Nuclear Operating Company

South Texas Project Electric Generating Station PO Box 289 Wadsworth, Texas 77483

April 21, 2003
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10CFR50.36

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

South Texas Project
Unit 1
Docket No. STN 50-498
Unit 1 Cycle 12 Core Operating Limits Report

In accordance with Technical Specification 6.9.1.6.d, the attached Core Operating Limits Report is submitted for South Texas Project Unit 1 Cycle 12.

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

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Director,
Nuclear Fuel & Analysis

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Attachment: Unit 1 Cycle 12 Core Operating Limits Report

A001

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SOUTH TEXAS PROJECT
UNIT 1 CYCLE 12

CORE OPERATING LIMITS REPORT

April 2003

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report for STPEGS Unit 1 Cycle 12 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 ΔT and Over-power ΔT setpoint parameter values are listed below:

Over-temperature ΔT Setpoint Parameter Values

τ_1 measured reactor vessel ΔT lead/lag time constant, $\tau_1 = 8$ sec
τ_2 measured reactor vessel ΔT lead/lag time constant, $\tau_2 = 3$ sec
τ_3 measured reactor vessel ΔT lag time constant, $\tau_3 = 0$ sec
τ_4 measured reactor vessel average temperature lead/lag time constant, $\tau_4 = 28$ sec
τ_5 measured reactor vessel average temperature lead/lag time constant, $\tau_5 = 4$ sec
τ_6 measured reactor vessel average temperature lag time constant, $\tau_6 = 0$ sec
K_1 Overtemperature ΔT reactor trip setpoint, $K_1 = 1.14$
K_2 Overtemperature ΔT reactor trip setpoint T_{avg} coefficient, $K_2 = 0.028/°F$
K_3 Overtemperature ΔT reactor trip setpoint pressure coefficient, $K_3 = 0.00143$/psig
T' Nominal full power T_{avg}, $T' \leq 592.0$ °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 ΔT Trip Setpoint shall be automatically reduced by 0.0% of its value at RATED THERMAL POWER.

(3) For each percent that the magnitude of $q_t - q_b$ exceeds +8%, the ΔT Trip Setpoint shall be automatically reduced by 2.65% of its value at RATED THERMAL POWER.

Over-power ΔT Setpoint Parameter Values

τ_1 measured reactor vessel ΔT lead/lag time constant, $\tau_1 = 8$ sec
τ_2 measured reactor vessel ΔT lead/lag time constant, $\tau_2 = 3$ sec
τ_3 measured reactor vessel ΔT lag time constant, $\tau_3 = 0$ sec
τ_6 measured reactor vessel average temperature lag time constant, $\tau_6 = 0$ sec
τ_7 Time constant utilized in the rate-lag compensator for T_{avg}, $\tau_7 = 10$ sec
K_4 Overpower ΔT reactor trip setpoint, $K_4 = 1.08$
K_5 Overpower ΔT reactor trip setpoint T_{avg} rate/lag coefficient, $K_5 = 0.02/°F$ for **increasing** average temperature, and $K_5 = 0$ for **decreasing** average temperature
K_6 Overpower ΔT reactor trip setpoint T_{avg} heatup coefficient $K_6 = 0.002/°F$ for $T > T''$ and, $K_6 = 0$ for $T \leq T''$
T'' Indicated full power T_{avg}, $T'' \leq 592.0$ °F
$f_2(\Delta I) = 0$ for all (ΔI)

2.3 SHUTDOWN MARGIN (Specification 3.1.1.1):

The SHUTDOWN MARGIN shall be:

2.3.1 Greater than 1.3% Δρ 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 –62.72 pcm/°F.
2.4.3 The 300 ppm, ARO, HFP, MTC shall be less negative than –53.72 pcm/°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 °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:

Revised Predicted MTC = Predicted MTC + AFD Correction - 3 pcm/°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 249 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 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[2]

a. Reactor Coolant System T_{avg}, $\leq$ 595 °F[3],

b. Pressurizer Pressure, > 2200 psig[4],

c. Minimum Measured Reactor Coolant System Flow $\geq$ 403,000 gpm[5].

3.0 REFERENCES

3.1 Letter from T. D. Croyle (Westinghouse) to D. F. Hoppes (STPNOC), "Unit 1 Cycle 12 Final Reload Evaluation," NF-TG-03-36, Rev. 1 (ST-UB-NOC-03002361, Rev. 1), March 18, 2003.

3.2 NUREG-1346, Technical Specifications, South Texas Project Unit Nos. 1 and 2.

3.3 STPNOC Calculation ZC-7035, Rev. 1, "Loop Uncertainty Calculation for RCS T_{avg} Instrumentation," October 19, 1998.

3.4 STPNOC Calculation ZC-7032, Rev. 3, "Loop Uncertainty Calculation for Narrow Range Pressurizer Pressure Monitoring Instrumentation," June 27, 2001.

3.5 Letter from T.D. Croyle (Westinghouse) to D.F. Hoppes (STPNOC), Unit 1 Cycle 12 Shutdown Margin Limits" NF-TG-03-50, Rev. 1 (ST-UB-NOC-03002375, Rev. 1), April 11, 2003

1 Applies to all fuel in the Unit 1 Cycle 12 core.

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

3 Includes a 1.9 °F measurement uncertainty per Reference 3.3.

4 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 10.7 psi measurement uncertainty as read on the QDPS display per Reference 3.4.

5 Includes a 2.8% flow measurement uncertainty.

Figure 1

Reactor Core Safety Limits - Four Loops in Operation

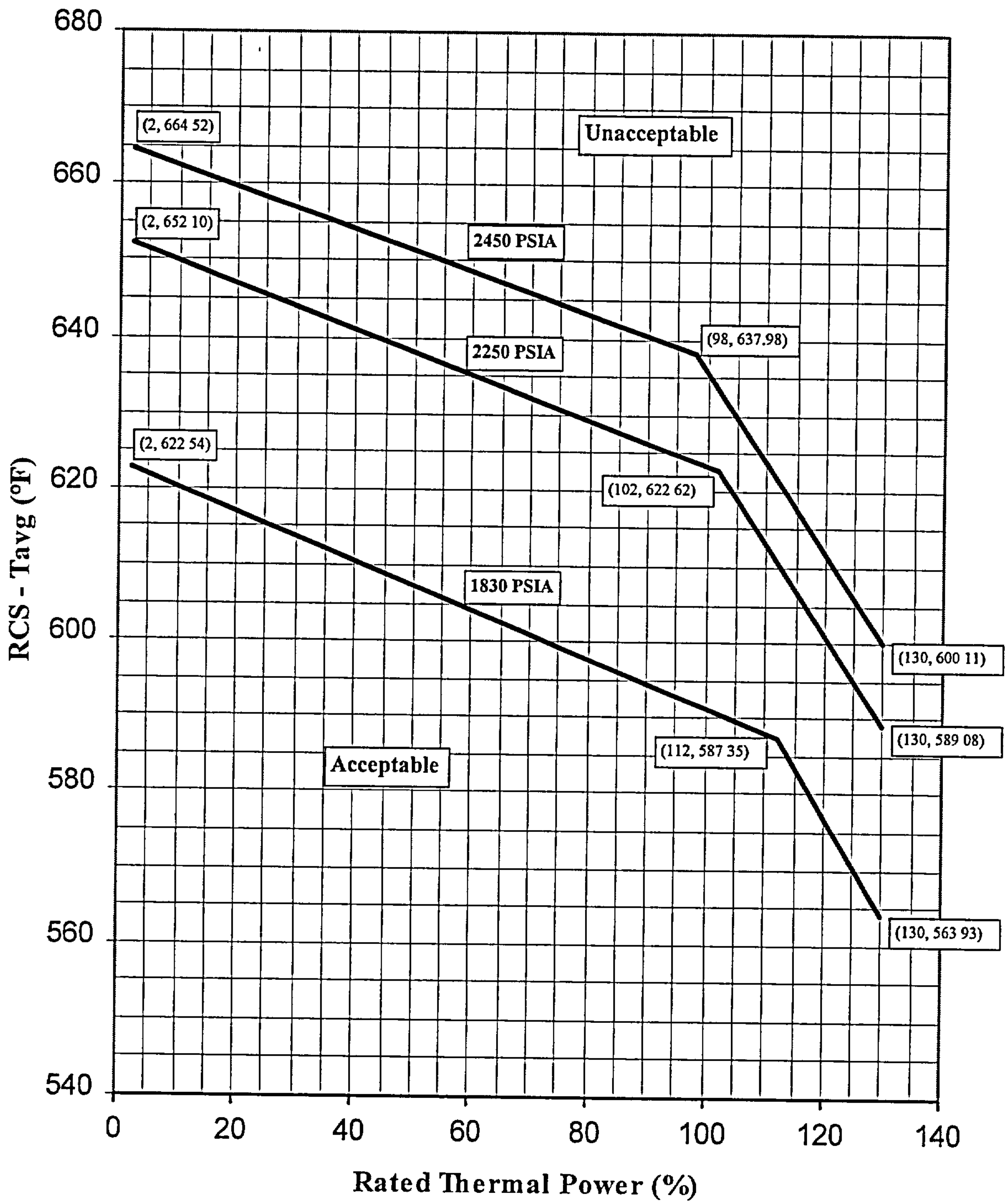


Figure 2

Required Shutdown Margin for Modes 3 & 4

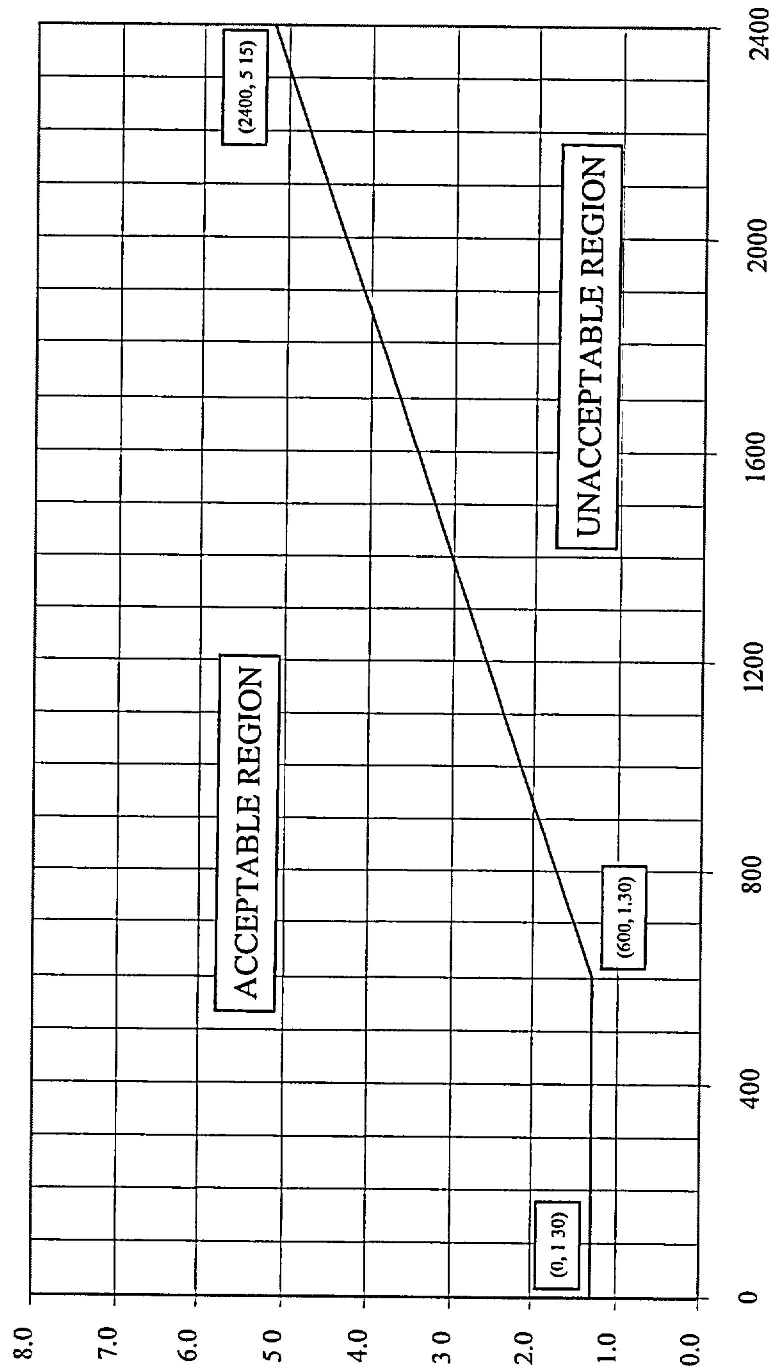


Figure 3

Required Shutdown Margin for Mode 5

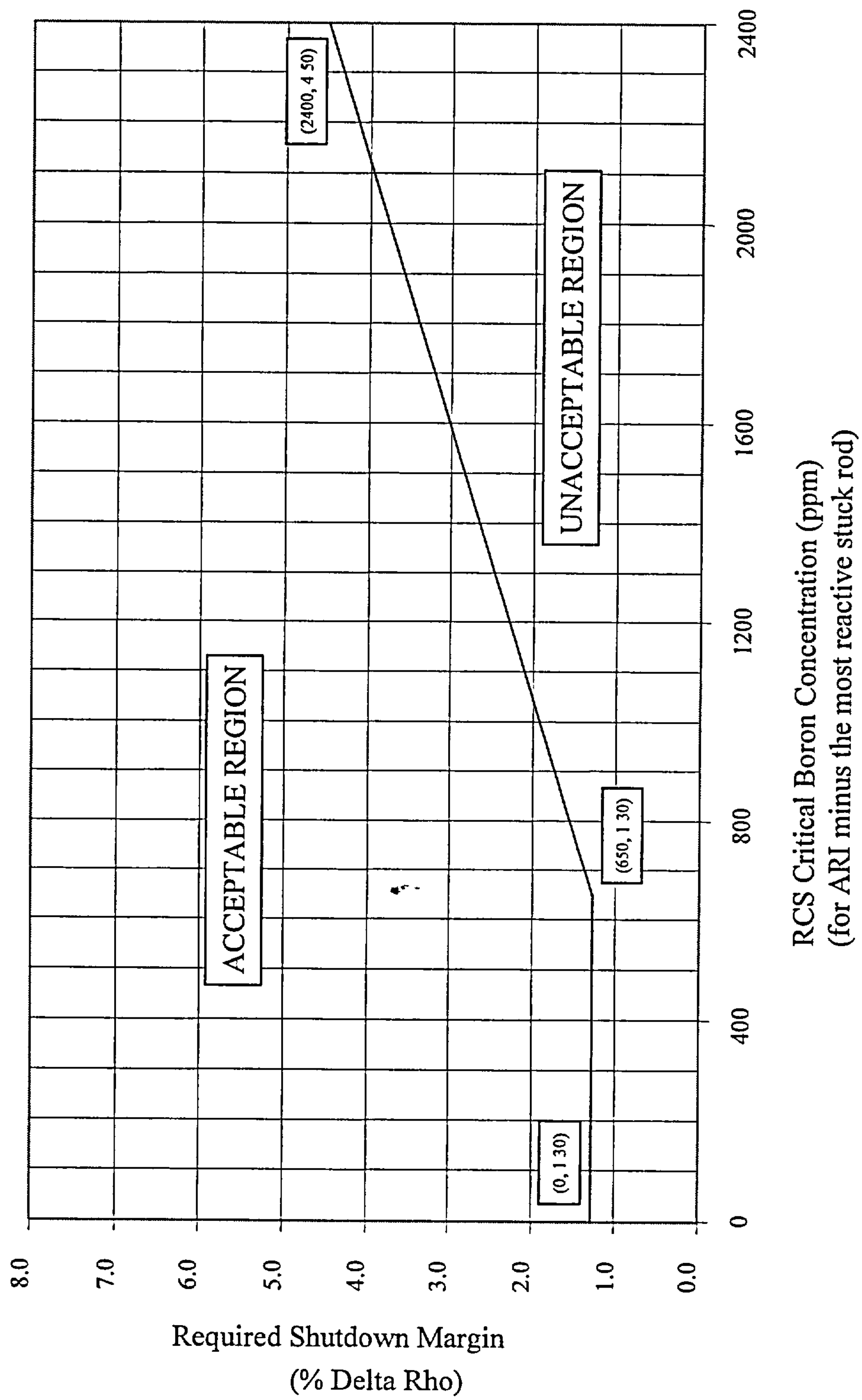


Figure 4

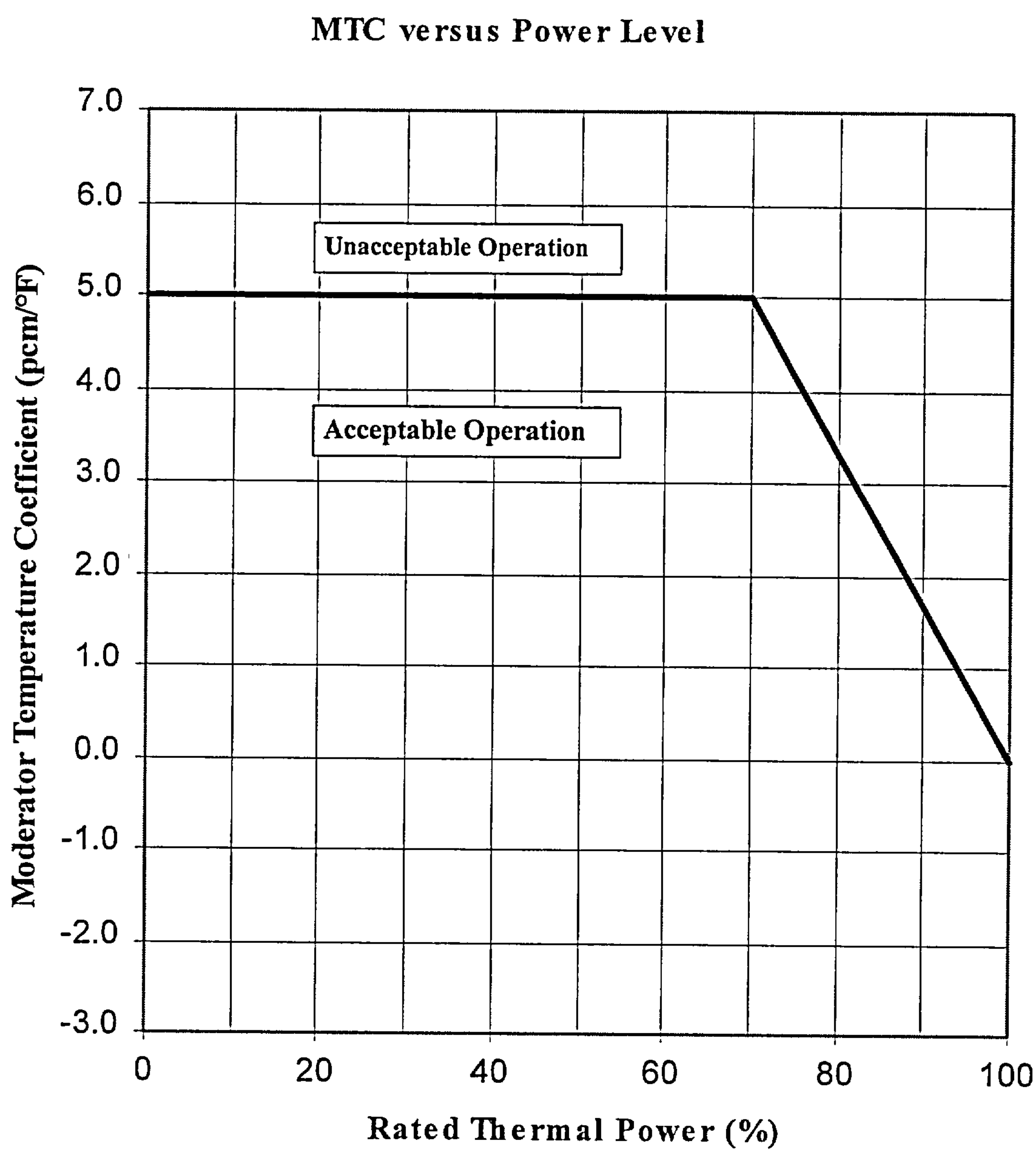
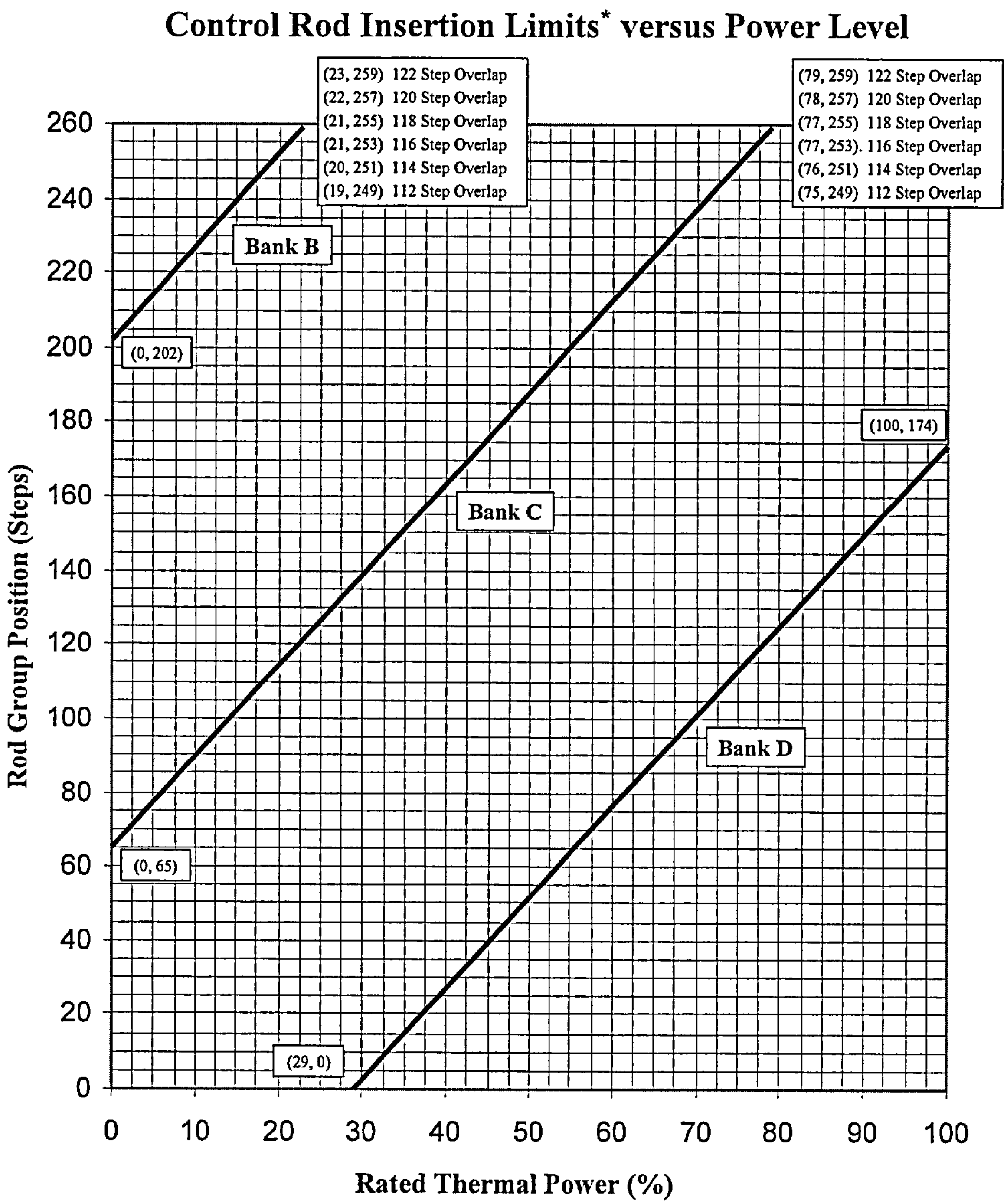

MTC versus Power Level
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
Unacceptable Operation
Acceptable Operation
Moderator Temperature Coefficient (pcm/°F)
0
20
40
60
80
100
Rated Thermal Power (%)

Figure 5



*Control Bank A is already withdrawn to Full Out Position Fully withdrawn region shall be the condition where shutdown and control banks are at a position within the interval of 249 and ≤259 steps withdrawn, inclusive

Figure 6

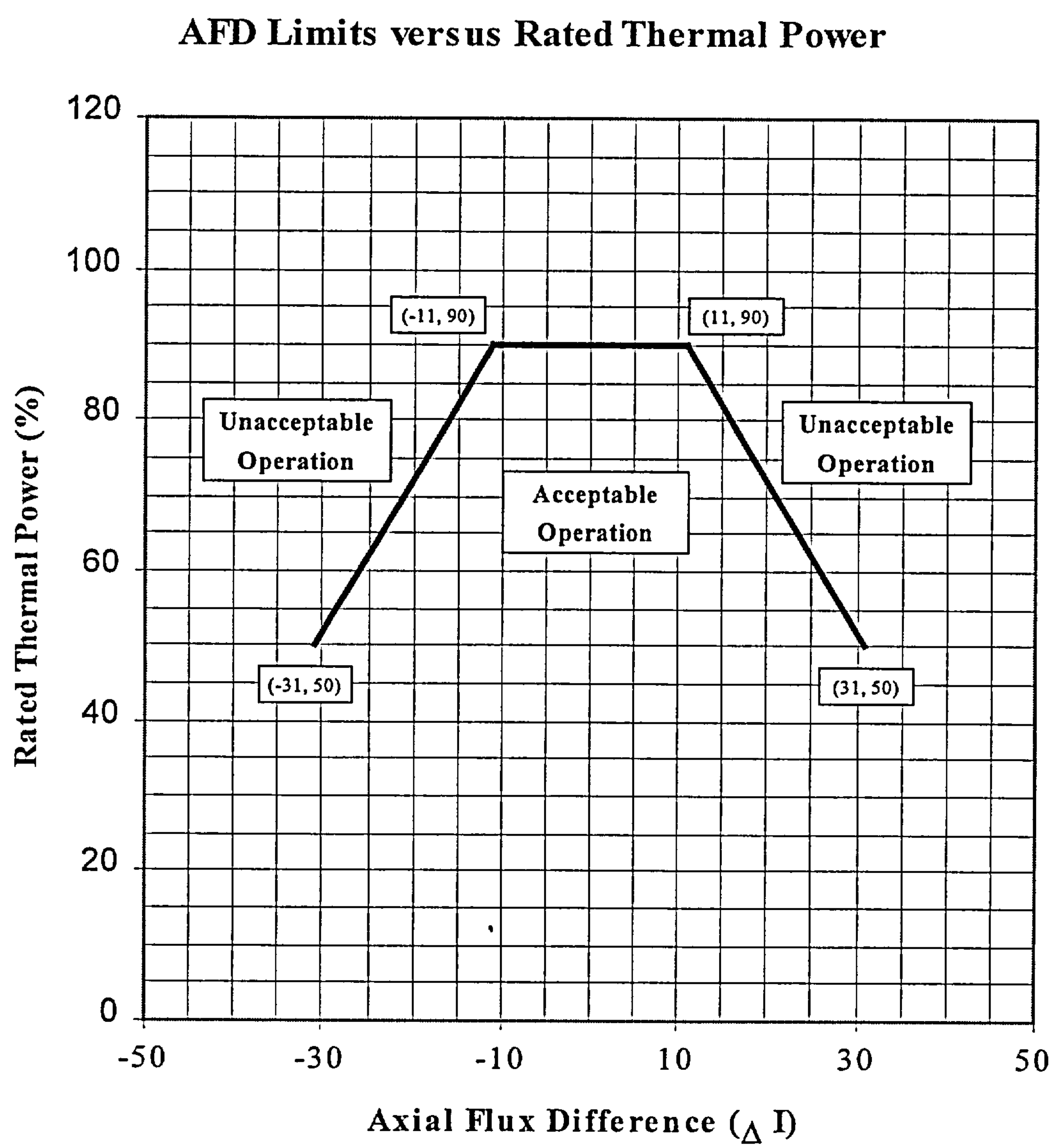

AFD Limits versus Rated Thermal Power
Rated Thermal Power (%)
120
100
80
60
40
20
0
-50
-30
-10
10
30
50
Axial Flux Difference (Δ I)
(-11, 90)
(11, 90)
(-31, 50)
(31, 50)
Unacceptable Operation
Acceptable Operation
Unacceptable Operation

Figure 7

K(Z) – Normalized $F_Q(Z)$ versus Core Height

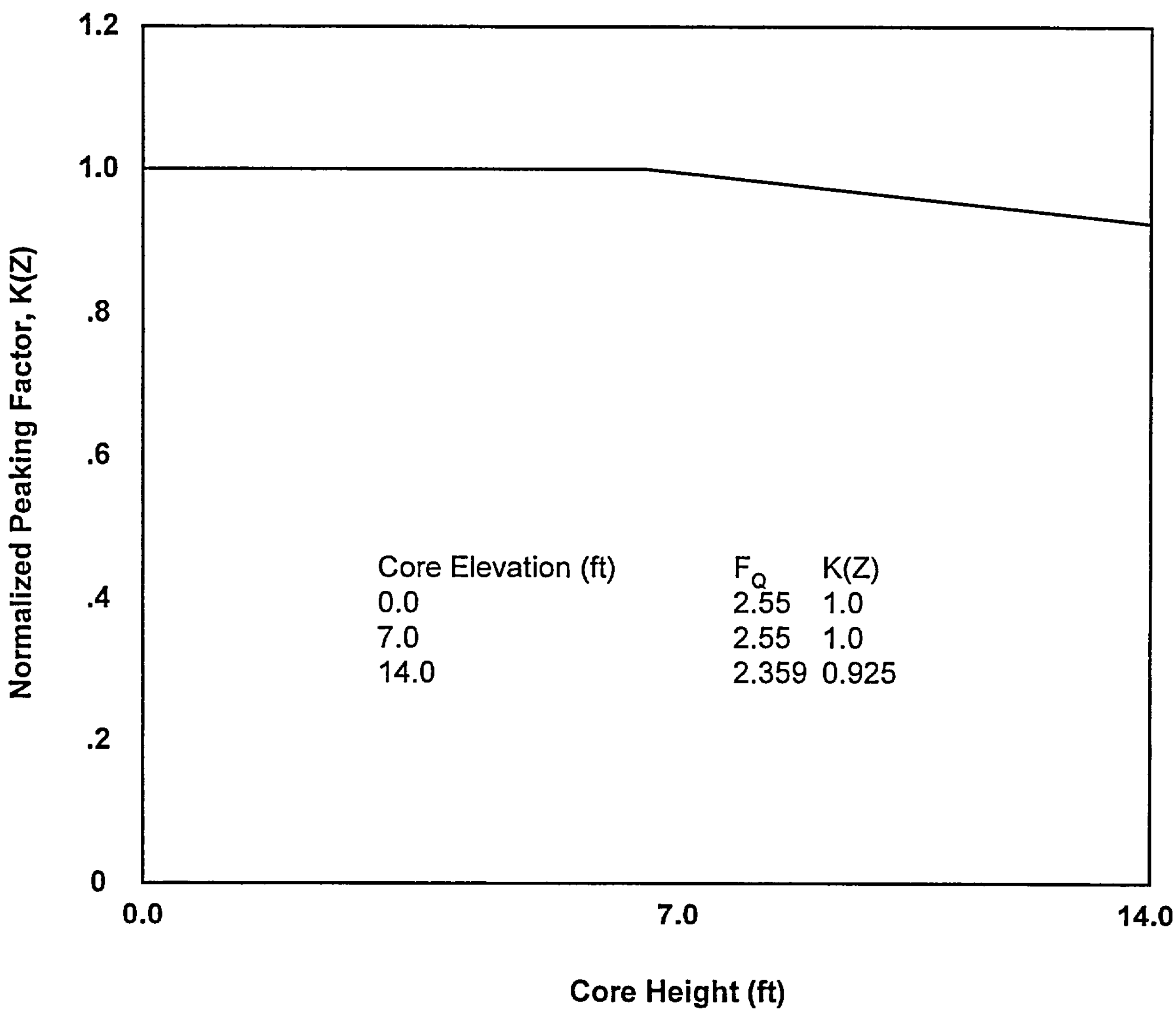


Table 1 (Part 1 of 2)

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}
14.0	1	4.143	6.8	37	1.895
13.8	2	3.614	6.6	38	1.888
13.6	3	3.086	6.4	39	1.883
13.4	4	2.557	6.2	40	1.878
13.2	5	2.248	6.0	41	1.876
13.0	6	2.006	5.8	42	1.874
12.8	7	2.025	5.6	43	1.873
12.6	8	2.020	5.4	44	1.874
12.4	9	2.012	5.2	45	1.877
12.2	10	1.988	5.0	46	1.884
12.0	11	1.970	4.8	47	1.893
11.8	12	1.960	4.6	48	1.903
11.6	13	1.961	4.4	49	1.911
11.4	14	1.967	4.2	50	1.916
11.2	15	1.972	4.0	51	1.920
11.0	16	1.975	3.8	52	1.916
10.8	17	1.976	3.6	53	1.910
10.6	18	1.977	3.4	54	1.908
10.4	19	1.976	3.2	55	1.908
10.2	20	1.978	3.0	56	1.904
10.0	21	1.981	2.8	57	1.896
9.8	22	1.984	2.6	58	1.881
9.6	23	1.988	2.4	59	1.862
9.4	24	1.993	2.2	60	1.833
9.2	25	2.001	2.0	61	1.798
9.0	26	2.009	1.8	62	1.765
8.8	27	2.017	1.6	63	1.736
8.6	28	2.024	1.4	64	1.745
8.4	29	2.032	1.2	65	1.751
8.2	30	2.038	1.0	66	1.775
8.0	31	2.041	0.8	67	1.935
7.8	32	2.033	0.6	68	2.217
7.6	33	2.000	0.4	69	2.562
7.4	34	1.965	0.2	70	2.906
7.2	35	1.935	0.0	71	3.250
7.0	36	1.909			

Table 1 (Part 2 of 2)

Unrodded F_{xy} for Each Core Height
For Cycle Burnups Greater Than or Equal to 10500 MWD/MTU

Core Height (Ft.)	Axial Point	Unrodded F_{xy}	Core Height (Ft.)	Axial Point	Unrodded F_{xy}
14.0	1	4.915	6.8	37	2.146
13.8	2	4.258	6.6	38	2.142
13.6	3	3.601	6.4	39	2.128
13.4	4	2.945	6.2	40	2.115
13.2	5	2.541	6.0	41	2.101
13.0	6	2.217	5.8	42	2.089
12.8	7	2.182	5.6	43	2.078
12.6	8	2.133	5.4	44	2.067
12.4	9	2.097	5.2	45	2.056
12.2	10	2.062	5.0	46	2.046
12.0	11	2.027	4.8	47	2.035
11.8	12	2.021	4.6	48	2.024
11.6	13	2.017	4.4	49	2.011
11.4	14	2.020	4.2	50	1.998
11.2	15	2.027	4.0	51	1.983
11.0	16	2.035	3.8	52	1.970
10.8	17	2.040	3.6	53	1.958
10.6	18	2.044	3.4	54	1.946
10.4	19	2.046	3.2	55	1.933
10.2	20	2.051	3.0	56	1.917
10.0	21	2.057	2.8	57	1.900
9.8	22	2.065	2.6	58	1.876
9.6	23	2.072	2.4	59	1.847
9.4	24	2.077	2.2	60	1.826
9.2	25	2.082	2.0	61	1.820
9.0	26	2.085	1.8	62	1.818
8.8	27	2.087	1.6	63	1.821
8.6	28	2.090	1.4	64	1.834
8.4	29	2.094	1.2	65	1.879
8.2	30	2.100	1.0	66	1.963
8.0	31	2.108	0.8	67	2.152
7.8	32	2.116	0.6	68	2.460
7.6	33	2.124	0.4	69	2.826
7.4	34	2.132	0.2	70	3.193
7.2	35	2.140	0.0	71	3.559
7.0	36	2.146			