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FLORIDA POWER & LIGHT COMPANY

REGULATORY FILE COPY

November 24, 1976
L-76-404

Office of Nuclear Reactor Regulation
Attention: Mr. Victor Stello, Director
Division of Operating Reactors
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555



Dear Mr. Stello:

Re: Turkey Point Unit 4
Docket No. 50-251
Heat Flux Hot Channel Factor (Fq)

In letters L-76-300 of August 19, 1976 and L-76-307 of August 25, 1976, Florida Power & Light Company described the reduction of the maximum allowable Heat Flux Hot Channel Factor (Fq) from 2.32 to 2.11. The reduction was caused by a change in the assumed reactor vessel upper head water temperature and by the effects of plugged steam generator tubes.

Since then, developments regarding the cracking of small bend radius steam generator tubes at another utility have led to additional tube plugging and a further reduction in the maximum allowable Fq from 2.11 to 2.08. Additional information regarding the revised Fq limit is attached.

Very truly yours,

Robert E. Uhrig
Vice President

REU/MAS/cpc

Attachment

cc: Mr. Norman C. Moseley
Robert Lowenstein, Esquire



12021

ATTACHMENT

Developments regarding the cracking of small bend radius steam generator tubes at VEPCO's Surry Unit 2 have led to steam generator tube inspections at Surry Units 1 and 2 and FPL's Turkey Point Unit 4. The overall inspection program was described in our letter L-76-369 of October 26, 1976. Significant inspection results and the hypothesis that was developed to explain the cracking phenomenon are contained in VEPCO letter 260B/092276 of November 15, 1976 and FPL letter L-76-403 of November 24, 1976. The corrective action being taken to return Turkey Point Unit 4 to service is also contained in L-76-403. The corrective action will consist of plugging all Row 1 tubes in all three Unit 4 steam generators. An additional 32 tubes will be plugged in steam generator 4B as a result of the sample removal operations. Thus, an additional 2.9% of the total number of Unit 4 steam generator tubes will be plugged as a result of the small bend radius tube inspections. To accommodate the effects of additional plugged steam generator tubes, the Unit 4 Fq limit will be further reduced from 2.11 to 2.08. The new Unit 4 Fq limit was derived as shown below:

$$[2.32 - A - B + C]\ D = 2.08$$

2.32 = previous limit on Fq

A = .31 = estimated reduction in Fq due to increase in upper head temperature from $T_{cold}$ to $T_{hot}$

B = .07 = estimated reduction in Unit 4 Fq due to plugged steam generator tubes

C = .05 = estimated increase in Fq due to the fact that the ECCS analysis peak clad temperature is 50° below the Final Acceptance Criteria

$D = \frac{2300}{2200}$ = factor for increasing Fq due to operation 100 Mwt below the power level used in the ECCS analysis

Since the limiting Fq is now 2.08, new analyses for normal operational modes and anticipated reactor conditions were performed by Westinghouse Electric Corporation for the remainder of core Cycle 3 for Turkey Point Unit 4. The power peaking calculations were made for operation without part length rods and were performed in accordance with the eighteen case analysis procedure accepted by the NRC for peaking factor reduction below 2.32. These calculations considered (1) operation in Mode A only, (2) different control strategies to minimize the duty on the plant's boron system and to bracket the plant operational techniques, and (3) load follow cycles for various part power levels.

ATTACHMENT (Continued)

Figure 1 shows that the locus of peaking factors, Fq·P, for CAOC operation within a ±5%ΔI band are within the previously limiting 2.11 envelope for Turkey Point Unit 4, Cycle 3, beyond the current burnup. It also shows that the locus of peaking factors is less than the new limit of 2.08.

The synthesis method of peaking factor calculations, the computer codes, and the cross-section generation procedures used were all identical to those described in "Topical Report - Power Distribution Control and Load Following Procedures", WCAP 8385 (Westinghouse Proprietary) and WCAP 8403 (Non-Proprietary), September, 1974. The values of $F_{xy}$ used in the synthesis of Fq for the unrodded and rodded planes are:

$$F_{xy}^{ARO}(Z) = \text{Max}\left[1.435,\ F_{xy}^{3D,ARO}(Z) \cdot \frac{F_{\Delta H}^{2D,ARO}}{F_{\Delta H}^{3D,ARO}} \cdot 1.03\right]$$

$$F_{xy}^{ROD}(Z) = \text{Max}\left[1.58,\ F_{xy}^{3D}(Z) \cdot \frac{F_{\Delta H}^{2D,ROD}}{F_{\Delta H}^{3D,ROD}} \cdot 1.03\right]$$

BOL, HFP, equilibrium Xenon conditions

The previous DNB analysis of axial power shapes resulting from Mode A operation with a ±5%ΔI operating band showed that the DNB design basis was met for an Fq·P upper envelope of 2.32. A reanalysis was not required for the lower Fq·P envelope of 2.08 since the ΔI operating band was unchanged.

Based on the above information, it is seen that the peaking factor and DNBR criteria can be met for operation of the remainder of Cycle 3 for Turkey Point Unit 4 at 100% power using the existing constant axial offset control procedures and relying only upon excore detector monitoring.

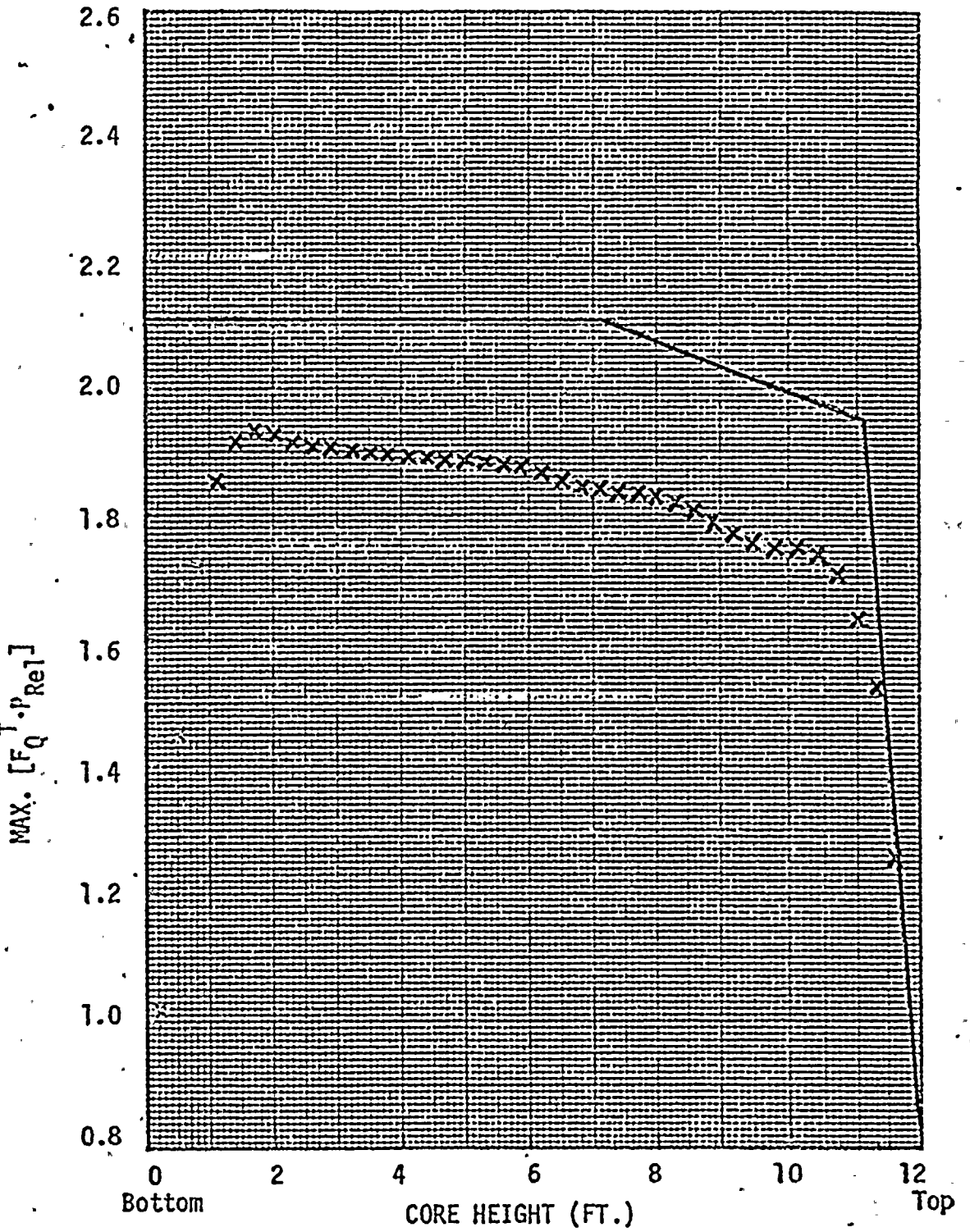


FIGURE 1 MAXIMUM $F_Q^T \cdot P_{Rel}$ Vs. AXIAL HEIGHT DURING NORMAL CORE OPERATION

TURKEY POINT UNIT NO. 4

CYCLE 3, BURNUP $\geq$2000 MWD/MTU