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

ENCLOSURE

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION RELATING TO VIPRE/WRB-1 DNBR THERMAL LIMIT FOR WESTINGHOUSE OFA FUEL ZION UNITS 1 AND 2 COMMONWEALTH EDISON COMPANY DOCKET NO. 50-295 AND 50-304

1.0 BACKGROUND

By letter dated December 15, 1988 Commonwealth Edison Company (CECo) submitted a report titled "VIPRE/WRB-1 DNBR Thermal Limit for Westinghouse OFA Fuel." Commonwealth Edison Company is developing transient analysis capability using computer codes RETRAN and VIPRE. RETRAN is used to calculate state variables, such as pressure, enthalpy, mass flow and power for the transient. These variables are used in the VIPRE thermal-hydraulic subchannel analysis code to calculate the minimum departure from nucleate boiling ratio (MDNBR). For most FSAR transients, the results are acceptable if the calculated MDNBR is greater than an established reference value.

CECo obtained the WRB-1 critical heat flux (CHF) correlation and related data base from Westinghouse. Since the thermal limit used by Westinghouse for the fuel types of interest was derived using the THINC subchannel code, CECo reproduced the Westinghouse analysis with VIPRE, which is the code CECo is using for transient analysis.

The NRC issued a Safety Evaluation Report (SER) for PWR VIPRE analysis (Ref. 2). Since the WRB-1 CHF correlation was not included in the scope of the SER, the licensee submitted this report to provide justification for the use of the VIPRE/WRB-1 combination for DNB analyses.

2.0 EVALUATION

To develop the thermal limit, CECo first obtained Westinghouse's documentation for the development of the WRB-1 correlation's thermal limit and the NRC review (Ref. 2) of the Westinghouse submittals. Next the CHF experimental tests performed by Westinghouse were modeled in VIPRE. The data base was the same one used by Westinghouse for the OFA fuel designs of interest. From the VIPRE subchannel analyses of the data base, a mean, standard deviation and effective degree of freedom were calculated as outlined in the NRC SER of the Westinghouse submittals. These values were used to calculate the 95 percent probability with 95 percent confidence (95/95) thermal limit value. The data was tested for biases in the correlation.

The data base consisted of 1108 data points from 22 different test assemblies. Table 2 of the report provided the statistical data for the OFA data base.

For each test assembly the number of data points, the average measured to predicted flux ratio (M/P) and the standard deviation were given. Group statistics were given assuming and not assuming poolability. Using the NRC recommended definitions from Reference 2, the means, standard deviation and degree of freedom were calculated. The thermal limit was then calculated using the Owens method. A thermal limit of 1.187 was calculated with a 95 percent probability and 95 percent confidence for DNB not occurring.

We have reviewed the data presented and used the data to check the detailed calculations for the input parameters to the final calculation of thermal limit. This analysis by CECo yielded a measured to predicted ratio mean of 0.9918 and a standard deviation of 0.0848. We agree that the licensee has performed the calculations correctly and that the value of 1.187 for the thermal limit is accurate.

3.0 CONCLUSIONS

Based on our review of the data and methods used to calculate the thermal limit, we conclude that the thermal limit of 1.187 is acceptable. This limit may be used by CECo in applicable transient analyses as a limit representing a 95 percent probability of not experiencing Departure from Nucleate Boiling (DNB) at a 95 percent confidence level.

4.0 REFERENCES

1. VIPRE/WRB-1 DNBR Thermal Limit for Westinghouse OFA Fuel, Doc. No. NFSR-0033, Commonwealth Edison Company, October 14, 1988.

2. "Topical Report Evaluations for WCAP-7956, WCAP-8054, WCAP-8762, and WCAP-8567/8568," memo from D. F. Ross (NRC) to D. B. Vassallo (NRC), April 10, 1978.

3. "Factors for One-Sided Tolerance Limits and for Variables Sampling Plans," SCR-607, D. B. Owen, March 1963, Sandia National Laboratories.