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Alabama Power
the southern electric system

January 31, 1991

Docket No. 50-364

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Gentlemen:

Joseph M. Farley Nuclear Plant - Unit 2
NRC Bulletin No. 88-11
Pressurizer Surge Line Thermal Stratification

By letter dated March 3, 1989, Alabama Power Company requested an alternate schedule to that requested in Bulletin 88-11. A schedule of two years from receipt of the Bulletin was requested to obtain the necessary additional monitoring data, define thermal transients, perform all required analyses and update the stress and fatigue analyses to ensure compliance with applicable code and regulatory requirements. The requested schedule, though different from that stated in action 1.b of Bulletin 88-11, was consistent with the requirement to update the stress and fatigue analyses within two years as stated in action 1.d of the Bulletin.

Westinghouse has performed a stress and fatigue analysis for Alabama Power Company of the Unit 2 pressurizer surge line including the effects of thermal stratification and striping. The results of the analysis are contained in the enclosed WCAP from Westinghouse. The existing surge line configurations for both units have been analyzed by this WCAP. The analysis indicates contact between the pipe and the pipe whip restraints on Unit 2. With this contact, the analysis has determined that Unit 2 pipe stress is not within code allowable. However, the code fatigue cumulative usage factor is within the code allowable.

It is Alabama Power Company's intent to develop a leak-before-break (LBB) analysis for the Unit 2 surge line to allow the removal of the pipe whip restraints and thus eliminate the contact with the piping. The results of that analysis will be submitted to the NRC for approval in accordance with GDC 4 within the next three months. After NRC review and approval of the LBB analysis, Alabama Power Company will remove the postulated pipe rupture of the surge line from the design basis. Alabama Power Company currently plans on removing the pipe whip restraints within two refueling outages following LBB approval. Until the modifications to the restraints are performed, Alabama Power Company will make procedural changes to limit the delta T in the surge line to less than 310°F which will keep the pipe stress within code allowable.

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The results of this plant specific analysis on Unit 2 demonstrates acceptance to the requirements of the ASME Code Section III, including both stress limits and fatigue usage, for the full licensed life of the unit once the whip restraint gaps are opened or restraints removed. The attached justification for continued operation covers the operation of Unit 2 until the whip restraints are modified. The enclosed report, the attached JCO, and this letter complete the response to NRC Bulletin 88-11 for Farley Unit 2.

Enclosures contain:

1. WCAP-12855 - Structural Evaluation of the Farley Units 1 and 2 Pressurizer Surge Lines, Considering the Effects of Thermal Stratification (Proprietary).

2. WCAP-12856 - Structural Evaluation of the Farley Units 1 and 2 Pressurizer Surge Lines, Considering the Effects of Thermal Stratification (Non-Proprietary).

Also enclosed are a Westinghouse authorization letter, CAW-91-122, accompanying affidavit, Proprietary Information Notice, and Copyright Notice.

As WCAP 12855 contains information proprietary to Westinghouse Electric Corporation, it is supported by an affidavit signed by Westinghouse, the owner of the information. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.790 of the Commission's regulations.

Accordingly, it is respectfully requested that the information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.790 of the Commission's regulations.

Correspondence with respect to the copyright or proprietary aspects of the items listed above or the supporting Westinghouse Affidavit should reference CAW-91-122 and should be addressed to R. P. DiPiazza, Manager, Operating Plant Licensing Support, Westinghouse Electric Corporation, P. O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

The information provided herein is true to the best of my knowledge and belief. If you have any questions, please advise.

Respectfully submitted,

ALABAMA POWER COMPANY

for W. G. Hairston, III

WGH,III/JGS:maf2217

Enclosures
Attachment

cc: Mr. S. D. Ebneter
Mr. S. T. Hoffman
Mr. G. F. Maxwell

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 31st DAY OF January, 1991.

Notary Public

MY COMMISSION EXPIRES SEPT 14 1994

JCO for Unit 2 Pressurizer Surge Line and Nozzles

Background

The subject of pressurizer surge line integrity has been under intense investigation since 1988. The NRC issued Bulletin 88-11 in December of 1988, but the Westinghouse Owners Group had put a program in place earlier that year and this allowed all owners group members to make a timely response to the bulletin. The Owners Group programs were completed in June of 1990, and have been followed by a series of plant specific evaluations. Westinghouse has performed a specific analysis of both Farley units and have issued the results in WCAP-12855.

Discussion

Following the general approach used in developing the surge line stratification transients for the WOG, a set of transients and stratification profile were developed specifically for Farley. A study was made of the historical operating experience at Farley and this information, as well as plant operating procedures and monitoring results, was used in development of the transients and profiles. The piping system was modeled by pipe, elbow, and linear and non-linear spring elements using the ANSYS computer code. The actual geometric and material parameters were included.

For the Farley surge line design, under the thermal stratification loadings, many unintended thermal constraint conditions were predicted to occur at the pipe whip restraint locations. This is mainly due to the fact that the pipe whip restraints were originally designed with the consideration of normal thermal expansion loading only, and consequently, less than adequate gap clearance for the higher displacements resulting from stratification exist in the pipe whip restraints. Therefore, the actual gapped conditions for wh restraints and actual spring can travel allowances were modeled using the existing support configuration. In order to meet the ASME Section III Code Stress limits, the surge lines were modeled and temperature profiles were loaded along the pipe. These temperature distributions were established from transients developed from the extensive work done for the WOG coupled with plant specific considerations for Farley Units 1 and 2. The maximum system delta T was taken as 320°F. This corresponds to a top to bottom (nonlinear step change) pipe temperature difference of 304°F.

Evaluation Results

The results of the global structural analysis provided thermal expansion moments and growth. The ASME Section III equation 12 stress intensity range was evaluated for both the existing configuration and the future support configuration where it was assumed the pipe was totally free from any thermal constraint caused by contact with the whip restraints and/or spring can bottomed out. For the existing and future support configuration, a system delta T = 320°F was evaluated. The maximum ASME equation 12 stress intensity range in the surge line was found to be under

the code allowable of 3Sm (51.4 ksi) for the future configuration only. The result for the existing configuration was greater than code allowable . The equation was then run with several system delta T values to determine what value would yield stress intensity within the code allowable. If the system delta T is maintained at 310°F or less, the stress from equation 12 is 50.96 ksi which is within code allowable. The system delta T in all these cases is the differential temperature between the RCS hot leg temperature and the pressurizer fluid temperature.

NRC Bulletin 88-11 required fatigue analysis to be performed in accordance with the latest ASME Section III requirements incorporating high cycle fatigue and thermal stratification transients. ASME fatigue usage factors have been calculated considering the phenomenon of thermal stratification and thermal striping at various locations in the surge line. Total stresses included the combined effects of pressure, OBE, thermal stratification and local striping stresses in the pipe wall. The total stresses for all transients in the bounding set were used to form combinations to calculate alternating stresses and resulting fatigue damage in the manner defined by the Code. Of the total stress, the stresses in the pipe due to pressure, local stratification, and striping effects in the pipe wall for the bounding transient set were similar to that of other plants. The maximum usage factor on the Farley surge lines occurred at the hot leg nozzle to pipe weld and yielded a factor of 0.7 which is within the code allowable of 1.0.

Conclusion

It is concluded that the Unit 2 pipe whip restraints will need the gaps opened in the future to allow unrestrained thermal movement to bring the stress intensity within code allowable. Until modifications can be made to the pipe whip restraints, a procedural change will be implemented to assure the system delta T does not exceed 310°F. With this procedural change, Unit 2 may continue to operate and not exceed Code allowable.