



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 147 TO FACILITY OPERATING LICENSE NO. DPR-32
AND AMENDMENT NO. 143 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 January 29, 1988, as supplemented February 20, 1989, Virginia Electric and Power Company (VEPCO, the licensee) submitted proposed Technical Specification revisions for the Surry Power Station, Units 1 and 2. The proposed revisions affect the reactor coolant system pressure/temperature (P/T) limits and the low temperature overpressure protection (LTOP) system setpoints. The revisions define operating limits through 15 effective full-power years (EFPY) of plant operation. The current operating limits are for 11 EFPY. This Safety Evaluation documents acceptance of the proposed changes.

2.0 EVALUATION

The proposed Technical Specifications revisions affect the P/T limits shown in Figure 3.1-1. This curve is being split into two curves, Figures 3.1-1 and 3.1-2, representing P/T limits for heatup and cooldown, respectively. In addition, the maximum heatup rate is limited to 40°F per hour. The proposed P/T limits on the reactor coolant system for heatup, cooldown, leak test, and criticality are valid through 15 EFPY, because the limits conform to the requirements of 10 CFR Part 50, Appendices G and H. VEPCO has also satisfied Generic Letter 88-11, because the method in Regulatory Guide (RG) 1.99, Rev. 2 was used to calculate Adjusted Reference Temperature (ART). Hence, the proposed P/T limits will be incorporated into the Surry Power Station Units 1 and 2 Technical Specifications. The LTOP system setpoint is changed based on the revised P/T limits.

2.1 P/T Curve Revision

To evaluate the P/T limits, the staff uses the following NRC regulations and guidance: Appendices G and H to 10 CFR Part 50; the ASTM Standards and the ASME Code, which are referenced in Appendices G and H; 10 CFR 50.36(c)(2); RG 1.99, Rev. 2; Standard Review Plan (SRP) Section 5.3.2; and Generic Letter 88-11. Appendix G requires the licensee to predict the effects of neutron irradiation on vessel embrittlement by calculating the adjusted reference temperature (ART) and Charpy upper shelf energy (USE). Generic Letter 88-11 requested that licensees and permittees use the methods in RG 1.99, Rev. 2 to predict the effect of neutron irradiation on reactor vessel materials. This

guide defines the ART as the sum of unirradiated reference temperature, the increase in reference temperature resulting from neutron irradiation, and a margin to account for uncertainties in the prediction method.

Appendix H to 10 CFR Part 50 requires licensees to establish a surveillance program to periodically withdraw surveillance capsules from the reactor vessel. Appendix H refers to the ASTM Standard which, in turn, requires that the capsules be installed in the vessel before startup and that they contain test specimens that are made from plate, weld, and heat-affected-zone (HAZ) materials of the reactor beltline.

The staff has evaluated the effect of neutron irradiation embrittlement on each beltline material in the Surry Units 1 and 2 reactor vessels. The amount of neutron irradiation embrittlement was calculated in accordance with RG 1.99, Rev. 2. The staff determined that the material with the highest ART at 15 EFPY for both units was the circumferential weld (W05) between the intermediate and lower shells in Unit 1 with a 0.21% copper (Cu), 0.58% nickel (Ni), and an initial RT_{ndt} of $-6^{\circ}F$.

The licensee has removed three surveillance capsules each from Surry Unit 1 and Surry Unit 2. Results from the three surveillance capsules from Unit 1 were published in Battelle-Columbus Laboratory reports for Capsules T and W and in Westinghouse Report WCAP-11415 for Capsule V. Results from the three surveillance capsules from Unit 2 were published in Battelle-Columbus Laboratory Reports for Capsules X and W and in Westinghouse Report WCAP-11499 for Capsule V. All surveillance capsules contained Charpy impact specimens and tensile specimens which were made from base metal, weld metal, and HAZ metal.

For the limiting beltline material, girth weld W05 between the intermediate and lower shells in Unit 1, the staff calculated the ART at 15 EFPY at $1/4T$ (T = reactor vessel beltline thickness) to be $228.9^{\circ}F$ using Section 1 of RG 1.99, Rev. 2.

The licensee used the method in Section 1 of RG 1.99, Rev. 2, to calculate an ART of $234.8^{\circ}F$ for the limiting material, girth weld W05. The licensee's ART of $234.8^{\circ}F$ is more conservative than the staff's ART of $228.9^{\circ}F$; therefore, it is acceptable. By substituting the ART of $234.8^{\circ}F$ into equations in SRP Section 5.3.2, the staff verified that the proposed P/T limits for heatup, cooldown, and hydrotest meet the beltline material requirements in Appendix G to 10 CFR Part 50.

In addition to beltline materials, Appendix G to 10 CFR Part 50 also imposes P/T limits based on the reference temperature for the reactor vessel closure flange materials. Section IV.2 of Appendix G states that when the pressure exceeds 20 percent of the preservice system hydrostatic test pressure, the temperature of the closure flange regions that are highly stressed by the bolt preload must exceed the reference temperature of the material in those regions by at least $120^{\circ}F$ for normal operation and by $90^{\circ}F$ for hydrostatic pressure tests and leak tests. Based on the flange reference temperature of $10^{\circ}F$, the staff has determined that the proposed P/T limits satisfy Section IV.2 of Appendix G.

2.2 PORV Setpoint Revision

At Surry, LTOP is provided by Technical Specification controls on charging pump operability, and by reactor coolant system (RCS) vent paths through operable power operated relief valves (PORVs). These controls ensure anticipated mass or energy addition transients cannot result in excessive RCS pressurization in low temperature conditions. The proposed revision reduces the PORV setpoint from 435 to 385 psig.

The most limiting mass addition transient was analyzed assuming an inadvertent actuation of a charging pump. The present Technical Specification 3.1.G.1.b allows only one charging pump to be operable when the RCS temperature is less than or equal to 350°F, which is the maximum RCS temperature for which LTOP is required. The analysis was performed to determine the pressure overshoot past the LTOP setpoint such that the Appendix G curves are not exceeded during the transient. Separate analyses were performed for each unit since the P/T limits are different for each unit. However, for ease of operation, the more restrictive (lower) limit was selected for the proposed Technical Specification.

The heat input transient was analyzed assuming a 50°F temperature difference between the steam generator and the RCS. A reactor coolant pump startup in one loop was assumed to maximize the heat transfer effect. As was the case for the mass addition transient, the pressure overshoot was calculated such that the Appendix G P/T curves for each unit were not exceeded.

The final setpoint of 385 psig was selected as the value which bounds both limiting transients. Considering the above factors, the staff concludes that the assumptions applied to the licensee's analyses are reasonably conservative and acceptable.

The licensee's analysis was performed using RETRAN 02/MOD02 to support the proposed Technical Specification changes. Both RETRAN 01/MOD03 and RETRAN 02/MOD02 have been generically approved by the NRC staff. Also, a VEPCO topical report on its plant-specific application of RETRAN 01/MOD03 has been reviewed and approved by the NRC staff. In addition, VEPCO submitted comparisons between RETRAN 01/MOD03 and RETRAN 02/MOD02 for a series of plant transients. This information demonstrated that the RETRAN 01/MOD03 and RETRAN 02/MOD02 code results are nearly identical for the VEPCO plant-specific models, except for the changes caused by the nonequilibrium pressurizer model in RETRAN 02/MOD02. However, the LTOP transient analysis deals with the RCS in water solid conditions, thus, it is not affected by the nonequilibrium pressurizer model. While VEPCO's application on the use of RETRAN 02/MOD02 has not been reviewed by the staff, the staff considers that reasonable assurance exists that the results of the licensee's analysis using RETRAN 02/MOD02 supports the proposed Technical Specification changes on LTOP.

In the modified Appendix G heatup limit curve, the cold leg temperature corresponding to the pressurizer safety valve setpoint of 2485 psig is 420°F. This point is used to bound all of the low temperature transient analyses. Below 420°F, the anticipated low temperature overpressurization transients

may be adequately mitigated by the automatic action of the pressurizer PORVs or by allowing sufficient time for operator response. Based on the results of the most limiting LTOP transient, the licensee-proposed Technical Specification PORV setpoint is less than or equal to 385 psig when the RCS average temperature is less than or equal to 350°F.

The licensee-proposed PORV setpoint change in Technical Specification 3.1.G.1.b and the associated Bases section reflect the above-discussed LTOP alignment temperatures and the heatup and cooldown rates identified by the updated Figures 3.1-1 and 3.1-2 in Technical Specification 3.1.B. The staff finds that they are reasonably conservative and acceptable.

3.0 SUMMARY

VEPCO has submitted proposed Technical Specification changes for the reactor coolant system pressure/temperature operating limits. The proposed limits have been developed consistent with the requirements of 10 CFR Part 50 Appendices G and H, and incorporate the methodology described in RG 1.99, Rev. 2, as requested in Generic Letter 88-11. VEPCO also proposes to change the PORV setpoint for low temperature overpressure protection. This setpoint provides adequate protection for anticipated pressurization transients for low temperature operations. The proposed changes to P/T limits and PORV setpoints provide acceptable operating conditions up to 15 effective full power years. Therefore, we find the proposed changes to be acceptable.

4.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.21, 51.32, and 51.35, an environmental assessment and finding of no significant impact have been prepared and published in the Federal Register on October 24, 1990 (55 FR 42919). Accordingly, based upon the environmental assessment, the Commission has determined that the issuance of these amendments will not have a significant effect on the quality of human environment.

5.0 CONCLUSION

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

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