



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REGARDING PROJECTED VALUES OF MATERIAL PROPERTIES

FOR FRACTURE TOUGHNESS REQUIREMENTS

FOR PROTECTION AGAINST PRESSURIZED THERMAL SHOCK EVENTS

DUQUESNE LIGHT COMPANY

BEAVER VALLEY POWER STATION, UNIT 1

DOCKET NO. 50-334

INTRODUCTION

As required by 10 CFR 50.61, "Fracture Toughness Requirements for protection Against Pressurized Thermal Shock" (PTS Rule) which was published in the Federal Register July 23, 1985, the licensee for each operating pressurized water reactor "shall submit projected values of RT_{PTS} (at the inner vessel) surface) of reactor vessel beltline materials by giving values from the time of submittal to the expiration date of the operating license. The assessment must specify the bases for the projection including the assumptions regarding core loading patterns. This assessment must be submitted by January 23, 1986, and must be updated whenever changes in core loadings, surveillance measurements or other information indicate a significant change in projected values."

By letter dated January 21, 1986, supplemented by letter dated May 16, 1986, Duquesne Light Company (the licensee or DLC) submitted projected values for RT_{PTS} together with material properties and fast neutron fluence of reactor vessel beltline material for Beaver Valley Power Station, Unit 1. The RT_{PTS} and fluence values were projected to 32 effective full power years (EFPPY) which is considered to be beyond the expiration date of the license.

EVALUATION OF THE MATERIALS ASPECTS

The controlling beltline material from the standpoint of PTS susceptibility was identified to be lower shell plate B6903-1.

The material properties of the controlling material and the associated margin and chemistry factor were reported to be:

	<u>Utility Submittal</u>	<u>Staff Evaluation</u>
Ci (copper content, %)	0.20	0.20
Ni (nickel content, %)	0.54	0.54
I (Initial RT_{NDT} , °F)	27	27
M (Margin, °F)		48
CF (Chemistry factor, °F)		121.8

The controlling material has been properly identified. The justification given for the copper and nickel contents and the initial RT_{NDT} are acceptable. The margin has been derived from consideration of the bases for these values, following the PTS Rule, Section 50.61 of 10 CFR Part 50. Assuming that the reported values of fluence are correct, Equation 1 of PTS rule governs, and the chemistry factor is as shown above.

EVALUATION OF THE FLUENCE ASPECTS

The following evaluation concerns the estimation of the fluence to the pressure vessel for 32 effective full power years of operation and the corresponding value of the RT_{PTS} .

The licensee submitted additional information on May 16, 1986 in response to a staff request regarding the fast neutron fluence to the inside surface of the pressure vessel. The methodology of the fluence calculation was based on the discrete ordinates code DOT with an ENDF-B/IV-based cross section set. The scattering is treated with a P_3 approximation. The code has been benchmarked by Westinghouse and its predictions for the surveillance capsule locations are within $\pm 15\%$ of the measured values. The methodology, the cross sections and the approximations used are acceptable.

The equation specified (in 10 CFR 50.61) as applicable to the Beaver Valley Unit 1 plant is:

$$RT_{PTS} = I + M + (-10 + 470 \cdot Cu + 350 \cdot Cu \cdot Ni) \cdot f^{0.27}$$

where:

I = Initial RT_{NDT}	= 27°
M = Uncertainty Margin	= 48°F
Cu = w/o Copper in shell plate B6903-1	= 0.20
Ni = w/o Nickel in shell plate B6903-2	= 0.54
f = peak fluence ($E \geq 1.0$ MeV) for 32 EFPY, lower shell plate B6903-1 in units of 10^{19} n/cm ²	= 4.5

Therefore:

$$RT_{PTS} = 27 + 48 + (-10 + 470 \times 0.20 + 350 \times 0.20 \times 0.54) \times 4.5^{0.27}$$

$$= 75 + 121.8 \times 1.5 = 257.8^\circ F$$

which is lower than 270°F the applicable PTS rule screening criterion and is acceptable.

In view of:

- (a) the pressure-temperature updating requirements for the fracture toughness of the beltline material in 10 CFR 50 Appendix G, and

- (b) the fact that the RT_{PTS} value is readily available from the calculation of the pressure-temperature limits, and
- (c) the staff desire to be informed on the current value of the RT_{PTS} for all PWRs,

we request that the licensee submit a re-evaluation of the RT_{PTS} and a comparison to the prediction of Reference 1 along with future Pressure-Temperature operating limits which are required by 10 CFR 50 Appendix G.* It should be noted that this re-evaluation is a requirement by 10 CFR 50.61, whenever core loadings, surveillance measurements, or other information indicate a significant change in projected values.

CONCLUSION

The licensee has calculated a RT_{PTS} of 257.8°F for plate material at the end of 32 EFPY, which is same as the nominal 32 EFPY considered in the development of the PTS Rule. This is less than 270°F, the screening criteria for the limiting material at the expiration date of the license. This is acceptable. However, in order for the staff to confirm the licensee's projected estimated RT_{PTS} throughout the life of the Beaver Valley 1 operating license, the licensee is requested to submit a re-evaluation of the RT_{PTS} and comparison to the predicted value with future pressure-temperature submittals which are required by 10 CFR 50, Appendix G.

Principal contributors

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Dated

August, 1986