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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION RELATED TO THE REVIEW OF ROD SWAP METHODOLOGY FOR NORTHERN STATES POWER COMPANY PRAIRIE ISLAND UNIT NOS. 1 & 2 DOCKET NOS. 50-282 & 50-306

Summary of Report

The report (Ref. 1) describes Northern States Power Company's (NSP) rod swap methodology. Rod Swap is an indirect means of measuring the reactivity worth of each individual bank by "swapping" it with the reference bank which is the highest worth bank. The report describes the calculational procedures used to generate the analytical data, the plant test procedures, the test review and acceptance criteria and the comparisons of the rod swap results with those from boron dilution for Prairie Island Unit 1 Cycle 9 and Prairie Island Unit 2 Cycle 8.

NSP's analytical methods used for this technique are those described in Reference 2. Rod worths are calculated for each bank individually, for banks in the normal boron dilution test sequence, and for each bank in the presence of the reference bank. A critical exchange reference position is calculated for each bank except the reference bank. The test procedure consists of first measuring the worth of the highest worth bank by boron dilution and then measuring each bank by swapping it with the reference bank. The reference bank is determined as the bank with the highest worth when inserted into an otherwise unrodded core. For each test bank, a critical position of the reference bank is determined and used to calculate the worth of the test bank.

The proposed method measures all banks as opposed to measuring only the control banks by the boron dilution method. The rod swap method has additional positive aspects for the licensee including less time involved and less water to process.

Summary of Evaluation

The test procedure proposed by NSP is the same as that used by other rod exchange techniques (Ref. 3 & 4) and is acceptable. The staff has previously reviewed the analytical methods used by NSP and found them acceptable (Ref. 5).

The method for obtaining the measured worth from the test data is similar to that used by Virginia Electric Power Company. NRC accepted this method in 1980 (Ref. 6). The method involves measuring the test bank worth in the

presence of the referenced bank. The calculated worth for the same configuration is compared with the measured worth. The staff finds this technique acceptable.

The licensee has proposed two levels (review and acceptance) of criteria. The review criterion is that each measured bank worth be within ±15% of the predicted value. Since all other banks are compared with the reference bank, the staff suggested an additional review criterion of ±10% on the reference bank. The licensee has agreed to this criterion. The acceptance criterion is that the total measured worth be within ±10% of the total predicted worth. The licensee proposed standard remedial actions if the criteria were not met. These criteria and remedial actions are acceptable. The staff also discussed with the licensee the additional conditions which are necessary for staff approval and these were agreed to by the licensee.

Regulatory Position

The staff has reviewed the rod swap methodology as proposed by NSP. Based on this review, the staff finds this method acceptable for the Prairie Island Nuclear Generating Plant (Units 1 and 2). The staff, however, requires the following conditions be met:

1) Whenever the rod swap technique is used, all banks (control and shutdown) are measured.
2) A review criterion of ±10% is applied to the reference bank..
3) The acceptance criterion of ±10% of total worth is to be applied to the total worth of all banks (control and shutdown).
4) NSP submits the data to NRR within 45 days of the first use of the rod swap technique after this approval for each unit.

Principle Contributor
M. Chatterton

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