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

September 6, 2018

Mr. John Dent, Jr.
Vice President-Nuclear and CNO
Nebraska Public Power District
72676 648A Avenue
Brownville, NE 68321

SUBJECT: COOPER NUCLEAR STATION - ISSUANCE OF AMENDMENT RE: SAFETY LIMIT MINIMUM CRITICAL POWER RATIO (EPID L-2018-LLA-0144)

Dear Mr. Dent:

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 261 to Renewed Facility Operating License No. DPR-46 for the Cooper Nuclear Station. The amendment consists of changes to the technical specifications (TSs) in response to your application dated May 10, 2018.

The amendment modifies TS Section 2.0, "Safety Limits (SLs)," by revising the two recirculation loop and single recirculation loop safety limit minimum critical power ratio values to reflect the results of a cycle-specific calculation.

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,

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. 261 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. 261
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 10, 2018, 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 license 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. 261, 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 prior to startup from Refuel Outage 30.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert J. Pascarelli, 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 Technical Specifications

Date of Issuance: September 6, 2018

ATTACHMENT TO LICENSE AMENDMENT NO. 261

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) 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. 261, 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 ≥ 1.13 for two recirculation loop operation or ≥ 1.16 for single recirculation loop operation.

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.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 261 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 10, 2018 (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML18137A199), Nebraska Public Power District (the licensee), requested changes to Technical Specification (TS) Section 2.0, "Safety Limits (SLs)," for the Cooper Nuclear Station (CNS). The proposed changes would revise the values of the safety limit minimum critical power ratio (SLMCPR) for two recirculation loop operation (TLO) and for single recirculation loop operation (SLO) to reflect the results of a cycle-specific calculation. Portions of the letter dated May 10, 2018, contain sensitive unclassified non-safeguards information (proprietary) and, accordingly, have been excluded from public disclosure.

2.0 REGULATORY EVALUATION

2.1 Background

Fuel design limits can be exceeded if the fuel produces heat equal to or greater than critical power. For boiling-water reactors (BWRs), heat produced by the fuel causes the water to partially vaporize in a stable process called nucleate boiling. As the amount of heat produced by the fuel increases, more of the water is vaporized and the vapor production changes the way the water boils. At a certain point, the efficiency of heat removal is impeded by vapor production and the temperature of the fuel cladding rises disproportionately to the heat generated. Critical power is a term used for the power at which the fuel departs from nucleate boiling and enters a transition to film boiling.

For BWRs, the critical power can be predicted using a correlation known as the General Electric (GE) critical quality boiling length correlation. Due to core-wide and operational variations, the margin to boiling transition is most easily described in terms of a critical power ratio (CPR), which is defined as the rod critical power, divided by the actual rod power. The greater a CPR value exceeds 1.0, the greater the margin to boiling transition.

The SLMCPR is calculated using a statistical process that takes into account operating parameters and uncertainties. The operating limit minimum critical power ratio (OLMCPR) is equal to the SLMCPR plus a CPR margin for transients. At the OLMCPR, at least 99.9 percent of the rods avoid boiling transition during steady-state operation and transients caused by a single operator error or equipment malfunction. The SLMCPR is verified on a cycle-specific basis because it is necessary to account for the core configuration-specific neutronic and thermal-hydraulic response.

2.2 Proposed Changes

On the basis of the calculations for CNS cycle-specific core reload analysis for Operating Cycle 31, the calculated SLMCPR would change from greater than or equal to (≥) 1.12 to ≥ 1.13 for TLO and from ≥ 1.14 to ≥ 1.16 for SLO. Accordingly, the licensee proposed to revise CNS TS 2.1.1.2 to read as follows:

> With the reactor steam dome pressure ≥ 785 psig [pounds per square inch gauge] and core flow ≥ 10% rated core flow:
>
> MCPR shall be ≥ 1.13 for two recirculation loop operation or ≥ 1.16 for single recirculation loop operation.

2.3 Regulations and Guidance

The regulatory requirements and guidance documents that the U.S. Nuclear Regulatory Commission (NRC or the Commission) staff considered in its review of the proposed amendment included the following:

- Section 182a of the Atomic Energy Act of 1954, as amended, requires applicants for nuclear power plant operating licenses to include TSs as part of the license. The TSs ensure the operational capability of structures, systems, and components that are required to protect the health and safety of the public. The NRC's regulatory requirements related to the content of the TSs are contained in Section 50.36, "Technical specifications," of Title 10 of the Code of Federal Regulations (10 CFR), which requires that the TSs include items in the following specific categories: (1) safety limits, limiting safety systems settings, and limiting control settings; (2) limiting conditions for operation; (3) surveillance requirements; (4) design features; and (5) administrative controls. However, the regulation does not specify the particular requirements to be included in TSs.

- The regulation in 10 CFR 50.36(c)(1)(i)(A) states, in part, that:

  > 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.

- Criterion 10, "Reactor Design," of Appendix A to 10 CFR Part 50, "General Design Criteria [GDC] for Nuclear Power Plants," states that "[t]he reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits [SAFDLs] are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences."

- The CNS construction predated the issuance of the GDC in Appendix A to 10 CFR Part 50. CNS is designed to conform to the proposed GDC published in the *Federal Register* on July 11, 1967 (32 FR 10213), except where commitments were made to specific 1971 GDC. The Atomic Energy Commission (AEC) accepted CNS's conformance with the proposed GDC. CNS's conformance with the draft GDC is described in Appendix F, "Conformance to AEC Proposed General Design Criteria," of the CNS Updated Safety Analysis Report (USAR).

- The CNS USAR Appendix F discussion of Criterion 6, "Reactor Core Design," of "Group II -- Protection by Multiple Fission Product Barriers," contains the following:

  > 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.

- Guidance on the acceptability of the reactivity control systems, the reactor core, and fuel system design is provided in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR [Light-Water Reactor] Edition." Specifically, NUREG-0800, Section 4.2, Revision 3, "Fuel System Design," dated March 2007 (ADAMS Accession No. ML070740002), specifies all fuel damage criteria for evaluation of whether fuel designs meet the SAFDLs. NUREG-0800, Section 4.4, Revision 2, "Thermal and Hydraulic Design" dated March 2007 (ADAMS Accession No. ML070550060), provides guidance on the review of thermal-hydraulic design in meeting the requirement of GDC 10 and the fuel design criteria established in NUREG-0800, Section 4.2. Section 4.2 of NUREG-0800 states that the CPR is to be established such that at least 99.9 percent of fuel rods in the core would not be expected to experience departure from nucleate boiling or boiling transition during normal operation or anticipated operational occurrences.

3.0 TECHNICAL EVALUATION

The SLMCPR numeric values in CNS TS 2.1.1.2 are SLs. The SLMCPR limit is established such that at least 99.9 percent of the fuel rods in the core would not be expected to experience the onset of transition boiling as a result of normal operation and transients, which in turn ensures fuel cladding damage does not occur. The SLMCPR limit is established such that fuel design limits are not exceeded during steady-state operation, normal operational transients, and abnormal operational transients. As such, fuel damage is calculated not to occur if the limit is not violated. However, because fuel damage is not directly observable, a step-back approach is

used to establish corresponding operating limits. The OLMCPR is established by summing the cycle-specific core reload transient analyses adders and the calculated SLMCPR values. The OLMCPR is required to be established and documented for each reload cycle as required by CNS TS 5.6.5, "Core Operating Limits Report (COLR)."

The absolute value of SLMCPR tends to vary cycle-to-cycle, typically due to the introduction of improved fuel bundle types, changes in fuel vendors or applicable computer codes, and changes in core loading pattern. Following the determination of the cycle-specific SLMCPR values, the OLMCPR values are derived. The cycle-specific SLMCPR numeric values are listed in CNS TS 2.1.1.2, and therefore, must be revised using the license amendment process.

Global Nuclear Fuel – Americas (GNF) performed the CNS Cycle 31 SLMCPR calculation consistent with NRC-approved methodologies and uncertainties, as documented in the following topical reports:

- NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel" (Revision specified in the COLR) (Not publicly available);

- NEDO-32601-A, "Methodology and Uncertainties for Safety Limit MCPR Evaluations," August 1999 (ADAMS Accession No. ML14093A216);

- NEDE-10958-P-A, "General Electric Thermal Analysis Basis Data, Correlation and Design Application," January 1977 (Not publicly available);

- NEDO-32505-A, "R-Factor Calculation Method for GE11, GE12 and GE13 Fuel," Revision 1, July 1999 (ADAMS Accession No. ML060520636);

The NRC staff reviewed the proposed changes to ensure that the generic methods were appropriately applied to CNS. The CNS Cycle 31 core consists of 548 GNF2 fuel assemblies. No plant hardware or operational changes are required with the proposed changes. CNS is a BWR of General Electric BWR/4 design, with a Mark 1 containment. The design of the BWR core and fuel is based on a proper combination of design variables, such as moderator-to-fuel volume ratio, core power density, thermal-hydraulic characteristics, fuel exposure level, nuclear characteristics of the core and fuel, heat transfer, flow distribution, void content, bundle power, and operating pressure.

The current required SLMCPR values from Cycle 30 in CNS TS 2.1.1.2 are $\geq$ 1.12 for TLO and $\geq$ 1.14 for SLO. Calculations performed by GNF for Cycle 31 resulted in a minimum calculated value of SLMCPR to be $\geq$ 1.13 for TLO and $\geq$ 1.16 for SLO. GNF's calculation of the revised plant-specific SLMCPR numeric values was performed as part of the reload licensing analysis for CNS Cycle 31, and is based upon NRC-approved methods, and therefore is acceptable.

The NRC staff further verified that the proposed changes would continue to meet the applicable regulations and requirements, and that the analysis performed to calculate the CNS Cycle 31 SLMCPR numeric values was based upon NRC-approved methodologies. The NRC staff concludes that the SLMCPR will continue to provide assurance that 99.9 percent of the fuel rods in the core will not exceed the CPR, and that fuel cladding integrity will be maintained under conditions of normal operation and with appropriate margin for anticipated operational occurrences.

3.1 Technical Evaluation Conclusion

Based on the foregoing evaluation, the NRC staff concludes that the licensee's proposed amendment to update the TSs to include cycle-specific SLMCPR numeric values is based on NRC-approved methodologies that have been approved for use with GNF2 fuels. The amendment is consistent with the regulatory requirements and guidance as discussed in Section 2.0 of this safety evaluation, and therefore, is acceptable. The NRC staff determined that the changes do not require any exemptions or relief from regulatory requirements. Defense-in-depth and sufficient safety margins will continue to be maintained. Therefore, based on the above considerations, the proposed changes to revise the SLMCPR values are acceptable. The licensee is authorized to change the SLMCPR in TS 2.1.1.2 from ≥ 1.12 to ≥ 1.13 for TLO and from ≥ 1.14 to ≥ 1.16 for SLO, at steam dome pressures greater than or equal to 785 psig and at core flows greater than or equal to 10 percent rated core flow.

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 August 20, 2018. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component 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 July 2, 2018 (83 FR 30984), 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: C. Jackson

Date: September 6, 2018

SUBJECT: COOPER NUCLEAR STATION - ISSUANCE OF AMENDMENT RE: SAFETY LIMIT MINIMUM CRITICAL POWER RATIO (EPID L-2018-LLA-0144) DATED SEPTEMBER 6, 2018

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ADAMS Accession No. ML18218A483 *by memorandum

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