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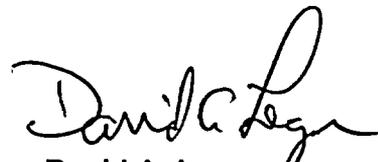
April 20, 2005  
NOC-AE-05001873  
STI: 31875234  
10CFR50.36

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
One White Flint North  
11555 Rockville Pike  
Rockville, MD 20852

South Texas Project  
Unit 1  
Docket Nos. STN 50-498  
Unit 1 Cycle 13 Core Operating Limits Report

In accordance with Technical Specification 6.9.1.6.d, the attached Core Operating Limits Report is submitted for Unit 1 Cycle 13. This report reflects core design changes made during the 1RE12 refueling outage.

If there are any questions concerning this report, please contact Scott Head at (361) 972-7136 or me at (361) 972-7795.

  
David A. Leazar  
Director,  
Nuclear Fuel & Analysis

jal

Attachment:

1. Unit 1 Cycle 13 Core Operating Limits Report, Rev. 0.

A001

cc:  
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UIC13-0  
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**SOUTH TEXAS PROJECT**

**Unit 1 Cycle 13**

**CORE OPERATING LIMITS REPORT**

Revision 0

## 1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report for STPEGS Unit 1 Cycle 13 has been prepared in accordance with the requirements of Technical Specification 6.9.1.6. The core operating limits have been developed using the NRC-approved methodologies specified in Technical Specification 6.9.1.6.

The Technical Specifications affected by this report are:

- 1) 2.1 SAFETY LIMITS
- 2) 2.2 LIMITING SAFETY SYSTEM SETTINGS
- 3) 3/4.1.1.1 SHUTDOWN MARGIN
- 4) 3/4.1.1.3 MODERATOR TEMPERATURE COEFFICIENT LIMITS
- 5) 3/4.1.3.5 SHUTDOWN ROD INSERTION LIMITS
- 6) 3/4.1.3.6 CONTROL ROD INSERTION LIMITS
- 7) 3/4.2.1 AFD LIMITS
- 8) 3/4.2.2 HEAT FLUX HOT CHANNEL FACTOR
- 9) 3/4.2.3 NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR
- 10) 3/4.2.5 DNB PARAMETERS

## 2.0 OPERATING LIMITS

The cycle-specific parameter limits for the specifications listed in Section 1.0 are presented below.

### 2.1 SAFETY LIMITS (Specification 2.1):

- 2.1.1 The combination of THERMAL POWER, pressurizer pressure, and the highest operating loop coolant temperature ( $T_{avg}$ ) shall not exceed the limits shown in Figure 1.

### 2.2 LIMITING SAFETY SYSTEM SETTINGS (Specification 2.2):

- 2.2.1 The Loop design flow for Reactor Coolant Flow-Low is 98,000 gpm.

2.2.2 The Over-temperature  $\Delta T$  and Over-power  $\Delta T$  setpoint parameter values are listed below:

**Over-temperature  $\Delta T$  Setpoint Parameter Values**

- $\tau_1$  measured reactor vessel  $\Delta T$  lead/lag time constant,  $\tau_1 = 8$  sec
- $\tau_2$  measured reactor vessel  $\Delta T$  lead/lag time constant,  $\tau_2 = 3$  sec
- $\tau_3$  measured reactor vessel  $\Delta T$  lag time constant,  $\tau_3 = 2$  sec
- $\tau_4$  measured reactor vessel average temperature lead/lag time constant,  $\tau_4 = 28$  sec
- $\tau_5$  measured reactor vessel average temperature lead/lag time constant,  $\tau_5 = 4$  sec
- $\tau_6$  measured reactor vessel average temperature lag time constant,  $\tau_6 = 2$  sec
- $K_1$  Overtemperature  $\Delta T$  reactor trip setpoint,  $K_1 = 1.14$
- $K_2$  Overtemperature  $\Delta T$  reactor trip setpoint  $T_{avg}$  coefficient,  $K_2 = 0.028/^\circ F$
- $K_3$  Overtemperature  $\Delta T$  reactor trip setpoint pressure coefficient,  $K_3 = 0.00143/psig$
- $T'$  Nominal full power  $T_{avg}$ ,  $T' \leq 592.0$   $^\circ F$
- $P'$  Nominal RCS pressure,  $P' = 2235$  psig

$f_1(\Delta I)$  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 such that:

- (1) For  $q_t - q_b$  between  $-70\%$  and  $+8\%$ ,  $f_1(\Delta I) = 0$ , where  $q_t$  and  $q_b$  are percent RATED THERMAL POWER in the top and bottom halves of the core respectively, and  $q_t + q_b$  is total THERMAL POWER in percent of RATED THERMAL POWER;
- (2) For each percent that the magnitude of  $q_t - q_b$  exceeds  $-70\%$ , the  $\Delta T$  Trip Setpoint shall be automatically reduced by  $0.0\%$  of its value at RATED THERMAL POWER; and
- (3) For each percent that the magnitude of  $q_t - q_b$  exceeds  $+8\%$ , the  $\Delta T$  Trip Setpoint shall be automatically reduced by  $2.65\%$  of its value at RATED THERMAL POWER.

**Over-power  $\Delta T$  Setpoint Parameter Values**

- $\tau_1$  measured reactor vessel  $\Delta T$  lead/lag time constant,  $\tau_1 = 8$  sec
- $\tau_2$  measured reactor vessel  $\Delta T$  lead/lag time constant,  $\tau_2 = 3$  sec
- $\tau_3$  measured reactor vessel  $\Delta T$  lag time constant,  $\tau_3 = 2$  sec
- $\tau_6$  measured reactor vessel average temperature lag time constant,  $\tau_6 = 2$  sec
- $\tau_7$  Time constant utilized in the rate-lag compensator for  $T_{avg}$ ,  $\tau_7 = 10$  sec
- $K_4$  Overpower  $\Delta T$  reactor trip setpoint,  $K_4 = 1.08$
- $K_5$  Overpower  $\Delta T$  reactor trip setpoint  $T_{avg}$  rate/lag coefficient,  $K_5 = 0.02/^\circ F$  for increasing average temperature, and  $K_5 = 0$  for decreasing average temperature
- $K_6$  Overpower  $\Delta T$  reactor trip setpoint  $T_{avg}$  heatup coefficient  $K_6 = 0.002/^\circ F$  for  $T > T''$ , and  $K_6 = 0$  for  $T \leq T''$
- $T''$  Indicated full power  $T_{avg}$ ,  $T'' \leq 592.0$   $^\circ F$
- $f_2(\Delta I) = 0$  for all  $(\Delta I)$

**2.3 SHUTDOWN MARGIN (Specification 3.1.1.1):**

The SHUTDOWN MARGIN shall be:

- 2.3.1 Greater than 1.3%  $\Delta\rho$  for MODES 1 and 2\*  
\*See Special Test Exception 3.10.1
- 2.3.2 Greater than the limits in Figure 2 for MODES 3 and 4.
- 2.3.3 Greater than the limits in Figure 3 for MODE 5.

**2.4 MODERATOR TEMPERATURE COEFFICIENT (Specification 3.1.1.3):**

- 2.4.1 The BOL, ARO, MTC shall be less positive than the limits shown in Figure 4.
- 2.4.2 The EOL, ARO, HFP, MTC shall be less negative than  $-62.6$  pcm/ $^{\circ}$ F.
- 2.4.3 The 300 ppm, ARO, HFP, MTC shall be less negative than  $-53.6$  pcm/ $^{\circ}$ F (300 ppm Surveillance Limit).

Where: BOL stands for Beginning-of-Cycle Life,  
EOL stands for End-of-Cycle Life,  
ARO stands for All Rods Out,  
HFP stands for Hot Full Power (100% RATED THERMAL POWER),  
HFP vessel average temperature is 592  $^{\circ}$ F.

- 2.4.4 The Revised Predicted near-EOL 300 ppm MTC shall be calculated using the algorithm from T.S. 6.9.1.6.b.10:

$$\text{Revised Predicted MTC} = \text{Predicted MTC} + \text{AFD Correction} - 3 \text{ pcm}/^{\circ}\text{F}$$

If the Revised Predicted MTC is less negative than the S.R. 4.1.1.3b limit and all of the benchmark data contained in the surveillance procedure are met, then an MTC measurement in accordance with S.R. 4.1.1.3b is not required.

**2.5 ROD INSERTION LIMITS (Specification 3.1.3.5 and 3.1.3.6):**

- 2.5.1 All banks shall have the same Full Out Position (FOP) of at least 250 steps withdrawn but not exceeding 259 steps withdrawn.
- 2.5.2 The Control Banks shall be limited in physical insertion as specified in Figure 5.
- 2.5.3 Individual Shutdown bank rods are fully withdrawn when the Bank Demand Indication is at the FOP and the Rod Group Height Limiting Condition for Operation is satisfied (T.S. 3.1.3.1).

**2.6 AXIAL FLUX DIFFERENCE (Specification 3.2.1):**

- 2.6.1 AFD limits as required by Technical Specification 3.2.1 are determined by CAOC Operations with an AFD target band of +5, -10%.
- 2.6.2 The AFD shall be maintained within the ACCEPTABLE OPERATION portion of Figure 6, as required by Technical Specifications.

**2.7 HEAT FLUX HOT CHANNEL FACTOR (Specification 3.2.2):**

- 2.7.1  $F_Q^{RTP} = 2.55$ .
- 2.7.2  $K(Z)$  is provided in Figure 7.
- 2.7.3 The  $F_{xy}$  limits for RATED THERMAL POWER ( $F_{xy}^{RTP}$ ) within specific core planes shall be:
- 2.7.3.1 Less than or equal to 2.102 for all cycle burnups for all core planes containing Bank "D" control rods, and
- 2.7.3.2 Less than or equal to the appropriate core height-dependent value from Table 1 for all unrodded core planes.
- 2.7.3.3  $PF_{xy} = 0.2$ .

These  $F_{xy}$  limits were used to confirm that the heat flux hot channel factor  $F_Q(Z)$  will be limited by Technical Specification 3.2.2 assuming the most-limiting axial power distributions expected to result for the insertion and removal of Control Banks C and D during operation, including the accompanying variations in the axial xenon and power distributions, as described in WCAP-8385. Therefore, these  $F_{xy}$  limits provide assurance that the initial conditions assumed in the LOCA analysis are met, along with the ECCS acceptance criteria of 10 CFR 50.46.

**2.8 ENTHALPY RISE HOT CHANNEL FACTOR (Specification 3.2.3):**

2.8.1  $F_{\Delta H}^{RTP} = 1.557^1$

2.8.2  $PF_{\Delta H} = 0.3$

**2.9 DNB PARAMETERS (Specification 3.2.5):**2.9.1 The following DNB-related parameters shall be maintained within the following limits:<sup>2</sup>

2.9.1.1 Reactor Coolant System  $T_{avg} \leq 595$  °F<sup>3</sup>,

2.9.1.2 Pressurizer Pressure,  $> 2200$  psig<sup>4</sup>,

2.9.1.3 Minimum Measured Reactor Coolant System Flow<sup>5</sup>  $> 403,000$  gpm.

**3.0 REFERENCES**

- 3.1 Letter from D. E. Robinson (Westinghouse) to D. F. Hoppes (STPNOC), "Unit 1 Cycle 13 Final Reload Evaluation (RE) Revision 1," ST-UB-NOC-05002532, Rev. 1, March 29 2005.
- 3.2 NUREG-1346, Technical Specifications, South Texas Project Unit Nos. 1 and 2.
- 3.3 STPNOC Calculation ZC-7035, Rev. 2, "Loop Uncertainty Calculation for RCS Tavg Instrumentation," Section 10.1, effective July 22, 2003.
- 3.4 STPNOC Calculation ZC-7032, Rev. 4, "Loop Uncertainty Calculation for Narrow Range Pressurizer Pressure Monitoring Instrumentation," Section 2.3, Page 9, effective July 22, 2003.
- 3.5 Condition Report Engineering Evaluation 03-6461-9, Revision 0, "Reload Safety Evaluation and Core Operating Limits Report for South Texas Unit 1 Cycle 13 Modes 1, 2, 3, 4, and 5."

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<sup>1</sup> Applies to all fuel in the Unit 1 Cycle 13 Core.

<sup>2</sup> A discussion of the processes to be used to take these readings is provided in the basis for Technical Specification 3.2.5.

<sup>3</sup> Includes a 1.9 °F measurement uncertainty per Reference 3.3.

<sup>4</sup> Limit not applicable during either a Thermal Power ramp in excess of 5% of RTP per minute or a Thermal Power step in excess of 10% RTP. Includes a 9.6 PSI measurement uncertainty as read on QDPS display per Reference 3.4.

<sup>5</sup> Includes a 2.8% flow measurement uncertainty.

Figure 1

Reactor Core Safety Limits - Four Loops in Operation

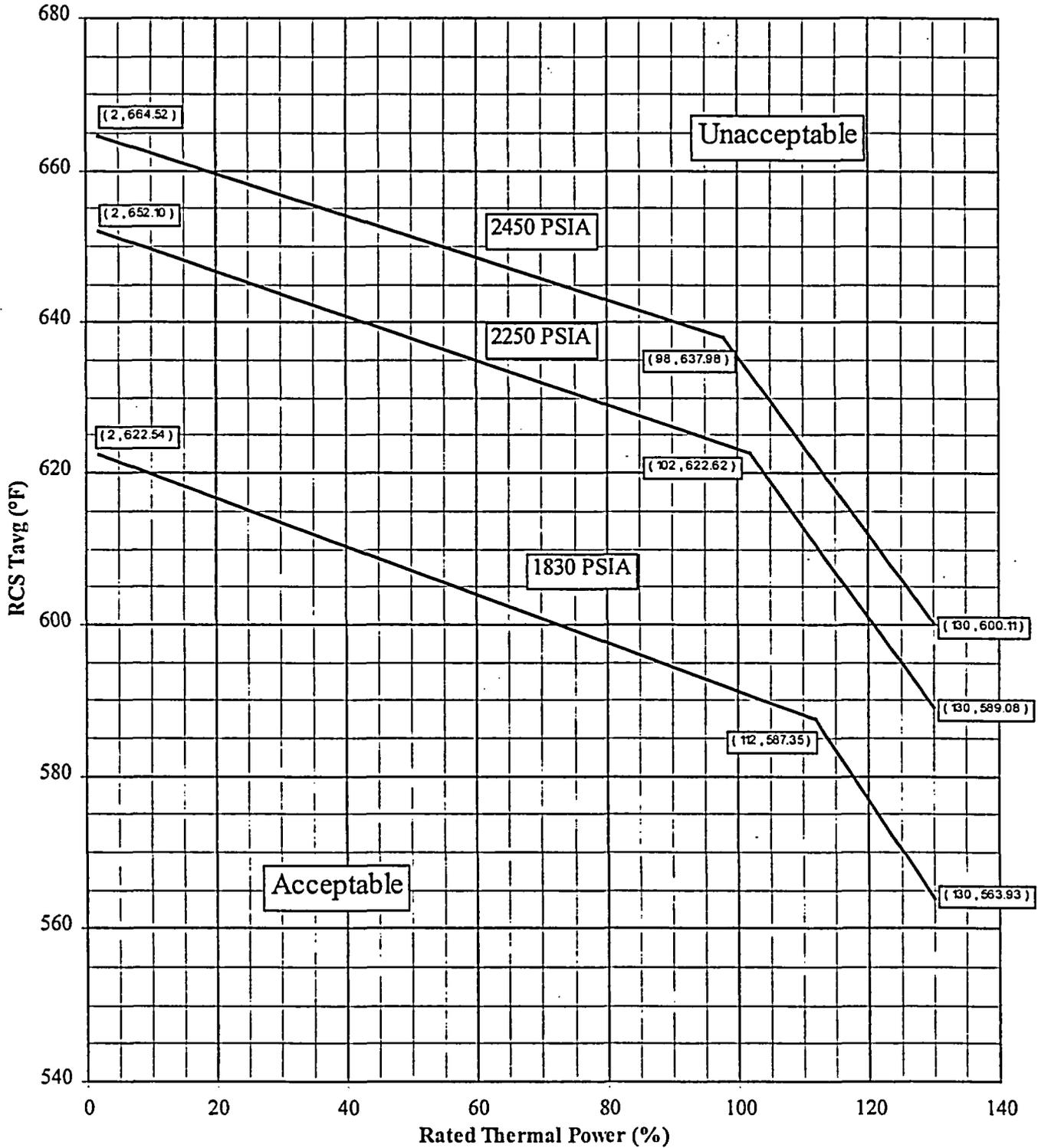


Figure 2

Required Shutdown Margin for Modes 3 & 4

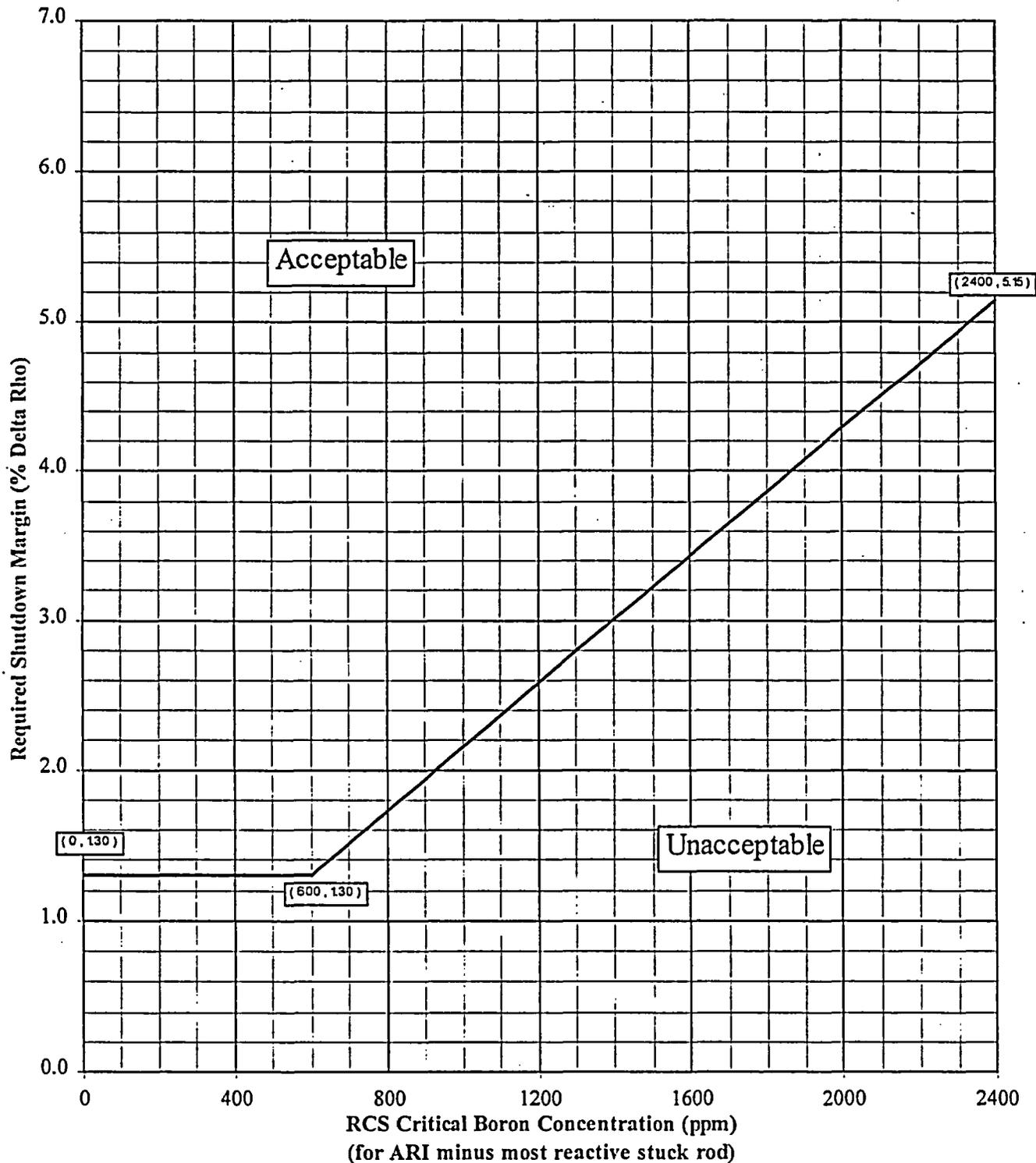


Figure 3

Required Shutdown Margin for Mode 5

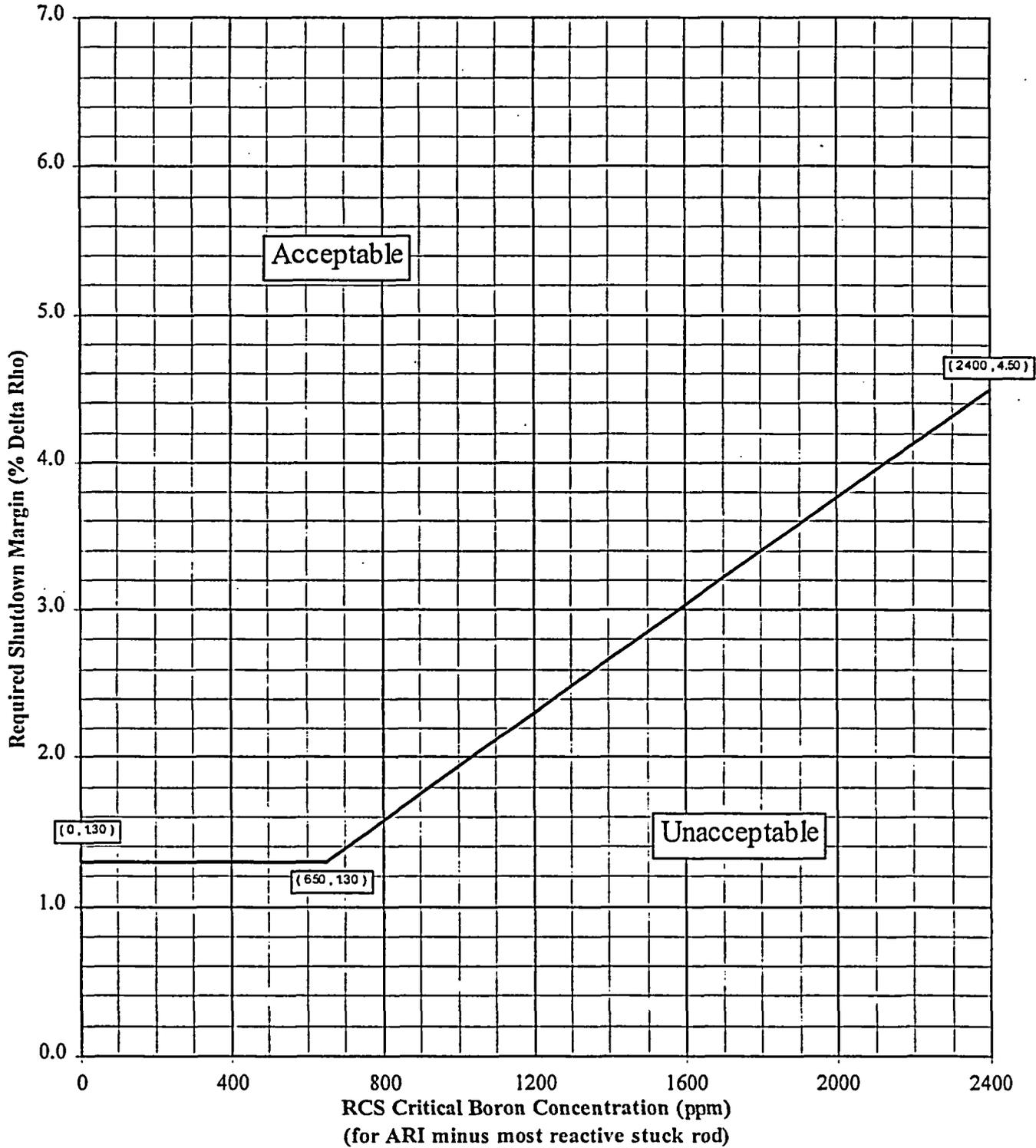


Figure 4

MTC versus Power Level

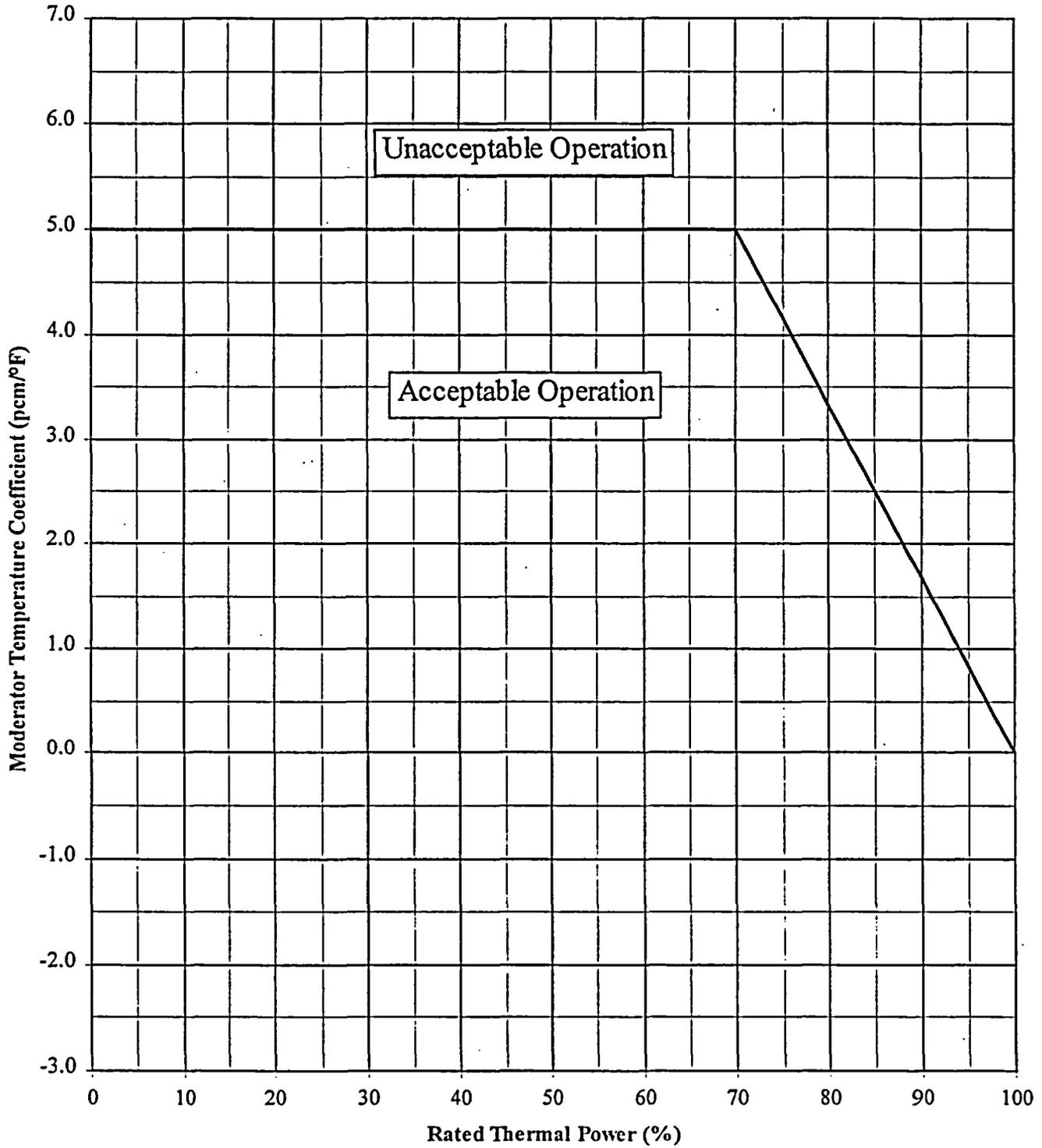


Figure 5

Control Rod Insertion Limits\* versus Power Level

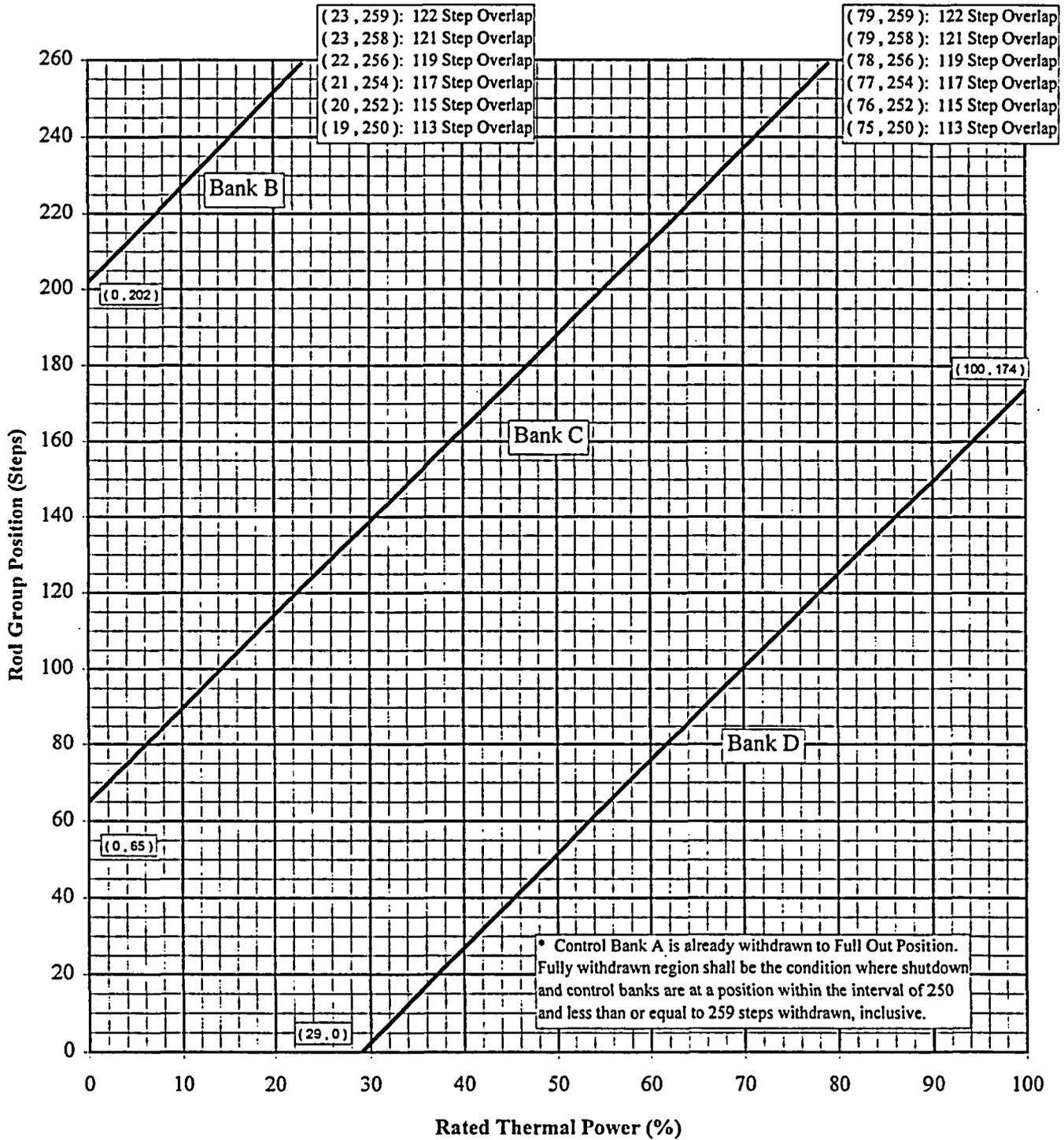


Figure 6

AFD Limits versus Power Level

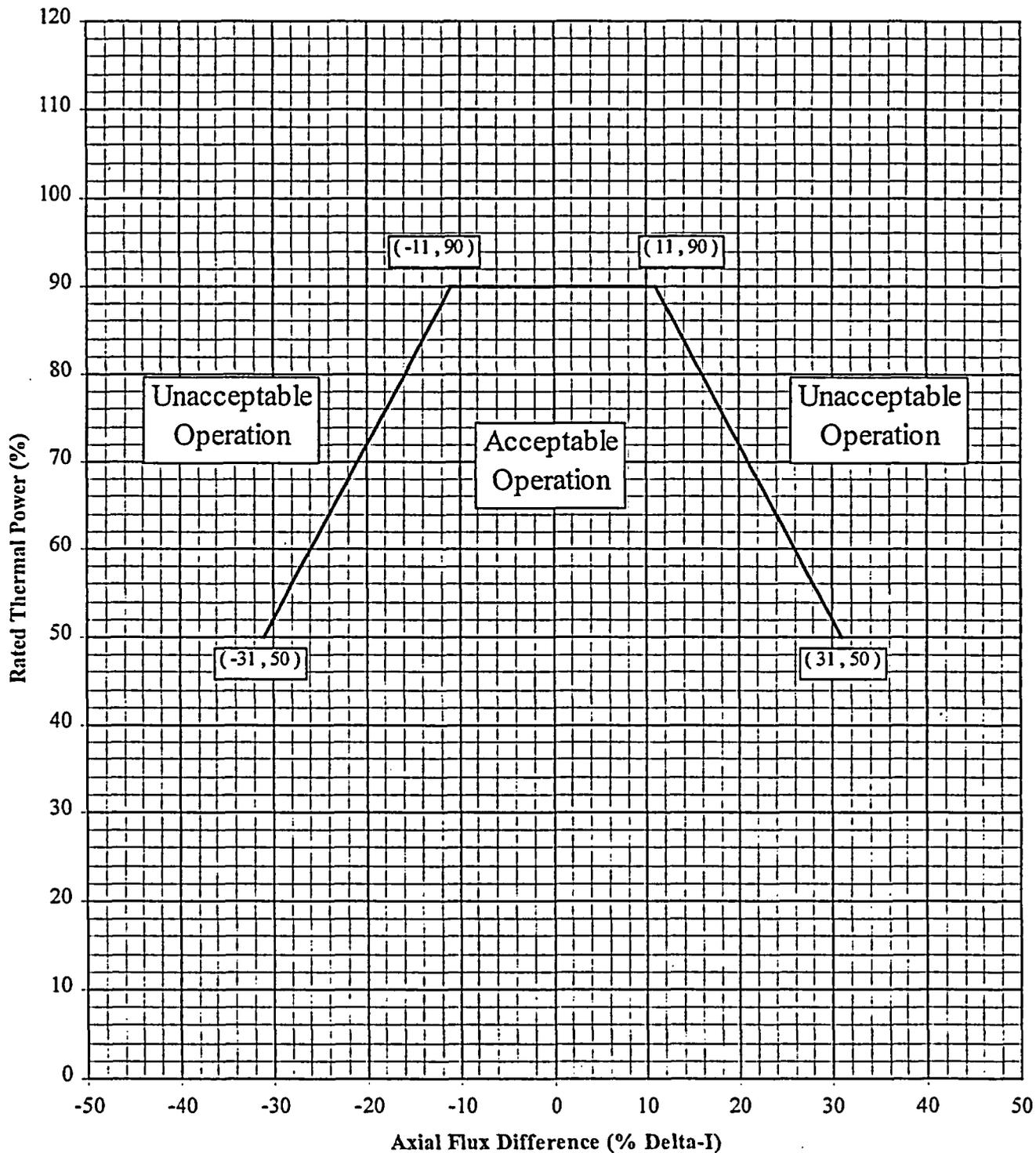


Figure 7

K(Z) - Normalized FQ(Z) versus Core Height

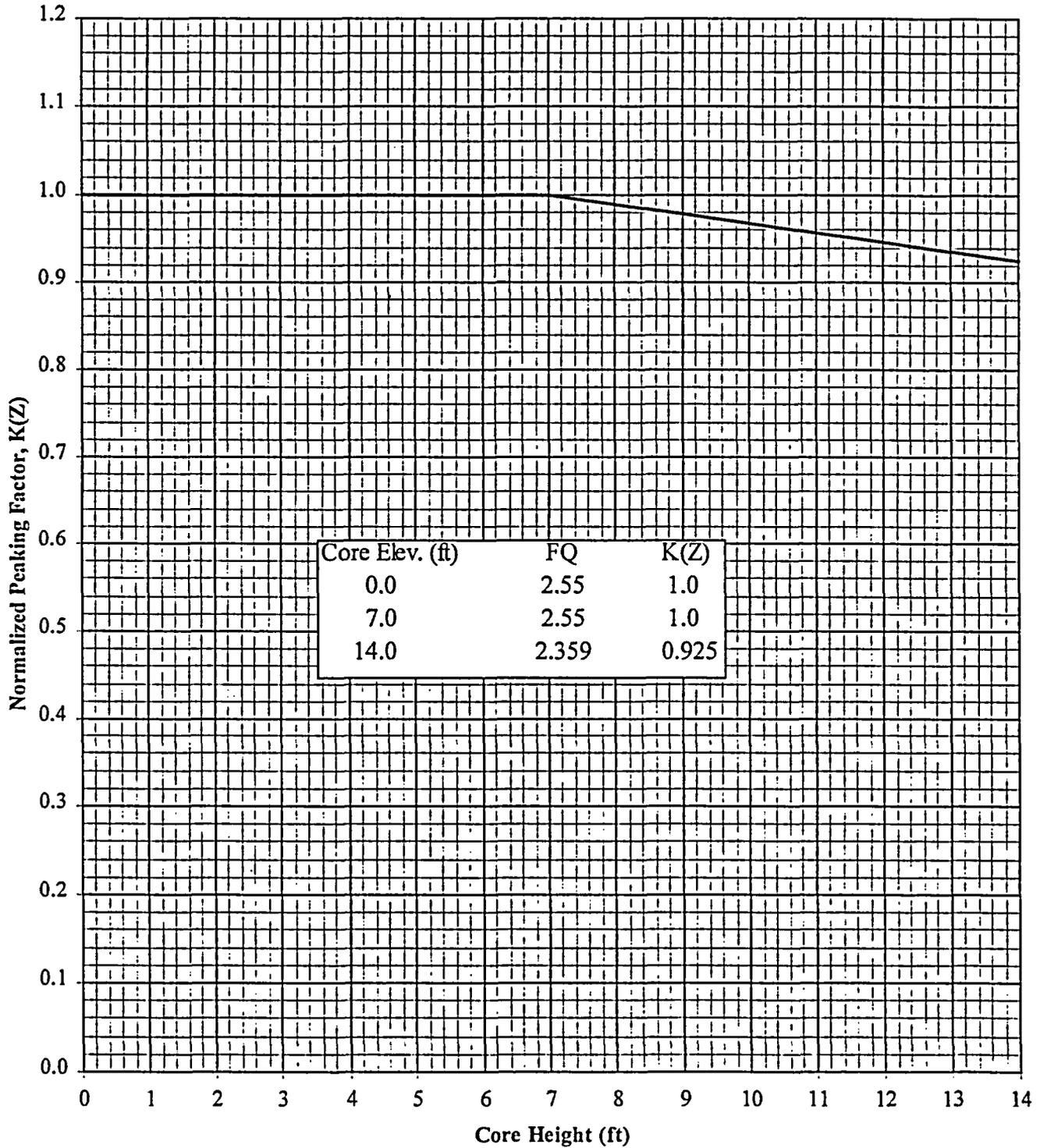


Table 1 (Part 1 of 2)  
Unrodded  $F_{xy}$  for Each Core Height  
for Cycle Burnups Less Than 10500 MWD/MTU

Core Height (Ft.)	Axial Point	Unrodded $F_{xy}$	Core Height (Ft.)	Axial Point	Unrodded $F_{xy}$
14.00	1	4.633	6.80	37	1.872
13.80	2	3.954	6.60	38	1.861
13.60	3	3.275	6.40	39	1.853
13.40	4	2.596	6.20	40	1.845
13.20	5	2.276	6.00	41	1.841
13.00	6	2.068	5.80	42	1.840
12.80	7	2.070	5.60	43	1.839
12.60	8	2.046	5.40	44	1.840
12.40	9	2.023	5.20	45	1.844
12.20	10	1.995	5.00	46	1.850
12.00	11	1.979	4.80	47	1.860
11.80	12	1.971	4.60	48	1.870
11.60	13	1.971	4.40	49	1.878
11.40	14	1.975	4.20	50	1.885
11.20	15	1.979	4.00	51	1.890
11.00	16	1.984	3.80	52	1.893
10.80	17	1.984	3.60	53	1.893
10.60	18	1.984	3.40	54	1.895
10.40	19	1.982	3.20	55	1.899
10.20	20	1.985	3.00	56	1.904
10.00	21	1.987	2.80	57	1.903
9.80	22	1.989	2.60	58	1.911
9.60	23	1.997	2.40	59	1.921
9.40	24	2.003	2.20	60	1.932
9.20	25	2.011	2.00	61	1.929
9.00	26	2.017	1.80	62	1.920
8.80	27	2.023	1.60	63	1.905
8.60	28	2.027	1.40	64	1.907
8.40	29	2.032	1.20	65	1.909
8.20	30	2.037	1.00	66	1.920
8.00	31	2.033	0.80	67	1.994
7.80	32	2.016	0.60	68	2.124
7.60	33	1.983	0.40	69	2.281
7.40	34	1.945	0.20	70	2.439
7.20	35	1.911	0.00	71	2.596
7.00	36	1.889			

Table 1 (Part 2 of 2)  
Unrodded Fxy for Each Core Height  
for Cycle Burnups Greater Than or Equal to 10500 MWD/MTU

Core Height (Ft.)	Axial Point	Unrodded Fxy	Core Height (Ft.)	Axial Point	Unrodded Fxy
14.00	1	4.778	6.80	37	2.144
13.80	2	4.129	6.60	38	2.139
13.60	3	3.480	6.40	39	2.127
13.40	4	2.831	6.20	40	2.115
13.20	5	2.450	6.00	41	2.101
13.00	6	2.153	5.80	42	2.089
12.80	7	2.149	5.60	43	2.077
12.60	8	2.121	5.40	44	2.067
12.40	9	2.096	5.20	45	2.057
12.20	10	2.055	5.00	46	2.047
12.00	11	2.032	4.80	47	2.038
11.80	12	2.026	4.60	48	2.028
11.60	13	2.019	4.40	49	2.017
11.40	14	2.022	4.20	50	2.006
11.20	15	2.027	4.00	51	1.994
11.00	16	2.031	3.80	52	1.982
10.80	17	2.033	3.60	53	1.969
10.60	18	2.035	3.40	54	1.957
10.40	19	2.036	3.20	55	1.945
10.20	20	2.041	3.00	56	1.931
10.00	21	2.048	2.80	57	1.916
9.80	22	2.056	2.60	58	1.891
9.60	23	2.065	2.40	59	1.858
9.40	24	2.072	2.20	60	1.841
9.20	25	2.078	2.00	61	1.839
9.00	26	2.084	1.80	62	1.835
8.80	27	2.089	1.60	63	1.836
8.60	28	2.095	1.40	64	1.853
8.40	29	2.100	1.20	65	1.853
8.20	30	2.106	1.00	66	1.877
8.00	31	2.112	0.80	67	2.127
7.80	32	2.119	0.60	68	2.605
7.60	33	2.127	0.40	69	3.195
7.40	34	2.135	0.20	70	3.786
7.20	35	2.142	0.00	71	4.377
7.00	36	2.145			