of the traveler
  - Approved as part of the consolidated line item improvement process (CLIIP)
  - CLIIP only available for fuel types identified in TSTF-564

BSEP Implementation of TSTF-564

- Duke Energy is implementing approved TSTF-564 with Framatome fuel types ATRIUM 10XM and ATRIUM 11
  - Eliminates the need of cycle-specific SLMCPR LAR on short approval timeline
- First reloads by unit
  - Unit 2 Cycle 25 – Startup March 2021
  - Unit 1 Cycle 24 – Startup March 2022
- Proposed date for LAR submittal
  - February 2020
- Final SE need date - March 2021 to support Unit 2 startup
- No changes to TS 5.6.5.b CPR correlations or SLMCPR methodology

$MCPR_{95/95}$ Determination

- TSTF-564 Rev. 2 Section 3.1

$$MCPR_{95/95}(i) = \mu_i + \kappa_i * \sigma_i \qquad \text{(Eq. 1)}$$

Where,

μ_i is the mean Experimental Critical Power Ratio (ECPR),

σ_i is the standard deviation of the ECPRs, and

κ_i is a statistical parameter chosen to provide 95% probability at 95% confidence (95/95) for the one-sided upper tolerance limit that depends on the number of samples (N_i) in the critical power database.

i is a fuel product line, such as GE14, GNF2, GNF3, and OPTIMA2.

- κ_i calculated using formulas attributed to Mary Gibbons Natrella (1963) as specified in TSTF-564

$MCPR_{95/95}$ Derivation

- Proprietary information redacted

Technical Specifications SLMCPR = $\mu + \kappa \cdot \sigma$

Product Line	ATRIUM 10XM	ATRIUM 11
Correlation Reference	1	2
Distribution	Normal	Normal
Mean of ECPR (μ)	[	]
Standard Deviation of ECPR (σ), %	[	]
Number of Data Points	[	]
Statistical Factor for 95/95 (κ)	[	]
TS SLMCPR	1.05	1.05

References:

1. ANP-10298P-A, ACE/ATRIUM 10XM Critical Power Correlation, Revision 1, March 2014.
2. ANP-10335P-A, ACE/ATRIUM 11 Critical Power Correlation, Revision 0, May 2018.

LAR Content

- BSEP 1 and 2 Tech Spec Markups (2.1.1.2 and 5.6.5.a.2)
- BSEP 1 and 2 Revised Tech Spec Pages
- BSEP 1 Tech Spec Bases Markup
  - Consistent with Bases markups included in TSTF-564
  - ATRIUM 11 identified as SL basis
- ATRIUM 10XM and ATRIUM 11 $MCPR_{95/95}$ Derivation

Summary

- Proposed date for LAR submittal – February 2020
- Final SE need date - March 2021 to support Unit 2 startup
- $MCPR_{95/95}$ calculated for Framatome's ATRIUM 10XM and ATRIUM 11 fuel types using approved TSTF-564 methodology
- Eliminates the need of cycle-specific LAR on short approval timeline


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