NRC FORM 195 (2-76)

U.S. NUCLEAR REGULATORY COMMISSION

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TO: Mr Rusche	FROM: Duke Pwr Co Raleigh, NC W O Parker Jr	DOCKET NUMBER 50-287 FILE NUMBER
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DESCRIPTION	ENCLOSURE
Ltr re our 10-12-76 ltr....trans the following:	Info relating to startup testing for Cycle 2 ....(1 cy encl rec'd)
PLANT NAME: Oconee #3	ACKNOWLEDGED DO NOT REMOVE

FOR ACTION/INFORMATION ENVIRO 10-28-76 ehf

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✓ ACRS 16 CYS ~~HOLDING~~/SENT To LA Sheppard			

DUKE POWER COMPANY
POWER BUILDING
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WILLIAM O. PARKER, JR.
VICE PRESIDENT
STEAM PRODUCTION

TELEPHONE: AREA 704
373-4083

October 20, 1976

Mr. Benard C. Rusche, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. A. Schwencer

Re: Oconee Unit 3
Docket No. 50-287

Dear Sir:

In response to your letter of October 12, 1976, information relating to startup testing for Oconee Unit 3 Cycle 2 is herewith submitted. Attached are descriptions of tests performed during Zero Power Physics Testing and Power Escalation Testing. Also discussed are acceptance criteria for the tests and the impact of measured parameters in regards to the accident analysis.

A summary report will be submitted within 90 days following the completion of physics testing.

Very truly yours,

William O. Parker Jr. by WAH

William O. Parker, Jr.

EDB:ge
Attachment(s)

TESTS PERFORMED DURING ZERO POWER PHYSICS TESTING

A. Initial Criticality

Initial criticality is achieved by withdrawal of control rods and boron dilution. Plots of inverse multiplication versus control rod position are maintained until the desired rod configuration is achieved. After rod motion has ceased, a steady rate of deboration is initiated, and plots of inverse multiplication versus time and boron concentration are maintained. During inverse multiplication plotting during deboration, at least two plots maintained by two persons using data from two different neutron detector channels are provided.

As an acceptance criterion for this test, the measured critical boron must equal 1200 ppm boron $\pm$ 100 ppm. Should this criterion be exceeded deboration is ceased and an evaluation conducted.

The results of this test has no impact on the Oconee accident analyses.

B. All Regulating Rods Out Boron Concentration

Execution of this test begins by borating regulating rod groups 5 and 6 to 100% withdrawn and group 7 to between 93 and 100% withdrawn. After achieving equilibrium boron conditions, group 7 is withdrawn to 100% withdrawn and the resulting reactivity change calculated by the reactimeter is recorded. The sum of the equilibrium boron concentration and the boron worth equivalent to the group 7 withdrawal is equal to the all rods out boron concentration.

A measured concentration of 1253 ppm boron $\pm$ 100 ppm borom is the acceptance criteria for this test.

This test does not directly relate to the Oconee accident analyses.

C. Temperature Coefficient of Reactivity

This test is executed by establishing equilibrium critical conditions in the reactor, then changing reactor coolant average temperature $\pm$ 5°F and compensating the reactivity addition with control rod movement. The reactimeter records these compensating movements as changes in reactivity to maintain the same relative power level. The differences in reactivities divided by the difference in temperatures and corrected for measurement uncertainties is the calculated temperature coefficient of reactivity. The moderator temperature coefficient is calculated by subtracting the isothermal doppler coefficient from the measured temperature coefficient.

The acceptance criteria for this test requires that the measured value of the temperature coefficient must equal that of the calculated value at the same boron concentration within $\pm$ 0.4 x 10E-4(DK/K)/°F., and that the calculated moderator temperature coefficient must be less than 0.5 x 10E-4(DK/k)/°F.

A non-positive moderator temperature coefficient at power levels above 95% of rated power is required such that the maximum clad temperatures will not exceed the Final Acceptance Criteria based on LOCA analyses. Below 95% of rated power, the Final Acceptance Criteria will not be exceeded with a positive moderator temperature coefficient of $+0.9 \times 10^{-4} \times (DK/K)/^{o}F$., corrected to 95% rated power. The FSAR analyses of other accidents assume a value of 0.5×10^{-4} $(DK/K)/^{o}F$ for the moderator temperature coefficient.

D. Regulating Rod Worth Measurements

After achieving critical steady state conditions, a boron concentration necessary to deborate control rod groups 7 and 6 to 0% withdrawn and group 5 to approximately 10% withdrawn is calculated. Deboration is commenced, and chemistry sampling is initiated on a 30 minute frequency. The resulting reactivity change is compensated for by inserting the control rod group at least every 300 micro rho and is recorded by the reactimeter. The differential worth is then calculated by dividing the difference in reactivity by the difference in control rod position, integral worths being, the sum of the differential worths.

If, after measurement of the integral worth for control rod groups 5 through 7, the measured value falls within 10% of the predicted value, the test is concluded. Should the integral value error be greater than 10%, control rod group 4 will be measured by boron swap as above. Should this integral worth value of control rod groups 4 through 7 be less than 10% in error, the test is concluded. If the error is between 10 and 15%, an evaluation must be made before proceeding with the zero power and power escalation sequence tests. Should the error be greater than 15%, the discrepancy must be resolved before power escalation may begin.

The deviations from calculated values used above are the results of both calculational and measurement uncertainties in order to provide a conservative result.

E. Boron Worth Measurements

The data acquired for the regulating rod worth measurements is used to calculate the differential boron worth in the following manner:

$$DBW = (DP)/(B2-B1)$$

where:

DBW = Differential Boron Worth

DP = Total Reactivity Change from Boron Concentration 1 and 2

B2 = Final Boron Concentration

B1 = Initial Boron Concentration

The measured differential boron worth must equal that of the predicted value at the same concentration to within $\pm$ 10%.

The results of this test has no direct impact on the Oconee accident analyses.

F. Ejected Rod Worth Measurement

In order to determine the worth of the worst case ejected control rod, the reactor is first stabilized at steady state critical conditions. The final boron concentration required to withdraw the worst case ejected rod to 100% withdrawn is calculated and boration is begun. Boron concentration by chemical analysis is then obtained every 30 monutes while the worst case ejected rod is withdrawn to compensate for boron injection. During movement of the worst case ejected rod to maintain power, the resulting reactivity changes are recorded by the reactimeter. After achieving 100% withdrawal of the worst case ejected rod, the rod is returned to 0% withdrawn using group 5 for reactivity compensation. The measured worth of the worst case ejected rod is the sum of the incremental reactivity additions recorded by the reactimeter.

As an acceptance criterion, the error adjusted worth of the ejected rod must not be in excess of 1.0% DK/K.

The above criterion must be met in order to assure the validity of the ejected rod accident analysis.

TESTS PERFORMED DURING POWER ESCALATION TESTING

A. Core Power Distribution

At equilibrium conditions of 40, 75 and 100% full power, the core power distribution test is executed in the following manner. Selected formats of output are demanded from the on-line computer and checked for:

1) Reasonable SPND background readings and background corrections

2) Reactor power imbalance values

3) Worst case extrapolated minimum DNBR

4) Quadrant power tilt

5) Extrapolated worst case maximum linear heat rate

6) Non-extrapolated worst case maximum linear heat rate

7) Radial and total power peaking factors

8) Reasonable tilt and imbalance values from backup incore detectors

As acceptance criteria the values obtained above must be within the limits specified by the Oconee Technical Specifications. This criteria assures that steady state conditions do not exceed those postulated for peaking and linear heat rate in the accident analyses.

B. Power Imbalance Detector Correlation Test

This test is performed at 75% full power by obtaining imbalances of -5, -10, -15, -20, 0 and +5% or the maximum imbalance possible by movement of the axial power shaping rods. Various data values are obtained from which the offsets, imbalances, maximum linear heat rates and DNB ratios for each imbalance condition are calculated. From these calculated values, comparisons are made to assure acceptable deviations from allowable limits. All offset and imbalance values must fall within the acceptable limits set for each detector system to assure that DNBR and maximum heat rate limits are not exceeded.

C. Reactivity Coefficients at Power

While at the 100% full power test plateay the temperature and power doppler coefficients of reactivity is measured by the following method. The controlling rod group differential reactivity is measured by the rapid insert/withdraw technique prior to and after each temperature/power change.

In order to measure the temperature coefficient, the average reactor coolant temperature is decreased and then increased by 5 °F. Compensating reactivity associated with each temperature change is obtained from the change in controlling rod group position and the coefficient is calculated from this information.

The power doppler coefficient is determined in a similar manner by decreasing and increasing reactor power by 5% full power while noting compensating control rod position changes.

Acceptance criteria require that the power coefficient of reactivity must be less than -0.55 x 10E-4(DK/K)/%FP, while the moderator temperature coefficient must not be positive at power levels above 95% full power. These limits assure that the values of doppler and moderator temperature coefficients assumed in the accident analyses continue to be conservative.