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AUTH.NAME AUTHOR AFFILIATION
HAMPTON,J.W. Duke Power Co.
RECIP.NAME RECIPIENT AFFILIATION
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SUBJECT: Responds to NRC 911101 ltr indicating that util earlier responses to NRC Bulletin 88-008 re thermal stresses in piping connected to RCS insufficient.Installation of temp monitoring instrumentation at each unit not beneficial.

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Duke Power Company
Oconee Nuclear Generation Department
P.O. Box 1439
Seneca, SC 29679

J.W. Hampton
Vice President
(803)885-3499 Office
(704)373-5222 Fax

DUKE POWER

April 1, 1992

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
NRC Bulletin 88-08, Thermal Stresses in Piping Connected to the Reactor Coolant System

By your letter dated November 1, 1991, you indicated that Duke's earlier response to NRC Bulletin 88-08 was not sufficient, and suggested four acceptable responses which could be used to provide continuing assurance for the life of the plant that unisolable sections of piping connected to the RCS will not be subjected to thermal stratification and thermal cycling that could cause fatigue failure of the piping.

We have reviewed and evaluated each of the acceptable responses for the Oconee Station and have concluded that temperature monitoring would be the only acceptable method you suggest, but believe that this method is not needed.

Acceptable Response No. 1 suggests that the system operating conditions be revised to reduce the pressure of the water upstream of the isolation valve to below that of the RCS pressure during power operation. For Oconee, the only unisolable piping potentially susceptible to unacceptable thermal stresses resulting from the type of event described in NRC Bulletin 88-08 was identified as portions of the Emergency Injection Lines of the High Pressure Injection System. The normally operating makeup pump pressurizes the upstream side of the isolation valves. In realistic terms, the pressure in the piping downstream of the isolation valves will be at a pressure somewhere between that of the RCS operating pressure and the makeup pump discharge pressure. There is no physical method of preventing this from occurring, short of having leak-proof valves. A pressure relieving device in this piping would diminish the system's ability to perform it's safety function. Therefore, Acceptable Response No.1 is not a viable option for Oconee.

Acceptable Response No. 2 suggests that the check valves closest to the RCS be relocated to a distance greater then 25 pipe diameters from the RCS nozzle. Although this may be physically possible, the greater distance to the check valves increases the amount of piping and fittings which would be unisolable from the RCS, and may

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diminish the plant safety margin. In addition, relocating the check valves further from the RCS would not be expected to affect the transients observed at Oconee. Therefore, Acceptable Response No. 2 is not a viable option for Oconee.

Acceptable Response No. 3 will be discussed in detail later.

Acceptable Response No. 4 suggests that pressure monitoring equipment be installed to detect leakage in injection lines, but also suggests that this is not the preferred method since pressure measurements cannot provide a measure of thermal cycling in the unisolable pipe sections. As stated in our discussion on Acceptable Response No. 1, the pressure in this section of piping will be at a value somewhere between that of the RCS operating pressure and that of the makeup pump discharge pressure. Pressure monitoring equipment would confirm this information, and be of marginal benefit. Therefore, Acceptable Response No. 4 is judged to not be viable for Oconee.

Returning to Acceptable Response No. 3, which suggests installation of temperature monitoring instrumentation for detection of piping thermal cycling due to valve leakage:

Duke's initial response to NRC Bulletin 88-08 included installation of temperature monitoring instrumentation on Oconee 1, and monitoring of plant conditions for several situations, including Startup, Power Operation, and Cooldown. The collected data did indicate stratified conditions, although leakage into the RCS similar to the Farley transient is not the dominating condition and is not readily apparent.

The most common transient appears to be a gentle, fluctuating interchange of fluid between the two RCS loops connected by the Emergency Injection piping, permitted by reverse flow thru one of the check valves with normal flow thru the other check valve. Instrumentation shows that this condition occurs for a portion of the time during power operation and it does not exist for the rest of the time of power operation. This condition does produce stratified flow for a short distance from the RCS but decays to average temperature quickly. The maximum top-to-bottom temperature of 120° F was observed at only one location on the piping. The most representative value of temperature rate of change was 10 F/min. However, during the unexpected reactor trip on 3-1-89, a higher rate of temperature change of 110 F/min was observed, accompanied by a flow that flushed out all stratified fluid. The most common transient occurred with a cycle time of from 20 to 53 minutes.

In order to assure that all possible conditions were bounded, we formulated a transient for analysis purposes using a maximum rate of temperature change of 156° F, from our earlier evaluation of the

Farley data, rather than the maximum 110° F we observed one time or the 10° F which would be more representative of our observed data. Additionally, a 150° F linear top-to-bottom maximum temperature difference was used rather than the 120° F value observed at only one location. The distance used was 20 feet from the nozzle weld to the RCS, rather than 10 feet where the data shows stratification to have dissipated, and a period of 10 minutes was used rather than the 20 to 53 minutes we observed, and assumed that this condition occurred continuously for the 40 year life of the plant, including refueling outages. Note that the assumed transient is much more severe than any observed in the monitoring program.

Our fatigue analysis indicated that the piping system can operate in this manner for the life of the plant, without modifications. Based on the data actually recorded, this analysis transient appears to be much more severe than any which could occur at any of the three Oconee Units, since the three units are identical in layout and operating characteristics. A higher valve leakage rate would tend to diminish the observed transient, not make it more severe.

Based on this discussion, it appears that Acceptable Response No. 3, Installation of Temperature Monitoring Instrumentation on each unit at Oconee would not be beneficial in increasing the margins of safety on the plant.

Duke would welcome the opportunity to discuss this response with the NRC.

Very truly yours,

J. W. Hampton

Mr. L. A. Wiens
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Mr. Paul E. Harmon
NRC Resident Inspector
Oconee Nuclear Station

Regional Administrator, Region II
U. S. Nuclear Regulatory Commission
101 Marietta Street, NW., Suite 2900
Atlanta, Georgia 30323