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

Enclosure 1

SAFETY EVALUATION BY THE OFFICE OF SPECIAL PROJECTS

FRACTURE TOUGHNESS REQUIREMENTS FOR PROTECTION AGAINST

PRESSURIZED THERMAL SHOCK EVENTS (10 CFR 50.61)

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT, UNIT 1

DOCKET NO. 50-327

1.0 INTRODUCTION

In accordance with 10 CFR Part 50.61(b)(1), each pressurized water reactor licensee shall have submitted an assessment of the pressure vessel reference temperature by January 23, 1986. This assessment of the reference temperature at the inner surface of the reactor vessel beltline materials is projected from the time of submittal to the expiration of the license. The assessment must specify the bases for the projection and the assumptions regarding core loading patterns. It must be updated whenever changes in core loadings, surveillance measurements or other information indicate a significant change in projected reference temperature values.

2.0 EVALUATION

By letter dated January 21, 1986, the Tennessee Valley Authority (TVA) submitted information for Sequoyah Unit 1 on the material properties and the fast neutron fluence (E greater than 1.0 MeV) of the reactor pressure vessel in compliance with the requirements of 10 CFR 50.61 (See References 1 and 2).

2.1 Material Properties

The controlling beltline material from the standpoint of PTS susceptibility was identified by TVA to be the intermediate forging. The material properties of the controlling material and the associated margin and chemistry factor were reported by TVA to be:

	TVA Submittal	Staff Evaluation
Cu (copper content, %)	0.15	0.15
Ni (nickel content, %)	1.00	1.00
I (Initial RT_{NDT}, °F	+40	+40
M (Margin, °F)	--	48
CF (Chemistry Factor, °F)	--	113.0

The results of the staff's evaluation are given in the second column above. The controlling material has been properly identified. The justifications given for the copper and nickel contents and the initial reference temperature, as defined in the ASME Code, Paragraph NB-2331, (RTNDT) are acceptable.

The margin has been derived from consideration of the bases for these values, following the PTS rule (10 CFR Part 50.61). Based on the reported values of fluence, Equation 1 of the PTS rule governs and the chemistry factor is as shown in the above table.

2.2 Fast Neutron Fluence

The following evaluation concerns the estimation of the fluence to the pressure vessel for 32 effective full power years of operation and the equations in 10 CFR Part 50.61(b)(2). The 32 effective full power years represent a 40-year design life based on an 80 percent capacity factor.

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, plant specific sources were used and the code has been benchmarked by Westinghouse. It's predictions for the surveillance capsule locations are within ±15% of the measured values. The intermediate vessel forging has been identified as the controlling material; therefore, the applicable value of the fluence is the peak of the azimuthal distribution. The fluence estimate is conservative and no future low leakage core loadings were assumed. The methodology, the cross sections and the approximations used are acceptable.

The applicable equation specified in 10 CFR 50.61(b)(2) for the pressure vessel PTS reference temperature (RT_{PTS}) for Sequoyah Unit 1 plant is the following:

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

where:

I = Initial RT_{NDT} = 40°F

M = Uncertainty Margin = 48°F

Cu = w/o Copper in Intermediate Forging = 0.15

Ni = w/o Nickel in Intermediate Forging = 1.00

f = Peak Azimuthal Fluence for 32 EFPT (E equal or greater than 1.0 MeV) Intermediate Forging in units of $10^{19} n/cm^2$ = 3.01

Therefore; the PTS reference temperature is:

$$RT_{PTS} = 40+48+(-10+470x0.15+350x0.15x1.0)x3.01^{0.27}$$
$$= 88+113x1.347 = 240.2°F$$

which is lower than 270°F which is the applicable PTS rule screening criterion in 10 CFR Part 50.61 (b)(2) and, therefore, the projected PTS reference temperature for Unit 1 is acceptable.

3.0 CONCLUSION

The staff concludes, based on the above, that the pressure vessel PTS reference temperature defined in 10 CFR Part 50.61(b)(2) is less than the applicable PTS screening criterion. Because the PTS reference temperature is projected to be within the screening criterion through the expiration of the Unit 1 license, TVA does not have to address 10 CFR Part 50.61(b)(3). In accordance with 10 CFR 50.61(b)(1), the staff will request that TVA submit an update to the information in the TVA letter dated January 21, 1986 whenever changes in core loadings, surveillance measurements, or other information indicate a significant change in projected reference temperature values.

4.0 REFERENCES

1. Letter from J. A. Domer, Tennessee Valley Authority to Director, NRR dated January 21, 1986.

2. WCAP-10340, "Analysis of Capsule T from the Tennessee Valley Authority Sequoyah Unit 1 Reactor Vessel Radiation Surveillance Program" dated May, 1983.

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