



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RESPONSE TO BULLETIN 88-11 PRESSURIZER SURGE LINE THERMAL STRATIFICATION

TENNESSEE VALLEY AUTHORITY

DOCKET NOS. 50-390/50-391

WATTS BAR NUCLEAR PLANT, UNITS 1 AND 2

INTRODUCTION

By letter dated March 30, 1992, the Tennessee Valley Authority (TVA) responded to NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification" for Watts Bar Nuclear Plant (WBN), Units 1 and 2. The response consisted of a Westinghouse topical report, WCAP-12777, "Structural Evaluation of Sequoyah Nuclear Plant and Watts Bar Units 1 and 2 Pressurizer Surge Lines, Considering the Effects of Thermal Stratification", dated December 1990.

EVALUATION

NRC Bulletin 88-11 requested all applicants for pressurized water reactor (PWR) operating licenses to take the following actions:

- 2.a Demonstrate that the pressurizer surge line (PSL) meets the applicable design codes and other FSAR and regulatory commitments for the licensed life of the plant before the issuance of the low power license. If analysis or test results show Code noncompliance, conduct of all actions specified below is requested.
- 2.b Evaluate operational alternatives or piping modifications needed to reduce fatigue and stresses to acceptable levels.
- 2.c Monitor the PSL for the effects of thermal stratification, beginning with hot functional testing; or obtain data through collective efforts to assess the extent of thermal stratification, thermal striping, and line deflections, and
- 2.d Update stress and fatigue analyses, as necessary, to ensure Code compliance.

Action 2.a was addressed by TVA in its March 30, 1992, letter. Westinghouse Electric Corporation (W) performed a study for the Westinghouse Owners Group (WOG), evaluating the adequacy of the PSL in operating plants considering the effect of thermal stratification and thermal striping during their 40-year service life. The results were reported in the W report WCAP-12639, "Pressurizer Surge Line Thermal Stratification Generic Detailed Analysis," dated June 1990. By letter dated August 6, 1991, the staff issued its safety evaluation regarding WCAP-12639 to the WOG, concluding that the methodology used to analyze and evaluate the stress and fatigue effects due to thermal stratification and thermal striping was acceptable. WCAP-12639 provided the

technical basis for the plant-specific transient development evaluated here for WBN.

The effect of stratification was taken into consideration by redefining the 200 design heatup-cooldown cycles with new heatup and cooldown transients developed from the actual monitoring data from several PWR plants. Using the ANSYS and WECAN computer codes, global and local stresses of PSL thermal stratification were calculated for WBN Units 1 and 2. Since TVA eliminated vertical PSL supports at WBN to minimize thermal load, TVA also decided to modify the gap size of a few whip constraints to allow sufficient thermal movement according to the stress analyses results. The results showed that the modified PSL piping and support arrangements will be in compliance with the applicable Code requirements for the design life of the plant. The maximum stresses due to thermal expansion (with stratification), pressure and weight meet the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, NB-3600 Equation 12 limits.

To ensure compliance with the applicable Code and license commitments, W also provided the fatigue analysis of the WBN Units 1 and 2 PSL. The fatigue usage factors were evaluated based on the requirements of Subsections NB-3600 and NB-3200 of ASME Section III. Five worst-case locations in the PSL were selected for the calculation. W used its own FATRK/CMS computer code for this part of the analysis; the maximum accumulated usage factor was found to be 0.25 at the hot leg nozzle to pipe weld and 0.36 at the pressurizer surge nozzle.

CONCLUSION

The staff has reviewed TVA's submittal and finds that the methodology used to analyze the effects of thermal stratification and striping in the WBN PSL are consistent with that of the W Generic Detailed Analysis (WCAP-12639). Accordingly, the staff concludes that TVA has satisfied the requested actions of Bulletin 88-11.

Principal Contributor: H. Shaw

Dated: October 30, 1992