

April 13, 2001

Mr. Mike Bellamy  
Site Vice President  
Entergy Nuclear Generation Company  
Pilgrim Nuclear Power Station  
600 Rocky Hill Road  
Plymouth, MA 02360

SUBJECT: PILGRIM NUCLEAR POWER STATION, EXEMPTION FROM THE  
REQUIREMENTS OF APPENDIX G TO PART 50 OF TITLE 10 OF THE *CODE  
OF FEDERAL REGULATIONS* (TAC NO. MB1016)

Dear Mr. Bellamy:

The Commission has granted the enclosed exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix G, for the Pilgrim Nuclear Power Station (Pilgrim). This action is in response to your letter of January 19, 2001, as supplemented by letter dated February 8, 2001, that submitted a request for exemption from the requirements of 10 CFR Part 50, Appendix G, to allow the use of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Code Cases N-588, "Alternative to Reference Flaw Orientation of Appendix G for Circumferential Welds in Reactor Vessels, Section XI Division 1," and N-640, "Alternative Reference Fracture Toughness for Development of P-T Limit Curves for ASME Section XI, Division 1," for Pilgrim. This exemption would support Entergy's application for a license amendment, dated November 22, 2000, as supplemented on January 30 and February 2, 2001, to revise the Technical Specifications' (TSs) pressure-temperature (P-T) limits for the remainder of operating Cycle 13 and operating Cycle 14. The licensee developed the new P-T limits using the methodologies in the ASME Code Cases N-588 and N-640, instead of the methodologies in 10 CFR Part 50, Appendix G.

Requests for such exemptions are allowed pursuant to 10 CFR 50.60(b), which allows licensees to use alternatives to the requirements of 10 CFR Part 50, Appendices G and H, if an exemption to use the alternatives is granted by the Commission pursuant to 10 CFR 50.12. According to 10 CFR Part 50.12(a)(1), the Commission may grant exemptions to the requirements of 10 CFR Part 50, if the exemptions are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security.

An exemption for Code Case N-588 is not needed if the limiting reactor vessel welds are axial. By letter dated February 8, 2001, Entergy confirmed that the limiting reactor vessel welds are axial and withdrew its request for exemption for use of Code Case N-588.

We are handling your request for amendment dated November 22, 2000, concurrently with this exemption request, but as a separate action.

M. Bellamy

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

Sincerely,

***/RA/***

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

Docket No. 50-293

Enclosure: Exemption

cc w/encls: See next page

M. Bellamy

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

Sincerely,

**/RA/**

Alan B. Wang, Project Manager, Section 2  
Project Directorate I  
Division of Licensing Project Management  
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Docket No. 50-293

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Pilgrim Nuclear Power Station

cc:

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UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION  
ENTERGY NUCLEAR GENERATION COMPANY  
PILGRIM NUCLEAR POWER STATION  
DOCKET NO. 50-293  
EXEMPTION

1.0 BACKGROUND

The Entergy Nuclear Generation Company (the licensee) is the holder of Facility Operating License No. DPR-35 which authorizes operation of the Pilgrim Nuclear Power Station. 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 Plymouth County, Massachusetts.

2.0 PURPOSE

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix G, 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 that “The appropriate requirements on both the pressure-temperature limits and the minimum permissible temperature must be met for all conditions.” In addition, 10 CFR Part 50, Appendix G, specifies that the requirements for these limits “must be at least as conservative as the limits obtained by following the methods of analysis and the margins of

safety of Appendix G of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code).” The approved methods of analysis in Appendix G of Section XI require the use of  $K_{Ia}$  fracture toughness curve in the determination of the P-T limits.

By letter dated November 22, 2000, Entergy submitted a license amendment request to update the P-T limit curves for Pilgrim. By letter dated January 19, 2001, Entergy requested NRC approval for an exemption to use Code Cases N-588 and N-640 as alternative methods for complying with the fracture toughness requirements in 10 CFR Part 50, Appendix G, for generating the P-T limit curves. Requests for such exemptions may be submitted pursuant to 10 CFR 50.60(b), which allows licensees to use alternatives to the requirements of 10 CFR Part 50, Appendices G and H, if the Commission grants an exemption pursuant to 10 CFR 50.12 to use the alternatives.

#### Code Case N-588

The methods of ASME Code Case N-588 provide alternative methods for calculating the stress intensities due to membrane stresses (i.e.,  $K_{Im}$  values) and thermal stresses (i.e.,  $K_{It}$  values) for both axially and circumferentially oriented flaws. However, the alternative methods in Code Case N-588 for calculating the  $K_{Im}$  values and  $K_{It}$  values for axially oriented flaws are equivalent to those specified in the 1995 Edition of Appendix G to Section XI of the ASME Code for axially oriented flaws. Appendix G to 10 CFR Part 50 requires that licensed utilities postulate the occurrence of an axially oriented flaw in each of the base metal materials and axial weld materials used to fabricate their RPVs. Exemptions to use ASME Code Case N-588 are, therefore, not necessary for RPVs that are limited in their beltline regions by base-metal or axial weld metal materials, because using the methods in the Code Case would not provide any benefit for evaluating the postulated axial flaws over those specified in the 1995 Edition of Appendix G to Section XI of the ASME Code. Since the Pilgrim RPV is currently limited by lower shell-to-intermediate shell axial welds fabricated from material heat number 27204/12008,

use of Code Case N-588 does not provide any benefit for Pilgrim. In a letter dated February 8, 2001, Entergy confirmed that the limiting reactor vessel welds are axial and withdrew its request for exemption for use of Code Case N-588.

#### Code Case N-640 (formerly Code Case N-626)

Code Case N-640 permits application of the lower bound static initiation fracture toughness value equation ( $K_{Ic}$  equation) as the basis for establishing the curves in lieu of using the lower bound crack arrest fracture toughness value equation (i.e., the  $K_{Ia}$  equation, which is based on conditions needed to arrest a dynamically propagating crack, and which is the method invoked by Appendix G to Section XI of the ASME Code). Use of the  $K_{Ic}$  equation in determining the lower bound fracture toughness in the development of the P-T operating limits curve is more technically correct than the use of the  $K_{Ia}$  equation since the rate of loading during a heatup or cooldown is slow and is more representative of a static condition than a dynamic condition. The  $K_{Ic}$  equation appropriately implements the use of the static initiation fracture toughness behavior to evaluate the controlled heatup and cooldown process of a reactor vessel. However, since use of Code Case N-640 constitutes an alternative to the requirements of Appendix G, licensees need staff approval to apply the Code Case methods to the P-T limit calculations.

### 3.0 DISCUSSION

Pursuant to 10 CFR 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. Special circumstances are present whenever, according to 10 CFR 50.12(a)(2)(ii), "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.”

Code Case N-640 (formerly Code Case N-626)

Entergy has requested, pursuant to 10 CFR 50.60(b), an exemption to use ASME Code Case N-640 (previously designated as Code Case N-626) as the basis for establishing the P-T limit curves. Appendix G to 10 CFR Part 50 has required use of the initial conservatism of the  $K_{Ia}$  equation since 1974 when the equation was codified. This initial conservatism was necessary due to the limited knowledge of RPV materials. Since 1974, the industry has gained additional knowledge about RPV materials, which demonstrates that the lower bound on fracture toughness provided by the  $K_{Ic}$  equation is well beyond the margin of safety required to protect the public health and safety from potential RPV failure. In addition, the RPV 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.

The ASME Working Group on Operating Plant Criteria (WGOPC) has concluded that application of Code Case N-640 to plant P-T limits is still sufficient to ensure the structural integrity of RPVs during plant operations. The staff has concurred with ASME’s determination. The staff had concluded that application of Code Case N-640 would not significantly reduce the safety margins required by 10 CFR Part 50, Appendix G. The staff also concluded that relaxation of the requirements of Appendix G to the Code by application of Code Case N-640 is acceptable and would maintain, pursuant to 10 CFR 50.12(a)(2)(ii), the underlying purpose of the NRC regulations to ensure an acceptable margin of safety for the Pilgrim RPV and reactor coolant pressure boundary (RCPB). Therefore, the staff concludes that Code Case N-640 is acceptable for application to the Pilgrim P-T limits.

The staff has determined that Entergy has provided sufficient technical bases for using the methods of Code Case N-640 for the calculation of the P-T limits for the Pilgrim RCPB.

The staff has also determined that application of Code Case N-640 to the P-T limit calculations will continue to serve the purpose in 10 CFR Part 50, Appendix G, for protecting the structural integrity of the Pilgrim RPV and RCPB. In this case, since strict compliance with the requirements of 10 CFR Part 50, Appendix G, is not necessary to serve the underlying purpose of the regulation, the staff concludes that application of Code Case N-640 to the P-T limit calculations meets the special circumstance provisions stated in 10 CFR 50.12(a)(2)(ii), for granting this exemption to the regulation.

#### 4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not endanger life or property or common defense and security, and is, otherwise, in the public interest. Also, special circumstances are present. Therefore, the Commission hereby grants Entergy Nuclear Generation Company an exemption from the requirements of 10 CFR Part 50, Appendix G, for Pilgrim.

Pursuant to 10 CFR 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 (66 FR 18986).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 13<sup>th</sup> day of April 2001.

FOR THE NUCLEAR REGULATORY COMMISSION

**/RA/**

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