SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
ON REACTOR VESSEL PRESSURE-TEMPERATURE LIMITS

WISCONSIN ELECTRIC POWER COMPANY
POINT BEACH NUCLEAR PLANT UNIT 1
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INTRODUCTION

In a letter from R. W. Britt to H. R. Denton, dated May 16, 1985, the Wisconsin Electric Power Company (the licensee) proposed the continued use of the Point Beach Unit 1 reactor vessel pressure-temperature limits specified in Figures 15.3.1-1 and 15.3.1-2 in the current plant Technical Specifications. The bases for the continued use of the temperature and pressure limits during heatup and cooldown are the test results from the Point Beach Unit 1 surveillance program contained in Reference 1.

DISCUSSION

Pressure-temperature limits must be calculated in accordance with the requirements of Appendix G, 10 CFR 50, which became effective on July 26, 1983. Pressure-temperature limits that are calculated in accordance with the requirements of Appendix G, 10 CFR 50, are dependent upon the initial reference temperature (RT_{NDT}) for the limiting materials in the beltline and closure flange regions of the reactor vessel and the increase in RT_{NDT} resulting from neutron irradiation damage to the limiting beltline material. The Point Beach Unit 1 reactor vessel was procured to the ASME Code requirements which did specify fracture toughness testing to determine the initial RT_{NDT} for each vessel material. The licensee indicated in Reference 2 that the initial RT_{NDT} for the limiting materials in the closure flange and beltline regions of the Point Beach Unit 1 vessel was estimated using the method recommended by the staff in Branch Technical Position MTEB 5-2, "Fracture Toughness Requirements", which is documented in the Standard Review Plan, Section 5.3.2, "Pressure-Temperature Limits".

The limiting beltline material is the weld metal which was fabricated using weld wire (heat no. 61782) and Linde 80 flux (lot no. 8350) (Reference 3). The licensee indicates that Branch Technical Position MTEB 5-2 results in an initial RT_{NDT} of $30^{o}F$ for this material (Reference 2). The chemical composition of this material is given in References 2 through 5. The licensee indicates that the limiting closure flange region material is the vessel head flange, in which the initial RT_{NDT} is estimated as $50^{o}F$ (Reference 2).

The increase in RT_{NDT} resulting from neutron irradiation damage depends upon the predicted amount of neutron fluence and the rate of embrittlement of the limiting reactor vessel beltline material. The licensee estimated that the neutron fluence at the inside surface of the limiting weld (15^{o}) will be 1.05×10^{19} n/cm^2 at 14 effective full power years (EFPY) (References 1 and 3).

The increase in RT_{NDT} resulting from neutron irradiation damage was estimated by the licensee according to Regulatory Guide 1.99 Rev. 1, "Effects of Residual Elements on Predicted Radiation Damage to Reactor Vessel Materials". Table 1 compares the observed increase in RT_{NDT} of the surveillance weld metal to that predicted according to Regulatory Guide 1.99 Rev. 1. The surveillance weld metal is not from the same heat of flux and wire as that used in the fabrication of the limiting beltline weld. However, it may be used to evaluate the effect of irradiation on the beltline weld, since it was fabricated using the same type of flux and wire as the limiting beltline weld. The surveillance material test results indicate that the increase in RT_{NDT} of surveillance weld metal is significantly less than that predicted by Regulatory Guide 1.99 Rev. 1. Hence, the Regulatory Guide should provide a conservative estimate as to the amount of increase in RT_{NDT} resulting from neutron irradiation for the Point Beach Unit 1 limiting reactor vessel beltline weld.

CONCLUSION

We have used the unirradiated RT_{NDT} for beltline and closure flange materials, which were previously discussed, the neutron fluence estimates of the licensee, the Regulatory Guide 1.99 Rev. 1 method of estimating neutron irradiation damage, and Standard Review Plan 5.3.2 method of calculating pressure-temperature limits to evaluate the licensee's proposed pressure-temperature limits. Our evaluation indicates that the pressure-temperature limits in the current plant Technical Specifications meet the safety margins of Appendix G, 10 CFR 50, for a period of time corresponding to 14 EFPY. Hence, the staff concludes that the licensee may continue to use the pressure-temperature limit curves in the current plant Technical Specifications for Point Beach Unit 1.

Principal Contributors:

B. Elliot
S. Lee

TABLE 1

Comparison of Observed and Calculated Increase in RT_{NDT} of Weld Metal in Surveillance Capsules

Surveillance Capsule	Capsule Fluence (n/cm^2)	Increase in RT_{NDT} Measured (^oF)	Increase in RT_{NDT} Calculated Using R.G. 1.99 Rev. 1 (^oF)
V	0.544×10^{19}	110	188
S	0.755×10^{19}	165	222
R	2.08×10^{19}	165	320
T	2.11×10^{19}	180	330

REFERENCES

(1) Westinghouse Report WCAP-10736, "Analysis of Capsule T From the Wisconsin Electric Power Company Point Beach Nuclear Plant Unit No. 1 Reactor Vessel Radiation Surveillance Program", S. E. Yanichko, V. A. Perone, and W. T. Kaiser, December 1984.

(2) Westinghouse Report WCAP-8743, "Heatup and Cooldown Limit Curves for the Wisconsin Electric Power Company and the Wisconsin Michigan Power Company Point Beach Nuclear Plant Unit No. 1", J. H. Phillips and O. Meeuwis, January 1977.

(3) Letter from C. W. Fay (Wisconsin Electric Power Company) to H. R. Denton (NRC), March 14, 1986, and Westinghouse Report WCAP-10638, "Adjoint Flux Program for Point Beach Units 1 and 2", S. L. Anderson and K. R. Balkey, December 1984.

(4) Letter from C. W. Fay (Wisconsin Electric Power Company) to H. R. Denton (NRC), January 20, 1986.

(5) Letter from T. G. Colburn (NRC) to C. W. Fay (Wisconsin Electric Power Company), September 4, 1986.

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