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

October 24, 2016

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

SUBJECT: COOPER NUCLEAR STATION - CORRECTION OF ERROR IN SAFETY EVALUATION ASSOCIATED WITH LICENSE AMENDMENT NO. 257 (CAC NO. MF7605)

Dear Mr. Limpias:

By letter dated October 17, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16272A137), the U.S. Nuclear Regulatory Commission (NRC) issued Amendment No. 257 to Renewed Facility Operating License No. DPR-46 for the Cooper Nuclear Station (CNS). The amendment modified Technical Specification 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.

Subsequent to the issuance of this amendment, the NRC was notified by Nebraska Public Power District (the licensee) that errors had been identified in the safety evaluation (SE) enclosed in the October 17, 2016, letter. Specifically, Section 3.2 of the SE contains a concluding statement as follows (**with emphasis added in bold**):

> 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.

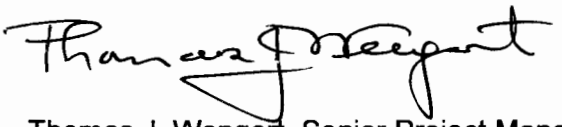
However, the correct statement is:

> Accordingly, the licensee is authorized to change the SLMCPR as existing in TS 2.1.1.2 from **greater** 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 or equal to** 785 psig and at core flows **greater than or equal to** 10 percent of rated core flow.

The NRC staff has determined that these errors were inadvertently introduced into the SE and were entirely editorial in nature. These corrections do not change any of the conclusions in the SE associated with the issuance of Amendment No. 257 for CNS, and do not affect the associated notice to the public.

Please find enclosed the replacement SE associated with this amendment. The revised page contains a marginal line indicating the areas of change. If you have any questions regarding this matter, please contact me at (301) 415-4037.

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

Enclosure:
Corrected Safety Evaluation Associated
with License Amendment No. 257

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ENCLOSURE

COOPER NUCLEAR STATION

DOCKET NO. 50-298

CORRECTED SAFETY EVALUATION ASSOCIATED WITH

LICENSE AMENDMENT NO. 257

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

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 greater 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 or equal to 785 psig and at core flows greater than or equal to 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
Corrected by letter dated October 24, 2016

The NRC staff has determined that these errors were inadvertently introduced into the SE and were entirely editorial in nature. These corrections do not change any of the conclusions in the SE associated with the issuance of Amendment No. 257 for CNS, and do not affect the associated notice to the public.

Please find enclosed the replacement SE associated with this amendment. The revised page contains a marginal line indicating the areas of change. If you have any questions regarding this matter, please contact me at (301) 415-4037.

Sincerely,

/RA/

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

Docket No. 50-298

Enclosure:
Corrected Safety Evaluation Associated
with License Amendment No. 257

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