UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 116 TO FACILITY OPERATING LICENSE NPF-35

AND AMENDMENT NO. 110 TO FACILITY OPERATING LICENSE NPF-52

DUKE POWER COMPANY, ET AL.

CATAWBA NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-413 AND 50-414

1.0 INTRODUCTION

By letter dated January 10, 1994, as supplemented March 21, 1994, Duke Power Company, et al. (the licensee), submitted a request for changes to the Catawba Nuclear Station, Units 1 and 2, Technical Specifications (TS). The requested changes would revise TS Table 2.2-1, TS 4.2.5, and the BASES to allow a change in the method for measuring reactor coolant system (RCS) flowrate from the calorimetric heat balance (CHB) method to a method based on a one-time normalization of the RCS cold leg elbow tap signals to constants derived from averaged valid calorimetrics from previous cycles. The March 21, 1994, letter provided clarifying information that did not change the initial scope of the January 10, 1994, application, and the initial proposed no significant hazards consideration determination.

2.0 EVALUATION

In the past, RCS flowrate has been determined, in accordance with TS 4.2.5.2 and 4.2.5.3, by the CHB method each 18 months since the issuance of Amendment Nos. 22 and 3, dated June 28, 1983, for McGuire Units 1 and 2 and since initial operation of Catawba Units 1 and 2. This is done by: (1) determining the energy transferred to the plant's steam generators (secondary side), (2) correcting this value for RCS pump heat input and system energy losses, and (3) dividing the result by the primary side differential enthalpy from the RCS cold to hot leg. This yields a value of RCS (primary side) flowrate that is then used to determine compliance with the TS minimum measured required RCS flowrate on TS Figure 3.2-1 and the footnote on TS Table 2.2-1.

The licensee believes that the measurement uncertainty in the calorimetric heat balance method is dominated by the uncertainty in determining the hot leg enthalpy; specifically, the hot leg temperature. In recent fuel cycles of operation, the licensee believes that a phenomenon termed hot leg temperature streaming has become more pronounced. The licensee has attributed this as being largely due to the increased usage of low neutron leakage reactor cores. The use of lower leakage core designs results in a higher percentage of the core power being produced in the inner core regions. This leads to an increased temperature distribution within the hot leg due to incomplete mixing in the upper plenum and results in different temperature readings by one or more of the three hot leg temperature sensors (RTDs) and an indication of an

average hot leg temperature that does not accurately reflect true bulk average hot leg coolant temperature. The hot leg coolant density is calculated from the temperature and impacts the calculated RCS flowrate. When reflected in the CHB method of determining RCS flowrate, the licensee believes that hot leg streaming results in calculation of a conservatively low RCS flowrate.

Previously, the indication from the cold leg elbow taps has been normalized each 18 months to result in an indication of RCS flow that is equivalent to that determined from the CHB. This indication is utilized by the reactor protection system (RPS) to trip the reactor on low RCS flowrate at the setpoint value specified in TS Table 2.2-1, Item 11. This normalization, each 18 months, has resulted in a data set of normalization factors (K values). The licensee believes that the trend of the non-normalized indications from the cold leg elbow taps over the life of the plant are more reflective of the expected actual trends in RCS flow, particularly for the last several fuel cycles, than the CHB results. Therefore, the licensee has proposed to determine a fixed value of the normalization factors, K, from the available plant lifetime data set, that would, henceforth, be applied to the cold leg elbow tap indication. The resulting indication of flow would then be used both as the flow input to the RPS and to determine compliance with TS Table 2.2-1, footnote **, on loop minimum measured flow and the TS Figure 3.2-1 required flow value to attain full power operation. The resulting data set of elbow tap coefficients are presented in the licensee's submittal of January 10, 1994.

The NRC staff met with the licensee on March 16, 1994, and requested that the licensee provide additional information. The licensee responded in its submittal dated March 21, 1994, as discussed below.

The licensee evaluated the effects on core pressure drop due to the transition to B&W fuel and found that a slight pressure decrease across the core would result. This would contribute to a small increase in RCS flow. The licensee evaluated the effects of steam generator tube plugging and sleeving on expected RCS flow and determined the expected contribution to an increase in flow resistance. It then calculated that the combination of steam generator and core changes during the EOC 7 refueling outage would result in a decrease in flow in each loop that ranged from 0.15% to 1.13%.

The licensee provided elbow tap differential pressure data from operating cycles 6 and 7. The staff evaluated these averaged/selected data and found sufficient stability to support use of elbow tap information in the manner proposed by the licensee for the remainder of cycle 8.

The staff requested the licensee to evaluate the most conservative assumption regarding the consequences of anticipated operational occurrences (AOOs) and accidents in the Final Safety Analysis Report, Section 15 events; namely, that the postulated conservatively low indication of RCS flow from the CHB is accurate, at a value of 379,285 gallons per minute (gpm) versus the minimum required value of 382,000 gpm. This would represent a flow deficit of 0.71%. In its March 21, 1994, submittal, the licensee evaluated the effects of this postulated flow deficit against the margins available for:

- Departure from Nucleate Boiling Ratio (DNBR) limited events,
- Secondary System Peak Pressure events,
- Primary System Peak Pressure events,
- Feedwater Line Break Long Term Core Cooling Analysis,
- Steam Generator Tube Rupture Dose Analysis,
- Loss of Coolant Accidents, and
- Boron Dilution Events

The licensee's evaluation concludes that margin exists for each event to account for a postulated 0.71% flow reduction and, accordingly, to allow Catawba, Unit 1, to operate at 100% power. In its summary in the March 21, 1994, submittal, the licensee cites a flow uncertainty margin of up to 0.27% flow based on the conclusion that the overall uncertainty on the measurement of RCS flow is 1.93% versus the 2.2% uncertainty now reflected on TS Figure 3.2-1. The staff has not accepted the lower value of 1.93% uncertainty since the components of this value attributable to flow temperature streaming have not been adjusted to reflect the increased uncertainty in hot leg RCS temperature observed in recent fuel cycles. This will be the subject of further review.

The licensee also identifies a DNB margin for the current Unit 1 cycle of 7.4% DNB for Mark BW fuel. The staff feels that the appropriate value is 4.6% which is the value identified in the licensee's application dated September 7, 1993, in support of the current fuel Cycle 8. The higher value of 7.4% is based on the results from a testing program sponsored by the licensee that has not been submitted to the NRC. Accordingly, those results have not been reviewed by the staff and are not relied on in this evaluation. These exclusions of certain specific licensee identified margins do not compromise the licensee's overall conclusions. This is based on the licensee's identification that the postulated 0.71% flow decrease translates to a 1.6% DNB penalty which is more than compensated for by the available 4.6% margin. The licensee has also determined that the remaining nine Westinghouse fuel assemblies have significant DNB margin based on the reduced value of their peaking factors in this fuel cycle.

The revised method for determining RCS flowrate was proposed by the licensee as being applicable to the Catawba Units 1 and 2 and McGuire Units 1 and 2 plants for the remainder of their life. While the NRC staff has concluded that the method is acceptable for a short period consistent with the remainder of fuel cycle 8 for Catawba, Unit 1, it is not prepared, at this time, to approve departure from the well-established CHB method for all four units for the remainder of their plant life. Therefore, the staff has restricted the approval given in this safety evaluation to the remainder of fuel cycle 8 for Catawba, Unit 1. The staff will continue to review the licensee's proposal with respect to the appropriate long term corrective action for the uncertainty attributable to hot leg streaming.

The licensee's revised method of determining RCS flowrate would provide an indicated flowrate of 389,533 gpm versus the value of 379,285 gpm provided by the CHB method. The staff concludes that, based on the issues discussed above, this provides adequate assurance that there will be at least the

≥82,000 gpm available to support continued Unit 1 operation at full power for the remainder of the current Cycle 8 fuel cycle.

Technical Specification Changes

The specific TS changes are as follows:

TS 4.2.5.2 and TS 4.2.5.3

The terms "calorimetric flow measurement" and "precision heat balance measurement" will be followed by an asterisk as proposed in the March 21, 1994, submittal to include the following notation:

> *For Unit 1 Cycle 8 only, RCS flow shall be measured using cold leg elbow tap ΔPs, normalized to constants derived from averaged valid calorimetrics from previous cycles.

This is the same in its effect as the licensee's January 10, 1994, submittal for modification of these TS except that the above provision limits reliance on the identified elbow tap normalization constants for Catawba, Unit 1, to the remainder of the present fuel Cycle 8.

TS Table 2.2-1

The values of the Reactor Coolant Flow-Low trip setpoint will be increased from 90% to 91% and the allowable value will be increased from 88.9% to 89.7% to account for an increase in the channel statistical allowance for the low flow trip signal attributable to the inclusion of allowances for elbow tap uncertainties since these will no longer be normalized out each 18 months by the CHB process.

TS Figure 3.2-1

As noted in the evaluation above, the licensee's proposal to lower the value of flow measurement uncertainty of 2.2% to 1.9% is not acted on by this amendment. This proposal will be the subject of further review.

BASES

The BASES to the TS were modified to reflect the above noted changes.

Certain previously existing TS pages have been replicated to preserve values for Unit 2 which are not changed by this amendment. On the basis of the above noted discussions, the staff concludes that these changes are acceptable for the remainder of Catawba, Unit 1, Cycle 8 operation.

3.0 STATE CONSULTATION

In accordance with the Commission's regulations, the South Carolina State official was notified of the proposed issuance of the amendments. The State official had no comments.

4.0 ENVIRONMENTAL CONSIDERATION

The amendments change requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and change surveillance requirements. The NRC 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 radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (59 FR 3743 dated January 26, 1994). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 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.

5.0 CONCLUSION

The Commission has 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, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

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