# VOGTLE ELECTRIC GENERATING PLANT (VEGP) UNIT 1 CYCLE 3

# CORE OPERATING LIMITS REPORT

REVISION 1

MAY 1991

9105300243 910524
PDR ADOCK 05000424
P PDR

## 1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for VEGP UNIT 1 CYCLE 3 has been prepared in accordance with the requirements of Technical Specification 6.8.1.6.

The Technical Specifications affected by this report are listed below:

| | |
|---|---|
| 3/4.1.1.1 | SHUTDOWN MARGIN - MODES 1 and 2 |
| 3/4.1.1.2 | SHUTDOWN MARGIN - MODES 3, 4 and 5 |
| 3/4.1.1.3 | Moderator Temperature Coefficient |
| 3/4.1.3.5 | Shutdown Rod Insertion Limit |
| 3/4.1.3.6 | Control Rod Insertion Limits |
| 3/4.2.1 | Axial Flux Difference |
| 3/4.2.2 | Heat Flux Hot Channel Factor - $F_Q(Z)$ |
| 3/4.2.3 | Nuclear Enthalpy Rise Hot Channel Factor - $F^N_{\Delta H}$ |

## 2.0 OPERATING LIMITS

The cycle-specific parameter limits for the specifications listed in Section 1.0 are presented in the following subsections. These limits have been developed using the NRC-approved methodologies specified in Technical Specification 6.8.1.6

### 2.1 SHUTDOWN MARGIN - MODES 1 AND 2 (Specification 3/4.1.1.1)

2.1.1 The SHUTDOWN MARGIN shall be greater than or equal to 1.3% $\Delta k/k$.

### 2.2 SHUTDOWN MARGIN - MODES 3, 4 AND 5 (Specification 3/4.1.1.2)

2.2.1 The SHUTDOWN MARGIN shall be greater than or equal to the limits shown in Figures 1 and 2.

### 2.3 Moderator Temperature Coefficient (Specification 3/4.1.1.3)

2.3.1 The Moderator Temperature Coefficient (MTC) limits are:

The BOL/ARO/HZP - MTC shall be less positive than $+0.7 \times 10^{-4}$ $\Delta k/k/^{\circ}F$ for power levels up to 70% RTP with a linear ramp to 0 $\Delta k/k/^{\circ}F$ at 100% RTP.

The EOL/ARO/RTP-MTC shall be less negative than $-4.8 \times 10^{-4}$ $\Delta k/k/^{\circ}F$.

2.3.2 The MTC Surveillance limit is:

The 300 ppm/ARO/RTP-MTC should be less negative than or equal to $-4.05 \times 10^{-4}$ $\Delta k/k/^{\circ}F$.

where: BOL stands for Beginning of Cycle Life
ARO stands for All Rods Out
HZP stands for Hot Zero THERMAL POWER
EOL stands for End of Cycle Life
RTP stands for RATED THERMAL POWER

### 2.4 Shutdown Rod Insertion Limit (Specification 3/4.1.3.5)

2.4.1 All shutdown rods shall be withdrawn to a position greater than or equal to 222 steps.

### 2.5 Control Rod Insertion Limits (Specification 3/4.1.3.6)

2.5.1 The control rod banks shall be limited in physical insertion as shown in Figure 3.

2.6 Axial Flux Difference (Specification 3/4.2.1)
(CAOC methodology)

2.6.1 The AXIAL FLUX DIFFERENCE (AFD) target band is +5%, -5% for core average accumulated burnup ≤ 3000 MWD/MTU.

2.6.2 The AFD target band is +3%, -12% for core average accumulated burnup > 3000 MWD/MTU.

where: MWD/MTU stands for megawatt days/metric ton of initial uranium metal.

2.6.3 The AFD Acceptable Operation Limits are provided in Figure 4.

2.7 Heat Flux Hot Channel Factor - $F_Q(Z)$ (Specification 3/4.2.2)
($F_{xy}$ methodology)

2.7.1 $$F_Q(Z) \leq \frac{F_Q^{RTP}}{P} * K(Z) \quad \text{for } P > 0.5$$

$$F_Q(Z) \leq \frac{F_Q^{RTP}}{0.5} * K(Z) \quad \text{for } P \leq 0.5$$

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

2.7.2 $F_Q^{RTP} = 2.30$

2.7.3 K(Z) is provided in Figure 5.

2.7.4 $F_{xy}^{L} = F_{xy}^{RTP} * (1 + PF_{xy} * (1-P))$

where: 1. $F_{xy}^{RTP}$ is less than or equal to 1.775 for all core planes containing Bank "D" control rods

2. For all unrodded core planes:

$F_{xy}^{RTP}$ is less than or equal to 1.705 for core elevations below 3.7 ft.

$F_{xy}^{RTP}$ is less than or equal to 1.660 for core elevations between 3.7 ft. and 8.1 ft.

$F_{xy}^{RTP}$ is less than or equal to 1.765 for core elevations above 8.1 ft.

2.7.5 $PF_{xy} = 0.2$

2.8 Nuclear Enthalpy Rise Hot Channel Factor - $F_{\Delta H}^{N}$ (Specification 3/4.2.3)

$$F_{\Delta H}^{N} \leq F_{\Delta H}^{RTP} * (1 + PF_{\Delta H} * (1-P))$$

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

2.8.1 $F_{\Delta H}^{RTP} = 1.55$

2.8.2 $PF_{\Delta H} = 0.3$

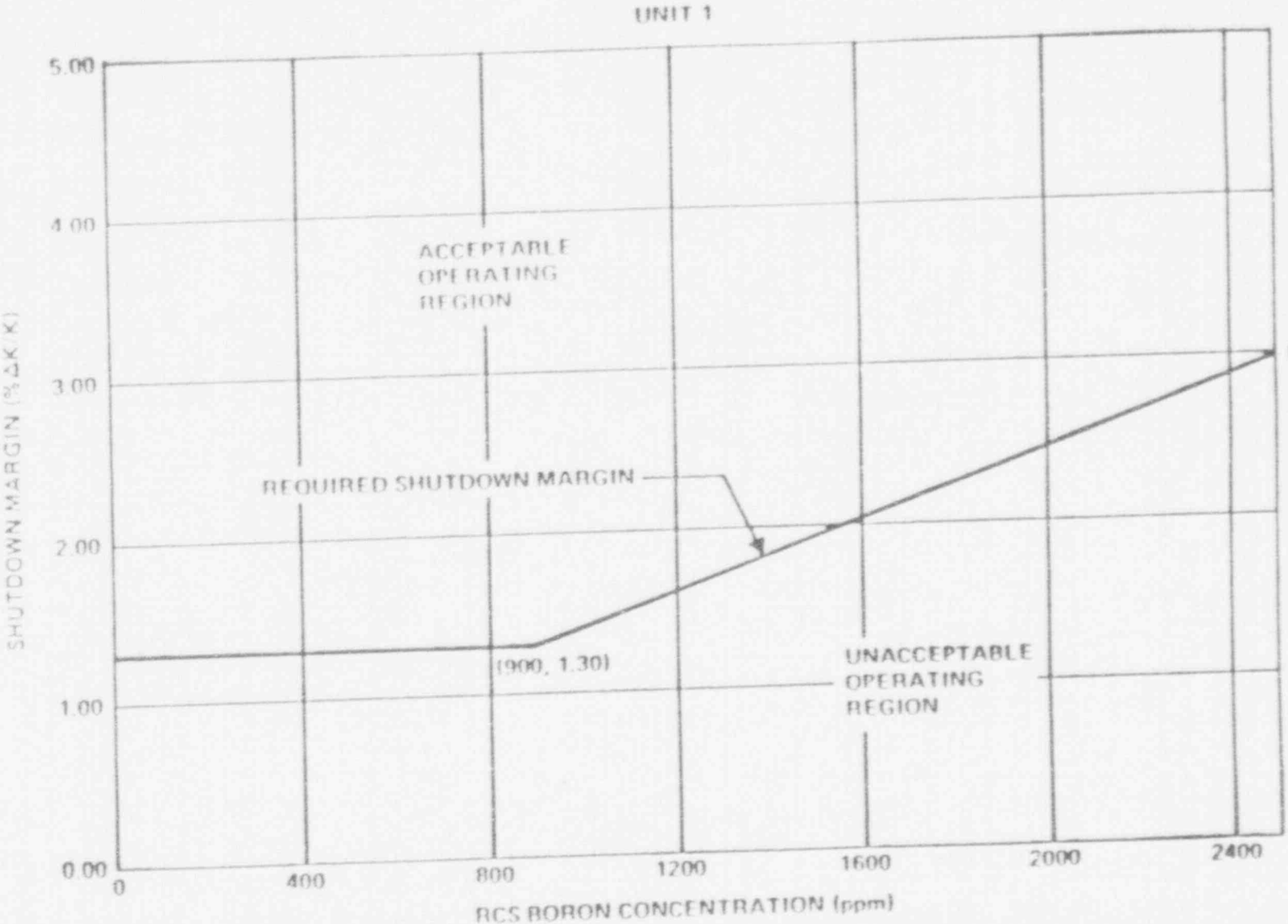


FIGURE 1

UNIT 1 REQUIRED SHUTDOWN MARGIN FOR MODES 3 AND 4 (MODE 4 WITH AT LEAST ONE REACTOR COOLANT PUMP RUNNING)

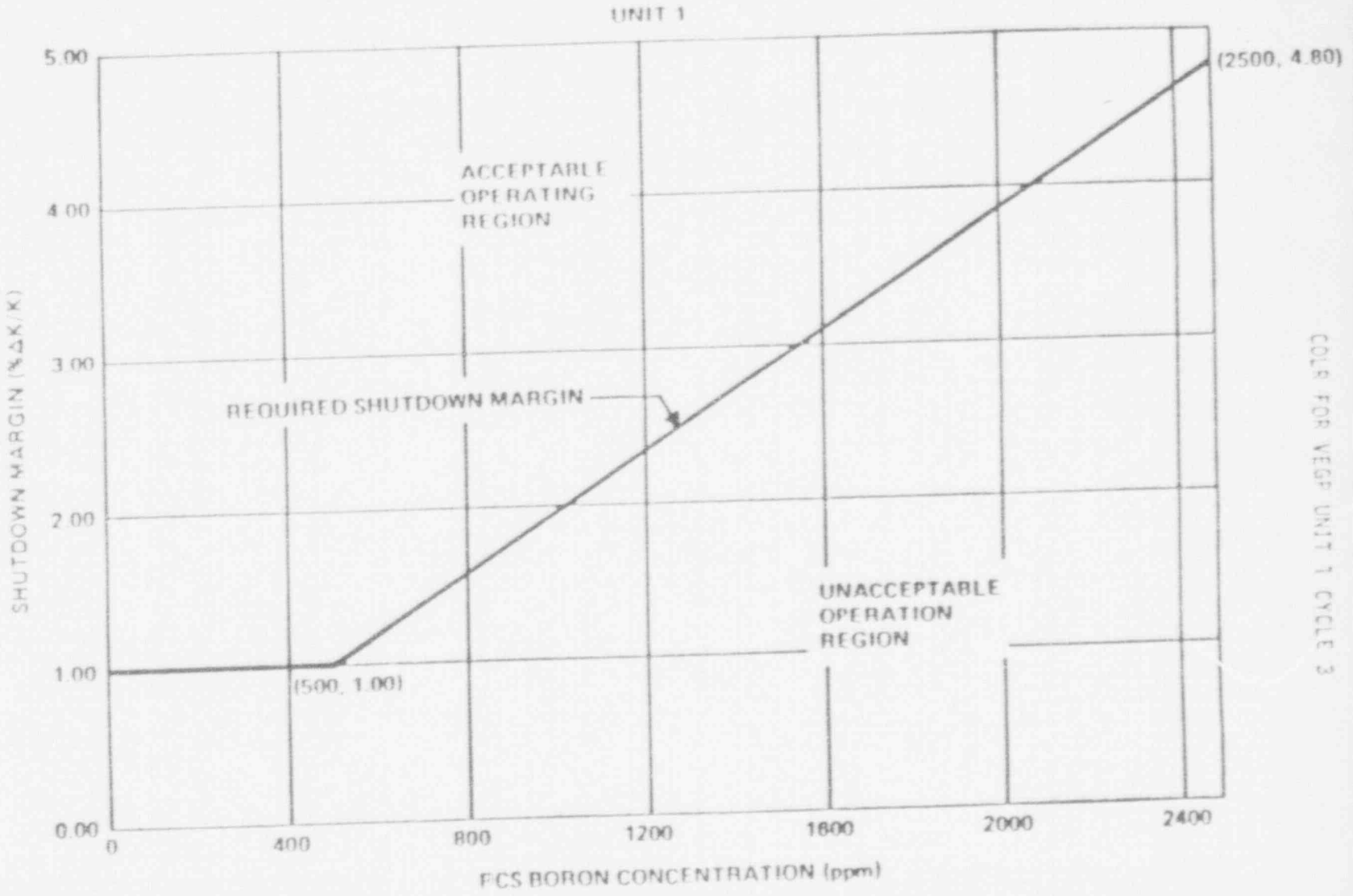


FIGURE 2

UNIT 1 REQUIRED SHUTDOWN MARGIN FOR MODE 5 (MODE 4 WITH NO REACTOR COOLANT PUMPS RUNNING)

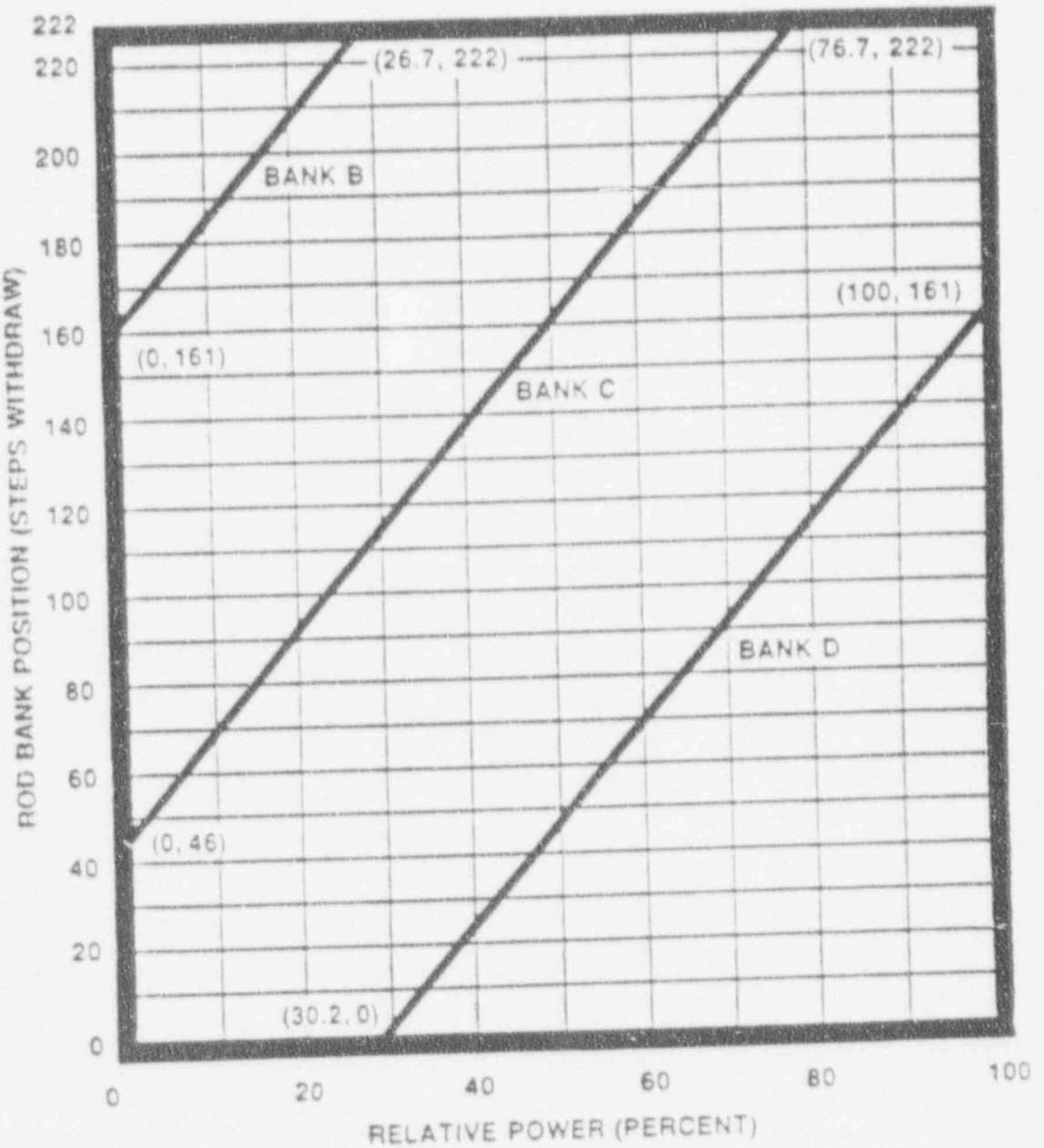


FIGURE 3

ROD BANK INSERTION LIMITS VERSUS THERMAL POWER

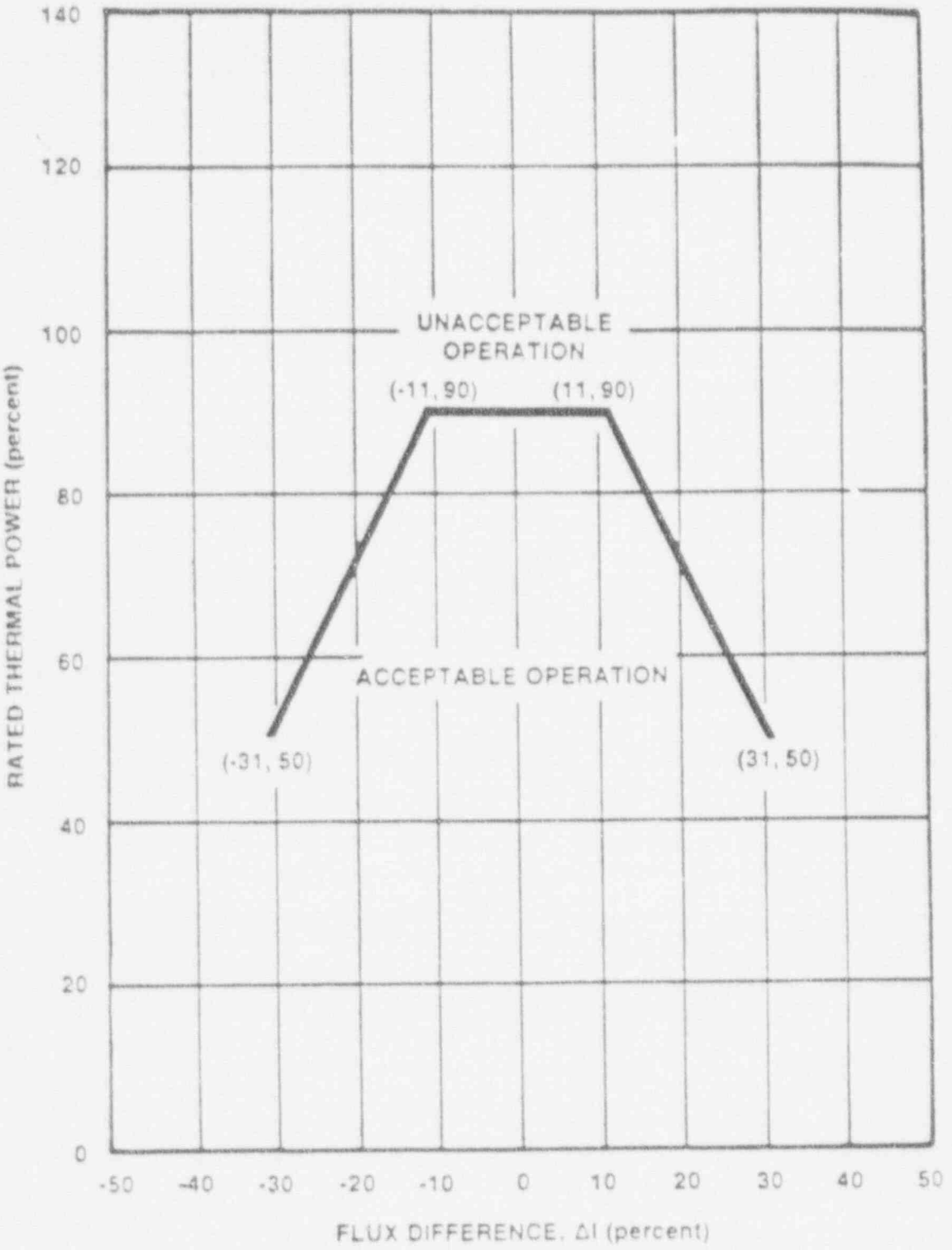


FIGURE 4

AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF RATED THERMAL POWER

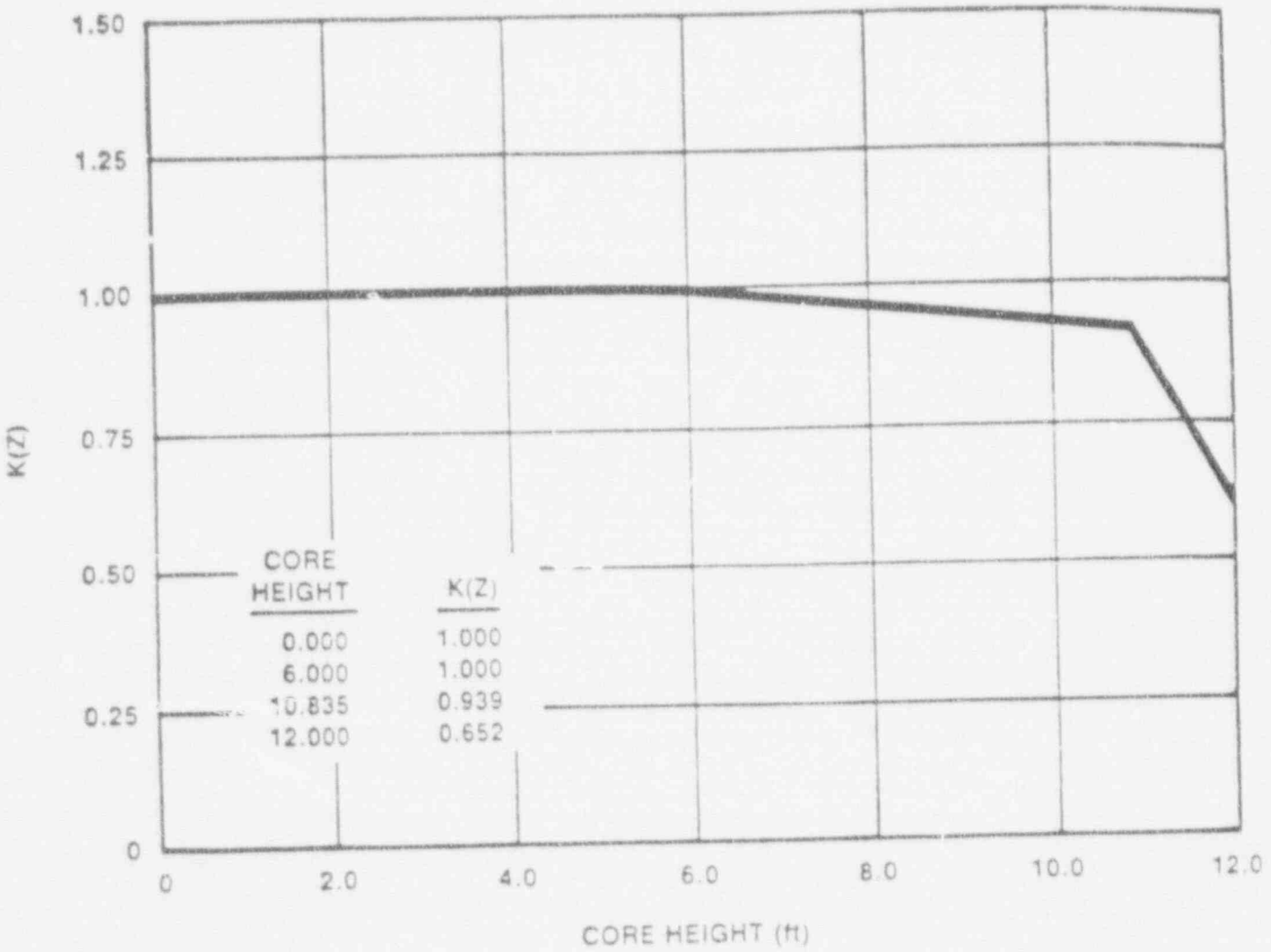


FIGURE 5

K(Z) - NORMALIZED $F_Q(Z)$ AS A FUNCTION OF CORE HEIGHT