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

October 17, 2016

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

SUBJECT: COOPER NUCLEAR STATION - ISSUANCE OF AMENDMENT RE: REVISION OF TECHICAL SPECIFICATIONS – SAFETY LIMIT MINIMUM CRITICAL POWER RATIO (CAC NO. MF7605)

Dear Mr. Limpias:

The U.S. Nuclear Regulatory Commission (NRC) has issued the enclosed Amendment No. 257 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 April 21, 2016, as supplemented by letter dated August 29, 2016.

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 next biweekly *Federal Register* notice.

Sincerely,

Thomas J. Wengert, Senior Project Manager
Plant Licensing IV-2 and Decommissioning
Transition Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-298

Enclosures:
1. Amendment No. 257 to DPR-46
2. Safety Evaluation

cc w/encls: Distribution via 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. 257
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 April 21, 2016, as supplemented by letter dated August 29, 2016, 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. 257, 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 29.

FOR THE NUCLEAR REGULATORY COMMISSION

Stephen S. Koenick, Acting Chief
Plant Licensing IV-2 and Decommissioning
Transition Branch
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: October 17, 2016

ATTACHMENT TO LICENSE AMENDMENT NO. 257

TO 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. 257, 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 ≥ 1.12 for two recirculation loop operation or ≥ 1.14 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
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 257 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 April 21, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML16120A370 and ML16120A371), as supplemented by letter dated August 29, 2016 (ADAMS Accession No. ML16252A223), Nebraska Public Power District (the licensee) requested changes to the Technical Specification (TS) Section 2.0, "Safety Limits (SLs)," for Cooper Nuclear Station (CNS). The proposed changes would revise the value 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 April 21, 2016, contain sensitive unclassified non-safeguards information (proprietary) and, accordingly, have been excluded from public disclosure.

The supplemental letter dated August 29, 2016, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the U.S. Nuclear Regulatory Commission (NRC) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on July 5, 2016 (81 FR 43664).

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, or better known as the GEXL 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, as calculated by GEXL, divided by the actual rod power. The greater a CPR value exceeds 1.0, the greater the margin to boiling transition is.

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.

In its letter dated April 21, 2016, the licensee provided the following system description:

> CNS is a boiling water reactor (BWR) of General Electric BWR4 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 CNS Cycle 30 core has 540 GNF2 and 8 GE14 fuel assemblies, and will be licensed by approval of the Cycle 30 core operating limits report (COLR). Cycle 30 is scheduled to end September 2018.

2.2 Regulatory Guidance

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," Revision 2 (ADAMS Accession No. ML070550060), Acceptance Criterion 1.B, states in part, that the limiting (minimum) value of CPR is to be established such that at least 99.9 percent of the fuel rods in the core would not be expected to experience departure from nucleate boiling during operation or anticipated operational occurrences.

2.3 General Design Criteria

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, General Design Criteria (GDC) 10, "Reactor design," 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 are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences."

In Attachment 1, Section 4.1, "Applicable Regulatory Requirements," of its application dated April 21, 2016, the licensee stated, in part, that

> As part of a reload core design, cycle specific transient analyses are performed to determine the required SLMCPR and the change in CPR for specific transients. To ensure that adequate margin is maintained, a design requirement based on a statistical analysis was selected, in that moderate frequency transients caused by a single operator error or equipment malfunction [i.e., anticipated operational occurrences as stated in GDC 10] shall be limited such that, considering uncertainties in manufacturing and monitoring the core operating state, at least 99.9% of the fuel rods would be expected to avoid boiling transition. The lowest allowable transient MCPR limit which meets the design requirement is termed the fuel cladding integrity SLMCPR.

CNS's construction predated the issuance of the GDCs in Appendix A[1] 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 to the CNS Updated Safety Analysis Report (USAR).

CNS's 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.

2.4 Technical Specifications

In 10 CFR 50.36, "Technical specifications," the NRC established its regulatory requirements related to the content of TSs. Pursuant to 10 CFR 50.36, TSs are required to include items in the following five 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. The regulation does not specify the particular requirements to be included in TSs.

Section 50.36(c)(1) of 10 CFR states, in part, that "[s]afety limits for nuclear reactors are limits upon important process variables that are found to be necessary to reasonably protect the

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[1] The 1967 proposed GDC as described in the CNS Updated Safety Analysis Report, Appendix F, constitute the licensing basis for CNS; however, the NRC staff concluded in its 1973 Safety Evaluation Report for CNS that the intent of the 1971 Final Rule for 10 CFR Part 50, Appendix A, had also been met.

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." TS 2.1.1 specifies the reactor core SLs for CNS.

The license amendment would change the SLMCPR values in TS 2.1.1.2 as follows:

Parameter	Current SLMCPR Value	Proposed SLMCPR Value
Two Recirculation Loop Operation	≥ 1.11	≥ 1.12
Single Recirculation Loop Operation	≥ 1.13	≥ 1.14

The licensee proposed to implement these TS changes prior to startup from Refuel Outage RE29.

3.0 TECHNICAL EVALUATION

3.1 NRC Staff 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 MCPR operating limits. The OLMCPR is established by summing the cycle-specific core reload transient analyses adders and the calculated SLMCPR values. The OLMCPR are required to be established and documented in the COLR for each reload cycle 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 Fuels (GNFs) performed the justification calculation of SLMCPR changes for CNS Cycle 30. The calculation was completed with NRC-approved methodologies and uncertainties as documented in the following reports:

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

- NEDC-32601P-A, "Methodology and Uncertainties for Safety Limit Minimum Critical Power Ratio Evaluations," August 1999 (Proprietary).

- NEDE-10958-P-A, "General Electric Thermal Analysis Basis Data, Correlation and Design Application," January 1977 (Proprietary).

- NEDC-32505P-A, "R-Factor Calculation Method for GE11, GE12 and GE13 Fuel," Revision 1, July 1999 (Proprietary).

The same methodologies were used for the CNS Cycle 29 calculation of SLMCPR.

The CNS core for Cycle 30 will consist of 540 GNF2 and 8 GE14 fuel assemblies. There are no plant hardware or operational changes required with this proposed change. On the basis of the analysis performed by GNF using NRC-approved methodologies above, the licensee has proposed to amend the CNS TS Section 2.1.1.2 to revise the SLMCPR for the Operating Cycle 30. This information regarding requested changes to the CNS TS SLMCPR is based on and is for the core rated power of 2,419 megawatts thermal, and at minimum core flow of 76.8 percent at rated power. The results for the plant-specific SLCMPR numeric values calculations ensure that more than 99.9 percent of the fuel rods in the core are expected to avoid boiling transition. GNF's calculation of the revised plant-specific SLMCPR numeric values for CNS Cycle 30 was performed as part of the reload licensing analysis and is based upon NRC-approved methods, and, therefore, is acceptable.

3.2 NRC Staff 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 and is consistent with the regulatory requirements and guidance as discussed in Section 2.0 of this safety evaluation, and therefore, is acceptable. Accordingly, the licensee is authorized to change the SLMCPR as existing in TS 2.1.1.2 from geater than or equal to (≥) 1.11 to ≥ 1.12 for two loop recirculation, and from ≥ 1.13 to ≥ 1.14 for single loop recirculation, at steam dome pressures greater than 785 psig and at core flows greater than 10 percent of 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. 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, and there has been no public comment on such finding published in the *Federal Register* on July 5, 2016 (81 FR 43664). 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: D. Woodyatt

Date: October 17, 2016

October 17, 2016

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

SUBJECT: COOPER NUCLEAR STATION - ISSUANCE OF AMENDMENT RE: REVISION OF TECHICAL SPECIFICATIONS – SAFETY LIMIT MINIMUM CRITICAL POWER RATIO (CAC NO. MF7605)

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Sincerely,

/RA/

Thomas J. Wengert, Senior Project Manager
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Transition Branch
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Office of Nuclear Reactor Regulation

Docket No. 50-298

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