

February 21, 2003

Mr. Jeffrey S. Forbes
Site Vice President
Monticello Nuclear Generating Plant
Nuclear Management Company, LLC
2807 West County Road 75
Monticello, MN 55362-9637

SUBJECT: MONTICELLO NUCLEAR GENERATING PLANT - EXEMPTION FROM THE
REQUIREMENTS OF 10 CFR PART 50, SECTION 50.60(a) AND APPENDIX G
(TAC NO. MB5078)

Dear Mr. Forbes:

The Commission has approved the enclosed exemption related to your application for exemption dated April 22, 2002, as supplemented September 16, 2002, for the Monticello Nuclear Generating Plant. The proposed exemption is from the requirements of Title 10 of the *Code of Federal Regulations*, Part 50, Section 50.60(a) and Appendix G, and would allow the use of American Society of Mechanical Engineers *Boiler and Pressure Vessel Code*, Code Case N-640, "Alternative Reference Fracture Toughness for Development of P-T Limit Curves," as the basis for the revised reactor pressure vessel pressure-temperature limit curves.

A copy of the exemption has been forwarded to the Office of the Federal Register for publication.

Sincerely,

/RA/

Darl S. Hood, Senior Project Manager, Section 1
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-263

Enclosure: Exemption

cc w/encl: See next page

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**No legal objection

*Provided exemption by memo

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Monticello Nuclear Generating Plant

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March 2002

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
NUCLEAR MANAGEMENT COMPANY, LLC
MONTICELLO NUCLEAR GENERATING PLANT
DOCKET NO. 50-263
EXEMPTION

1.0 BACKGROUND

The Nuclear Management Company, LLC (the licensee), is the holder of Facility Operating License No. DPR-22 which authorizes operation of the Monticello Nuclear Generating Plant (MNGP). The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the U.S. Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of a boiling water reactor located in Wright County, Minnesota.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 50.60(a), requires, in part, that except where an exemption is granted by the Commission, all light-water nuclear power reactors must meet the fracture toughness requirements for the reactor coolant pressure boundary set forth in Appendices G and H to 10 CFR Part 50. Appendix G to 10 CFR Part 50 requires that pressure-temperature (P/T) limits be established for reactor pressure vessels (RPVs) during normal operating and hydrostatic or leak-rate testing conditions. Specifically, 10 CFR Part 50, Appendix G, states, "The appropriate requirements on both the pressure-temperature limits and the minimum permissible temperature must be met for all conditions." Appendix G of 10 CFR Part 50 specifies that the requirements for these limits

are the American Society of Mechanical Engineers *Boiler and Pressure Vessel Code* (ASME Code), Section XI, Appendix G, limits.

To address provisions of a proposed amendment to change the P/T limits in the Monticello Technical Specifications, the licensee requested an exemption from the application of specific requirements of 10 CFR Part 50, Section 50.60(a) and Appendix G, to allow the use of ASME Code Case N-640, "Alternative Reference Fracture Toughness for Development of P-T Limit Curves." ASME Code Case N-640 permits the use of alternate reference fracture toughness (i.e., use of " K_{IC} fracture toughness curve" instead of " K_{IA} fracture toughness curve," where K_{IC} and K_{IA} are "Reference Stress Intensity Factors," as defined in ASME Code, Section XI, Appendices A and G, respectively) for RPV materials in determining the P/T limits. Since the K_{IC} fracture toughness curve shown in ASME Code, Section XI, Appendix A, Figure A-2200-1, provides greater allowable fracture toughness than the corresponding K_{IA} fracture toughness curve of ASME Code, Section XI, Appendix G, Figure G-2210-1, using ASME Code Case N-640 to establish the P/T limits would be less conservative than the methodology currently endorsed by 10 CFR Part 50, Appendix G. Therefore, an exemption is required to use ASME Code Case N-640.

The proposed exemption is needed to allow the licensee to implement ASME Code Case N-640 in order to revise the method used to determine RPV P/T limits because continued use of the present curves unnecessarily restricts the P/T operating windows for the reactor coolant system (RCS). Since the P/T operating window is defined by the P/T operating and test limit curves developed in accordance with the ASME Code, Section XI, Appendix G, procedure, continued operation of MNGP with the current P/T curves without the relief provided by ASME Code Case N-640 would unnecessarily require that the RPV be maintained at a temperature exceeding 212 °F in a limited operating window during pressure tests. Consequently, steam vapor hazards would continue to be a safety concern for personnel

conducting inspections in the primary containment. Implementation of the proposed P/T curves, as allowed by ASME Code Case N-640, would not significantly reduce the margin of safety and would eliminate steam vapor hazards by allowing inspections in the primary containment to be conducted at a lower coolant temperature.

3.0 DISCUSSION

Pursuant to 10 CFR Part 50, Section 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50 when (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security, and (2) when special circumstances are present. These special circumstances include the following:

- 1) Pursuant to 10 CFR Part 50, Section 50.12(a)(2)(ii), the circumstance that application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule. ASME Code, Section XI, Appendix G, provides procedures for determining the allowable loading on the RPV and is approved for that purpose by 10 CFR Part 50, Appendix G. Application of these procedures in the determination of P/T operating and test curves satisfies the underlying requirement that (1) the reactor coolant pressure boundary be operated in a regime having a sufficient margin to ensure, when stressed, the vessel boundary behaves in a ductile manner and the probability of a rapidly propagating fracture is minimized; and (2) P/T operating and test limit curves provide an adequate margin in consideration of uncertainties in determining the effects of irradiation on material properties.

The ASME Code, Section XI, Appendix G, procedure was conservatively developed based upon the level of knowledge existing in 1974 concerning RPV materials and

the estimated effects of operation. Since 1974, the level of knowledge concerning these topics has greatly expanded. This increased knowledge permits relaxation of the ASME Code, Section XI, Appendix G, requirements via application of ASME Code Case N-640, while maintaining the underlying purpose of the ASME Code and NRC regulations to ensure an acceptable margin of safety.

- 2) Pursuant to 10 CFR Part 50, Section 50.12(a)(2)(iii), compliance would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted, or those incurred by others similarly situated. The P/T operating window from the RCS is defined by the P/T operating and test limit curves developed in accordance with the ASME Code, Section XI, Appendix G procedure. As previously noted, continued operation of MNGP with these P/T curves without the relief provided by ASME Code Case N-640 would unnecessarily restrict the P/T operating window. This restriction requires the MNGP Operations Staff to maintain a high temperature during pressure tests and also subjects the inspection personnel to increased safety hazards while conducting inspections of systems with the potential for steam leaks in a primary containment at elevated temperatures.

This constitutes an unnecessary burden that can be alleviated by the application of ASME Code Case N-640 in the development of the proposed P/T limit curves. Implementation of the proposed P/T limit curves, as allowed by ASME Code Case N-640, would not significantly reduce the margin of safety.

- 3) Pursuant to 10 CFR Part 50, Section 50.12(a)(2)(v), compliance will provide “only temporary relief from the applicable regulation and the licensee . . . has made good faith efforts to comply with the regulation.” The NRC staff finds that the licensee for MNGP has made a good faith effort to comply with the regulation, and the requested

exemption provides only temporary relief from the applicable regulation until such time that the NRC generically approves ASME Code Case N-640 for use by the nuclear industry.

The NRC staff examined the licensee's rationale to support the exemption request and concluded that the use of the ASME Code Case N-640 would satisfy 10 CFR Part 50, Section 50.12(a)(1) as follows:

1) The requested exemption is authorized by law:

No law exists which precludes the activities covered by this exemption request. The regulation 10 CFR Part 50, Section 50.60(b), allows the use of alternatives to 10 CFR Part 50, Appendices G and H, when an exemption is granted by the Commission pursuant to 10 CFR Part 50, Section 50.12.

2) The requested exemption does not present an undue risk to the public health and safety:

ASME Code Case N-640 permits the use of alternate reference fracture toughness (K_{IC} fracture toughness curve instead of K_{IA} fracture toughness curve) for RPV Materials in determining the P/T limits. The K_{IC} fracture toughness curve is shown in ASME Code, Section XI, Appendix A, Figure A-2200-1, and provides greater allowable fracture toughness than the corresponding K_{IA} fracture toughness curve of ASME Code, Section XI, Appendix G, Figure G-2210-1. The other margins involved with the ASME Code, Section XI, Appendix G process of determining P/T limit curves remain unchanged.

Use of the K_{IC} curve in determining the lower bound fracture toughness in the development of the P/T operating limits curve is more technically correct than the K_{IA} curve. The K_{IC} curve models the slow heatup and cooldown process of a reactor vessel. The K_{IC} curve appropriately implements the use of static initiation fracture toughness behavior to evaluate the controlled heatup and cooldown process of a RPV.

Use of this approach is justified by the initial conservatism of the K_{IA} curve when the curve was codified in 1974. This initial conservatism was necessary due to limited knowledge of RPV material fracture toughness. Since 1974, additional knowledge has been gained about the fracture toughness of vessel materials and their fracture response to applied loads. The additional knowledge demonstrates that the lower bound fracture toughness provided by the K_{IA} curve is well beyond the margin of safety required to protect against potential RPV failure. The lower bound K_{IC} fracture toughness provides an adequate margin of safety to protect against potential RPV failure and does not present an undue risk to public health and safety.

P/T limit curves based on the K_{IC} fracture toughness limits will enhance overall plant safety by opening the P/T operating window. Since the RCS P/T operating window is defined by the P/T operating and test limit curves developed in accordance with the ASME Code, Section XI, Appendix G, procedure, continued operation of MNGP with these P/T limit curves without using ASME Code Case N-640 would unnecessarily require the RPV to be maintained at a temperature exceeding 212 °F in a limited operating window during the pressure test. Consequently, steam vapor

hazards would continue to be one of the safety concerns for personnel conducting inspections in the primary containment.

Use of the revised curves would result in a reduction in the challenges to operators in maintaining a high temperature in a limited operating window and would eliminate steam vapor hazards by allowing inspections in primary containment to be conducted at lower coolant temperature, while continuing to provide an adequate margin of safety.

3) The requested exemption will not endanger the common defense and security:

The common defense and security are not endangered by this exemption request.

On the basis of the conservatism that is explicitly incorporated into the methodologies of 10 CFR Part 50, Appendix G, and ASME Code, Section XI, Appendix G, the NRC staff concludes that application of ASME Code Case N-640, as described above, would provide an adequate margin of safety against brittle failure of the RPV. This is also consistent with the determination that the NRC staff has reached for other licensees under similar conditions based upon the same considerations. The NRC staff has previously granted exemptions to use ASME Code Case N-640 for the Quad Cities Nuclear Power Station and the Limerick Generating Station Unit 1 where the NRC staff concluded that application of ASME Code Case N-640 would provide adequate safety margins consistent 10 CFR Part 50, Appendix G, and Appendix G to ASME Code, Section XI. In the same cases, the NRC staff also concluded that relaxation of the methodology in Appendix G to ASME Code, Section XI, by application of ASME Code Case N-640 is acceptable, and pursuant to 10 CFR 50.12(a)(2)(ii), would maintain the underlying purpose of the NRC regulations to ensure an acceptable margin of safety for the Quad Cities and Limerick Generating Station Unit 1 RPVs and RCSs. The licensee's proposal to use ASME Code Case N-640 for generation of the MNGP P/T limit curves is predicated on

the same technical basis as was used for generation of the P/T limits for Quad Cities and Limerick Generating Station Unit 1.

Therefore, the NRC staff concludes that pursuant to 10 CFR Part 50, Section 50.12(a)(1), and 10 CFR Part 50, Section 50.12(a)(2)(ii), (iii), and (v), granting an exemption is appropriate and that the methodology of ASME Code Case N-640 may be used to revise the P/T limits for MNGP.

4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR Part 50, Section 50.12(a), the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants the Nuclear Management Company, LLC, an exemption from the requirements of 10 CFR Part 50, Section 50.60(a) and 10 CFR Part 50, Appendix G, for MNGP.

Pursuant to 10 CFR Part 50, Section 51.32, the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment (68 FR 8052).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 21st day of February 2003.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

John A. Zwolinski, Director
Division of Licensing Project Management
Office of Nuclear Reactor Regulation