



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 26 TO FACILITY OPERATING LICENSE NO. NPF-69
NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT NUCLEAR POWER STATION, UNIT NO. 2
DOCKET NO. 50-410

INTRODUCTION

In response to Generic Letter 88-11, "NRC Position on Radiation Embrittlement of Reactor Vessel Materials and Its Effect on Plant Operation," Niagara Mohawk Power Corporation (the licensee) proposed to revise the pressure/temperature (P/T) limits in the Nine Mile Point Nuclear Station, Unit No. 2 (NMP-2) Technical Specifications, Section 3/4.4.6 and the associated Bases. The proposed revision was documented in letters from the licensee dated November 28, 1988, March 21, 1990, and November 13, 1990. The proposed revision would also make the proposed P/T limits applicable for 12.8 effective full power years (EFPY). The proposed P/T limits were developed based on Regulatory Guide (RG) 1.99, Revision 2. The proposed revision provides up-to-date P/T limits for the operation of the reactor coolant system during heatup, cooldown, criticality, and hydrotest.

BACKGROUND

The P/T limits are among the limiting conditions of operations in the Technical Specifications. Appendices G and H of 10 CFR Part 50 describe specific requirements for fracture toughness and reactor vessel material surveillance that must be considered in setting P/T limits.

Appendix G of 10 CFR Part 50 specifies fracture toughness and testing requirements for reactor vessel materials in accordance with the ASME Code and, in particular, that the beltline materials in the surveillance capsules be tested in accordance with Appendix H of 10 CFR Part 50. Appendix H, in turn, refers to ASTM Standards. These tests define the extent of vessel embrittlement at the time of capsule withdrawal in terms of the increase in reference temperature. Appendix G also requires the licensee to predict the effects of neutron irradiation on vessel embrittlement by calculating the adjusted nil-ductility transition reference temperature (ART) and Charpy upper shelf energy (USE). Generic Letter 88-11 requested that licensees use the methods in RG 1.99, Revision 2, to predict the effect of neutron irradiation on reactor vessel materials. This guide defines the ART as the sum of

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unirradiated reference temperature, the increase in reference temperature resulting from neutron irradiation, and a margin to account for uncertainties in the prediction method.

Appendix H of 10 CFR Part 50 requires the licensee to establish a surveillance program to periodically withdraw surveillance capsules from the reactor vessel. Appendix H refers to the ASTM Standards which, in turn, require that the capsules be installed in the vessel before startup and that they contain test specimens made from plate, weld, and heat-affected-zone (HAZ) materials of the reactor beltline.

EVALUATION

The staff evaluated the effect of neutron irradiation embrittlement on each beltline material in the NMP-2 reactor vessel. The amount of irradiation embrittlement was calculated in accordance with RG 1.99, Revision 2. The staff has determined that the materials with the highest ART at 12.8 EFPY were plates C3147-1 and C3147-2 with 0.11% copper (Cu), 0.63% nickel (Ni), and an initial RT_{ndt} (nil-ductility transition reference temperature) of 0°F.

The licensee has not removed any surveillance capsules from the NMP-2 reactor vessel. All surveillance capsules contain Charpy impact specimens and tensile specimens made from base metal, weld metal, and HAZ metal.

For the limiting beltline materials, plates C3147-1 and C3147-2, the staff calculated the ART to be 56.93°F at 1/4T (T - reactor vessel beltline thickness) and 45.54°F at 3/4T for 12.8 EFPY. The staff used a neutron fluence of $4.6E17$ n/cm² at 1/4T and $2.0E17$ n/cm² at 3/4T. The ART was determined by Section 1 of RG 1.99, Revision 2, because no surveillance capsules have been removed from the NMP-2 reactor vessel.

The licensee used the method in RG 1.99, Revision 2, to calculate an ART of 56.93°F at 1/4T and 45.54°F at 3/4T at 12.8 EFPY for the same limiting plates. Substituting the ART of 56.93°F into equations in Standard Review Plan Section 5.3.2, the staff verified that the proposed P/T limits for heatup, cooldown, criticality, and hydrotest meet the beltline material requirements in Appendix G of 10 CFR Part 50.

In addition to beltline materials, Appendix G of 10 CFR Part 50 also imposes P/T limits based on the reference temperature for the reactor vessel closure flange materials. Section IV.2 of Appendix G states that when the pressure exceeds 20% of the preservice system hydrostatic test pressure, the temperature of the closure flange regions highly stressed by the bolt preload must exceed the reference temperature of the material in those regions by at least 120°F for normal operation and by 90°F for hydrostatic pressure tests and leak tests. Paragraph IV.A.3 of Appendix G states "an exception may be made for boiling water reactor vessels when water level is within the normal range for power operation and the pressure is less than 20 percent of the preservice system hydrostatic test pressure. In this case the minimum permissible temperature is 60°F (33°C) above the reference temperature of the closure flange regions that are highly stressed by the bolt preload." Based on the flange reference temperature of 10°F, the staff has determined that the proposed P/T limits satisfy Section IV.2 of Appendix G.



Section IV.B of Appendix G requires that the predicted Charpy USE at end of life be above 50 ft-lb. The material with the lowest initial Charpy USE is plate C3147-1 with 74 ft-lb. Using Figure 2 of RG 1.,99, Revision 2, the staff calculated that the end of life USE will be 64.4 ft-lb. This is greater than 50 ft-lb and, therefore, is acceptable.

SUMMARY

The staff concludes that the proposed P/T limits for the reactor coolant system for heatup, cooldown, leak test, and criticality are valid through 12.8 EFY because the limits conform to the requirements of Appendices G and H of 10 CFR Part 50. The licensee's submittal also satisfies Generic Letter 88-11 because the licensee used the method in RG 1.99, Revision 2, to calculate the ART. Hence, the proposed P/T limits may be incorporated into the NMP-2 Technical Specifications.

ENVIRONMENTAL CONSIDERATION

This amendment involves a change in the installation or use of the facility components located within the restricted areas as defined in 10 CFR Part 20. The staff has determined that this 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 this amendment involves no significant hazards consideration and there has been no public comment on such finding. Accordingly, this 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 this amendment.

CONCLUSION

We have 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, and (2) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated: January 11, 1991

PRINCIPAL CONTRIBUTOR:

J. Tsao

