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DENTON,H.R. OFFICE OF NUCLEAR REACTOR REGULATION

SUBJECT: Documents 781218 conversation re stresses at welds 2 & 4 of replacement recirculation safe ends.Forwards breakdown of sustained stress values in the calculation of welds 2 & 4 stress index values.

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LEE LIU
SENIOR VICE PRESIDENT — ENGINEERING

January 8, 1979
IE-79-32

Mr. Harold Denton
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

The purpose of this letter is to document a phone conversation of December 18, 1978 between members of Iowa Electric, General Electric and the Nuclear Regulatory Commission staff.

The discussion centered mainly around the stresses at welds #2 and #4 (nozzle to safe end and safe end to pipe welds) of replacement recirculation inlet safe ends.

1. It was verified that the safe end stress reports included the thermal differential expansion stresses caused by the dissimilar materials. This stress was calculated by the finite element computer program. The zero stress temperature input into the program was 70 ^{o}F.

2. At weld #4, the finite element program reports compressive stresses in both the longitudinal and hoop directions on the stainless steel side of the weld and tensile stresses on the alloy 600 side. These results were also confirmed by a shell type computer model.

3. The highest stress index value at weld #4 occurred on the stainless steel side. The secondary portion of the stress index value was reported as zero since thermal stresses were compressive. The stainless steel side of the weld joint had the greater stress index value because the primary stress contribution to the stress index value was larger for stainless steel than for alloy 600.

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4. The stress index value at weld #4 was calculated using a finite element stress analysis since the safe ends are considered as part of the reactor vessel. This is consistent with the analysis methods used to calculate stress index values on previous safe ends evaluations. For weld #5 (pipe to pipe), the stress index value was calculated using the ASME Section III NB3600 piping equations and factors which is consistent with the stress index calculations on previous piping weld joints.

For further clarification, we are also enclosing a breakdown of the sustained stress values in the calculation of the stress index values for welds #2 and #4.

Very truly yours,

Lee Liu
Senior Vice President-Engineering

LL/KAM/sb

cc: K. Meyer
D. Arnold
R. Lowenstein
R. Clark (NRC)
H. Rehrauer
B-31c

STRESS INDEX SUMMARY

WELD #2 (ALLOY 600 SIDE)

PRIMARY STRESSES

LOAD	STRESS COMPONENTS			
	σ_z	σ_θ	σ_r	$\tau_{z\theta}$
PRESSURE	0.68	5.66	-1.05	0
DEAD WEIGHT	1.29	0	0	0.20
TOTAL	1.97	5.66	-1.05	0.20

PRINCIPLE STRESSES = 1.96, 5.67, -1.05

SECONDARY STRESSES

LOAD	σ_z	σ_θ	σ_r	$\tau_{z\theta}$
THERMAL RFE NOZZLE REACTION	3.37	0	0	1.36
STEADY STATE THERMAL	-13.2	-6.3	-3.5	0.6
TOTAL	-9.83	-6.3	-3.5	1.96

PRINCIPLE STRESSES = -10.7, -5.43, -3.5

PEAK STRESSES = 0 (STRESS CONCENTRATION FACTOR = 1.0)

RESIDUAL STRESSES = 40.0

$$S.I. = \frac{P_M + P_B}{S_Y} + \frac{Q + F + (RESID)}{S_Y + (.002)E}$$

$$S.I. = \frac{5.67}{28.5} + \frac{0 + 0 + 40}{28.5 + (.002)(29.5 \times 10^3)} = .66$$

WELD #4 (STN STL SIDE)

PRIMARY STRESSES

LOAD	STRESS COMPONENTS			
	σ_z	σ_θ	σ_r	$\tau_{z\theta}$
PRESSURE	3.06	9.76	-1.37	0
DEAD WEIGHT	2.28	0	0	0.36
TOTAL	5.34	9.76	-1.37	0.36

PRINCIPLE STRESSES = 5.31, 9.79, -1.37

SECONDARY STRESSES

LOAD	σ_z	σ_θ	σ_r	$\tau_{z\theta}$
THERMAL RFE NOZZLE REACTION	6.5	0	0	2.65
STEADY STATE THERMAL	-8.8	-11.1	-4.8	-0.6
TOTAL	-2.3	-11.1	-4.8	2.05

PRINCIPLE STRESSES = -1.84, -11.55, -4.8

PEAK STRESSES = 0 (STRESS CONCENTRATION FACTOR = 1.0)

RESIDUAL STRESSES = 37.0

$$S.I. = \frac{P_M + P_B}{S_Y} + \frac{Q + F + (RESID)}{S_Y + (.002)E}$$

$$S.I. = \frac{9.79}{19.1} + \frac{0 + 0 + 37}{19.1 + (.002)(25.9 \times 10^3)} = 1.03$$