Letter to N. C. Moseley from Duke Power Company dated April 14, 1975.

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A. C. THIES
SENIOR VICE PRESIDENT
PRODUCTION AND TRANSMISSION

P. O. BOX 2178

April 14, 1975

Mr. Norman C. Moseley, Director
U. S. Nuclear Regulatory Commission
Suite 818
230 Peachtree Street, Northwest
Atlanta, Georgia 30303

Re: Oconee Unit 1
Docket No. 50-269

Dear Mr. Moseley:

The following information concerning the hot zero power ejected rod worth measurement and the evaluation of the results thereof for Oconee 1, Cycle 2 is submitted as a special report.

The hot zero power ejected rod worths for Oconee 1, Cycle 2 were measured during the zero power physics testing on March 10 and 11, 1975. The purpose of these measurements was to verify that the measured maximum ejected rod worth at hot zero power conditions (a) is less than the Technical Specification 3.5.2.3 limit of 1.0% $\Delta k/k$ when the reactor is critical with a normal control rod configuration and (b) compare acceptably with the predicted value of $0.9 \pm 0.1\%$ $\Delta k/k$.

The measurements were performed at zero power, 532°F, and 2155 psig conditions on control rods at core locations L-14 (Group 6 rod) and H-8 (Group 7 rod) predicted to yield the maximum ejected rod worth. The test method consisted of moving the designated control rod from the fully inserted position to the fully withdrawn position, compensating for the resulting reactivity change by either Control Rod Group 5 insertion or boron addition to the reactor coolant. In order to compare the measured ejected rod worths with the predicted values, which were based on Group 5 at 0% wd, the measured ejected rod worths were extrapolated, where applicable, to Group 5 at 0% wd condition by using the correlation between ejected rod worth and inserted control rod group worth. The results of the measurements indicated that the ejected rod worths would be less than the 1.0% $\Delta k/k$ limit when the reactor is critical with the normal control rod configuration of Group 5 at 50% wd and Groups 6 and 7 fully inserted. However, the measured ejected rod worth at core location H-8 was 1.13% $\Delta k/k$ when Group 5 was at a 9% wd position, thus exceeding

the predicted value of 0.9 ± 0.1% Δk/k. Therefore, in order to preclude any possibility of exceeding the Technical Specification limit on ejected rod worth, an administrative control requiring Group 5 to be at least 60 percent withdrawn prior to reactor criticality and during normal low power operation was invoked.

The initial calculations of the ejected rod worths were performed using a simplified PDQ model, which had compared favorably with the Cycle 1 measurements. The maximum ejected rod worth for the beginning of Cycle 2 was predicted to be 1.02% Δk/k at core location L-14. Based on the correlation between calculated and measured ejected rod worths available in November 1974 in B&W reactors, B&W expected the measurement to yield a value of 0.9 ± .1% Δk/k. However, calculations performed using a more detailed PDQ model with finer mesh spacings predicted a maximum ejected rod worth of 1.2% Δk/k at core location H-8.

Because of the conflict in predictions (finer mesh spacing calculations versus correlations with previous Cycle 1 measurements), establishment of the maximum ejected rod worth value was deferred until the measurements could be performed. The results of the measurements agreed very closely with the finer mesh spacing model results, as shown in Enclosure 1. Thus the discrepancy between measured and predicted ejected rod worths has resulted from using a simplified model.

The variation of the ejected rod worth with core lifetime, as predicted by the more detailed model, is such that the maximum ejected rod worth (with Group 5 fully inserted) increases from 1.2% Δk/k at the beginning-of-cycle to 1.25% Δk/k at 50 EFPD, becomes 0.74% Δk/k following the control rod interchange at 50 EFPD, and increases to 0.80% Δk/k at the end-of-cycle. Duke and B&W have reviewed the results of this more detailed model calculation along with the measurement results and have determined that withdrawing Control Rod Group 5 to a minimum 60% withdrawn position prior to criticality and during normal low power operation will assure adequate margin for the 1.0% Δk/k Technical Specification limit until the control rod interchange. After the control rod interchange, no minimum withdrawal of the regulating groups (5, 6 and 7) is required to assure that the 1.0% Δk/k Technical Specification limit is met.

Thus, the discrepancy between the measured ejected rod worths and their predicted values for Oconee 1, Cycle 2 has been satisfactorily resolved; and appropriate administrative controls have been implemented for ensuring an adequate margin for the Technical Specification limit on ejected rod worths.

Very truly yours,

A. C. Thies

ACT:vr
Enclosure

Enclosure 1

COMPARISON OF MEASURED EJECTED ROD WORTHS WITH CALCULATED VALUES

(Oconee 1, Cycle 2, BOL, Zero Power, 532°F, and 21.5 psig Conditions)

Core Location of Control Rod for Ejected Rod Worth Measurement	Test Method	Control Rod Group 5 Position When The Designated Ejected Rod is Fully Withdrawn (% wd)	Ejected Rod Worth (% Δk/k)		
			Measured Worth	Measured Worth When Extrapolated to Group 5 Position of 0% wd	Calculated Worth
L-14	Rod Swap	8	0.46	0.50	0.58
L-14	Rod Swap	51	0.20		
L-14	Rod Swap	78	0.15		
H-8	Rod Swap	9	1.13	1.20	1.20
H-8	Boron Swap	62	0.64		

Note: Extrapolation of measured ejected rod worths to Group 5 at 0% wd condition is valid only for those cases when Group 5 is less than 20% wd.

Calculated ejected rod worths correspond to Group 5 at 0% wd condition.