



SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION

UNIT 1 CYCLE 6

CORE OPERATING LIMITS REPORT

April 1995



## 1 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report for STPEGS Unit 1 Cycle 6 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) 3/4.1.1.3 Moderator Temperature Coefficient Limits
- 2) 3/4.1.3.5 Shutdown Rod Insertion Limit
- 3) 3/4.1.3.6 Control Rod Insertion Limits
- 4) 3/4.2.1 AFD Limits
- 5) 3/4.2.2 Heat Flux Hot Channel Factor
- 6) 3/4.2.3 Nuclear Enthalpy Rise Hot Channel Factor

## 2 OPERATING LIMITS

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

### 2.1 MODERATOR TEMPERATURE COEFFICIENT (Specification 3.1.1.3)

2.1.1 The BOL, ARO, MTC shall be less positive than the limits shown in Figure 1.

2.1.2 The EOL, ARO, HFP, MTC shall be less negative than  $-6.12 \times 10^{-4} \Delta k/k/^\circ F$ .

2.1.3 The 300 ppm, ARO, HFP, MTC shall be less negative than  $-5.22 \times 10^{-4} \Delta k/k/^\circ F$  (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 589 °F



2.2 ROD INSERTION LIMITS (Specification 3.1.3.5 and 3.1.3.6)

2.2.1 The Control Rod Insertion limits are provided in Figure 2.

2.2.2 Fully withdrawn for all Control and Shutdown Banks shall be at least 249 steps withdrawn but not exceeding 259 steps withdrawn.

2.2.3 All banks shall have the same Full Out Position (FOP).

2.3 AXIAL FLUX DIFFERENCE (Specification 3.2.1)

2.3.1 AFD limits as required by Technical Specification 3.2.1 are determined by CAOC Operations with an AFD target band of +3, -12%.

2.3.2 The AFD shall be maintained within the ACCEPTABLE OPERATION portion of Figure 3, as required by Technical Specifications.

2.4 HEAT FLUX HOT CHANNEL FACTOR (Specification 3.2.2)

2.4.1  $F_Q^{RTP} = 2.70$ .

2.4.2  $K(Z)$  is provided in Figure 4.

2.4.3 The  $F_{xy}$  limits for RATED THERMAL POWER ( $F_{xy}^{RTP}$ ) within specific core planes shall be:

2.4.3.1 less than or equal to 2.102 for all core planes containing Bank "D" control rods, and

2.4.3.2 less than or equal to the appropriate core height-dependent value from Table 1 for all unrodded core planes.

2.4.3.3  $PF_{xy} = 0.2$ .



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 10CFR50.46.

## 2.5 ENTHALPY RISE HOT CHANNEL FACTOR (Specification 3.2.3)

Standard Fuel  
2.5.1  $F_{\Delta H}^{RTP} = 1.49$ .

VANTAGE 5H Fuel  
 $F_{\Delta H}^{RTP} = 1.557$ .

2.5.2  $PF_{\Delta H} = 0.3$ .

$PF_{\Delta H} = 0.3$ .

## 3 REFERENCES

- 3.1 Correspondence Serial Number ST-UB-HL-1458, Letter from Robert C. Cobb (Westinghouse) to Dave Hoppes (HL&P), Core Operating Limits Report, Unit 1 Cycle 6, 4-6-95.
- 3.2 NUREG-1346, Technical Specifications, South Texas Project Unit Nos. 1 and 2.
- 3.3 Correspondence Serial Number ST-WN-HS-940275, Letter from Mary Ann Sinwell (Westinghouse) to D. A. Leazar (HL&P), Accumulator Water JCO, 8-9-94



FIGURE 1  
MTC versus Power Level

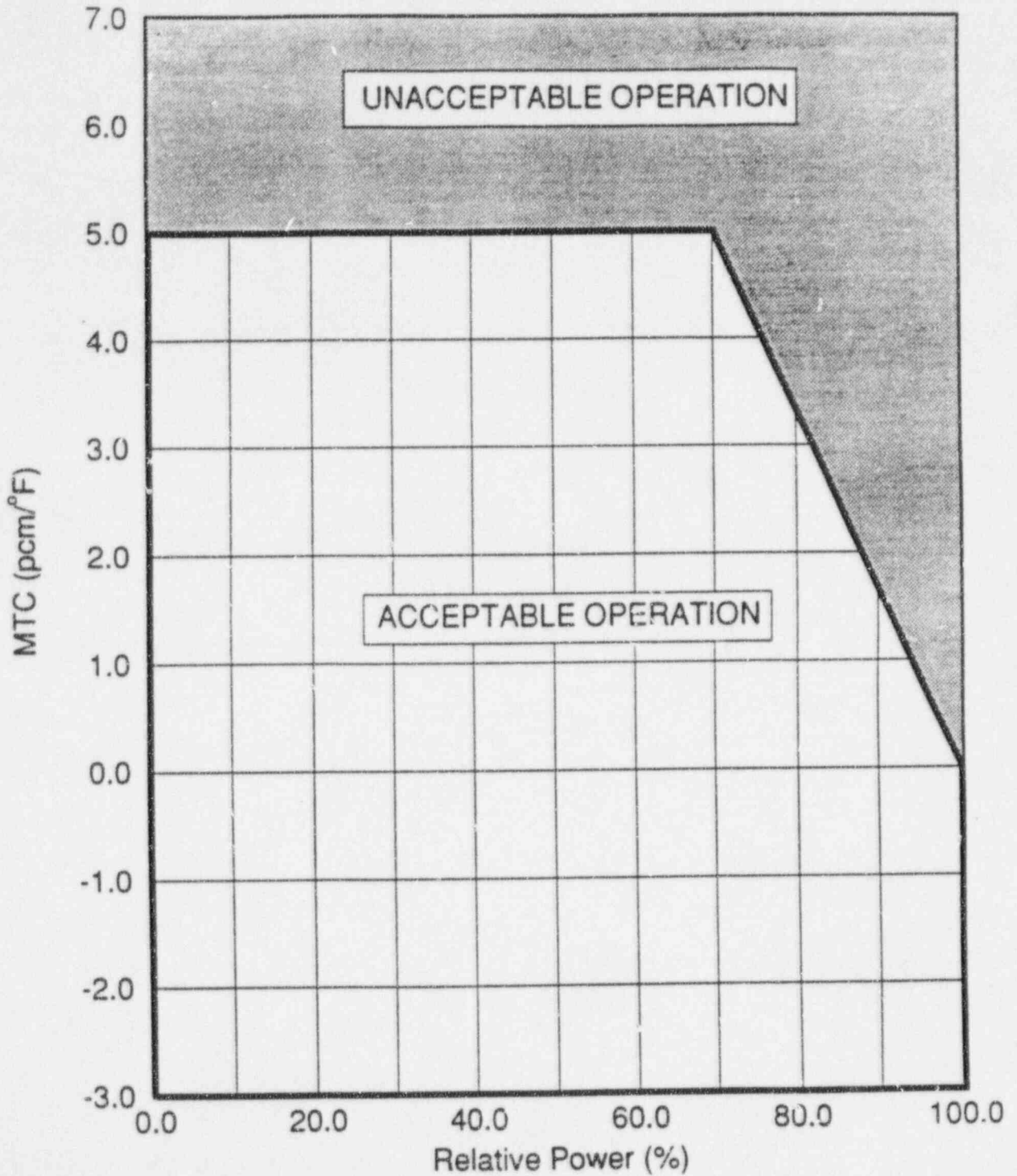
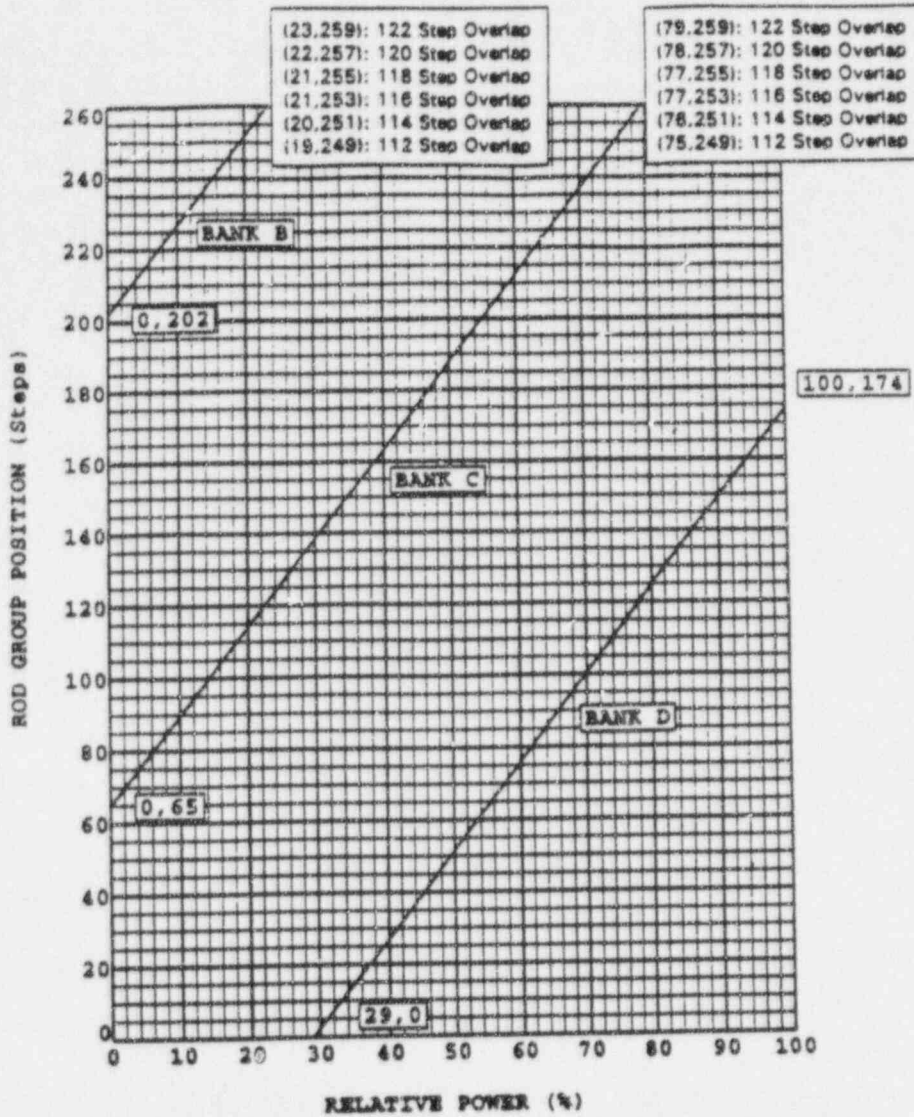




FIGURE 2  
Control Rod Insertion Limits\* Versus Power Level



\* 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  $\geq 249$  and  $\leq 259$  steps withdrawn, inclusive.





FIGURE 3  
AFD Limits versus Rated Thermal Power

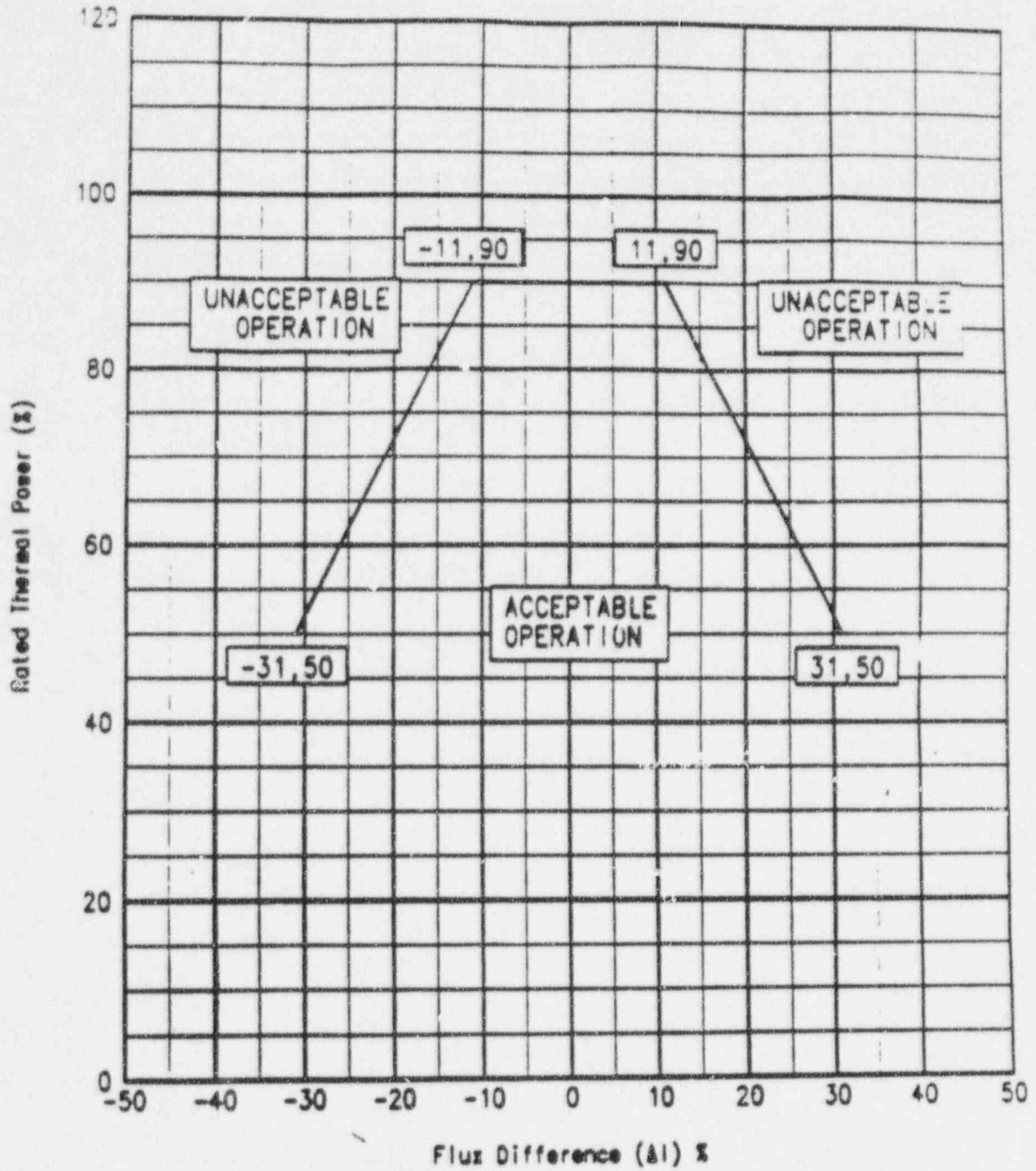




FIGURE 4  
K(Z) - Normalized  $F_Q(Z)$  versus Core Height

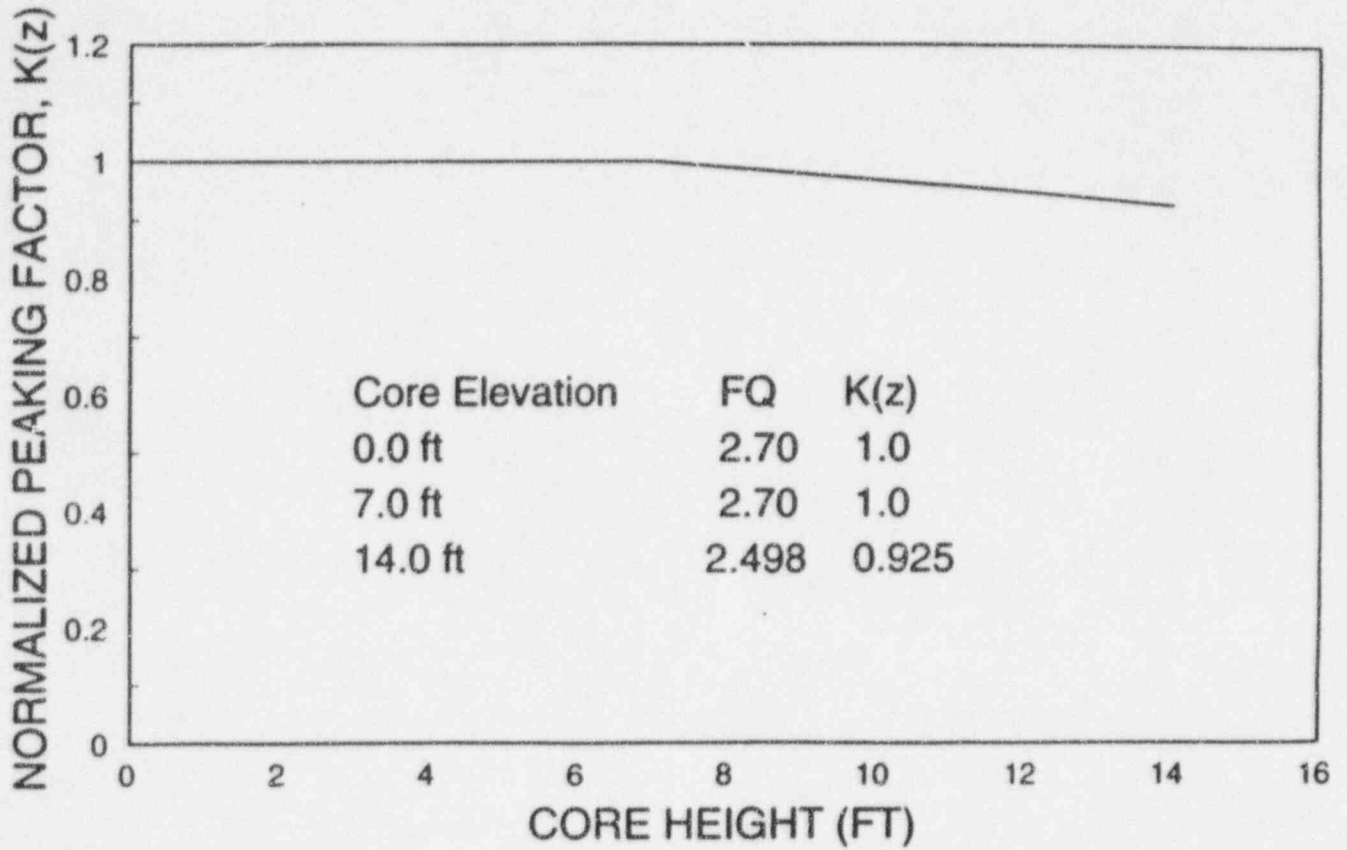






Table 1  
Unrodded Fxy for Each Core Height

Core Height (Ft.)	Unrodded Fxy	Core Height (Ft.)	Unrodded Fxy
0.000	1.927	7.200	1.973
0.200	1.899	7.400	1.970
0.400	1.871	7.600	1.966
0.600	1.847	7.800	1.963
0.800	1.823	8.000	1.960
1.000	1.799	8.200	1.957
1.200	1.779	8.400	1.953
1.400	1.770	8.600	1.947
1.600	1.775	8.800	1.940
1.800	1.800	9.000	1.935
2.000	1.825	9.200	1.930
2.200	1.848	9.400	1.926
2.400	1.861	9.600	1.922
2.600	1.871	9.800	1.917
2.800	1.875	10.000	1.912
3.000	1.878	10.200	1.906
3.200	1.871	10.400	1.899
3.400	1.865	10.600	1.891
3.600	1.858	10.800	1.883
3.800	1.855	11.000	1.874
4.000	1.851	11.200	1.865
4.200	1.849	11.400	1.862
4.400	1.853	11.600	1.865
4.600	1.870	11.800	1.878
4.800	1.887	12.000	1.890
5.000	1.903	12.200	1.901
5.200	1.920	12.400	1.909
5.400	1.939	12.600	1.915
5.600	1.957	12.800	1.906
5.800	1.974	13.000	1.900
6.000	1.989	13.200	1.957
6.200	1.992	13.400	2.035
6.400	1.989	13.600	2.122
6.600	1.985	13.800	2.227
6.800	1.980	14.000	2.331
7.000	1.976		



SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION

UNIT 2 CYCLE 4

CORE OPERATING LIMITS REPORT

March 1995



## 1 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report for STPEGS Unit 2 Cycle 4 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) | 3/4.1.1.3 | Moderator Temperature Coefficient Limits |
| 2) | 3/4.1.3.5 | Shutdown Rod Insertion Limit             |
| 3) | 3/4.1.3.6 | Control Rod Insertion Limits             |
| 4) | 3/4.2.1   | AFD Limits                               |
| 5) | 3/4.2.2   | Heat Flux Hot Channel Factor             |
| 6) | 3/4.2.3   | Nuclear Enthalpy Rise Hot Channel Factor |

## 2 OPERATING LIMITS

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

### 2.1 MODERATOR TEMPERATURE COEFFICIENT (Specification 3.1.1.3)

2.1.1 The BGL, ARO, MTC shall be less positive than the limits shown in Figure 1.

2.1.2 The EOL, ARO, HFP, MTC shall be less negative than  $-6.3 \times 10^{-4} \Delta k/k/^\circ F$ .

2.1.3 The 300 ppm, ARO, HFP, MTC shall be less negative than  $-5.4 \times 10^{-4} \Delta k/k/^\circ F$  (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)



## 2.2 ROD INSERTION LIMITS (Specification 3.1.3.5 and 3.1.3.6)

2.2.1 The Control Rod Insertion limits are provided in Figure 2.

2.2.2 Fully withdrawn for all Control and Shutdown Banks shall be at least 249 steps withdrawn but not exceeding 259 steps withdrawn.

2.2.3 All banks shall have the same Full Out Position (FOP).

## 2.3 AXIAL FLUX DIFFERENCE (Specification 3.2.1)

2.3.1 AFD limits as required by Technical Specification 3.2.1 are determined by CAOC Operations with an AFD target band of +3, -12%.

2.3.2 The AFD shall be maintained within the ACCEPTABLE OPERATION portion of Figure 3, as required by Technical Specifications.

## 2.4 HEAT FLUX HOT CHANNEL FACTOR (Specification 3.2.2)

2.4.1  $F_Q^{RTP} = 2.50$ .

2.4.2  $K(Z)$  is provided in Figure 4.

2.4.3 The  $F_{xy}$  limits for RATED THERMAL POWER ( $F_{xy}^{RTP}$ ) within specific core planes shall be:

2.4.3.1 less than or equal to 1.946 for all core planes containing Bank "D" control rods, and

2.4.3.2 less than or equal to the appropriate core height-dependent value from Table 1 for all unrodded core planes.

2.4.3.3  $PF_{xy} = 0.2$ .



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 10CFR50.46.

## 2.5 ENTHALPY RISE HOT CHANNEL FACTOR (Specification 3.2.3)

2.5.1  $F_{\Delta H}^{RTP} = 1.46$ .

2.5.2  $PF_{\Delta H} = 0.3$ .

## 3 REFERENCES

- 3.1 Correspondence Serial Number ST-UB-HL-1446, Letter from Robert C. Cobb (Westinghouse) to Dave Hoppes (HL&P), Core Operating Limits Report, Unit 2, Mid-Cycle 4, 3-15-95.
- 3.2 NUREG-1346, Technical Specifications, South Texas Project Unit Nos. 1 and 2.



FIGURE 1  
MTC versus Power Level

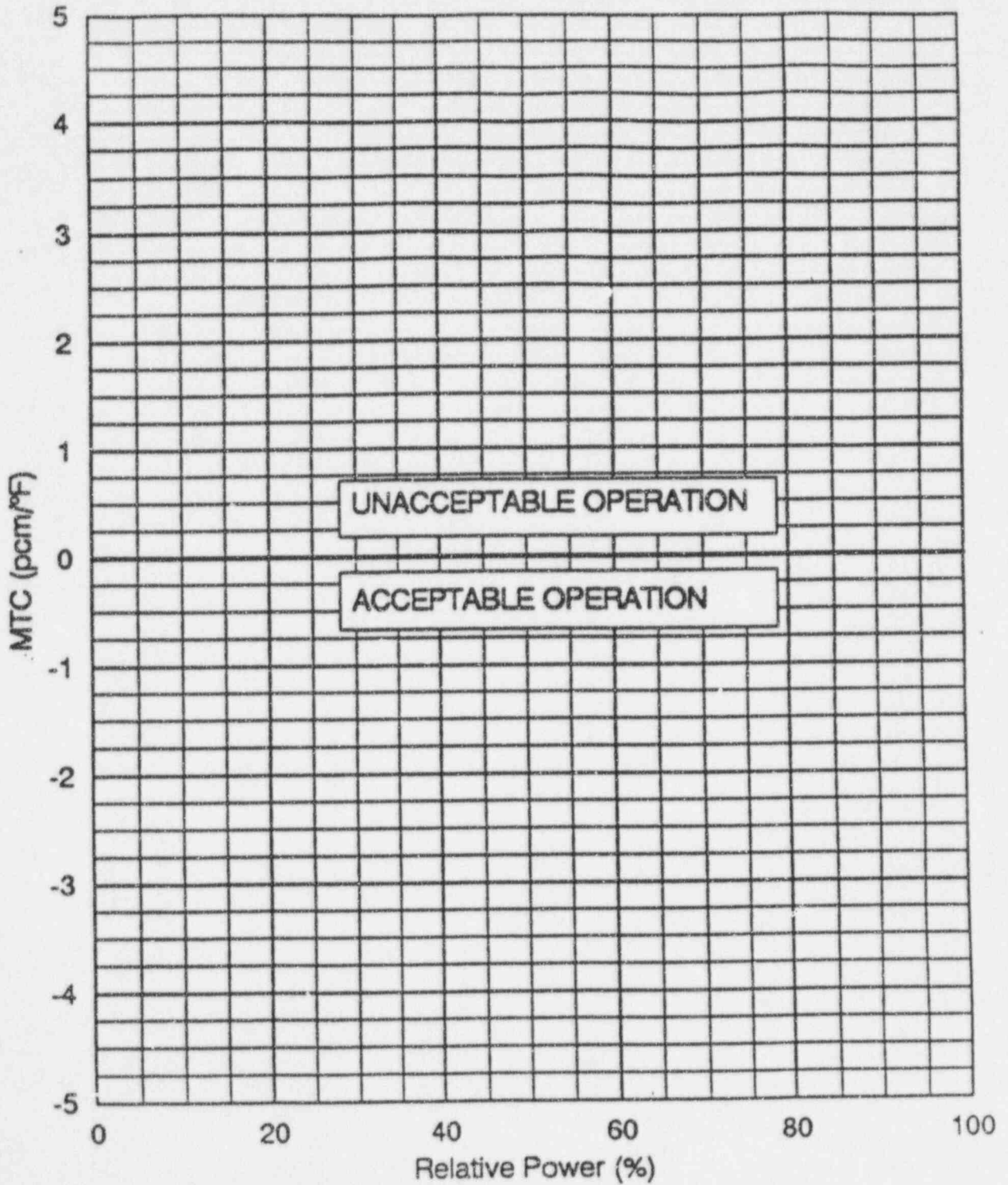
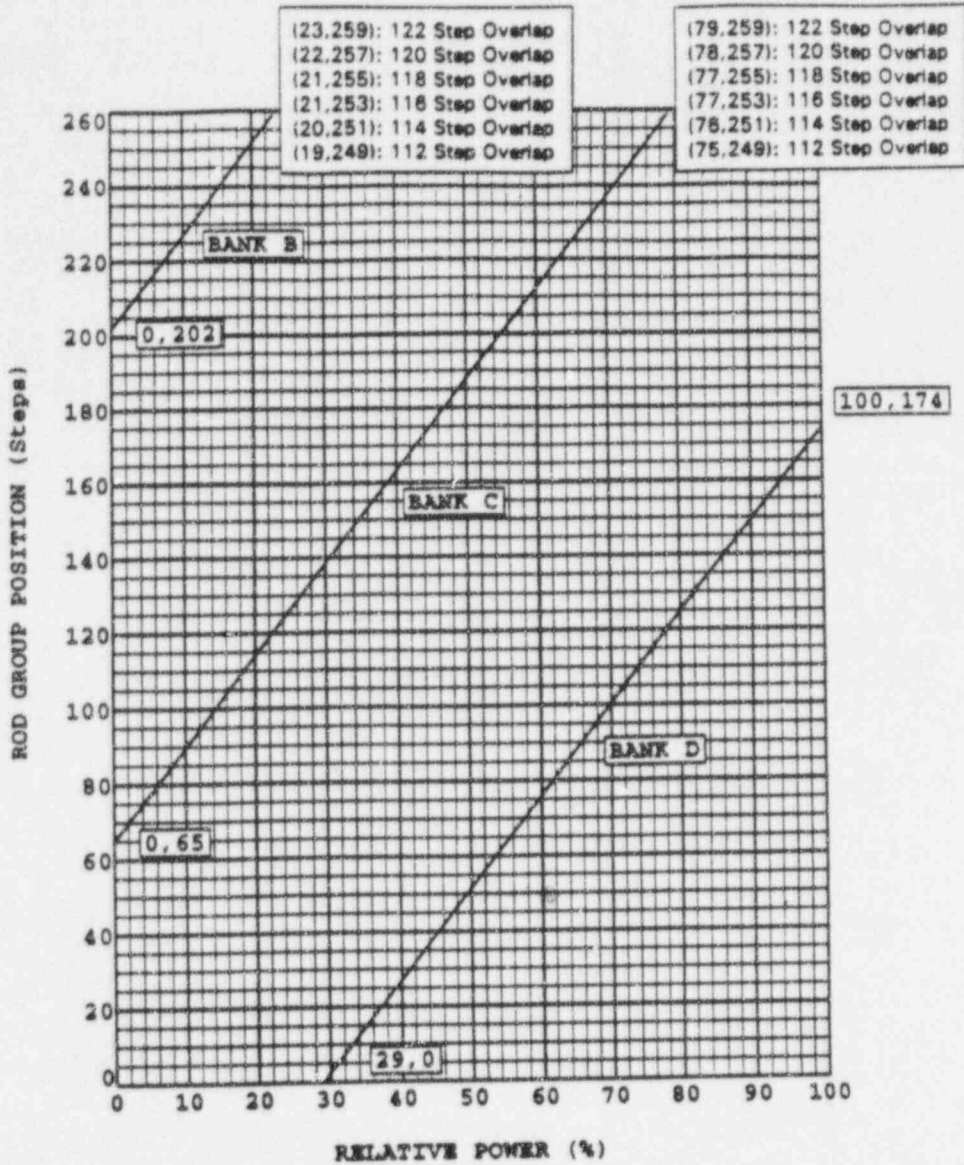




FIGURE 2

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 shutdowns and control banks are at a position within the interval of  $\geq 249$  and  $\leq 259$  steps withdrawn, inclusive.



FIGURE 3  
AFD Limits versus Rated Thermal Power

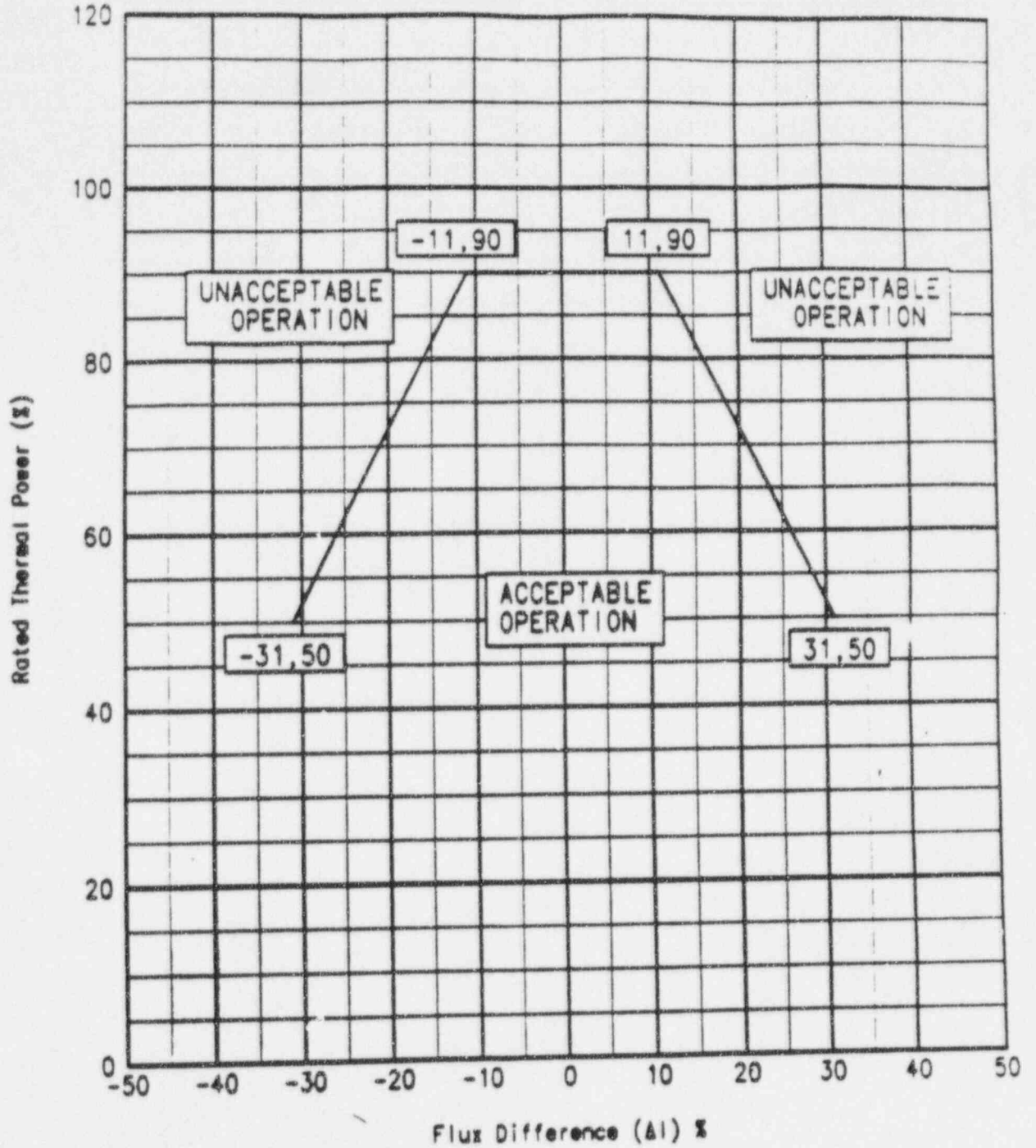




FIGURE 4

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

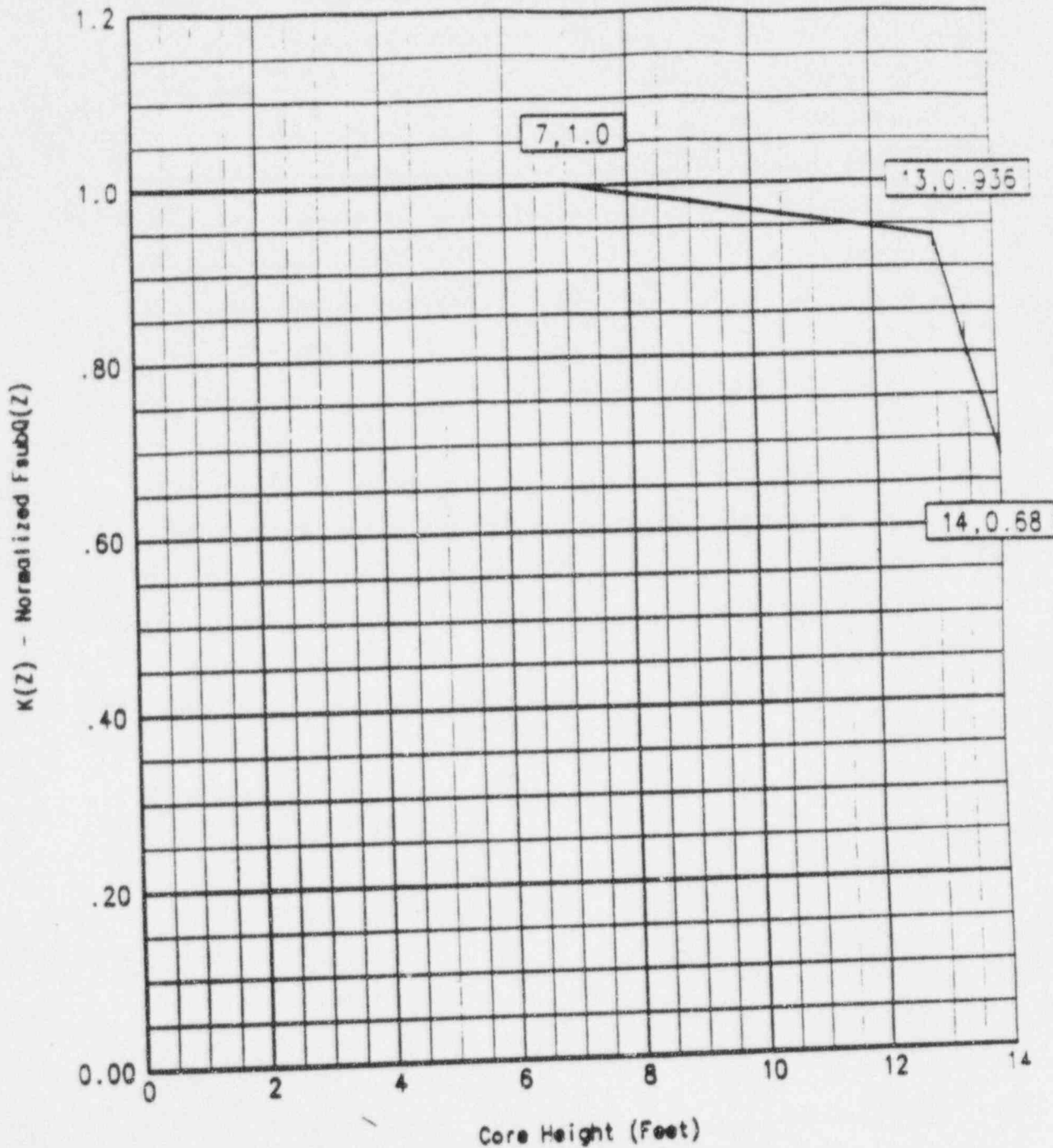




Table 1 (Part 1 of 2)  
Unrodded Fxy for Each Core Height  
for Burnups from BOC to 10,000 MWD/MTU

Core Height (Ft.)	Unrodded Fxy	Core Height (Ft.)	Unrodded Fxy
0.000	4.668	7.200	1.752
0.200	3.219	7.400	1.739
0.400	2.506	7.600	1.726
0.600	2.138	7.800	1.717
0.800	1.950	8.000	1.709
1.000	1.841	8.200	1.704
1.200	1.778	8.400	1.699
1.400	1.744	8.600	1.695
1.600	1.729	8.800	1.692
1.800	1.723	9.000	1.691
2.000	1.730	9.200	1.692
2.200	1.736	9.400	1.695
2.400	1.743	9.600	1.698
2.600	1.754	9.800	1.705
2.800	1.772	10.000	1.710
3.000	1.771	10.200	1.714
3.200	1.809	10.400	1.719
3.400	1.824	10.600	1.727
3.600	1.833	10.800	1.735
3.800	1.839	11.000	1.745
4.000	1.840	11.200	1.753
4.200	1.835	11.400	1.758
4.400	1.825	11.600	1.768
4.600	1.815	11.800	1.784
4.800	1.806	12.000	1.806
5.000	1.799	12.200	1.832
5.200	1.793	12.400	1.863
5.400	1.788	12.600	1.897
5.600	1.784	12.800	1.943
5.800	1.781	13.000	2.019
6.000	1.778	13.200	2.062
6.200	1.778	13.400	2.193
6.400	1.779	13.600	2.501
6.600	1.780	13.800	3.233
6.800	1.782	14.000	4.328
7.000	1.768		



Table 1 (Part 2 of 2)  
Unrodded Fxy for Each Core Height  
for Burnups from 10,000 MWD/MTU to EOC

Core Height (Ft.)	Unrodded Fxy	Core Height (Ft.)	Unrodded Fxy
0.000	3.579	7.200	2.008
0.200	2.540	7.400	2.004
0.400	2.057	7.600	2.001
0.600	1.814	7.800	2.001
0.800	1.699	8.000	2.001
1.000	1.640	8.200	2.000
1.200	1.618	8.400	2.000
1.400	1.616	8.600	2.013
1.600	1.628	8.800	2.024
1.800	1.647	9.000	2.035
2.000	1.674	9.200	2.041
2.200	1.702	9.400	2.037
2.400	1.731	9.600	2.028
2.600	1.762	9.800	2.007
2.800	1.795	10.000	1.986
3.000	1.828	10.200	1.964
3.200	1.861	10.400	1.942
3.400	1.891	10.600	1.921
3.600	1.918	10.800	1.900
3.800	1.935	11.000	1.880
4.000	1.942	11.200	1.863
4.200	1.954	11.400	1.850
4.400	1.970	11.600	1.840
4.600	1.980	11.800	1.835
4.800	1.985	12.000	1.820
5.000	1.994	12.200	1.801
5.200	2.004	12.400	1.795
5.400	2.006	12.600	1.800
5.600	2.003	12.800	1.828
5.800	2.006	13.000	1.890
6.000	2.011	13.200	1.901
6.200	2.020	13.400	1.972
6.400	2.029	13.600	2.168
6.600	2.024	13.800	2.696
6.800	2.018	14.000	3.461
7.000	2.013		