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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 96 TO FACILITY OPERATING LICENSE NO. DPR-23

CAROLINA POWER AND LIGHT COMPANY

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

DOCKET NO. 50-261

Introduction

The licensee, the Carolina Power and Light Company (CP&L), for (HBR-2) has proposed, in Reference 1, a revision to the HBR-2 Technical Specifications. The change specifically addresses a change to the graph of "Normalized Axial Dependence Factor for F_q versus Elevation" as depicted in Figure 3.10-3 of the Technical Specifications. This graph is also referred to as the K(z) curve.

The K(z) curve, in conjunction with the Technical Specification total peaking factor, F_Q^T, defines the allowable linear heat generation rates as a function of core elevation. This curve is utilized to assure conformance to 10 CFR 50.46 for a "range of power distribution shapes and peaking factors representing power distributions that may occur over the core lifetime" as required by Section I.A of Appendix K to 10 CFR 50.

The licensee has provided, in References 2 and 3, the results of large and small break LOCA analyses performed to demonstrate that the proposed K(z) curve provides compliance to 10 CFR 50.46. These analyses were performed by Westinghouse. This report evaluates these analyses and the proposed change to the HBR-2 Technical Specifications.

Evaluation

Large Break LOCA Analysis

HBR-2 is currently operating Cycle 10 with a core composed entirely of Exxon

fuel. The large break LOCA analyses originally performed to support the Cycle 10 HBR-2 Technical Specifications were performed by Exxon and provided in references 4, 5 and 6. These analyses demonstrated that the Technical Specification K(z) curve, with an F_Q^T of 2.32, provided conformance to 10 CFR 50.46.

On September 30, 1985, Exxon notified Region V, pursuant to the requirements of 10 CFR 21.21(b), that an error existed in the large break LOCA analyses performed for HBR-2 which supported the then current fuel cycle. The licensee provided, in Reference 7, revised LOCA/ECCS analyses, with the error corrected, for HBR-2. As a result of these revised analyses, the licensee, in Reference 8, administratively limited the allowed F_Q^T and K(z) values to the values utilized in the revised analyses. The staff's evaluation of these revised analyses and the licensee's administration limits is found in Reference 9.

In order to rejustify the Technical Specification F_Q^T value of 2.32, the licensee submitted, in Reference 2, a new large break LOCA analysis, performed by Westinghouse, for HBR-2. In addition, a new analysis was also performed to assure that the proposed change to the Technical Specification K(z) curve requested in Reference 1 remained valid and unaffected by this error.

To construct the input deck for the analysis, Westinghouse utilized the input model for Turkey Point Unit 3 as a basis. Modifications to the model were made to reflect the HBR-2 power level, primary system operating characteristics, Emergency Core Cooling Systems, steam generator characteristics and the Exxon fuel. The information used to model the fuel was supplied by Exxon. As a result of the modifications, and in recognition of the similarity in the primary system designs of HBR-2 and Turkey Point Unit 3, the input model utilized appropriately reflects the HBR-2 design. It is noted that the analysis was performed with an F_Q^T of 2.32 and 5% steam generator tube plugging.

The analysis was performed using the Westinghouse 1981 evaluation model with BART. This is an NRC approved ECCS evaluation model which conforms to the requirements of Appendix K to 10 CFR 50.

The licensee provided the analysis of a double-ended cold leg guillotine break with a discharge coefficient of 0.4. Previous Westinghouse analyses for HBR-2, which was performed with the October 1975 evaluation model, demonstrated this case to be the limiting large break LOCA. In addition, the Turkey Point Unit 3 LOCA analyses performed with the 1981 Westinghouse evaluation model with BART has demonstrated that this case is the limiting large break LOCA. Thus, the licensee concluded that analysis of only this break size was sufficient for demonstrating compliance to 10 CFR 50.46.

To demonstrate the adequacy of the proposed K(z) curve, the licensee performed the analysis using a chopped cosine power shape which was peaked at the 6-foot elevation. This power shape was determined to be the limiting power shape for large break LOCA analyses as part of the approval of the initial 1975 Westinghouse evaluation model. The licensee noted that sensitivity studies have been performed with the 1981 Westinghouse evaluation model with BART which confirm that the chopped cosine power shape yields higher peak cladding temperature than skewed power shapes allowed by the K(z) curve.

The Westinghouse analysis for this limiting break resulted in a peak cladding temperature of 2199°F. The maximum local metal-water reaction was 7.09% and the total hydrogen generation was less than 0.3%. All these values satisfy the requirements of 10 CFR 50.46.

We have examined the licensee's analysis. Based upon the previous HBR-2 analyses and the recent Turkey Point Unit 3 analyses, we find that the case analyzed is the limiting large break LOCA. Since Westinghouse has performed sensitivity analyses which demonstrated that the chopped cosine power shape produces that highest peak cladding temperature, we find that the power shape utilized is sufficient for demonstrating compliance with Section I.A of Appendix K. We also find that an approved evaluation model has been utilized, as required by 10 CFR 50.46, and the results demonstrate conformance to 10 CFR 50.46.

Based upon our review, we have concluded that the large break LOCA analysis demonstrates that HBR-2 satisfies the requirements of 10 CFR 50.46. Thus, the Technical Specification limits of an F_Q^T of 2.32 and the proposed

modification to the K(z) curve is acceptable. We note, however, that these conclusions apply only up to the steam generator tube plugging limit of 5% utilized in the analysis.

Small Break Analysis

As part of the proposed modification to the K(z) curve, the licensee altered the third line segment. This portion of the K(z) curve is applied over the 10.8 to 12 foot core elevations. This portion of the K(z) curve is utilized to assure that the consequences of small break LOCAs satisfy the requirements of 10 CFR 50.46. In References 2 and 3, the licensee provided the results of small break LOCA analysis performed by Westinghouse to demonstrate conformance to 10 CFR 50.46.

Similar to the large break LOCA evaluation described above, Westinghouse modified the Turkey Point Unit 3 small break model to reflect HBR-2. In this case, however, the analysis was not based upon the Exxon fuel, but rather the Westinghouse 15x15 OFA fuel. The licensee stated that the two fuel designs are very similar and that the design differences would have only a small effect on the small break LOCA analysis during core heatup.

The analysis was performed using the approved WFLASH small break LOCA ECCS evaluation model. A three inch cold leg break was analyzed as it was the worst case break for Turkey Point Unit 3. The licensee noted that the increased power level for HBR-2 would tend to make the worst case break larger, however, the reduced safety injection flow would tend to make smaller break sizes more limiting. Thus, the licensee concluded that the three inch break would be representative of the worst case break for HBR-2.

In performing the analysis, Westinghouse utilized a top-skewed power shaped which followed the proposed K(z) curve from 10 to 10.8 feet. Above 10.8 feet, the power shape used linearly decreased to an allowed F_q at 12 feet of 1.5. This power shape allows linear heat generation rates in excess of the proposed K(z) curve. Specifically, the proposed curve linearly decreases above the 10.8 feet elevation to an F_q of 1.0 at 12 feet.

The analysis of the three inch line break resulted in a peak cladding temperature of 1801°F. Local metal-water reaction was 2.25%, while whole-core hydrogen generation was less than 0.3%. Thus, the criteria of 10 CFR 50.46 were satisfied.

Our review of the licensee's analysis has concluded that the revised third line segment of the proposed K(z) curve provides compliance to 10 CFR 50.46. Specifically, we note that the licensee has utilized an approved evaluation model which complies with the requirements of Appendix K to 10 CFR 50.46. We have also examined the similarity in fuel rod designs and have concluded that use of the OFA design would result in a similar cladding heat up during the core uncovery phase. In addition, because of the substantially higher linear heat generation rates utilized in the analysis any impact of the difference in fuel design has been conservatively addressed. Thus, since the analysis demonstrates conformance to 10 CFR 50.46, we find the proposed Technical Specification change for the K(z) curve to be acceptable.

Conclusion

Based upon the licensee revised large and small break evaluations, we find the proposed modification to the Technical Specification K(z) curve to be acceptable. In addition, the revised analyses demonstrate the acceptability of the current Technical Specification F_Q value of 2.32. Thus, the administrate limits imposed by the licensee in Reference 8, and approved by the NRC is Reference 9, are no longer needed. Our conclusions apply only up to the steam generator tube plugging limit of 5% utilized in the analysis.

Environmental Consideration

This amendment involves a change in the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The staff has determined that the amendment involves 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 this amendment involves no

significant hazards consideration and there has been no public comment on such finding. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR Sec 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 this amendment.

Conclusion

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 this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated: December 23, 1985

Principal Contributor:

R. Jones

References

1. Letter, A. B. Cutter (CP&L) to S. A. Varga (NRC), Subject: Revised K(z) Curve - Technical Specification Figure 3.10-3, July 1, 1985.

2. Letter, S. R. Zimmerman (CP&L) to S. A. Varga (NRC), Subject: Westinghouse K(z) Analysis, November 8, 1985.

3. Letter, S. R. Zimmerman (CP&L) to S. A. Varga (NRC), Subject: Correction to K(z) Submittal, November 26, 1985.

4. "H. B. Robinson Unit 2 Large Break LOCA-ECCS Analysis With Increased Enthalpy Rise Factor," XN-NF-84-72, July, 1984.

5. "H. B. Robinson Unit 2 Large Break LOCA-ECCS Analysis With Increased Enthalpy Rise Factor: Break Spectrum," XN-NF-84-72 Supplement 1, August, 1984.

6. "H. B. Robinson Unit 2 Large Break LOCA-ECCS Analysis With Increased Enthalpy Rise Factor: K(z) Curve," XN-NF-84-72 Supplement 2, August, 1984.

7. Letter, A. B. Cutter (CP&L) to S. A. Varga (NRC), Subject: Recent Error in Exxon Fuel Calculation, October 8, 1985.

8. Letter, A. B. Cutter (CP&L) to S. A. Varga (NRC), Subject: Operating Plans Under Revised LOCA Analyses, October 15, 1985.

9. Letter, G. Requa (NRC), to E. E. Utley (CP&L), Subject: Revised LOCA Analysis, H. B. Robinson Steam Electric Plant Unit No. 2, December 12, 1985.

10. Letter, S. A. Varga (NRC) to E. E. Utley (CP&L), Subject: NUREG-0737, Item II.K.3.30 - Revised Small-Break Loss-Of-Coolant Accident Methods, H. B. Robinson, Unit No. 2 (TAC No. 45860), July 10, 1985.

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significant hazards consideration and there has been no public comment on such finding. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR Sec 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 this amendment.

Conclusion

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10. Letter, S. A. Varga (NRC) to E. E. Utley (CP&L), Subject: NUREG-0737, Item II.K.3.30 - Revised Small-Break Loss-Of-Coolant Accident Methods, H. B. Robinson, Unit No. 2 (TAC No. 45860), July 10, 1985.