UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 12, 2020

Mr. John Dent, Jr.
Vice President-Nuclear and
Chief Nuclear Officer
Nebraska Public Power District
Cooper Nuclear Station
72676 648A Avenue
P.O. Box 98
Brownville, NE 68321

SUBJECT: COOPER NUCLEAR STATION - ISSUANCE OF AMENDMENT NO. 265 RE: ADOPTION OF TECHNICAL SPECIFICATIONS TASK FORCE (TSTF) TRAVELER TSTF-564, REVISION 2, "SAFETY LIMIT MCPR" (EPID L-2019-LLA-0127)

Dear Mr. Dent:

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 265 to Renewed Facility Operating License No. DPR-46 for Cooper Nuclear Station. The amendment consists of changes to the Technical Specifications (TSs) in response to your application dated May 23, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19171A266).

The amendment revises the TSs based on Technical Specifications Task Force (TSTF) traveler TSTF-564, Revision 2, "Safety Limit MCPR [Minimum Critical Power Ratio]," dated October 24, 2018 (ADAMS Accession No. ML18297A361). The amendment revises the Cooper Nuclear Station TS Safety Limit 2.1.1.2 and TS 5.6.5, "Core Operating Limits Report (COLR)."

A copy of the related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

/RA/

Thomas J. Wengert, Senior Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-298

Enclosures:
1. Amendment No. 265 to DPR-46
2. Safety Evaluation

cc: Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

NEBRASKA PUBLIC POWER DISTRICT

DOCKET NO. 50-298

COOPER NUCLEAR STATION

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 265
Renewed License No. DPR-46

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Nebraska Public Power District (the licensee), dated May 23, 2019, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. DPR-46 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A as revised through Amendment No. 265, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. The license amendment is effective as of its date of issuance and shall be implemented within 60 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Jennifer L. Dixon-Herrity

Digitally signed by Jennifer L. Dixon-Herrity
Date: 2020.05.12 15:33:43 -04'00'

Jennifer L. Dixon-Herrity, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility Operating License No. DPR-46 and the Technical Specifications

Date of Issuance: May 12, 2020

ATTACHMENT TO LICENSE AMENDMENT NO. 265

RENEWED FACILITY OPERATING LICENSE NO. DPR-46

COOPER NUCLEAR STATION

DOCKET NO. 50-298

Replace the following pages of the Renewed Facility Operating License No. DPR-46 and Appendix A Technical Specifications with the enclosed revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Renewed Facility Operating License

REMOVE	INSERT
-3-	-3-

Technical Specifications

REMOVE	INSERT
2.0-1	2.0-1
5.0-21	5.0-21

(5) Pursuant to the Act and 10 CFR Parts 30, 40, and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by operation of the facility.

C. This license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations in 10 CFR Chapter I: Part 20, Section 30.34 of Part 30, Section 40.41 of Part 40, Sections 50.54 and 50.59 of Part 50, and Section 70.32 of Part 70; is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

The licensee is authorized to operate the facility at steady state reactor core power levels not in excess of 2419 megawatts (thermal).

(2) Technical Specifications

The Technical Specifications contained in Appendix A as revised through Amendment No. 265, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

(3) Physical Protection

The licensee shall fully implement and maintain in effect all provisions of the Commission-approved physical security, training and qualification and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822) and to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The combined set of plans, which contain Safeguards Information protected under 10 CFR 73.21, are entitled: "Cooper Nuclear Station Safeguards Plan," submitted by letter dated May 17, 2006.

NPPD shall fully implement and maintain in effect all provisions of the Commission-approved cyber security plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The NPPD CSP was approved by License Amendment No. 238 as supplemented by changes approved by License Amendments 244 and 249.

(4) Fire Protection

NPPD shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the license amendment request dated April 24, 2012 (and supplements dated July 12, 2012, January 14, 2013, February 12, 2013, March 13, 2013, June 13, 2013, December 12, 2013, January 17, 2014, February 18, 2014, and April 11, 2014), and as approved in the safety evaluation dated April 29, 2014. Except where NRC approval for changes or deviations is required by 10 CFR 50.48(c), and provided no other regulation, technical specification, license condition or requirement would require prior NRC approval, the licensee may make changes to the fire protection program without prior approval of the Commission if

2.0 SAFETY LIMITS (SLs)

2.1 SLs

2.1.1 Reactor Core SLs

2.1.1.1 With the reactor steam dome pressure < 785 psig or core flow < 10% rated core flow:

THERMAL POWER shall be ≤ 25% RTP.

2.1.1.2 With the reactor steam dome pressure ≥ 785 psig and core flow ≥ 10% rated core flow:

MCPR shall be ≥ 1.07.

2.1.1.3 Reactor vessel water level shall be greater than the top of active irradiated fuel.

2.1.2 Reactor Coolant System Pressure SL

Reactor steam dome pressure shall be ≤ 1337 psig.

2.2 SL Violations

With any SL violation, the following actions shall be completed within 2 hours:

2.2.1 Restore compliance with all SLs; and

2.2.2 Insert all insertable control rods.

5.6 Reporting Requirements (continued)

5.6.3 Radioactive Effluent Release Report

The Radioactive Effluent Release Report covering the operation of the unit shall be submitted in accordance with 10 CFR 50.36a. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit. The material provided shall be consistent with the objectives outlined in the ODAM and the Process Control Program and in conformance with 10 CFR 50.36a and 10 CFR 50, Appendix I, Section IV.B.1.

5.6.4 (Deleted)

5.6.5 Core Operating Limits Report (COLR)

a. Core operating limits shall be established prior to each reload cycle, or prior to any remaining portion of a reload cycle, and shall be documented in the COLR for the following:

1. The Average Planar Linear Heat Generation Rates for Specifications 3.2.1 and 3.7.7.

2. The Minimum Critical Power Ratio for Specifications 3.2.2 and 3.7.7, and $MCPR_{99.9\%}$ for Specification 3.2.2.

3. The Linear Heat Generation Rates for Specifications 3.2.3 and 3.7.7.

4. The three Rod Block Monitor Upscale Allowable Values for Specification 3.3.2.1.

5. The power/flow map defining the Stability Exclusion Region for Specification 3.4.1.

b. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

1. NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel" (Revision specified in the COLR).

UNITED STATES
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WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 265 TO

RENEWED FACILITY OPERATING LICENSE NO. DPR-46

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

DOCKET NO. 50-298

1.0 INTRODUCTION

By application dated May 23, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19171A266), Nebraska Public Power District (NPPD, the licensee) submitted a license amendment request (LAR) for Cooper Nuclear Station (Cooper), which is a boiling water reactor (BWR).

The LAR proposed to revise the value of the Technical Specification (TS) 2.1.1.2 reactor core safety limit (SL) minimum critical power ratio (MCPR). The MCPR protects against boiling transition on the fuel rods in the core. The current MCPR value is dependent on the number of recirculation loops in operation and ensures that 99.9 percent of the fuel rods in the core are not susceptible to boiling transition, which is referred to as the $MCPR_{99.9\%}$. The revised MCPR would 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, which is referred to as the $MCPR_{95/95}$. The $MCPR_{95/95}$ is not dependent on the number of recirculation loops in operation. Additionally, TS 5.6.5, “Core Operating Limits Report (COLR),” would be modified to require that the COLR include the cycle-specific value for $MCPR_{99.9\%}$, which would still be used to calculate the MCPR operating limit (OL).

The proposed changes are based on Technical Specifications Task Force (TSTF) traveler TSTF-564, Revision 2, “Safety Limit MCPR,” dated October 24, 2018 (ADAMS Accession No. ML18297A361). The U.S. Nuclear Regulatory Commission (NRC or the Commission) issued a final safety evaluation (SE) approving traveler TSTF-564, Revision 2, on November 16, 2018 (ADAMS Accession No. ML18299A069). The NRC staff issued a revised final model SE for traveler TSTF-564, Revision 2, on February 25, 2020 (ADAMS Accession No. ML19248C823).

The licensee has proposed several variations from the TS changes described in traveler TSTF-564, Revision 2. The variations are described in Section 2.2 of this SE and evaluated in Section 3.6 of this SE.

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 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 critical power predicted using the correlation to the actual assembly power, 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, 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 or equal to 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 it 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 MCPR SL. As discussed in Section III, Chapter 7 of the Cooper Updated Safety Analysis Report (USAR) (ADAMS Accession No. ML19137A130) and the Standard Technical Specifications (STSs) for General Electric BWR plant designs in NUREG-1433 and

NUREG-1434,[1] the current calculation 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.

The fuel cladding SL for pressurized-water reactor (PWR) designs, described in the STSs for Babcock & Wilcox, Westinghouse, and Combustion Engineering[2] plants in NUREG-1430, NUREG-1431, and NUREG-1432,[3] respectively, correspond to a 95 percent probability at a 95 percent confidence level that departure from nucleate boiling (DNB) 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.

The TSs for Cooper also have a limiting condition for operation (LCO) that governs MCPR, known as the MCPR OL. The OL on MCPR is an LCO that must be met to ensure that anticipated operational occurrences (AOOs) 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. The MCPR OL is already a COLR parameter and as such, the methodology to calculate it is included in TS 5.6.5.b. The MCPR SL (i.e., the $MCPR_{99.9\%}$) is calculated using the same methodology as the MCPR OL.

2.0 REGULATORY EVALUATION

2.1 Description of TS Sections

2.1.1 TS 2.1.1, "Reactor Core SLs"

The SLs ensure that specified acceptable fuel design limits are not exceeded during steady-state operation, normal operational transients, and AOOs.

Cooper TS 2.1.1.2 currently requires that 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, the MCPR shall be ≥ 1.13 for two recirculation loop operation or ≥ 1.16 for single recirculation loop operation. The MCPR SL (also referred to as $MCPR_{99.9\%}$) ensures that 99.9 percent of the fuel rods in the core are not susceptible to boiling transition.

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[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).

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

[3] 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).

2.1.2 TS 5.6.5, "Core Operating Limits Report (COLR)"

Cooper TS 5.6.5 requires core operating limits to be established prior to each reload cycle, or prior to any remaining portion of a reload cycle. This TS requires that these limits be documented in the COLR.

2.2 Proposed Changes to the TSs

The licensee proposed to revise the MCPR SL in TS 2.1.1.2 to make it cycle-independent, consistent with the method described in traveler TSTF-564, Revision 2.

The proposed changes to the Cooper TSs revise the value of the MCPR SL in TS 2.1.1.2 to 1.07, with corresponding changes to the associated TS 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 (also referred to as the $MCPR_{95/95}$ SL) is not dependent on the number of recirculation loops in operation.

The $MCPR_{99.9\%}$ (i.e., the current MCPR SL) is an input to the MCPR OL in 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 TS changes include revisions to TS 5.6.5 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.

In addition, the licensee proposed variations from the TS changes described in TSTF-564 and the applicable parts of the NRC staff's SE. The proposed variations are described below:

- The Cooper TSs utilize different numbering than the STSs on which TSTF-564 was based. Specifically, Section 5.6.5 of the Cooper TSs is numbered 5.6.3 in TSTF-564.

- The traveler and accompanying SE discuss the applicable regulatory requirements and guidance, including Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, General Design Criteria (GDC). Cooper was not licensed to the 10 CFR Part 50, Appendix A, GDC. The Cooper equivalent of the referenced GDC is located in Appendix F of the Cooper USAR. Specifically, the traveler and accompanying SE refer to GDC 10, "Reactor design." Cooper is licensed to the proposed GDC, which appeared in a July 11, 1967, issue of the *Federal Register* (32 FR 10213). Criterion 6 is the proposed GDC equivalent to GDC 10.

2.3 Applicable Regulatory Requirements and Guidance

The regulation at 10 CFR 50.36(a)(1) requires an applicant for an operating license to include in the application proposed TSs in accordance with the requirements of 10 CFR 50.36. The applicant must also include in the application, a "summary statement of the bases or reasons for such specifications, other than those covering administrative controls. . . ." However, per 10 CFR 50.36(a)(1), these TS bases "shall not become part of the technical specifications."

As required by 10 CFR 50.36(c)(1), TSs will include safety limits, limiting safety system settings, and limiting control settings. The regulation, 10 CFR 50.36(c)(1)(i)(A), states, in part:

> 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 a limiting condition for operation of a nuclear reactor is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the technical specifications until the condition can be met." Additionally, as required by 10 CFR 50.36(c)(5), TSs must include administrative controls, which are "the provisions relating to organization and management, procedures, recordkeeping, review and audit, and reporting necessary to assure operation of the facility in a safe manner."

Criterion 6, "Reactor Core Design," which was published in the *Federal Register* on July 11, 1967, and which is applicable to Cooper, states, in part:

> The reactor core shall be designed to function throughout its design lifetime, without exceeding acceptable fuel damage limits which have been stipulated and justified. The core design, together with reliable process and decay heat removal systems shall provide for this capability under all expected conditions of normal operation with appropriate margins for uncertainties and for transient situations which can be anticipated, including the effects of the loss of power to recirculation pumps, tripping out of a turbine generator set, isolation of the reactor from its primary heat sink, and loss of all offsite power."

The limits placed on the MCPR act as an acceptable fuel design limit to prevent boiling transition, which has the potential to result in fuel rod cladding failure, and are used to meet proposed Criterion 6.

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 [Light Water reactor] Edition" (SRP), Section 4.4, "Thermal and Hydraulic Design,"[4] provides the following two examples of acceptable approaches to meet SRP acceptance Criterion 1 for establishing fuel design limits:

> 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.

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

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.

The NRC staff's guidance for the review of TSs is in Chapter 16.0, Revision 3, "Technical Specifications," of the SRP, dated March 2010 (ADAMS Accession No. ML100351425). As described therein, as part of the regulatory standardization effort, the NRC staff has prepared STSs for each of the LWR nuclear designs. Accordingly, the NRC staff's review considers whether the proposed changes are consistent with the applicable reference STSs (i.e., the current STSs), as modified by NRC-approved travelers. The STS applicable to Cooper is NUREG-1433, Revision 4.0.

3.0 TECHNICAL EVALUATION

3.1 Basis for Proposed Change

As discussed in Section 1.3 of this SE, the current MCPR SL (i.e., the $MCPR_{99.9\%}$ SL) is dependent on the 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., LAR) to support the subsequent fuel cycle.

The licensee proposed to change the calculation for determining the MCPR SL for Cooper so that it is no longer cycle-dependent, reducing the frequency of revisions and eliminating the need for NRC's review on an accelerated schedule. The proposed methodology for determining the MCPR SL aligns it with the DNBR SL used in PWRs, which ensures a 95 percent probability at a 95 percent confidence level that no fuel rods will experience DNB.

The NRC staff finds that calculating the revised MCPR SL based on the 95/95 criterion is acceptable because it meets SRP Section 4.4, acceptance Criterion 1. The remainder of this SE evaluates whether the methodology for determining the revised MCPR SL provides the intended result and documents the review to ensure that the revised MCPR SL can be adequately determined in the core using various types of fuel, that the proposed SL continues to fulfil the necessary functions of an SL without unintended consequences, and that the proposed changes have been adequately implemented in the Cooper TSs.

3.2 Revised MCPR SL Definition

As discussed in Section 1.2 of this SE, the ECPR distribution quantifies the uncertainty associated with the correlation. Traveler TSTF-564, Revision 2, provides the following formula:

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

where μ_i is the mean ECPR and σ_i is the standard deviation of the ECPR distribution. The statistical parameter (κ_i) is selected, based on the number of samples in the critical power database, 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 is a commonly used statistical formula 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[5] and was also reported by M. G. Natrella,[6] as referenced in traveler TSTF-564, Revision 2. Example values of *κ* are provided in Table 2 of traveler TSTF-564, Revision 2. Table 1 of the traveler includes some reference values of the $MCPR_{95/95}$.

As discussed by Piepel and Cuta[7] 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. TSTF letter dated May 29, 2018 (ADAMS Accession No. ML18149A320), 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 calculating the $MCPR_{95/95}$. 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 operating domain).

In the SE of traveler TSTF-564, Revision 2, the NRC staff found that the definition of the $MCPR_{95/95}$ appropriately establishes 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 method for determining $MCPR_{95/95}$ can be used to establish acceptable fuel design limits in the Cooper TSs.

3.3 Determination of Revised MCPR SL for Mixed Cores

The entire Cooper reactor core is currently loaded with Global Nuclear Fuel 2 (GNF2) fuel bundles. No determination of MCPR SL for mixed core is required in this section.

3.4 MCPR Safety and Operating Limits

As discussed in the TSTF letter dated May 29, 2018, the $MCPR_{99.9\%}$ SL is expected to always be greater than the $MCPR_{95/95}$ SL 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 traveler. This is consistent with evaluations performed for PWRs using a 95/95 upper tolerance limit on the correlation uncertainty as an SL.

Consistent with traveler TSTF-564, Revision 2, the licensee is not proposing any change to LCO 3.2.2 and will continue to calculate the MCPR OL using the $MCPR_{99.9\%}$. The $MCPR_{99.9\%}$ will continue to be calculated in the same way as it is currently, using the whole core.

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[5] D. B. Owen, "Factors for One-Sided Tolerance Limits and for Variables Sampling Plans," Sandia Corporation, SCR-607, March 1963, ADAMS Accession No. ML14031A495.
[6] M. G. Natrella, "Experimental Statistics," National Bureau of Standards, National Bureau of Standards Handbook 91 August 1963.
[7] 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.

Consistent with traveler TSTF-564, Revision 2, the licensee proposed to revise TS 5.6.5 to require inclusion of the cycle-specific value of the $MCPR_{99.9\%}$ in the COLR to ensure that the uncertainties being removed from the MCPR SL are still included as part of the MCPR OL. The methods used for determining $MCPR_{99.9\%}$ are included in the list of COLR references contained in TS 5.6.5.b. The changes to TS 5.6.5.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 finds that the changes proposed by the licensee will retain an adequate level of conservatism in the MCPR SL in TS 2.1.1.2 and that plant- and cycle-specific uncertainties will be retained in the MCPR OL as specified in the COLR. The $MCPR_{95/95}$ represents a lower limit on the value of the $MCPR_{99.9\%}$, because the $MCPR_{99.9\%}$ should always 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 2).

3.5 Implementation of the Revised MCPR SL in the TSs

The licensee proposed to change the value of the SL in TS 2.1.1.2 from 1.13 for two recirculation loop operation or 1.16 for single recirculation loop operation to 1.07, consistent with the value from Table 1 of the TSTF-564, Revision 2, for the fuel type in use at Cooper (i.e., GNF2). The licensee appropriately evaluated the fuel in use at Cooper and the NRC staff determined that the limiting $MCPR_{95/95}$ for the fuel was provided for inclusion in TS 2.1.1.2, consistent with the process described in traveler TSTF-564, Revision 2.

The NRC staff finds that the proposed MCPR value of 1.07 in Cooper TS 2.1.1.2 is acceptable because it was calculated using Equation 1 from traveler TSTF-564, Revision 2, and reported at a precision of two digits past the decimal point with the hundredths digit rounded up. Thus, the proposed TS change is acceptable.

The licensee also proposed that Cooper TS 5.6.5 require the $MCPR_{99.9\%}$ value used to calculate the LCO 3.2.2 “MCPR” limit to be specified in the COLR. Thus, Cooper TS 5.6.5.b will continue to reference appropriate NRC-approved methodologies for determination of the $MCPR_{99.9\%}$ and the MCPR OL, which will ensure that cycle-specific parameters are determined such that applicable limits are met. Therefore, the NRC staff finds the proposed change acceptable.

The NRC staff reviewed the licensee’s proposed TS changes and finds that the licensee appropriately implemented the revised MCPR SL, as discussed in this SE.

3.6 Evaluation of Variations from TSTF-564, Revision 2

In its application, the licensee identified the following variations from the TS changes described in TSTF-564 and the applicable portions of the NRC staff’s SE:

- The Cooper TSs utilize different numbering than the STSs on which TSTF-564 was based. Specifically, Section 5.6.5 of the Cooper TS is numbered 5.6.3 in TSTF-564.

  The NRC staff finds that this variation is acceptable because it is editorial in nature and does not affect the applicability of TSTF-564 to the Cooper TSs.

- The traveler and accompanying SE discuss the applicable regulatory requirement and guidance, including the 10 CFR Part 50, Appendix A, GDC. Cooper was not licensed to the 10 CFR Part 50, Appendix A, GDC. The Cooper equivalent of the referenced GDC is located in Appendix F of the Cooper USAR. Specifically, the traveler and accompanying SE refer to GDC 10. Cooper is licensed to the proposed GDC, which appeared in a July 11, 1967, issue of the *Federal Register*. Criterion 6 is the proposed GDC equivalent to GDC 10.

The NRC staff evaluated this variation and determined that the difference between proposed GDC 6 and 10 CFR Part 50, Appendix A, GDC 10 does not alter the conclusion that the proposed change is applicable to Cooper. Therefore, this variation is acceptable.

3.7 NRC Staff Conclusion

The NRC staff reviewed the licensee's proposed TS changes and determined that the proposed SL associated with TS 2.1.1.2 was calculated in a manner consistent with the process described in traveler TSTF-564, Revision 2, and was therefore acceptably modified to suit the revised definition of the MCPR SL. 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 Cooper's Proposed Criterion 6 by ensuring that no fuel damage results during normal operation and AOOs. The NRC staff determined that the proposed changes to Cooper TS 5.6.5 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.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Nebraska State official was notified of the proposed issuance of the amendment on December 2, 2019. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes requirements with respect to installation or use of facility components located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration published in the *Federal Register* on September 10, 2019 (84 FR 47549), and there has been no public comment on such finding. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: S. Peng, NRR

Date: May 12, 2020

SUBJECT: COOPER NUCLEAR STATION - ISSUANCE OF AMENDMENT NO. 265 RE: ADOPTION OF TECHNICAL SPECIFICATIONS TASK FORCE (TSTF) TRAVELER TSTF-564, REVISION 2, "SAFETY LIMIT MCPR" (EPID L-2019-LLA-0127) DATED MAY 12, 2020

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