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September 28, 2006

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Ladies and Gentlemen:

ULNRC-05335

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CALLAWAY PLANT
DOCKET NUMBER 50-483
CORE OPERATING LIMITS REPORT
Reference: ULNRC-05228, dated November 4, 2005

Attached is the Callaway Plant Cycle 15 Core Operating Limits Report (COLR), Revision 1. The referenced letter transmitted the Callaway Plant Cycle 15 COLR, Revision 0. Revision 1 of the COLR revises the Table A.1 of the W(z) values to change the exclusion zone from 15% to 8%. The W(z) values are used in Technical Specification 3.2.1 and Surveillance Requirement 3.2.1.2 for determining $F_Q^W(z)$. All other COLR information is unchanged. This report is provided to the NRC Staff for information. It has been prepared in accordance with the requirements of Technical Specification 5.6.5.

If you have any questions concerning this report, please contact us.

Very truly yours,

David Shafer
for Keith D. Young
Manager, Regulatory Affairs

Attachment: Callaway Cycle 15 Core Operating Limits Report, Rev. 1

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CALLAWAY CYCLE 15

CORE OPERATING LIMITS REPORT

(Revision 1)

September 2006

Reviewed by: KRB 10-27-06

Approved by: BKH 10/28/06

Curve Book Figure 13-1, Rev 45

TOTAL PAGES 13

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Callaway Plant Cycle 15 has been prepared in accordance with the requirements of Technical Specification 5.6.5.

The Core Operating Limits affecting the following Technical Specifications are included in this report.

3.1.1, 3.1.4, 3.1.5, 3.1.6, 3.1.8	Shutdown Margin
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
3.2.2	Nuclear Enthalpy Rise Hot Channel Factor
3.2.3	Axial Flux Difference

2.0 OPERATING LIMITS

The cycle-specific parameter limits for the specifications listed in Section 1.0 are presented in the subsections which follow. These limits have been developed using the NRC-approved methodologies specified in Technical Specification 5.6.5.

2.1 Shutdown Margin
(Specifications 3.1.1, 3.1.4, 3.1.5, 3.1.6, and 3.1.8)

2.1.1 The Shutdown Margin in MODES 1-4 shall be greater than or equal to 1.3% Δk/k.

2.1.2 The Shutdown Margin prior to blocking Safety Injection below P-11 in MODES 3 and 4 shall be greater than 0% Δk/k as calculated at 200°F.

2.1.3 The Shutdown Margin in MODE 5 shall be greater than or equal to 1.0% Δk/k.

2.2 Moderator Temperature Coefficient
(Specification 3.1.3)

2.2.1 The Moderator Temperature Coefficient shall be less positive than the limits shown in Figure 1. These limits shall be referred to as upper limit.

The Moderator Temperature Coefficient shall be less negative than -47.9 pcm/°F. This limit shall be referred to as the lower limit.

2.2.2 The MTC 300 ppm surveillance limit is -40.4 pcm/°F (all rods withdrawn, Rated Thermal Power condition).

2.2.3 The MTC 60 ppm surveillance limit is -45.5 pcm/°F (all rods withdrawn, Rated Thermal Power condition).

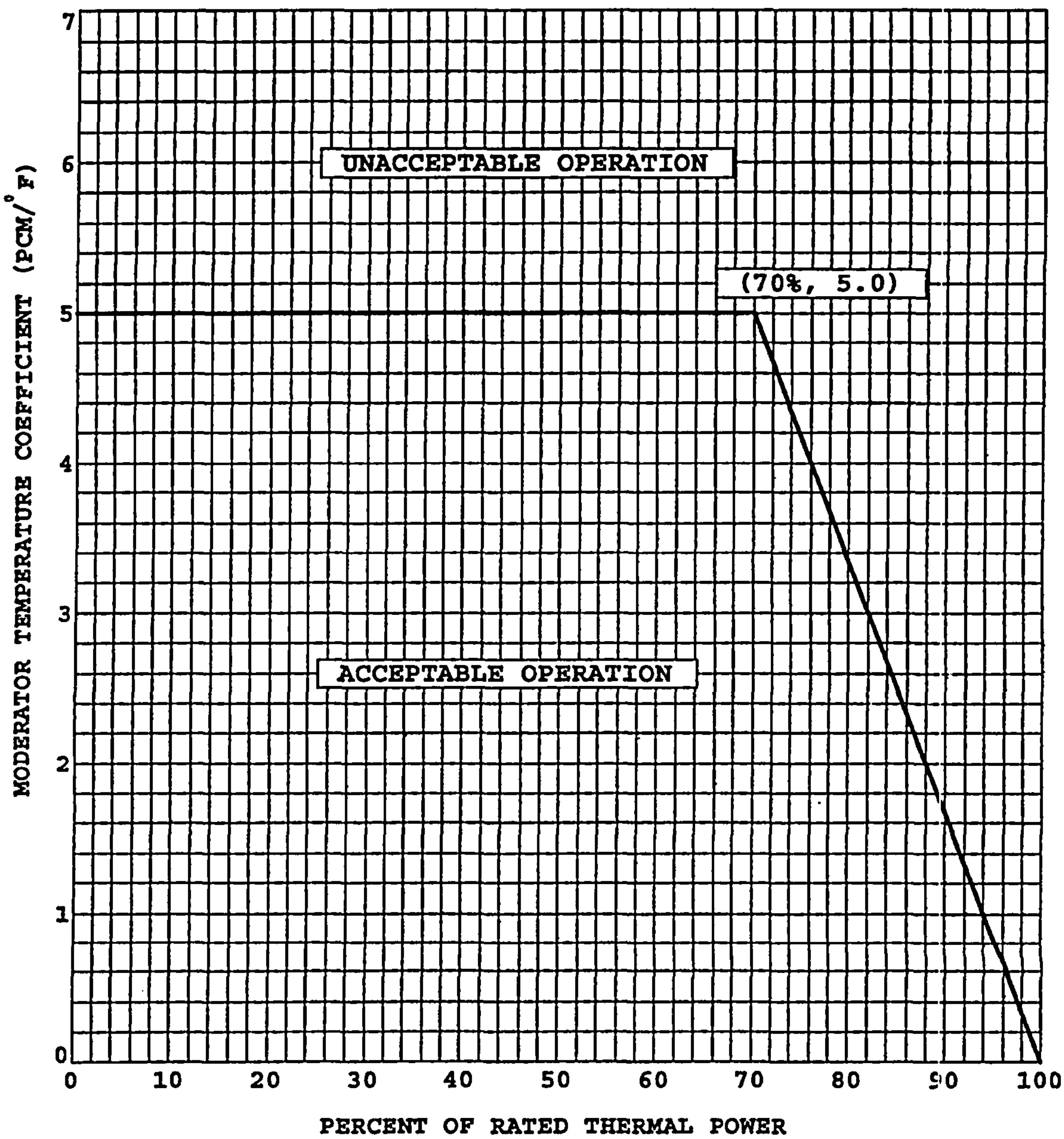

Figure 1

Callaway Cycle 15
Moderator Temperature Coefficient
Versus Power Level

Curve Book Figure 13-1, Rev 45

2.3 Shutdown Bank Insertion Limits
(Specification 3.1.5)

The shutdown banks shall be withdrawn to at least 225 steps.

2.4 Control Bank Insertion Limits
(Specification 3.1.6)

2.4.1 Control Bank insertion limits are specified by Figure 2.

2.4.2 Control Bank withdrawal sequence is A-B-C-D. The insertion sequence is the reverse of the withdrawal sequence.

2.4.3 The difference between each sequential Control Bank position is 115 steps when not fully inserted and not fully withdrawn.

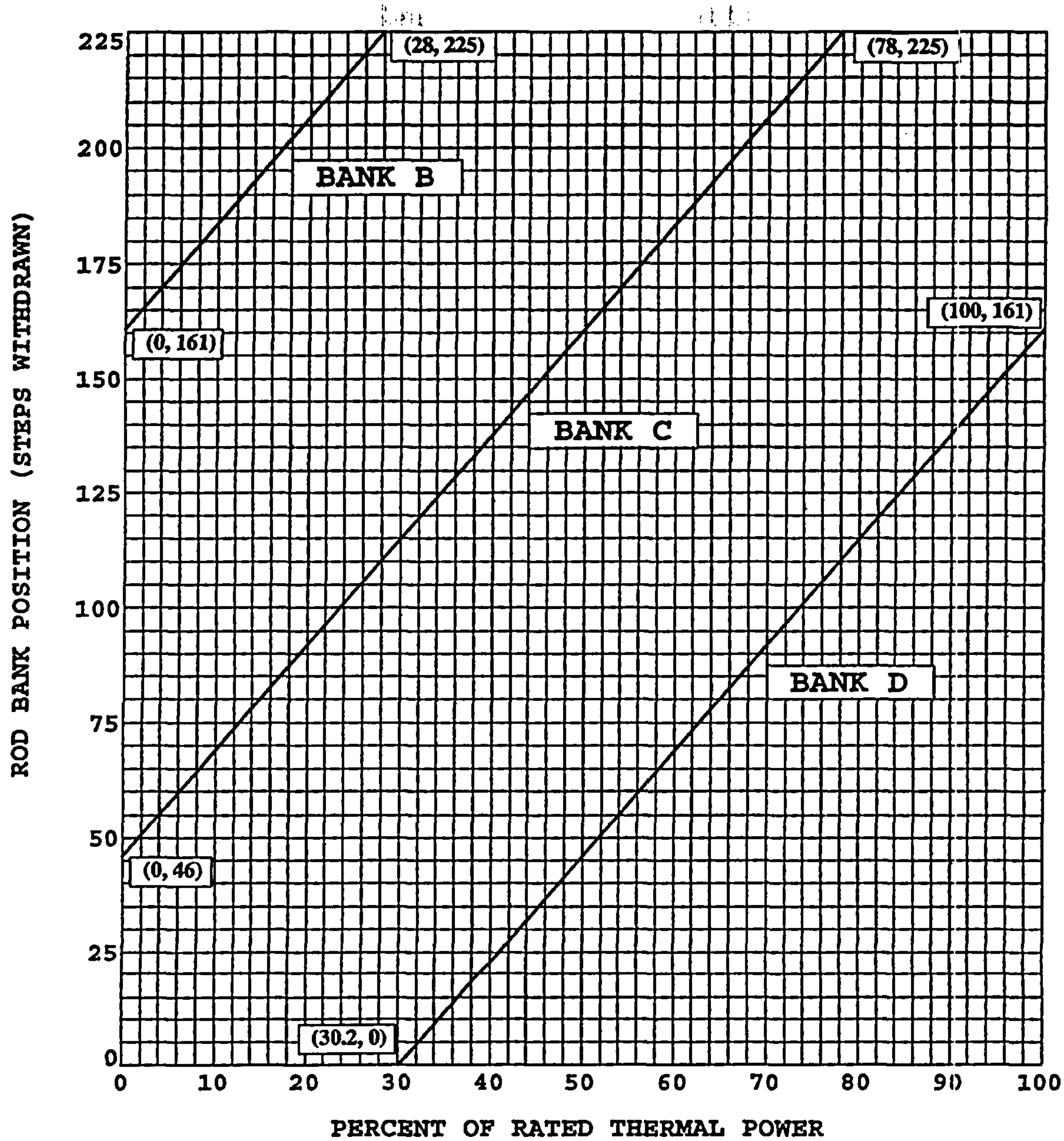

Figure 2

Callaway Cycle 15
Rod Bank Insertion Limits
Versus Rated Thermal Power - Four Loop Operation

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

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

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

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

2.5.1 $F_Q^{RTP} = 2.50$

2.5.2 K(Z) is provided in Figure 3.

2.5.3 The W(z) functions that are to be used in Technical Specification 3.2.1 and Surveillance Requirement 3.2.1.2 for determining $F_Q^W(z)$ are shown in Table A.1.

The W(z) values have been determined for several burnups up to 18000 MWD/MTU in Cycle 15. This permits determination of W(z) at any cycle burnup up to 18000 MWD/MTU through the use of three point interpolation. For cycle burnups greater than 18000 MWD/MTU, use of 18000 MWD/MTU W(z) values without interpolation or extrapolation is conservative. The W(z) values were determined assuming Cycle 15 operates with RAOC strategy. Also included is a W(z) function that bounds the W(z) values for all Cycle 15 burnups. Use of the bounding W(z) values will be conservative for any Cycle 15 burnup; however, additional margin may be gained by using the burnup dependent W(z) values.

Table A.2 shows the burnup dependent F_Q penalty factors for Cycle 15. These values shall be used to increase $F_Q^W(z)$ when required by Technical Specification Surveillance Requirement 3.2.1.2. A 2% penalty factor should be used at all cycle burnups that are outside the range of Table A.2.

Table A.1
W(z) versus Core Height
(Top and Bottom 8% Excluded)

Height (feet)	150 MWD/MTU	4000 MWD/MTU	10000 MWD/MTU	18000 MWD/MTU	Bounding W(z)
0.00 (bottom)	1.0000	1.0000	1.0000	1.0000	1.0000
0.17	1.0000	1.0000	1.0000	1.0000	1.0000
0.33	1.0000	1.0000	1.0000	1.0000	1.0000
0.50	1.0000	1.0000	1.0000	1.0000	1.0000
0.67	1.0000	1.0000	1.0000	1.0000	1.0000
0.83	1.0000	1.0000	1.0000	1.0000	1.0000
1.00	1.3920	1.4410	1.4216	1.3306	1.4481
1.17	1.3793	1.4249	1.4103	1.3229	1.4326
1.33	1.3646	1.4064	1.3968	1.3136	1.4146
1.50	1.3491	1.3864	1.3821	1.3037	1.3950
1.67	1.3331	1.3656	1.3665	1.2935	1.3746
1.83	1.3165	1.3440	1.3502	1.2831	1.3535
2.00	1.2990	1.3215	1.3329	1.2722	1.3335
2.17	1.2809	1.2984	1.3150	1.2611	1.3150
2.33	1.2626	1.2753	1.2967	1.2499	1.2967
2.50	1.2441	1.2517	1.2781	1.2384	1.2781
2.67	1.2253	1.2291	1.2592	1.2268	1.2601
2.83	1.2064	1.2101	1.2403	1.2151	1.2422
3.00	1.1911	1.1952	1.2228	1.2039	1.2251
3.17	1.1817	1.1861	1.2105	1.1974	1.2130
3.33	1.1784	1.1829	1.2057	1.1974	1.2085
3.50	1.1768	1.1805	1.2039	1.1977	1.2072
3.67	1.1750	1.1772	1.2024	1.1988	1.2066
3.83	1.1725	1.1735	1.2001	1.2027	1.2069
4.00	1.1694	1.1693	1.1973	1.2072	1.2079
4.17	1.1657	1.1643	1.1938	1.2109	1.2110
4.33	1.1619	1.1586	1.1896	1.2136	1.2137
4.50	1.1591	1.1538	1.1846	1.2154	1.2154
4.67	1.1571	1.1498	1.1790	1.2166	1.2166
4.83	1.1548	1.1454	1.1726	1.2177	1.2177
5.00	1.1520	1.1404	1.1654	1.2178	1.2178
5.17	1.1483	1.1349	1.1576	1.2162	1.2162
5.33	1.1436	1.1290	1.1492	1.2130	1.2130
5.50	1.1421	1.1215	1.1395	1.2113	1.2113
5.67	1.1423	1.1153	1.1315	1.2108	1.2108
5.83	1.1471	1.1169	1.1324	1.2149	1.2149
6.00	1.1570	1.1211	1.1385	1.2244	1.2244
6.17	1.1698	1.1286	1.1528	1.2369	1.2369
6.33	1.1807	1.1349	1.1652	1.2473	1.2473
6.50	1.1916	1.1439	1.1762	1.2572	1.2572
6.67	1.2031	1.1560	1.1864	1.2669	1.2669
6.83	1.2141	1.1680	1.1951	1.2744	1.2744

Table A.1
W(z) versus Core Height
(Top and Bottom 8% Excluded)

Height (feet)	150 MWD/MTU	4000 MWD/MTU	10000 MWD/MTU	18000 MWD/MTU	Bounding W(z)
7.00	1.2239	1.1801	1.2025	1.2800	1.2800
7.17	1.2324	1.1925	1.2082	1.2837	1.2837
7.33	1.2394	1.2046	1.2119	1.2853	1.2853
7.50	1.2448	1.2159	1.2158	1.2849	1.2849
7.67	1.2485	1.2260	1.2201	1.2824	1.2824
7.83	1.2504	1.2348	1.2229	1.2780	1.2780
8.00	1.2501	1.2424	1.2258	1.2709	1.2709
8.17	1.2481	1.2486	1.2302	1.2623	1.2706
8.33	1.2466	1.2536	1.2352	1.2553	1.2709
8.50	1.2466	1.2563	1.2385	1.2492	1.2717
8.67	1.2472	1.2582	1.2414	1.2465	1.2726
8.83	1.2478	1.2639	1.2498	1.2508	1.2746
9.00	1.2508	1.2720	1.2624	1.2584	1.2790
9.17	1.2614	1.2816	1.2762	1.2655	1.2893
9.33	1.2750	1.2945	1.2893	1.2724	1.3028
9.50	1.2883	1.3177	1.2996	1.2780	1.3216
9.67	1.3003	1.3516	1.3066	1.2820	1.3524
9.83	1.3124	1.3867	1.3125	1.2866	1.3867
10.00	1.3248	1.4220	1.3175	1.2922	1.4220
10.17	1.3392	1.4558	1.3218	1.2979	1.4558
10.33	1.3595	1.4839	1.3267	1.3029	1.4839
10.50	1.3822	1.5107	1.3329	1.3103	1.5107
10.67	1.4029	1.5384	1.3402	1.3212	1.5384
10.83	1.4205	1.5616	1.3485	1.3305	1.5616
11.00	1.4351	1.5774	1.3563	1.3352	1.5774
11.17	1.0000	1.0000	1.0000	1.0000	1.0000
11.33	1.0000	1.0000	1.0000	1.0000	1.0000
11.50	1.0000	1.0000	1.0000	1.0000	1.0000
11.67	1.0000	1.0000	1.0000	1.0000	1.0000
11.83	1.0000	1.0000	1.0000	1.0000	1.0000
12.00 (top)	1.0000	1.0000	1.0000	1.0000	1.0000

Table A.2

F_Q Penalty Factors as a Function of Cycle Burnup

Cycle 15 Burnup	$F_Q^W(z)$ Penalty Factor (%)
1351	3.06
1523	3.43
1694	3.01
1866	2.55
2038	2.10

Note: All cycle burnups not in the range of the above table shall use a 2.0% penalty factor for compliance with Surveillance Requirement 3.2.1.2.

For values of burnup between two of those listed in the first column, the greater of the two corresponding penalty factors shall be used for compliance with Surveillance Requirement 3.2.1.2.

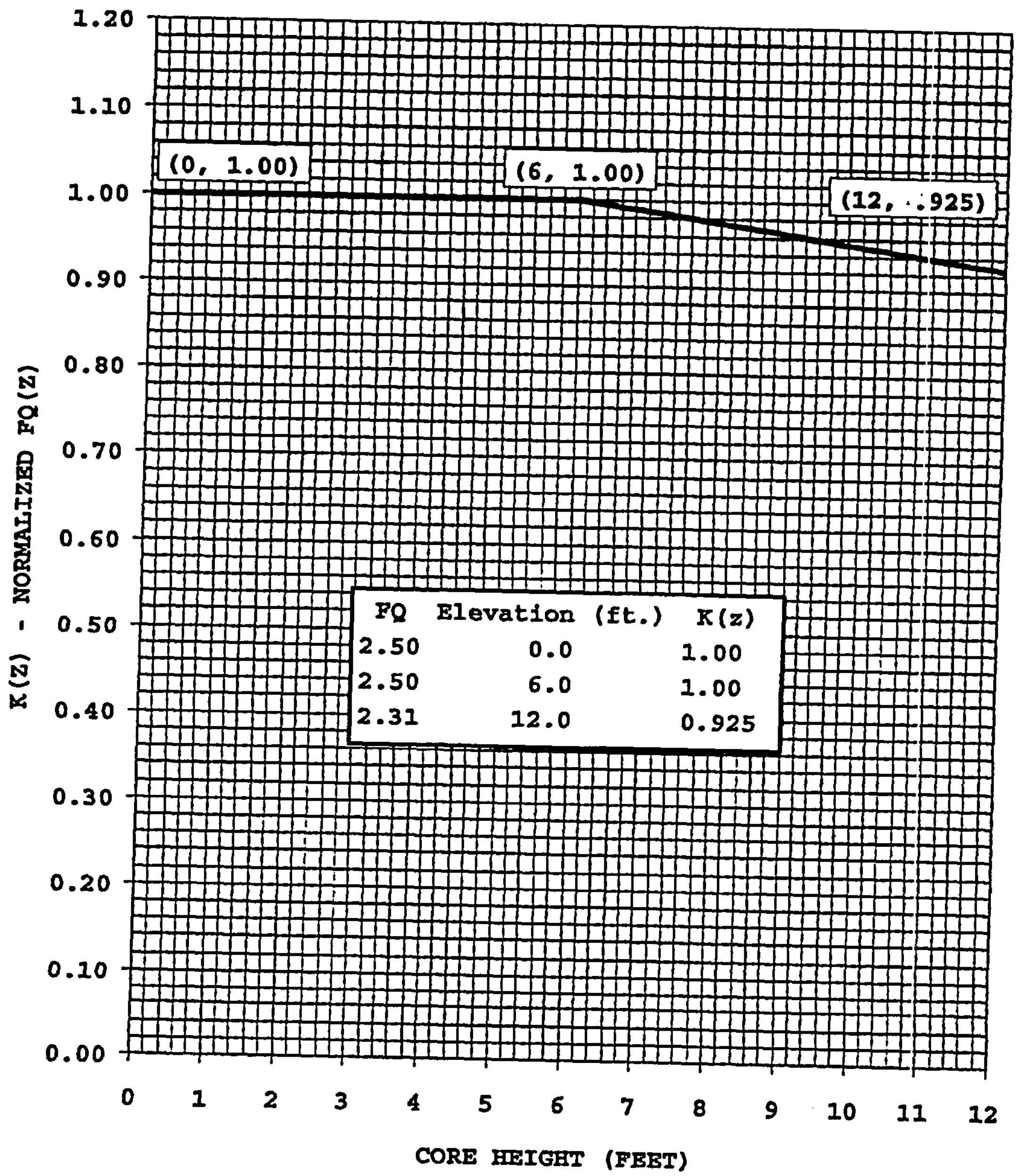

Figure 3

Callaway Cycle 15
K(z) - Normalized $F_Q(z)$
as a Function of Core Height

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

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

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

2.6.1 $F_{\Delta H}^{RTP} = 1.59$

2.6.2 $PF_{\Delta H} = 0.3$

2.7 Axial Flux Difference
(Specification 3.2.3)

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

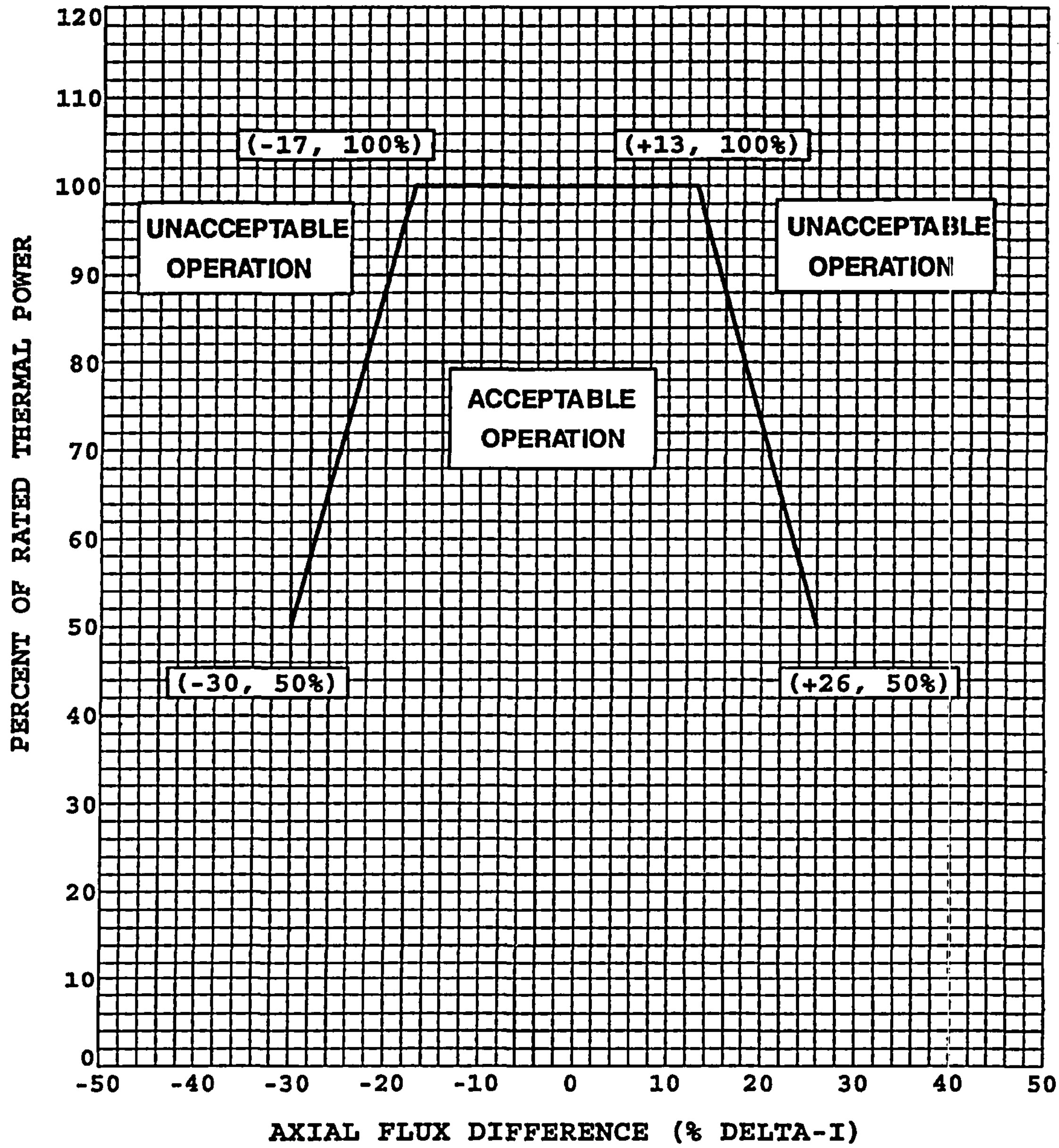

Figure 4

Callaway Cycle 15
Axial Flux Difference Limits as a Function of Rated Thermal Power for RAOC