SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 82 TO FACILITY OPERATING LICENSE NO. DPR-23

CAROLINA POWER AND LIGHT COMPANY

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

DOCKET NO. 50-261

In letter from M. A. Mc Duffie to S. A. Varga dated October 14, 1983, the Carolina Power & Light Company (CPLC) requested a change to the H. B. Robinson Steam Electric Plant Unit No. 2 (HBR-2) reactor vessel pressure temperature limits, Figures 3.1-1 and 3.1-2 of the plants technical specifications. CPLC indicates that the pressure-temperature limits will meet the requirements of Appendix G, 10 CFR 50, for a period of time corresponding to 10 effective full power years (EFPY).

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 reqirements of Appendix G, 10 CFR 50, are dependent upon the initial 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 HBR-2 reactor vessel was procured prior to the issuance of the Appendix G, 10 CFR 50 regulation. However, the HBR-2 reactor vessel materials must meet the safety margins and testing requirements of the regulation. Appendix G, 10 CFR 50, requires that samples from each reactor vessel material be fracture toughness tested to determine their initial (unirradiated) RT_{NDT}. The limiting reactor vessel materials were not fracture toughness tested to determine their initial RT_{NDT}. The initial RT_{NDT} of the limiting reactor vessel materials were determined using the criteria in Branch Technical Position - MTEB 5-2 which is documented in Standard Review Plan Section 5.3.2 of NUREG-0800.

The limiting beltline material is the weld metal which was fabricated using Linde 1092 flux and RACO 3 wire with nickel added. The licensee indicates that Branch Technical Position MTEB 5-2 results in an initial RT_{NDT} of 0°F for this material. The licensee indicates that the limiting closure flange region material is the vessel flange forging, in which the initial RT_{NDT} is estimated as 40°F.

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 indicates that at 7.48 EFPY the neutron fluence at the inside surface of the limiting weld was $13.5 \times 10^{18} n/cm^2$ and that the subsequent

rate of increase in fluence per EFPY would be $1.05 \times 10^{18n}/cm^2$ (Reported in the meeting summary memorandum dated February 11, 1983 between CP&L and the NRC staff). This rate of increase results in a predicted neutron fluence for the limiting weld at the inside surface of $1.61 \times 10^{19n}/cm^2$ at 10 EFPY. The rate of increase in neutron fluence was reviewed and accepted by the staff.

The incease in RT_{NDT} resulting from neutron irradiation damage was estimated by the licensee using the upper limit lines in 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 using the upper bound limit line in Regulatory Guide 1.99 Rev. 1 and the Guthrie Mean Formula in Commission Report SECY 82-465. 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 the upper bound limit line of Regulatory

Guide 1.99, Rev. 1. Hence, the Regulatory Guide upper bound limit line should provide a conservative estimate as to the amount of increase in RT_{NDT} resulting from neutron irradiation for the HBR-2 limiting reactor vessel beltline weld.

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 applicant's proposed pressure-temperature limits. Our evaluation indicates that the proposed pressure-temperature limit curves meet the safety margins of Appendix G, 10 CFR 50, for a period of time corresponding to 10 EFPY. Hence, the proposed curves may be incorporated into the HBR-2 Technical Specification.

Environmental Consideration

This amendment involves a change in the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The staff has determined that the 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 occupation 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 Sec 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: September 4, 1984

Principal Contributor:

B. Elliot

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} (°F)			
		Observed	Calculated Using R.G. 1.99 Rev.1[2]	Calculated Using Guthrie[1] Formula	Mean
Capsule T [3]	4.11×10^{19}	285	320	334	
Capsule V [4]	4.51×10^{18}	175	220	184	

1. Guthrie Formula is identified on page E-6 of Commission Report SECY-82-465, "Pressurized Thermal Shock (PTS)"
2. Calculation using the upper limit line of Regulatory Guide 1.99 Rev. 1, "Effects of Residual Elements on Predicted Radiation Damage to Reactor Vessel Materials"
3. Capsule T test results are reported in Westinghouse Report WCAP 10304, "Analysis of Capsule T From H. B. Robinson Unit 2 Reactor Vessel Radiation Surveillance Program
4. Capsule V test results are reported in Southwest Research Institute Report, "Reactor Vessel Material Surveillance Program For H. B. Robinson Unit No. 2 Analysis of Capsule V"