DRAFT SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO TECHNICAL SPECIFICATIONS TASK FORCE TRAVELER

TSTF-564, REVISION 1, "SAFETY LIMIT MCPR"

USING THE CONSOLIDATED LINE ITEM IMPROVEMENT PROCESS

(EPID L-2017-PMP-0007)

1.0 INTRODUCTION AND BACKGROUND

By letter dated May 29, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18149A320), the Technical Specifications Task Force (TSTF) submitted Traveler TSTF-564, Revision 1, "Safety Limit MCPR [Minimum Critical Power Ratio]." Traveler TSTF-564, Revision 1, proposed changes to the Standard Technical Specifications (STS) for boiling-water reactor (BWR) designs.[1] These changes will be incorporated into future revisions of NUREG-1433 and NUREG-1434. Associated changes were also made to the technical specification (TS) Bases.

The proposed changes revise the basis, calculational method, and the value of the TS safety limit (SL) 2.1.1.2, which protects against boiling transition on the fuel rods in the core. The current basis ensures that 99.9 percent of the fuel rods in the core are not susceptible to boiling transition. The revised basis will ensure that there is a 95 percent probability at a 95 percent confidence level that no fuel rods will be susceptible to boiling transition using an SL based on critical power ratio (CPR) data statistics. Technical Specification 5.6.3, "Core Operating Limits Report [(COLR)]," is also modified.

This STS change will be made available to licensees through the consolidated line item improvement process (CLIIP) and is applicable to licensees utilizing those vendor-specific and fuel bundle types which are specified in Table 1 of the traveler.

The U.S. Nuclear Regulatory Commission (NRC) staff transmitted requests for additional information (RAIs) to the TSTF by letter dated April 12, 2018 (ADAMS Accession No. ML18095A229). Responses to these RAIs were transmitted from the TSTF by letter dated May 29, 2018 (ADAMS Accession No. ML18149A320).

1.1 Background on Boiling Transition

During steady-state operation in a BWR, most of the coolant in the core is in a flow regime known as annular flow. In this flow regime, a thin liquid film is pushed up the surface of the fuel rod cladding by the bulk coolant flow, which is mostly water vapor with some liquid water droplets. This provides effective heat removal from the cladding surface; however, under

[1] U.S. Nuclear Regulatory Commission, "Standard Technical Specifications, General Electric Plants BWR/4," NUREG-1433, Volume 1, "Specifications," and Volume 2, "Bases," Revision 4.0, April 2012 (ADAMS Accession Nos. ML12104A192 and ML12104A193).

U.S. Nuclear Regulatory Commission, "Standard Technical Specifications, General Electric Plants BWR/6," NUREG-1434, Volume 1, "Specifications," and Volume 2, "Bases," Revision 4.0, April 2012 (ADAMS Accession Nos. ML12104A195 and ML12104A196).

certain conditions, the annular film may dissipate, which reduces the heat transfer and results in an increase in fuel cladding surface temperature. This phenomenon is known as boiling transition or dryout. The elevated surface temperatures resulting from dryout may cause fuel cladding damage or failure.

1.2 Background on Critical Power Correlations

For a given set of reactor operating conditions (pressure, flow, etc.), dryout will occur on a fuel assembly at a certain power, known as the critical power. Because the phenomena associated with boiling transition are complex and difficult to model purely mechanistically, thermal-hydraulic test campaigns are undertaken using electrically heated prototypical fuel bundles to establish a comprehensive database of critical power measurements for each BWR fuel product. These data are then used to develop a critical power correlation that can be used to predict the critical power for assemblies in operating reactors. This prediction is usually expressed as the ratio of the actual assembly power to the critical power predicted using the correlation, known as the CPR.

One measure of the correlation's predictive capability is based on its validation relative to the test data. For each point *j* in a correlation's test database, the experimental critical power ratio (ECPR) is defined as the ratio of the measured critical power to the calculated critical power,[2] or:

$$\mathrm{ECPR}_j = \frac{\text{Measured Critical Power}_j}{\text{Calculated Critical Power}_j}$$

For ECPR values less than or equal to 1, the calculated critical power is greater than the measured critical power and the prediction is considered to be non-conservative. Because the measured critical power includes random variations due to various uncertainties, evaluating the ECPR for all of the points in the dataset (or, ideally, a subset of points that were not used in the correlation's development) results in a probability distribution. This ECPR distribution allows the predictive uncertainty of the correlation to be determined. This uncertainty can then be used to establish a limit above which there can be assumed that boiling transition will not occur (with a certain probability and confidence level).

1.3 Background on Thermal-Hydraulic Safety Limits

To protect against boiling transition, BWRs have implemented an SL on the CPR, known as the minimum critical power ratio (MCPR) SL. As discussed in NUREG-1433 and NUREG-1434 for General Electric BWR designs, the current basis of the MCPR SL is to prevent 99.9 percent of the fuel in the core from being susceptible to boiling transition. This limit is typically developed by considering various cycle-specific power distributions and uncertainties, and is highly dependent on the cycle-specific radial power distribution in the core. As such, the limit may need to be updated as frequently as every cycle.

[2] Consistent with the definition used in Section 3.1 of the revised TSTF traveler (ADAMS Accession No. ML18149A320) and associated RAI response (i.e., RAI 1) (ADAMS Accession No. ML18149A320).

The fuel cladding SL for pressurized-water reactor (PWR) designs, described in the STS for Babcock & Wilcox, Westinghouse, and Combustion Engineering[3] plants in NUREG-1430, NUREG-1431, and NUREG-1432,[4] respectively, correspond to a 95 percent probability at a 95 percent confidence level that departure from nucleate boiling will not occur. As a result of the overall approach taken in developing the PWR limits, they are only dependent on the fuel type(s) in the reactor and the corresponding departure from nucleate boiling ratio (DNBR) correlations. The limits are not cycle-dependent and are typically only updated when new fuel types are inserted in the reactor.

BWRs also have a limiting condition for operation (LCO) that governs MCPR, known as the MCPR operating limit (OL). The OL on MCPR is an LCO which must be met to ensure that anticipated operational occurrences do not result in fuel damage. The current MCPR OL is calculated by combining the largest change in CPR from all analyzed transients, also known as the ΔCPR, with the MCPR SL.

2.0 REGULATORY EVALUATION

2.1 Description of STS Sections

2.1.1 TS 2.1.1, "Reactor Core SLs"

Safety limits ensure that specified acceptable fuel design limits are not exceeded during steady state operation, normal operational transients, and anticipated operational occurrences (AOOs).

Technical Specification 2.1.1.2 currently requires that with the reactor steam dome pressure greater than or equal to (≥) 785 pounds per square inch gauge (psig) and core flow ≥ 10 percent rated core flow, MCPR shall be ≥ [1.07] for two recirculation loop operation or ≥ [1.08] for single recirculation loop operation. The value in brackets represents plant-specific parameters. The MCPR SL ensures that 99.9 percent of the fuel in the core is not susceptible to boiling transition.

2.1.2 TS 5.6.3, "Core Operating Limits Report [(COLR)]"

Technical Specification 5.6.3 requires core operating limits to be established prior to each reload cycle, or prior to any remaining portion of a reload cycle. These limits are required to be documented in the COLR.

2.2 Proposed Changes to the STS

Traveler TSTF-564, Revision 1, proposed a method for determining a revised, cycle-independent MCPR SL for any BWR fuel applicable to all BWR designs. Though the process for determining a revised MCPR SL is broadly applicable to any BWR fuel, the traveler provides a table of sample limits for fuels from Global Nuclear Fuel and Westinghouse Electric

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[3] Denotes applicability to Combustion Engineering plants with digital control systems only.

[4] U.S. Nuclear Regulatory Commission, "Standard Technical Specifications, Babcock and Wilcox Plants," NUREG-1430, Volume 1, "Specifications," and Volume 2, "Bases," Revision 4.0, April 2012 (ADAMS Accession Nos. ML12100A177 and ML12100A178).

U.S. Nuclear Regulatory Commission, "Standard Technical Specifications, Westinghouse Plants," NUREG-1431, Volume 1, "Specifications," and Volume 2, "Bases," Revision 4.0, April 2012 (ADAMS Accession Nos. ML12100A222 and ML12100A228).

U.S. Nuclear Regulatory Commission, "Standard Technical Specifications, Combustion Engineering Plants," NUREG-1432, Volume 1, "Specifications," and Volume 2, "Bases," Revision 4.0, April 2012 (ADAMS Accession Nos. ML12102A165 and ML12102A169).

Company. The original MCPR SL, referred to in traveler TSTF-564, Revision 1, as the $MCPR_{99.9\%}$ SL, ensures that 99.9 percent of the fuel in the core is not susceptible to boiling transition. The revised MCPR SL, referred to in traveler TSTF-564, Revision 1, as the $MCPR_{95/95}$ SL, ensures there is a 95 percent probability at a 95 percent confidence level that no fuel rods will be susceptible to transition boiling. Additional changes to the STS and TS Bases proposed in the traveler support the revision of the SL.

The proposed changes to the STS revise the value of the MCPR SL in TS 2.1.1.2, with corresponding changes to the associated bases. The change to TS 2.1.1.2 replaces the existing separate SLs for single- and two-recirculation loop operation with a single limit since the revised SL is no longer dependent on the number of recirculation loops in operation. In addition, the current MCPR SL is renamed $MCPR_{99.9\%}$ and the new MCPR SL is named $MCPR_{95/95}$. Corresponding changes are made to the associated TS Bases.

The $MCPR_{99.9\%}$ (i.e., the current MCPR SL) is an input to the MCPR operating limits (OL) in limiting condition of operation (LCO) 3.2.2, "Minimum Critical Power Ratio (MCPR)." While the definition and method of calculation of both the $MCPR_{99.9\%}$ and the LCO 3.2.2 MCPR OL remains unchanged, the proposed STS changes include revisions to TS 5.6.3, to require the $MCPR_{99.9\%}$ value used in calculating the LCO 3.2.2 MCPR OL to be included in the cycle-specific COLR. Corresponding TS Bases changes for LCO 3.2.2 and TS 5.6.3 support the proposed STS changes.

2.3 Applicable Regulatory Requirements and Guidance

Section IV, "The Commission Policy," of the "Final Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors," published in the *Federal Register* on July 22, 1993 (58 FR 39132), states, in part:

> The purpose of Technical Specifications is to impose those conditions or limitations upon reactor operation necessary to obviate the possibility of an abnormal situation or event giving rise to an immediate threat to the public health and safety by identifying those features that are of controlling importance to safety and establishing on them certain conditions of operation which cannot be changed without prior Commission approval.
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> …[T]he Commission will also entertain requests to adopt portions of the improved STS [(e.g., TSTF-563)], even if the licensee does not adopt all STS improvements …In accordance with this Policy Statement, improved STS have been developed and will be maintained for each NSSS [nuclear steam supply system] owners group. The Commission encourages licensees to use the improved STS as the basis for plant-specific Technical Specifications. …[I]t is the Commission intent that the wording and Bases of the improved STS be used … to the extent practicable.

As described in the Commission's "Final Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors," NRC and industry task groups for new STS recommended that improvements include greater emphasis on human factors principles in order to add clarity and understanding to the text of the STS, and provide improvements to the Bases of STS, which provides the purpose for each requirement in the specification. The improved vendor-specific STS were developed and issued by the NRC in September 1992.

As required by 10 CFR 50.36(c), TSs will include items in the following categories: (1) *Safety limits, limiting safety system settings, and limiting control settings*. As required by 10 CFR 50.36(c)(1)(i)(A), safety limits for nuclear reactors are “limits upon important process variables that are found to be necessary to reasonably protect the integrity of certain of the physical barriers that guard against the uncontrolled release of radioactivity. If any safety limit is exceeded, the reactor must be shut down. The licensee shall notify the Commission, review the matter, and record the results of the review, including the cause of the condition and the basis for corrective action taken to preclude recurrence. Operation must not be resumed until authorized by the Commission.”

As required by 10 CFR 50.36(c)(2)(i), the TSs will include LCOs, which are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When an LCO is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the TSs until the condition can be met.

General Design Criterion 10 (GDC), “Reactor design,” of 10 CFR Part 50 Appendix A, “General Design Criteria of Nuclear Power Plants,” states:

> The reactor core and associated coolant control and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.

Most plants have a plant-specific design criterion similar to GDC 10. The limit placed on the MCPR acts as a specified acceptable fuel design limit to prevent boiling transition, which has the potential to result in fuel rod cladding failure.

The NRC staff’s guidance contained in Revision 2 of NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition” (SRP), Section 4.4, “Thermal and Hydraulic Design,”[5] provides the following two examples of acceptable approaches to meeting the SRP acceptance criteria for establishing fuel design limits (as stated in SRP Acceptance Criterion 1):

A. For departure from nucleate boiling ratio (DNBR), CHFR [critical heat flux ratio] or CPR correlations, there should be a 95-percent probability at the 95-percent confidence level that the hot rod in the core does not experience a DNB or boiling transition condition during normal operation or AOOs.

B. The limiting (minimum) value of DNBR, CHFR, or CPR correlations is to be established such that at least 99.9 percent of the fuel rods in the core will not experience a DNB or boiling transition during normal operation or AOOs.

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[5] U.S. Nuclear Regulatory Commission, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR [Light-Water Reactor] Edition,” NUREG-0800, Section 4.4, “Thermal and Hydraulic Design, Revision 2, March 2007 (ADAMS Accession No. ML070550060).

3.0 TECHNICAL EVALUATION

3.1 Basis for Proposed Change

As discussed in Section 2.3 of traveler TSTF-564, Revision 1, and Section 1.3 of this safety evaluation, the current MCPR SL (i.e., the $MCPR_{99.9\%}$) is affected by each plant's cycle-specific core design, especially including the core power distribution, fuel type(s) in the reactor, and the power-to-flow operating domain for the plant. As such, it is frequently necessary to change the MCPR SL to accommodate new core designs. Changes to the MCPR SL are usually determined late in the design process and necessitate an accelerated NRC review (i.e., license amendment request) to support the subsequent fuel cycle.

Traveler TSTF-564, Revision 1, proposes to change the basis for the MCPR SL so that it is no longer cycle-dependent, reducing the frequency of revisions and eliminating the need for NRC review on an accelerated schedule. The proposed revised basis for the MCPR SL aligns it with that of the DNBR SL used in PWRs, which, as previously noted in Section 2.3 of this safety evaluation, provides a 95 percent probability at a 95 percent confidence level that no fuel rods will experience departure from nucleate boiling.

The intent of the proposed basis for the revised MCPR SL is acceptable to the NRC staff based on the discussion in SRP Section 4.4, SRP Acceptance Criterion 1. The remainder of this safety evaluation is devoted to ensuring that the methodology for determining the revised MCPR SL provides the intended result, that the revised MCPR SL can be adequately determined in cores using various types of fuel, that the proposed SL continues to fulfill the necessary functions of an SL without unintended consequences, and that the proposed changes have been adequately implemented in the STS and associated TS Bases.

3.2 Revised MCPR SL Definition

As discussed in Section 1.2 of this safety evaluation, a critical power correlation's ECPR distribution quantifies the uncertainty associated with the correlation. The TSTF traveler provides a definition for a limit that bounds 95 percent of a correlation's ECPR distribution at a 95 percent confidence level, according to the following formula:

$$\mathrm{MCPR}_{95/95}(i) = \mu_i + \kappa_i \sigma_i$$

where μ_i is the correlation's mean ECPR, σ_i is the standard deviation of the correlation's ECPR distribution, 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." This formula is commonly used to determine a 95/95 one-sided upper tolerance limit for a normal distribution, which is appropriate for the situation under consideration. The factor κ is generally attributed to D. B. Owen[6] and was also reported by M. G. Natrella[7] as referenced in traveler TSTF-564, Revision 1. Example values of κ are provided in Table 2 of the TSTF traveler. Table 1 of the TSTF traveler includes some reference values of the $MCPR_{95/95}$.

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[6] D. B. Owen, "Factors for One-Sided Tolerance Limits and for Variables Sampling Plans," Sandia Corporation, SCR-607, March 1963, ADAMS Accession No. ML14031A495.

[7] M. G. Natrella, "Experimental Statistics," National Bureau of Standards, National Bureau of Standards Handbook 91, August 1963.

As discussed by Piepel and Cuta[8] for DNBR correlations, the acceptability of this approach is predicated on a variety of assumptions, including the assumptions that the correlation data comes from a common population and that the correlation's population is distributed normally. These assumptions are typically addressed generically when a critical power or critical heat flux correlation is reviewed by the NRC staff, who may apply penalties to the correlation to account for any issues identified. In its response to an RAI, the TSTF states that such penalties applied during the NRC's review of the critical power correlation would be imposed on the mean or standard deviation used in the calculating the $MCPR_{95/95}$ (ADAMS Accession No. ML18149A320). These penalties would also continue to be imposed in the determination of the $MCPR_{99.9\%}$, along with any other penalties associated with the process of (or other inputs used in) determining the $MCPR_{99.9\%}$ (e.g., penalties applied to the $MCPR_{99.9\%}$ SL for operation in the Maximum Extended Load Limit Line Analysis Plus (MELLLA+) operating domain).

The NRC staff finds the definition of the $MCPR_{95/95}$ will appropriately establish a 95/95 upper tolerance limit on the critical power correlation and that any issues in the underlying correlation will be addressed through penalties on the correlation mean and standard deviation, as necessary. Therefore, the NRC staff concludes that the $MCPR_{95/95}$ definition, as proposed, establishes an acceptable fuel design limit and is acceptable.

3.3 Determination of Revised MCPR SL for Mixed Cores

The TSTF proposed that a core containing a variety of fuel types would evaluate the $MCPR_{95/95}$ for all of the fresh and once-burnt fuel in the core and apply the most limiting (i.e., the largest) value of $MCPR_{95/95}$ for each of the applicable fuel types as the MCPR SL. As stated in Section 3.1 of the TSTF traveler, this is because bundles that are twice-burnt or more at the beginning of the cycle have significant MCPR margin relative to the fresh and once-burnt fuel. In its response to an RAI (ADAMS Accession No. ML18149A320), the TSTF provided additional justification for this assertion. The justification is that the MCPR for twice-burnt and greater fuel is far enough from the MCPR for the limiting bundle that its probability of boiling transition is very small compared to the limiting bundle and it can be neglected in determining the SL. Results of a study provided in the RAI response indicate that this is the case even for fuel operated on short (12-month) reload cycles. As discussed in the RAI, twice-burnt or greater fuel bundles are included in the cycle-specific evaluation of the $MCPR_{99.9\%}$ and the MCPR OL. If a twice-burnt or greater fuel bundle is found to be limiting, it would be governed by the MCPR OL, which will always be more restrictive than both the $MCPR_{95/95}$ and the $MCPR_{99.9\%}$. The NRC staff found this justification to be appropriate and determined that it is acceptable to determine the $MCPR_{95/95}$ SL for the core based on the most limiting value of the $MCPR_{95/95}$ for the fresh and once-burnt fuel in the core.

The NRC staff reviewed the information furnished by the TSTF and determined that the process for establishing the revised MCPR SL for mixed cores ensures that the limiting fuel types in the core will be evaluated and the limiting $MCPR_{99.9\%}$ will be appropriately applied as the SL. The NRC staff therefore found this process to be acceptable.

The size, mean, and standard deviation of the ECPR database may need to be provided by a fuel vendor to determine the $MCPR_{95/95}$ for a legacy fuel type. The value of κ depends on the number of samples (N_i) in the critical power database. If the number of data points in the

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[8] G. F. Piepel and J. M. Cuta, "Statistical Concepts and Techniques for Developing, Evaluating, and Validating CHF Models and Corresponding Fuel Design Limits," SKI Technical Report, 93:46, 1993.

database is not supplied by the vendor, the TSTF response to an RAI stated that a value of κ = 1.8 would be imposed on the $MCPR_{95/95}$ determination, on the basis that any database used to develop a critical power correlation will need at least 500 points to be acceptable.[9] The limiting value from either the new or legacy fuel would then be applied as the SL. The NRC staff finds that there are potential circumstances where the number of data points used in determining the correlation's uncertainty may not correspond to a κ value of 1.8; for example, future correlations may need fewer data points, or the subset of data used to determine a correlation's uncertainty may be smaller than the full correlation database. Therefore, the NRC staff determined that a κ value of 1.8 for legacy fuel types where the number of data points N is not provided may not be acceptable, and the κ used in determining the $MCPR_{95/95}$ must be justified to be appropriate or conservative for the fuel type and correlation in question. This determination does not affect the overall acceptability of the process for determining the $MCPR_{95/95}$ for a mix of fuel types as discussed above. The NRC staff also notes that, as stated in Section 1.0 of this SE, this STS change is only available to licensees through the CLIIP when using the fuel bundle types specified in Table 1 of the traveler. Therefore, the use of legacy fuels, for which this determination would be relevant, is outside the scope of a CLIIP application.

3.4 Relationship Between MCPR Safety and Operating Limits

In its response to an RAI, the TSTF discussed that $MCPR_{99.9\%}$ is expected to always be greater than the $MCPR_{95/95}$ for two reasons. First, because the $MCPR_{99.9\%}$ includes uncertainties not factored into the $MCPR_{95/95}$, and second, because the 99.9 percent probability basis for determining the $MCPR_{99.9\%}$ is more conservative than the 95 percent probability at a 95 percent confidence level used in determining the $MCPR_{95/95}$. The level of conservatism in the $MCPR_{95/95}$ SL is appropriate because the lead fuel rod in the core (i.e., the limiting fuel rod with respect to MCPR) is used to evaluate whether any fuel rods in the core are susceptible to boiling transition, which is also discussed in the TSTF RAI response (i.e., RAI 2(a) (ADAMS Accession No. ML18149A320)). This is consistent with evaluations performed for PWRs using a 95/95 upper tolerance limit on the correlation uncertainty as an SL.

The TSTF traveler proposed that the MCPR OL defined in LCO 3.2.2 would continue to be evaluated using the $MCPR_{99.9\%}$ as an input. The $MCPR_{99.9\%}$ will continue to be evaluated in the same way as it is currently, using the whole core. The TSTF traveler also changes TS 5.6.3, to require the cycle-specific value of the $MCPR_{99.9\%}$ to be included in the COLR. The methods supporting the inclusion of the $MCPR_{99.9\%}$ must also therefore be included in the list of COLR references contained in TS 5.6.3.b.[10] The changes to TS 5.6.3.b help to ensure that the uncertainties being removed from the MCPR SL are still included as part of the MCPR OL and will continue to appropriately inform plant operation.

The NRC staff therefore determined that the changes proposed by the TSTF will retain an adequate level of conservatism in the MCPR SL in TS 2.1.1.2 while appropriately ensuring that plant- and cycle-specific uncertainties will be retained in the MCPR OL. The NRC staff notes that the $MCPR_{95/95}$ represents a hard floor on the value of the $MCPR_{99.9\%}$, which should always

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[9] The NRC staff notes that a κ value of 1.8 corresponds to N = 300 data points, as provided in Table T-11b of NUREG-1475, "Applying Statistics," Revision 1, March 2011 (ADAMS Accession No. ML11102A076). This is more conservative than the κ for N = 500 data points, which would be 1.763.

[10] The MCPR OL is already a COLR parameter and as such, the methodology to calculate it should already be included in TS 5.6.3.b. In current BWR methodologies for all major U.S. fuel suppliers, the MCPR SL (i.e., the $MCPR_{99.9\%}$) is calculated using the same methodology as the MCPR OL. Should this change, because the $MCPR_{99.9\%}$ and the MCPR OL are both COLR parameters, both methodologies would need to be included in TS 5.6.3.b.

be higher since it accounts for numerous uncertainties that are not included in the $MCPR_{95/95}$ (as discussed in Section 3.1 of traveler TSTF-564, Revision 1, and the TSTF's response to RAI 7).

3.5 Implementation of the Revised MCPR SL in the TS

The value reported in TS 2.1.1.2 will be the value calculated using Equation 1 from traveler TSTF-564, Revision 1, at a precision of two digits past the decimal point with the hundreds digit rounded up. This is consistent with the current practice for PWR DNBR SLs and is acceptable to the NRC staff. As previously discussed, the value of the MCPR OL provided in LCO 3.2.2 will continue to be reported in the COLR. The COLR will be required to contain the cycle-specific $MCPR_{99.9\%}$ value and TS 5.6.3.b will continue to reference appropriate NRC-approved methodologies for determination of the $MCPR_{99.9\%}$ and the MCPR OL.

Traveler TSTF-564, Revision 1, added new language to the TS 2.1.1 Bases to provide the basis for the redefined MCPR SL. In its response to an RAI, the TSTF revised the TS Bases to specify the fuel type on which the SL is based. Though the traveler is intended to be applicable to all types of fuel, the existing STS bases only discuss certain fuel vendors. As discussed in RAI responses to RAIs 1, 10, and 12, the TSTF proposed changes to the STS bases for issues directly related to the implementation of the revised MCPR SL.

The NRC staff reviewed the proposed TS and Bases changes and found that the TSTF appropriately implemented the revised MCPR SL, as discussed in the proposed TSTF-564, Revision 1 traveler.

4.0 CONCLUSION

The NRC staff reviewed traveler TSTF-564, Revision 1, which proposed changes to NUREG-1433 and NUREG-1434. The NRC staff determined that the proposed definition of the MCPR SL in TS 2.1.1.2 was acceptably modified and will be calculated in a manner consistent with the new definition. Under the new definition, the MCPR SL will continue to protect the fuel cladding against the uncontrolled release of radioactivity by preventing the onset of boiling transition, thereby fulfilling the requirements of 10 CFR 50.36(c)(1) for SLs. The MCPR OL in LCO 3.2.2 remains unchanged and will continue to meet the requirements of 10 CFR 50.36(c)(2) (and GDC 10 or the equivalent plant-specific design criterion) by ensuring that no fuel damage results during normal operation and AOOs. The NRC staff determined that the changes to TS 5.6.3 proposed in the traveler are acceptable; upon adoption of the revised MCPR SL, the COLR will be required to contain the $MCPR_{99.9\%}$, supporting the determination of the MCPR OL using current methodologies.

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