Nuclear Operating Company

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

December 2, 2002
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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 2
Docket No. STN 50-499
Unit 2 Cycle 10 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 2 Cycle 10. This report does not reflect the end of life moderator temperature coefficient amendment (Amendments 144/132), issued on November 26, 2002, because it was completed prior to the amendment date.

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

kaw

Attachment: Unit 2 Cycle 10 Core Operating Limits Report

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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

Cornelius F. O'Keefe
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

M. T. Hardt/W. C. Gunst
City Public Service

Mohan C. Thadani
U. S. Nuclear Regulatory Commission

R. L. Balcom
Reliant Energy, Inc.

A. Ramirez
City of Austin

C. A. Johnson
AEP - Central Power and Light Company

Jon C. Wood
Matthews & Branscomb

31526846

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SOUTH TEXAS PROJECT
ELECTRIC GENERATING STATION
UNIT 2 CYCLE 10
CORE OPERATING LIMITS REPORT

Revision 0

November 2002

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report for STPEGS Unit 2 Cycle 10 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)	3/4.1.1.3	MODERATOR TEMPERATURE COEFFICIENT LIMITS
4)	3/4.1.3.5	SHUTDOWN ROD INSERTION LIMITS
5)	3/4.1.3.6	CONTROL ROD INSERTION LIMITS
6)	3/4.2.1	AFD LIMITS
7)	3/4.2.2	HEAT FLUX HOT CHANNEL FACTOR
8)	3/4.2.3	NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR
9)	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;

(Continued on next page)

(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; and

(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.

<u>Over-power ΔT Setpoint Parameter Values</u>

τ_1	measured reactor vessel ΔT lead/lag time constant, τ_1 = 8 sec
τ_2	measured reactor vessel ΔT lead/lag time constant, τ_2 = 3 sec
τ_3	measured reactor vessel ΔT lag time constant, τ_3 = 0 sec
τ_6	measured reactor vessel average temperature lag time constant, τ_6 = 0 sec
τ_7	Time constant utilized in the rate-lag compensator for T_{avg}, τ_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 $T \le T''$
T"	Indicated full power T_{avg}, $T'' \le 592.0$ °F
$f_2(\Delta I)$	= 0 for all (ΔI)

2.3 MODERATOR TEMPERATURE COEFFICIENT (Specification 3.1.1.3):

2.3.1 The BOL, ARO, MTC shall be less positive than the limits shown in Figure 2.
2.3.2 The EOL, ARO, HFP, MTC shall be less negative than -61.2 pcm/°F.
2.3.3 The 300 ppm, ARO, HFP, MTC shall be less negative than -53.6 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 ROD INSERTION LIMITS (Specification 3.1.3.5 and 3.1.3.6):

2.4.1 All banks shall have the same Full Out Position (FOP) of at least 250 steps withdrawn but not exceeding 259 steps withdrawn.
2.4.2 The Control Banks shall be limited in physical insertion as specified in Figure 3.
2.4.3 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).

2.5 AXIAL FLUX DIFFERENCE (Specification 3.2.1):

2.5.1 AFD limits as required by Technical Specification 3.2.1 are determined by CAOC Operations with an AFD target band of +5, -10%.
2.5.2 The AFD shall be maintained within the ACCEPTABLE OPERATION portion of Figure 4, as required by Technical Specifications.

2.6 HEAT FLUX HOT CHANNEL FACTOR (Specification 3.2.2):

2.6.1 $F_Q^{RTP} = 2.55$.
2.6.2 K(Z) is provided in Figure 5.
2.6.3 The F_{xy} limits for RATED THERMAL POWER (F_{xy}^{RTP}) within specific core planes shall be:
- 2.6.3.1 Less than or equal to 2.102 for all cycle burnups for all core planes containing Bank "D" control rods, and
- 2.6.3.2 Less than or equal to the appropriate core height-dependent value from Table 1 for all unrodded core planes.
- 2.6.3.3 $PF_{xy} = 0.2$.

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.

2.7 ENTHALPY RISE HOT CHANNEL FACTOR (Specification 3.2.3):

2.7.1 $F_{\Delta H}^{RTP} = 1.557$[1]
2.7.2 $PF_{\Delta H} = 0.3$

2.8 DNB PARAMETERS (Specification 3.2.5):

2.8.1 The following DNB-related parameters shall be maintained within the following limits:[2]
- a. Reactor Coolant System T_{avg}, ≤ 595 °F[3],
- b. Pressurizer Pressure, > 2200 psig[4],
- c. Minimum Measured Reactor Coolant System Flow[5] > 403,000 gpm.

3.0 REFERENCES

3.1 Letter from T. D. Croyle (Westinghouse) to D. F. Hoppes (STPNOC), "Unit 2 Cycle 10 Final Reload Evaluation," NF-TG-02-86 (ST-UB-NOC-02002294), October 1, 2002.

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 Tavg 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.

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[1] Applies to all fuel in the Unit 2 Cycle 10 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 QDPS display per Reference 3.4.

[5] Includes a 2.8% flow measurement uncertainty.

Figure 1

Reactor Core Safety Limits - Four Loops in Operation

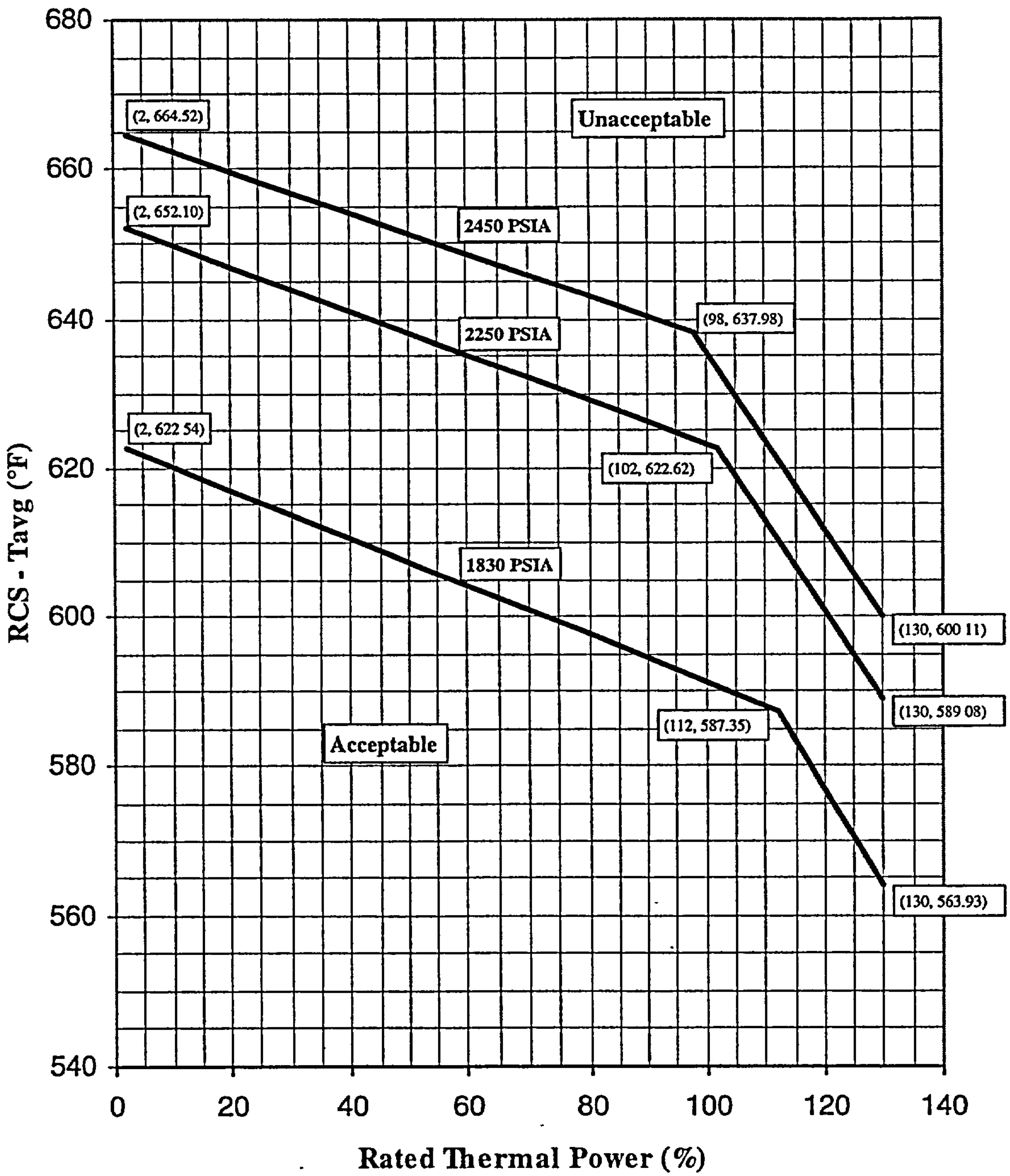


Figure 2

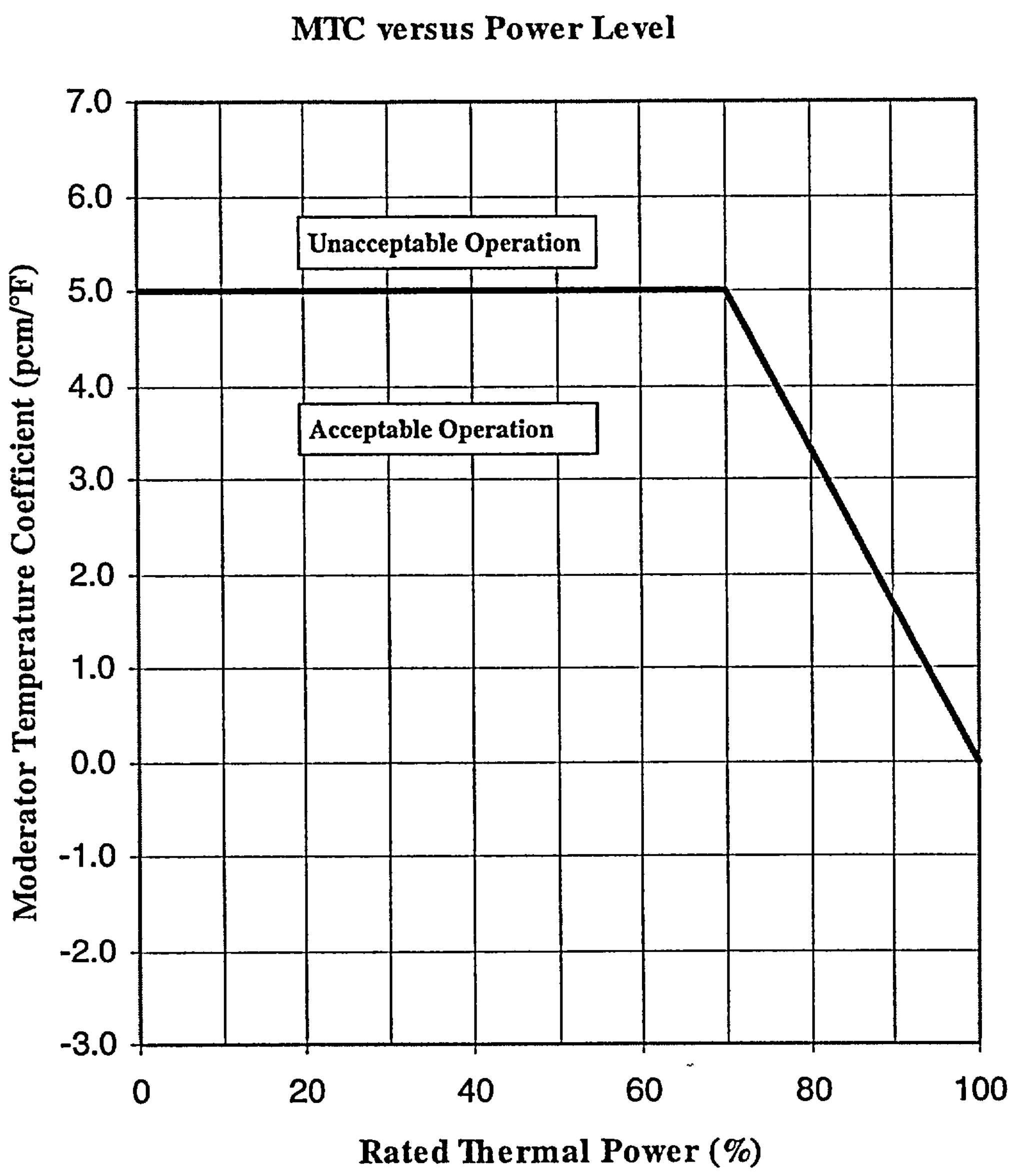
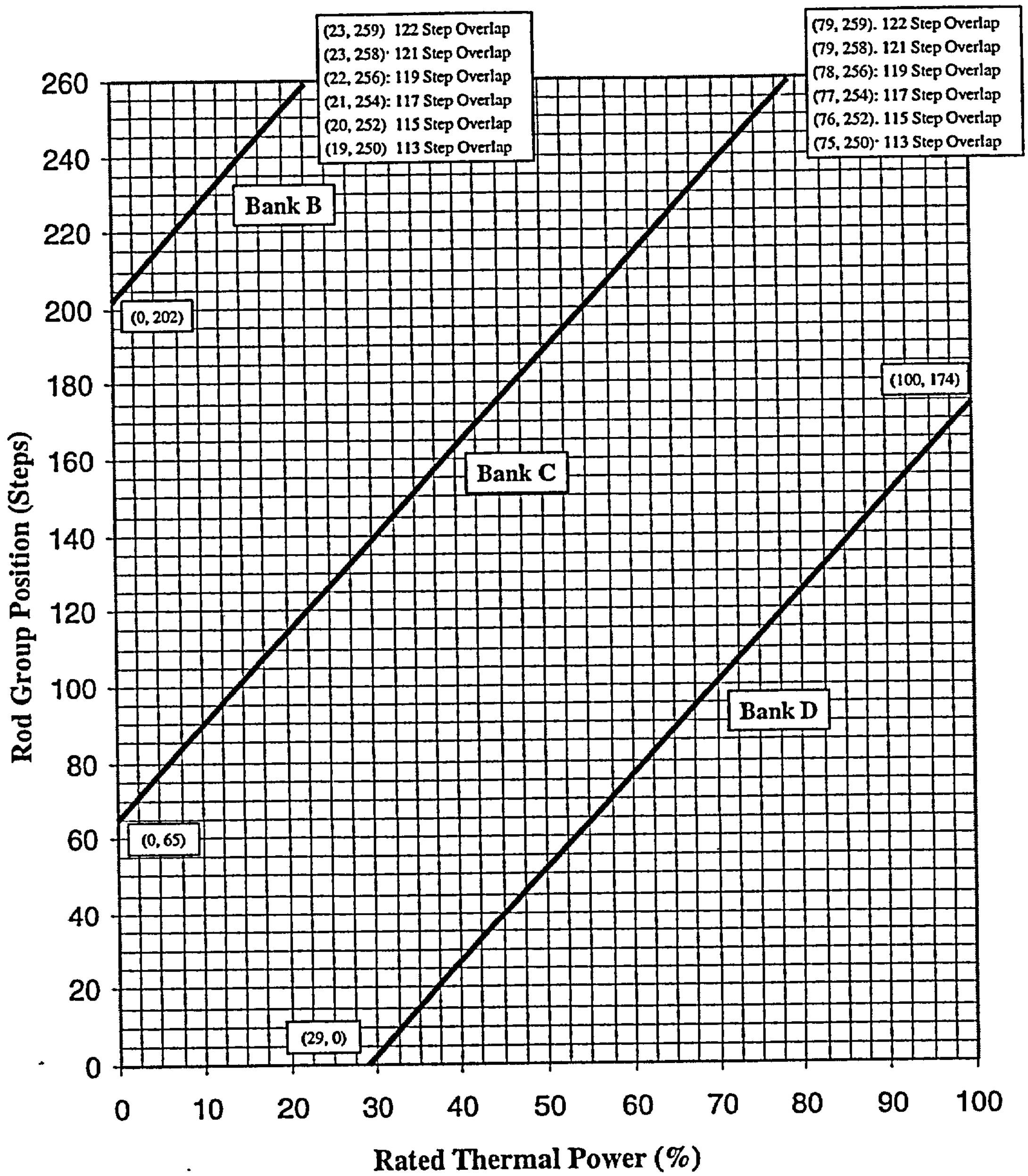

MTC versus Power Level
Unacceptable Operation
Acceptable Operation
Moderator Temperature Coefficient (pcm/°F)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0
20
40
60
80
100
Rated Thermal Power (%)

Figure 3

Control Rod Insertion Limits* versus Power Level



*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 250 and ≤259 steps withdrawn, inclusive.

Figure 4

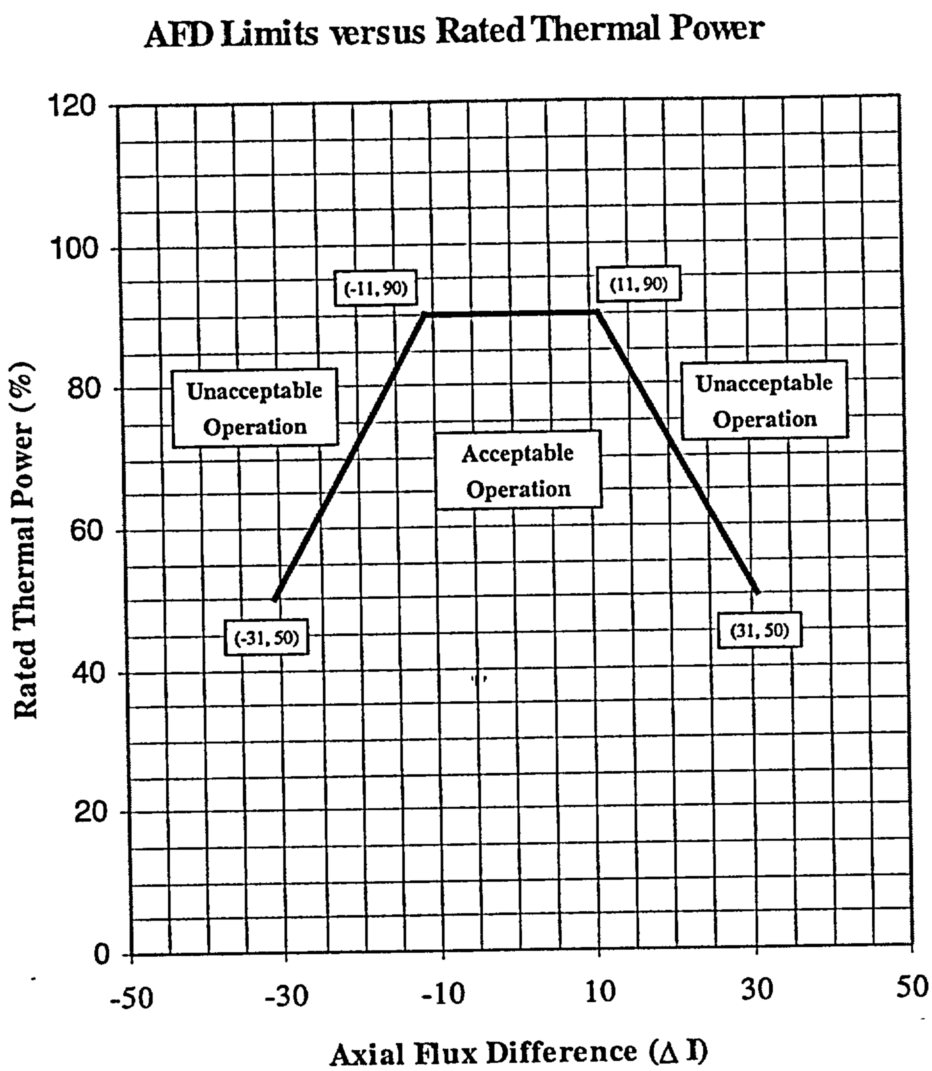

AFD Limits versus Rated Thermal Power
120
100
80
60
40
20
0
Rated Thermal Power (%)
-50
-30
-10
10
30
50
Axial Flux Difference (Δ I)
(-11, 90)
(11, 90)
(-31, 50)
(31, 50)
Unacceptable Operation
Acceptable Operation
Unacceptable Operation

Figure 5

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

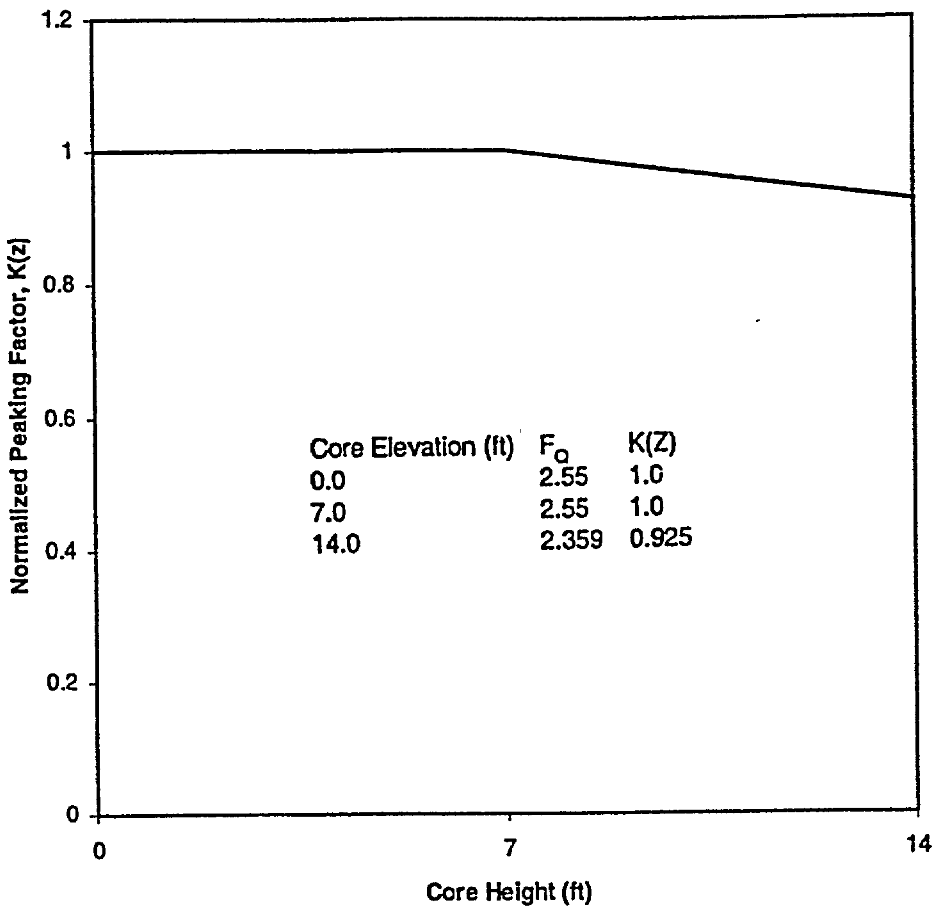


Table 1 (Part 1 of 2)

Unrodded F_{xy} for Each Core Height

for Cycle Burnups Less Than 9000 MWD/MTU

Core Height (Ft.)	Axial Point	Unrodded F_{xy}	Core Height (Ft.)	Axial Point	Unrodded F_{xy}
14.00	1	5.689	6.80	37	1.955
13.80	2	4.773	6.60	38	1.937
13.60	3	3.857	6.40	39	1.921
13.40	4	2.941	6.20	40	1.907
13.20	5	2.493	6.00	41	1.893
13.00	6	2.193	5.80	42	1.878
12.80	7	2.172	5.60	43	1.867
12.60	8	2.123	5.40	44	1.856
12.40	9	2.087	5.20	45	1.853
12.20	10	2.058	5.00	46	1.856
12.00	11	2.033	4.80	47	1.860
11.80	12	2.018	4.60	48	1.865
11.60	13	2.017	4.40	49	1.871
11.40	14	2.018	4.20	50	1.881
11.20	15	2.016	4.00	51	1.892
11.00	16	2.011	3.80	52	1.898
10.80	17	2.005	3.60	53	1.901
10.60	18	2.000	3.40	54	1.899
10.40	19	1.995	3.20	55	1.897
10.20	20	1.992	3.00	56	1.901
10.00	21	1.989	2.80	57	1.907
9.80	22	1.987	2.60	58	1.914
9.60	23	1.986	2.40	59	1.917
9.40	24	1.984	2.20	60	1.921
9.20	25	1.983	2.00	61	1.917
9.00	26	1.983	1.80	62	1.911
8.80	27	1.986	1.60	63	1.904
8.60	28	1.989	1.40	64	1.908
8.40	29	1.995	1.20	65	1.950
8.20	30	2.004	1.00	66	2.039
8.00	31	2.015	0.80	67	2.260
7.80	32	2.028	0.60	68	2.641
7.60	33	2.028	0.40	69	3.094
7.40	34	2.014	0.20	70	3.547
7.20	35	1.990	0.00	71	4.001
7.00	36	1.971			

Table 1 (Part 2 of 2)
Unrodded Fxy for Each Core Height
for Cycle Burnups Greater Than or Equal to 9000 MWD/MTU

Core Height (Ft.)	Axial Point	Unrodded F_{xy}	Core Height (Ft.)	Axial Point	Unrodded F_{xy}
14.00	1	4.440	6.80	37	2.075
13.80	2	3.949	6.60	38	2.085
13.60	3	3.400	6.40	39	2.096
13.40	4	2.827	6.20	40	2.094
13.20	5	2.474	6.00	41	2.088
13.00	6	2.189	5.80	42	2.077
12.80	7	2.171	5.60	43	2.066
12.60	8	2.140	5.40	44	2.054
12.40	9	2.114	5.20	45	2.044
12.20	10	2.088	5.00	46	2.035
12.00	11	2.065	4.80	47	2.027
11.80	12	2.055	4.60	48	2.021
11.60	13	2.054	4.40	49	2.010
11.40	14	2.058	4.20	50	1.998
11.20	15	2.063	4.00	51	1.983
11.00	16	2.070	3.80	52	1.970
10.80	17	2.071	3.60	53	1.959
10.60	18	2.071	3.40	54	1.949
10.40	19	2.070	3.20	55	1.934
10.20	20	2.072	3.00	56	1.917
10.00	21	2.076	2.80	57	1.895
9.80	22	2.082	2.60	58	1.870
9.60	23	2.083	2.40	59	1.844
9.40	24	2.081	2.20	60	1.813
9.20	25	2.077	2.00	61	1.798
9.00	26	2.071	1.80	62	1.786
8.80	27	2.061	1.60	63	1.779
8.60	28	2.051	1.40	64	1.778
8.40	29	2.044	1.20	65	1.806
8.20	30	2.038	1.00	66	1.870
8.00	31	2.032	0.80	67	2.031
7.80	32	2.031	0.60	68	2.295
7.60	33	2.034	0.40	69	2.590
7.40	34	2.042	0.20	70	2.828
7.20	35	2.053	0.00	71	2.885
7.00	36	2.065			