

VOGTLE ELECTRIC GENERATING PLANT (VEGP) UNIT 2 CYCLE 3

CORE OPERATING LIMITS REPORT

MARCH 1992

## COLR for VEGP UNIT 2 CYCLE 3

### 1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for VEGP UNIT 2 CYCLE 3 has been prepared in accordance with the requirements of Technical Specification 6.8.1.6.

The Technical Specifications affected by this report are listed below:

3/4.1.1.1	SHUTDOWN MARGIN - MODES 1 and 2
3/4.1.1.2	SHUTDOWN MARGIN - MODES 3, 4 and 5
3/4.1.1.3	Moderator Temperature Coefficient
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
3/4.2.2	Heat Flux Hot Channel Factor - $f_0(Z)$
3/4.2.3	Nuclear Enthalpy Rise Hot Channel Factor - $F_{CH}^N$

## COLR for VEGP UNIT 2 CYCLE 3

### 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 Technical Specification 6.8.1.6.

#### 2.1 SHUTDOWN MARGIN - MODES 1 AND 2 (Specification 3/4.1.1.1)

2.1.1 The SHUTDOWN MARGIN shall be greater than or equal to 1.3%  $\Delta k/k$ .

#### 2.2 SHUTDOWN MARGIN - MODES 3, 4 AND 5 (Specification 3/4.1.1.2)

2.2.1 The SHUTDOWN MARGIN shall be greater than or equal to the limits shown in Figures 1 and 2.

#### 2.3 Moderator Temperature Coefficient (Specification 3/4.1.1.3)

2.3.1 The Moderator Temperature Coefficient (MTC) limits are:

The BOL/ARO/HZP - MTC shall be less positive than  $+0.7 \times 10^{-4} \Delta k/k/^{\circ}F$  for power levels up to 70% RTP with a linear ramp to 0  $\Delta k/k/^{\circ}F$  at 100% RTP.

The EOL/ARO/RTP-MTC shall be less negative than  $-5.6 \times 10^{-4} \Delta k/k/^{\circ}F$ .\*

2.3.2 The MTC Surveillance limit is:

The 300 ppm/ARO/RTP-MTC should be less negative than or equal to  $-4.85 \times 10^{-4} \Delta k/k/^{\circ}F$ .\*

where: 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

#### 2.4 Shutdown Rod Insertion Limit (Specification 3/4.1.3.5)

2.4.1 The shutdown rods shall be withdrawn to a position greater than or equal to 225 steps.

#### 2.5 Control Rod Insertion Limits (Specification 3/4.1.3.6)

2.5.1 The control rod banks shall be limited in physical insertion as shown in Figure 3.

\* Based on full-power T-average of 586.4°F.

COLR for VEGP UNIT 2 CYCLE 3

2.6 Axial Flux Difference (Specification 3/4.2.1)  
{RAOC methodology}

2.6.1 The Axial Flux Difference (AFD) Acceptable Operation Limits are provided in Figure 4.

2.7 Heat Flux Hot Channel Factor -  $F_o(Z)$  (Specification 3/4.2.2)  
{ $F_o$  methodology}

$$2.7.1 \quad F_o(Z) \leq \frac{F_o^{RTP}}{P} * K(Z) \quad \text{for } P > 0.5$$

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

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

$$2.7.2 \quad F_o^{RTP} = 2.50$$

2.7.3  $K(Z)$  is provided in Figure 5.

$$2.7.4 \quad F_o^C(Z) \leq \frac{F_o^{RTP} * K(Z)}{P * W(Z)} \quad \text{for } P > 0.5$$

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

2.7.5  $W(Z)$  values are provided in Figures 6 through 8.

COLR for VEGP UNIT 2 CYCLE 3

2.8 Nuclear Enthalpy Rise Hot Channel Factor -  $F_{AH}^N$  (Specification 3/4.2.3)

$$2.8.1 \quad F_{AH}^N \leq F_{AH}^{RTP} * (1 + PF_{AH} * (1-P))$$

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

$$2.8.2a \quad F_{AH}^{RTP} = 1.57 \text{ for LOPAR fuel, and}$$

$$2.8.2b \quad F_{AH}^{RTP} = 1.65 \text{ for VANTAGE 5 fuel}$$

$$2.3.3 \quad PF_{AH} = 0.3 \text{ for LOPAR and VANTAGE 5 fuel}$$

COLR FOR VEGP UNIT 2 CYCLE 3

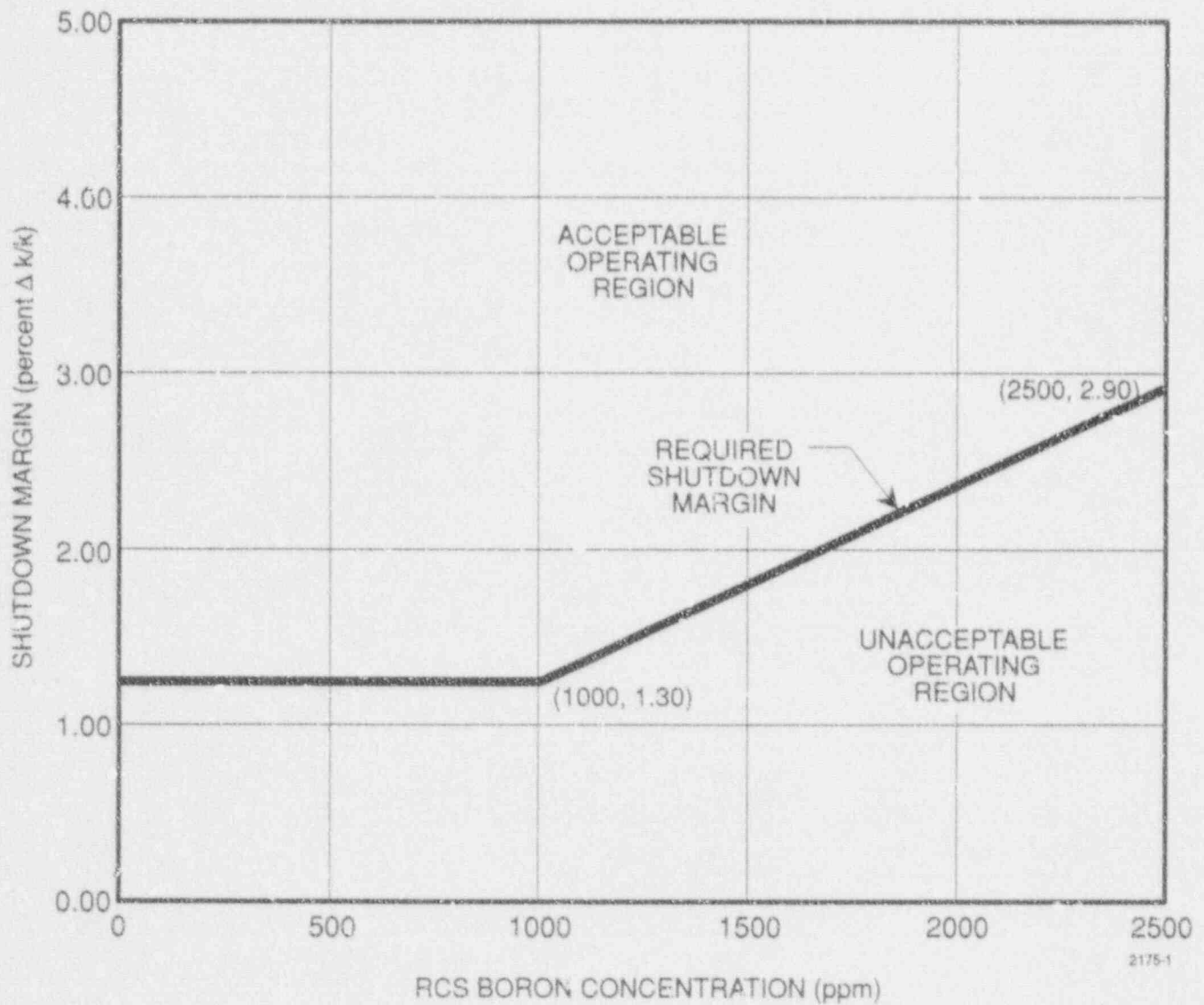


FIGURE 1

REQUIRED SHUTDOWN MARGIN FOR MODES 3 AND 4 (MODE 4 WITH AT LEAST ONE REACTOR COOLANT PUMP RUNNING)

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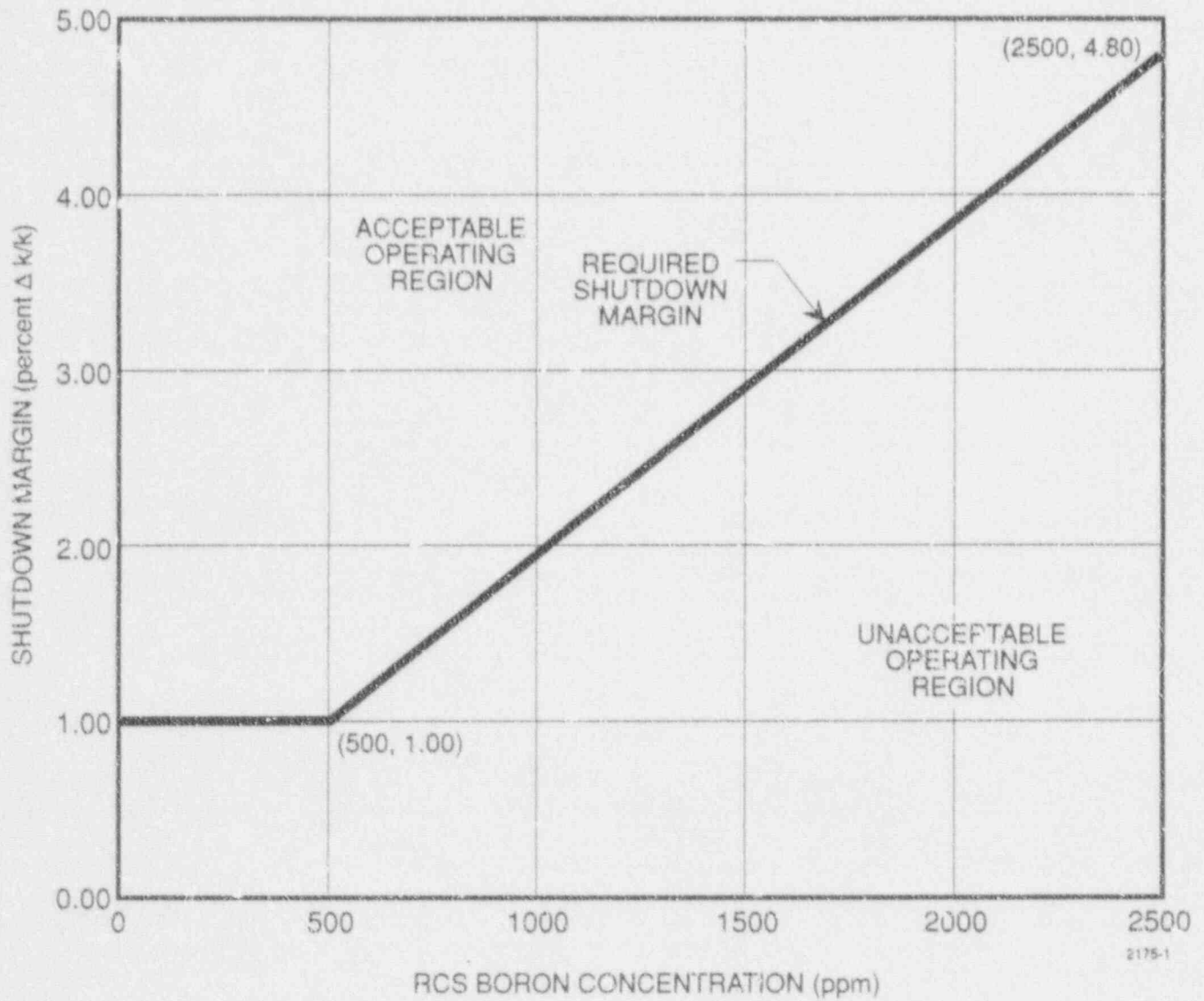
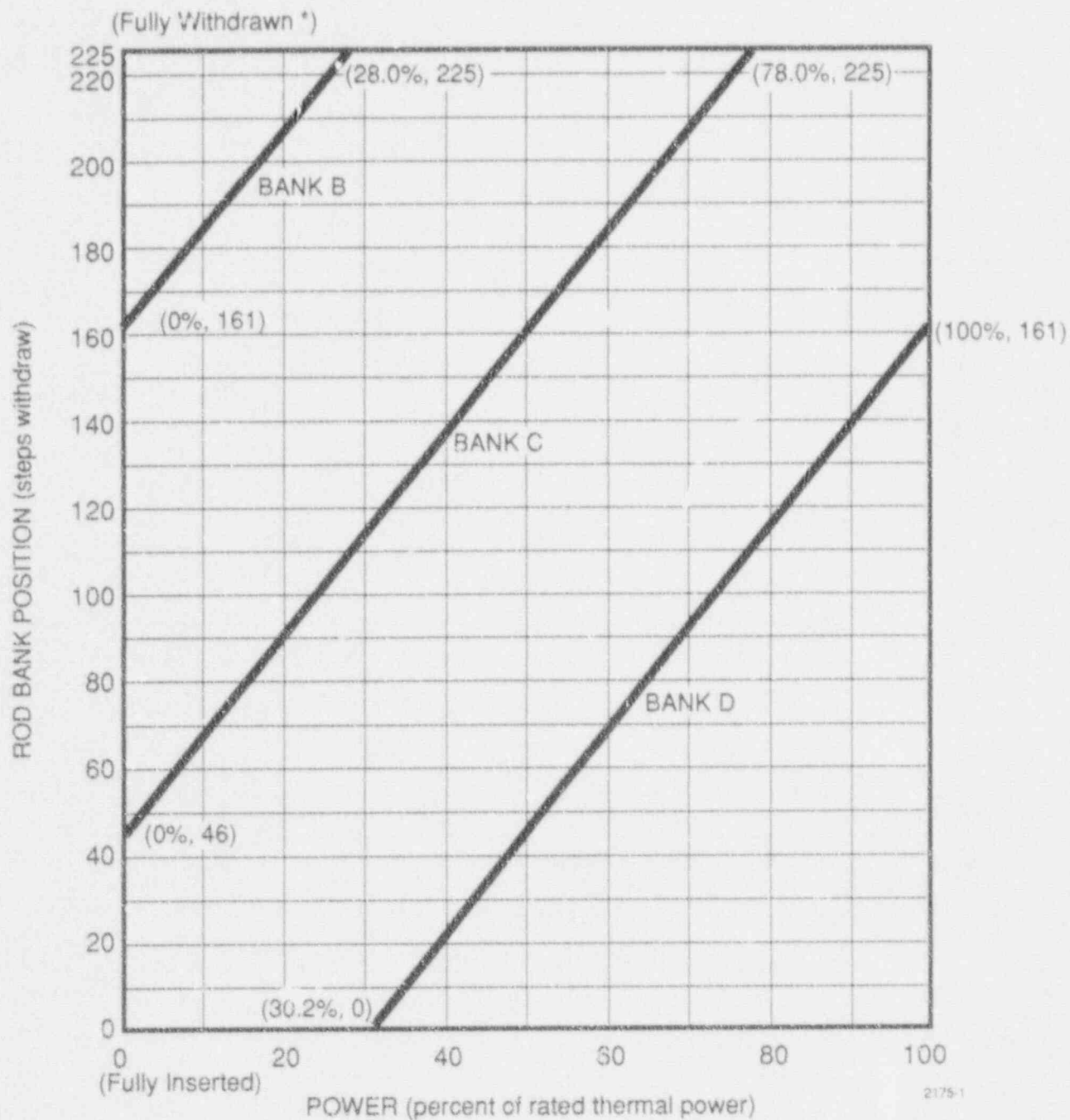


FIGURE 2

REQUIRED SHUTDOWN MARGIN FOR MODES 4 AND 5 (MODE 4 WITH NO REACTOR COOLANT PUMPS RUNNING)



# COLR FOR VEGP UNIT 2 CYCLE 3



\* Fully withdrawn shall be the condition where control rods are at a position within the interval  $\geq 225$  and  $\leq 231$  steps withdrawn.

FIGURE 3  
ROD BANK INSERTION LIMITS VERSUS THERMAL POWER



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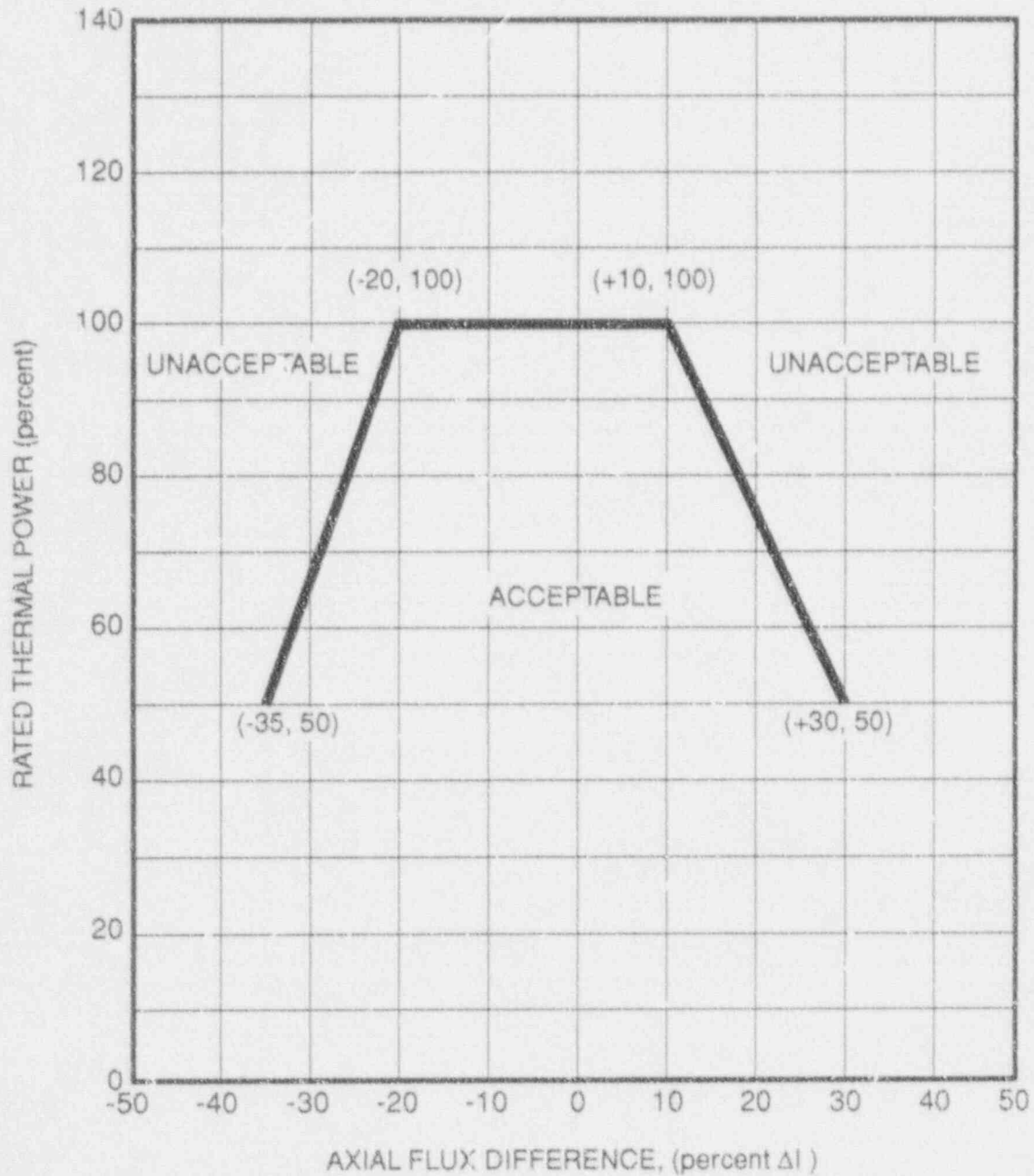


FIGURE 4

AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF RATED THERMAL POWER  
FOR RAOC

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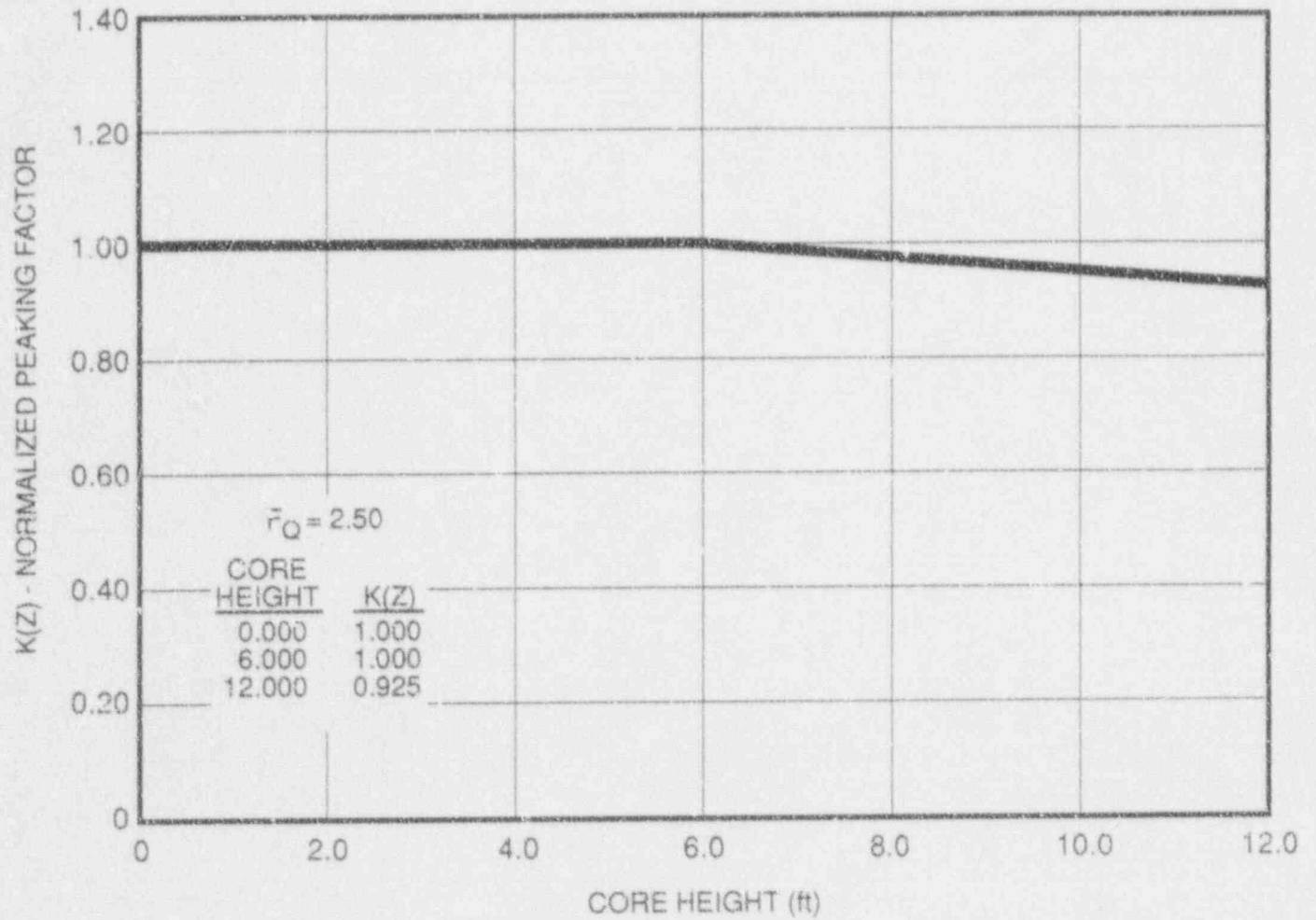


FIGURE 5

K(Z) - NORMALIZED  $F_Q(Z)$  AS A FUNCTION OF CORE HEIGHT

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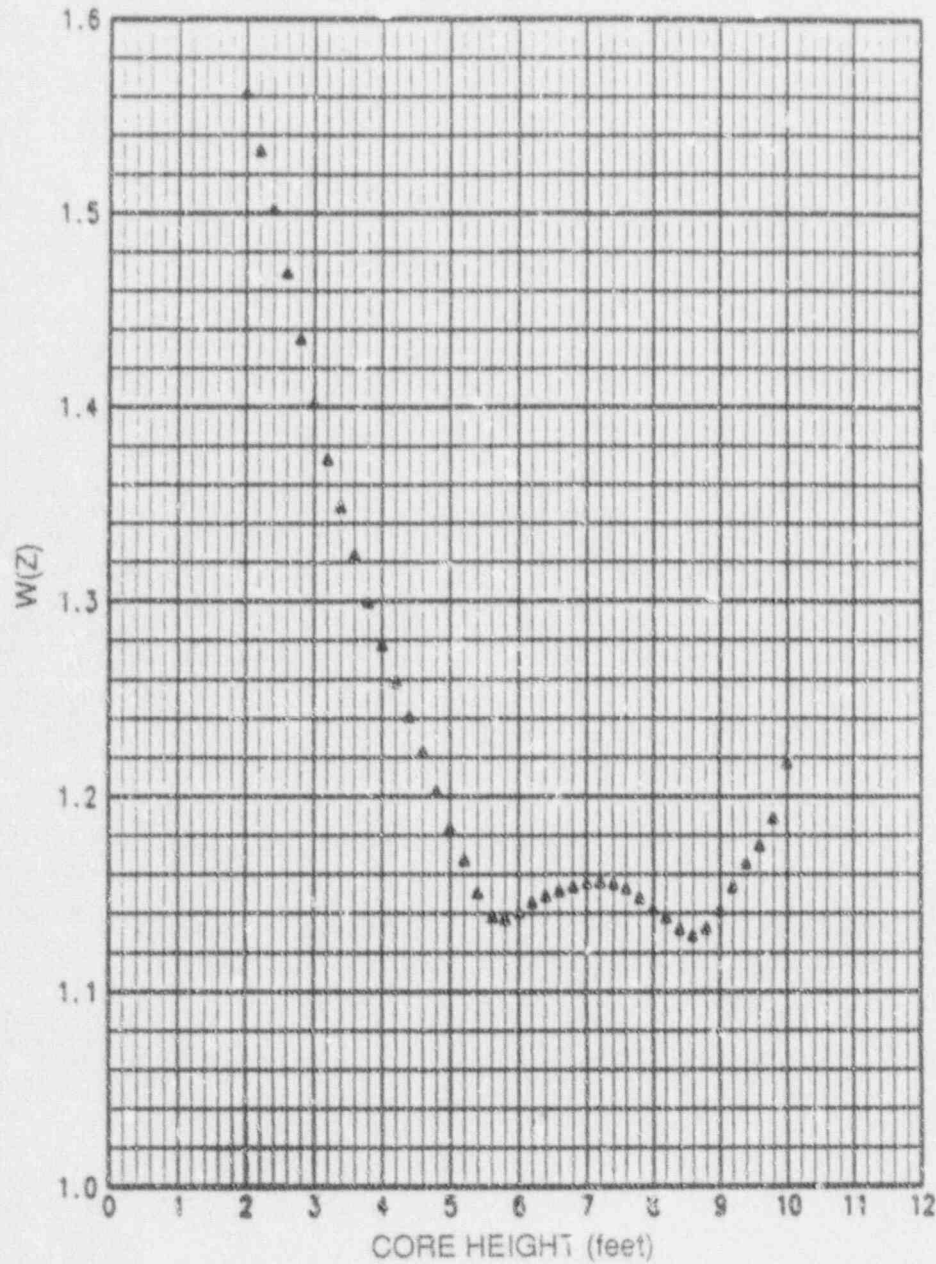


FIGURE 6  
RAOC W(Z) AT 150 MWD/MTU

Axial Point	Elevation (feet)	SQL w(Z)
* 1	12.00	1.0000
* 2	11.80	1.0000
* 3	11.60	1.0000
* 4	11.40	1.0000
* 5	11.20	1.0000
* 6	11.00	1.0000
* 7	10.80	1.0000
* 8	10.60	1.0000
* 9	10.40	1.0000
* 10	10.20	1.0000
11	10.00	1.2177
12	9.80	1.1892
13	9.60	1.1750
14	9.40	1.1660
15	9.20	1.1540
16	9.00	1.1421
17	8.80	1.1329
18	8.60	1.1289
19	8.40	1.1324
20	8.20	1.1382
21	8.00	1.1428
22	7.80	1.1483
23	7.60	1.1531
24	7.40	1.1556
25	7.20	1.1566
26	7.00	1.1559
27	6.80	1.1540
28	6.60	1.1520
29	6.40	1.1496
30	6.20	1.1461
31	6.00	1.1412
32	5.80	1.1373
33	5.60	1.1388
34	5.40	1.1510
35	5.20	1.1677
36	5.00	1.1841
37	4.80	1.2031
38	4.60	1.2230
39	4.40	1.2414
40	4.20	1.2591
41	4.00	1.2779
42	3.80	1.2997
43	3.60	1.3240
44	3.40	1.3487
45	3.20	1.3734
46	3.00	1.4026
47	2.80	1.4355
48	2.60	1.4696
49	2.40	1.5019
50	2.20	1.5326
51	2.00	1.5625
* 52	1.80	1.0000
* 53	1.60	1.0000
* 54	1.40	1.0000
* 55	1.20	1.0000
* 56	1.00	1.0000
* 57	0.80	1.0000
* 58	0.60	1.0000
* 59	0.40	1.0000
* 60	0.20	1.0000
* 61	0.00	1.0000

This figure is referred to by Technical Specifications 4.2.2.2d, B3/4.2.2

\* Top and Bottom 15% Excluded per Technical Specification 4.2.2.2

# COLR FOR VEGP UNIT 2 CYCLE 3

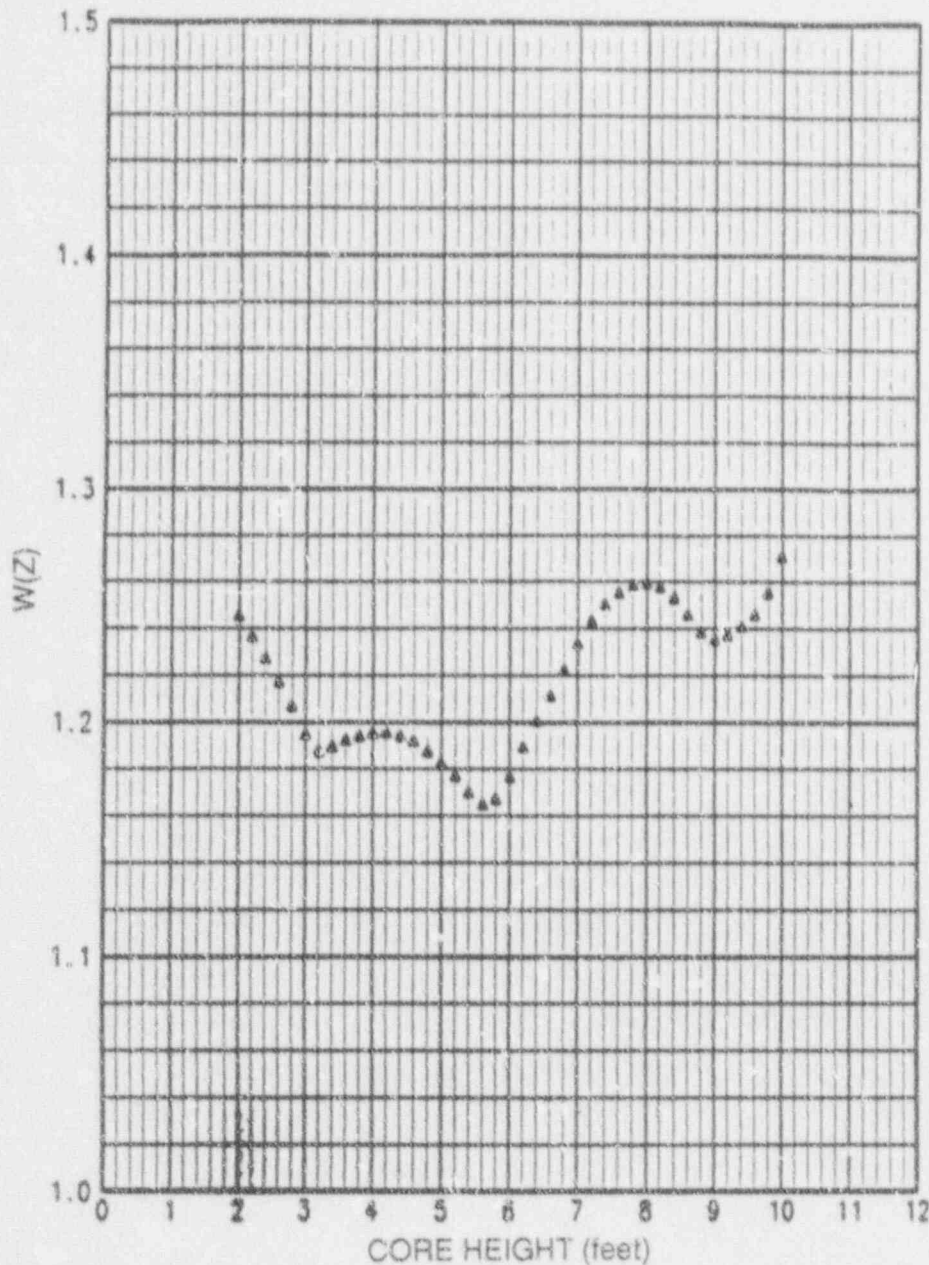


FIGURE 7  
RAOC W(Z) AT 8000 MWD/MTU

Axial Point	Elevation (feet)	W(Z)
1	12.00	1.0000
2	11.80	1.0000
3	11.60	1.0000
4	11.40	1.0000
5	11.20	1.0000
6	11.00	1.0000
7	10.80	1.0000
8	10.60	1.0000
9	10.40	1.0000
10	10.20	1.0000
11	10.00	1.2713
12	9.80	1.2557
13	9.60	1.2464
14	9.40	1.2414
15	9.20	1.2377
16	9.00	1.2358
17	8.80	1.2386
18	8.60	1.2462
19	8.40	1.2534
20	8.20	1.2580
21	8.00	1.2597
22	7.80	1.2569
23	7.60	1.2558
24	7.40	1.2507
25	7.20	1.2436
26	7.00	1.2341
27	6.80	1.2228
28	6.60	1.2116
29	6.40	1.2009
30	6.20	1.1899
31	6.00	1.1773
32	5.80	1.1677
33	5.60	1.1654
34	5.40	1.1705
35	5.20	1.1776
36	5.00	1.1829
37	4.80	1.1880
38	4.60	1.1923
39	4.40	1.1946
40	4.20	1.1960
41	4.00	1.1959
42	3.80	1.1945
43	3.60	1.1928
44	3.40	1.1900
45	3.20	1.1880
46	3.00	1.1952
47	2.80	1.2071
48	2.60	1.2176
49	2.40	1.2275
50	2.20	1.2369
51	2.00	1.2459
52	1.80	1.0000
53	1.60	1.0000
54	1.40	1.0000
55	1.20	1.0000
56	1.00	1.0000
57	0.80	1.0000
58	0.60	1.0000
59	0.40	1.0000
60	0.20	1.0000
61	0.00	1.0000

This figure is referred to by Technical Specifications 4.2.2.2d, B3/4.2.2

\* Top and Bottom 15% Excluded per Technical Specification 4.2.2.2

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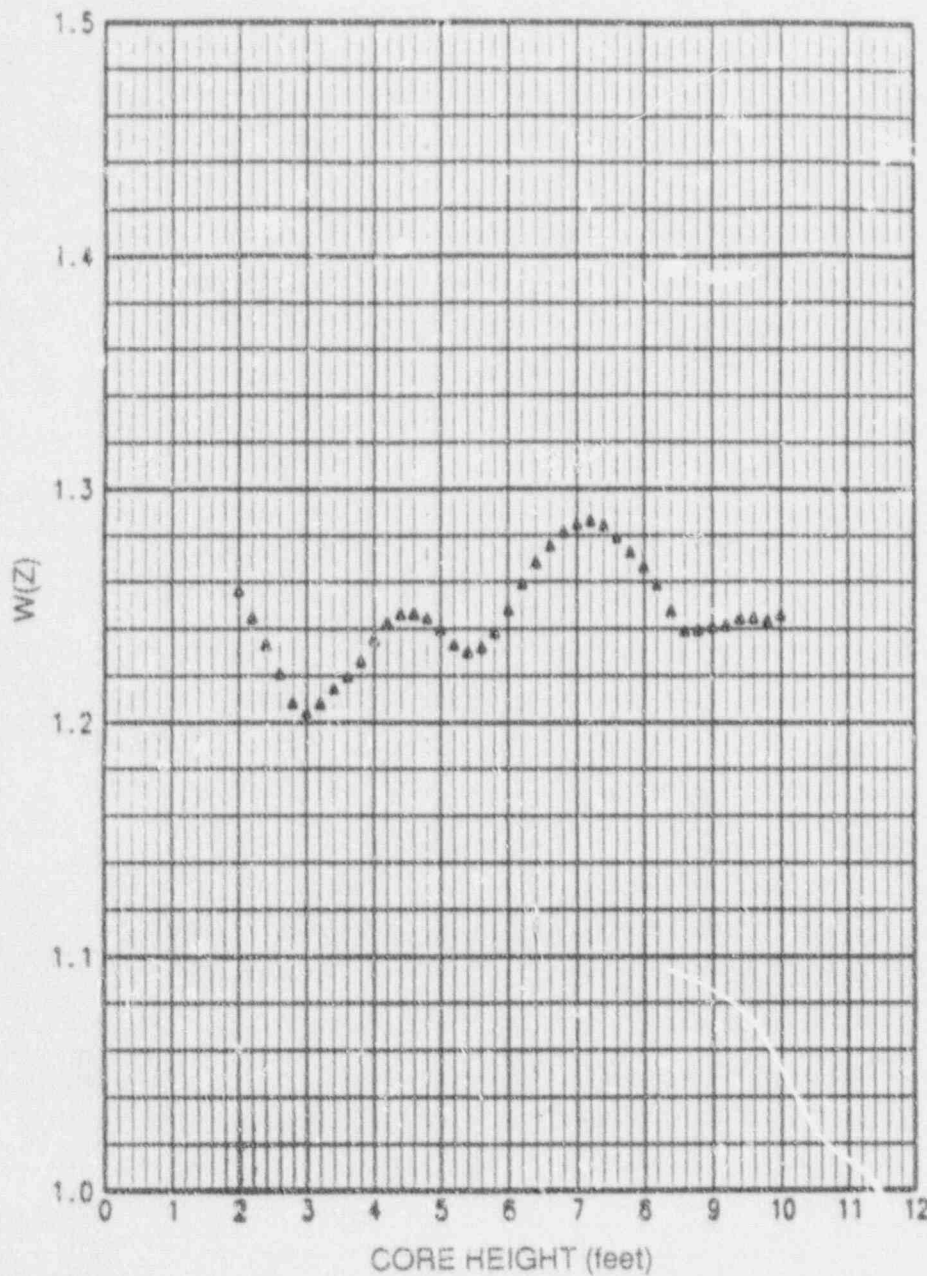


FIGURE 8

RAOC W(Z) AT 16000 MWD/MTU

Axial Point	Elevation (feet)	ECI #121
1	12.00	1.0000
2	11.80	1.0000
3	11.60	1.0070
4	11.40	1.0000
5	11.20	1.0000
6	11.00	1.0000
7	10.80	1.0000
8	10.60	1.0000
9	10.40	1.0000
10	10.20	1.0000
11	10.00	1.2464
12	9.80	1.2436
13	9.60	1.2449
14	9.40	1.2446
15	9.20	1.2420
16	9.00	1.2412
17	8.80	1.2399
18	8.60	1.2394
19	8.40	1.2479
20	8.20	1.2590
21	8.00	1.2668
22	7.80	1.2731
23	7.60	1.2792
24	7.40	1.2845
25	7.20	1.2865
26	7.00	1.2853
27	6.80	1.2817
28	6.60	1.2759
29	6.40	1.2685
30	6.20	1.2595
31	6.00	1.2486
32	5.80	1.2388
33	5.60	1.2326
34	5.40	1.2304
35	5.20	1.2334
36	5.00	1.2402
37	4.80	1.2449
38	4.60	1.2468
39	4.40	1.2466
40	4.20	1.2430
41	4.00	1.2356
42	3.80	1.2262
43	3.60	1.2200
44	3.40	1.2147
45	3.20	1.2084
46	3.00	1.2046
47	2.80	1.2086
48	2.60	1.2211
49	2.40	1.2335
50	2.20	1.2449
51	2.00	1.2568
52	1.80	1.0000
53	1.60	1.0000
54	1.40	1.0000
55	1.20	1.0000
56	1.00	1.0000
57	0.80	1.0000
58	0.60	1.0000
59	0.40	1.0000
60	0.20	1.0000
61	0.00	1.0000

This figure is referred to by Technical Specifications 4.2.2.2d, B3/4.2.2

\* Top and Bottom 15% Excluded per Technical Specification 4.2.2.2