



South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

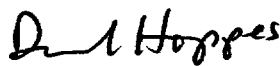
August 5, 2003
NOC-AE-03001570
10CFR50.36

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 No. STN 50-498
Unit 1 Cycle 12 Core Operating Limits Report, Revision 1

In accordance with Technical Specification 6.9.1.6.d, the attached Revision 1 to the Unit 1 Cycle 12 Core Operating Limits Report is submitted for South Texas Project. This report reflects core design changes made during the Bottom Mounted Instrumentation (BMI) outage.

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


for David A. Leazar
Director,
Nuclear Fuel & Analysis

kaw

Attachment: Unit 1 Cycle 12 Core Operating Limits Report, Revision 1

A001

cc:

(paper copy)

Ellis W. Merschoff
Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, Texas 76011-8064

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

Richard A. Ratliff
Bureau of Radiation Control
Texas Department of Health
1100 West 49th Street
Austin, TX 78756-3189

Jeffrey Cruz
U. S. Nuclear Regulatory Commission
P. O. Box 289, Mail Code: MN116
Wadsworth, TX 77483

C. M. Canady
City of Austin
Electric Utility Department
721 Barton Springs Road
Austin, TX 78704

(electronic copy)

A. H. Gutterman, Esquire
Morgan, Lewis & Bockius LLP

L. D. Blaylock
City Public Service

Mohan C. Thadani
U. S. Nuclear Regulatory Commission

R. L. Balcom
Texas Genco, LP

A. Ramirez
City of Austin

C. A. Johnson
AEP Texas Central Company

Jon C. Wood
Matthews & Branscomb



**SOUTH TEXAS PROJECT
UNIT 1 CYCLE 12**

CORE OPERATING LIMITS REPORT

Revision 1

July 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, $K_2 = 0.028/^\circ F$
 K_3 Overtemperature ΔT reactor trip setpoint pressure coefficient, $K_3 = 0.00143/\text{psig}$
 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 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, $K_5 = 0.02/^\circ F$ for increasing average temperature, and $K_5 = 0$ for decreasing average temperature
 K_6 Overpower ΔT reactor trip setpoint T_{avg} heatup coefficient $K_6 = 0.002/^\circ F$ 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 (ΔI)

2.3 SHUTDOWN MARGIN (Specification 3.1.1.1):

The SHUTDOWN MARGIN shall be:

- 2.3.1 Greater than 1.3% Δp 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 $-62.72 \text{ pcm}/^{\circ}\text{F}$.
- 2.4.3 The 300 ppm, ARO, HFP, MTC shall be less negative than $-53.72 \text{ pcm}/^{\circ}\text{F}$ (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:

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

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 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 $F_{\text{HTP}} = 2.55$.
- 2.7.2 $K(Z)$ is provided in Figure 7.
- 2.7.3 The F_{XY} limits for RATED THERMAL POWER (F_{HTP}) within specific core planes shall be:
 - 2.7.3.1 Less than or equal to 1.903 for cycle burnups less than or equal to 10500 MWD/MTU, and less than or equal to 2.102 for cycle burnups greater than 10500 MWD/MTU, 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 $PF_{\text{XY}} = 0.2$.

These F_{Δ} 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_{Δ} 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):

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

$$2.8.2 \quad PF_{\Delta H} = 0.3$$

2.9 DNB PARAMETERS (Specification 3.2.5):

2.9.1 The following DNB-related parameters shall be maintained within the following limits²

- a. Reactor Coolant System T_{avg} , ≤ 595 °F³,
- b. Pressurizer Pressure, > 2200 psig⁴,
- c. Minimum Measured Reactor Coolant System Flow $\geq 403,000$ gpm⁵.

3.0 REFERENCES

- 3.1 Letter from T. D. Croyle (Westinghouse) to D. F. Hoppes (STPNOC), "Unit 1 Cycle 12 Redesign Final Unbound Reload Evaluation," NF-TG-03-76 (ST-UB-NOC-03002399), July 7, 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.

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

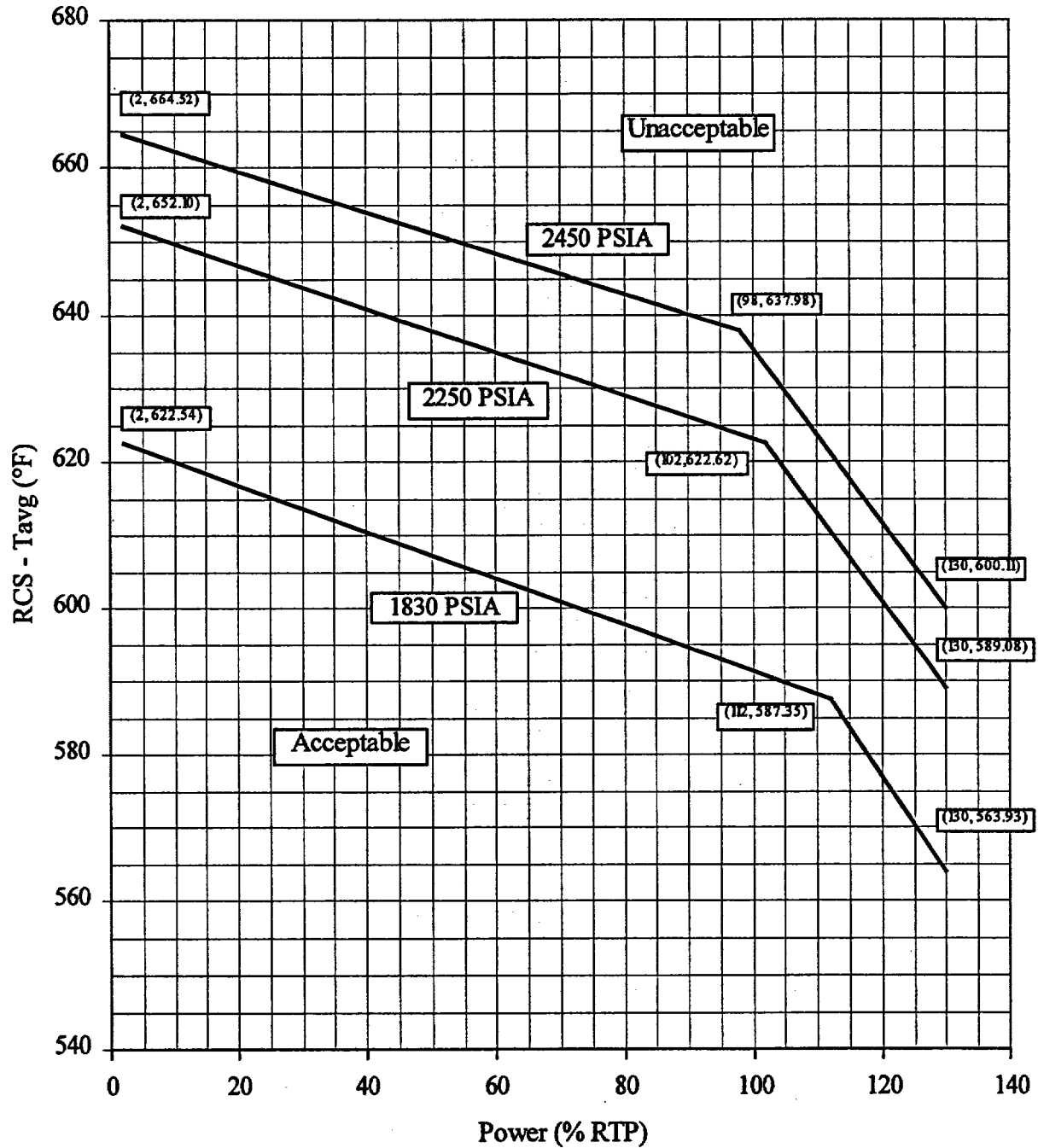


Figure 2

Required Shutdown Margin for Modes 3 & 4

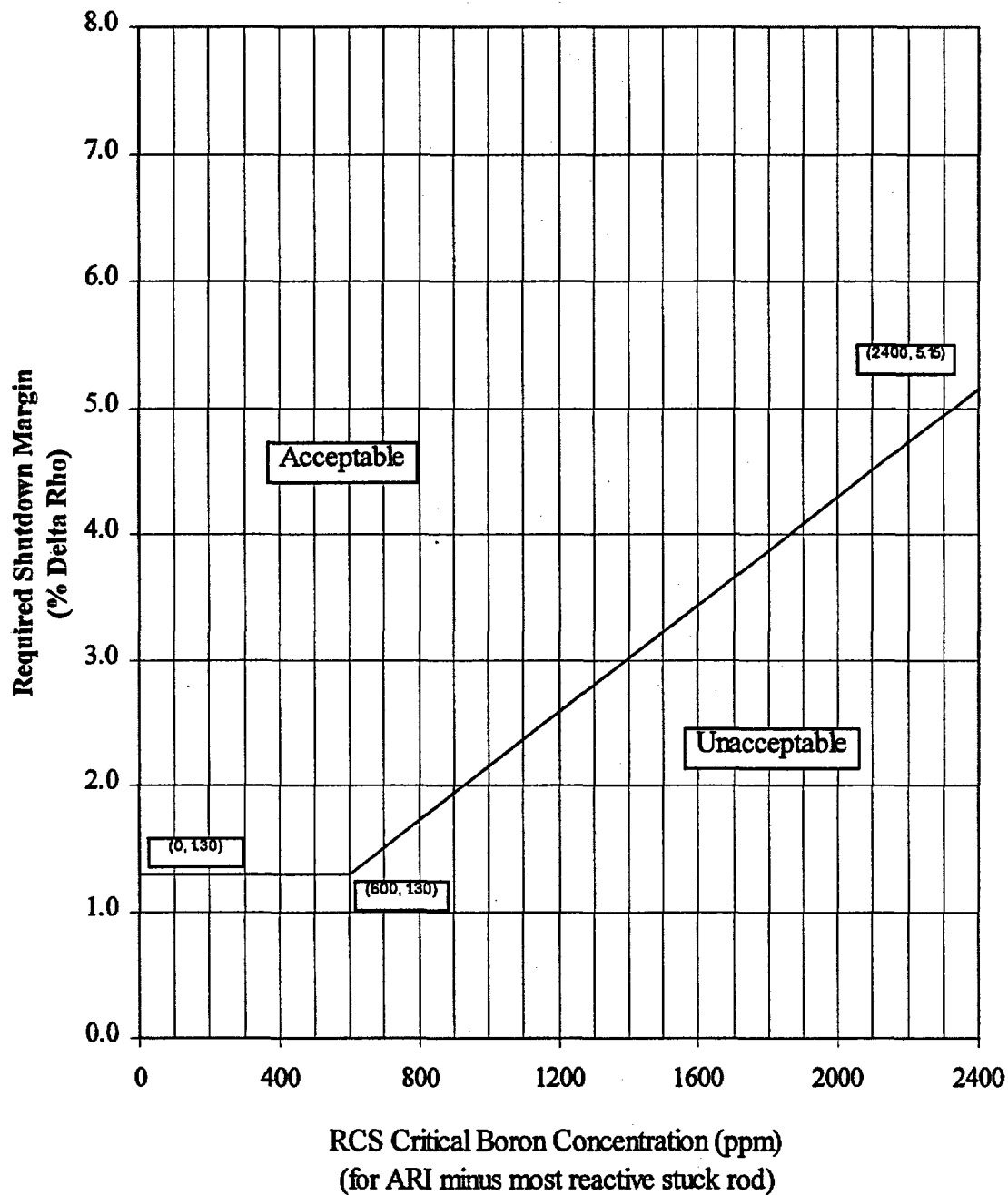


Figure 3

Required Shutdown Margin for Mode 5

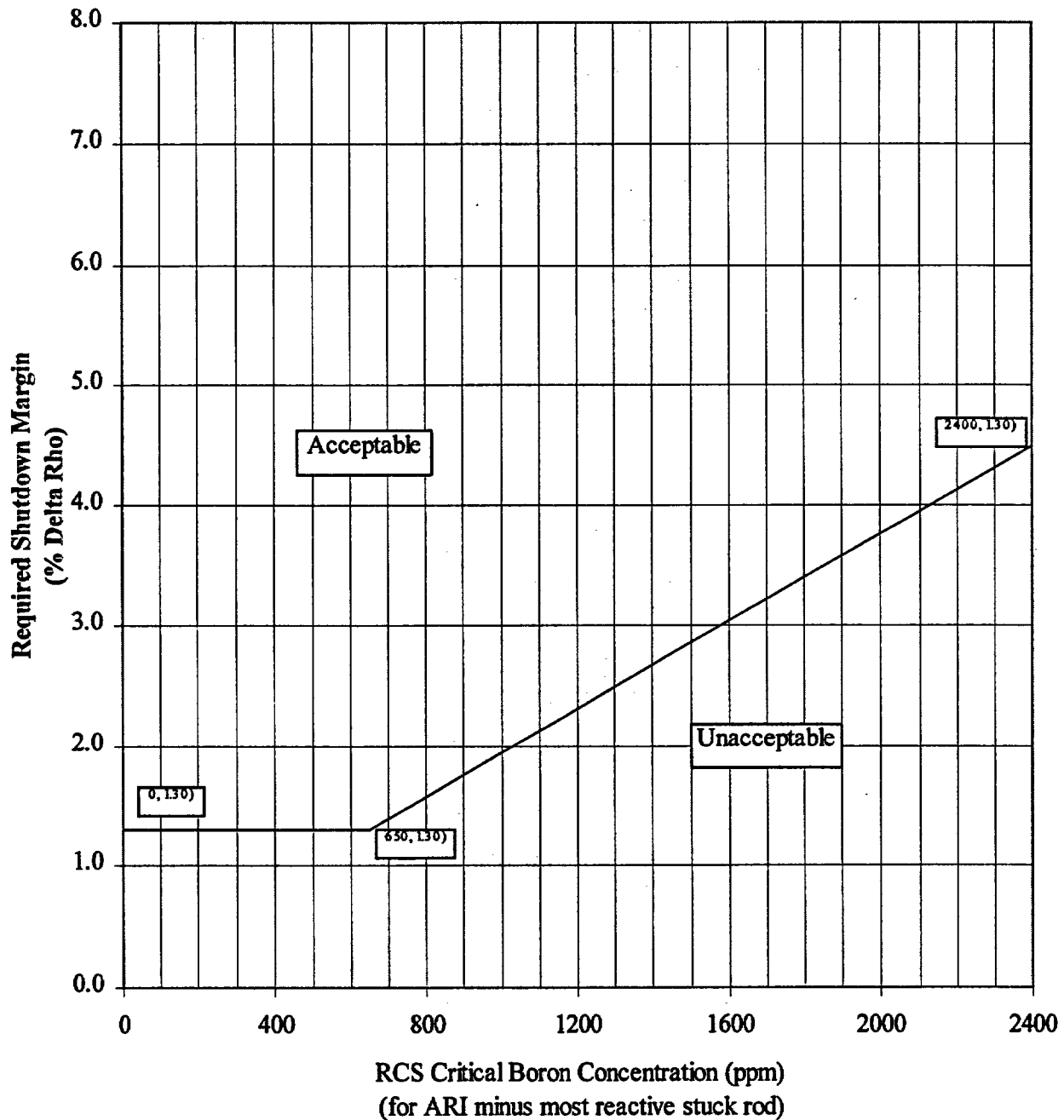


Figure 4

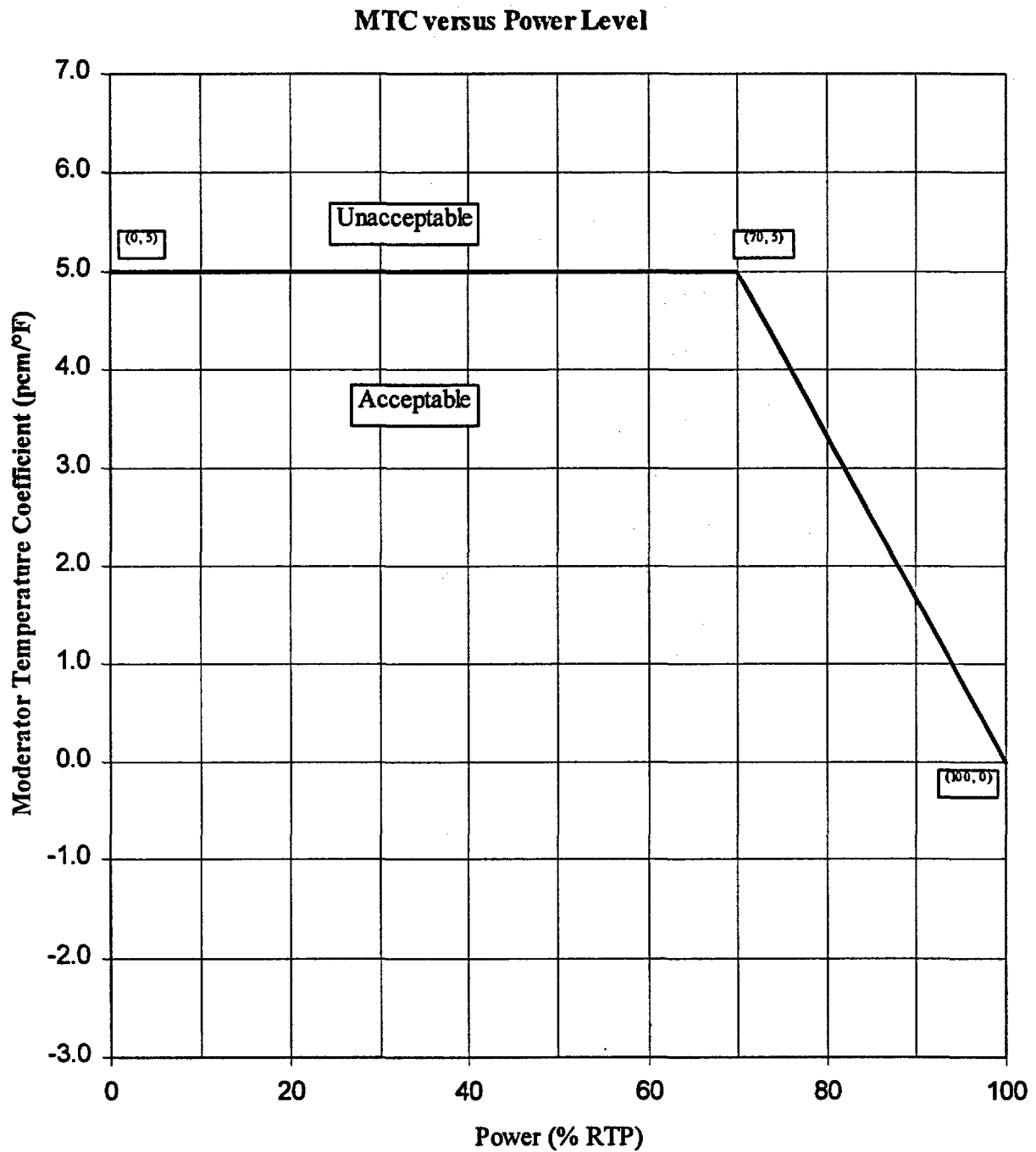
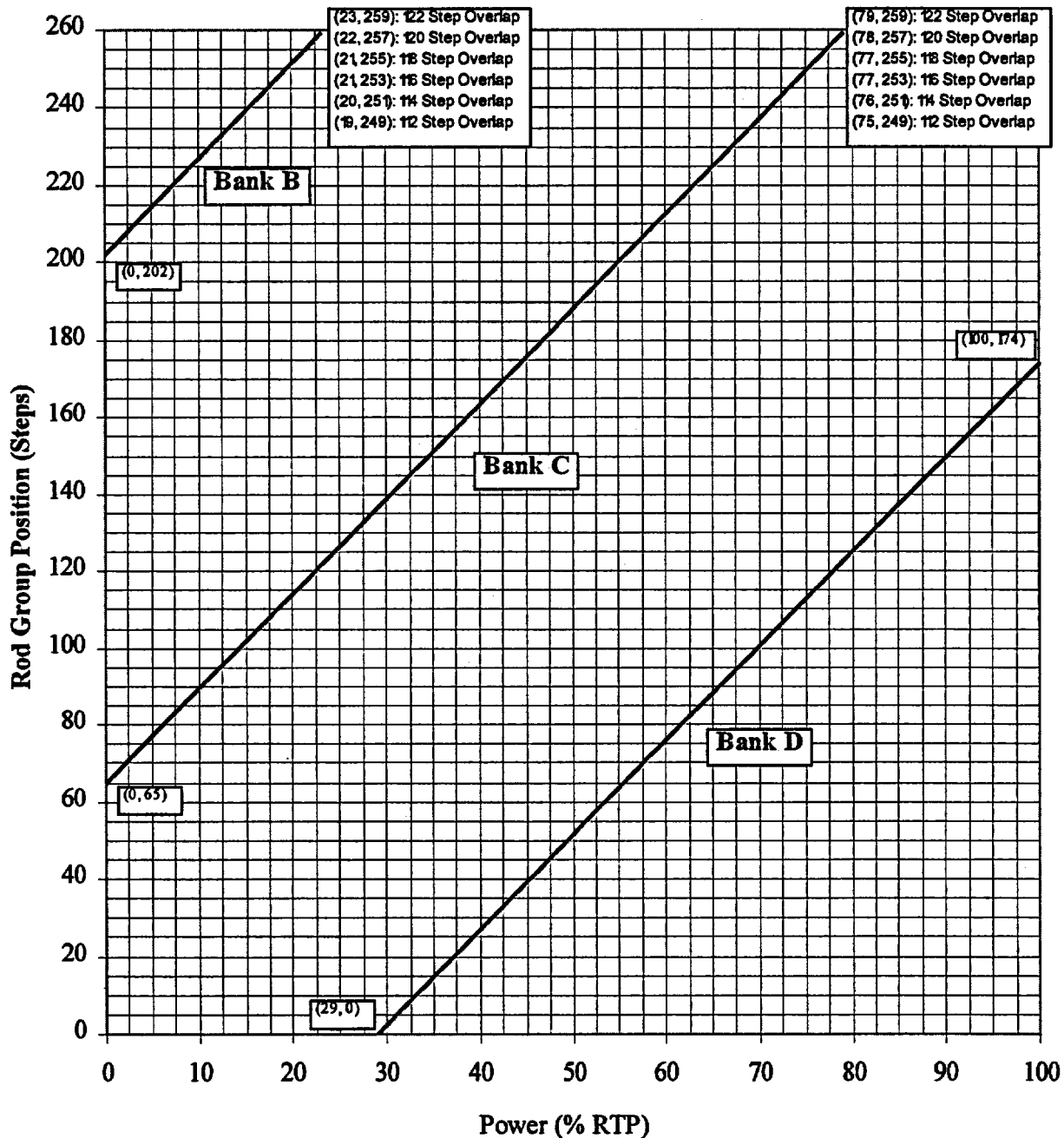


Figure 5
Control Rod Insertion Limits* versus Power Level


* Control Bank A is already withdrawn to the 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

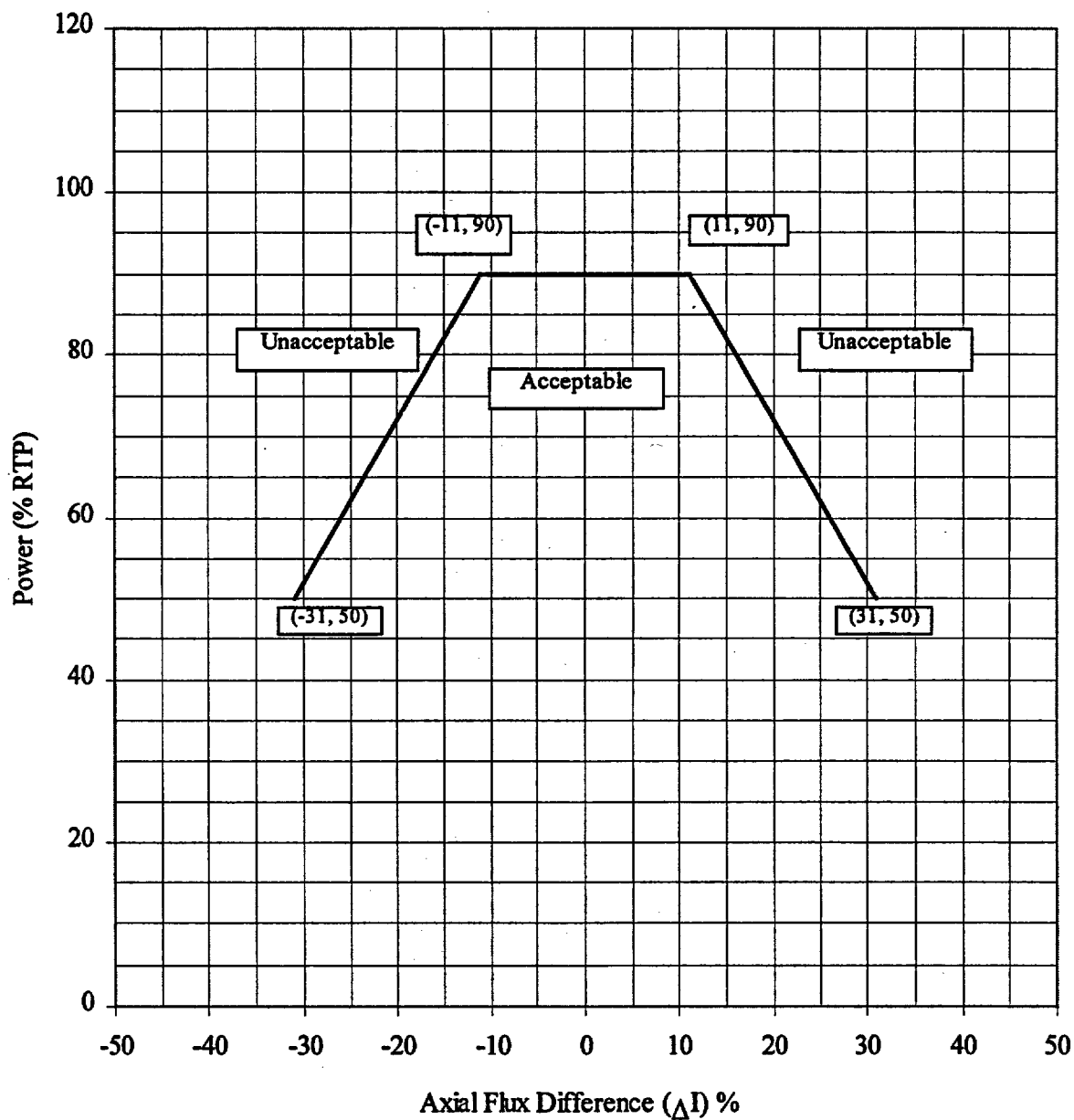


Figure 7

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

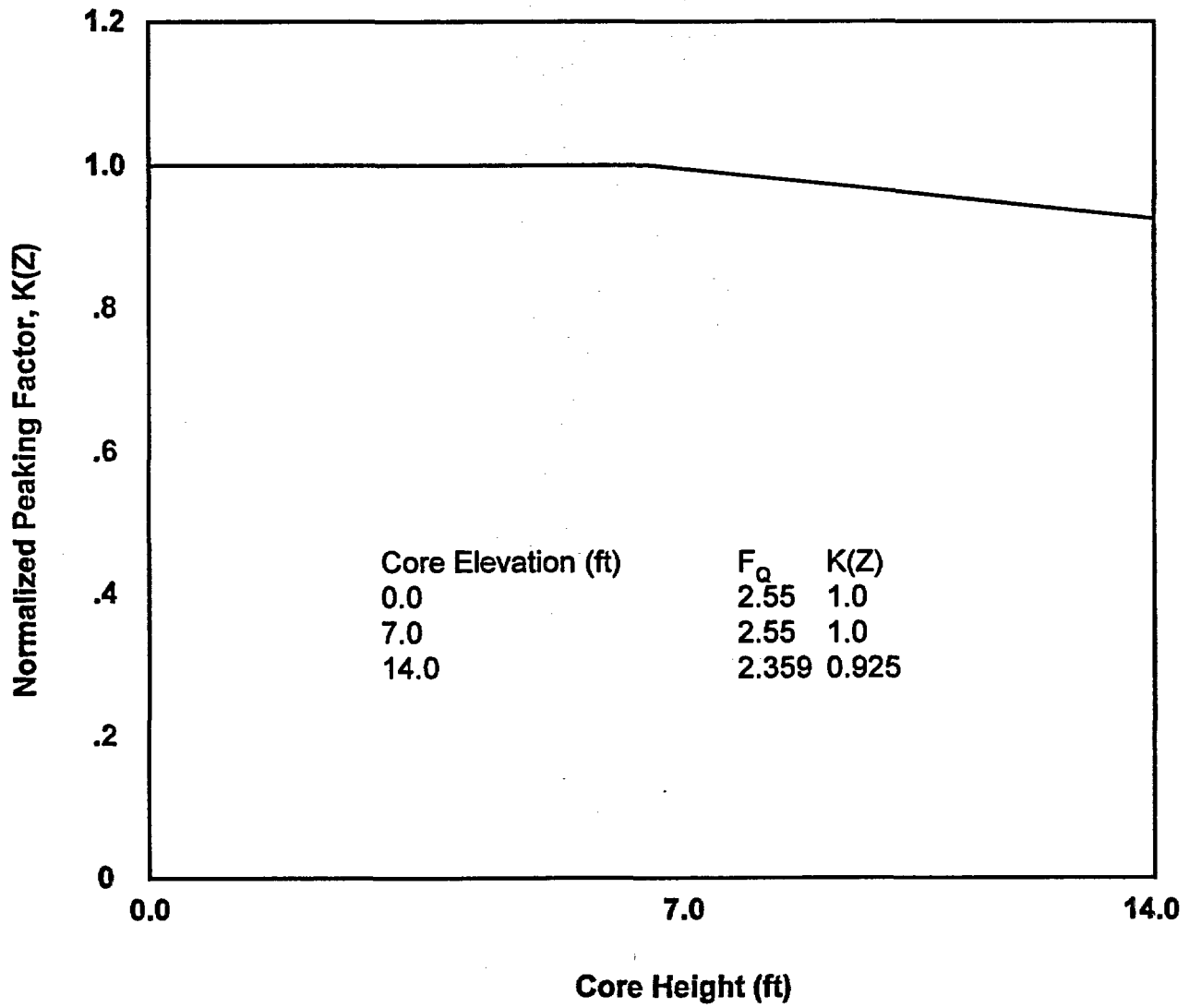


Table 1 (Part 1 of 2)

Unrodded F_{xy} for Each Core Height
For Cycle Burnups Less Than 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	4.122	6.8	37	1.942
13.8	2	3.613	6.6	38	1.932
13.6	3	3.104	6.4	39	1.923
13.4	4	2.594	6.2	40	1.916
13.2	5	2.290	6.0	41	1.908
13.0	6	2.049	5.8	42	1.902
12.8	7	2.053	5.6	43	1.897
12.6	8	2.038	5.4	44	1.894
12.4	9	2.022	5.2	45	1.893
12.2	10	1.995	5.0	46	1.895
12.0	11	1.974	4.8	47	1.896
11.8	12	1.962	4.6	48	1.897
11.6	13	1.959	4.4	49	1.893
11.4	14	1.959	4.2	50	1.887
11.2	15	1.956	4.0	51	1.889
11.0	16	1.951	3.8	52	1.890
10.8	17	1.946	3.6	53	1.892
10.6	18	1.944	3.4	54	1.898
10.4	19	1.942	3.2	55	1.905
10.2	20	1.947	3.0	56	1.910
10.0	21	1.952	2.8	57	1.913
9.8	22	1.957	2.6	58	1.890
9.6	23	1.965	2.4	59	1.862
9.4	24	1.972	2.2	60	1.831
9.2	25	1.980	2.0	61	1.826
9.0	26	1.989	1.8	62	1.833
8.8	27	2.000	1.6	63	1.849
8.6	28	2.011	1.4	64	1.857
8.4	29	2.021	1.2	65	1.874
8.2	30	2.030	1.0	66	1.913
8.0	31	2.034	0.8	67	2.046
7.8	32	2.024	0.6	68	2.292
7.6	33	2.005	0.4	69	2.593
7.4	34	1.986	0.2	70	2.895
7.2	35	1.964	0.0	71	3.197
7.0	36	1.952			

Table 1 (Part 2 of 2)

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

Core Height (Ft.)	Axial Point	Unrodded F_{xy}	Core Height (Ft.)	Axial Point	Unrodded F_{xy}
14.0	1	4.784	6.8	37	2.137
13.8	2	4.133	6.6	38	2.131
13.6	3	3.481	6.4	39	2.117
13.4	4	2.829	6.2	40	2.103
13.2	5	2.436	6.0	41	2.089
13.0	6	2.124	5.8	42	2.078
12.8	7	2.107	5.6	43	2.068
12.6	8	2.080	5.4	44	2.059
12.4	9	2.054	5.2	45	2.050
12.2	10	2.028	5.0	46	2.041
12.0	11	1.998	4.8	47	2.032
11.8	12	1.996	4.6	48	2.021
11.6	13	2.001	4.4	49	2.009
11.4	14	2.008	4.2	50	1.997
11.2	15	2.015	4.0	51	1.983
11.0	16	2.020	3.8	52	1.970
10.8	17	2.025	3.6	53	1.957
10.6	18	2.027	3.4	54	1.945
10.4	19	2.029	3.2	55	1.934
10.2	20	2.033	3.0	56	1.918
10.0	21	2.039	2.8	57	1.896
9.8	22	2.045	2.6	58	1.871
9.6	23	2.052	2.4	59	1.856
9.4	24	2.059	2.2	60	1.838
9.2	25	2.066	2.0	61	1.835
9.0	26	2.071	1.8	62	1.834
8.8	27	2.074	1.6	63	1.840
8.6	28	2.078	1.4	64	1.859
8.4	29	2.082	1.2	65	1.915
8.2	30	2.088	1.0	66	2.011
8.0	31	2.095	0.8	67	2.212
7.8	32	2.105	0.6	68	2.528
7.6	33	2.116	0.4	69	2.903
7.4	34	2.127	0.2	70	3.277
7.2	35	2.136	0.0	71	3.651
7.0	36	2.139			