

pressure-temperature (P-T) limits be established for reactor pressure vessels (RPVs) during normal operating and hydrostatic or leak rate testing conditions. Specifically, Appendix G to 10 CFR part 50 states that “[t]he appropriate requirements on both the pressure-temperature limits and the minimum permissible temperature must be met for all conditions.” Furthermore, Appendix G to 10 CFR part 50 specifies that the requirements for these limits are based on the application of evaluation procedures given in Appendix G to Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code). Appendix G to 10 CFR part 50 also specifies that the Editions and Addenda of the ASME Code which are incorporated by reference in 10 CFR 50.55a apply to the requirements in Appendix G to 10 CFR part 50. In the 2003 Edition of 10 CFR, the NRC endorsed Editions and Addenda of the ASME Code through the 1998 Edition and 2000 Addenda. However, Entergy has currently incorporated the 1989 Edition of the ASME Code into the IP3 licensing basis for defining the ASME Code requirements which apply to the facility’s ASME Code, Section XI program. Hence, with respect to the statements from Appendix G to 10 CFR part 50 referenced above, it is the 1989 Edition of Appendix G to Section XI of the ASME Code which continues to apply to IP3. Finally, 10 CFR 50.60(b) states that, “[p]roposed alternatives to the described requirements in [Appendix G] of this part or portions thereof may be used when an exemption is granted by the Commission under [10 CFR 50.12].”

Entergy has requested, in a separate submittal dated May 28, 2003, an amendment to the IP3 Technical Specification (TS) P-T limit curves. In order to address the provisions of this amendment, Entergy has also requested that the staff exempt IP3 from the application of specific requirements of Appendix G to 10 CFR part 50, and substitute the use of ASME Code Case N-640. ASME Code Case N-640 permits the use of an alternate reference fracture toughness curve for RPV materials when determining P-T limits. The proposed exemption request is consistent with, and is needed to support, the proposed IP3 TS amendment that was provided in the separate submittal. The proposed IP3 TS amendment will revise the P-T limits for heatup, cooldown, and inservice test limitations for the reactor coolant system (RCS) through 20 effective full-power years of operation.

#### *Code Case N-640*

The requested exemption would allow use of ASME Code Case N-640 in conjunction with Appendix G to Section XI of the ASME Code, 10 CFR 50.60(a), and Appendix G to 10 CFR part 50 to establish P-T limits for the IP3 RPV.

The licensee’s proposed TS amendment to revise the P-T limits for IP3 relies, in part, on the requested exemption. These revised P-T limits have been developed using the lower bound  $K_{IC}$  fracture toughness curve given in Appendix A to Section XI of the ASME Code, Figure A-2200-1, in lieu of the lower bound  $K_{IA}$  fracture toughness curve given in Appendix G to Section XI of the ASME Code, Figure G-2210-1, as the basis fracture toughness curve for defining the IP3 P-T limits. All 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 as the basis fracture toughness curve for the development of P-T operating limits is technically correct. The  $K_{IC}$  curve appropriately implements the use of a relationship based on static initiation fracture toughness behavior to evaluate the controlled heatup and cooldown process of an RPV, whereas the  $K_{IA}$  fracture toughness curve, as given in Appendix G to Section XI of the ASME Code, was developed from more conservative crack arrest and dynamic fracture toughness test data. The application of the  $K_{IA}$  fracture toughness curve was initially codified in Appendix G to Section XI of the ASME Code in 1974 to provide a conservative representation of RPV material fracture toughness. This initial conservatism was necessary due to the limited knowledge of RPV material behavior in 1974. Since that time, however, additional knowledge about RPV materials has been gained, which demonstrates that the lower bound on fracture toughness, provided by the  $K_{IA}$  fracture toughness curve, is well beyond the margin of safety required to protect the public health and safety from potential RPV failure.

In addition, P-T limit curves based on the  $K_{IC}$  fracture toughness curve will enhance overall plant safety by opening the P-T operating window with the greatest safety benefit in the region of low temperature operations. The operating window through which the operator heats up and cools down the RCS is determined by the difference between the maximum allowable pressure, determined by Appendix G to Section XI of the ASME Code, and the minimum required pressure for the

reactor coolant pump (RCP) seals adjusted for instrument uncertainties. A narrow operating window could potentially have an adverse safety impact by increasing the possibility of inadvertent overpressure protection system (OPPS) actuation due to pressure surges associated with normal plant evolutions such as RCS pump starts and swapping operating charging pumps with the RCS in a water-solid condition.

Since application of ASME Code Case N-640 provides appropriate procedures to establish maximum postulated defects and to evaluate those defects in the context of establishing RPV P-T limits, this application of the Code Case maintains an adequate margin of safety for protecting RPV materials from brittle failure. Therefore, the licensee concluded that these considerations were special circumstances pursuant to 10 CFR 50.12(a)(2)(ii), “[a]pplication 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.”

In summary, the ASME Code, Section XI, Appendix G procedure was conservatively developed based on the level of knowledge existing in 1974 concerning reactor coolant pressure boundary materials and the estimated effects of operation. Since 1974, the level of knowledge about the fracture mechanics behavior of RCS materials has been greatly expanded, especially in regard to the effects of radiation embrittlement and the understanding of fracture toughness properties under static and dynamic loading conditions.

#### **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 the public health and safety, and are consistent with the common defense and security; and (2) when special circumstances are present.

Special circumstances, pursuant to 10 CFR 50.12(a)(2)(ii), are present because the continued operation of IP3 with the P-T curves developed in accordance with Appendix G to Section XI of the ASME Code, without the relief provided by ASME Code Case N-640, is not necessary to achieve the underlying purpose of Appendix G to 10 CFR part 50. Application of ASME Code Case N-640 in lieu of the requirements of Appendix G to Section XI of the ASME Code provides an acceptable alternative evaluation procedure, which will