

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

CORE OPERATING LIMITS REPORT

Unit 1 - Cycle 18

Revision 0

Note: This report is not part of the Technical Specifications.
This report is referenced in Technical Specifications.

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This report provides the values of the limits for Unit 1 Cycle 18 as required by Technical Specification Section 6.7.A.6. These values have been established using NRC approved methodology and are established such that all applicable limits of the plant safety analysis are met.

Heat Flux Hot Channel Factor Limits

$$F_q^{RTP} = 2.40$$

K(Z) values are provided in Figure 1.

V(Z) values are provided in Figures 2a through 2f.

Reference Technical Specification Sections: 3.10.B.1 and 3.10.B.2

Nuclear Enthalpy Rise Hot Channel Factor Limits

$$F_{\Delta H}^{RTP} = 1.77$$

$$PFDH = 0.3$$

If the nuclear enthalpy rise hot channel factor exceeds its limit in Technical Specification 3.10.B.1, reduce reactor power and the high neutron flux trip setpoint by 3.33% for each percent that the measured nuclear enthalpy rise hot channel factor exceeds the 3.10.B.1 limit.

Reference Technical Specification Sections: 3.10.B.1, 3.10.B.2, and 3.10.B.3

Linear Heat Generation Rate

The 95% probability level ECCS analysis calculation utilized a peak linear heat generation rate of 14.788 kw/ft.

The Appendix K ECCS analysis calculation utilized a peak linear heat generation rate of 15.167 kw/ft for the F_Q limit of 2.40.

Reference Technical Specification Section: 3.10.B

Axial Flux Difference Limits

The Axial Flux difference limits are provided in Figure 3.

The Axial Flux Difference target band is $\pm 5\%$.

Reference Technical Specification Sections: 3.10.B.4 through 3.10.B.9

Shutdown Rod Insertion Limits

The shutdown rods shall be fully withdrawn.

Reference Technical Specification Sections: 3.10.D

Control Rod Insertion Limits

The control rod banks shall be limited in physical insertion as shown in Figures 4, 5, and 6.

Reference Technical Specification Sections: 3.10.D and 3.10.G

Reactor Coolant Flow Limit

The reactor coolant system flow shall be $\geq 178,000$ gpm.

Reference Technical Specification Sections: 3.10.J

Penalty on F_Q for Small Break LOCA - $K(z)$

The Small and Large Break LOCA analyses performed for this cycle are valid for $F_Q \leq 2.80$ and $F_Q \leq 2.40$, respectively. The F_Q limit for the Large Break LOCA analysis is more limiting than the F_Q limit for the Small Break LOCA analysis. The Small Break LOCA analysis incorporates the $K(z)$ methodology. However, since the Small Break LOCA is less limiting than the Large Break LOCA analysis, no $K(z)$ penalty needs to be applied to calculations of most limiting F_Q values. Thus for the equation in Technical Specification 3.10.B, $K(z)$ is equal to 1. $K(z)$ is shown graphically in Figure 1.

Transient Power Distribution Penalty for F_Q - $V(z)$

Table 1 summarizes the bounding $V(z)$ values for the middle 80% of the core for Prairie Island Unit 1 Cycle 18. The $V(z)$ penalty takes the form of straight lines connecting data points determined as a function of core height. A particular $V(z)$ curve is valid over a given exposure range and equilibrium Axial Offset (AO) range as noted in Table 1. The $V(z)$ penalty for each exposure and AO range is shown graphically in Figures 2a - 2f.

Table 1
Bounding V(z) Values

Exposure Range	z (ft), V(z)
0 - 1.5 GWd/MtU Eq AO range: -3% to +5% Operating Band: $\pm 5\% \Delta I$	0.25, 1.120
	1.25, 1.106
	2.75, 1.085
	3.75, 1.081
	5.75, 1.084
	7.75, 1.060
	8.75, 1.072
	10.25, 1.090
	11.75, 1.092
0 - 4 GWd/MtU Eq AO range: -6% to +4% Operating Band: $\pm 5\% \Delta I$	0.25, 1.120
	1.25, 1.106
	2.75, 1.087
	3.75, 1.081
	5.75, 1.086
	7.75, 1.076
	8.75, 1.090
	10.25, 1.103
	11.75, 1.109
0 - 8 GWd/MTU Eq AO range: -6% to +3% Operating Band: $\pm 5\% \Delta I$	0.25, 1.120
	1.25, 1.106
	2.75, 1.090
	3.75, 1.081
	5.75, 1.086
	7.75, 1.085
	8.75, 1.094
	10.25, 1.105
	11.75, 1.109

Table 1

Bounding V(z) Values (continued)

Exposure Range	z (ft), V(z)
0 - 13 GWd/MTU	0.25, 1.120
Eq AO range: -6% to +2%	1.25, 1.109
Operating Band: $\pm 5\% \Delta I$	2.75, 1.090
	3.75, 1.081
	5.75, 1.086
	7.75, 1.091
	8.75, 1.097
	10.25, 1.105
	11.75, 1.109
0 - 16.5 GWd/MtU	0.25, 1.122
Eq AO range: -4% to +4%	1.25, 1.120
Operating Band: $\pm 5\% \Delta I$	2.75, 1.094
	3.75, 1.093
	5.75, 1.110
	7.75, 1.102
	8.75, 1.097
	10.25, 1.106
	11.75, 1.115
0 - EOC GWd/MtU	0.25, 1.127
Eq AO range: -4% to +4%	1.25, 1.126
Operating Band: $\pm 5\% \Delta I$	2.75, 1.094
	3.75, 1.100
	5.75, 1.114
	7.75, 1.113
	8.75, 1.097
	10.25, 1.109
	11.75, 1.115

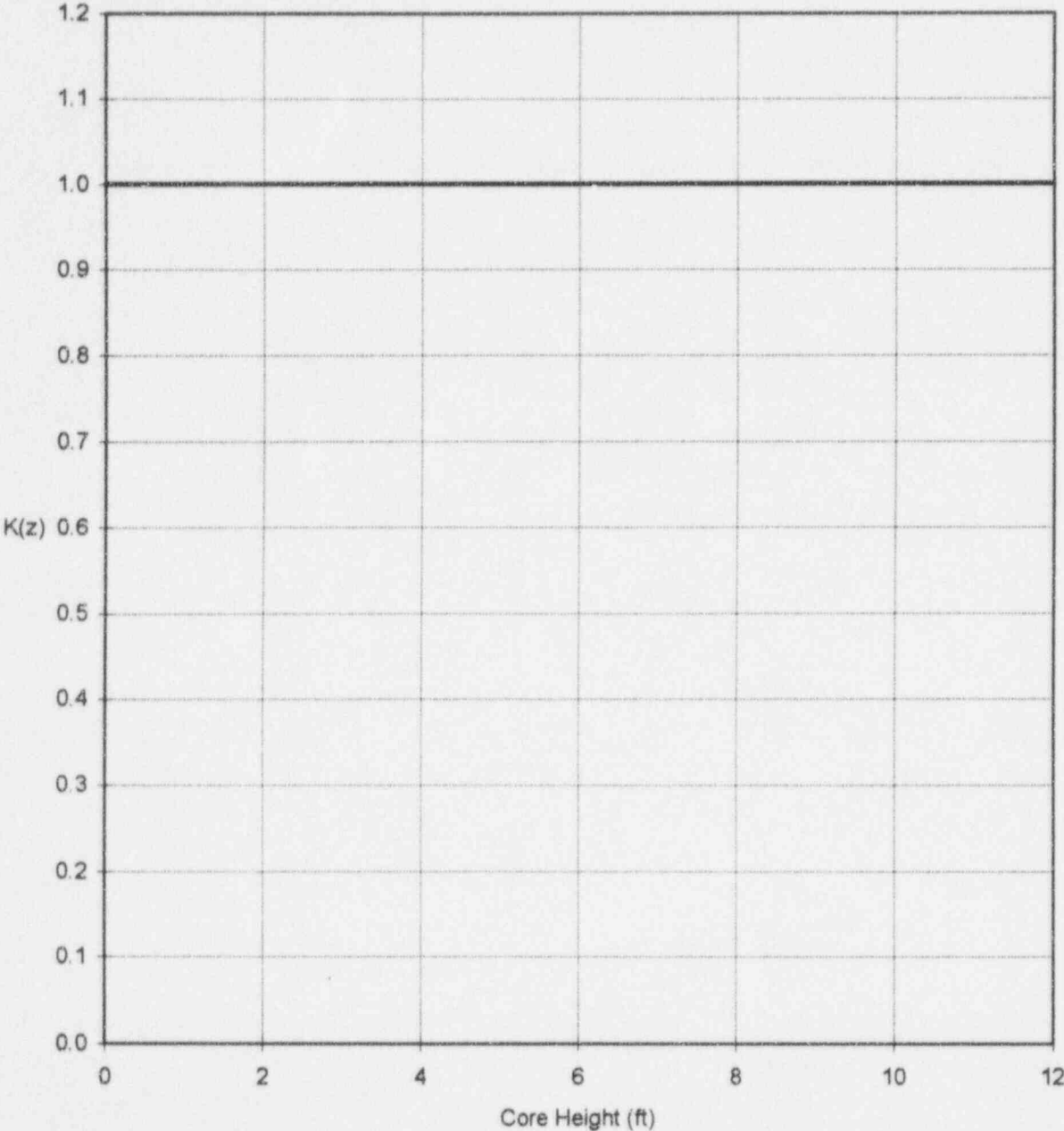


Figure 1 HOT CHANNEL FACTOR NORMALIZED
OPERATING ENVELOPE

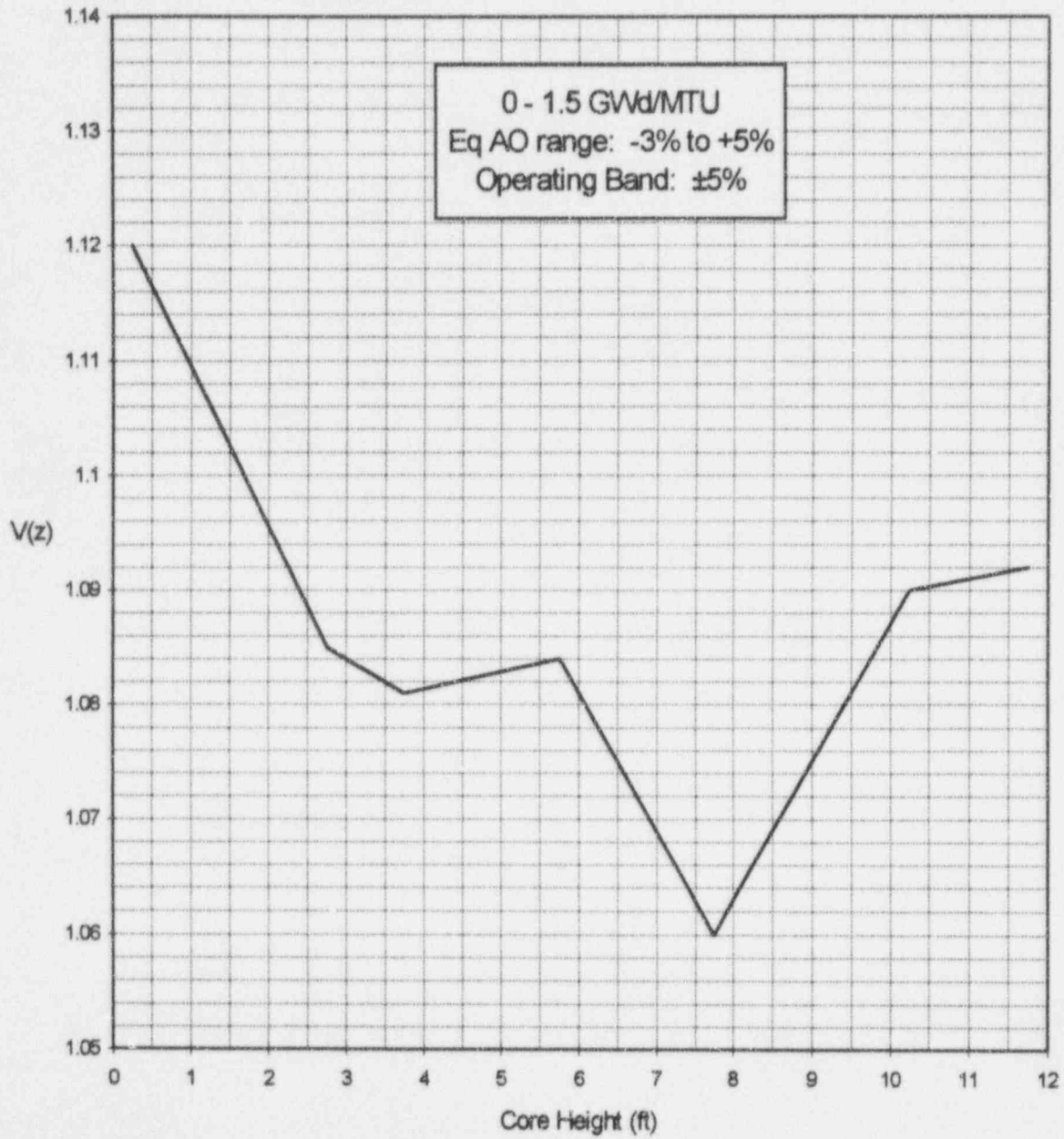


Figure 2a Bounding V(Z) Value
From 0 - 1.5 GWd/MTU

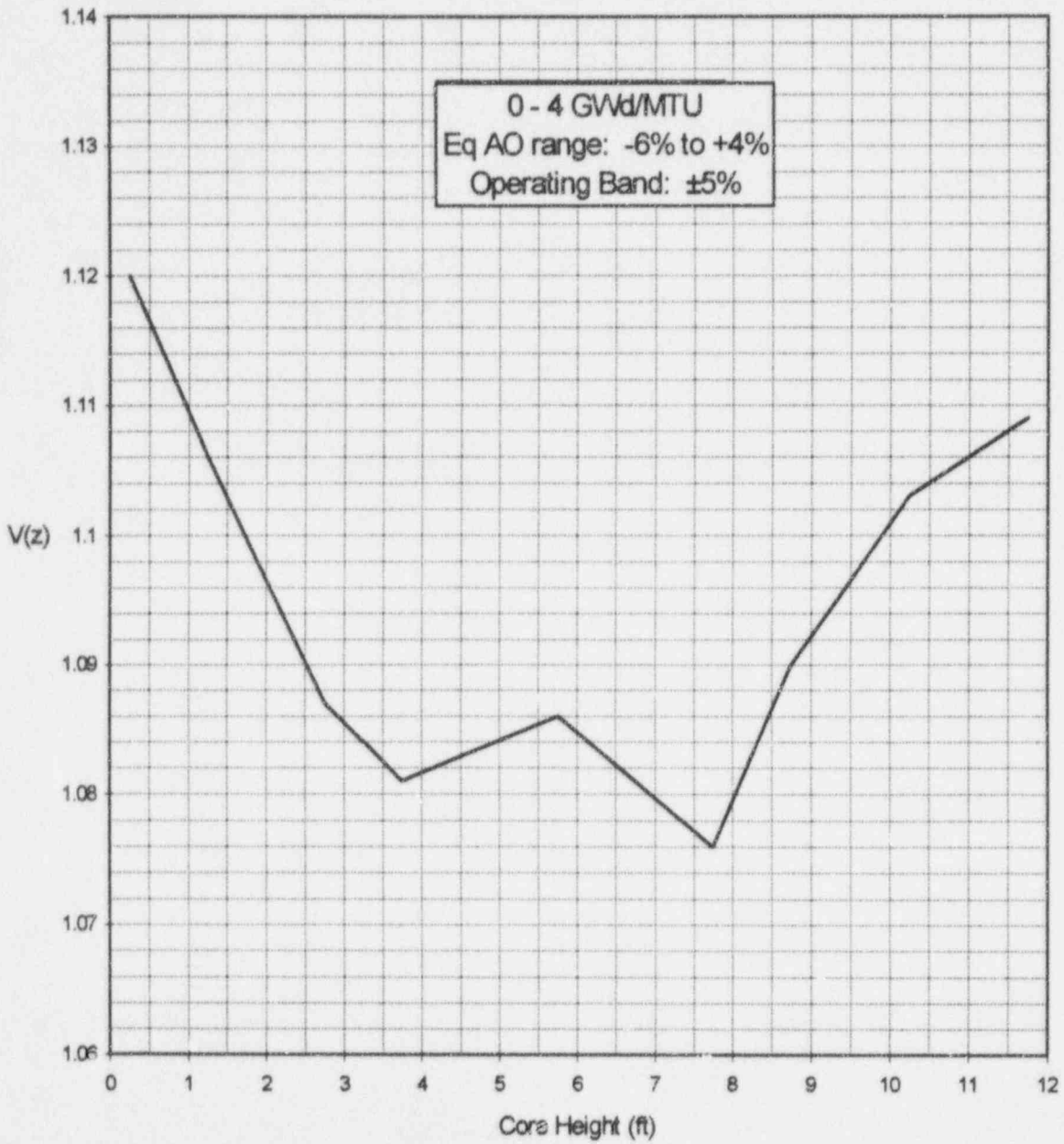


Figure 2b Bounding V(Z) Values
From 0 - 4 GWd/MTU

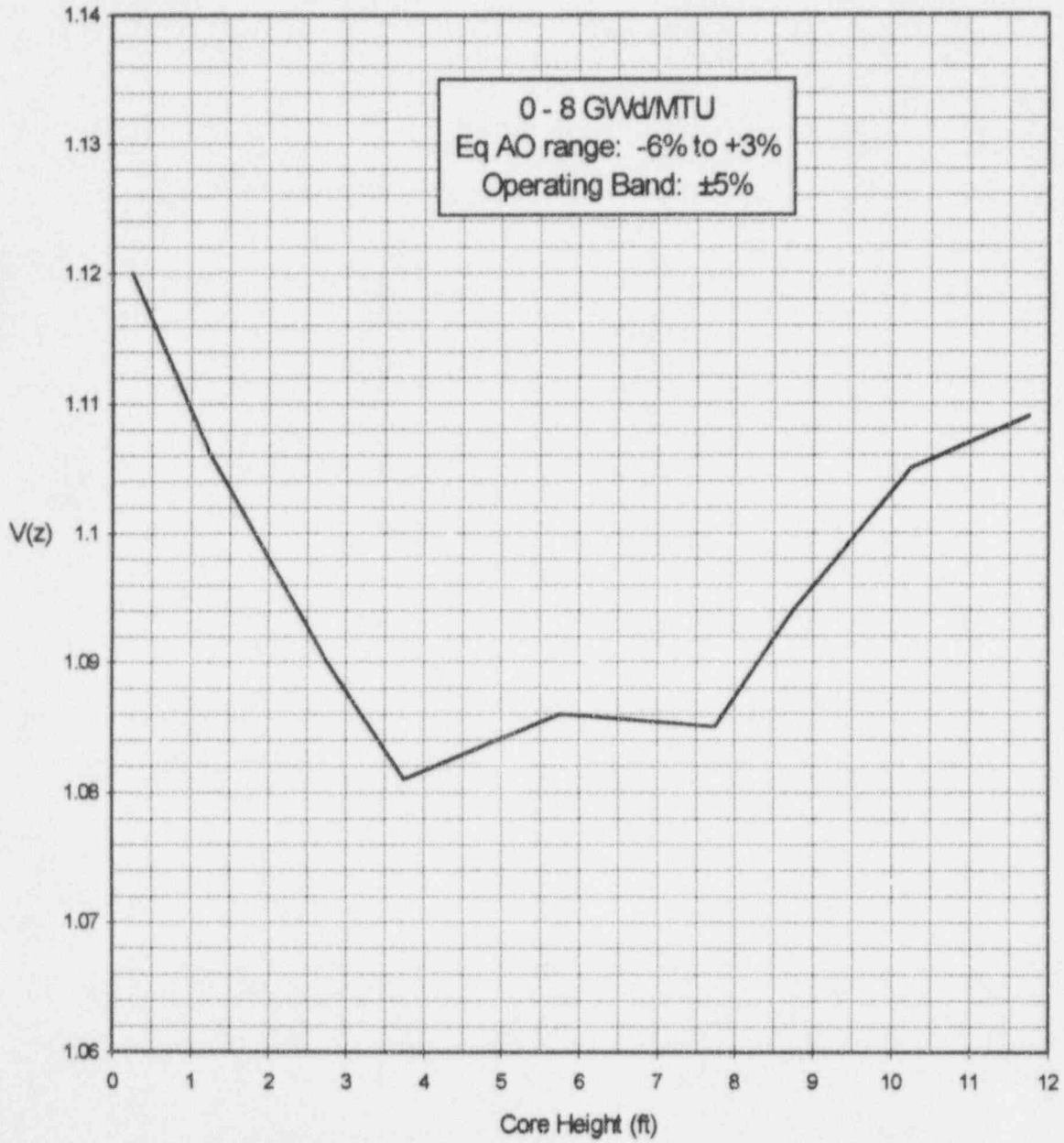


Figure 2c Bounding V(Z) Values
From 0 - 8 GWd/MTU

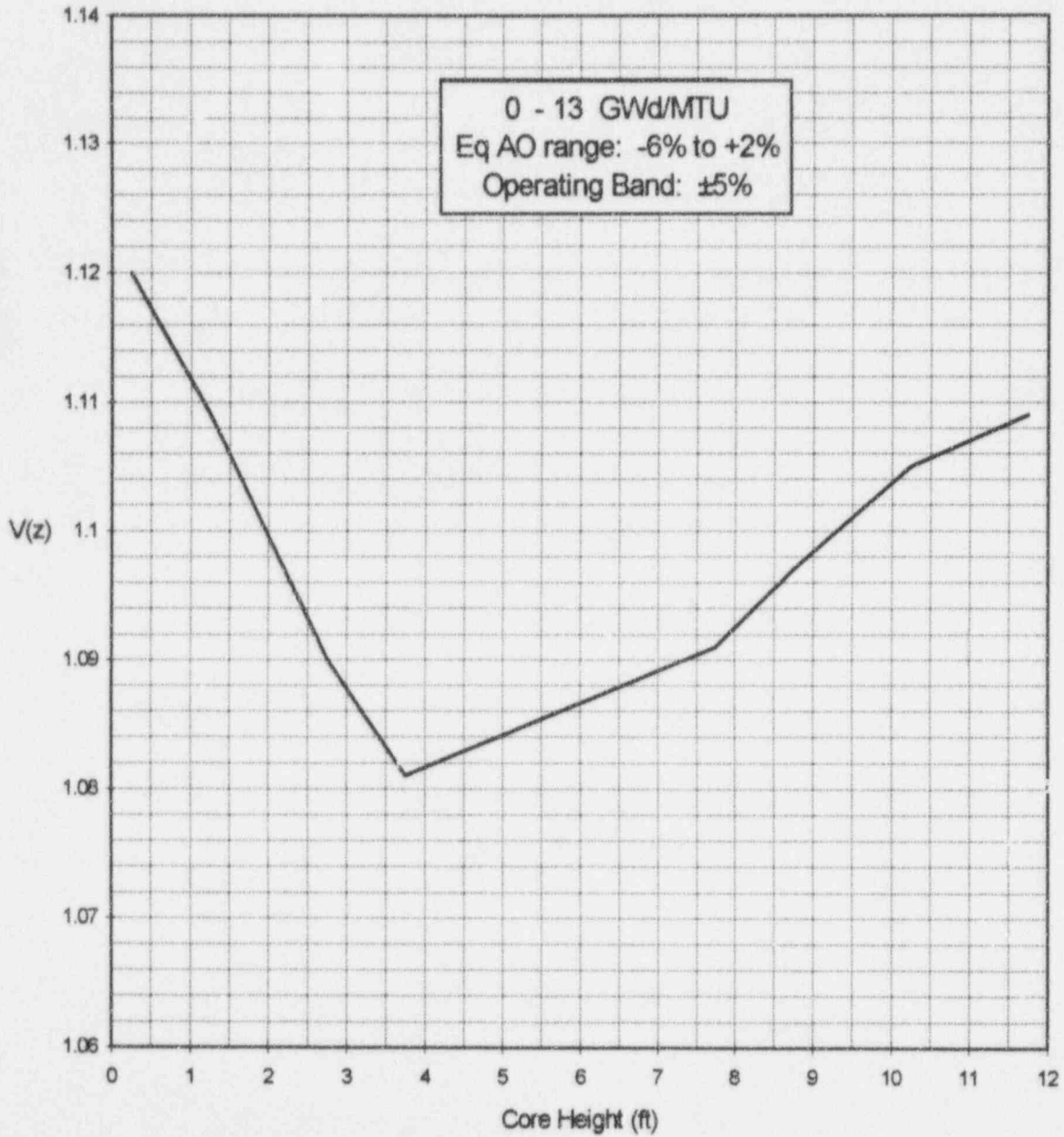


Figure 2d Bounding V(Z) Values
From 0 - 13 GWd/MTU

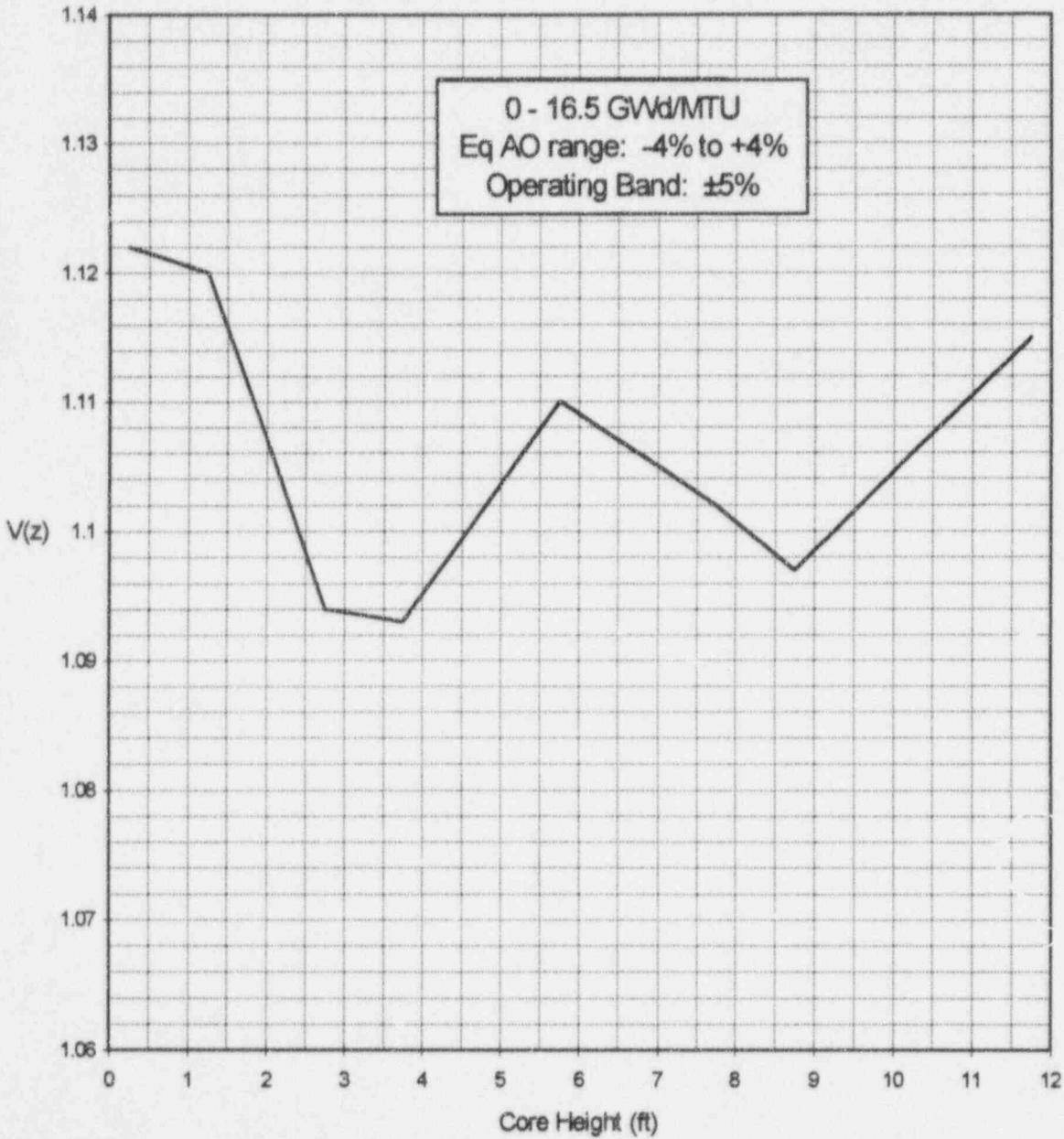


Figure 2e Bounding V(Z) Values
From 0 - 16.5 GWd/MTU

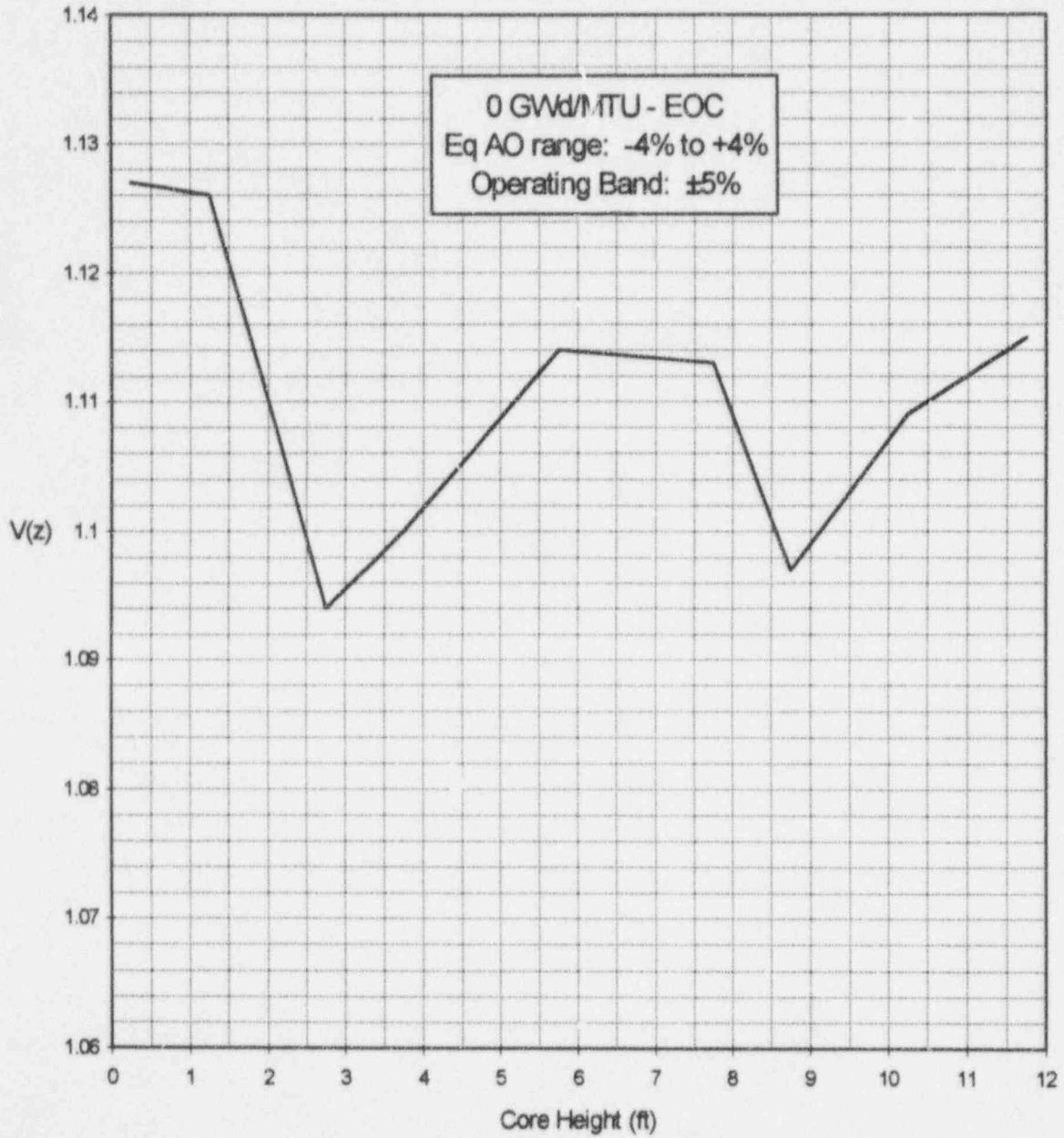


Figure 2f Bounding V(Z) Values
From BOC - EOC

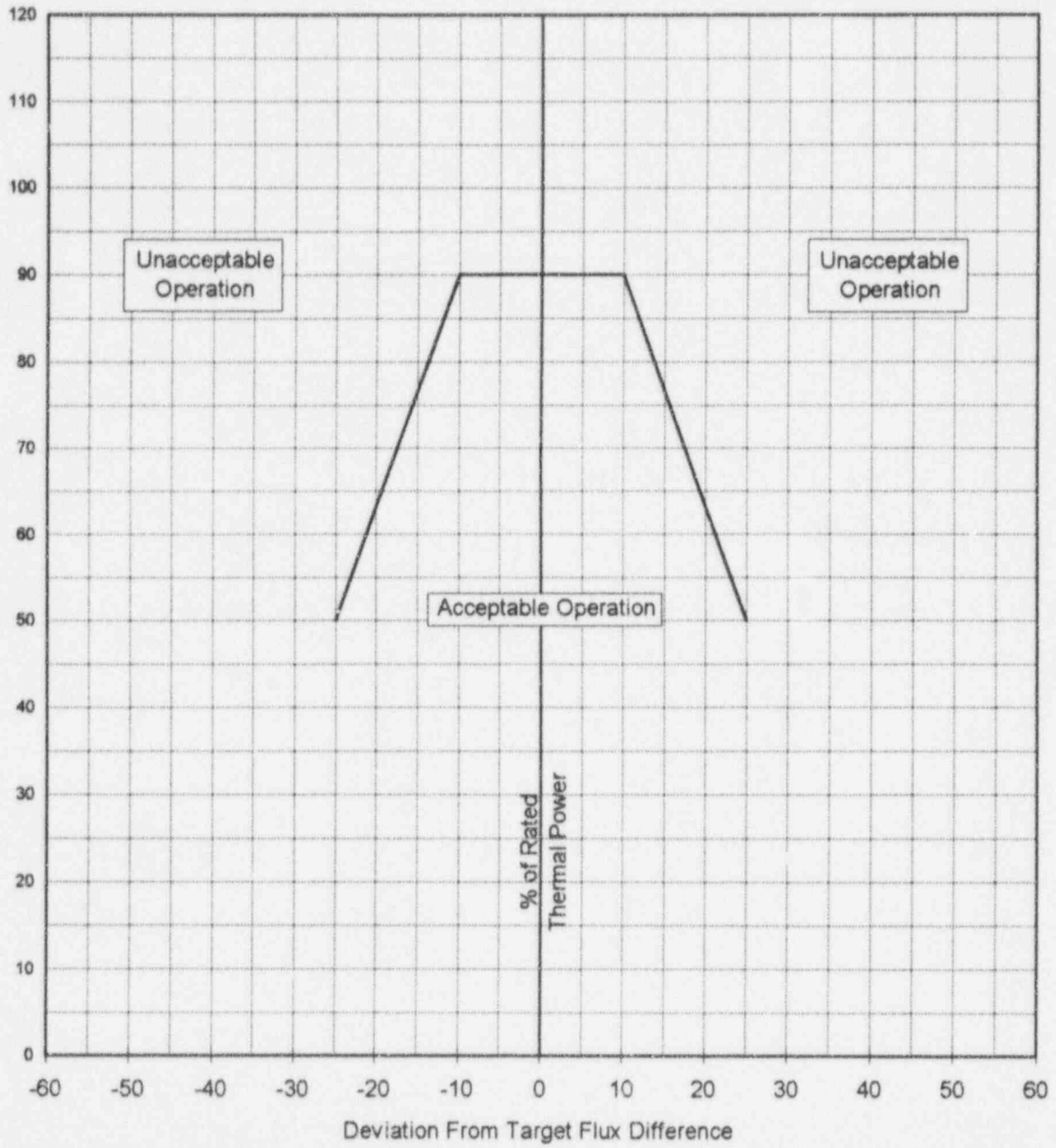


Figure 3 DEVIATION FROM TARGET FLUX DIFFERENCE AS A FUNCTION OF THERMAL POWER

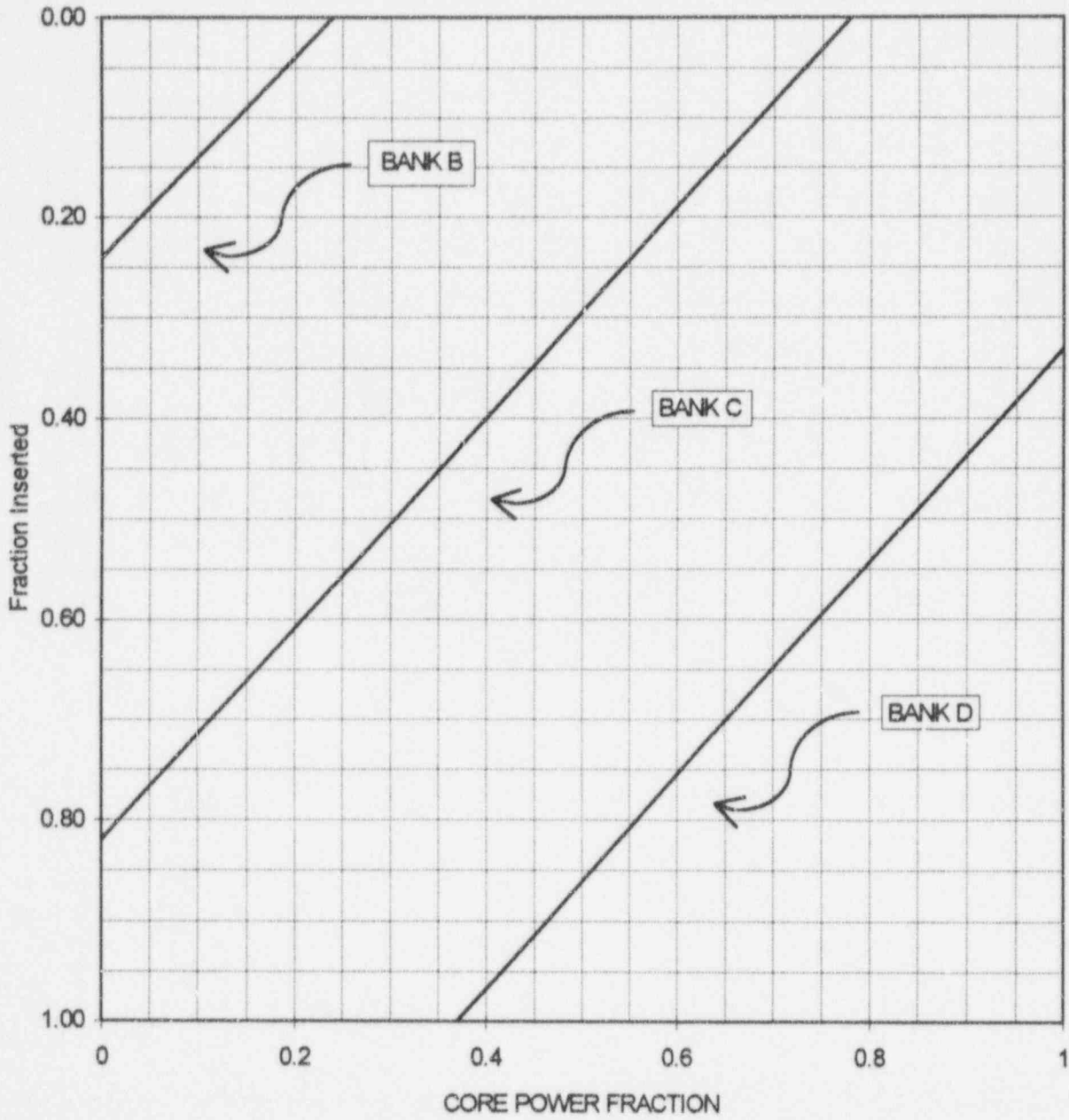


Figure 4 CONTROL BANK INSERTION LIMIT

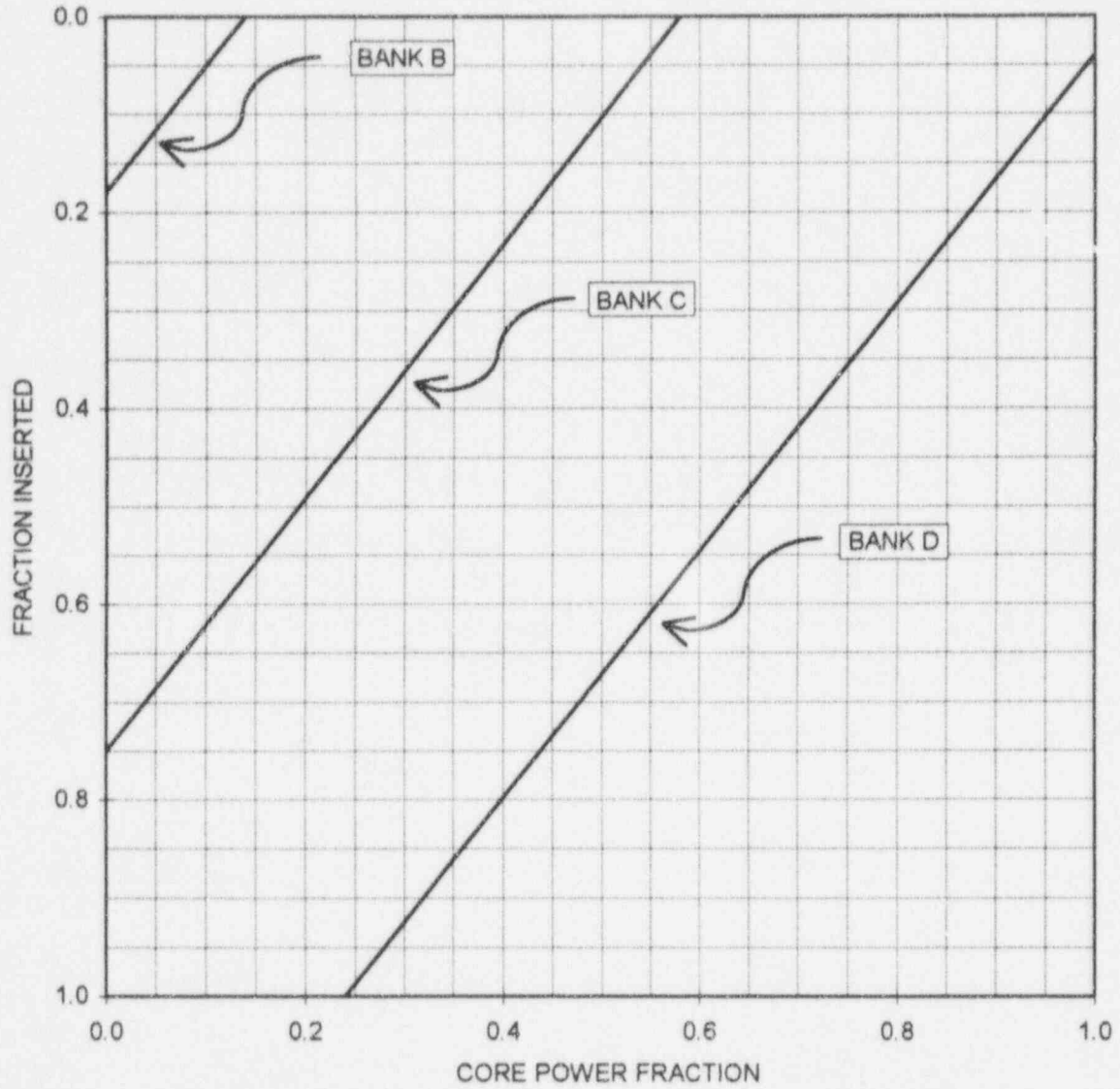


Figure 5 INSERTION LIMITS
100 STEP OVERLAP WITH ONE
BOTTOMED ROD
(Technical Specification 3.10.G.3)

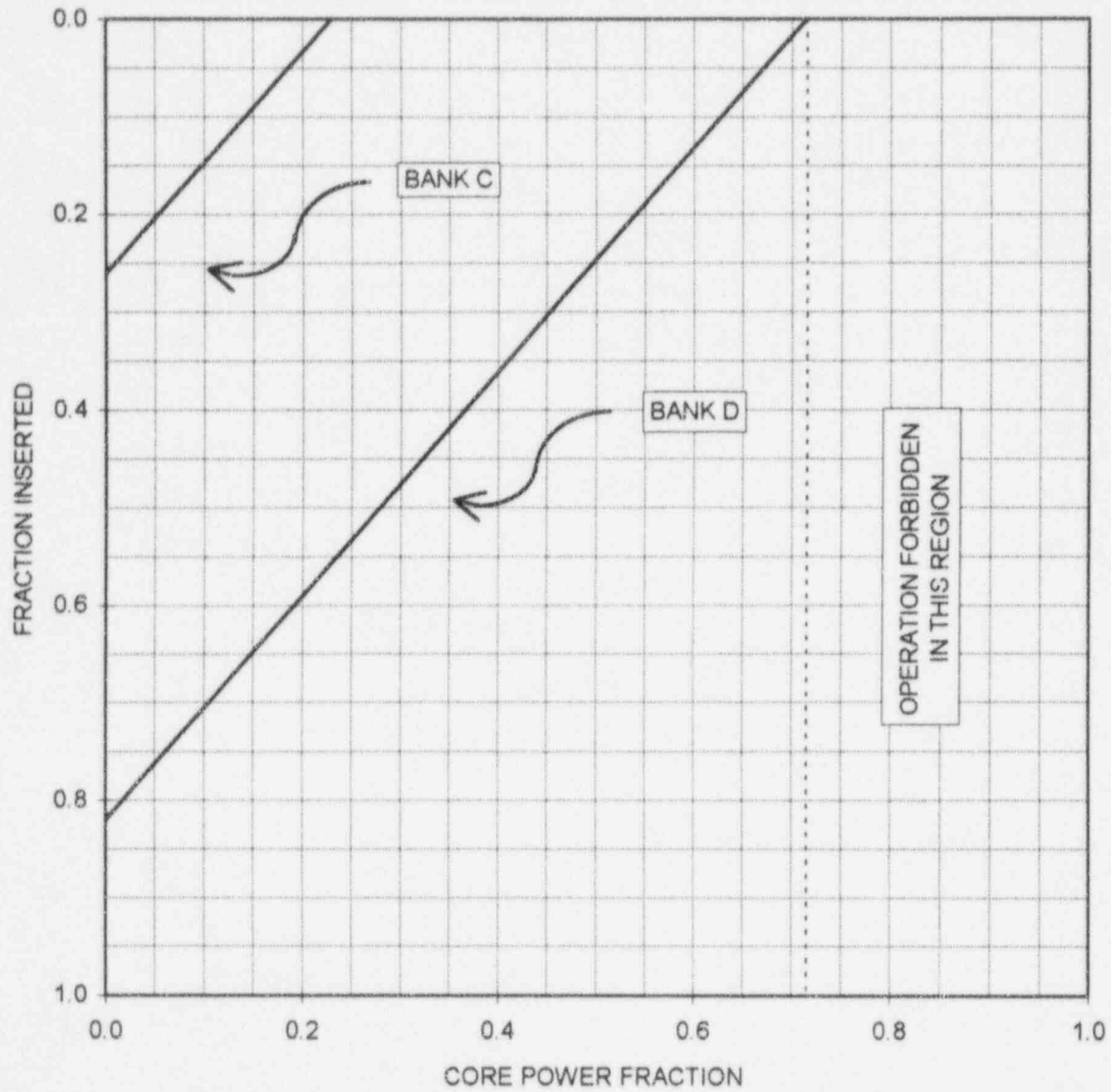

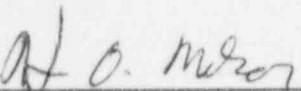

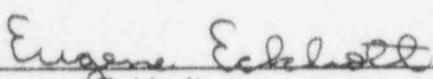


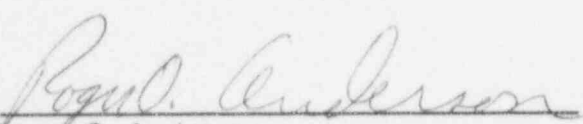
Figure 6 INSERTION LIMITS -
100 STEP OVERLAP WITH ONE
INOPERABLE ROD
(Technical Specification 3.10.G.4)

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