Florida
Power
CORPORATION
Crystal River Unit 3
Docket No. 50-302

January 31, 1991
3F0191-07

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

Subject: Response to NRC Bulletin 88-11: Pressurizer Surge Line Thermal Stratification

Reference: B&WOG letter (OG-813) to the NRC, dated December 31, 1990

Dear Sir:

This letter submits Florida Power Corporation's (FPC) final response to NRC Bulletin 88-11 in accordance with Bulletin Reporting Action 3. FPC is providing background for the response, a summary description of the report that describes the program used to assure the surge line remains operational, a summary of the results, and conclusions. The Crystal River Unit 3 (CR-3) pressurizer surge line is operational, all Bulletin actions are complete, and the results are available for inspection.

BACKGROUND

NRC Bulletin 88-11 requested FPC to establish and implement a program to ensure the structural integrity of the surge line by visual inspections and, with an update of the Crystal River Unit 3 (CR-3) pressurizer surge line stress and fatigue analysis, to ensure compliance with ASME Code requirements. The B&W Owners Group (BWOG) developed a comprehensive program to address the Bulletin requirements. Each member utility of the BWOG was represented and closely participated in all phases of the program. The BWOG developed a report, BAW-2127, dated December 1990 which provides a detailed description of the BWOG response to the technical issues addressed by the Bulletin. The BWOG provided copies of BAW-2127 to the NRC in the reference letter. A copy of BAW-2127 is also provided as an attachment to this letter.

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SUMMARY OF BAW-2127 CONTENTS

A detailed description of the BWOG response to the technical issues addressed by the Bulletin is provided in BAW-2127. A brief description of each section follows:

- Section 1 provides the background for the thermal stratification, striping and cycling issues, and a summary of the surge line fatigue analysis results and conclusions,
- Section 2 describes the technical approach which has been developed by the BWOG,
- Section 3 discusses the justification for the generic approach taken by the licensees of B&W lowered loop plants,
- Section 4 describes the development of the revised thermal-hydraulic design basis conditions for the surge line,
- Sections 5 and 6 describe the stress and fatigue analyses performed for the surge line piping and its nozzles,
- Section 7 provides conclusions resulting from the BWOG program with regard to the revised design basis transients which represent surge line thermal conditions and the structural integrity of the surge line,
- Section 8 states the conditions which form the basis for the analysis,
- Section 9 provides a listing of all the references, and
- The Appendices provide a detailed discussion of the striping and stratification tests which were used as aids in developing the design basis transients.

RESULTS

Based upon the data obtained from a review of the operating history of B&W lowered loop plants and the experimental data obtained during the thermal monitoring of the Oconee Unit 1 surge line, the BWOG concluded that the original design basis thermal transients did not adequately represent surge line thermal conditions. The plant heatup and cooldown transients were the most significant contributor to the fatigue usage factor for surge line components. This conclusion led to the BWOG program which correlated the Oconee Unit 1 stratification data and other operating information into a set of design basis transients accurately representing surge line conditions for the operating plants.

Structural loading analyses were performed to generate internal forces and moments in the surge line for the thermal conditions defined in the revised design basis transients. The resulting internal forces and moments were applied in the fatigue stress analysis for the surge line and the associated nozzles. The fatigue stress analyses took into consideration the stress ranges for the global effects due to thermal stratification, the localized effects due to thermal stratification, the pressure ranges, the operating basis earthquake, the thermal striping, and the fluid flow conditions. All resulting stress intensities were shown to be within the allowable limits of the ASME Code, Section III, 1986 Edition with no Addenda. Table 1 summarizes the total fatigue usage factors for the components in the CR-3 surge line for a 40 year plant life (including past and future fatigue).

The development of the revised design basis thermal-hydraulic transients and the stress and fatigue analyses for the surge line are based upon specific assumptions regarding plant configuration and operating practices. These assumptions are:

1. There are no interferences of the surge line with other structures,

2. Surge line movement is within the travel range of each snubber,

3. Branch moments at the surge line drain nozzle connection are within the respective maximum allowables (for deadweight, operating basis earthquake, and thermal stratification), and

4. Operation within the revised design basis thermal transients will be assured in the future by operating procedures which will:

   - limit the pressurizer-to-reactor coolant system (RCS) temperature difference during plant heatups and cooldowns and

   - prevent surveillance tests from being performed that cause rapid additions of water to the RCS with a pressurizer-to-RCS temperature greater than 220°F.

FPC has confirmed that the assumptions made by B&W in developing these bases are bounded at CR-3. CR-3 operating procedures are being revised to include the surge line operational limit curve shown in Figure 8-1 of BAW-2127. FPC will use the revised procedures starting with the first heatup or cooldown that is required for CR-3 after January 31, 1991. The licensed operators have been briefed on the revised operational limitations.

CONCLUSIONS

As a result of the ASME Code, Section III fatigue analyses, the total fatigue usage factor is less than 1.0 at all locations of the CR-3 surge line and its nozzles. The revised design basis thermal transients and the analyses of resultant stresses provide assurance that the 40 year licensed life of CR-3 will be met considering past and future transients. The revised operating transients will accommodate normal variations in operations and ensure margin in the total fatigue usage factor.

Sincerely,

P. M. Beard, Jr.
Senior Vice President
Nuclear Operations

PMB:JWT
Attachment

xc: Regional Administrator, Region II
Senior Resident Inspector
NRR Project Manager

TABLE 1

CR-3 PRESSURIZER SURGE LINE SPECIFIC TOTAL FATIGUE USAGE FACTORS

Location	Usage Factor[c]
Most Critical Straight Pipe	0.37
Most Critical Elbow[a]	0.64
Second Most Critical Elbow[b]	0.60
Drain Nozzle Branch	0.25
Pressurizer Surge Nozzle Safe End-to-Elbow Weld	0.32
Pressurizer Surge Nozzle-to-Head Corner	0.32
Hot Leg Surge Nozzle-to-Surge Line Weld	0.19
Hot Leg Surge Nozzle-to-Hot Leg Corner	0.42
Hot Leg Surge Nozzle End of Nozzle Taper	0.62

(a) Vertical elbow located at the bottom of the surge line riser.

(b) Vertical elbow located just below the pressurizer.

(c) Total fatigue usage factor for a 40 year plant life including past and future fatigue.

STATE OF FLORIDA

COUNTY OF CITRUS

P. M. Beard, Jr. states that he is the Senior Vice President, Nuclear Operations for Florida Power Corporation; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission the information attached hereto; and that all such statements made and matters set forth therein are true and correct to the best of his knowledge, information, and belief.

P. M. Beard, Jr.
Senior Vice President
Nuclear Operations

Subscribed and sworn to before me, a Notary Public in and for the State and County above named, this 31st day of January 1991.

Notary Public

Notary Public, State of Florida at Large,
My Commission Expires: Notary Public, State of Florida My Commission Expires Oct. 17, 1994 Bonded Thru Troy Fain - Insurance Inc.