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JAN 21 1977

Docket No. 50-346

Toledo Edison Company
 ATTN: Mr. Lowell E. Roe
 Vice President, Facilities
 Development
 Edison Plaza
 300 Madison Avenue

Gentlemen:

bcc: JRBuchanan, NSIC, TBAbernathy, TIC

EFFECTS OF FUEL ROD BOWING ON DEPARTURE FROM NUCLEATE BOILING

On August 9, 1976, Westinghouse Electric Corporation presented data to the NRC staff which showed that previously developed methods for accounting for the effect of fuel rod bowing on departure from nucleate boiling may not contain adequate thermal margin when unheated rods (such as thimble tubes) are present. We have evaluated the impact of the Westinghouse data on all operating pressurized water reactors (PWR's). Models for treating the effects of fuel rod bowing on thermal-hydraulic performance have been derived for all PWR's. The models are based on the propensity of the individual fuel designs to bow and on the thermal analysis methods used to predict the coolant conditions for both normal operation and anticipated transients.

The staff has reviewed the extent of rod bowing which occurs with Babcock & Wilcox (B&W) fuel. Based on this review, an equation was derived for the clearance reduction between fuel rods due to fuel rod bowing as a function of burnup:

$$\frac{\Delta C}{C_0} = a + b \sqrt{BU}$$

where $\frac{\Delta C}{C_0}$ is the fractional amount of closure

Bu is the bundle average burnup, and a, b are empirical constants fitted to B&W rod bow data.

The reduction in departure from nucleate boiling ratio (DNBR) due to fuel rod bowing is assumed to vary linearly with the reduction in clearance between the fuel rods (or fuel rod and thimble rod) but can

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never be lower than that due to the pitch reduction factor used by the manufacturers of reactor cores to account for the reduction in DNBR due to pitch reduction from fabrication tolerances and initial rod bow.

You are requested to consider a rod bow penalty for the Davis-Besse Nuclear Power Station Unit No. 1 as described in Section 3.2 of our "Interim Safety Evaluation Report on Effects of Fuel Rod Bowing on Thermal Margin Calculations for Light Water Reactors", a copy of which is enclosed. As discussed in Section 3.2 of that report, you should use the rod bow versus burnup curve appropriate to your fuel in conjunction with the Westinghouse curve of DNBR reduction versus rod bow to determine the reduction in DNBR as a function of burnup. In determining a rod bow penalty, you may propose appropriate thermal margins as discussed in Section 2.5 of that report to help offset the DNBR reduction. You are also requested to provide us with your plans for accommodating any resulting rod bow penalty in your proposed technical specification operating limits.

Please provide the information requested above for our review by February 1, 1977.

Sincerely,

Original Signed by
John F. Stolz

John F. Stolz, Chief
Light Water Reactors
Branch No. 1
Division of Project Management

Enclosure:
As stated

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