
# SOUTH TEXAS PROJECT
# ELECTRIC GENERATING STATION
# UNIT 2 CYCLE 7
# CORE OPERATING LIMITS REPORT

October 1998

# 1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report for STPEGS Unit 2 Cycle 7 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 LIMITS |
| 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 |

# 2.0 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 $-6.12 \times 10^{-4}$ $\Delta k/k/°F$.

2.1.3 The 300 ppm, ARO, HFP, MTC shall be less negative than $-5.22 \times 10^{-4}$ $\Delta k/k/°F$ (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2.2.1 All banks shall have the same Full Out Position (FOP) of at least 254 steps withdrawn but not exceeding 259 steps withdrawn.

2.2.2 The Control Banks shall be limited in physical insertion as specified in Figure 2.

2.2.3 Individual Shutdown bank rods are fully withdrawn when the Bank Demand Indication is at the FOP and the Rod Group Height Limiting Condition for Operation is satisfied (T.S. 3.1.3.1).

## 2.3 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 $F_Q^{RTP} = 2.55$.

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 10 CFR 50.46.

For Unit 2 Cycle 7, the L(Z) penalty is not applied (i.e., L(Z) = 1.0 for all core elevations).

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

| | Standard Fuel | VANTAGE 5H / RFA Fuel |
|---|---|---|
| 2.5.1 | $F_{\Delta H}^{RTP} = 1.49.$ | $F_{\Delta H}^{RTP} = 1.557.$ |
| 2.5.2 | $PF_{\Delta H} = 0.3.$ | $PF_{\Delta H} = 0.3.$ |

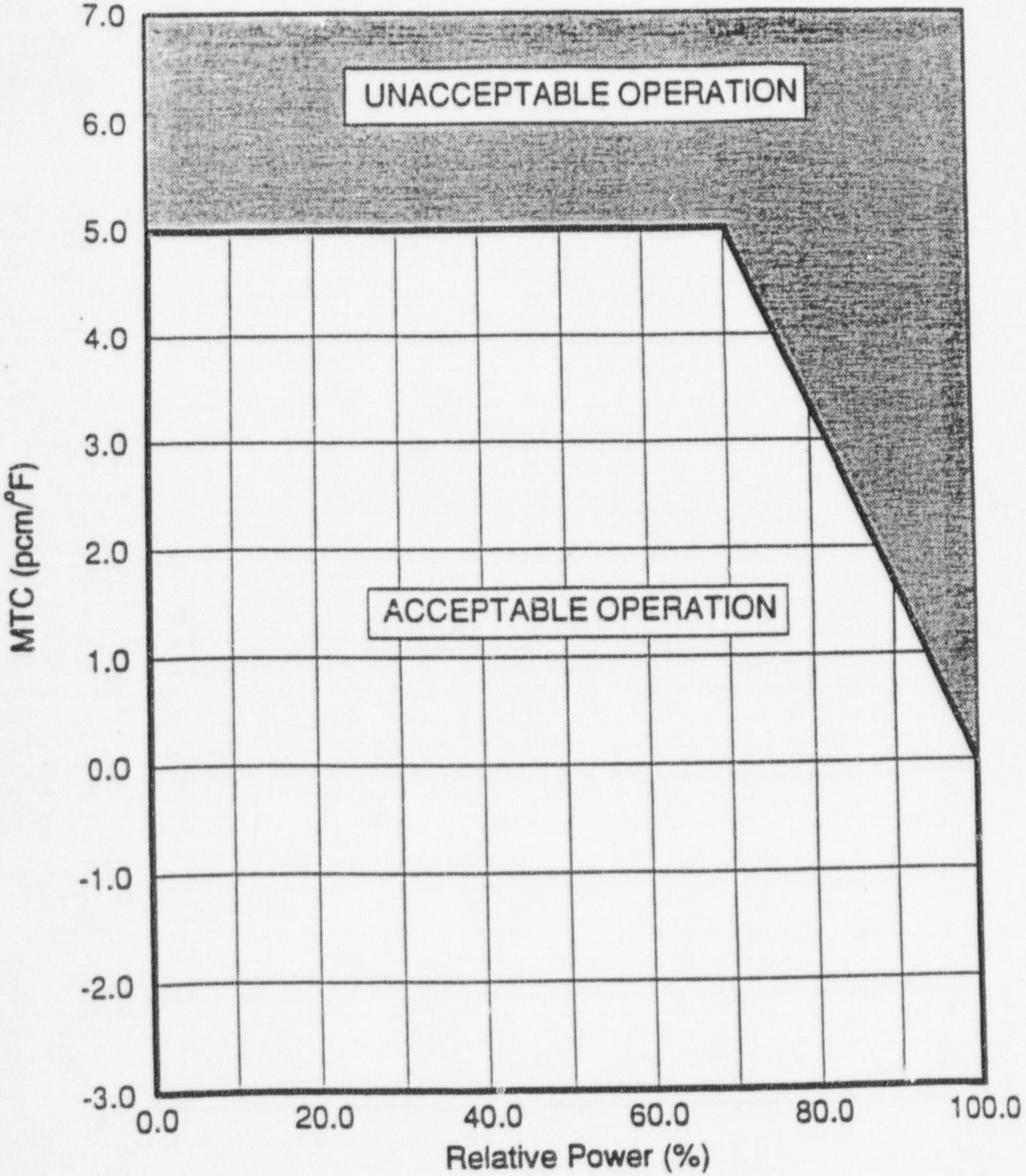
## 3.0 REFERENCES

3.1 Letter from N. R. Metcalf (Westinghouse) to Dave Hoppes (STPNOC), "Unit 2 Cycle 7 Core Operating Limits Reports," 98TG-G-0064 (ST-UB-NOC-1840), October 12, 1998.

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

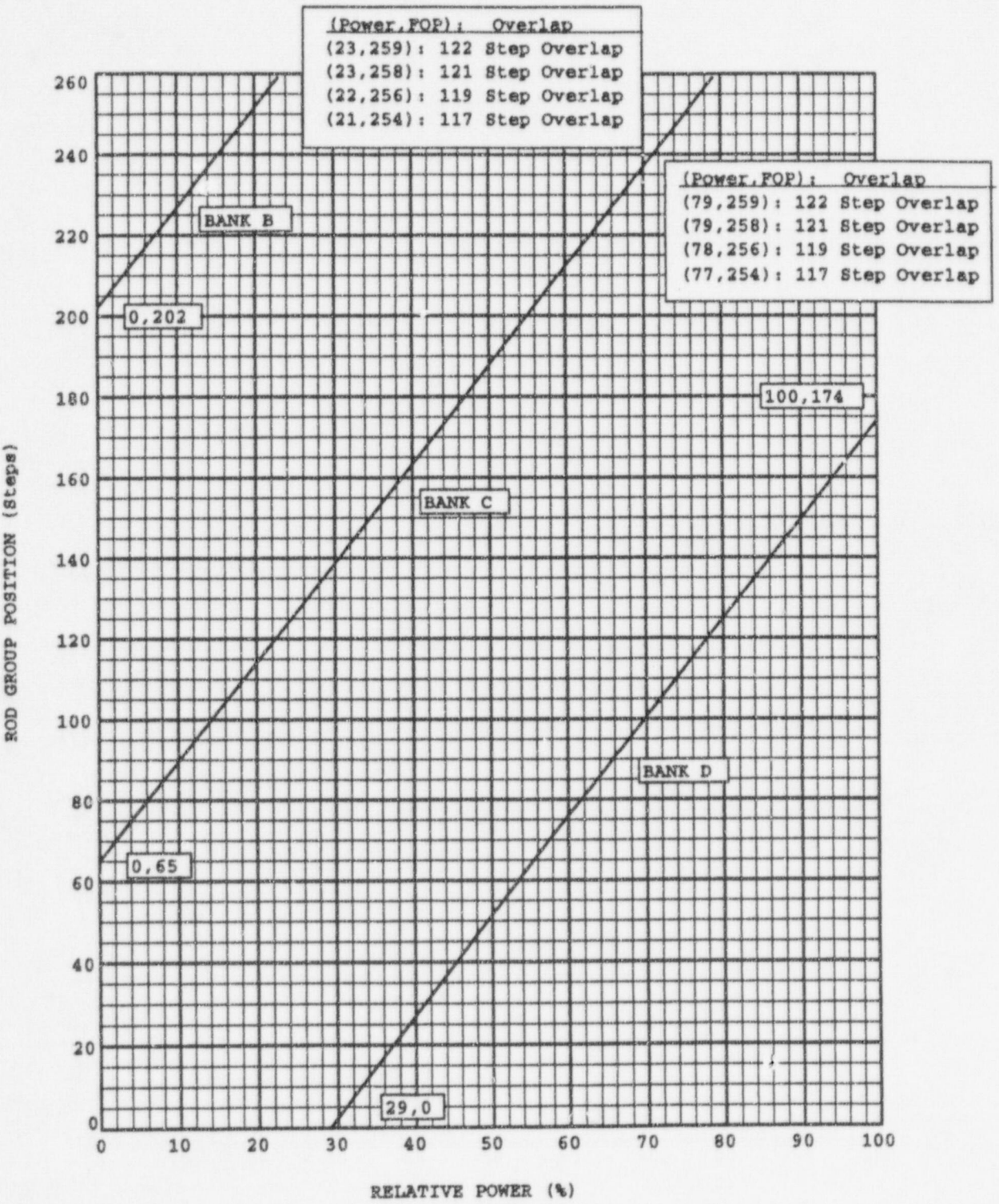
**Figure 1**

**MTC versus Power Level**



## Figure 2

## Control Rod Insertion Limits* versus Power Level




* Control Bank A is already withdrawn to Full Out Position.

**Figure 3**

**AFD Limits versus Rated Thermal Power**

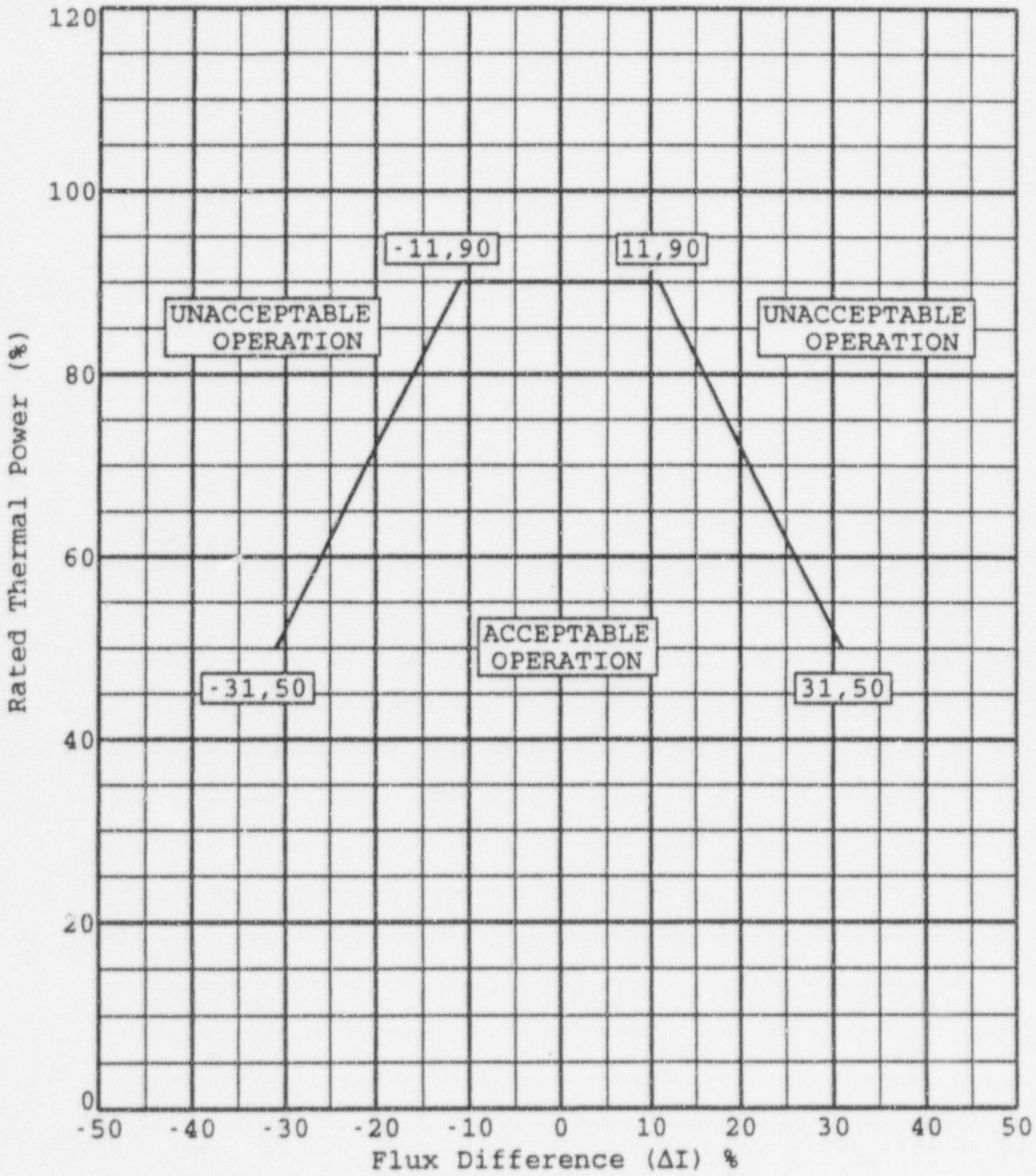
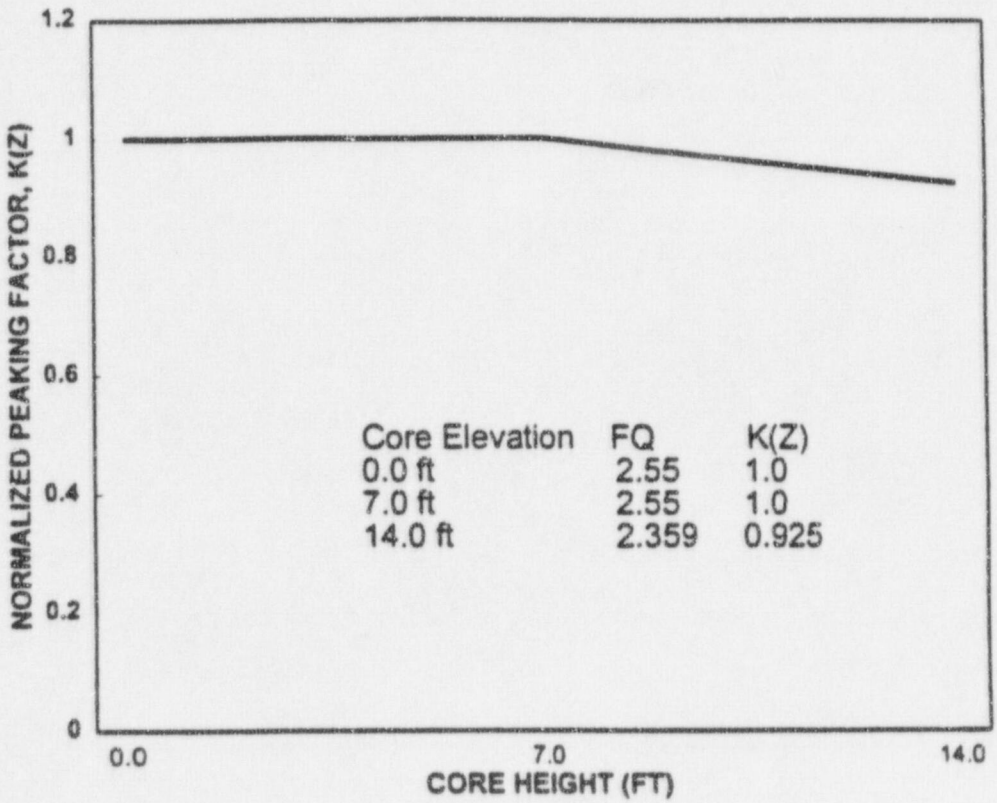


**Figure 4**

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



## Table 1

## Unrodded $F_{xy}$ for Each Core Height*

| Core Height (Ft.) | Unrodded $F_{xy}$ | Core Height (Ft.) | Unrodded $F_{xy}$ |
|---|---|---|---|
| 14.000 | 3.443 | 6.800 | 1.905 |
| 13.800 | 3.125 | 6.600 | 1.907 |
| 13.600 | 2.793 | 6.400 | 1.909 |
| 13.400 | 2.453 | 6.200 | 1.911 |
| 13.200 | 2.193 | 6.000 | 1.909 |
| 13.000 | 2.032 | 5.800 | 1.905 |
| 12.800 | 1.987 | 5.600 | 1.904 |
| 12.600 | 1.975 | 5.400 | 1.907 |
| 12.400 | 1.983 | 5.200 | 1.916 |
| 12.200 | 1.985 | 5.000 | 1.923 |
| 12.000 | 1.994 | 4.800 | 1.929 |
| 11.800 | 2.007 | 4.600 | 1.926 |
| 11.600 | 2.029 | 4.400 | 1.923 |
| 11.400 | 2.024 | 4.200 | 1.924 |
| 11.200 | 2.000 | 4.000 | 1.927 |
| 11.000 | 1.949 | 3.800 | 1.937 |
| 10.800 | 1.918 | 3.600 | 1.951 |
| 10.600 | 1.899 | 3.400 | 1.945 |
| 10.400 | 1.892 | 3.200 | 1.929 |
| 10.200 | 1.889 | 3.000 | 1.908 |
| 10.000 | 1.886 | 2.800 | 1.886 |
| 9.800 | 1.883 | 2.600 | 1.862 |
| 9.600 | 1.878 | 2.400 | 1.844 |
| 9.400 | 1.872 | 2.200 | 1.831 |
| 9.200 | 1.866 | 2.000 | 1.816 |
| 9.000 | 1.861 | 1.800 | 1.805 |
| 8.800 | 1.857 | 1.600 | 1.788 |
| 8.600 | 1.855 | 1.400 | 1.786 |
| 8.400 | 1.854 | 1.200 | 1.777 |
| 8.200 | 1.857 | 1.000 | 1.779 |
| 8.000 | 1.862 | 0.800 | 1.896 |
| 7.800 | 1.872 | 0.600 | 2.113 |
| 7.600 | 1.884 | 0.400 | 2.381 |
| 7.400 | 1.895 | 0.200 | 2.643 |
| 7.200 | 1.901 | 0.000 | 2.893 |
| 7.000 | 1.903 | | |

* For Unit 2 Cycle 7, the L(Z) penalty is not applied (i.e., L(Z) = 1.0 for all core elevations).