

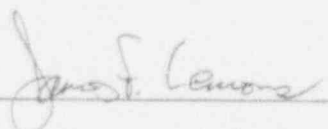
SEQUOYAH NUCLEAR PLANT UNIT 2, CYCLE 6

CORE OPERATING LIMITS REPORT



REVISION 1

November 12, 1993

Prepared:


Nuclear Fuel11-15-93
Date

Reviewed:


Reactor Engineering Supervisor11-17-93
Date
Technical Support Manager11-18-93
Date
PORC Chairman1 Dec 93
DateRevision 1Pages affected All

Reason for Revision The EOL/ARO/RTP-MTC and 300 ppm
surveillance limits specified in Section 2.1 are
revised to reflect new calculational methodology.
Format is also revised to reflect current standard.

COLR FOR SEQUOYAH UNIT 2 CYCLE 6

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Sequoyah Unit 2 Cycle 6 has been prepared in accordance with the requirements of Technical Specification (TS) 6.9.1.14.

The TSS affected by this report are listed below:

- 3/4.1.1.3 Moderator Temperature Coefficient (MTC)
- 3/4.1.3.5 Shutdown Rod Insertion Limit
- 3/4.1.3.6 Control Rod Insertion Limits
- 3/4.2.1 Axial Flux Difference (AFD)
- 3/4.2.2 Heat Flux Hot Channel Factor ($F_Q(Z)$)
- 3/4.2.3 Nuclear Enthalpy Hot Channel Factor (F_{LH}^N)

2.0 OPERATING LIMITS

The cycle-specific parameter limits for the specifications listed in section 1.0 are presented in the following subsections. These limits have been developed using the NRC approved methodologies specified in TS 6.9.1.14.

The following abbreviations are used in this section:

BOL stands for Beginning of Cycle Life
ARO stands for All Rods Out
HZP stands for Hot Zero THERMAL POWER
EOL stands for End of Cycle Life
RTP stands for RATED THERMAL POWER

2.1 Moderator Temperature Coefficient - MTC (Specification 3/4.1.1.3)

2.1.1 The MTC limits are:

The BOL/ARO/HZP-MTC shall be less positive than 0 $\Delta k/k/^{\circ}F$ (BOL limit). With the measured BOL/ARO/HZP-MTC more positive than -1.2×10^{-5} $\Delta k/k/^{\circ}F$ (as-measured MTC limit), establish control rod withdrawal limits to ensure the MTC remains less positive than 0 $\Delta k/k/^{\circ}F$ for all times in core life.

The EOL/ARO/RTP-MTC shall be less negative than or equal to -4.5×10^{-6} $\Delta k/k/^{\circ}F$. +

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2.1.2 The 300 ppm surveillance limit is:

The measured 300 ppm/ARO/RTP-MTC should be less negative than or equal to $-3.75 \times 10^{-4} \Delta k/k/^{\circ}F$. +

2.2 Shutdown Rod Insertion Limit (Specification 3/4.1.3.5)

2.2.1 The shutdown rods shall be withdrawn to a position greater than or equal to 225 steps withdrawn.

2.3 Control Rod Insertion Limits (Specification 3/4.1.3.6)

2.3.1 The control rod banks shall be limited in physical insertion as shown in Figure 1.

2.4 Axial Flux Difference - AFD (Specification 3/4.2.1)

2.4.1 The axial flux difference (AFD) limits are provided in Figure 2.

2.5 Heat Flux Hot Channel Factor - $F_0(Z)$ (Specification 3/4.2.2)

$$F_0(Z) \leq \frac{F_0^{RTP}}{P} * K(Z) \quad \text{for } P > 0.5$$

$$F_0(Z) \leq \frac{F_0^{RTP}}{0.5} * K(Z) \quad \text{for } P \leq 0.5$$

$$\text{where } P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$$

2.5.1 $F_0^{RTP} = 2.32$

2.5.2 $K(Z)$ is provided in Figure 3.

COLR FOR SEQUOYAH UNIT 2 CYCLE 6

2.5.3 Note that the W(Z) values required by TS SR 4.2.2.2 are provided in Figures 4 through 8. This information is sufficient to determine W(Z) versus core height for all cycle burnups through the use of three point interpolation.

2.6 Nuclear Enthalpy Rise Hot Channel Factor - $F_{\Delta H}^N$
(Specification 3/4.2.3)

$$F_{\Delta H}^N \leq F_{\Delta H}^{RTP} * (1 + PF_{\Delta H} * [1 - P])$$

$$\text{where } P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$$

2.6.1 $F_{\Delta H}^{RTP} = 1.55$

2.6.2 $PF_{\Delta H} = 0.3$

COLR For Sequoyah Unit 2 Cycle 6

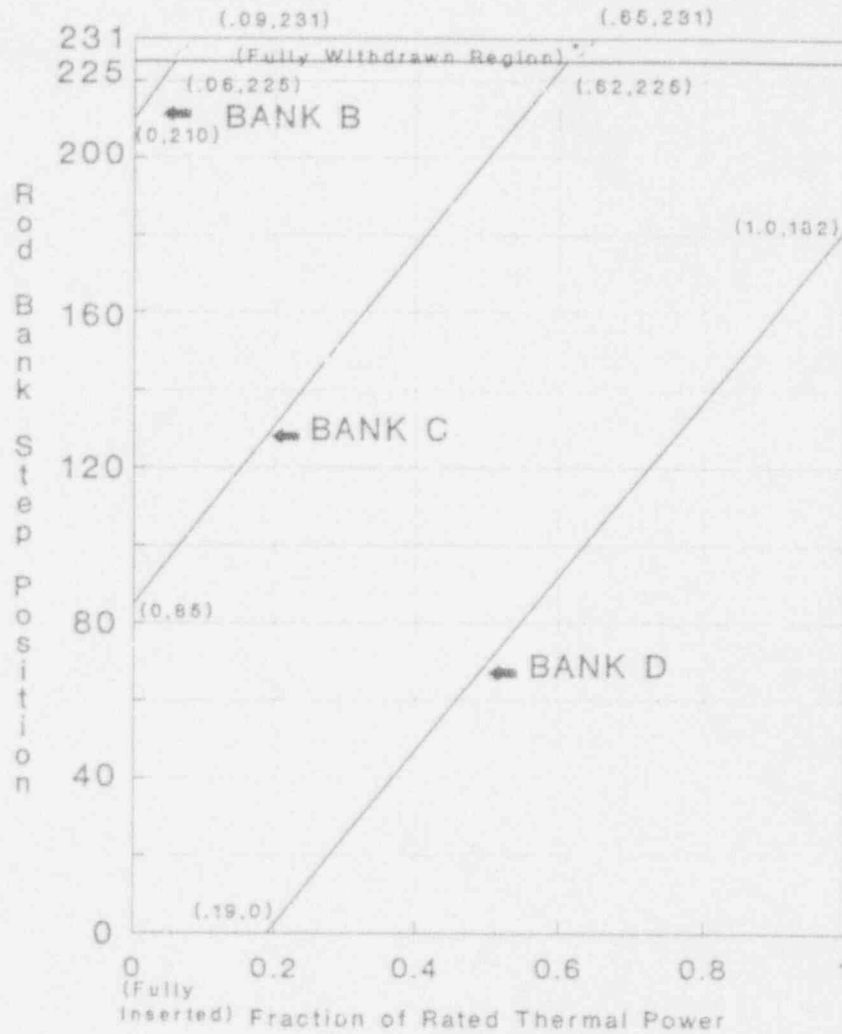


FIGURE 1
Rod Bank Insertion Limits Versus
Thermal Power Four Loop Operation

* Fully withdrawn region shall be the condition where shutdown and control banks are at a position within the interval of ≥ 225 and ≤ 231 steps withdrawn, inclusive.

COLR For Sequoyah Unit 2 Cycle 6

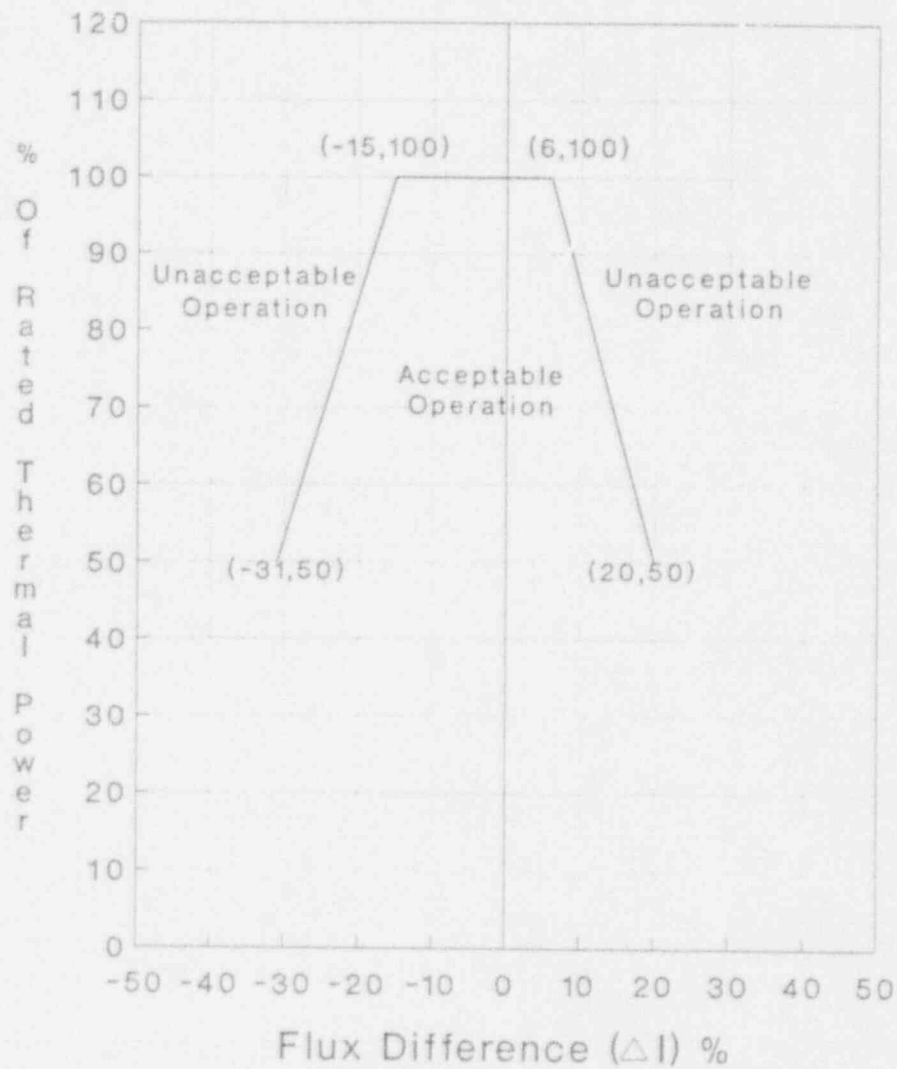


FIGURE 2

Axial Flux Difference Limits As
A Function Of Rated Thermal Power

COLR For Sequoyah Unit 2 Cycle 6

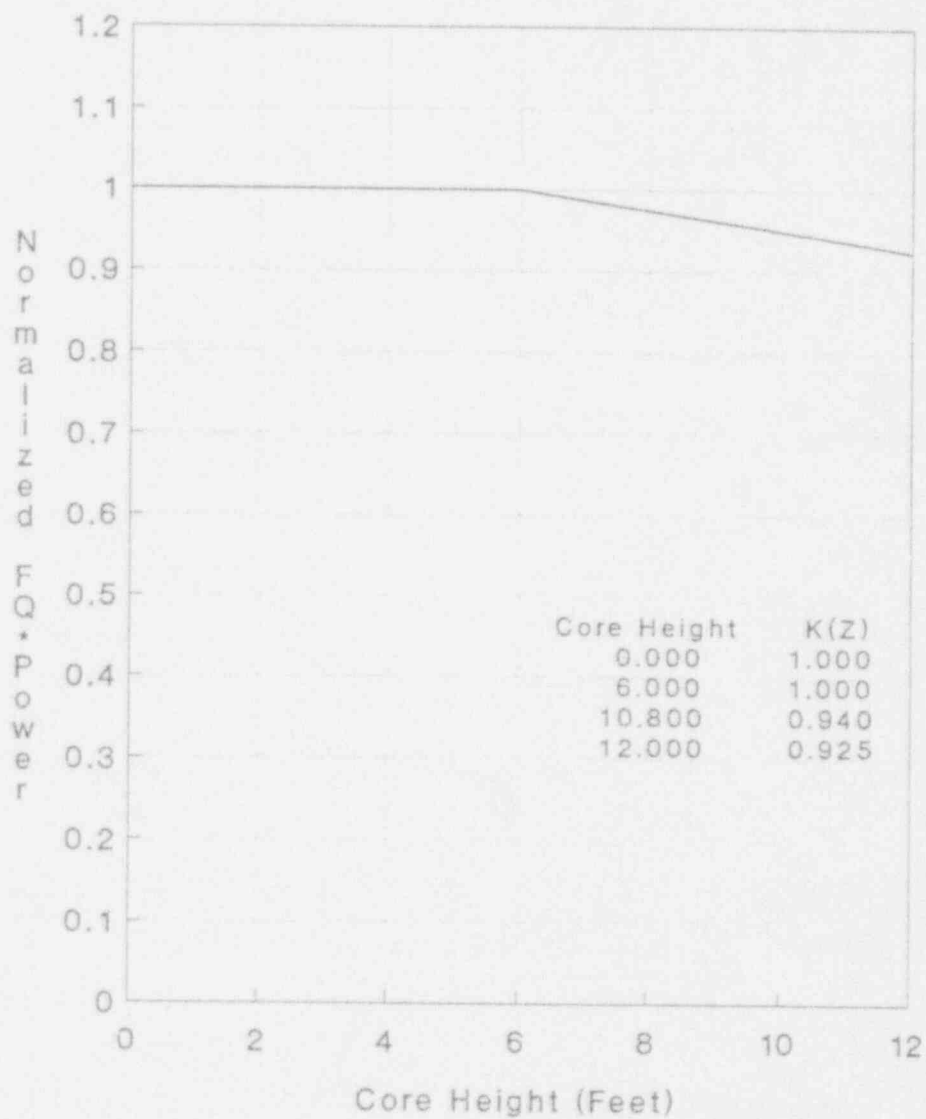


FIGURE 3

K(Z) - Normalized Fq(Z) as a Function of Core Height

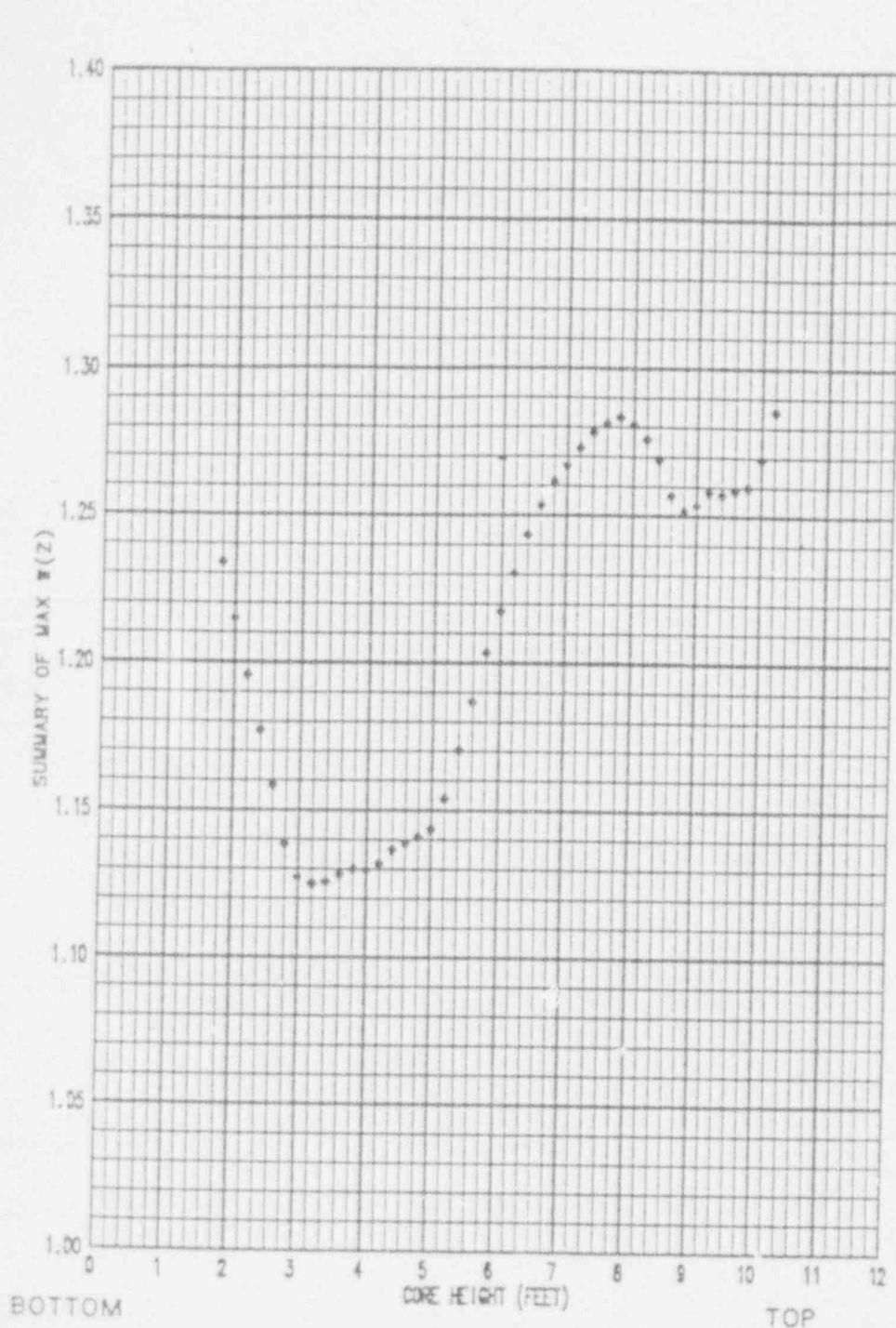
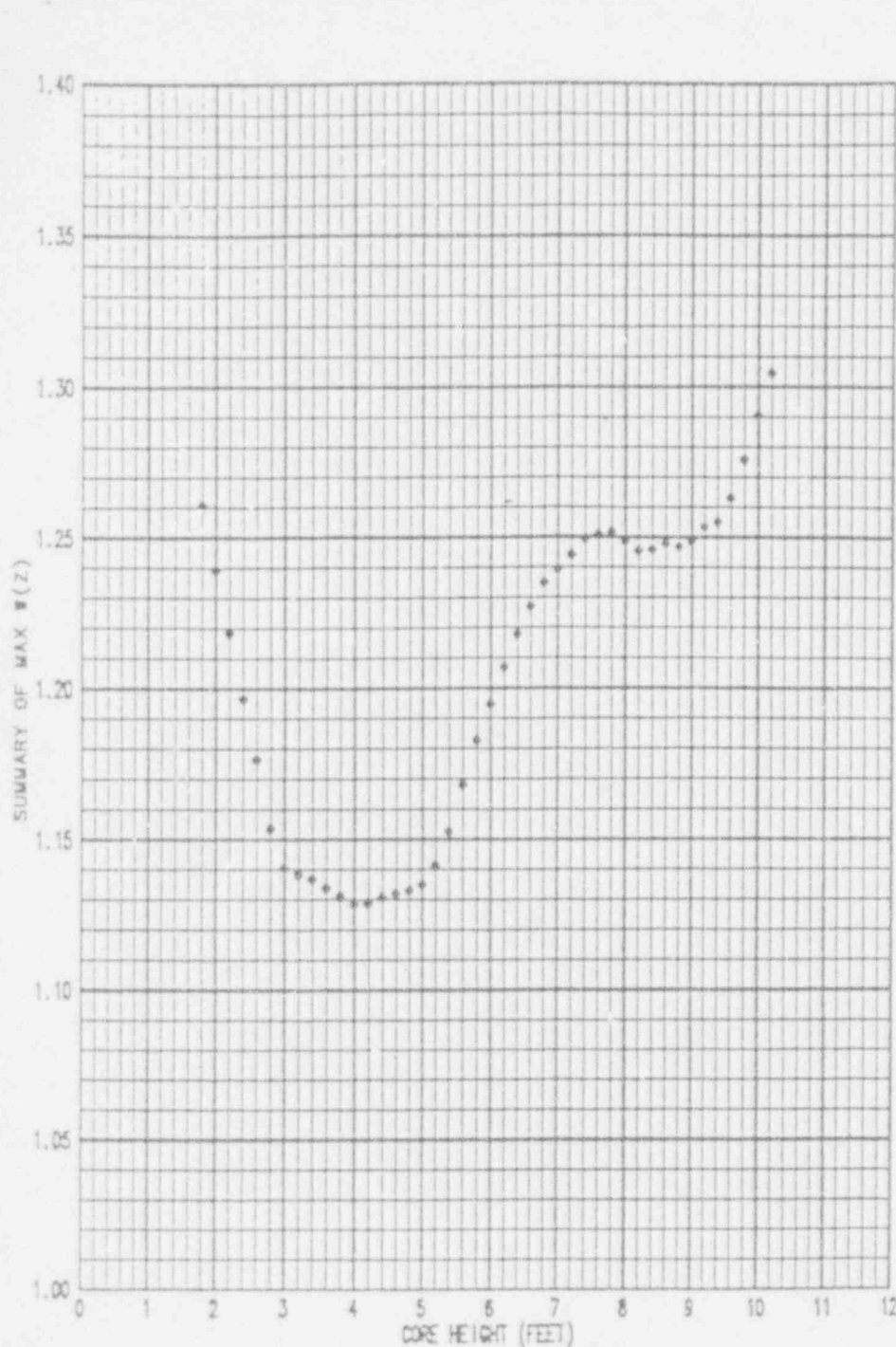


FIGURE 4

SEQUOYAH UNIT 2 CYCLE 6
RAOC SUMMARY OF MAX W(Z) AT 150 MWD/MTU

* TOP AND BOTTOM 15% EXCLUDED AS PER TECH SPEC 4.2.2.G

Height (Feet)	MAX W(Z)
0.000	1.0000
0.200	1.0000
0.400	1.0000
0.600	1.0000
0.800	1.0000
1.000	1.0000
1.200	1.0000
1.400	1.0000
1.600	1.0000
1.800	1.2337
2.000	1.2148
2.200	1.1958
2.400	1.1771
2.600	1.1584
2.800	1.1385
3.000	1.1272
3.200	1.1250
3.400	1.1257
3.600	1.1282
3.800	1.1301
4.000	1.1297
4.200	1.1320
4.400	1.1365
4.600	1.1388
4.800	1.1411
5.000	1.1436
5.200	1.1540
5.400	1.1704
5.600	1.1868
5.800	1.2034
6.000	1.2177
6.200	1.2306
6.400	1.2434
6.600	1.2533
6.800	1.2614
7.000	1.2669
7.200	1.2729
7.400	1.2782
7.600	1.2814
7.800	1.2833
8.000	1.2809
8.200	1.2759
8.400	1.2688
8.600	1.2570
8.800	1.2518
9.000	1.2536
9.200	1.2581
9.400	1.2574
9.600	1.2587
9.800	1.2597
10.000	1.2693
10.200	1.2855
10.400	1.0000
10.600	1.0000
10.800	1.0000
11.000	1.0000
11.200	1.0000
11.400	1.0000
11.600	1.0000
11.800	1.0000
12.000	1.0000



Height (Feet)	MAX W(Z)
0.000	1.0000
0.200	1.0000
0.400	1.0000
0.600	1.0000
0.800	1.0000
1.000	1.0000
1.200	1.0000
1.400	1.0000
1.600	1.0000
1.800	1.2509
2.000	1.2391
2.200	1.2184
2.400	1.1967
2.600	1.1765
2.800	1.1535
3.000	1.1405
3.200	1.1384
3.400	1.1369
3.600	1.1339
3.800	1.1311
4.000	1.1285
4.200	1.1288
4.400	1.1309
4.600	1.1320
4.800	1.1330
5.000	1.1350
5.200	1.1414
5.400	1.1525
5.600	1.1680
5.800	1.1826
6.000	1.1947
6.200	1.2069
6.400	1.2177
6.600	1.2270
6.800	1.2349
7.000	1.2392
7.200	1.2441
7.400	1.2493
7.600	1.2509
7.800	1.2518
8.000	1.2484
8.200	1.2455
8.400	1.2459
8.600	1.2479
8.800	1.2489
9.000	1.2485
9.200	1.2534
9.400	1.2551
9.600	1.2630
9.800	1.2750
10.000	1.2906
10.200	1.3045
10.400	1.0000
10.600	1.0000
10.800	1.0000
11.000	1.0000
11.200	1.0000
11.400	1.0000
11.600	1.0000
11.800	1.0000
12.000	1.0000

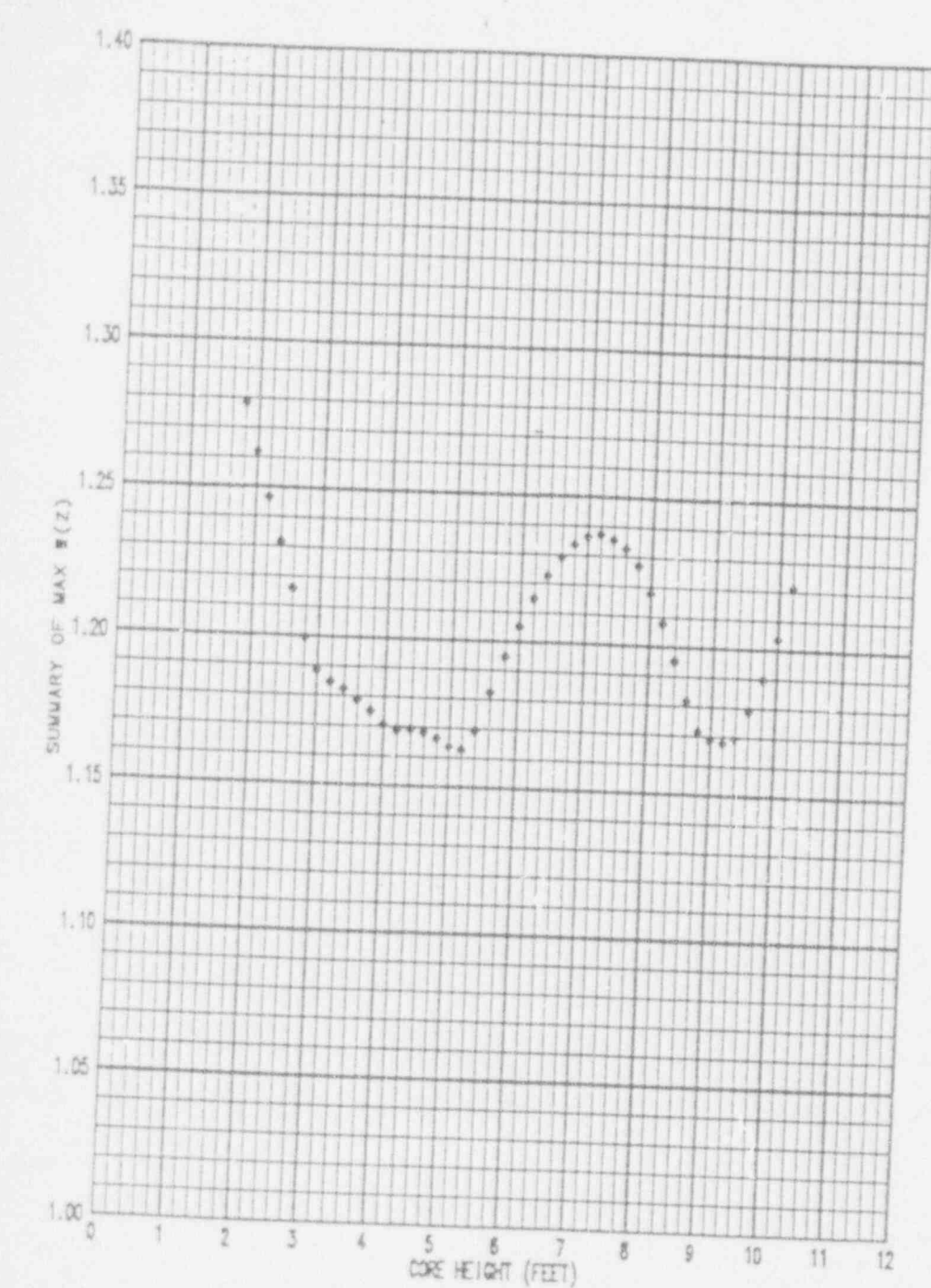
BOTTOM

FIGURE 5

TOP

SEQUOYAH UNIT 2 CYCLE 6
RAOC SUMMARY OF MAX W(Z) AT 4000 MWD/MTU

* TOP AND BOTTOM 15% EXCLUDED AS PER TECH SPEC 4.2.2.G



BOTTOM

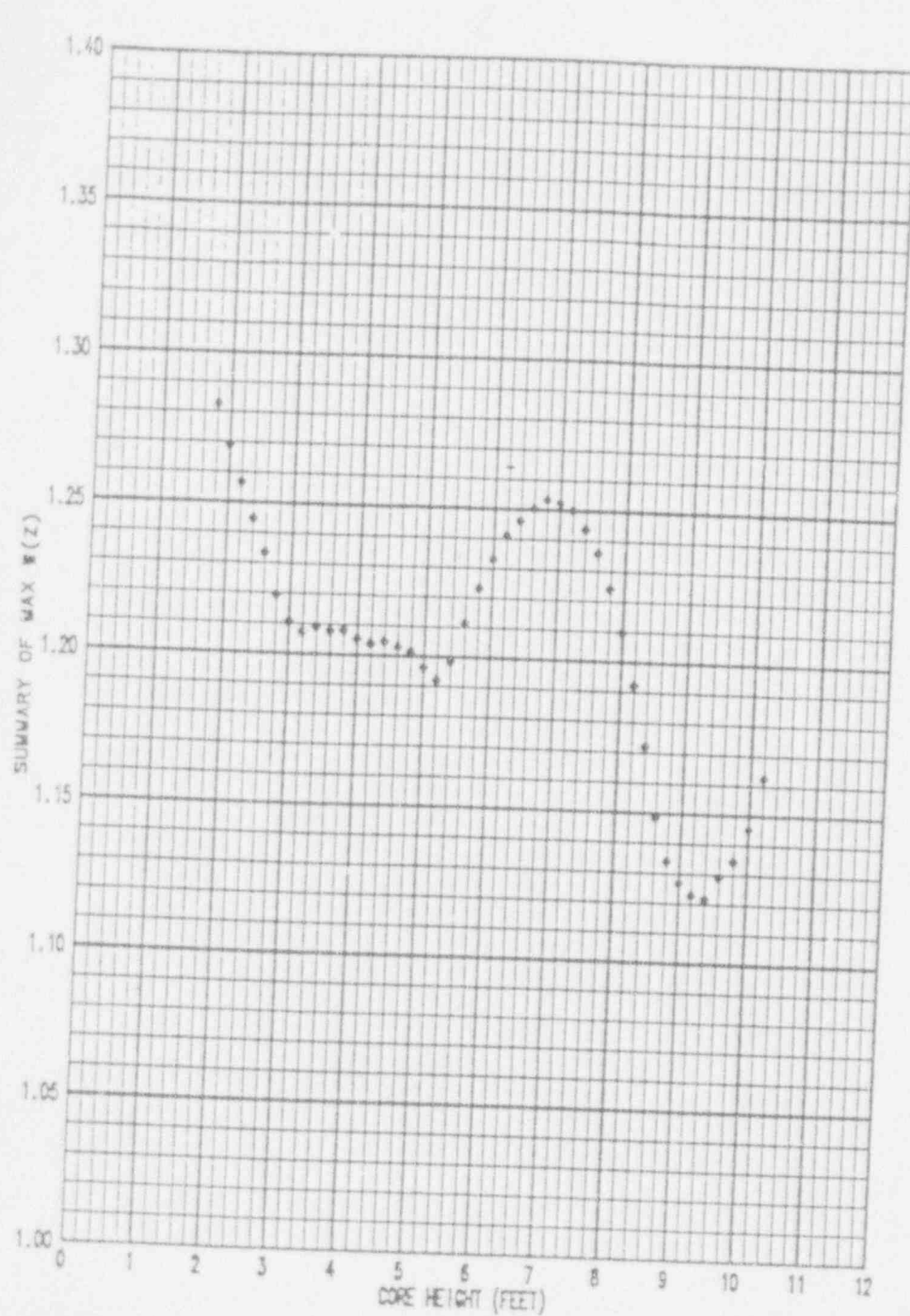
FIGURE 6

TOP

SEQUOYAH UNIT 2 CYCLE 6
RAOC SUMMARY OF MAX W(Z) AT 7000 MWD/MTU

* TOP AND BOTTOM 15% EXCLUDED AS PER TECH SPEC 4.2.2.G

Height (Feet)	MAX W(Z)
0.000	1.0000
0.200	1.0000
0.400	1.0000
0.600	1.0000
0.800	1.0000
1.000	1.0000
1.200	1.0000
1.400	1.0000
1.600	1.0000
1.800	1.2785
2.000	1.2619
2.200	1.2465
2.400	1.2314
2.600	1.2160
2.800	1.1993
3.000	1.1885
3.200	1.1847
3.400	1.1824
3.600	1.1786
3.800	1.1750
4.000	1.1706
4.200	1.1689
4.400	1.1692
4.600	1.1687
4.800	1.1664
5.000	1.1636
5.200	1.1626
5.400	1.1691
5.600	1.1824
5.800	1.1948
6.000	1.2052
6.200	1.2141
6.400	1.2228
6.600	1.2290
6.800	1.2336
7.000	1.2363
7.200	1.2373
7.400	1.2354
7.600	1.2325
7.800	1.2271
8.000	1.2178
8.200	1.2078
8.400	1.1952
8.600	1.1817
8.800	1.1716
9.000	1.1687
9.200	1.1678
9.400	1.1693
9.600	1.1789
9.800	1.1898
10.000	1.2038
10.200	1.2213
10.400	1.0000
10.600	1.0000
10.800	1.0000
11.000	1.0000
11.200	1.0000
11.400	1.0000
11.600	1.0000
11.800	1.0000
12.000	1.0000



Height (Feet)	MAX W(Z)
0.000	1.0000
0.200	1.0000
0.400	1.0000
0.600	1.0000
0.800	1.0000
1.000	1.0000
1.200	1.0000
1.400	1.0000
1.600	1.0000
1.800	1.2827
2.000	1.2690
2.200	1.2568
2.400	1.2447
2.600	1.2333
2.800	1.2194
3.000	1.2105
3.200	1.2073
3.400	1.2090
3.600	1.2078
3.800	1.2082
4.000	1.2053
4.200	1.2038
4.400	1.2047
4.600	1.2029
4.800	1.2013
5.000	1.1963
5.200	1.1921
5.400	1.1983
5.600	1.2114
5.800	1.2232
6.000	1.2330
6.200	1.2411
6.400	1.2462
6.600	1.2507
6.800	1.2532
7.000	1.2523
7.200	1.2501
7.400	1.2437
7.600	1.2359
7.800	1.2242
8.000	1.2098
8.200	1.1923
8.400	1.1721
8.600	1.1488
8.800	1.1341
9.000	1.1271
9.200	1.1229
9.400	1.1217
9.600	1.1291
9.800	1.1345
10.000	1.1454
10.200	1.1624
10.400	1.0000
10.600	1.0000
10.800	1.0000
11.000	1.0000
11.200	1.0000
11.400	1.0000
11.600	1.0000
11.800	1.0000
12.000	1.0000

BOTTOM

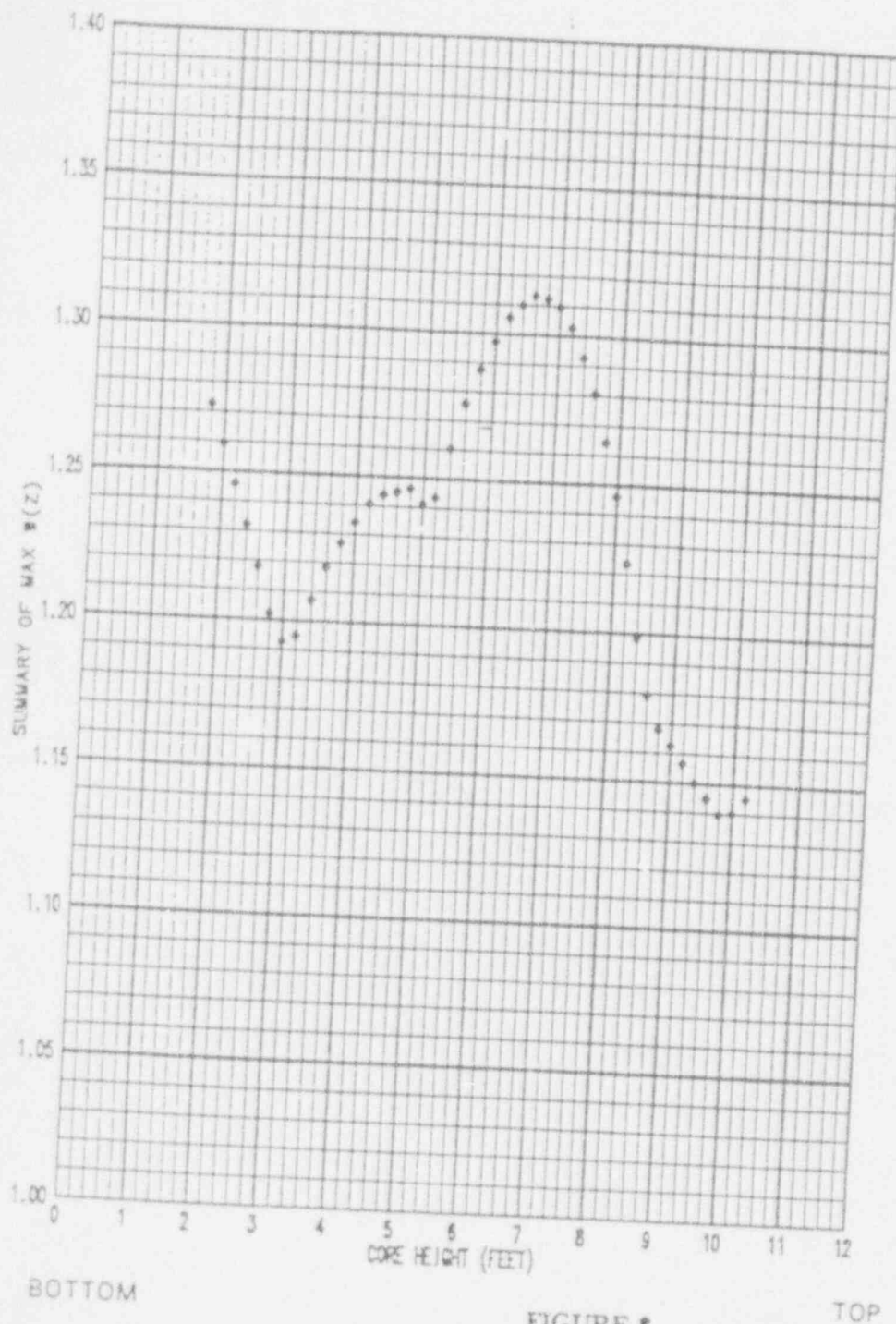
FIGURE 7

TOP

SEQUOYAH UNIT 2 CYCLE 6
RAOC SUMMARY OF MAX W(Z) AT 10000 MWD/MTU

* TOP AND BOTTOM 15% EXCLUDED AS PER TECH SPEC 4.2.2.G

MARCH 1992



Height (Feet)	MAX W(Z)
0.000	1.0000
0.200	1.0000
0.400	1.0000
0.600	1.0000
0.800	1.0000
1.000	1.0000
1.200	1.0000
1.400	1.0000
1.600	1.0000
1.800	1.2728
2.000	1.2593
2.200	1.2459
2.400	1.2322
2.600	1.2180
2.800	1.2022
3.000	1.1927
3.200	1.1949
3.400	1.2072
3.600	1.2183
3.800	1.2269
4.000	1.2340
4.200	1.2405
4.400	1.2438
4.600	1.2451
4.800	1.2463
5.000	1.2414
5.200	1.2437
5.400	1.2604
5.600	1.2759
5.800	1.2877
6.000	1.2973
6.200	1.3058
6.400	1.3101
6.600	1.3132
6.800	1.3122
7.000	1.3098
7.200	1.3027
7.400	1.2927
7.600	1.2807
7.800	1.2643
8.000	1.2482
8.200	1.2234
8.400	1.1985
8.600	1.1752
8.800	1.1679
9.000	1.1625
9.200	1.1566
9.400	1.1501
9.600	1.1451
9.800	1.1397
10.000	1.1402
10.200	1.1454
10.400	1.0000
10.600	1.0000
10.800	1.0000
11.000	1.0000
11.200	1.0000
11.400	1.0000
11.600	1.0000
11.800	1.0000
12.000	1.0000

FIGURE 8

SEQUOYAH UNIT 2 CYCLE 6
RAOC SUMMARY OF MAX W(Z) AT 14000 MWD/MTU

* TOP AND BOTTOM 15% EXCLUDED AS PER TECH SPEC 4.2.2.G