



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

ENCLOSURE

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATING TO RELOAD STARTUP PHYSICS TEST PROGRAM

DUKE POWER COMPANY

MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

CATAWBA NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-369 AND 50-370

DOCKET NOS. 50-413 AND 50-414

1.0 INTRODUCTION

By letter dated February 2, 1988, Duke Power Company (DPC), the licensee for the McGuire and Catawba Nuclear Stations, Units 1 and 2, submitted a startup physics test program which would be used for plant cycle startup following a refueling outage. The purpose of the submittal was to formally document the minimum reload physics tests necessary to ensure that the reactor core can be operated as designed. DPC states that there were no significant changes in the proposed physics test program to that currently being performed following refueling at the four units. NRC approval was requested because the proposed reload startup physics program was intended to replace the initial cycle physics test program described in the FSARs.

The DPC startup physics test program is modeled primarily after the ANSI/ANS 19.6.1-1985 standard on reload start-up tests for PWRs. This standard has been extensively reviewed by the staff, as well as others, and incorporates the changes and views suggested by the staff. By letter dated April 18, 1985, this standard was approved with comments by the NRC staff member on the American National Standards Committee N17 on Research Reactors, Reactor Physics, and Radiation Shielding. The standard ANSI/ANS-19.6.1-1985 currently serves as the staff guidance on the minimum startup physics test program for a PWR following a refueling outage.

8805250266 880518
PDR ADOCK 05000369
P PDR

The staff performed an initial review of DPC's February 2, 1988 submittal and by letter dated March 11, 1988, informed DPC that the proposed startup physics test program was unacceptable. A telephone conference call was held on March 24, 1988 to discuss the denial and to identify the means for resolving the staff's concerns. Subsequently, DPC resubmitted its proposed startup physics test program by letter dated April 14, 1988.

The staff's evaluation of the proposed DPC startup physics test program, as resubmitted, follows.

2.0 EVALUATION

Because DPC's proposed startup physics test program is modeled after the ANSI/ANS-19.6.1-1985 standard on reload startup physics tests for PWRs and because this standard provides acceptable guidance on such tests for the staff, our review and evaluation of DPC's test program was performed on the basis of conformance to the standard. The staff's evaluation of each proposed test follows:

A. Critical Boron Concentration Measurement - All Rods Out

DPC has changed the description of the tests initial condition which states that the lead test bank should be inserted to less than 20 inches in the core to state that the lead test bank should be near fully withdrawn. DPC states that this limits the inserted reactivity to the verified measurement range of the reactivity computer (typically + 0.00055 delta rho for positive reactivity insertions) rather than to an arbitrary bank position. This change is acceptable since it meets the intent of standard ANSI-19.6.1-1985.

The staff concludes that the initial conditions, the test method, and acceptance criterion are consistent with the standard and, therefore, this test is acceptable.

B. Isothermal Temperature Coefficient

The staff concludes that the initial conditions, the test method, and acceptance criterion are consistent with the standard and, therefore, this test is acceptable.

C. Control Rod Bank Worth

By letter dated May 22, 1987, the NRC had previously approved DPC's rod swap methodology based upon a two-level set of criteria: (1) review criteria associated with meeting design criteria and (2) acceptance criteria associated with meeting safety analyses assumptions. The review criteria correspond to the recommended test criteria of the ANSI/ANS-19.6.1-1985 standard. DPC states that if a review criteria is missed, remedial action will be taken based on the NRC's May 22, 1987 Safety Evaluation Report on DPC's rod swap methodology. These review and acceptance criteria are acceptable since they meet the intent of the ANSI/ANS-19.6.1-1985 standard.

The staff concludes that the initial conditions, the test method, the review and acceptance criteria, and the fact that all control and shutdown banks will be measured, constitute an acceptable control rod bank worth test program in accordance with the standard and this test is, therefore, acceptable.

D. Flux Symmetry Check Low Power

DPC has changed the upper power level limit of this test from the 30% recommended by the ANSI/ANS-19.6.1-1985 standard to 40% of full rated thermal power. We find that this is acceptable because moderator feedback effects in going from 30% to 40% power are not expected to affect significantly any power distribution asymmetries. This change is desired by DPC to improve scheduling flexibility of testing during the refueling outage.

Rather than using symmetric core locations for performing the test, DPC uses all operable instrumented locations and compares measured to predicted values of $F_{\Delta H}^N$ or normalized reaction rates. This change to the test method is required due to the limited number of quarter core symmetric instrumented locations and the use of a movable fission detector.

The staff concludes that both of the changes described above are acceptable since they meet the intent of the ANSI/ANS-19.6.1-1985 standard with regard to the flux symmetry test at low power. The initial conditions, the test method, and acceptance criteria are consistent with the standard and, therefore, this test is acceptable.

E. Core Power Distribution - Intermediate Power

DPC has changed the lower limit of the power range recommended in the ANSI/ANS-19.6.1-1985 standard from 40% to 50% power. Similarly, DPC has changed the upper limit from 75% to 80% power. These changes in the upper and lower limits have been proposed by DPC to improve scheduling flexibility of testing during the refueling outage. Neither of these changes is of any significance since the intent of the test is to measure the core power distribution at some intermediate power level with broadly defined but arbitrary limits on the power range. Thus the DPC changes meet the intent of the ANSI/ANS-19.6.1-1985 standard for performing a core power distribution measurement at some intermediate power level.

The staff concludes that the initial conditions, the test method and acceptance criteria are consistent with the standard and, therefore, this test is acceptable.

F. Core Power Distribution - High Power

The staff concludes that the initial conditions, test method, and acceptance criteria are in accordance with the standard and, therefore, this test is acceptable.

G. All Rods Out Critical Boron Concentration - High Power

The staff concludes that the initial conditions, test method, and acceptance criterion are in accordance with the standard and, therefore, this test is acceptable.

The ANSI/ANS-19.6.1-1985 standard also requires the measurement of the critical boron concentration at hot, zero power with all control rods inserted. DPC does not explicitly include this test as part of its reload startup physics test program. However, DPC notes that this test would be performed as part of the control rod bank worth test using the rod swap method. The staff concurs with DPC's assessment concerning this test and the changes noted when the reference bank of the rod swap method is used for the test. The staff concludes that DPC's inclusion of this test in the control rod bank worth test is acceptable because the intent of ANSI/ANS-19.6.1-1985 standard with regard to the comparison of measured and predicted differential boron worth is met.

DPC states that the reload startup physics test program is a minimum program. Additional tests will be performed when circumstances or unusual conditions require them. This position is acceptable to the staff and conforms to current industry practices.

3.0 CONCLUSIONS

For the reasons discussed above, the staff concludes that DPC's proposed reload startup physics test program for McGuire and Catawba Nuclear Stations,

Units 1 and 2 is acceptable because it meets, with the changes noted, the intent of the test program discussed in the ANSI/ANS-19.6.1-1985 standard used for staff guidance.