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SUBJECT: Forwards response to NRC 990623 RAI to support review of pending request for amend to reactor pressure-temp limit curve TS.

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Docket No. 50-397

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Gentlemen:

Subject: **WNP-2, OPERATING LICENSE NPF-21**
**REQUEST FOR AMENDMENT**
**TECHNICAL SPECIFICATION 3.4.11**
**(ADDITIONAL INFORMATION)**

Reference: Letter, dated June 23, 1999, Jack Cushing (NRC) to JV Parrish (SS), "Request for Additional Information (RAI) for the Washington Public Power Supply System Nuclear Project No. 2 (TAC No. MA5307)"

In the reference, the staff requested that additional information be provided to support review of our pending request for an amendment to the reactor pressure-temperature limit curve Technical Specification.

The additional information is included as an attachment. Should you have any questions or desire additional information regarding this matter, please call me or PJ Inserra at (509) 377-4147.

Respectfully,

DW Coleman

DW Coleman
Manager, Regulatory Affairs
Mail Drop PE20

Attachment

A001

cc: EW Merschoff - NRC RIV
JS Cushing - NRR
NRC Sr. Resident Inspector - 927N
DL Williams - BPA/1399
TC Poindexter - Winston & Strawn

Question 1: *Pressure Stress Intensity Calculation. Please provide the equation for the pressure stress intensity calculation. In addition, please provide an example using the 150° F, 158 psig point from Figure 3.4.11-3 of your submittal. Provide all parameters that appear in the pressure stress intensity equation.*

Response

The pressure stress intensity was calculated using ASME Code (Section XI, 1989 Edition) Figure G-2214-1 and ASME equation $K_{Im} = M_m * \sigma_m$. The allowable pressure was calculated using a combination of ASME equation $K_{Im} = M_m * \sigma_m$ and standard reactor pressure vessel hoop stress equation $P = \sigma_m t / R$ [where P = pressure (psig), $\sigma_m$ = allowable applied stress, t = 9.625 inches (thicker shell section) and R = the mean radius of the vessel at the thicker shell section (130.3 inches)]. The following parameters were calculated using an Energy Northwest verified computer program.

$K_{Ia} = 39.47\ ksi\sqrt{in}$

$K_{It} = 27.09\ ksi\sqrt{in}$

$K_{Im} = 6.19\ ksi\sqrt{in}$

$M_m = 2.89$

P = 158 psig

Using the computer parameters and associated equations, the calculations for allowable pressure are as follows:

$6.19\ ksi\sqrt{in} = 2.89 * \sigma_m$

$\sigma_m = 2.142\ ksi$

Therefore: $P = (2.142\ ksi * 9.625\ in) / 130.3\ in = 158$ psig

The above calculation uses the limiting values of 110°F (150°F minus 40°F) and 158 psig from proposed Technical Specification Figure 3.4.11-2, "Non-Nuclear Heating and Cooldown Curve." Proposed Technical Specification Figure 3.4.11-3, "Nuclear Heating and Cooldown Curve," has an additional conservatism in that the 110°F value was increased by 40°F, as required by 10 CFR 50 (Appendix G), which increased the allowable temperature at pressure to 150°F. Appendix G to 10 CFR 50 requires that the pressure-temperature relationship provide at least a 40°F margin over that required for non-nuclear heatup and cooldown.

A reactor pressure vessel fluid temperature of 110°F is used because there are no thermocouples in the beltline region to measure vessel metal temperature. The fluid temperature is then adjusted to the 1/4t thickness using ASME Code (Section XI, 1989 Edition) Figure G-2214-3. The minimum temperature used at the 1/4t thickness is conservatively set at 80°F for a corresponding 110°F fluid temperature. The 80°F represents the minimum temperature for bolt-up.

*Question 2:* *Thermal Stress Intensity Calculation. If ASME Code Figure G-2214-2 was used for the thermal stress calculation, please provide the detailed information needed to use the figure. If an equation was used instead, please provide the equation and Young's Modulus, the coefficient of thermal expansion, and Poisson's ratio. For either approach, use the 150° F, 158 psig point from Figure 3.4.11-3 of your submittal as an example, and provide values for the thermal diffusivity, heatup or cooldown rate, and wall thickness.*

Response

The ASME Code, Section XI (1989 Edition), Figure G-2214-2 was used for the thermal stress calculation. The following parameters were used in the thermal calculation for 110°F (150°F minus the 40°F conservative margin required by 10 CFR 50, Appendix G).

Thermal Diffusivity at 110°F = 0.427 ft.sq./hr

Heatup/Cooldown Rate = 100°F/hr

Wall (Vessel Shell) Thickness = 9.625 inches

Where $\Delta T = \frac{t^2}{2*\beta} * 100°F/\text{hour}$

$\Delta T = 75.255° F$

$\Delta T$ = differential temperature through wall

$t$ = vessel thickness

$\beta$ = thermal diffusivity at temperature

The $K_{It}$ value was determined using ASME Code (Section XI, 1989 Edition) Figure G-2214-2, where $K_{It} = M_t * \Delta T_w$ ($M_t$ was determined to be 0.36 for a 9.625 inch thick vessel wall). The $M_t$ value was then multiplied by 75.255°F to obtain a $K_{It}$ value of 27.091 $ksi\sqrt{in}$.

Question 3 *Fracture Toughness Equation. Identify the fracture toughness equation used in your calculation.*

Response

The ASME Code, Section XI (1989 Edition), Figure G-2210-1 was used for the fracture toughness calculation. The equation is as follows:

$K_{Ia} - 26.78 = 1.233 \exp. [0.0145 (T - RT_{NDT} + 160)]$

Where $K_{Ia}$ was calculated conservatively using 80°F as the minimum ¼t metal temperature (associated with the 110°F and 158 psig points). The $RT_{NDT}$ value used is 79.2°F.