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December 5, 1983

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Ms. E. G. Adensam, Chief
Licensing Branch No. 4

Re: McGuire Nuclear Station
Docket No. 50-370

Dear Mr. Denton:

Attached are responses to NRC Staff questions concerning Duke Power Company's request for change to the McGuire Nuclear Station-Unit 2 Technical Specification on Reactor Coolant System flow. These were discussed with Staff reviewers on December 2, 1983.

Please advise if there are additional questions concerning this matter.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

GAC/php

Attachment

cc: Mr. W. T. Orders
NRC Resident Inspector
McGuire Nuclear Station

Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
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HRD/HBT/GAC
December 5, 1983

McGuire Nuclear Station
Response to Questions on Technical Specification Change on
Reactor Coolant System Flow

1. Attachment 2B of your letter of November 18, 1983 states that the plant-specific relationship for flow and DNBR based on thermal-hydraulic sensitivity studies for the worst case is $\frac{\partial flow}{\partial DNBR} = \frac{1\ \%}{1.6\%}$

   What is the worst case that has been analyzed to determine this relationship? Is this 1.6 to 1 ratio of ΔDNBR vs ΔFlow the highest value for all transients? Also provide a description of how the sensitivity studies are performed.

<u>Response</u>

The conditions that resulted in the maximum DNBR sensitivity to flow were 120% power, 2400 psia, and a temperature necessary to yield the DNBR design limit (i.e., DNB core limits). The typical cell sensitivity was used even though the thimble cell was DNBR limited, since the typical cell is more sensitive to flow. Statepoints representative of possible operating conditions (normal operation and accident) were analyzed using THINC IV. Conditions ranged from operating at core DNB limits to undergoing a loss of flow accident. Each statepoint was analyzed at nominal flow (e.g., 100% flow for core limit conditions, approximately 80% flow for loss of flow) and at 97.5% of nominal flow. The DNBR penalty associated with each statepoint was calculated for both typical and thimble cells, and the largest penalty was determined. For a 2.5% reduction in flow, the largest DNBR penalty was 4.0%. This results in a $\frac{\partial flow}{\partial DNBR} = \frac{1\ \%}{1.6\%}$.

2. Attachment 2B also states that "generally" the following relationships between core power, flow and DNBR are applicable:

$$\frac{\partial Flow}{\partial DNBR} = \frac{1\%}{1\%}$$

$$\frac{\partial Power}{\partial DNBR} = \frac{1\ \%}{1.8\%}$$

   What is the basis or justification for using the ΔDNBR vs ΔPower ratio of 1.8 for this Technical Specification change? Is it the worst value, i.e., the lowest value for all transient?

<u>Response</u>

The value of 1.8 used for the sensitivity of DNBR to power was derived from the work performed in the area of rod bow penalty in 1976-1977. Information dealing with the penalty and generic margins is discussed in "Revised Interim Safety Evaluation Report on the Effects of Fuel Rod Bowing on Thermal Margin

Calculations for Light Water Reactors", NRC report, February 16, 1977. The T/ H analyses performed to derive this value show that the conditions used are almost identical to those used to calculate the flow sensitivity as explained in Question 1. Previous DNBR sensitivity studies have shown that the DNBR sensitivity to power is very similar to the sensitivity to $F_{\Delta H}^{N}$. Therefore, a value of 1.8 is appropriate for power when considering the tradeoff between power and flow.

3. In the revised Bases for "Power Distribution Limits" of the McGuire Technical Specifications, a total of 9.1% credit is used, i.e., 5.9% is used to partially offset fuel rod bowing penalty and 3.2% is used to trade off against measured flow being as much as 2% lower than thermal design flow plus uncertainties. Provide the sources of the 9.1% thermal margin, and explain how the credit is obtained. We will require that the Technical Specification Bases include the breakdown components of the 9.1% credit.

Response

The 9.1% thermal margin is due to conservatisms used in design analyses in comparison to conditions justified in the FSAR. The following is a summary of the conservatisms used in McGuire's cycle 1 analyses.

Design Limit DNBR of 1.30 vs. 1.28
Grid Spacing (Ks) of 0.046 vs. 0.059
Thermal Diffusion Coefficient of 0.038 vs. 0.059
DNBR Multiplier of 0.86 vs. 0.88
Pitch Reduction

The margins associated with each of the above conservatisms was determined by using THINC IV to compare results with and without the conservatisms. This work was performed to assess the amount of thermal margin available to offset rod bow penalties. From Duke Power's perspective, it would be preferable to have this information presented and explained in the FSAR rather than in the bases of the Technical Specifications. Operation of Unit 2 beyond Cycle 1 will not be based on the same conservatisms due to a change in the method of analysis. As a result, future comparisons to the above values would be inappropriate. However, Duke Power has no objectives to putting these values in the Technical Specification bases for the remainder of Cycle 1.

4. With regard to the Limiting Safety System Settings, it is stated that the current setpoint equation has been determined to be adequate if the $f(\Delta I)$ penalty on the Overtemperature ΔT equation is revised as shown in the Note 1 of Table 2.2-1 of the proposed Technical Specification revisions. What analysis have you done to determine its adequacy?

Response

A reanalysis of the Overtemperature ΔT setpoint with a 2% reduction in Reactor Coolant System flow was performed using the methodology described in WCAP-8745, "Design Bases for the Thermal Overpower ΔT and Thermal Overtemperature ΔT Trip Function".