UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 34 TO FACILITY OPERATING LICENSE NPF-35

AND AMENDMENT NO. 25 TO FACILITY OPERATING LICENSE NPF-52

CATAWBA NUCLEAR STATION, UNITS 1 AND 2

DUKE POWER COMPANY, ET AL.

I. INTRODUCTION

By letter dated July 31, 1985, and supplemented November 8 and December 26, 1985, and March 7, 1986, Duke Power Company, et al., (the licensee) proposed changes to Figure 3.2-3 of Technical Specification (TS) 3/4.2.3 for Catawba Nuclear Station, Units 1 and 2. The changes would delete the DNB limit line and add a graduated scale to allow tradeoff of reactor coolant system (RCS) flow against reactor thermal power (RTP) level.

In response to NRC staff concerns, on July 1, 1987, the licensee supplemented its earlier request to provide: (a) an additional action statement for reductions in the high flux trip setpoint at various operating conditions, (b) additional information concerning the adequacy of the overtemperature Delta-T setpoint for various DNBR events, and (c) additional information concerning the F Delta-H equation. Because the July 1, 1987, submittal provided clarification of, proposed additional restrictions on, certain aspects of the request, the substance of the changes noticed in the Federal Register and the proposed no significant hazards determination were not affected.

II. EVALUATION

1. Operation with RCS flow less than 396,100 gpm

The licensee proposes that Figure 3.2-3 titled "Reactor Coolant System Total Flow Rate Versus R-Four Loops in Operation" be modified to permit operation at a reduced flow rate (i.e., about 95% of full flow) which would be compensated by an appropriate reduction in reactor power level. The reduced power level ensures that the thermal margin is maintained at a value equivalent to that for full flow. In addition, the licensee proposes to delete the DNB limit line to prevent operation misinterpretation because the rod bow factor (R_2) is not associated with TS 3/4.2.3 or Figure 3.2-3 and thus the DNB limit line serves no useful purpose.

The current best estimate flow at Catawba Unit 1 is 399,122 gpm which is only 0.76 of 1% above the TS limit of 396,100 gpm. Considering an expected variance in flow measurement of about 2.2%, the licensee believes the proposed revision is needed because of the severity of the existing TS if any flow measurement indicates a flow slightly less than 396,100 gpm.

The licensee proposes to reduce RTP level by 2% for each 1% reduction in the measured RCS flow below the TS flow requirement for 100% power which is equal to 396,100 gpm. Westinghouse calculations show, with penalties added for conservatism, that a 5% reduction in flow results in a 4.4% reduction in power. The staff's independent audit (using W-3 correlation sensitivity factors reported in References (1) and (2)) show that, for the worst case reported in Reference (2), a 5% reduction in flow requires a 4.32% reduction in power. The licensee's plan to use a 10% reduction in power for a 5% reduction in flow is conservative. Furthermore, this ratio of RTP level to RCS flow was used for the McGuire Nuclear Station TS and has been reviewed and approved by the NRC staff.

Based on the above evaluation, the staff concludes that the proposed modification to Figure 3.2-3 of TS 3/4.2.3 for using a 2/1 power to flow relationship for a maximum of 5% reduction in flow is acceptable.

The staff also finds the elimination of the DNB limit line in Figure 3.2-3 to be acceptable as it was originally for an "R_2" value associated with rod bow penalty. In the November 8, 1985, letter, the licensee stated that a rod bow penalty is not applied to Catawba as there is approximately 10% margin between the safety analysis and design limit DNBR values. This is partially used to offset a 2.7% DNBR rod bow penalty. The staff agrees with the licensee's statements and licensee's treatment of rod bow penalty.

2. Reduction in High Flux Trip Setpoint

The justification for the 2% RTP reduction per 1% RCS flow reduction was based upon the sensitivities of DNBR to power and flow determined by several independent sources using different assumptions and computer codes. The licensee stated that the plant response to an FSAR Chapter 15 transient initiated from the reduced flow/reduced power operating regions would continue to satisfy the applicable acceptance criteria based upon margins available in the Chapter 15 analyses, protection system setpoint calculations, and thermal-hydraulic analyses including the use of a minimum allowable DNBR greater than that justified by the Improved Thermal Design Procedure.

The licensee confirmed that adequate margins exist in the related analyses to justify the proposed TS changes. The limiting events in regard to the proposed operating regions are the reactivity insertion transients which increase reactor power. The RCCA group withdrawal analyses provide the most limiting cases with the reactor trip signal assumed to be due to either the Overtemperature Delta-T or the Power Range Neutron Flux-High Trip Setpoint trip functions. The licensee determined that the low flow penalties for the RCCA group withdrawals initiated from the proposed operating regions would require dedication of most of the available DNBR margin. Thus, the use of protection system setpoint reductions and more restrictive limits on core power distributions, as described below, to compensate for the potential RCS flow reduction was appropriate.

By letter dated July 1, 1987, the licensee provided a revision to the proposed TS changes which includes an action statement requiring a reduction in the Power Range Neutron Flux-High Trip Setpoint to below the normal setpoint by the same amount (% RTP) as the power reduction required by Figure 3.2-3 (2% RTP per 1% RCS flow). By maintaining the 2% RTP per 1% RCS flow trade-off at the trip conditions as well as the steady-state conditions, the high flux setpoint reduction ensures the DNBR margin existing in the FSAR analyses is maintained for those events assumed to utilize the Power Range Neutron Flux-High Trip Setpoint trip function.

Based on its review, the staff finds that the protection system setpoint reduction is acceptable because it appropriately compensates for the potential RCS flow reduction and is sufficiently conservative for DNBR events.

3. Overtemperature Delta-T Trip Function

For those FSAR Chapter 15 events which assume Overtemperature Delta-T trip function protection, the licensee concluded that an administrative control on a term within the setpoint equation and the restriction of core power distributions are adequate to ensure that margins in the analyses are maintained. The term Delta-T_o in the setpoint equation (TS Table 2.2-1) is defined as the indicated Delta-T at rated thermal power. Delta-T_o is defined as the equivalent Delta-T at 100% RTP. The effect of the greater of the measured RCS flow or 396,100 gpm, results in an effective Overtemperature Delta-T setpoint reduction and maintains DNBR margins for those cases reliant upon the overtemperature Delta-T trip. The ratio of the measured Delta-T to Delta-T_o is thus equivalent to %RTP and is compared to the Overtemperature Delta-T trip setpoint. By maintaining Delta-T_o at or below the equivalent Delta-T at 100% RTP and 396,100 gpm, any flow deficiency will result in an increase in the actual Delta-T and an overestimation of power level. The overestimation of power is equivalent to a trip setpoint reduction of approximately 1% RTP per 1% flow deficiency.

Based on its review, the staff finds that this compensation is acceptable for maintaining the effectiveness of the Overtemperature Delta-T protection.

4. F Delta-H Equation

The F Delta-H equation is in TS 3/4.2.3 which states that "the combination of indicated RCS total flow rate and R shall be maintained in the region of allowable operation shown in Figure 3.2-3, for four loop operation."

The licensee has factored the 2/1 power to flow tradeoff into the F Delta-H equation and in Figure 3.2-3. For example, at the maximum power reduction of 10% corresponding to a flow reduction of 5% and with F Delta-H maintained at the full power value of 1.49, the value of R is 0.971. This condition is shown in Figure 3.2-3 where RTP equals 90% and the RCS flow is 95% of the required flow or .95 X (396,100 gpm) = 376,3000 gpm.

The limitation placed on F Delta-H for reduced RCS flow conditions prevents the usual allowance for increasing F Delta-H at reduced power levels. Reductions in power levels combined with a RCS flow deficiency and increased radial peaking do not maintain DNBR margin and thus the F Delta-H restrictions in Figure 3.2-3 are required.

Based on its review, the staff finds that Figure 3.2-3 was appropriately adjusted and, therefore, it is acceptable.

III. ENVIRONMENTAL CONSIDERATION

The amendments involve a change in use of facility components located within the restricted area as defined in 10 CFR Part 20 and changes in surveillance requirements. The staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational exposures. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there have been no public comments on such finding. Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR Section 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

IV. CONCLUSION

The Commission made a proposed determination that the amendments involve no significant hazards consideration which was published in the Federal Register (51 FR 30563) on August 27, 1986, and consulted with the state of South Carolina. No public comments were received, and the state of South Carolina did not have any comments.

We have concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations, and the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

References

(1) Chelemer, H., L. H. Boman, and D. R. Sharp, WCAP-8567, "Improved Thermal Design Procedure," Westinghouse Electric Corporation, Pittsburgh, Pennsylvania, July 1975.

(2) Hesson, G. M., and J. M. Cuta, FATE-79-101, "Analysis of the Sensitivity of Calculated MDNBR to Eight Selected DNB Parameters," Battelle Pacific Northwest Laboratories, Richland, Washington, March 1979.

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