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Docket No. 50-29

SEP 1 8 1975

Yankee Atomic Electric Company
ATTN: Mr. C. Carl Andognini, Assistant
to the Vice President
20 Turnpike Road
Westboro, Massachusetts 01581

Gentlemen:

RE: Yankee-Rowe Atomic Power Station

The Commission has recently formulated a position with respect to review of licensee proposals for utilizing Constant Axial Offset Control (CACC) with peaking factors lower than 2.32 or a ΔI band wider than ±5% in Westinghouse reactors.

Since you may sometime find it necessary to make such a proposal, this position, Branch Technical Position CPB 4.3-1, is enclosed for your use. It is to be incorporated into the Commission's Standard Review Plans.

Sincerely,

THIS DOCUMENT CONTAINS
POOR QUALITY PAGES

Original signed by
R. A. Purple

Robert A. Purple, Chief
Operating Reactors Branch #1
Division of Reactor Licensing

Enclosure:
Branch Technical Position,
CPB 4.3-1

cc w/enclosure:
See next page

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cc: Mr. Donald G. Allen, President
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BRANCH TECHNICAL POSITION CPB 4.3-1
WESTINGHOUSE CONSTANT AXIAL OFFSET CONTROL (CAOC)

BACKGROUND

In connection with the staff review of WCAP-8185 (17x17), we reviewed and accepted a scheme developed by Westinghouse for operating reactors in such a fashion that throughout the core cycle including during the most limiting power maneuvers the total peaking factor, F_Q, will not exceed the value consistent with the LOCA or other limiting accident analysis. This operating scheme called constant axial offset control (CAOC), involves maintaining the axial flux difference within a narrow tolerance band around a burnup-dependent target in an attempt to minimize the variation of the axial distribution of xenon during plant maneuvers.

Originally (early '74), the maximum allowable F_Q (for LOCA) was 2.5 or greater. Later (late '74), when needed changes were made to the ECCS evaluation model, Westinghouse, in order to meet physics analysis commitments to all its customers at virtually the same time, did a generic analysis (one designed to suit a spectrum of operating and soon-to-be-operating reactors) and showed that most plants could meet the requirements of Appendix K and CFR 50.46 (i.e., 2200°F peak clad temperature) if $F_Q \leq 2.32$. Also, Westinghouse showed that CAOC procedures employing a $\pm$ 5% target band would limit peak F_Q for each of these reactors to less than 2.32.

We recognized at that time, however, that not all plants needed to maintain F_Q below 2.32 to meet FAC, or, needed to operate within a $\pm$ 5% band to achieve $F_Q \leq 2.32$. In fact, Point Beach was allowed to operate with a wider band because the Wisconsin Electric Power Company demonstrated to our satisfaction that the reactors could be maneuvered within a wider band (+6,-9%) and still hold F_Q below 2.32. We fully expected that in time most plants would have individual CAOC analyses and procedures tailored to the requirements of their plant-specific ECCS analyses.

Therefore, when we accepted CAOC it was not just $F_Q = 2.32$ and a ± 5% band width we were approving, but the CAOC methodology. This is analogous to our review and approval of ECCS and fuel performance evaluation models.

The CAOC methodology, which is described in WCAP-8385 (Ref. 1), entails (1) establishing an envelope of allowed power shapes and power densities, (2) devising an operating strategy for the cycle which maximizes plant flexibility (maneuvering) and minimizes axial power shape changes, (3) demonstrating that this strategy will not result in core conditions that violate the envelope of permissible core power characteristics, and (4) demonstrating that this power distribution control scheme can be effectively supervised with out-of-core detectors.

Westinghouse argues that point 3, above, is achieved by calculating all of the load follow maneuvers planned for the proposed cycle and showing that the maximum power densities expected are within limits. These calculations are performed with a radial/axial synthesis method which has been shown to predict conservative power densities when compared to experiment. While we have accepted CAOC on the basis of these analyses, we have also required that power distributions be measured throughout a number of representative (frequently, limiting) maneuvers early in cycle life to confirm that peaking factors are no greater than predicted. Additionally, we are sponsoring a series of calculations at BNL to check aspects of the Westinghouse analysis.

The power distribution measurement tests described above will, of course, automatically relate incore and excore detector responses, and thereby validate that power distribution control can be managed with excore detectors.

BRANCH TECHNICAL POSITION

Whenever an applicant or licensee proposes CAOC for other than $F_Q = 2.32$ and $\Delta I = \pm 5\%$ he is expected to provide:

1. Analyses of F_Q x power fraction showing the maximum $F_Q(z)$ at power levels up to 100% and DNB performance with allowed axial shapes relative to the design bases for overpower and loss of flow transients. The envelope of

these analyses must be shown to be valid for all normal operating modes and anticipated reactor conditions. (See Table 1 of Reference 2 for the cases which must be analyzed to form such an envelope.)

2. A description of the codes used, how cross-sections for cycle were determined, and what F_{xy} values were used.

3. A commitment to perform load-follow tests wherein F_Q is determined by taking incore maps during the transient (NOTE: Westinghouse has outlined for both the NRC staff and the ACRS an augmented startup test program designed to confirm experimentally the predicted power shapes. The details of this program will be disclosed in a soon-to-be-issued WCAP report. The tests will be carried out at several representative - both 15x15 and 17x17 - reactors. We have endorsed these tests as has the ACRS in its June 12, 1975 Diablo letter. In addition, for the near term, we plan to require that those licensees who propose to depart from the previously approved peaking factor and target band width perform similar tests, precisely which ones to be determined on a case-by-case basis, to broaden our confidence in analytical methods by extending the comparison of prediction with measurement to include more and more burnup histories.)

<u>REFERENCE</u>

1. T. Morita, et al., "Power Distribution Control and Load Following Procedures," WCAP-8403, Westinghouse Electric Corporation, September 1974. (Ed. Note - WCAP-8403 and -8385 are the non-proprietary and proprietary versions of the same document.)

2. C. Eicheldinger, Westinghouse Electric Corporation, letter to D. B. Vassallo, U.S. Nuclear Regulatory Commission, July 16, 1975.