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Docket No.: 50-425

NL-05-1739

U. S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D. C. 20555-0001

**Vogtle Electric Generating Plant**  
**Unit 2 Cycle 12 Core Operating Limits Report**

Ladies and Gentlemen:

Pursuant to the reporting requirements of Vogtle Electric Generating Plant (VEGP) Technical Specification 5.6.5 Southern Nuclear Operating Company (SNC) is submitting Revision 0 of the Unit 2 Cycle 12 Core Operating Limits Report (COLR).

This letter contains no NRC commitments. If you have any questions, please advise.

Sincerely,

A handwritten signature in black ink, appearing to read "Don E. Grissette", is written over a horizontal line.

Don E. Grissette

DEG/RJF/daj

Enclosure: Unit 2 Cycle 12 Core Operating Limits Report

cc: Southern Nuclear Operating Company  
Mr. J. T. Gasser, Executive Vice President  
Mr. T. E. Tynan, General Manager – Plant Vogtle  
RType: CVC7000

U. S. Nuclear Regulatory Commission  
Dr. W. D. Travers, Regional Administrator  
Mr. C. Gratton, NRR Project Manager – Vogtle  
Mr. G. J. McCoy, Senior Resident Inspector – Vogtle

**VOGTLE ELECTRIC GENERATING PLANT (VEGP) UNIT 2 CYCLE 12**

**CORE OPERATING LIMITS REPORT**

**REVISION 0**

**SEPTEMBER 2005**

## COLR for VEGP UNIT 2 CYCLE 12

### 1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for VEGP UNIT 2 CYCLE 12 has been prepared in accordance with the requirements of Technical Specification 5.6.5.

The Technical Requirement affected by this report is listed below:

13.1.1 SHUTDOWN MARGIN - MODES 1 and 2

The Technical Specifications affected by this report are listed below:

3.1.1 SHUTDOWN MARGIN - MODES 3, 4 and 5

3.1.3 Moderator Temperature Coefficient

3.1.5 Shutdown Bank Insertion Limits

3.1.6 Control Bank Insertion Limits

3.2.1 Heat Flux Hot Channel Factor -  $F_Q(Z)$

3.2.2 Nuclear Enthalpy Rise Hot Channel Factor –  $F_{\Delta H}^N$

3.2.3 Axial Flux Difference

3.9.1 Boron Concentration

## COLR for VEGP UNIT 2 CYCLE 12

### 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 NRC-approved methodologies, including those specified in Technical Specification 5.6.5.

#### 2.1 SHUTDOWN MARGIN - MODES 1 AND 2 (Technical Requirement 13.1.1)

2.1.1 The SHUTDOWN MARGIN shall be greater than or equal to 1.30 percent  $\Delta k/k$ .

#### 2.2 SHUTDOWN MARGIN - MODES 3, 4 AND 5 (Specification 3.1.1)

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 3.1.3)

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  $-5.50 \times 10^{-4} \Delta k/k/^{\circ}F$ .<sup>1</sup>

2.3.2 The MTC Surveillance limits are:

The 300 ppm/ARO/RTP-MTC should be less negative than or equal to  $-4.75 \times 10^{-4} \Delta k/k/^{\circ}F$ .<sup>1</sup>

The 60 ppm/ARO/RTP-MTC should be less negative than  $-5.35 \times 10^{-4} \Delta k/k/^{\circ}F$ .<sup>1</sup>

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 Bank Insertion Limits (Specification 3.1.5)

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

#### 2.5 Control Bank Insertion Limits (Specification 3.1.6)

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

<sup>1</sup> Applicable for full-power T-average of 586.4°F to 587.4°F.

## COLR for VEGP UNIT 2 CYCLE 12

### 2.6 Heat Flux Hot Channel Factor - $F_q(Z)$ (Specification 3.2.1)

$$2.6.1 \quad F_q(Z) \leq \frac{F_q^{RTP}}{P} * K(Z) \quad \text{for } P > 0.5$$

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

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

$$2.6.2 \quad F_q^{RTP} = 2.50$$

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

$$2.6.4 \quad F_q(Z) \leq \frac{F_q^{RTP}}{P * W(Z)} * K(Z) \quad \text{for } P > 0.5$$

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

2.6.5  $W(Z)$  values are provided in Figures 6 through 9.

2.6.6 The  $F_q(Z)$  penalty factors are provided in Table 1.

## COLR for VEGP UNIT 2 CYCLE 12

### 2.7 Nuclear Enthalpy Rise Hot Channel Factor - $F_{\Delta H}^N$ (Specification 3.2.2)

$$2.7.1 \quad F_{\Delta H}^N \leq F_{\Delta H}^{RTP} * (1 + PF_{\Delta H} * (1-P))$$

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

$$2.7.2 \quad F_{\Delta H}^{RTP} = 1.65$$

$$2.7.3 \quad PF_{\Delta H} = 0.3$$

### 2.8 Axial Flux Difference (Specification 3.2.3)

2.8.1 The Axial Flux Difference (AFD) Acceptable Operation Limits are provided in Figure 5.

### 2.9 Boron Concentration (Specification 3.9.1)

2.9.1 The boron concentration shall be greater than or equal to 1950 ppm.<sup>1</sup>

<sup>1</sup>This concentration bounds the condition of  $k_{eff} \leq 0.95$  (all rods in less the most reactive rod) and subcriticality (all rods out) over the entire cycle. This concentration includes additional boron to address uncertainties and  $B^{10}$  depletion.

COLR for VEGP UNIT 2 CYCLE 12

TABLE 1

$F_Q(Z)$  PENALTY FACTOR

<u>Cycle Burnup (MWD/MTU)</u>	<u><math>F_Q(Z)</math> Penalty Factor</u>
5061	1.020
5275	1.022
5488	1.021
5702	1.020

Notes:

1. The Penalty Factor, to be applied to  $F_Q(Z)$  in accordance with SR 3.2.1.2, is the maximum factor by which  $F_Q(Z)$  is expected to increase over a 39 EFPD interval (surveillance interval of 31 EFPD plus the maximum allowable extension not to exceed 25% of the surveillance interval per SR 3.0.2) starting from the burnup at which the  $F_Q(Z)$  was determined.
2. Linear interpolation is adequate for intermediate cycle burnups.
3. For all cycle burnups outside the range of the table, a penalty factor of 1.020 shall be used.

COLR for VEGP UNIT 2 CYCLE 12

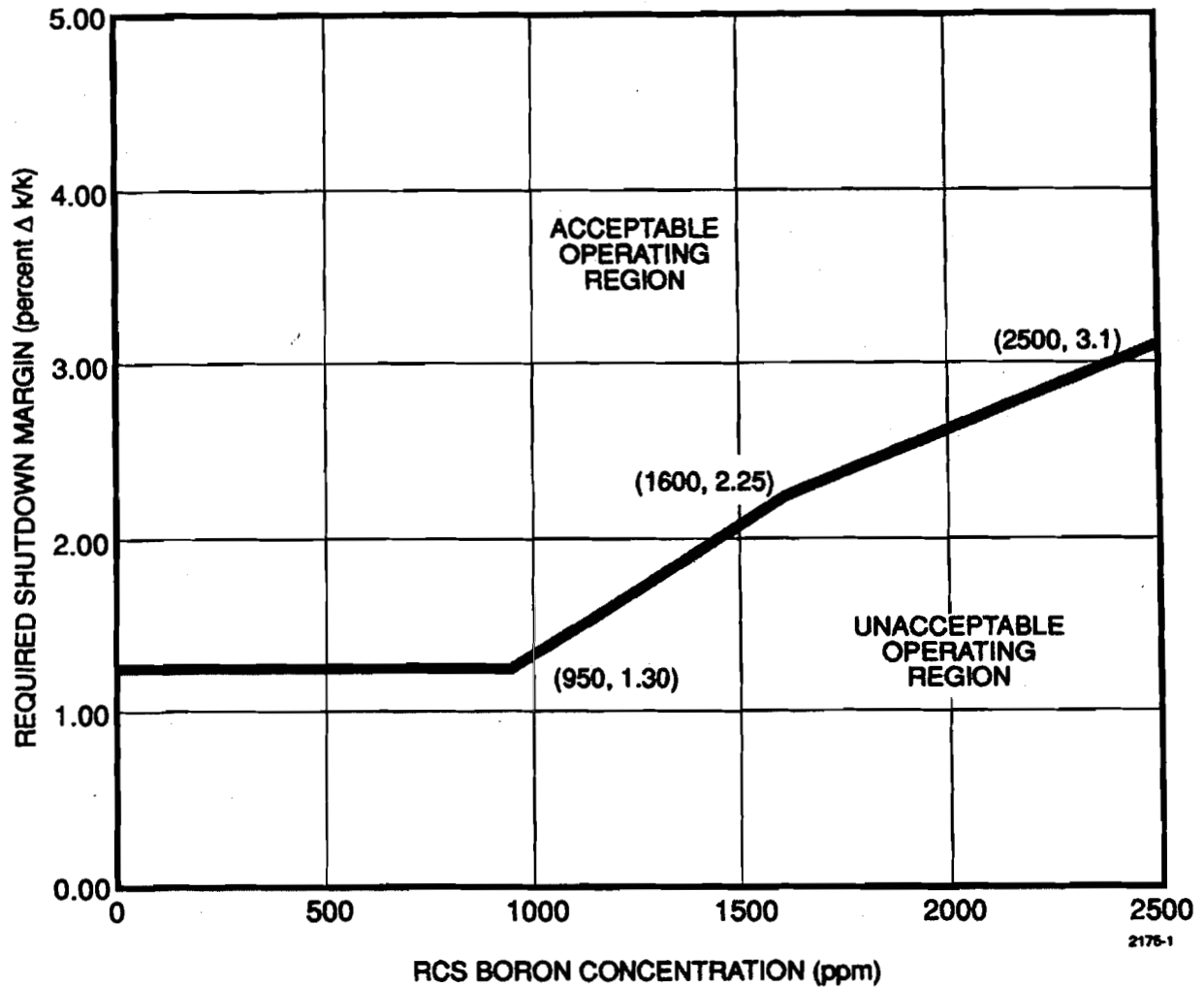


FIGURE 1

REQUIRED SHUTDOWN MARGIN FOR MODES 3 AND 4 (FOUR LOOPS FILLED AND VENTED  
AND AT LEAST ONE REACTOR COOLANT PUMP RUNNING)



COLR for VEGP UNIT 2 CYCLE 12

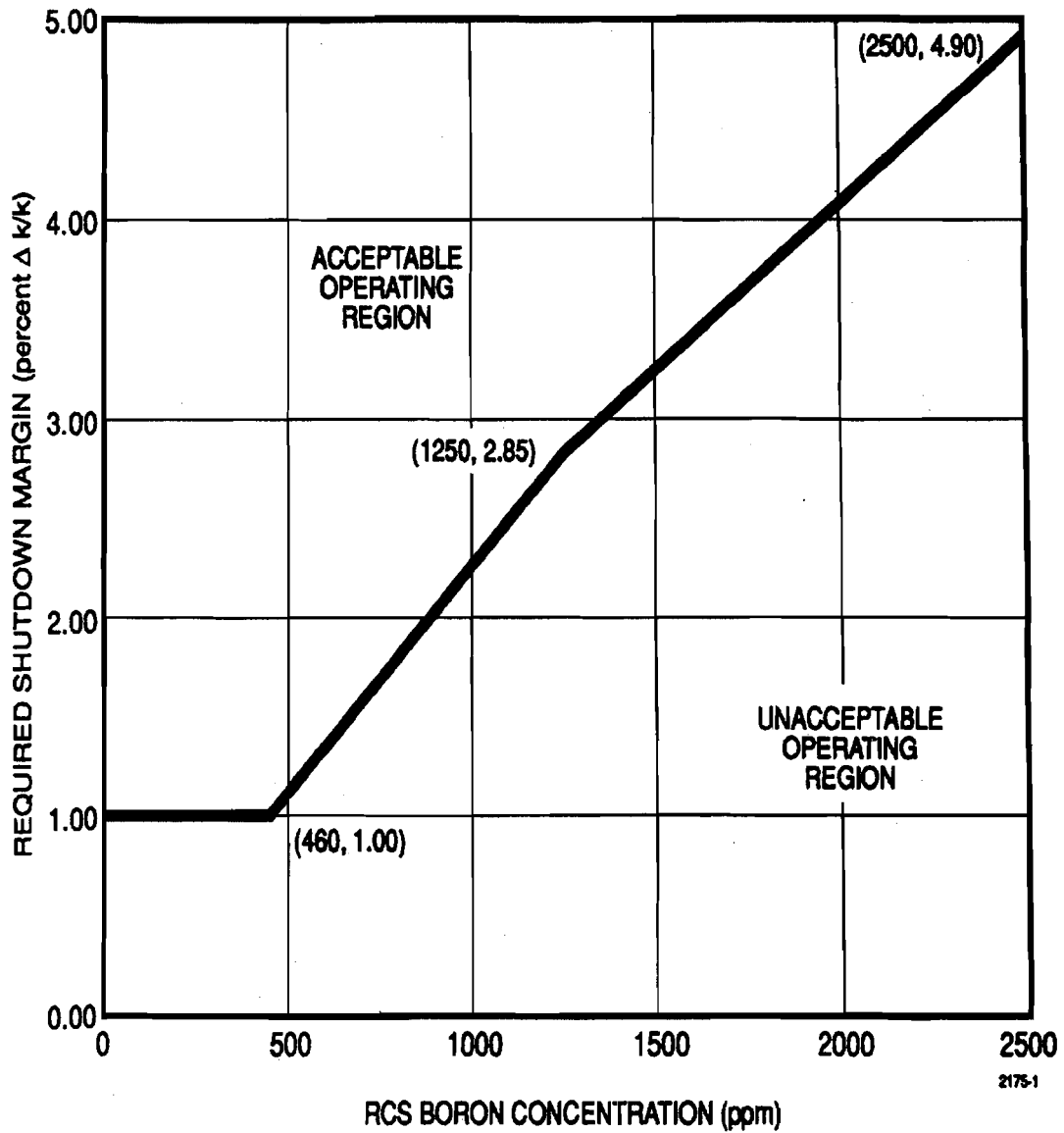
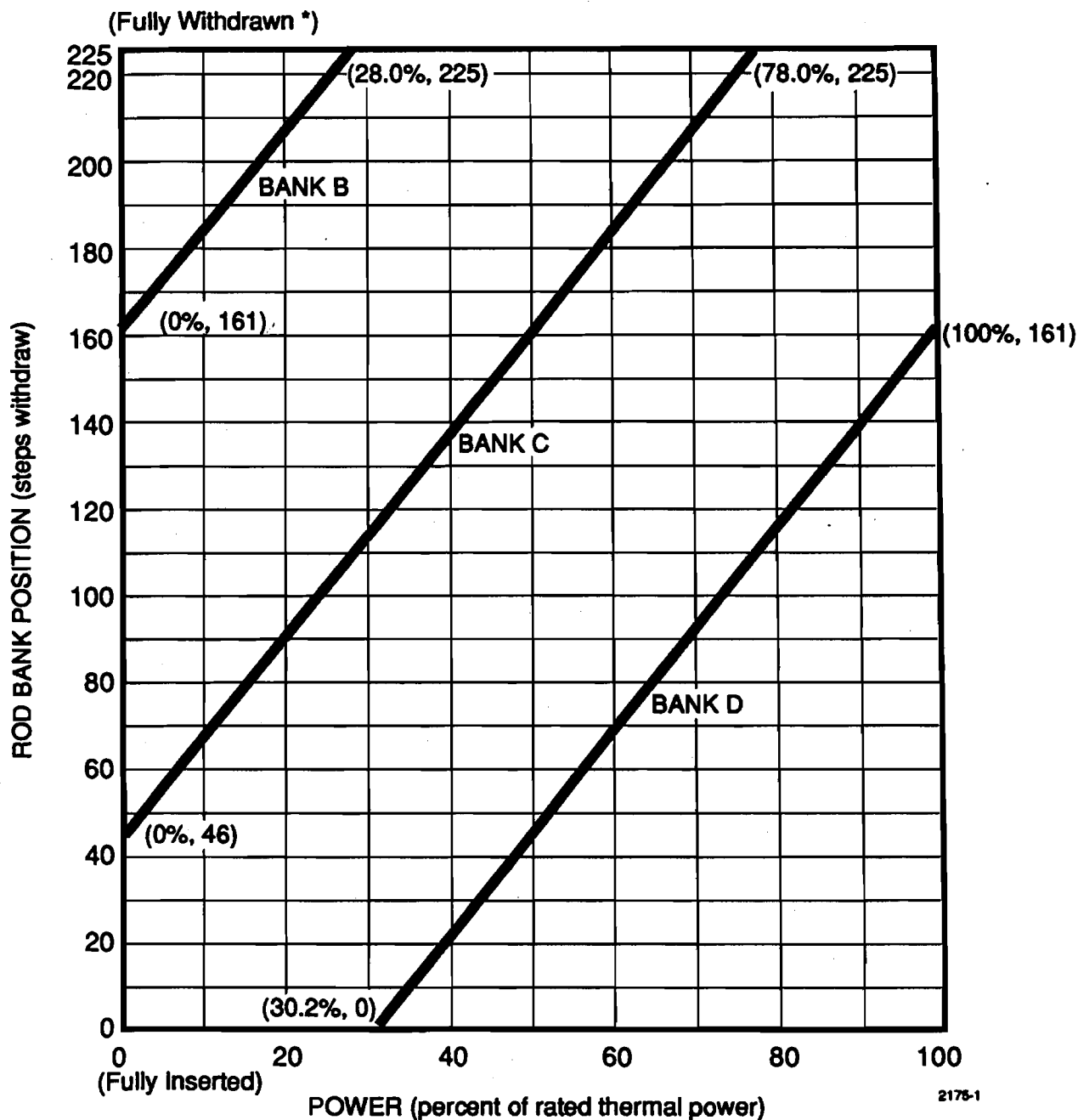


FIGURE 2

REQUIRED SHUTDOWN MARGIN FOR MODES 4 AND 5 (MODE 4 WHEN  
FIGURE 1 NOT APPLICABLE)

COLR for VEGP UNIT 2 CYCLE 12



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

Note: The Rod Bank Insertion Limits are based on the control bank withdrawal sequence A, B, C, D and a control bank tip-to-tip distance of 115 steps.

FIGURE 3

ROD BANK INSERTION LIMITS VERSUS % OF RATED THERMAL POWER

COLR for VEGP UNIT 2 CYCLE 12

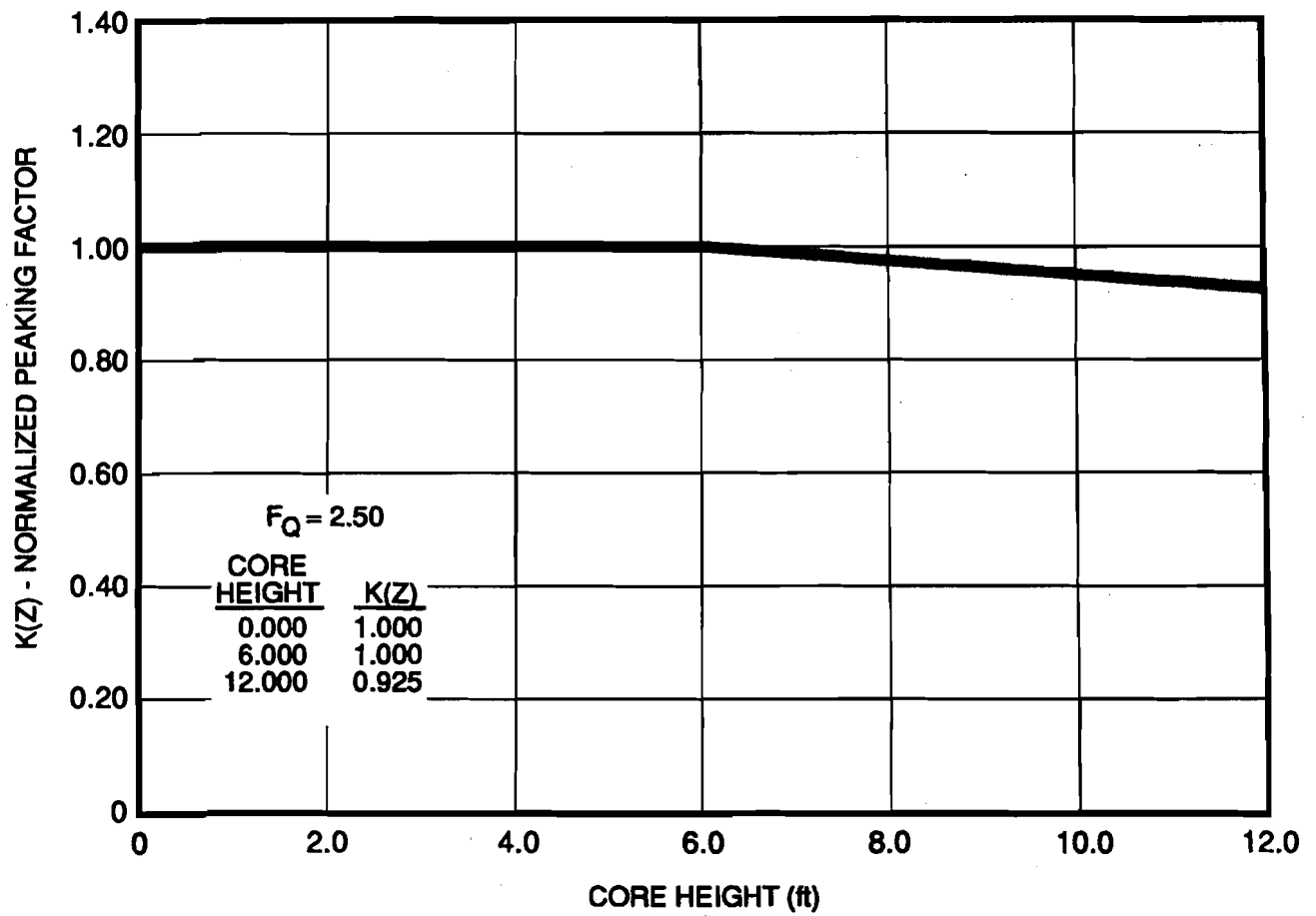


FIGURE 4

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

COLR for VEGP UNIT 2 CYCLE 12

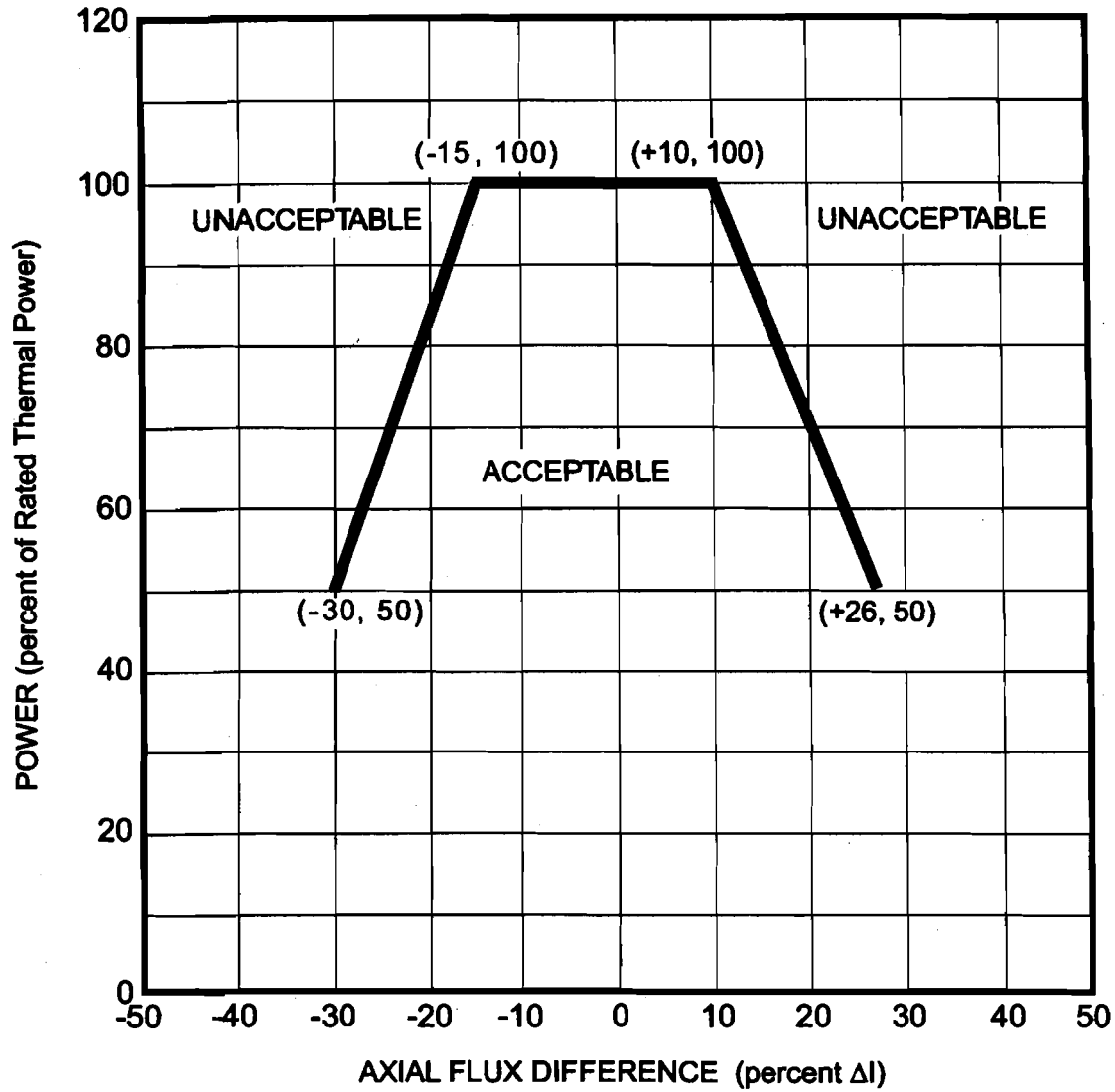
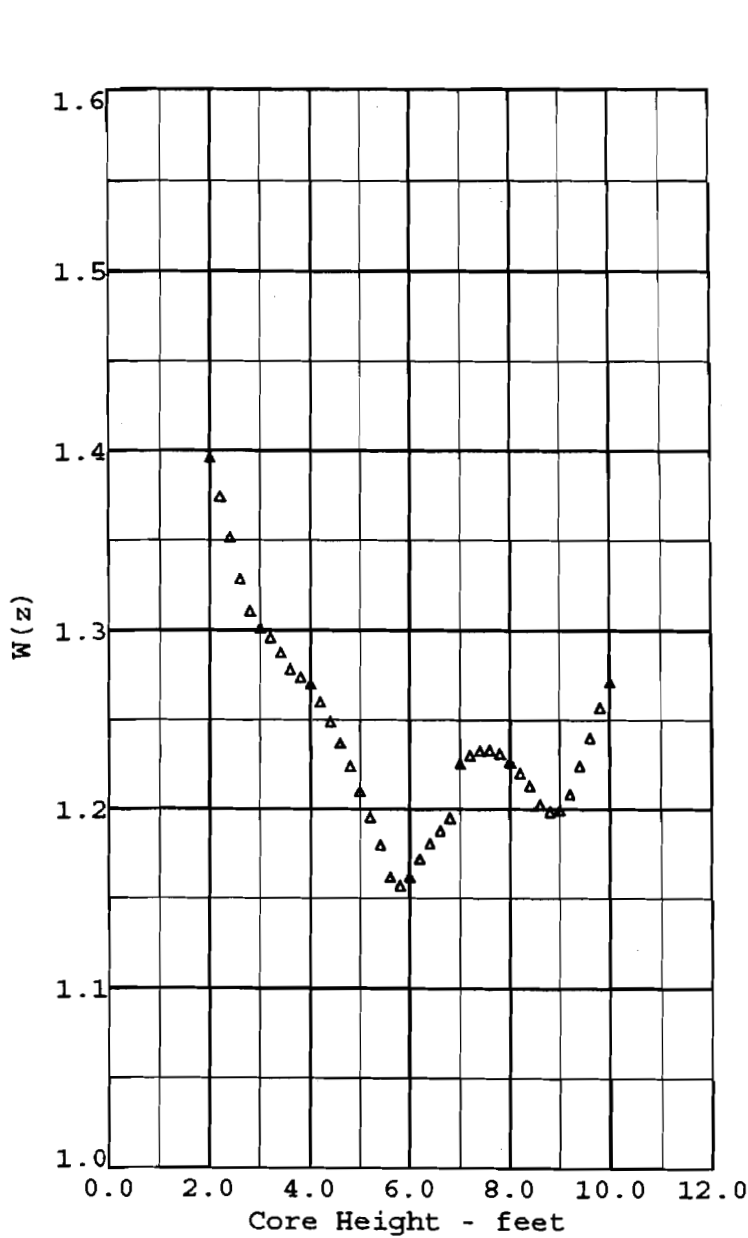


FIGURE 5

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

# COLR for VEGP UNIT 2 CYCLE 12



This figure is referred to by Specification B3.2.1

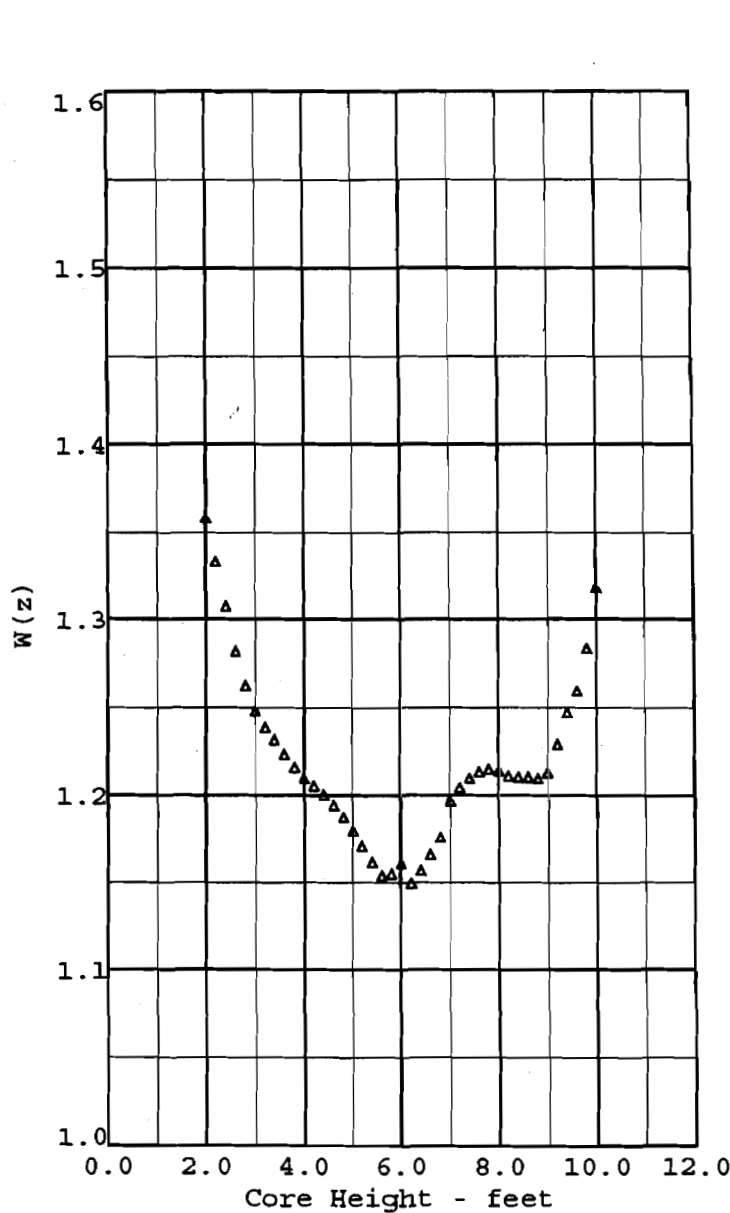
These W(Z) values are consistent with Figure 5, and are valid over the HFP  $T_{avg}$  temperature range from 586.4 to 587.4°F.

Axial Point	Elevation (feet)	BOL 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	1.2714
12	9.80	1.2570
13	9.60	1.2402
14	9.40	1.2242
15	9.20	1.2087
16	9.00	1.1997
17	8.80	1.1987
18	8.60	1.2027
19	8.40	1.2132
20	8.20	1.2203
21	8.00	1.2264
22	7.80	1.2313
23	7.60	1.2334
24	7.40	1.2329
25	7.20	1.2304
26	7.00	1.2257
27	6.80	1.1952
28	6.60	1.1880
29	6.40	1.1807
30	6.20	1.1720
31	6.00	1.1622
32	5.80	1.1571
33	5.60	1.1620
34	5.40	1.1798
35	5.20	1.1954
36	5.00	1.2100
37	4.80	1.2240
38	4.60	1.2371
39	4.40	1.2491
40	4.20	1.2600
41	4.00	1.2700
42	3.80	1.2735
43	3.60	1.2781
44	3.40	1.2875
45	3.20	1.2957
46	3.00	1.3013
47	2.80	1.3106
48	2.60	1.3284
49	2.40	1.3516
50	2.20	1.3742
51	2.00	1.3960
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

\* Top and Bottom 15% Excluded per Technical Specification B3.2.1

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

# COLR for VEGP UNIT 2 CYCLE 12



This figure is referred to by Specification B3.2.1

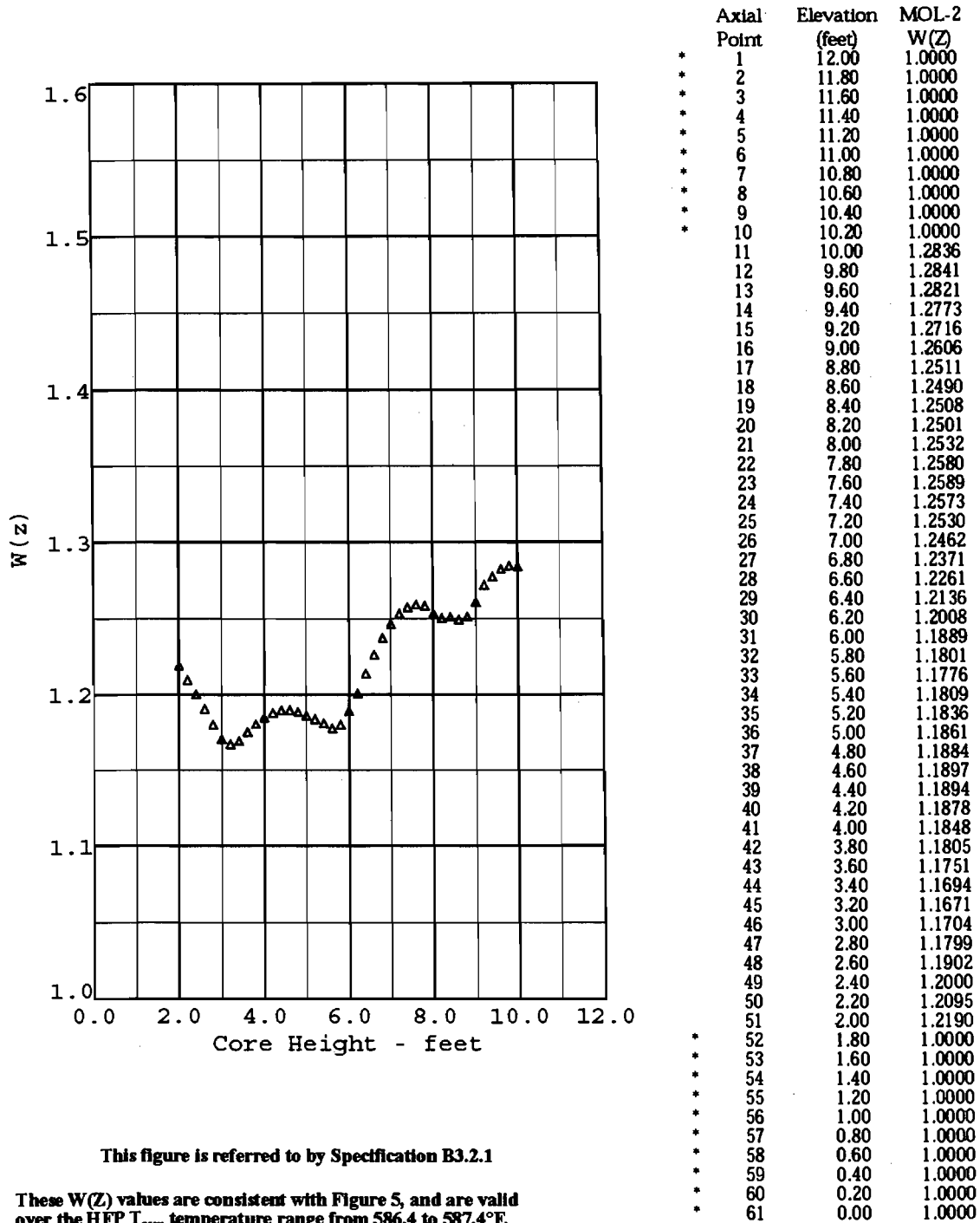
These W(Z) values are consistent with Figure 5, and are valid over the HFP  $T_{avg}$  temperature range from 586.4 to 587.4°F.

Axial Point	Elevation (feet)	MOL-1 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	1.3181
12	9.80	1.2837
13	9.60	1.2596
14	9.40	1.2470
15	9.20	1.2290
16	9.00	1.2129
17	8.80	1.2098
18	8.60	1.2105
19	8.40	1.2107
20	8.20	1.2111
21	8.00	1.2139
22	7.80	1.2151
23	7.60	1.2135
24	7.40	1.2098
25	7.20	1.2042
26	7.00	1.1968
27	6.80	1.1760
28	6.60	1.1662
29	6.40	1.1570
30	6.20	1.1496
31	6.00	1.1610
32	5.80	1.1552
33	5.60	1.1540
34	5.40	1.1619
35	5.20	1.1712
36	5.00	1.1798
37	4.80	1.1876
38	4.60	1.1945
39	4.40	1.2005
40	4.20	1.2054
41	4.00	1.2097
42	3.80	1.2162
43	3.60	1.2235
44	3.40	1.2318
45	3.20	1.2385
46	3.00	1.2481
47	2.80	1.2623
48	2.60	1.2822
49	2.40	1.3079
50	2.20	1.3332
51	2.00	1.3580
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

\* Top and Bottom 15% Excluded per Technical Specification B3.2.1

**FIGURE 7**  
**RAOC W (Z) AT 4000 MWD/MTU**

# COLR for VEGP UNIT 2 CYCLE 12



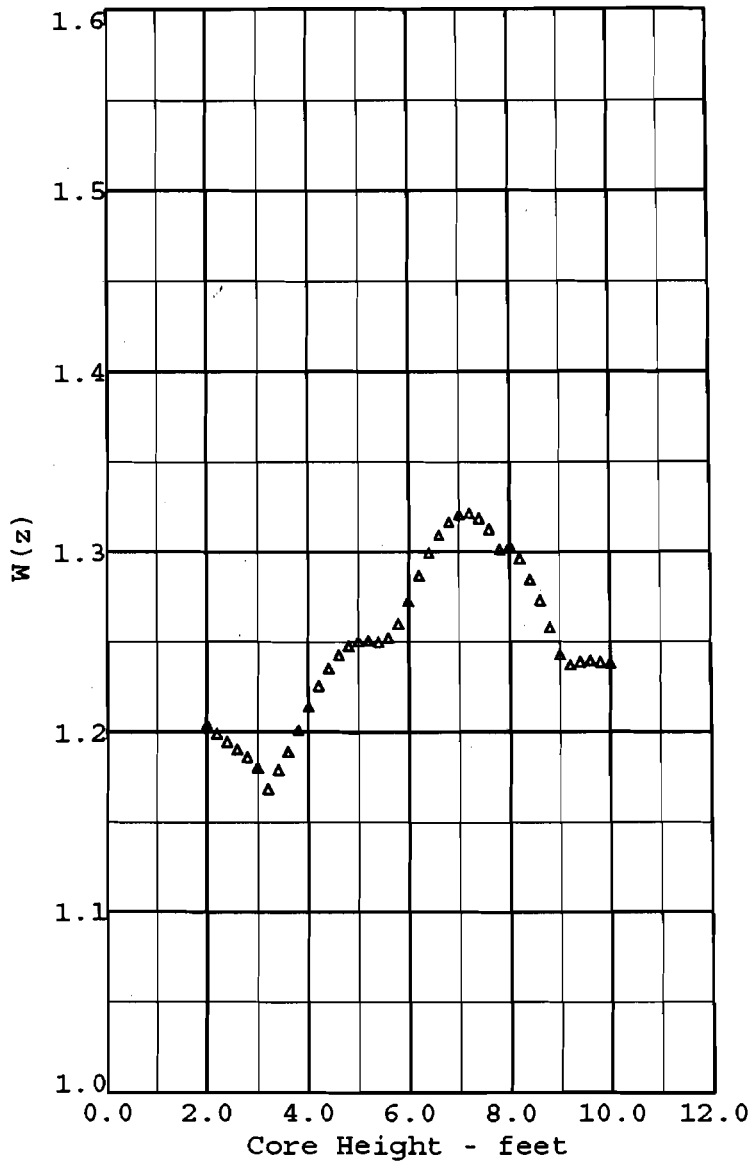
This figure is referred to by Specification B3.2.1

These  $W(Z)$  values are consistent with Figure 5, and are valid over the HFP  $T_{avg}$  temperature range from 586.4 to 587.4°F.

\* Top and Bottom 15% Excluded per Technical Specification B3.2.1

**FIGURE 8**  
**RAOC W (Z) AT 12000 MWD/MTU**

# COLR for VEGP UNIT 2 CYCLE 12



This figure is referred to by Specification B3.2.1

These W(Z) values are consistent with Figure 5, and are valid over the HFP  $T_{avg}$  temperature range from 586.4 to 587.4°F.

Axial Point	Elevation (feet)	EOL 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	1.2384
12	9.80	1.2387
13	9.60	1.2395
14	9.40	1.2389
15	9.20	1.2371
16	9.00	1.2428
17	8.80	1.2579
18	8.60	1.2731
19	8.40	1.2844
20	8.20	1.2959
21	8.00	1.3034
22	7.80	1.3014
23	7.60	1.3125
24	7.40	1.3185
25	7.20	1.3211
26	7.00	1.3202
27	6.80	1.3161
28	6.60	1.3090
29	6.40	1.2992
30	6.20	1.2867
31	6.00	1.2724
32	5.80	1.2599
33	5.60	1.2522
34	5.40	1.2499
35	5.20	1.2507
36	5.00	1.2503
37	4.80	1.2476
38	4.60	1.2426
39	4.40	1.2353
40	4.20	1.2258
41	4.00	1.2141
42	3.80	1.2009
43	3.60	1.1889
44	3.40	1.1791
45	3.20	1.1685
46	3.00	1.1803
47	2.80	1.1859
48	2.60	1.1903
49	2.40	1.1946
50	2.20	1.1993
51	2.00	1.2042
* 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

\* Top and Bottom 15% Excluded per Technical Specification B3.2.1

**FIGURE 9**  
**RAOC W (Z) AT 20000 MWD/MTU**