WOLF CREEK
NUCLEAR OPERATING CORPORATION

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U. S. Nuclear Regulatory Commission
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Reference: Letter WM 89-0158 dated May 31, 1989, from B. D. Withers, WCNOC to NRC
Subject: Docket No. 50-482: Summary of Results of Stress and Fatigue Analysis Associated with NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification"

Gentlemen:

The purpose of this letter is to transmit a summary of Wolf Creek Nuclear Operating Corporation's (WCNOC) results from updating the pressurizer surge line stress and fatigue analysis as requested by NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification". The Attachment provides a description of the analytical approaches used to update the stress and fatigue analysis to ensure compliance with applicable Code requirements and a summary of the results. The Attachment is being submitted in accordance with the commitments made in the Reference and NRC Bulletin 88-11.

WCNOC participated in a program for resolution of this issue through the Westinghouse Owners Group (WOG). The WOG program provided a methodology for a generic detailed analysis based on ASME stress and fatigue evaluations of groups of plants. Subsequently, WCNOC utilized plant specific data to verify the applicability of the generic detailed analysis for Wolf Creek Generating Station.

If you have any questions concerning this matter, please contact me or Mr. H. K. Chernoff of my staff.

Very truly yours,

John A. Bailey

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JAB/jra

Attachment

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RESULTS OF STRESS AND FATIGUE ANALYSIS REGARDING PRESSURIZER SURGE LINE THERMAL STRATIFICATION

Background

On December 20, 1988, the NRC issued NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification" which requested utilities to establish and implement a program to confirm pressurizer surge line integrity. The bulletin required utilities to perform the actions summarized below and inform the staff of the actions taken to resolve this issue.

Action 1.a. - Perform a visual inspection (ASME, Section XI, VT-3).

Action 1.b. - Perform a plant specific or generic bounding analysis to demonstrate that the surge line meets applicable design codes and other FSAR and regulatory commitments for the design life of the plant. If the analysis does not demonstrate compliance with these requirements, submit a justification for continued operation (JCO) or bring the plant to cold shutdown, as appropriate and implement actions 1.c. and 1.d. to develop a detailed analysis.

Action 1.c. - Obtain data on thermal stratification, thermal striping, and line deflections either by plant specific monitoring or through collective efforts among plants with a similar surge line design.

Action 1.d. - Update detailed stress and fatigue analyses of the surge line to ensure compliance with applicable code requirements incorporating any observations from 1.a. The analysis should be based on the applicable plant specific or referenced data.

Westinghouse Owners Group Program

Bounding Evaluation and JCO

In October 1988, the Westinghouse Owners Group (WOG) implemented a program to address the issue of surge line stratification. As part of the WOG program, surge line physical design and plant operational data were collected for all domestic Westinghouse PWRs. A bounding evaluation was performed which compared WOG plants to those for which detailed plant specific analysis had been performed. Since this evaluation provided less than full design life verification, a generic justification for continued operation (JCO) was developed for use by each of the WOG plants. The technical basis of the generic JCO was submitted to the NRC in WCAP-12277, "Westinghouse Owners Group Bounding Evaluation for Pressurizer Surge Line Thermal Stratification". Wolf Creek Nuclear Operating Corporation (WCNOC) submitted a plant specific JCO in letter WM 89-0158 dated May 31, 1989 which concluded that it was acceptable for WCGS to continue power operation for at least ten additional heatup-cooldown cycles.

Generic Detailed Analysis

Since the evaluation discussed above provided less than full design life verification, Action 1.b. of the bulletin required that Actions 1.c. and 1.d. be implemented to develop a detailed analysis of the surge line. In June 1989, the WOG implemented a program for generic detailed analysis. This program was based on individual detailed analyses of groups of plants. The WOG provided recommendations to utilities regarding the need for additional monitoring data. Monitoring data was received by the WOG and used to redefine the existing design transients to account for the stratification phenomenon. Based on the predicted similarity of response to stratification, analysis groups were formed for which system structural models were created for computer analyses.

Surge line fatigue evaluations are typically performed using the methods of ASME Section III, NB-3600 for all piping components. Based on the requirements in the bulletin, ASME Section III, 1986 Edition was used to evaluate fatigue on surge lines with stratification loading. The results of the generic detailed analysis demonstrated acceptable ASME Section III equation 12 stress and fatigue usage in the surge line and reactor coolant loop nozzle for 15 plants including WCGS.

The results of the generic detailed analysis are documented in WCAP-12639, "Westinghouse Owners Group Pressurizer Surge Line Thermal Stratification Generic Detailed Analysis Program Summary Report". This WCAP was transmitted to the NRC on August 3, 1990 and in a subsequent meeting in November 1990, the NRC indicated acceptance of the technical content of the WCAP and the WOG program.

WCNOC Specific Analysis

WCNOC performed additional plant specific analysis of the surge line piping and Reactor Coolant System (RCS) loop nozzle to further verify the applicability of the generic detailed analysis. The verification analysis was performed using the methodology described in WCAP-12639 and utilized WCGS surge line monitoring data gathered during two plant heatups and one cooldown. In addition to the monitoring data, plant operating procedures and previous heatup and cooldown data were utilized to support this analysis. The results of this analysis identified that the maximum equation 12 stress is 51.5 ksi for past operation with system $\Delta T = 345^{\circ}F$ and 47.9 ksi for future operation with system $\Delta T \leq 320^{\circ}F$. The Code allowable stress is 57.9 ksi. System ΔT is the difference between pressurizer temperature and RCS hot leg temperature. Additionally, the analysis resulted in a calculated cumulative usage factor of 0.4. The Code allowable usage factor is 1.0. This analysis also evaluated pipe supports for the stratification loads and displacement and the results were acceptable in accordance with ASME Section III Subsection NF. Pipewhip restraint gaps and pipe displacement were evaluated and were found to be acceptable.

The pressurizer nozzle was not within the scope of evaluation required by this bulletin. The pressurizer nozzles at WCGS are oriented vertically, and therefore do not experience local stratification effects. In the performance of the required evaluation, it was identified that thermal stratification in the piping typically causes higher global bending moments at the pressurizer nozzle than considered in the original design. The WOG generic detailed analysis did not address the affects of stratification on the stress and fatigue of the pressurizer nozzle. A stress and fatigue analysis for the pressurizer nozzle at WCGS is in progress. Preliminary review of the loads indicates that the nozzle is qualified since the loads are estimated to be in the acceptable range. The results of the complete analysis on the pressurizer nozzle will be completed by March 29, 1991.

Based on the WOG generic detailed analysis and the WCGS plant specific analysis, WCNOC has demonstrated that the pressurizer surge line meets the applicable design codes and other USAR and regulatory commitments for the licensed life of the plant.