

RE-21 CORE OPERATING LIMITS REPORT

CYCLE 4 COLR

RE DEPT SUPERVISOR
OPERATIONS MANAGER

Paul V. Gunning
Joseph M. Gault
SIGNATURE

7/11/99
July 11, 1999
DATE

REVISION 01-04-00

1.0 CORE OPERATING LIMITS REPORT

The Core Operating Limits Report for Seabrook Station Unit 1, Cycle 4 has been prepared in accordance with the requirements of Technical Specification 6.8.1.6.

The Technical Specifications affected by this report are:

- 1) 3.1.1.1 Shutdown Margin Limit for MODES 1,2,3,4
- 2) 3.1.1.2 Shutdown Margin Limit for MODE 5
- 3) 3.1.1.3 Moderator Temperature Coefficient
- 4) 3.1.3.5 Shutdown Rod Insertion Limit
- 5) 3.1.3.6 Control Rod Insertion Limits
- 6) 3.2.1 Axial Flux Difference
- 7) 3.2.2 Heat Flux Hot Channel Factor
- 8) 3.2.3 Nuclear Enthalpy Rise Hot Channel Factor

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 Limit for MODES 1,2,3, and 4: (Specification 3.1.1.1)

- A) The Shutdown Margin shall be greater than or equal to 1.3% $\Delta k/k$, in MODES 1,2,3.
- B) The Shutdown Margin shall be greater than or equal to 1.7% $\Delta k/k$ in MODE 4.

2.2 Shutdown Margin Limit for Mode 5: (Specification 3.1.1.2)

The Shutdown Margin shall be greater than or equal to 1.7% $\Delta k/k$.

2.3 Moderator Temperature Coefficient: (Specification 3.1.1.3)

- 2.3.1 The Moderator Temperature Coefficient (MTC) shall be less positive than 0 $\Delta k/k/^{\circ}F$ for Beginning of Cycle Life (BOL). All Rods Out (ARO), Hot Zero Thermal Power conditions.
- 2.3.2 MTC shall be less negative than -4.2×10^{-4} $\Delta k/k/^{\circ}F$ for End of Cycle Life (EOL), ARO, Rated Thermal Power conditions.
- 2.3.3 The 300 ppm ARO, Rated Thermal Power MTC shall be less negative than -3.3×10^{-4} $\Delta k/k/^{\circ}F$ (300 ppm Surveillance Limit).

- 2.4 Shutdown Rod Insertion Limit: (Specification 3.1.3.5)
- 2.4.1 The shutdown rods shall be fully withdrawn. The fully withdrawn position is defined as the interval within 225 steps withdrawn to the mechanical fully withdrawn position inclusive.
- 2.5 Control Rod Insertion Limits: (Specification 3.1.3.6)
- 2.5.1 The control rod banks shall be limited in physical insertion as specified in Figure 1.
- 2.6 Axial Flux Difference: (Specification 3.2.1)
- 2.6.1 The Axial Flux Difference (AFD) Target Band is + 3%, - 12%.
- 2.6.2 The indicated AFD may deviate outside the required band specified in 2.6.1 (above) at greater than or equal to 50% but less than 90% of RATED THERMAL POWER provided the indicated AFD is within the Acceptable Operation Limits as specified in Figure 2.
- 2.7 Heat Flux Hot Channel Factor: (Specification 3.2.2)
- 2.7.1 $F_Q^{RTP} = 2.32$
- 2.7.2 $K(Z)$ is specified in Figure 3.
- 2.7.3 $PF_{xy} = 0.2$
- 2.7.4 The F_{xy} limits for Rated Thermal Power within specific core planes shall be:
- 2.7.4.1 F_{xy} (RTP) less or equal to 1.839 for all planes containing blanks D + C control rods.
- 2.7.4.2 F_{xy} (RTP) less than or equal to 1.784 for all planes containing bank D control rods.
- 2.7.4.3 F_{xy} (RTP) less than or equal to 1.644 for all unrodded planes; and
- 2.7.4.4 See Figure 4 for a plot of $F_Q = (Z) \times P(REL)$ versus axial core height.
- 2.8 Nuclear Enthalpy Rise Hot Channel Factor: (Specification 3.2.3)
- 2.8.1 $F_{\Delta H}^{RTP} = 1.490$ for the movable incore detector system
- $F_{\Delta H}^{RTP} = 1.488$ for the fixed incore detector system
- 2.8.2 $PF_{\Delta H} = 0.2$

Figure 1
Rod Bank Insertion Limits vs. Thermal Power
Four-Loop Operation

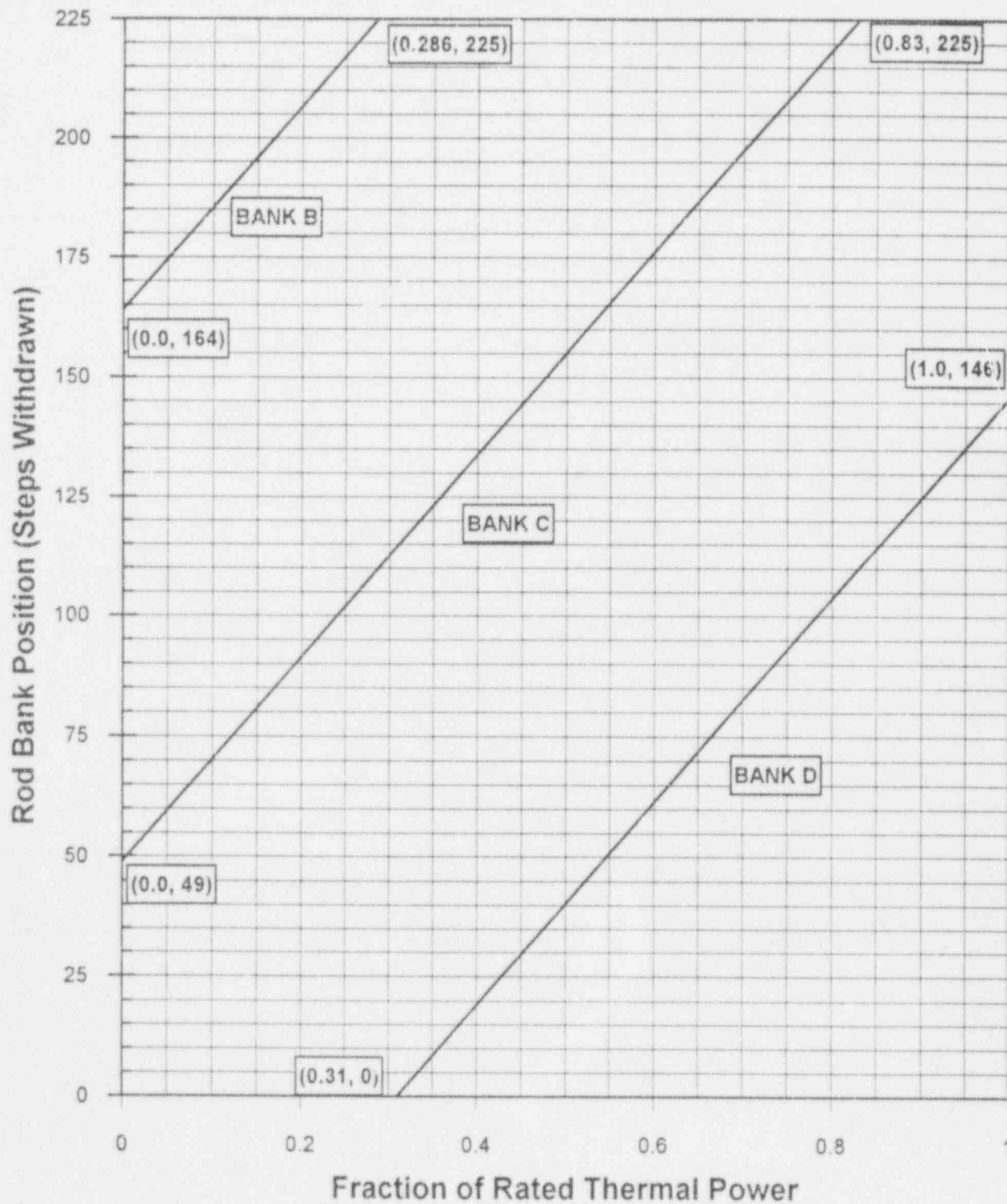


Figure 2
Axial Flux Difference Limits as a Function of
Rated Thermal Power

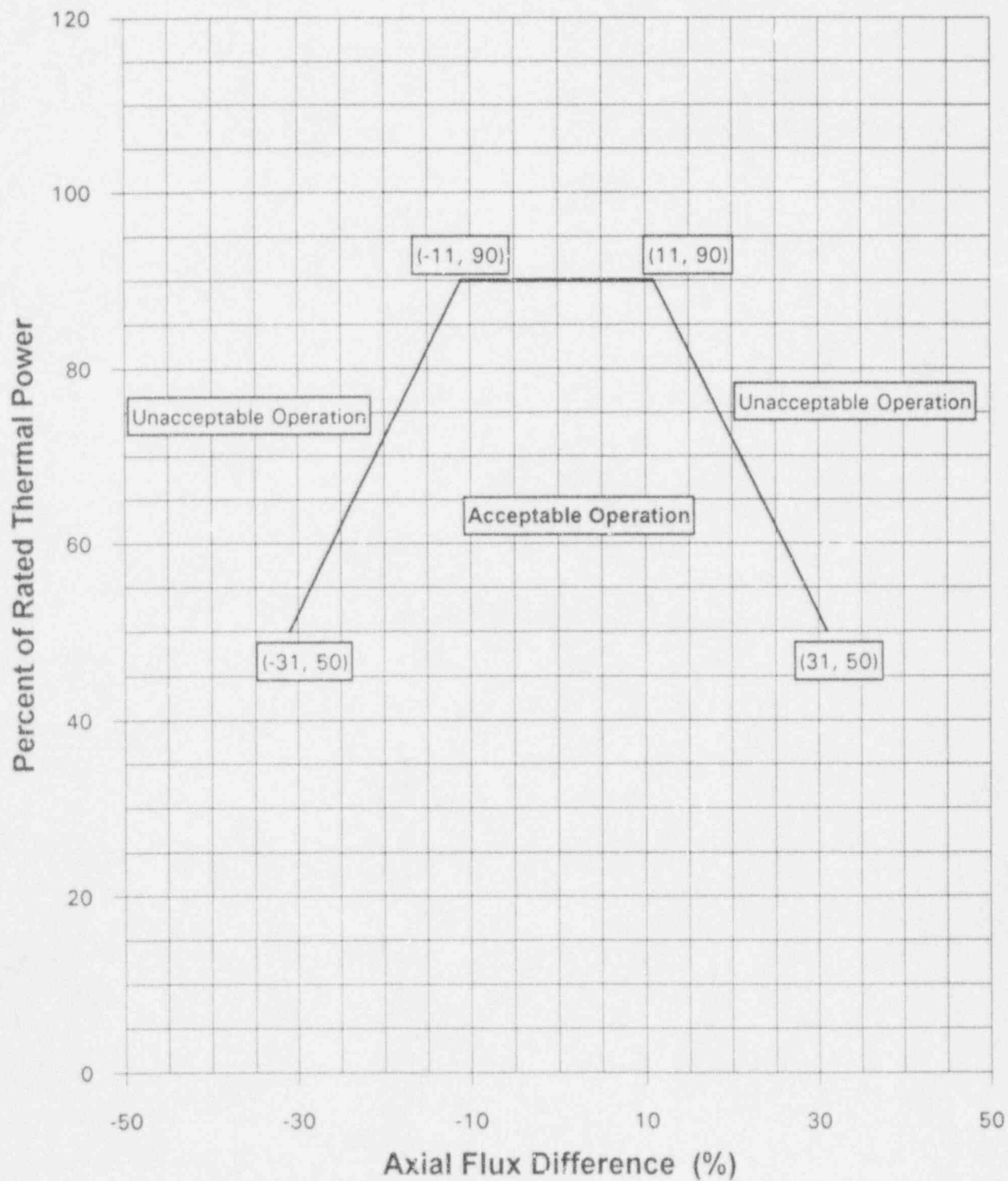


Figure 3
K(Z) - Normalized Fq(Z) as a Function
of Core Height

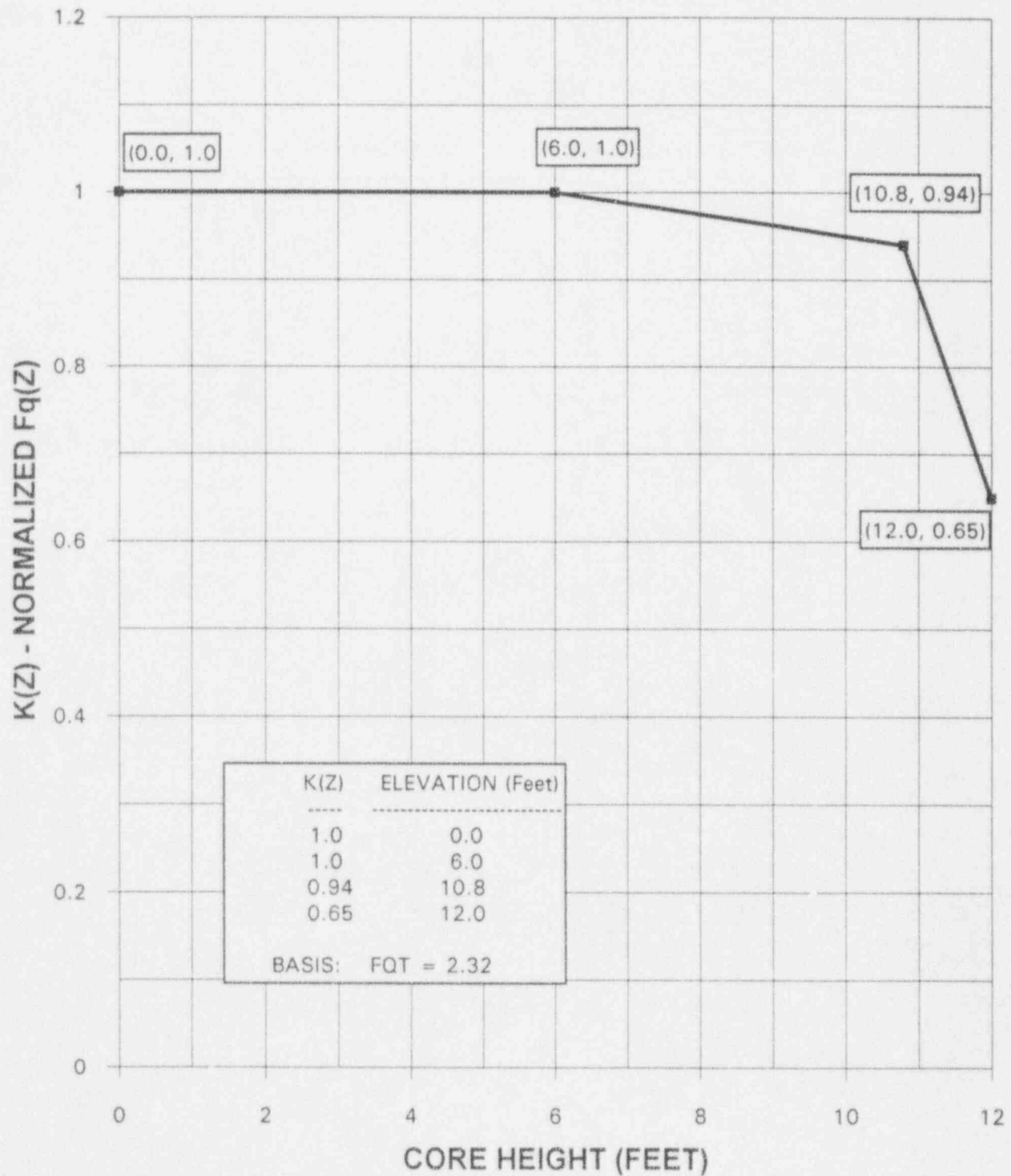


Figure 4
Maximum $[F_q \times P(\text{REL})]$ vs. Core Height

