UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 207 TO FACILITY OPERATING LICENSE NO. DPR-32

AND AMENDMENT NO. 207 TO FACILITY OPERATING LICENSE NO. DPR-37

VIRGINIA ELECTRIC AND POWER COMPANY

SURRY POWER STATION, UNIT NOS. 1 AND 2

DOCKET NOS. 50-280 AND 50-281

1.0 INTRODUCTION

By letter dated June 8, 1995, the Virginia Electric and Power Company (the licensee) submitted changes to the pressure-temperature (P/T) limits in the Surry Units 1 and 2 Technical Specifications (TS). The licensee revised the P/T limits to provide new limits that are valid to the end-of-license (28.8 effective full power years (EFPY) for Unit 1 and 29.4 EFPY for Unit 2). The licensee also proposed a revision to the associated low temperature overpressure protection (LTOP) enabling temperature methodology and the power operated relief valve (PORV) setpoint.

The staff evaluated the P/T limits based on the following NRC regulations and guidance: Appendix G to 10 CFR Part 50; Generic Letters 88-11 and 92-01; Regulatory Guide (RG) 1.99, Rev. 2; and Standard Review Plan (SRP) Section 5.3.2. Appendix G to 10 CFR Part 50 requires that P/T limits for the reactor vessel must be at least as conservative as those obtained by Appendix G to Section III of the ASME Code. GL 88-11 requires that licensees use the methods in RG 1.99, Rev. 2, to predict the effect of neutron irradiation by calculating the adjusted reference temperature (ART) of reactor vessel materials. The ART is defined as the sum of the initial nil-ductility transition reference temperature (RT_{NDT}) of the material, the increase in RT_{NDT} caused by neutron irradiation, and a margin to account for uncertainties in the prediction method. The increase in RT_{NDT} is calculated from the product of a chemistry factor and a fluence factor. The chemistry factor may be calculated using credible surveillance data, obtained by the licensee's surveillance program, as directed by Position 2 of Regulatory Guide (RG) 1.99, Rev. 2. If credible surveillance data is not available, the chemistry factor is calculated dependent upon the amount of copper and nickel in the vessel material as specified in Table 1 of RG 1.99, Rev. 2. GL 92-01 requires licensees to submit reactor vessel materials data, which the staff uses in the review of the P/T limits submittals.

SRP 5.3.2 provides guidance on calculation of the P/T limits using linear elastic fracture mechanics methodology specified in Appendix G to Section III of the ASME Code. The linear elastic fracture mechanics methodology postulates sharp surface defects that are normal to the direction of maximum stress and have a depth of one-fourth of the reactor vessel beltline thickness (1/4T) and a length of 1-1/2 times the beltline thickness. The critical locations in the vessel for this methodology are the 1/4T and 3/4T locations, which correspond to the maximum depth of the postulated inside surface and outside surface defects, respectively.

2.0 EVALUATION

2.1 Pressure Vessel Heatup and Cooldown Curves

For the Surry Units 1 and 2 reactor vessels, the licensee determined that the most limiting materials at the 1/4T and 3/4T locations is the intermediate-to-lower shell circumferential weld (SA-1585) in Unit 1. The licensee calculated an ART of 228.4°F at the 1/4T location and an ART of 189.5°F at the 3/4T location at 28.8 EFPY. The integrated surveillance data used for this material is based on B&WOG Capsule CR3-LG1 and Point Beach 1 surveillance data. The neutron fluence used in the ART calculation was 2.45 x 10^{19} n/cm^2 at the 1/4T location and 0.938 x 10^{19} n/cm^2 at the 3/4T location. The initial RT_{NDT} for the limiting weld was -5°F, the generic value reported in BAW-2166. The margin term used in calculating the ART for the limiting weld was 48°F.

The staff verified for Surry Units 1 and 2 that the copper and nickel content and initial RT_{NDT} agreed with the reactor vessel integrity database (RVID) as reported by the licensee in response to GL 92-01. The staff used the data from the RVID to perform an independent calculation of the ART values for the limiting materials using RG 1.99, Revision 2. The staff also verified that the licensee's surveillance data meet the credibility criteria of the RG. Evaluation of criteria 3 and 5 which address scatter in ΔRT_{NDT} values and correlation monitor materials, respectively will be presented in more detail in the following paragraph. In addition, the staff used the surveillance data, as submitted in previous reports to the NRC, to perform an independent calculation of the ART values for the surveillance materials using Position 2 of RG 1.99, Revision 2.

Comparisons of measured to predicted ΔRT_{NDT} values for all surveillance material are shown in Tables 1 and 2 for Units 1 and 2, respectively. The comparison of the measured to predicted ΔRT_{NDT} values indicate that all measured values are within one standard deviation (17°F for plates and 28°F for welds) of the predicted values which satisfies credibility criterion 3. Figure 1 shows ΔRT_{NDT} values vs. fluence for all correlation monitor materials from heat SHSS02 (heat designation in the Power Reactor Embrittlement Database (PREDB). The material is from the Oak Ridge National Laboratory (ORNL) Heavy Section Steel Technology (HSST) program. The plot indicates that the surveillance data for the Surry Units 1 and 2 correlation monitor materials are within the scatter band of the entire material data base which satisfies credibility criterion 5.

Based on the calculations, the staff verified that the licensee's limiting material for Surry Units 1 and 2 is the intermediate-to-lower shell circumferential weld (SA-1585) in Unit 1. The staff's calculated ART values for the limiting materials agreed with the licensee's calculated ART values.

Substituting the ART values for Surry Units 1 and 2 into equations in SRP 5.3.2, the staff verified that the proposed P/T limits for heatup, cooldown and hydrostatic tests satisfy the requirements in Paragraphs IV.A.2 and IV.A.3 of Appendix G of 10 CFR Part 50.

In addition to beltline materials, Appendix G of 10 CFR Part 50 also imposes a minimum temperature at the closure head flange based on the reference temperature for the flange material. Section IV.A.2 of Appendix G states that when the pressure exceeds 20% of the preservice system hydrostatic test pressure, the temperature of the closure flange regions highly stressed by the bolt preload must exceed the reference temperature of the material in those regions by at least 120°F for normal operation and by 90°F for hydrostatic pressure tests and leak tests. Based on the flange RT_{NDT} of 10°F for Unit 1 and <10 °F for Unit 2 provided by the licensee, the staff has determined that the proposed P/T limits have satisfied the requirement for the closure flange region during normal operation, hydrostatic pressure test and leak test.

2.2 Enabling Temperature

The enabling temperature is presently set at 350 ^{0}F and no change has been proposed. The reason is that 350 ^{0}F is conservative using the ASME Code Case N-514 required calculation of the enabling temperature i.e. RT_{NDT} + 50 ^{0}F + (instrument uncertainty). The new RT_{NDT} value has been estimated at 228.4 ^{0}F and instrument uncertainty at 21 ^{0}F for an enabling temperature of 299.4 ^{0}F. The existing enabling temperature of 350 ^{0}F is conservative and, therefore, is acceptable.

2.3 PORV Lift Setpoint.

A PORV lift setpoint of ≤ 390 psig has been proposed. To validate this value the licensee estimated the pressure overshoot in a mass addition (inadvertent startup of a charging pump) and heat addition transients (inadvertent reactor coolant system (RCS) pump startup with a 50 ^{0}F ΔT between the RCS and the steam generators). The temperatures and corresponding estimated pressures are as follows: (100 ^{0}F, 200 psig), (150 ^{0}F, 250 psig), (200 ^{0}F, 300 psig), (250 ^{0}F,340 psig), (300 ^{0}F, 380 psig), (325 ^{0}F, 400 psig). Therefore, for a 350 ^{0}F enabling temperature the proposed 390 psig is a conservative lift setpoint and it is acceptable.

3.0 SUMMARY

The staff has performed an independent analysis to verify the licensee's proposed P/T limits. The staff concludes that the proposed P/T limits for heatup, cooldown and hydrostatic tests are valid until the end-of-license because 1) the limits conform to the requirements of Appendix G of 10 CFR Part 50 and GL 88-11, 2) the material properties and chemistry used in calculating the P/T limits are consistent with data submitted under GL 92-01, 3) the surveillance data used in calculating the P/T limits are consistent with data in surveillance reports submitted to the staff, and 4) the surveillance data meets the credibility criteria of RG 1.99, Rev. 2. Hence, the proposed P/T limits may be incorporated in the Surry Units 1 and 2 Technical Specifications. In addition, the proposed editorial changes in the Bases section of the Technical Specifications are consistent with the P/T limits change; therefore, they are acceptable. Moreover, based upon our review of the revised enabling temperature methodology, we find the 350°F enabling temperature and the proposed PORV setpoint of 390 psig acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Virginia State official was notified of the proposed issuance of the amendments. The State official had no comment.

5.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.32 an environmental assessment has been published (60 FR 54710) in the Federal Register on October 25, 1995. Accordingly, the Commission has determined that the issuance of this amendment will not result in any environmental impacts other than those evaluated in the Final Environmental Statement.

6.0 CONCLUSION

The Commission has 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, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of these amendments will not be inimical to the common defense and security or to the health and safety of the public.

7.0 REFERENCES

1. Regulatory Guide 1.99, Radiation Embrittlement of Reactor Vessel Materials, Revision 2, May 1988

2. NUREG-0800, Standard Review Plan, Section 5.3.2: Pressure-Temperature Limits

3. Code of Federal Regulations, Title 10, Part 50, Appendix G, Fracture Toughness Requirements

4. Generic Letter 88-11, NRC Position on Radiation Embrittlement of Reactor Vessel Materials and its Impact on Plant Operations, July 12, 1988

5. ASME Boiler and Pressure Vessel Code, Section III, Appendix G for Nuclear Power Plant Components, Division 1, "Protection Against Nonductile Failure"

6. June 8, 1995, Letter from J. P. O'Hanlon to USNRC Document Control Desk, Subject: Request for Exemption - ASME Code Case N-514 Proposed Technical Specifications Change Revised Pressure/Temperature Limits and LTOPS Setpoint

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COMPARISON OF MEASURED TO PREDICTED DELTA RTndt FOR SURRY UNIT 1 SURVEILLANCE MATERIAL

MATERIAL	CAPSULE	Δ RTndt (Measured)	Δ RTndt (Predicted)	Measured-Predicted
Lower Shell Plate C4415-1	T	50	56	-6
	V	110	107	3
Lower Shell Axial Weld L2 SA-1526	TMI 1 - E (WF-25)	124	119	5
	TMI 1 - C (WF-25)	203	213	-10
	B&WOG CR3-LG1 (WF25)	214	191	23
	V	240	262	-22
	T	167	146	21
Intermediate to Lower Shell Circ. Weld SA-1585	B&WOG CR3-LG1	148	132	16
	Point Beach 1 - V (SA-1263)	110	109	1
	Point Beach 1 - S (SA-1263)	165	142	23
	Point Beach 1 - R (SA-1263)	165	186	-21
	Point Beach 1 - T (SA-1263)	175	184	-9

TABLE 1

COMPARISON OF MEASURED TO PREDICTED DELTA RTndt FOR SURRY UNIT 2 SURVEILLANCE MATERIAL

MATERIAL	**CAPSULE**	**Δ RTndt (Measured)**	**Δ RTndt (Predicted)**	**Measured-Predicted**
Lower Shell Plate	X	50	45	5
C4339-1	V	75	78	-3
Intermediate to Lower Shell Circ. Weld	X	95	86	9
R3008	V	145	150	-5

TABLE 2

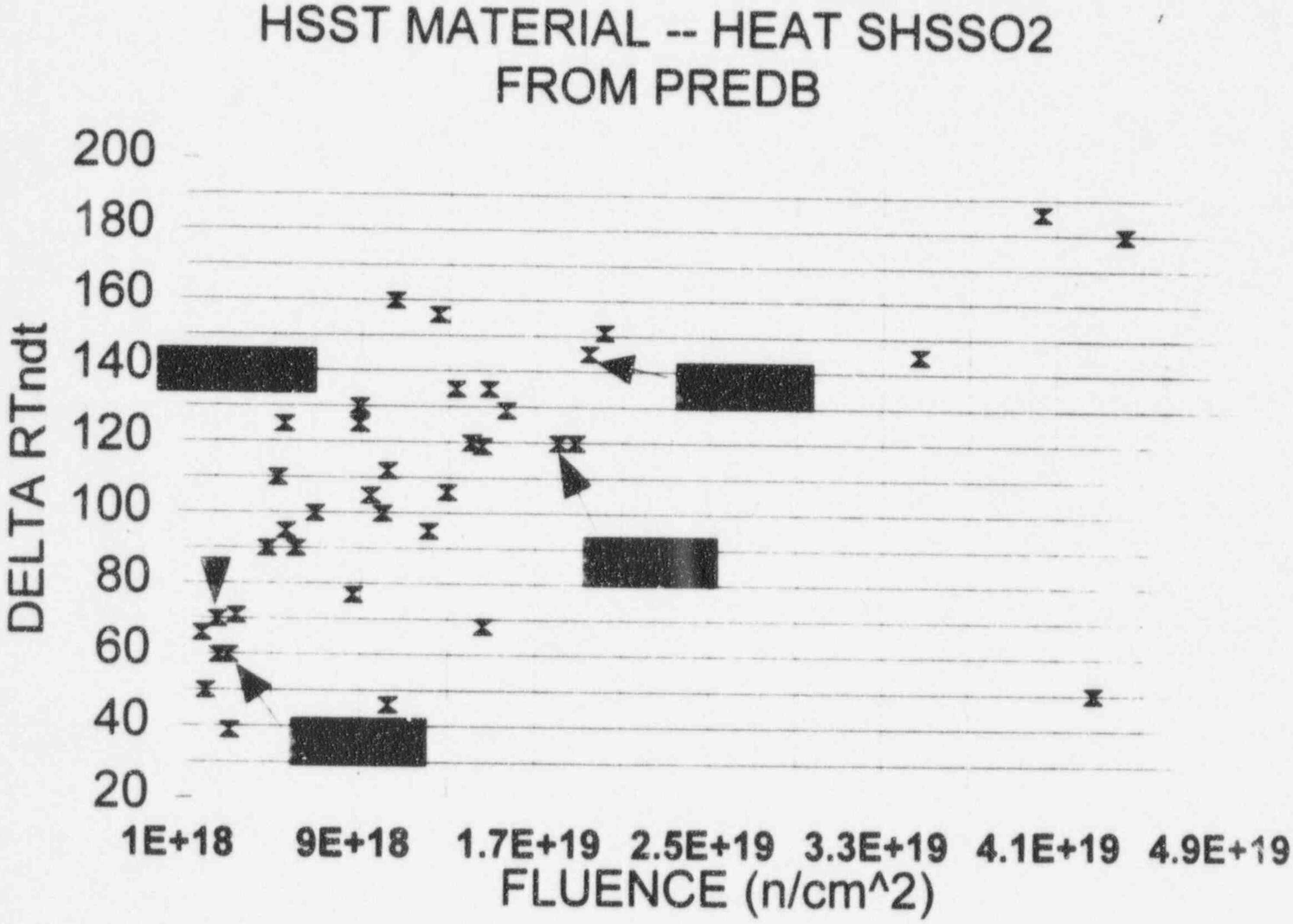
HSST MATERIAL -- HEAT SHSSO2
FROM PREDB
DELTA RTndt
200
180
160
140
120
100
80
60
40
20
1E+18
9E+18
1.7E+19
2.5E+19
3.3E+19
4.1E+19
4.9E+19
FLUENCE (n/cm^2)

FIGURE 1