FENOC
FirstEnergy Nuclear Operating Company

Beaver Valley Power Station
P.O. Box 4
Shippingport, PA 15077-0004

Lew W. Myers
Senior Vice President

412-393-5234
Fax: 724-643-8069

March 24, 2000
L-00-029

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Subject: Beaver Valley Power Station, Unit No. 1
Docket No. 50-334, License No. DPR-66
Cycle 14 Reload and Core Operating Limits Report

Beaver Valley Power Station, Unit No. 1 completed the thirteenth cycle of operation on February 15, 2000, with a burnup of 18199.53 MWD/MTU. This letter describes the Cycle 14 reload design, provides a copy of the Core Operating Limits Report (COLR) in accordance with Technical Specification 6.9.5, and documents our review in accordance with 10 CFR 50.59 including our determination that no unreviewed safety question is involved.

The Cycle 14 core configuration features a low leakage pattern and involves replacing 1 Region 1, 12 Region 10B, 8 Region 12, 20 Region 13A and 13B and 28 Region 14A and 14B fuel assemblies with 9 reinserted Region 1, 40 fresh Region 16A fuel assemblies enriched to 4.20 nominal weight percent, and 20 fresh Region 16B fuel assemblies enriched to 4.60 nominal weight percent. The center fuel assembly from Region 1 will be replaced with another Region 1 fuel assembly from Cycle 1.

The mechanical design of the Region 16A and 16B fuel assemblies is similar to the previous reload fuel assemblies except for the following changes:

1) The top and bottom inconel grids have changed from a double twist tab of the inner-to-outer strap joint to a 3-tab inner-to-outer joint configuration. The previous configuration for the inner-to-outer strap joint in the 17X17 top and bottom inconel grids incorporated two twist tabs which protruded entirely through the outer strap. The twist tabs hold the outer strap in place during brazing of the grid and are ground flush with the outer strap after brazing.

   The 3-tab design incorporates a tab at the center of the interface and two twist tabs at each extremity. The new center tab extends almost completely through the outer strap, therefore eliminating the need to grind off the tab after brazing. The two twist tabs provide additional strength at

A001

the extremities of the interface, which is where cracking of the braze material has been observed in the past for the previous joint design.

2) The axial blankets for Regions 16A and 16B will have annular pellets in the Integral Fuel Burnable Absorber (IFBA) rods only. Annular pellets in the axial blankets provide additional void volume to provide increased rod internal pressure margin.

3) The elimination of the top nozzle instrumentation plug is a design change that reduces the total number of component parts required to fabricate and assemble a 17X17 fuel assembly. The new design eliminates the instrumentation plug that has to be welded into a counterbore in the top nozzle adapter plate and replaces it with a blind hole with a small weep hole that is machined into the top nozzle adapter plate. The purpose of this change is for a manufacturing process improvement to increase manufacturing flexibility. The design change meets all functional and design requirements specified for the top nozzle, and does not adversely impact the form, fit or function of the fuel assembly.

4) Low Force top nozzle assemblies are the result of a spring force optimization effort for plants with the VANTAGE+ fuel assembly type (i.e., ZIRLO™ thimbles, VANTAGE+ holddown springs and fuel assembly length = 156.300 inch). The goal was to minimize the excess holddown force to make them less susceptible to Incomplete Rod Insertion (IRI).

   The spring pack on the Low Force top nozzle assembly is 0.260 inch shorter than the VANTAGE+ spring pack and was designed and tested to ensure that its spring rate is the same as that of a VANTAGE+ spring pack. In addition, a holddown spring force evaluation has confirmed that the Low Force top nozzle maintains its low force capabilities while still meeting design requirements.

Eight Power Suppression Assemblies (PSAs) will continue to be utilized as in previous cycles. The PSAs, located on the core periphery, contain hafnium rodlets to reduce local neutron leakage near the reactor vessel lower plate.

These modifications meet fuel assembly and rod design criteria and will not adversely affect the core safety considerations. Fuel rod design evaluations for the new fuel were performed using NRC approved methodology to demonstrate that the fuel rod design bases are satisfied.

FirstEnergy Nuclear Operating Company has performed a review of this reload core design including a review of the core characteristics to determine those parameters affecting the postulated accidents described in the Updated Final Safety Analysis Report (UFSAR). The consequences of those accidents described in the UFSAR which could potentially be affected by the reload core characteristics were evaluated in accordance with the NRC approved methodology described in WCAP-9272-P-A "Westinghouse Reload Safety Evaluation Methodology." The effect of the reload design was either accommodated within the conservatisms of the assumptions used in the current analysis design basis, or it was demonstrated through evaluation that the reload parameters would not change the conclusions of the UFSAR.

No technical specification changes are required as a result of this reload design.

The Core Operating Limits Report (COLR) is enclosed in accordance with Technical Specification 6.9.5.d. The COLR has been updated for this cycle by 1) revising the Technical Specification location in the first paragraph pursuant to Amendment No. 220, 2) revising the figure numbers referenced on pages 4.1-1 and 4.1-2 to coincide with the Figures shown on pages 4.1-3 through 4.1-6, 3) revising the CF_Q design limit from 2.4 to 2.3 on page 4.1-1 in order to use available design margin in the current fuel design to demonstrate continued compliance with peak clad temperature limits for Large Break LOCA analysis [Reference Letter L-99-163 dated November 4, 1999, ECCS Evaluation Models], 4) revising the radial peaking factor at rated thermal power [F_{XY} (RTP)] limits for unrodded core planes on page 4.1-2, and 5) revising Figure 4.1-4 to address the maximum total peaking factor times relative power limits for the Cycle 14 core.

The Beaver Valley Onsite Safety Committee and Nuclear Safety Review Board have reviewed the Reload Safety Evaluation and COLR and determined that this reload design will not adversely affect the safety of the plant and does not involve an unreviewed safety question.

Sincerely,

Lew W. Myers

Lew W. Myers

Enclosure

c: Mr. D. S. Collins, Project Manager
Mr. D. M. Kern, Sr. Resident Inspector
Mr. H. J. Miller, NRC Region I Administrator
Mr. L. E. Ryan (BRP/DEP)
Mary E. O'Reilly (FirstEnergy Legal Department)

4.1 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report provides the cycle specific parameter limits developed in accordance with the NRC approved methodologies specified in Technical Specification Administrative Control 6.9.5.

Specification 3.1.3.5 Shutdown Rod Insertion Limits

The shutdown rods shall be withdrawn to at least 225 steps.

Specification 3.1.3.6 Control Rod Insertion Limits

Control Banks A and B shall be withdrawn to at least 225 steps.

Control Banks C and D shall be limited in physical insertion as shown in Figure 4.1-1.

Specification 3.2.1 Axial Flux Difference

NOTE: The target band is $\pm 7\%$ about the target flux from 0% to 100% RATED THERMAL POWER.

The indicated Axial Flux Difference:

a. Above 90% RATED THERMAL POWER shall be maintained within the $\pm 7\%$ target band about the target flux difference.

b. Between 50% and 90% RATED THERMAL POWER is within the limits shown on Figure 4.1-2.

c. Below 50% RATED THERMAL POWER may deviate outside the target band.

Specification 3.2.2 $F_Q(Z)$ and F_{xy} Limits

$$F_Q(Z) \leq \frac{CF_Q}{P} * K(Z) \qquad \text{for } P > 0.5$$

$$F_Q(Z) \leq \frac{CF_Q}{0.5} * K(Z) \qquad \text{for } P \leq 0.5$$

Where: $CF_Q = 2.3$ $\qquad P = \dfrac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$

K(Z) = the function obtained from Figure 4.1-3.

The F_{xy} limits [$F_{xy}(L)$] for RATED THERMAL POWER within specific core planes shall be:

$F_{xy}(L) = F_{xy}(RTP)(1 + PF_{xy} * (1-P))$

Where: For all core planes containing D-Bank:

$F_{xy}(RTP) \leq 1.71$

For unrodded core planes:

$F_{xy}(RTP) \leq 1.76$ from 1.8 ft. elevation to 3.0 ft. elevation

$F_{xy}(RTP) \leq 1.83$ from 3.0 ft. elevation to 6.6 ft. elevation

$F_{xy}(RTP) \leq 1.81$ from 6.6 ft. elevation to 7.8 ft. elevation

$F_{xy}(RTP) \leq 1.76$ from 7.8 ft. elevation to 9.6 ft. elevation

$F_{xy}(RTP) \leq 1.70$ from 9.6 ft. elevation to 10.2 ft. elevation

$PF_{xy} = 0.2$

$$P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$$

Figure 4.1-4 provides the maximum total peaking factor times relative power ($F_Q^T * P_{rel}$) as a function of axial core height during normal core operation.

Specification 3.2.3 $F^N_{\Delta H}$

$F^N_{\Delta H} \leq CF_{\Delta H} * (1 + PF_{\Delta H} (1-P))$

Where: $CF_{\Delta H} = 1.62$

$PF_{\Delta H} = 0.3$

$$P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$$

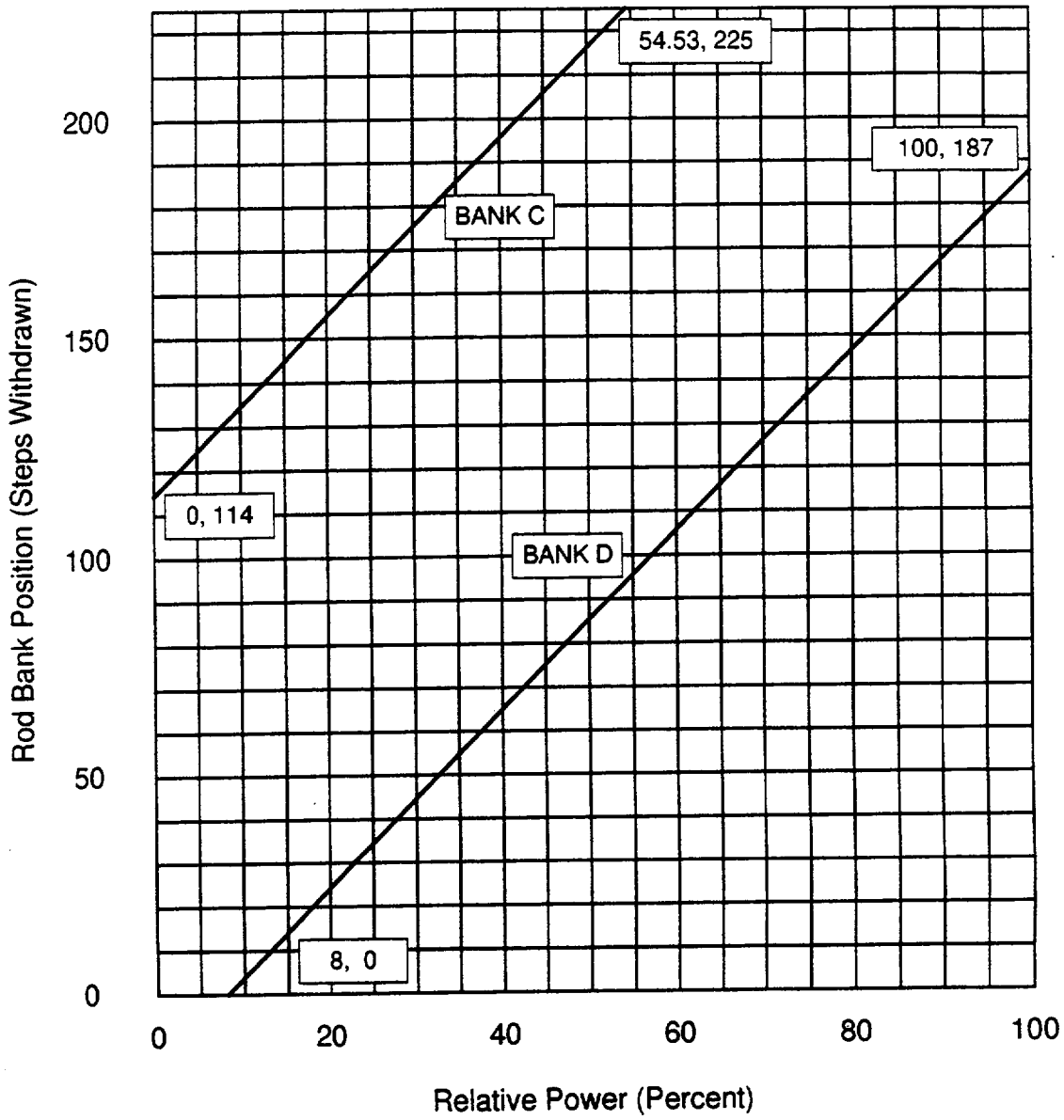


FIGURE 4.1-1
CONTROL ROD INSERTION LIMITS

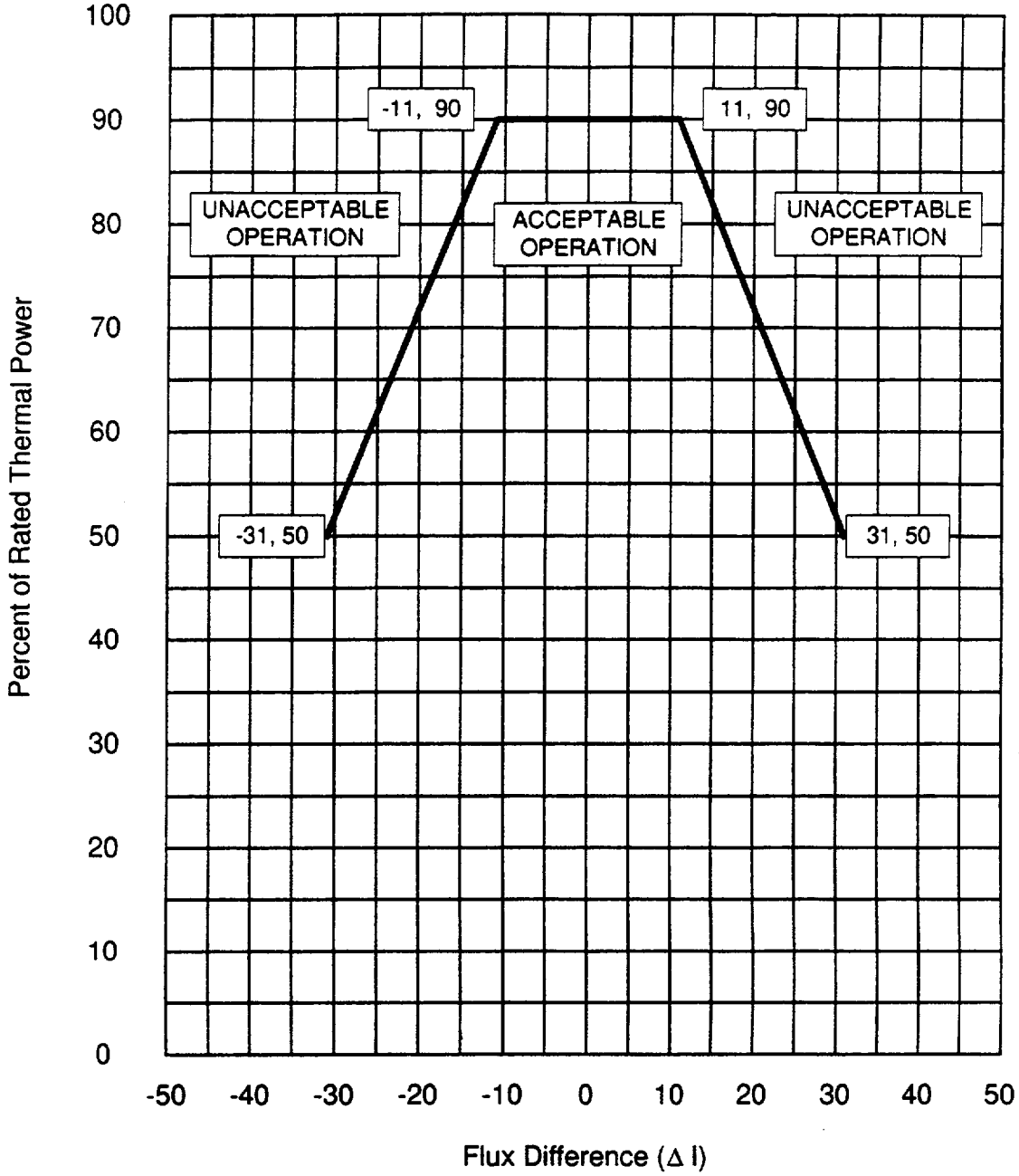


FIGURE 4.1-2
AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF RATED THERMAL POWER

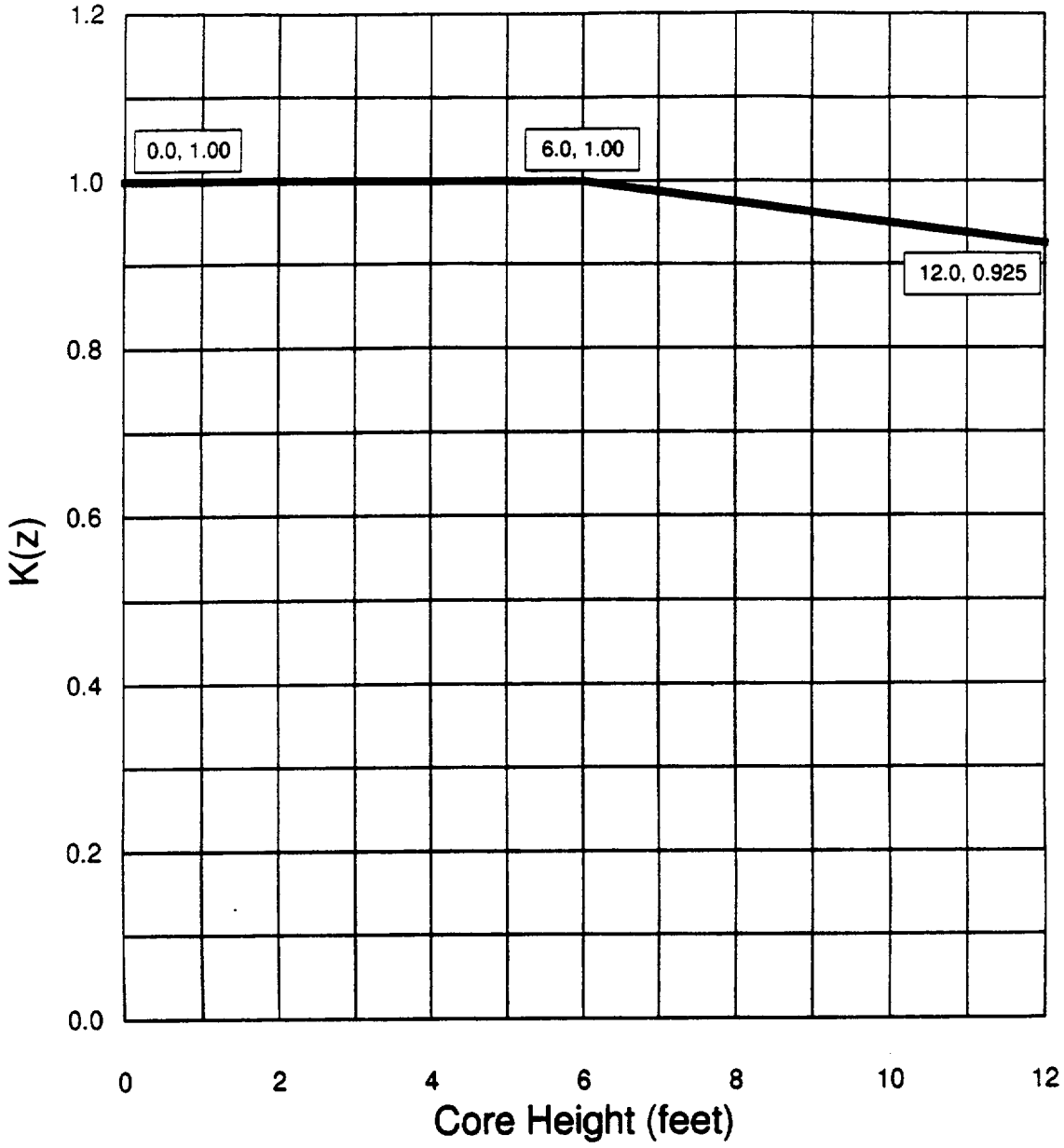
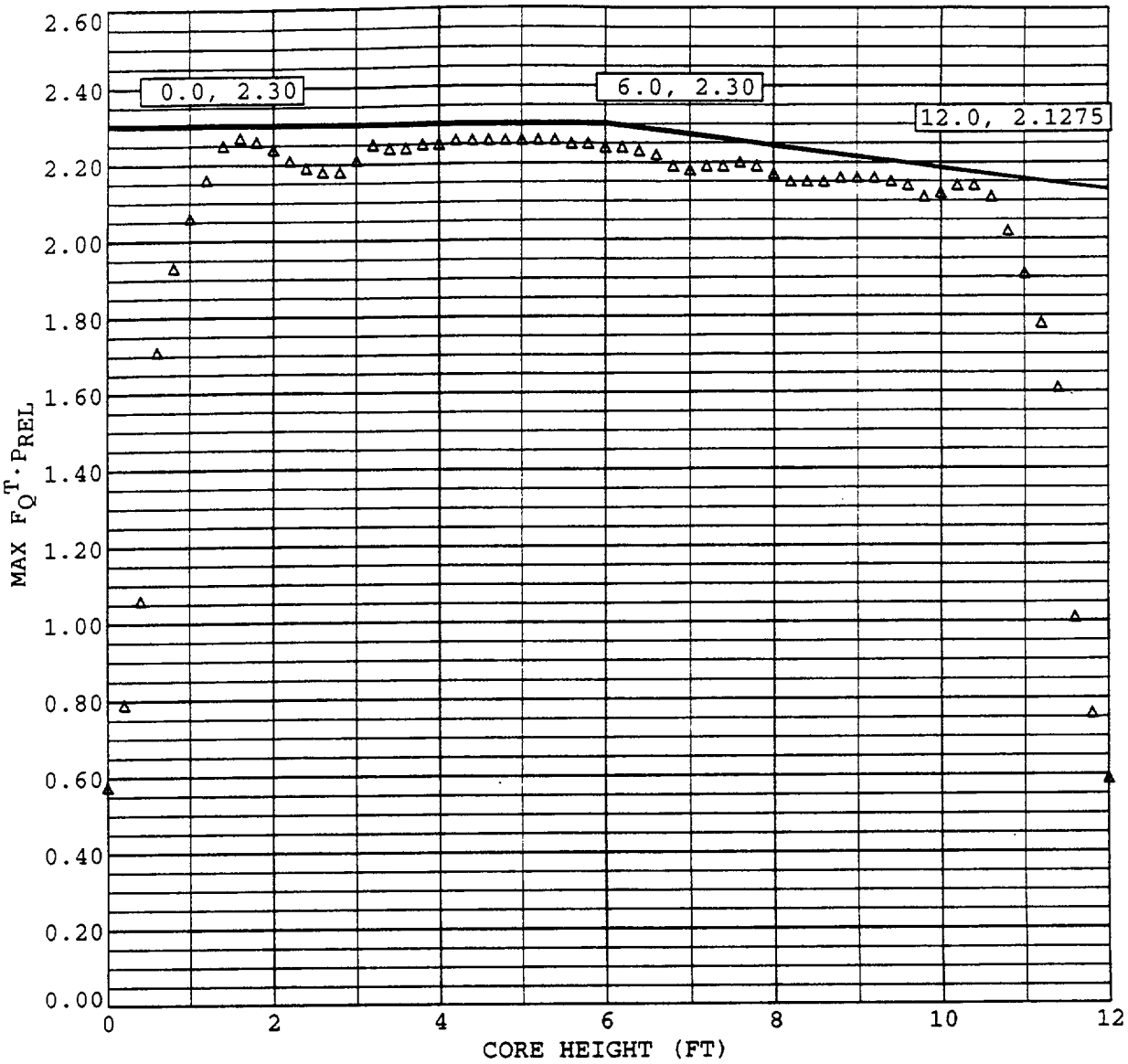


FIGURE 4.1-3
F_QT NORMALIZED OPERATING ENVELOPE, K(Z)



Basis F_{XY}
≤ 1.76 From 1.8 FT. UP TO 3.0 FT.
≤ 1.83 From 3.0 FT. UP TO 6.6 FT.
≤ 1.81 From 6.6 FT. UP TO 7.8 FT.
≤ 1.76 From 7.8 FT. UP TO 9.6 FT.
≤ 1.70 From 9.6 FT. UP TO 10.2 FT.

FIGURE 4.1-4
MAXIMUM (F_QT *PREL) VS AXIAL CORE HEIGHT
DURING NORMAL OPERATION