RE-21 CORE OPERATING LIMITS REPORT

CYCLE 5

COLR

RE DEPT SUPERVISOR — SIGNATURE — DATE

OPERATIONS MANAGER — SIGNATURE — DATE

REVISION 01-05-00

1.0 Core Operating Limits Report

This Core Operating Limits Report for Seabrook Station Unit 1, Cycle 5 has been prepared in accordance with the requirements of Technical Specification 6.8.1.6.

The Technical Specifications affected by this report are:

1) 2.2.1 Limiting Safety System Settings
2) 3.1.1.1 Shutdown Margin Limit for MODES 1, 2, 3, 4
3) 3.1.1.2 Shutdown Margin Limit for MODE 5
4) 3.1.1.3 Moderator Temperature Coefficient
5) 3.1.3.5 Shutdown Rod Insertion Limit
6) 3.1.3.6 Control Rod Insertion Limits
7) 3.2.1 Axial Flux Difference
8) 3.2.2 Heat Flux Hot Channel Factor
9) 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 Limiting Safety System Settings: (Specification 2.2.1)

2.1.1 **Cycle Dependent Overtemperature ΔT Trip Setpoint Parameters and Function Modifier:**

2..1.1.1 $K_1 = 1.145$

2.1.1.2 $K_2 = 0.020 / °F$

2.1.1.3 $K_3 = 0.001 / psig$

2.1.1.4 Channel Total Allowance (TA) = N.A.

2.1.1.5 Channel Z = N.A.

2.1.1.6 Channel Sensor Error (S) = N.A.

2.1.1.7 Allowable Value - The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 2.2% of ΔT span (150 PU_ΔT).

2.1.1.8 $F_1(\Delta I)$ is a function of the indicated difference between top and bottom detectors of the power-range neutron ion chambers with gains to be selected based on measured instrument response during plant startup tests. $F_1(\Delta I)$ is specified in Figure 1.1.

2.1.2 **Cycle Dependent Overpower ΔT Trip Setpoint Parameters and Function Modifier:**

2.1.2.1 $K_4 = 1.070$

2.1.2.2 $K_5 = 0.020 / °F$ for increasing average temperature and $K_5 = 0.0$ for decreasing average temperature.

2.1.2.3 $K_6 = -0.00196 / °F$ for $T > T''$ and $K_6 = 0.0$ for $T \leq T''$, where:

T = Average temperature (°F), and

T'' = Indicated T_{avg} at RATED THERMAL POWER (Calibration temperature for ΔT instrumentation $\leq$ 588.5 °F).

2.1.2.4 Channel Total Allowance (TA) = N.A.

2.1.2.5 Channel Z = N.A.

2.1.2.6 Channel Sensor Error (S) = N.A.

2.1.2.7 Allowable Value - The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 2.1% of ΔT span (150 PU_ΔT).

2.1.2.8 $F_2(\Delta I)$ is a function of the indicated difference between top and bottom detectors of the power-range neutron ion chambers with gains to be selected based on measured instrument response during plant startup tests. $F_2(\Delta I)$ is specified in Figure 1.2.

2.2 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 % ΔK/K, in MODES 1, 2, 3.

B) The Shutdown Margin shall be greater than or equal to 1.8 % ΔK/K in MODE 4.

2.3 Shutdown Margin Limit For MODE 5: (Specification 3.1.1.2)

The Shutdown Margin shall be greater than or equal to 1.8 % ΔK/K.

2.4 Moderator Temperature Coefficient: (Specification 3.1.1.3)

2.4.1 The Moderator Temperature Coefficient (MTC) shall be less positive than $+2.19 \times 10^{-5}$ ΔK/K/°F for Beginning of Cycle Life (BOL), All Rods Out (ARO), Hot Zero Thermal Power conditions.

2.4.2 MTC shall be less negative than -4.2×10^{-4} ΔK/K/°F for End of Cycle Life (EOL), ARO, Rated Thermal Power conditions.

2.4.3 The 300 ppm ARO, Rated Thermal Power MTC shall be less negative than -3.3×10^{-4} ΔK/K/°F (300 ppm Surveillance Limit)

2.5 Shutdown Rod Insertion Limit: (Specification 3.1.3.5)

2.5.1 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.

2.6 Control Rod Insertion Limits: (Specification 3.1.3.6)

2.6.1 The control rod banks shall be limited in physical insertion as specified in Figure 2.

2.7 Axial Flux Difference: (Specification 3.2.1)

2.7.1 For operation with the Fixed Incore Detector Alarm OPERABLE, the indicated AFD must be within the Acceptable Operation Limits specified in Figure 3.1.

2.7.2 For operation with the Fixed Incore Detector Alarm inoperable, the indicated AFD must be within the Acceptable Operation Limits specified in Figure 3.2.

2.8 Heat Flux Hot Channel Factor: (Specification 3.2.2)

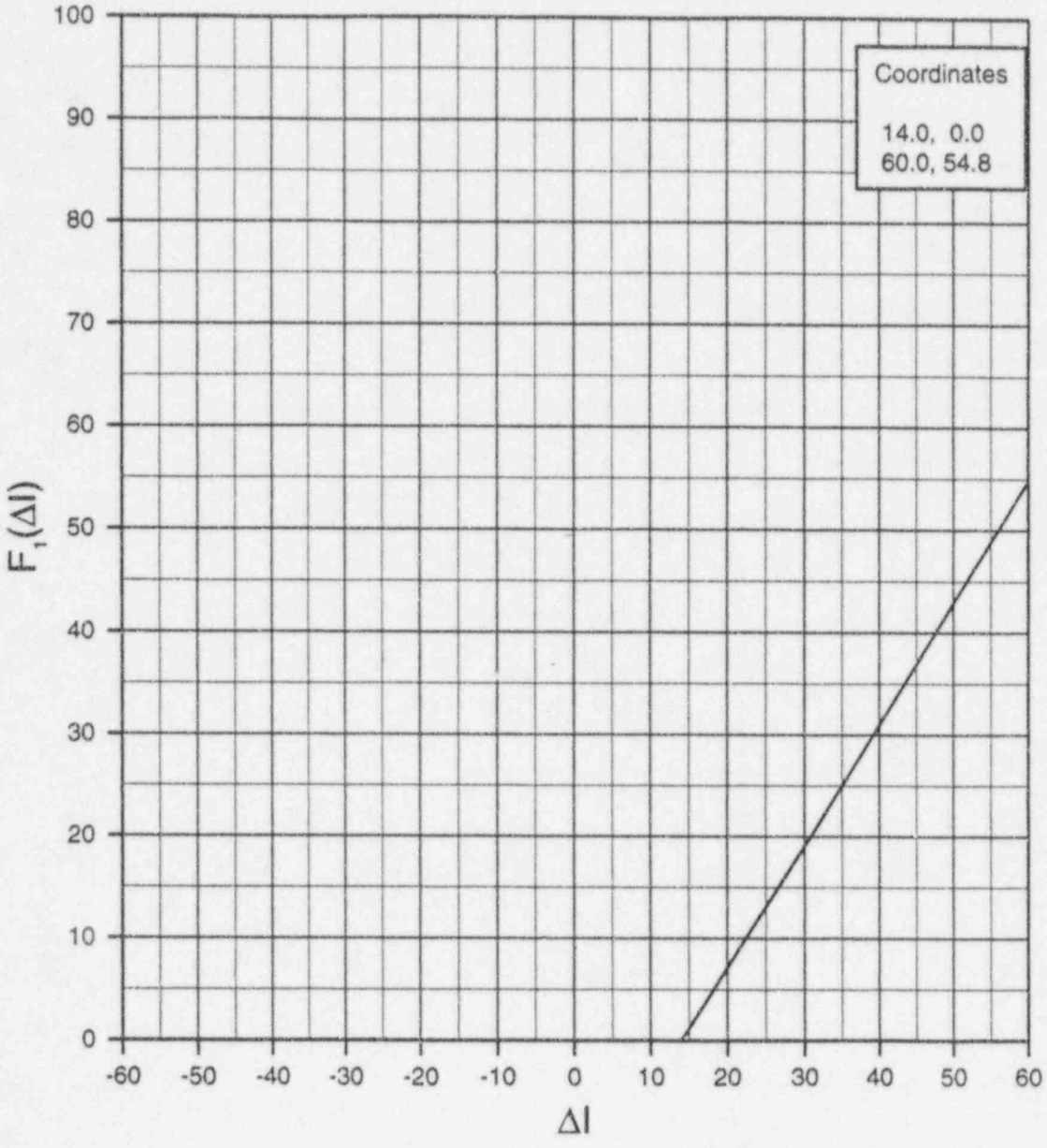
2.8.1 $F^{RTP}_{Q} = 2.50$

2.8.2 For operation with the Fixed Incore Detector Alarm OPERABLE, the K(z) used to satisfy surveillance requirements 4.2.2.2 and 4.2.2.4 is specified in Figure 4.1.

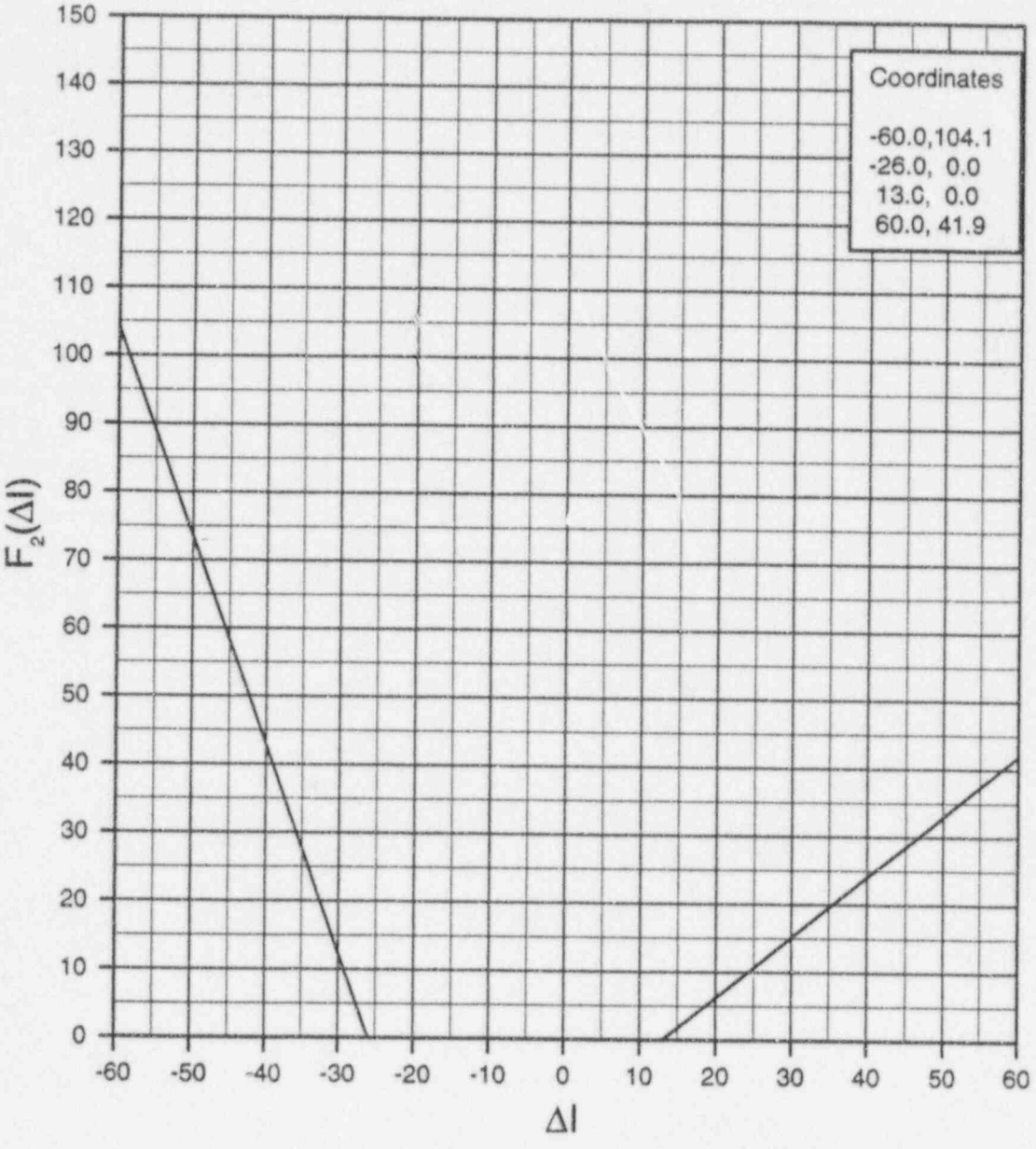
2.8.3 For operation with the Fixed Incore Detector Alarm inoperable, the K(z) used to satisfy surveillance requirement 4.2.1.2 is specified in Figures 4.2, 4.3, 4.4, and 4.5.

2.9 Nuclear Enthalpy Rise Hot Channel Factor: (Specification 3.2.3)

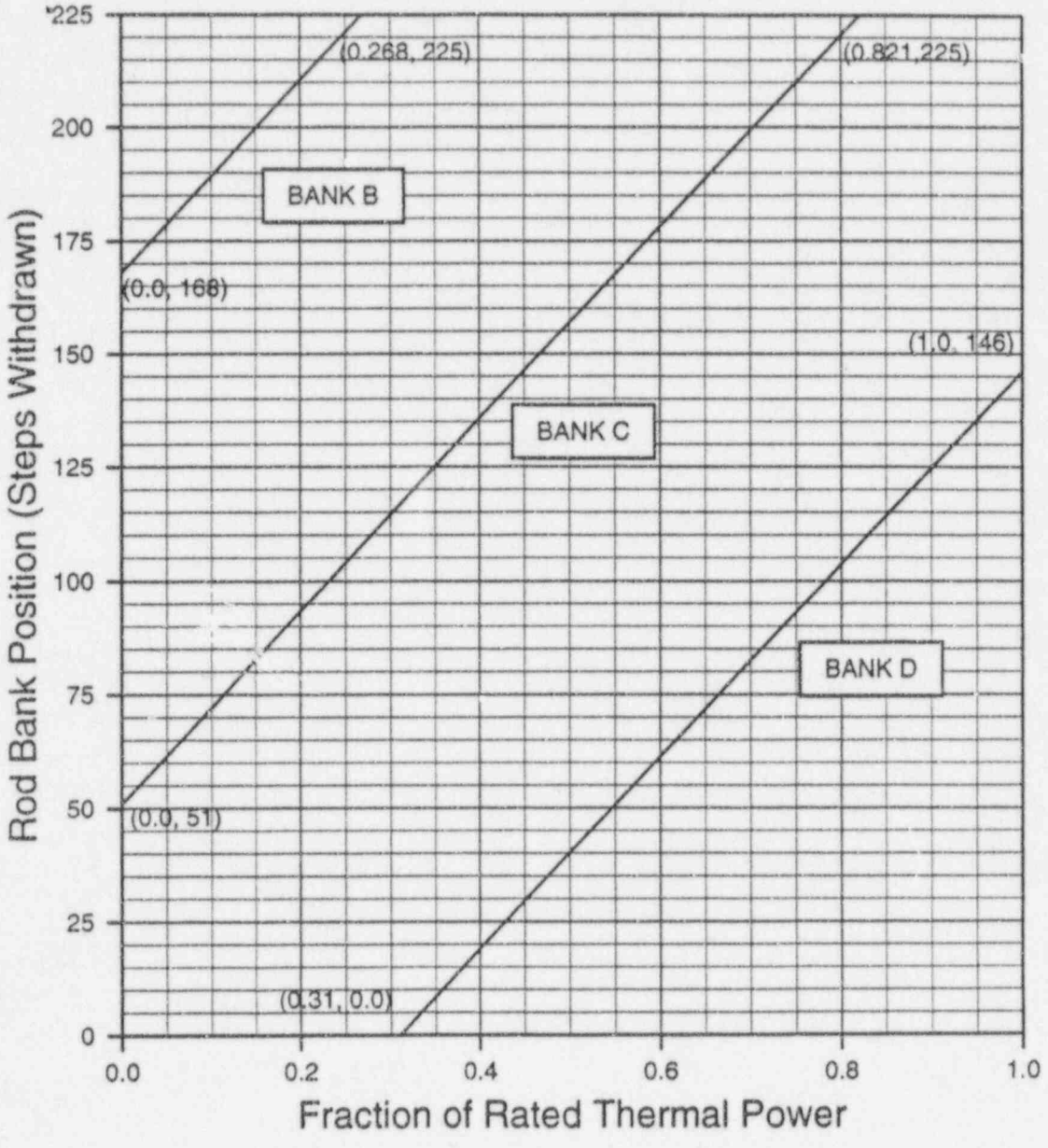
The limits on $F^{N}_{\Delta H}$ are specified in Figure 5. The limits apply to $F^{N}_{\Delta H}$ measured using either the fixed or movable incore detectors since a bounding measurement error has been allowed for in determination of the design DNBR limit value.



SEABROOK STATION CYCLE 5 CORE OPERATING LIMITS REPORT	Overtemperature ΔT Trip $F_1(\Delta I)$ Axial Flux Imbalance Penalty Function FIGURE 1.1



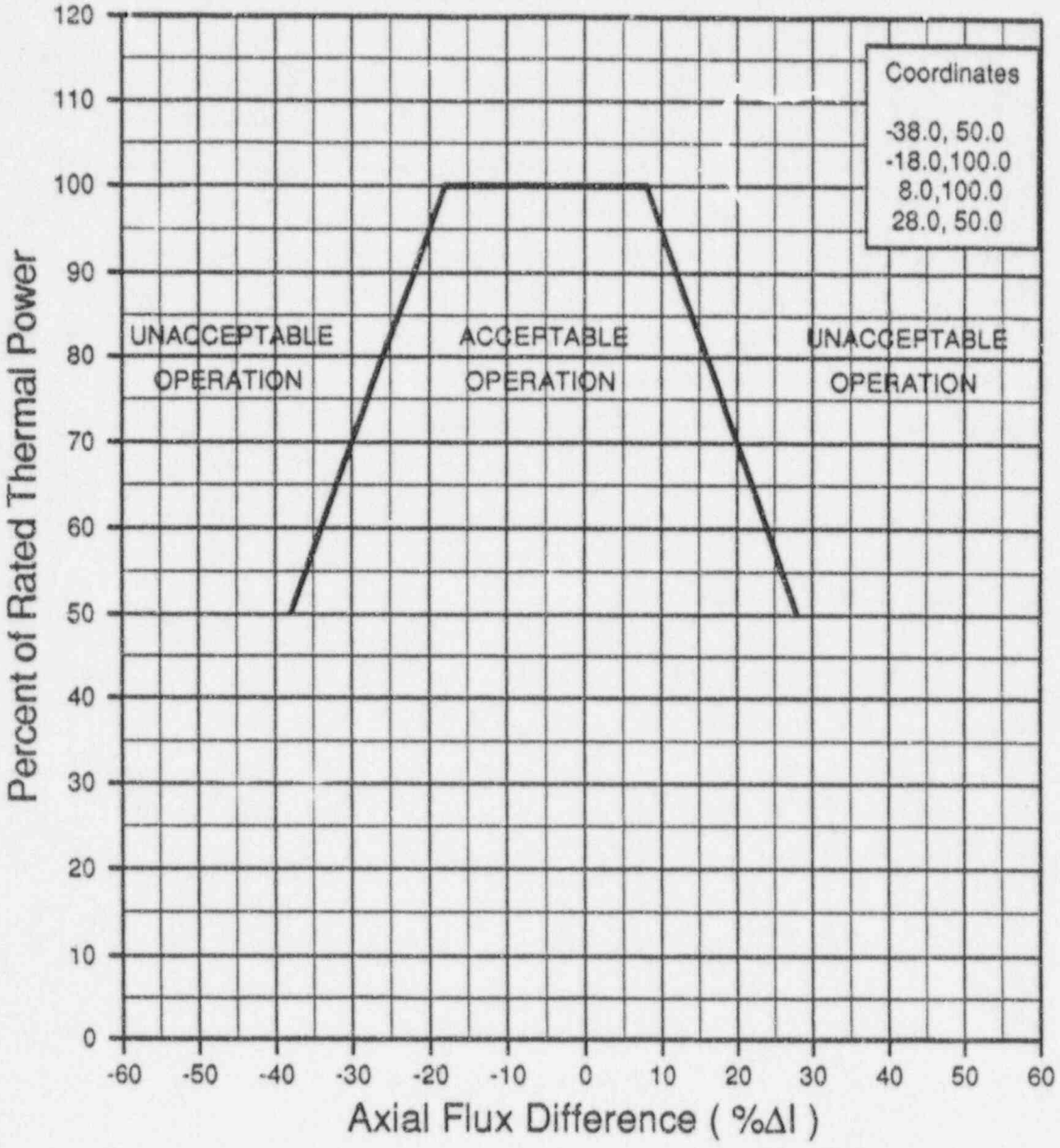
SEABROOK STATION CYCLE 5 CORE OPERATING LIMITS REPORT	Overpower ΔT Trip $F_z(\Delta I)$ Axial Flux Imbalance Penalty Function FIGURE 1.2



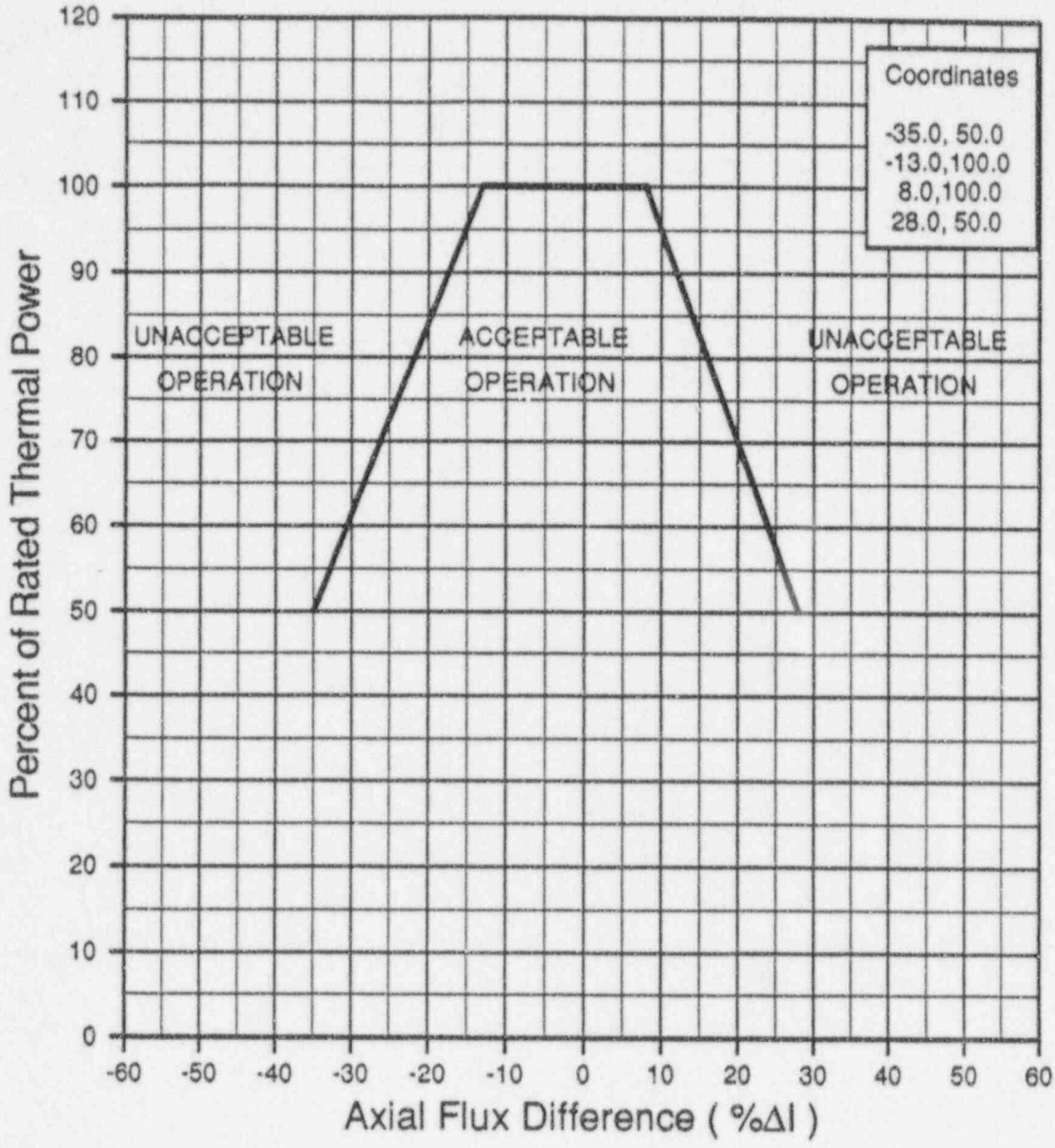
Bank A must be fully withdrawn* prior to power operation.

* Fully Withdrawn is defined as the All-Rods-Out position. The control rod insertion limits have been revised to permit ARO repositioning between 225 and 231 steps withdrawn.

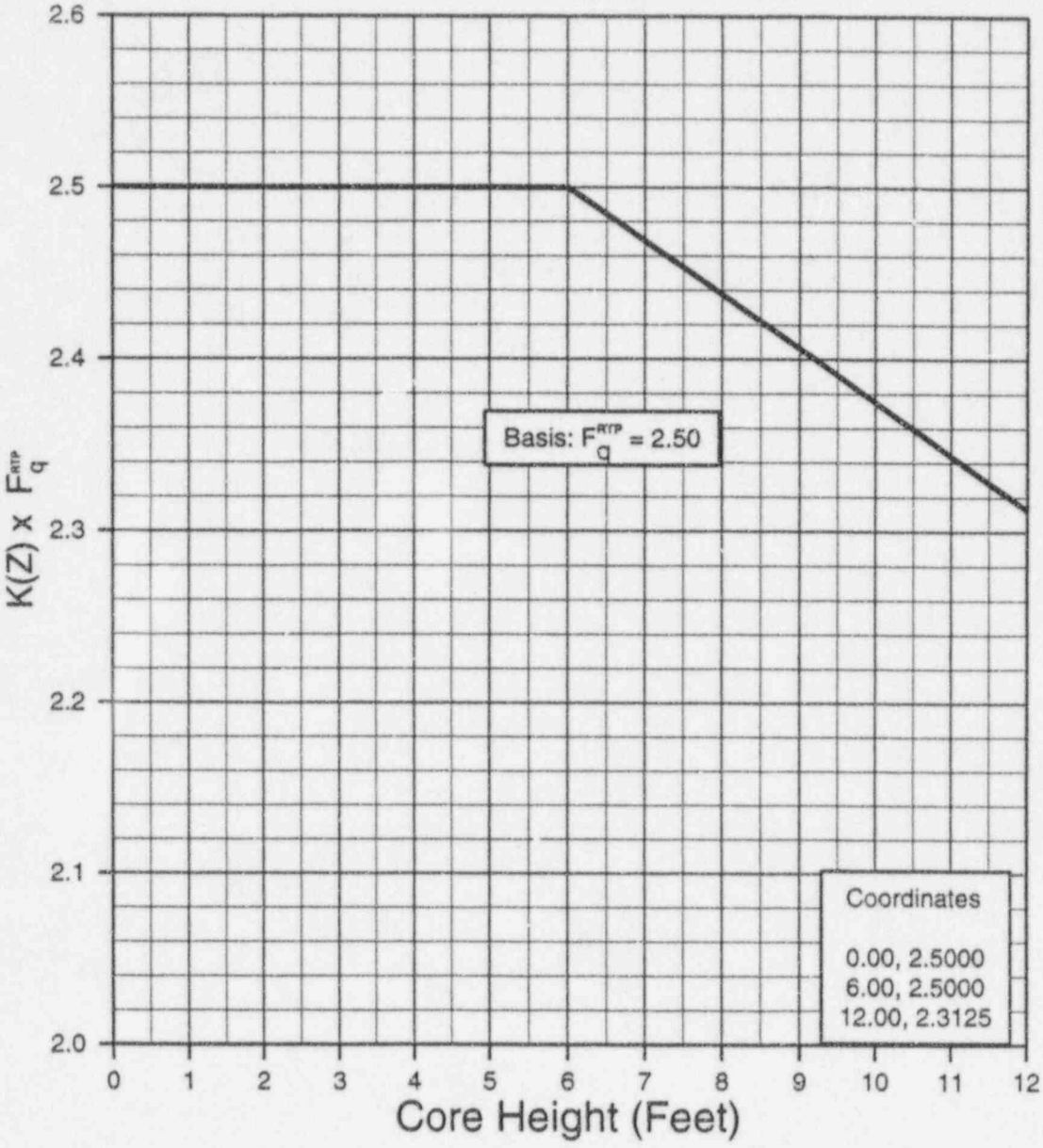
SEABROOK STATION CYCLE 5 CORE OPERATING LIMITS REPORT	Rod Bank Insertion Limits versus Thermal Power Four-Loop Operation FIGURE 2



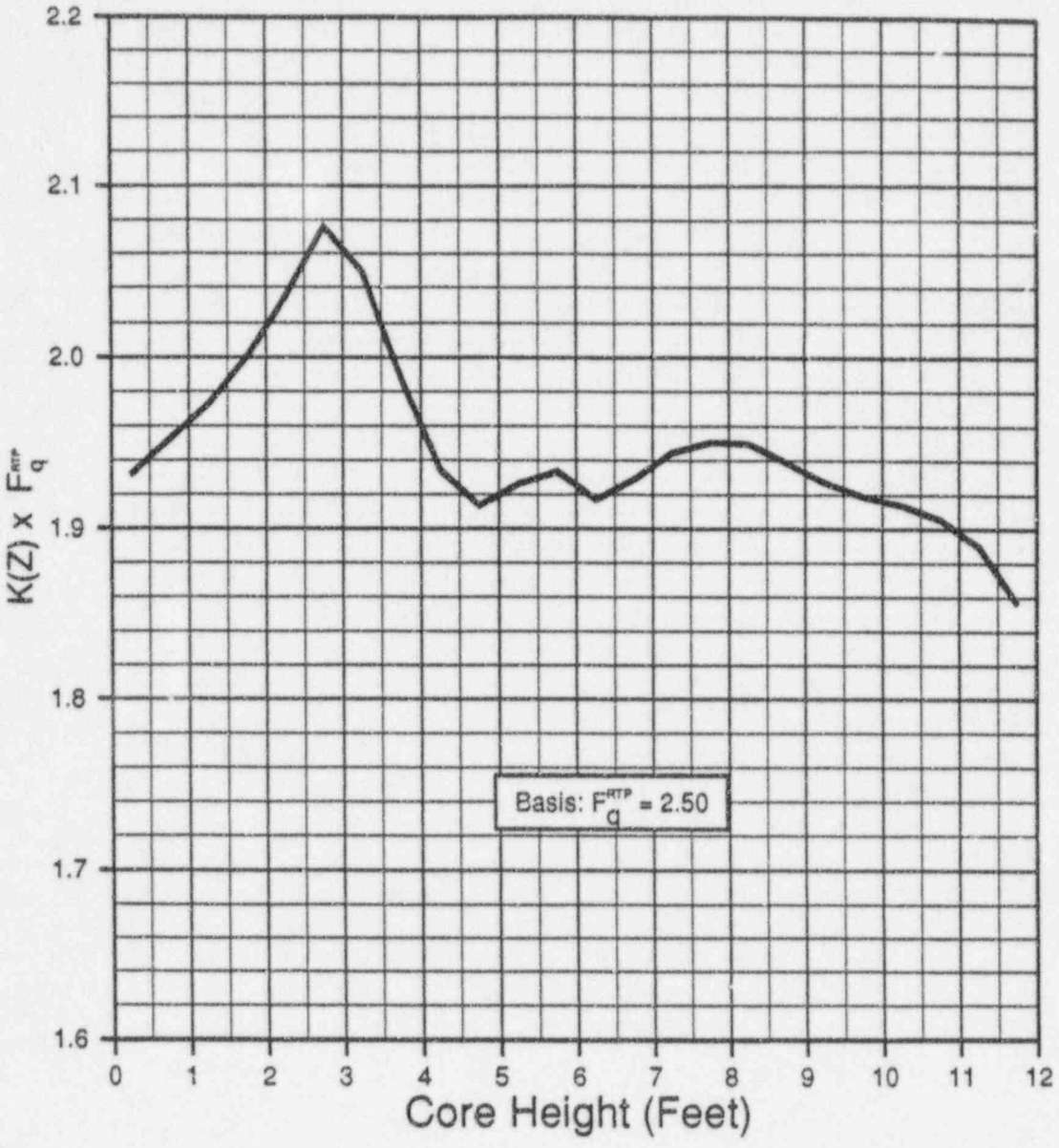
SEABROOK STATION CYCLE 5 CORE OPERATING LIMITS REPORT	Axial Flux Difference Limits as a Function of Rated Thermal Power for Operation With Fixed Incore Detector System Alarm OPERABLE FIGURE 3.1



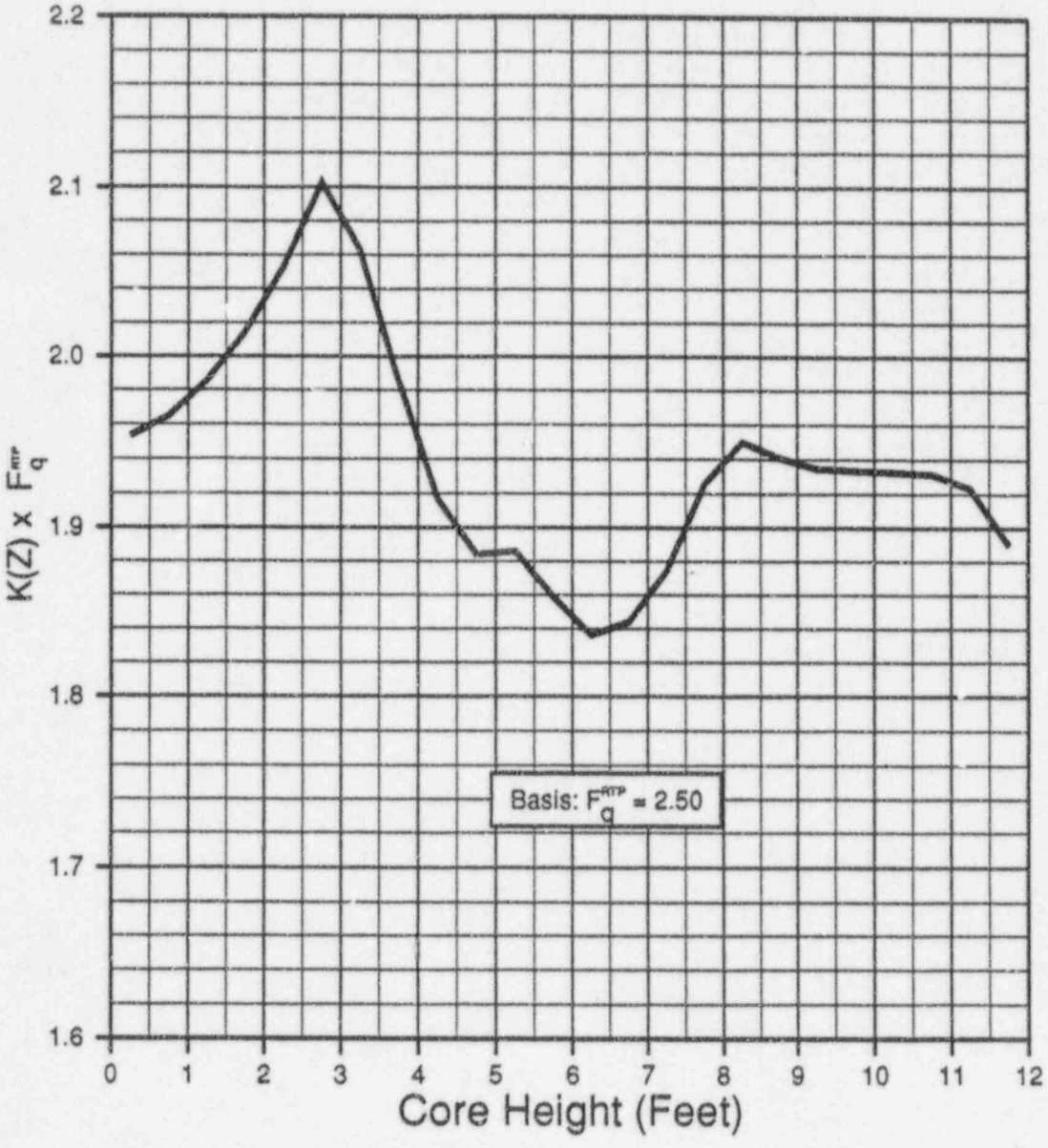
SEABROOK STATION CYCLE 5 CORE OPERATING LIMITS REPORT	Axial Flux Difference Limits as a Function of Rated Thermal Power for Operation With Fixed Incore Detector System Alarm Inoperable FIGURE 3.2



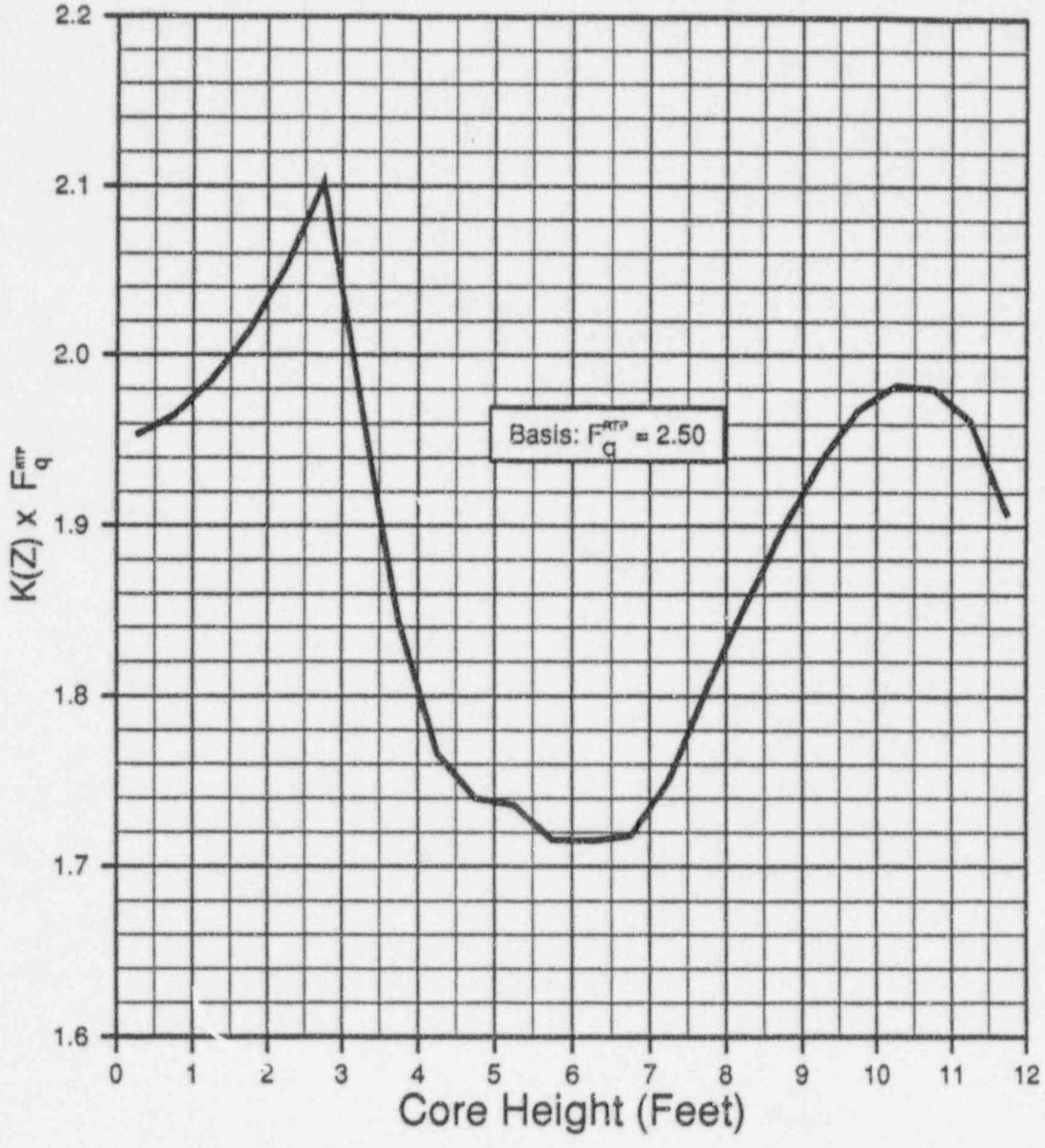
SEABROOK STATION CYCLE 5 CORE OPERATING LIMITS REPORT	F_q (Z) Limit As A Function of Core Height for Operation with Fixed Incore Detector System Alarm OPERABLE FIGURE 4.1



SEABROOK STATION CYCLE 5 CORE OPERATING LIMITS REPORT	F_q (Z) Limit As A Function of Core Height for Operation with Fixed Incore Detector System Alarm Inoperable and Cycle Average Burnup < 8.0 GWD/Mtu FIGURE 4.2



SEABROOK STATION CYCLE 5 CORE OPERATING LIMITS REPORT	F_q (Z) Limit As A Function of Core Height for Operation with Fixed Incore Detector System Alarm Inoperable and Cycle Average Burnup 8.0 to 14.0 GWD/Mtu FIGURE 4.3



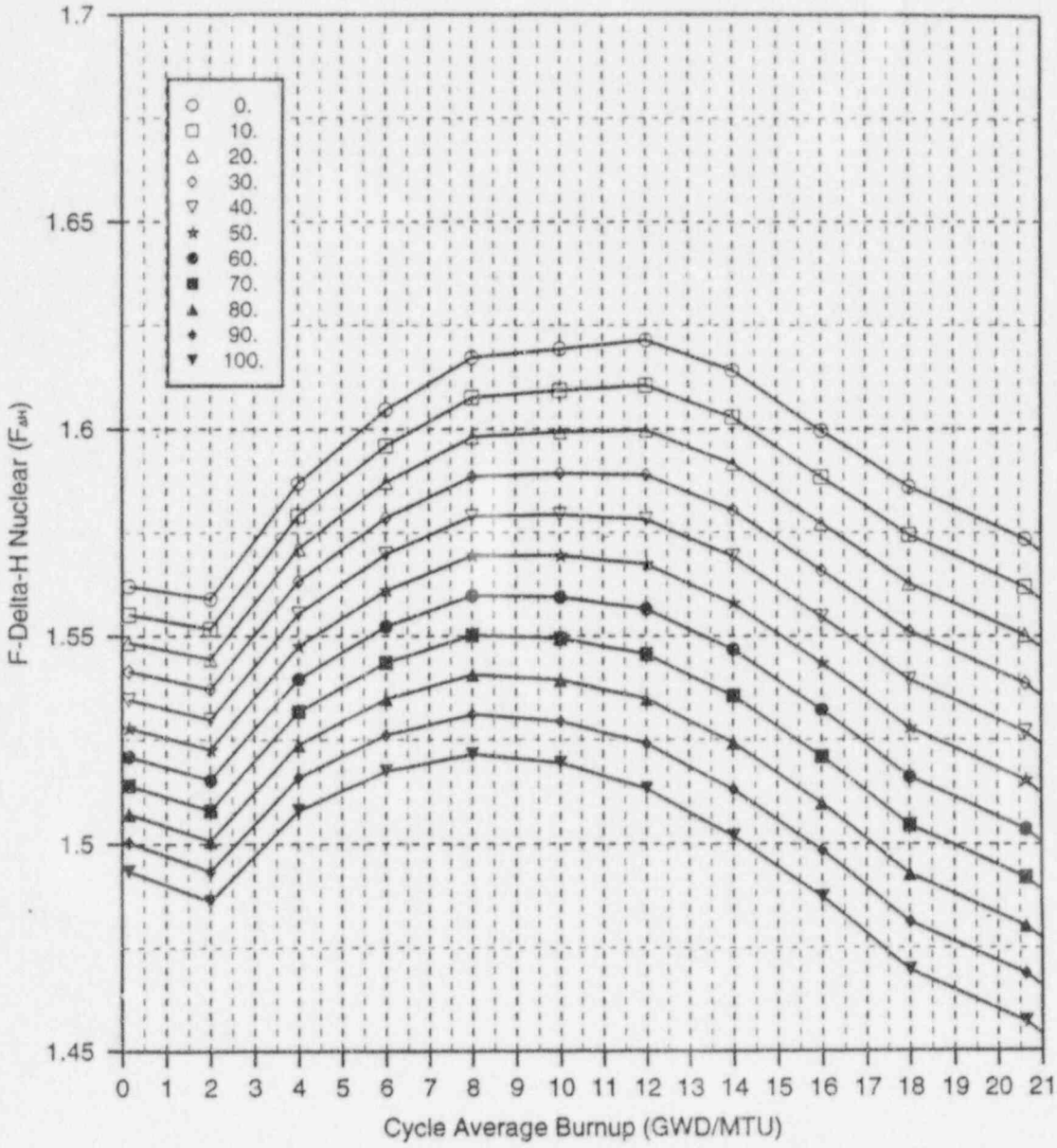
SEABROOK STATION CYCLE 5 CORE OPERATING LIMITS REPORT	F_q (Z) Limit As A Function of Core Height for Operation with Fixed Incore Detector System Alarm Inoperable and Cycle Average Burnup > 14.0 GWD/Mtu FIGURE 4.4

$K(Z) \times F_q^{RTP}$

Height (feet)	< 8.0 GWD/Mtu	8.0-14.0 GWD/Mtu	> 14.0 GWD/Mtu
0.250	1.931	1.953	1.953
0.750	1.952	1.965	1.965
1.250	1.973	1.986	1.986
1.750	2.000	2.014	2.014
2.250	2.035	2.053	2.053
2.750	2.076	2.103	2.103
3.250	2.050	2.063	1.972
3.750	1.987	1.986	1.843
4.250	1.934	1.917	1.766
4.750	1.913	1.884	1.740
5.250	1.926	1.886	1.736
5.750	1.934	1.859	1.716
6.250	1.917	1.836	1.715
6.750	1.929	1.844	1.718
7.250	1.945	1.875	1.750
7.750	1.951	1.926	1.805
8.250	1.950	1.950	1.853
8.750	1.939	1.941	1.899
9.250	1.927	1.935	1.939
9.750	1.919	1.934	1.968
10.250	1.914	1.933	1.983
10.750	1.906	1.932	1.980
11.250	1.890	1.923	1.962
11.750	1.856	1.890	1.906

Basis: $F_q^{RTP} = 2.50$

SEABROOK STATION CYCLE 5 CORE OPERATING LIMITS REPORT	Coordinates for F_q (Z) Limit As A Function of Core Height for Operation with Fixed Incore Detector System Alarm Inoperable FIGURE 4.5



SEABROOK STATION CYCLE 5 CORE OPERATING LIMITS REPORT	All-Rods-Out Nuclear Enthalpy Rise Hot Channel Factor Versus Power Level FIGURE 5