

April 22, 2002

Mr. R. T. Ridenoure
Division Manager - Nuclear Operations
Omaha Public Power District
Fort Calhoun Station FC-2-4 Adm.
Post Office Box 550
Fort Calhoun, NE 68023-0550

SUBJECT: FORT CALHOUN STATION, UNIT NO. 1 - ISSUANCE OF AMENDMENT
(TAC NO. MB3654)

Dear Mr. Ridenoure:

The Commission has issued the enclosed Amendment No. 207 to Facility Operating License No. DPR-40 for the Fort Calhoun Station, Unit No. 1 (FCS). The amendment consists of changes to the Technical Specifications (TSs) in response to Omaha Public Power District's (OPPD) application dated December 14, 2001, as supplemented by letter dated February 13, 2002.

The amendment deletes TS Figures 2-1A (Reactor Coolant System (RCS) -Temperature Limits for Heatup) and 2-1B (RCS Pressure -Temperature Limits for Cooldown) and replaces them with a single Figure 2-1. Additionally, the licensee proposes to change the lowest service temperature from 182°F to 164°F to be in compliance with the American Society of Mechanical Engineers (ASME) Section III, NB-2332, and change the basis for the minimum boltup temperature to be in compliance with ASME Section XI, Appendix G. The Bases section for TS 2.1 is being updated to reflect the use of ASME Code Case N-640 and the Westinghouse Electric Company/Combustion Engineering (W/CE) pressure temperature (P-T) limit curve methodology as applicable. Finally, based on the replacement of Figures 2-1A and 2-1B with a single Figure 2-1, the following TSs are required to be changed: 2.1.1(8), 2.1.2(1), 2.1.2(2), 2.1.2(6), 2.1.2(6)(a), 2.1.2(6)(c), 2.1.2(6)(d), and 2.1.6(4) as these sections reference the deleted curves. In a separate submittal, OPPD requested that the NRC grant an exemption to Facility Operating License No. DPR-40 to use ASME Code Case N-640, in conjunction with the W/CE's P-T limit curve methodology. The use of ASME Code Case N-640 would allow OPPD to deviate from complying with the requirements in 10 CFR Part 50, Appendix G, for generating the P-T limit curves. By letter dated February 28, 2002, the Commission granted the exemption to OPPD to use Code Case N-640 for the FCS P-T limits.

The NRC staff has completed its review of the licensee's amendment request for revision of the P-T limit curves and concluded that the P-T limits for heatup and cooldown of the reactor coolant system meet the requirements in Appendix G to Section XI of the ASME Code and Appendix G to 10 CFR Part 50, as modified by ASME Code Case N-640. Hence, the revised P-T limit curves in the FCS TSs are acceptable.

Mr. R. T. Ridenoure

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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,

/RA/

Alan B. Wang, Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-285

Enclosures: 1. Amendment No. 207 to DPR-40
2. Safety Evaluation

cc w/encls: See next page

Mr. R. T. Ridenoure

- 2 -

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OMAHA PUBLIC POWER DISTRICT

DOCKET NO. 50-285

FORT CALHOUN STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 207
License No. DPR-40

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by the Omaha Public Power District (the licensee) dated December 14, 2001, as supplemented by letter dated February 13, 2002, 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, Facility Operating License No. DPR-40 is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 3.B. of Facility Operating License No. DPR-40 is hereby amended to read as follows:

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 207, 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 30 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Stephen Dembek, Chief, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical
Specifications

Date of Issuance: April 22, 2002

ATTACHMENT TO LICENSE AMENDMENT NO. 207

FACILITY OPERATING LICENSE NO. DPR-40

DOCKET NO. 50-285

Replace the following pages of Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain vertical lines indicating the areas of change.

REMOVE

viii
2-2a
2-3
2-4
2-5
2-6

Figure 2-1A
Figure 2-1B
2-7
2-7a
2-15

INSERT

viii
2-2a
2-3
2-4
2-5
2-6
2-6a
2-6b
2-6c
Figure 2-1
Figure 2-1B
2-7
2-7a
2-15

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 207 TO FACILITY OPERATING LICENSE NO. DPR-40
OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT NO. 1
DOCKET NO. 50-285

1.0 INTRODUCTION

By application dated December 14, 2001, as supplemented by letter dated February 13, 2002, Omaha Public Power District (OPPD) requested changes to the Technical Specifications (TSs Appendix A to Facility Operating License No. DPR-40) for the Fort Calhoun Station, Unit No. 1 (FCS). The requested changes would delete TS Figures 2-1A (Reactor Coolant System (RCS) - Temperature Limits for Heatup) and 2-1B (RCS Pressure - Temperature Limits for Cooldown) and replace them with a single Figure 2-1. Additionally, the licensee proposes to change: (1) the lowest service temperature from 182°F to 164°F to be in compliance with the American Society of Mechanical Engineers (ASME) Section III, NB-2332, and (2) the basis for the minimum boltup temperature to be in compliance with the ASME Section XI, Appendix G. The Bases for TS 2.1 is being updated to reflect the use of ASME Code Case N-640 and Westinghouse Electric Company/Combustion Engineering (W/CE) pressure temperature (P-T) limit curve methodology as applicable. Finally, based on the replacement of Figures 2-1A and 2-1B with a single Figure 2-1, the following TS are required to be changed: 2.1.1(8), 2.1.2(1), 2.1.2(2), 2.1.2(6), 2.1.2(6)(a), 2.1.2(6)(c), 2.1.2(6)(d), and 2.1.6(4) as they reference the deleted curves.

The supplemental letter dated February 13, 2002, 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 January 22, 2002 (67 FR 2928).

2.0 BACKGROUND

The NRC has established requirements in 10 CFR Part 50, Appendix G, to protect the integrity of the reactor coolant pressure boundary in nuclear power plants. Appendix G to 10 CFR Part 50 requires the pressure-temperature (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 Boiler and Pressure Vessel (B&PV) Code were applied. The methodology of Appendix G to ASME Section XI postulates the existence of a sharp surface flaw in the reactor pressure vessel (RPV) that is normal to the direction of the maximum applied stress. 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 one-fourth of the wall thickness and a length equal to 1.5 times the wall thickness. The basic parameter in Appendix G to ASME Section XI 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}) factor, which is a function of the metal temperature at the flaw tip, and the 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. Regulatory Guide (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 for the effects of neutron irradiation.

The methodology of Appendix G to ASME Section XI requires that P-T limit curves must satisfy a safety factor of 2.0 on primary membrane (pressure) stress intensity factor (K_{IM}) and a safety factor of 1.0 on the thermal stress (K_{IT}) for normal plant operations (including heatups, cooldowns, and transient operating conditions). The safety factor of 2.0 for K_{IM} drops to 1.5 for leak rate or hydrostatic pressure tests. Table 1 in 10 CFR Part 50, Appendix G, provides the staff's criteria for meeting the P-T limit requirements of Appendix G to ASME Section XI and minimum temperature requirements for several modes of operation.

By letter dated December 14, 2001, OPPD, submitted a license amendment request to change the P-T limit curves in the FCS TSs. OPPD provided additional information by letter dated February 13, 2002, in response to the staff's request for additional information. In a separate letter dated December 14, 2001, OPPD requested NRC's approval to use methods in ASME Code Case N-640, in conjunction with the W/CE P-T limit curve methodology. The use of ASME Code Case N-640 would allow OPPD to deviate from complying with the requirements in 10 CFR Part 50, Appendix G, for generating the P-T limit curves. This exemption was submitted in accordance with 10 CFR Part 50.60(b), which allows licensees to use alternatives to the requirements of 10 CFR Part 50, Appendices G and H, and was requested pursuant to the provisions of 10 CFR Part 50.12. This exemption would allow OPPD to use ASME Code Case N-640 (regarding the use of the lower bound static initiation fracture toughness value (K_{Ic}) equation as the basis for establishing the P-T curves) as an alternative to the method invoked by Appendix G to Section XI of the ASME Code. This exemption was approved on February 28, 2002.

OPPD's TS change requests are stated below:

1. Delete TS Figure 2-1A (Reactor Coolant System (RCS) Pressure - Temperature Limits for Heatup).
2. Delete TS Figure 2-1B (Reactor Coolant System (RCS) Pressure - Temperature Limits for Cooldown).
3. Update the P-T limit curves.
4. Change the lowest service temperature from 182°F to 164°F to be in compliance with the American Society of Mechanical Engineers (ASME) Code Section III, NB-2332.

5. Change the basis for the minimum boltup temperature to be in accordance with ASME Code Section XI, Appendix G.
6. Replace TS Figures 2-1A and 2-1B with a single TS Figure 2-1, which is a composite P/T limit curve (comprising hydrostatic test curve, and the composite heatup and cooldown curve) for 40 effective full power years (EFPY) of operation.

The existing P-T limit curves are currently authorized for operation to 24.25 EFPY. OPPD is requesting approval for revised P-T limit curves to allow operation up to 40 EFPY.

3.0 EVALUATION

3.1 Licensee's Bases for Request

The heatup and cooldown P-T limit curves are established to provide assurance of RPV integrity during plant operation. All components of the RCS are designed to withstand the effects of loads resulting from system pressure and temperature changes. These loads are introduced by heatup and cooldown operations, power transients, and reactor trips. In accordance with Appendix G to 10 CFR Part 50, the TSs limit the pressure and temperature changes during heatup and cooldown to preclude non-ductile failure of the carbon and low alloy RCS materials. These operational limits are defined by the P-T limit curves for heatup and cooldown. These curves are used for operational guidance during heatup and cooldown maneuvering when pressure and temperature indications are monitored and compared with the applicable curve to determine that operation is within the allowable region.

ASME Code Case N-640, "Alternative Fracture Toughness for Development of P-T Curves for ASME Section XI, Division I," provides an alternate method for determining the fracture toughness of reactor vessel materials for use in establishing P-T limit curves. ASME Code Case N-640 allows the use of the lower bound static initiation fracture toughness K_{Ic} rather than the more restrictive lower bound crack arrest fracture toughness factor K_{Ia} required by ASME Code Section XI, Appendix G. The staff approved OPPD's use of Code Case N-640 by exemption dated February 28, 2002.

OPPD evaluated the effect of neutron irradiation embrittlement on limiting welds in the FCS RPV. The amount of irradiation embrittlement was calculated in accordance with RG 1.99, Rev. 2. OPPD determined that the limiting material was axial weld 3-410 fabricated using tandem weld wire heat numbers 12008/13253. OPPD determined that the ARTs of the material at the clad-to-base metal interface were 261.56°F at 40 EFPY of operation (fluence = 2.15×10^{19} n/cm²). OPPD further calculated the ART for the 1/4T location (237.76°F) and the 3/4T (187.97°F) location. The P-T limit curves submitted by the licensee utilized the ART values and are, therefore, valid through 40 EFPY of operation.

The lowest service temperature is defined by ASME Boiler and Pressure Vessel Code, 1996 Edition, Section III, NB-2332 as the initial RT_{NDT} for piping and materials for pumps, valves and fittings with any pipe connections plus 100°F. In addition, a temperature instrumentation uncertainty of 14°F will be applied. This temperature uncertainty conservatively bounds those instruments in the control room that operators will use to determine RCS temperature. The

RT_{NDT} of 50°F for piping, pumps, and valves is estimated based on shop experience and fabrication specification for later plants. Therefore, the lowest service temperature of 164°F is proposed to replace the lowest service temperature of 183°F currently in the TS.

In accordance with ASME Boiler and Pressure Vessel Code, 1995 Edition and Addenda through 1996 Addenda, Section XI, Appendix G, the minimum boltup temperature should be at least equal to the initial RT_{NDT} temperature for the material in the stressed regions, adjusted for any effects of irradiation, plus temperature instrument uncertainty. OPPD applied the RT_{NDT} of 10°F and instrument error of 14°F for a minimum boltup temperature of 24°F. The proposed TS Figure 2-1 has been conservatively analyzed to an indicated temperature of 64°F and OPPD will change TS 2.1.2(6)(c) and the Bases to 64°F. However, since the low temperature overpressure (LTOP) is currently only analyzed to 82°F, OPPD will maintain the minimum boltup temperature at 82°F until a revised LTOP analysis is submitted to the NRC for review and approval.

In addition to beltline materials, 10 CFR Part 50, Appendix G imposes heatup and cooldown limitations based on the reference temperature for the RPV closure flange region materials. Section IV.A.2 of Appendix G states that when the pressure exceeds 20 percent of the pre-service system hydrostatic test pressure, the temperature of the closure flange regions highly stressed by bolt preload must exceed the reference temperature of the materials in those regions by at least 120°F for normal operation and 90°F for hydrostatic and leak tests. The pre-service system hydrostatic test pressure for the FCS RPV was 3125 psi. Based on the limiting unirradiated flange region RT_{NDT} of 10°F, OPPD has determined that imposing a minimum allowable temperature limit of 144°F when pressure exceeds 625 psig satisfies Section IV.A.2 of 10 CFR Part 50, Appendix G.

3.2 Evaluation

For the FCS RPV, the licensee provided P-T limit curves for normal operating conditions and pressure testing conditions effective to 40 EFPY. To evaluate the validity of the licensee's proposed curves, the staff performed an independent assessment. The staff applied the methodologies of the 1995 Edition with 1996 Addenda of Appendix G to ASME Section XI and 10 CFR Part 50, Appendix G, as modified by the methodologies of ASME Code Case N-640, as the bases for its independent assessment.

The staff's assessment also included an independent calculation of the ART values for both the 1/4T and 3/4T locations of the FCS RPV beltline regions based on the neutron fluence specified in the submittal for the FCS RPV at 40 EFPY of operation. For the evaluation of the limiting beltline materials, the staff confirmed that the ARTs were based on the methodology of RG 1.99, Revision 2.

The results of the staff's independent assessment agreed with the P-T limit curve values submitted by the licensee. The staff also confirmed that OPPD's P-T limit curves included appropriate minimum temperature requirements that were at least as conservative as those required in Table 1 to 10 CFR Part 50, Appendix G, as exempted and modified by the ASME Code Case N-640.

Based on the staff's review and evaluation of OPPD's proposed TS changes for FCS, the staff has determined that the proposed P-T limit curves satisfy the requirements of 10 CFR Part 50.60(a), Appendix G to 10 CFR Part 50, and Appendix G to the 1995 Edition with 1996 Addenda of Section XI of the ASME Code, as modified by the application of ASME Code Case N-640. Furthermore, the staff has determined that changing the lowest service temperature from 182°F to 164°F is in compliance with ASME Section III, NB-2332, and that changing the basis for the minimum boltup temperature is in accordance with ASME Section XI, Appendix G. Therefore, the staff concludes that the updated P-T limit curves, lowest service temperature, and minimum boltup temperature proposed by OPPD will continue to provide an acceptable margin of safety, and provide sufficient assurance that FCS will be operated in a manner that will protect the RPV against brittle fracture. The proposed changes are therefore acceptable.

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 (67 FR 2928). 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.

Principal Contributor: T. Bloomer

Date: April 22, 2002

Ft. Calhoun Station, Unit 1

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