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DUKE POWER

May 2, 1997

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

Subject: McGuire Nuclear Station, Units 1 and 2,
Docket Nos. 50-369 and 370
Supplement to Replacement SG Proposed TS Amendment
(TACs M90590 and M90591

By letters dated September 30, 1994 and September 18, 1995, Duke Power Company submitted proposed revisions to the McGuire Units 1 and 2 Technical Specifications. The proposed changes were related to replacement of the steam generators for each unit.

On May 1, 1997, a conference call was held between representatives of the NRC Staff and Duke Power Company. The Staff requested further explanation of Duke's scaling of RETRAN-predicted steam generator tube leak flowrates for use in offsite dose analyses for rod ejection and locked rotor accidents. The requested information is provided in Attachment 1.

Please contact R. O. Sharpe at (704) 382-0956 if you have any questions.

Very truly yours,

H. B. Barron

Attachment

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xc:

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Description of Scaling RETRAN-predicted Steam Generator Tube Leak Flowrates For Input To Offsite Dose Analyses for Rod Ejection and Locked Rotor Accidents

The Duke Power methodology for analyzing the offsite dose consequences for the UFSAR locked rotor and rod ejection accidents uses a simple scaling process for determining the allowable Technical Specification leakage through a pre-existing steam generator tube leak. The methodology and the basis for the methodology are as follows.

The NRC-approved RETRAN-02 model for the McGuire Nuclear Station is used to simulate the system thermal-hydraulic transient response for the locked rotor and the rod ejection accidents. The initial and boundary conditions assumed in these simulations result in a conservative prediction of the plant transient response used to develop thermal-hydraulic inputs for the offsite dose analysis. A significant contribution to the offsite dose consequences for these two accidents is the small amount of primary coolant that leaks into the steam generator secondary due to the pre-existing steam generator tube leak rate allowed by Technical Specifications. Even though the leak rate is very small, it is a significant source term for the offsite dose calculation. The primary coolant activity is high due to the assumed failure of a percentage of the fuel pins which results from exceeding the DNBR limit.

The RETRAN-02 model includes a simple RETRAN junction representing the steam generator tube leak. This junction connects the primary loop to the steam generator secondary at the location of the steam generator tube leak. The transient flow through the junction is calculated by the RETRAN momentum equation. As the pressures in the adjacent volumes change during the transient, the flowrate through the junction changes. The changes in the primary coolant water properties during the transient also affect the flowrate through the junction. All of the time-dependent changes in the local fluid conditions that affect the primary-to-secondary leak rate are calculated by RETRAN.

The Technical Specification limit on steam generator tube leak rate is a very small number, on the order of 100 gpd (0.07 gpm). Considering that the primary coolant mass is approximately 500,000 lbm, and the steam generator mass is approximately

100,000 lbm, this small tube leak flowrate will have no significant effect on the plant thermal-hydraulic response during a rod ejection or locked rotor accident. In other words, the normalized tube leak flow will be the same regardless of the tube leak rate modeled in RETRAN. For example, assuming a constant leak flow of 100 gpd, only 4.2 gallons will leak through the tube in one hour. This small mass transfer will not affect the pressures or water properties in the adjacent volumes.

Since tube leak flows in this range are insignificant in terms of the transient response of the plant, an initial leak flow can be arbitrarily selected for the RETRAN junction. This leak flow is obtained by iterating on the input value for the tube leak junction flow area until a desired initial leak flow is obtained. This initial leak flow value can be a value such as 1 gpd, 10 gpd, 50 gpd, 100 gpd, etc., provided that the plant response is not affected by selecting too large of a value. Any appropriate value will provide the desired result, which is the normalized time-dependent change in the leak rate. The absolute value of the leak rate is unimportant except that it be selected as a small value. For convenience a value which is equivalent to a normalized value of 1, or 10, or 100 in the desired units (gpd) is selected to minimize the chance of introducing a mathematical error in the subsequent scaling of the normalized leak flow. In the analyses of interest, an initial normalized steam generator tube leak flow rate of 100 gpd was chosen for the above reasons.

The RETRAN analysis then provides the time-dependent behavior of the tube leak flowrate based on an initial normalized leak flow of 100 gpd. The leak rate changes from its initial value of 100 gpd based on the changes in the pressures in the adjacent volumes and based on the changes in the upstream water properties.

The initial dose analyses are then performed assuming this time-dependent leak rate (or integrated time-dependent leakage) and the other required boundary conditions. If additional conservatism is desired, any decrease in the leak rate can be ignored. For example, if assuming that the initial leak rate remains constant for the duration of the analysis is conservative, then that assumption can be made. However, crediting the time-dependent behavior of the leak flow is sufficiently conservative.

If the initial dose analysis result exceeds the acceptance criterion, then a reduction in the tube leak rate assumed in the dose analysis is required. In this case, Duke would be required to submit a Technical Specification Amendment. The amendment would reflect the reduced tube leak rate assumed in the dose calculation. If the initial dose analysis result is significantly less than the acceptance criterion, then an increase in the tube leak rate assumed in the dose analysis is justified.

Either an increase or a decrease in the tube leak rate or integrated leakage modeled in the RETRAN analysis can be obtained by simply scaling the RETRAN results by the ratio of the revised initial leak rate divided by the existing initial leak rate. For example, if the initial RETRAN analysis assumed a 100 gpd tube leak rate, and revised results for a 135 gpd leak rate are desired, then the revised results are simply the initial RETRAN results multiplied by the factor 135/100. This simple scaling process is justified based on the argument presented above that small tube leaks in this range do not affect the plant transient response. This means that the normalized transient response is the same for all small tube leaks. Consequently, there is no need to reanalyze the transient response with the revised tube leak flowrate.

The above process can be used to scale the RETRAN-predicted results for a change in the initial steam generator tube leak rate for the locked rotor and rod ejection accidents. This process is only valid for small initial tube leak rates, and cannot be used for large leak rates such as that which results from the rupture of a steam generator tube.