

July 14, 2004

Mr. Randall K. Edington  
Vice President-Nuclear and CNO  
Nebraska Public Power District  
P. O. Box 98  
Brownville, NE 68321

SUBJECT: COOPER NUCLEAR STATION - ISSUANCE OF AMENDMENT REQUEST TO  
REVISE TECHNICAL SPECIFICATION 3.4.9 PRESSURE TEMPERATURE  
CURVE FIGURES 3.4.9-1, 3.4.9-2, AND 3.4.9-3 (TAC NO. MC1940)

Dear Mr. Edington:

The Commission has issued the enclosed Amendment No. 204 to 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 January 29, 2004, as supplemented by letter dated April 8, 2004.

The amendment would revise TS 3.4.9 Pressure Temperature Curve figures 3.4.9-1, 3.4.9-2, and 3.4.9-3 for Heatup/Cooldown-Core not Critical, Pressure Test and Heatup/Cooldown-Core Critical conditions.

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

Sincerely,  
*/RA/*

Michelle C. Honcharik, Project Manager, Section 1  
Project Directorate IV  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-298

Enclosures: 1. Amendment No. 204 to DPR-46  
2. Safety Evaluation

cc w/encls: See next page

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NEBRASKA PUBLIC POWER DISTRICT

DOCKET NO. 50-298

COOPER NUCLEAR STATION

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 204  
License No. DPR-46

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Nebraska Public Power District (the licensee) dated January 29, 2004, as supplemented by letter dated April 8, 2004, 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 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. 204, are hereby incorporated in the license. The Nebraska Public Power District 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  
**/RA/**

Robert A. Gramm, Chief, Section 1  
Project Directorate IV  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical  
Specifications

Date of Issuance: July 14, 2004

ATTACHMENT TO LICENSE AMENDMENT NO. 204

FACILITY OPERATING LICENSE NO. DPR-46

DOCKET NO. 50-298

Replace the following pages of the 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.

REMOVE

3.4-23

3.4-24

3.4-25

INSERT

3.4-23

3.4-24

3.4-25

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 204 TO

FACILITY OPERATING LICENSE NO. DPR-46

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

DOCKET NO. 50-298

1.0 INTRODUCTION

By application dated January 29, 2004 (ADAMS Accession No. ML040340749), as supplemented by letter dated April 8, 2004 (ADAMS Accession No. ML041040760), Nebraska Public Power District (the licensee), requested changes to the Technical Specifications (TSs) for Cooper Nuclear Station (CNS). The supplement dated April 8, 2004, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on March 16, 2004 (69 FR 12371).

The proposed changes would revise the TS 3.4.9 Pressure Temperature (P/T) Limit Curve Figures 3.4.9-1, 3.4.9-2, and 3.4.9-3. Specifically, the amendment would revise the reactor vessel P/T limit curves graphically represented in Figures 3.4.9-1 (non-nuclear heatup or cooldown), 3.4.9-2 (inservice hydrostatic and inservice tests), and 3.4.9-3 (pressure-temperature limits for criticality) valid through the end of Cycle 23.

The January 29, 2004, submittal requested changes to the TSs to implement the proposed P/T limit curves to 32 effective full power years (EFPYs) of operation, corresponding to the end of the current operating license. The proposed P/T limit curves were based on vessel fluence calculations based on analysis from a 1993 surveillance capsule dosimetry analysis reported by General Electric Nuclear Energy (GE) in Document No. GE-NE-523-159-1292 (DRF B13-01662), "Cooper Nuclear Station Vessel Surveillance Materials Testing and Fracture Toughness Analysis," Revision 0, February 1993, SI File No. COOP-05Q-202. The cross sections and computational methods used to calculate the vessel fluence in the 1993 GE report do not conform to the guidance of Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," March 2001. The licensee's analyses to demonstrate the conservatism of the proposed P/T limit curves to the end-of-license are all predicated on the validity of the 1993 GE estimate of the fluence and have not been updated to reflect computational improvements and do not conform to the guidance in RG 1.190.

In the April 8, 2004, submittal the licensee amended its request to limit the proposed P/T limit curves to the end of operating Cycle 23. Before the end of Cycle 23, estimated for October 2006, the licensee will recalculate the vessel fluence following the guidance in RG 1.190 and establish the validity of the proposed P/T curves or reevaluate them based on new fluence values obtained using a NRC staff approved methodology.

## 2.0 REGULATORY EVALUATION

The NRC staff finds that the licensee in Section 5.0 of its submittal identified the applicable regulatory requirements. The NRC has established requirements in Appendix G to Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR) to protect the integrity of the reactor coolant pressure boundary in nuclear power plants.

Appendix G to 10 CFR Part 50 requires the P/T limits for an operating plant to be at least as conservative as those that would be generated if the methods of Appendix G to Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) were applied. The methodology of Appendix G to Section XI of the ASME Code postulates the existence of a sharp surface flaw in the reactor pressure vessel (RPV). For materials in the beltline and upper and lower head regions of the RPV, the maximum flaw size is postulated to have a depth that is equal to 1/4 of the thickness and a length equal to 1½ times the thickness. For the case of evaluating RPV nozzles, the surface flaw is postulated to propagate parallel to the axis of the nozzle's corner radius.

The basic parameter in Appendix G to Section XI of the ASME Code for calculating P/T limit curves is the stress intensity factor,  $K_I$ , which is a function of the stress state and flaw configuration. The methodology requires that licensees determine the reference stress intensity ( $K_{IA}$  or  $K_{IC}$ ) factors, which vary as a function of temperature, from the reactor coolant system (RCS) operating temperatures, and from the adjusted reference temperatures (ARTs) for the limiting materials in the RPV. Thus, the critical locations in the RPV beltline and head regions are the 1/4-thickness (1/4T) and 3/4-thickness (3/4T) locations, which correspond to the points of the crack tips if the flaws are initiated and grown from the inside and outside surfaces of the vessel, respectively. RG 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," provides an acceptable method of calculating ARTs for ferritic RPV materials. The methods of RG 1.99, Revision 2, include methods for adjusting the ARTs of materials in the beltline region of the RPV, where the effects of neutron irradiation may induce an increased level of embrittlement in the materials.

The methodology of Appendix G to Section XI of the ASME Code requires that P/T curves must satisfy a safety factor of 2.0 on stress intensities arising from primary membrane and bending stresses during normal plant operations (including heatups, cooldowns, and transient operating conditions) and a safety factor of 1.5 on stress intensities arising from primary membrane and bending stresses when leak rate or hydrostatic pressure tests are performed on the RCS. Table 1 to 10 CFR Part 50, Appendix G provides the NRC staff's criteria for meeting the P/T limit requirements of Appendix G to Section XI of the ASME Code and the minimum temperature requirements of the rule for bolting up the vessel during normal and pressure testing operations.

The licensee applied the methodologies of the 1995 Edition of Appendix G to Section XI of the ASME Code as modified by Code Case N-640. The provisions of ASME Code Cases N-588,

N-640, and N-641 that are applicable to P/T limit curve development were incorporated into Appendix G to Section XI of the ASME Code 1998 edition through 2000 addenda which is the edition and addenda codified in 10 CFR 50.55a, effective October 28, 2002. Application of versions of ASME Code Section XI, Appendix G through the 1998 edition/2000 addenda therefore meet the requirements of 10 CFR Part 50, Appendix G.

### 3.0 TECHNICAL EVALUATION

The NRC staff has reviewed the licensee's technical and regulatory analyses in support of its proposed license amendment which are described in Sections 4.0 and 5.0 of the licensee's submittal.

#### 3.1 Assessment of Neutron Fluence Levels

The NRC staff has examined the licensee's proposal against Appendix G of 10 CFR Part 50; RG 1.99, Revision 2; and RG 1.190.

In general, the estimate of the neutron fluence enters the computation of the P/T limit curves through the transition temperature shift term ( $\Delta RT_{NDT}$ ) which accounts for neutron irradiation effects in the relation for the allowable stress intensity factor.

On October 31, 1991, after 11.2 EFPYs of operation, the second surveillance capsule was removed from the CNS RPV. Based in part on dosimetry data from this surveillance capsule, the 32 EFPY fluence value at the vessel inside surface was projected to be  $1.6 \times 10^{18}$  n/cm<sup>2</sup>. However, this neutron fluence estimate was calculated with computer codes and methodologies that have not been reviewed and approved by the NRC staff for licensing applications.

The licensee's January 29, 2004, submittal requested a TS change to the P/T curves effective to the end of the current license. The NRC staff finds that the licensee's computation of the effect of irradiation on the ductile-to-brittle temperature is dependent on the fast flux estimate from the 1993 GE report and, therefore, does not conform to the guidance provided in RG 1.190. The validity of that estimate, without a fluence calculation based on NRC reviewed and accepted computer codes and methodologies can not be established.

However, in letter dated April 8, 2004, the licensee amended its submittal and requested that the revision to the reactor vessel P/T limit curves specified be effective only through the end of Cycle 23, which is essentially for one operating cycle. The NRC staff finds this requested limitation to be acceptable. This conclusion is based on the following technical considerations:

- a. Cycle 23 ends well before the end of the current license, the reactor will have experienced 22.8 EFPYs of operation. The fast neutron fluence is a monotonic function of operating time and would be at its maximum at the end of the license. Therefore, the fluence at the end of Cycle 23 will be about 30 percent less than the fluence expected at the end of the facility's licensed life.
- b. In addition, the licensee instituted low-leakage-core fuel management strategy (placing three or four cycle burned fuel bundles on the core periphery) shortly after the first set of surveillance capsules were removed. Low-leakage fuel management will increase the estimated 30 percent margin to the end of license.



The NRC staff concludes that there is sufficient margin and operation will be acceptable to the end of Cycle 23 as proposed in the licensee's letter dated April 8, 2004.

### 3.2 P/T Limit Curve Assessment

For normal operating conditions, with the core not critical and pressure testing condition curves, individual P/T curves were proposed for the lower head in addition to the composite curves proposed for the beltline, nozzles, and upper vessel regions of the RPV. To test the validity of the proposed curves, the NRC staff performed an independent assessment of the licensee's submittal. The NRC staff applied the methodologies of the 1995 Edition of Appendix G to Section XI of the ASME Code and 10 CFR Part 50, Appendix G, as modified by the methodology of ASME Code Case N-640, as the bases for its independent assessment.

The NRC staff's assessment included an independent calculation of the ART values for both the 1/4T and 3/4T locations of the CNS RPV beltline regions based on the neutron fluence specified in the submittal for the CNS to 32 EFPY. For the evaluation of the limiting beltline materials, the NRC staff confirmed that the ARTs and P/T limit curves were based on the methodology of RG 1.99, Revision 2. For the evaluation of the limiting material in the limiting nozzle and lower head evaluations, the NRC staff applied the plant-specific design basis data provided by the licensee.

The NRC staff confirmed that the proposed P/T limit curves included appropriate minimum temperature requirements that were at least as conservative as those required in Table 1 of 10 CFR Part 50, Appendix G.

At the end of Cycle 23, the CNS reactor will accumulate 22.8 EFPYs of operation. The remaining 9.2 EFPYs of operation constitutes about 29 percent of the total irradiation time representing adequate calculational margin for operation to the end of Cycle 23. Therefore, the NRC staff finds the requested approval of the validity of the proposed P/T limit curves to the end of Cycle 23 to be acceptable.

### 3.3 Technical Conclusion

Based on the NRC staff's review and evaluation of the licensee's proposed P/T limit curves for CNS, the NRC staff has determined that the proposed P/T limit curves are consistent with the requirements of 10 CFR 50.60, "Acceptance criteria for fracture prevention measures for lightwater nuclear power reactors for normal operation," and the requirements of Appendix G to 10 CFR Part 50. The NRC staff concludes that the updated P/T limit curves proposed by the licensee for operation through Cycle 23, will continue to provide an acceptable level of margin and safety, and will provide sufficient assurance that the CNS reactor will be operated in a manner that will protect the RPV against brittle fracture, because of the large margin between the calculated time and the end of the proposed applicability period. The proposed curves (Figures 3.4.9-1, 3.4.9-2, and 3.4.9-3) are, therefore, acceptable for incorporation into the TSs and for use until the end of Cycle 23, which is currently estimated by the licensee to be October 2006. The approval of the P/T limit curves through the end of Cycle 23 will afford the licensee the opportunity to recalculate the vessel fluence using a NRC staff approved methodology complying with the guidance in RG 1.190. For operation beyond Cycle 23, the licensee must

submit for review and approval, an amendment request justifying the use of the curves beyond Cycle 23 which satisfies the guidance of RG 1.190.

#### 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 March 16, 2004 (69 FR 12371). 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) 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.

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Date: July 14, 2004

Cooper Nuclear Station

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