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U. S. Nuclear Regulatory Commission
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Ref 10 CFR 50.36(c)(5)

Subject: Comanche Peak Nuclear Power Plant (CPNPP)
Docket No. 50-446
Core Operating Limits Report (COLR), Unit 2 Cycle 20, (ERX-21-001, Revision 0)

Dear Sir of Madam:

Enclosed is the Core Operating Limits Report (COLR) for Comanche Peak Nuclear Power Plant (CPNPP) Unit 2, Cycle 20, (ERX-21-001, Rev. 0). This report is prepared and submitted pursuant to Technical Specification 5.6.5.

This communication contains no new commitments regarding CPNPP Unit 2.

Should you have any questions, please contact Garry W Struble at (254) 897-6628 or garry.struble@luminant.com.

Sincerely,

Jack C. Hicks

Jack C. Hicks

Enclosure: Unit 2 Cycle 20 Core Operating Limits Report, (ERX-21-001, Rev. 0)

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ERX-21-001, Rev. 0

CPNPP UNIT 2 CYCLE 20

CORE OPERATING LIMITS REPORT

October 2021

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1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for CPNPP UNIT 2 CYCLE 20 has been prepared in accordance with the requirements of Technical Specification 5.6.5.

The Technical Specifications affected by this report are listed below:

SL 2.1	SAFETY LIMITS (SLs)
LCO 3.1.1	SHUTDOWN MARGIN (SDM)
LCO 3.1.3	MODERATOR TEMPERATURE COEFFICIENT (MTC)
LCO 3.1.4	ROD GROUP ALIGNMENT LIMITS
LCO 3.1.5	SHUTDOWN BANK INSERTION LIMITS
LCO 3.1.6	CONTROL BANK INSERTION LIMITS
LCO 3.1.8	PHYSICS TESTS EXCEPTIONS - MODE 2
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LCO 3.9.1	BORON CONCENTRATION

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 5.6.5b, Items 1 through 4 and 7 through 15. These limits have been determined such that all applicable limits of the safety analysis are met.

2.1 SAFETY LIMITS (SLs) (SL 2.1)

2.1.1 In MODES 1 and 2, the combination of thermal power, reactor coolant system highest loop average temperature, and pressurizer pressure shall not exceed the safety limits specified in Figure 1.

2.2 SHUTDOWN MARGIN (SDM) (LCO 3.1.1)

2.2.1 The SDM shall be greater than or equal to 1.3% $\Delta k/k$ in MODE 2 with $K_{eff} < 1.0$, and in MODES 3, 4, and 5.

2.3 MODERATOR TEMPERATURE COEFFICIENT (MTC) (LCO 3.1.3)

2.3.1 The MTC upper and lower limits, respectively, are:

The BOL/ARO/HZP-MTC shall be less positive than +5 pcm/°F.

The EOL/ARO/RTP-MTC shall be less negative than -40 pcm/°F.

2.3.2 SR 3.1.3.2

The MTC surveillance limit is:

The 300 ppm/ARO/RTP-MTC shall be less negative than or equal to -31 pcm/°F.

The 60 ppm/ARO/RTP-MTC shall be less negative than or equal to -38 pcm/°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 ROD GROUP ALIGNMENT LIMITS (LCO 3.1.4)

2.4.1 The SDM shall be greater than or equal to 1.3% Δk/k in MODES 1 and 2.

2.5 SHUTDOWN BANK INSERTION LIMITS (LCO 3.1.5)

2.5.1 The shutdown rods shall be fully withdrawn. Fully withdrawn shall be the condition where shutdown rods are at a position within the interval of 218 and 231 steps withdrawn, inclusive.

2.5.2 The SDM shall be greater than or equal to 1.3% Δk/k in MODE 1, MODE 2 with any control bank not fully inserted.

2.6 CONTROL BANK INSERTION LIMITS (LCO 3.1.6)

2.6.1 The control banks shall be limited in physical insertion as shown in Figure 2.

2.6.2 The control banks shall always be withdrawn and inserted in the prescribed sequence. For withdrawal, the sequence is control bank A, control bank B, control bank C, and control bank D. The insertion sequence is the reverse of the withdrawal sequence.

2.6.3 A 115 step Tip-to-Tip relationship between each sequential control bank shall be maintained.

2.6.4 The SDM shall be greater than or equal to 1.3% $\Delta k/k$ in MODE 1, MODE 2 with keff $\geq$ 1.0.

2.7 PHYSICS TESTS EXCEPTIONS - MODE 2 (LCO 3.1.8)

2.7.1 The SDM shall be greater than or equal to 1.3% $\Delta k/k$ in MODE 2 during PHYSICS TESTS.

2.8 HEAT FLUX HOT CHANNEL FACTOR ($F_Q(Z)$) (LCO 3.2.1)

2.8.1 $$F_Q(Z) \leq \frac{F_Q^{RTP}}{P} [K(Z)] \text{ for } P > 0.5$$

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

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

2.8.2 $F_Q^{RTP} = 2.50$

2.8.3 K(Z) is provided in Figure 3.

2.8.4 Elevation and burnup dependent W(Z) values are provided in Figures 4, 5, 6, 7 and 8. For W(Z) data at a desired burnup not listed in the figures, but less than the maximum listed burnup, values at 3 or more burnup steps should be used to interpolate the W(Z) data to the desired burnup with a polynomial type fit that uses the nearest three burnup steps. For W(Z) data at a desired burnup outside of the listed burnup steps, a linear extrapolation of the W(Z) data for the nearest two burnup steps can be used.

2.8.5 SR 3.2.1.2

If the two most recent $F_Q(Z)$ evaluations show an increase in the expression

maximum over Z $[\ F_Q^C(Z)\ /\ K(Z)\ ]$,

the burnup dependent values in Table 1 shall be used instead of a constant 2% to increase $F_Q^W(Z)$ per Surveillance Requirement 3.2.1.2, Note a. A constant factor of 2% shall be used for all cycle burnups that are outside the range of Table 1.

2.9 NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR ($F^N_{\Delta H}$) (LCO 3.2.2)

2.9.1 $F^N_{\Delta H} \leq F^{RTP}_{\Delta H}\,[1 + PF_{\Delta H}\,(1-P)]$

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

2.9.2 $F^{RTP}_{\Delta H} =$ 1.60 for all Fuel Assembly Regions

2.9.3 $PF_{\Delta H} =$ 0.3

2.10 AXIAL FLUX DIFFERENCE (AFD) (LCO 3.2.3)

2.10.1 The AFD Acceptable Operation Limits are provided in Figure 9.

2.11 REACTOR TRIP SYSTEM (RTS) INSTRUMENTATION (LCO 3.3.1)

2.11.1 The numerical values pertaining to the Overtemperature N-16 reactor trip setpoint are listed below;

K_1 = 1.15

K_2 = 0.0139 /°F

K_3 = 0.00071 /psig

$T_c°$ = indicated loop specific T_c at Rated Thermal Power, °F

P^1 ≥ 2235 psig

τ_1 ≥ 10 sec

τ_2 ≤ 3 sec

$f_1(\Delta q) = -2.78 \cdot \{(q_t-q_b) + 18\%\}$ when $(q_t-q_b) \leq -18\%$ RTP

$= 0\%$ when -18% RTP $< (q_t-q_b) < +10.0\%$ RTP

$= 2.34 \cdot \{(q_t-q_b) - 10.0\%\}$ when $(q_t-q_b) \geq +10.0\%$ RTP

2.12 RCS PRESSURE, TEMPERATURE, AND FLOW DEPARTURE FROM NUCLEATE BOILING (DNB) LIMITS (LCO 3.4.1)

2.12.1 RCS DNB parameters for pressurizer pressure, RCS average temperature, and RCS total flow rate shall be within the surveillance limits specified below:

2.12.2 SR 3.4.1.1

Pressurizer pressure $\geq$ 2220 psig (4 channels)

$\geq$ 2222 psig (3 channels)

The pressurizer pressure limits correspond to the analytical limit of 2205 psig used in the safety analysis with allowance for measurement uncertainty. These uncertainties are based on the use of control board indications and the number of available channels.

2.12.3 SR 3.4.1.2

RCS average temperature $\leq$ 592 °F (4 channels)

$\leq$ 591 °F (3 channels)

The RCS average temperature limits correspond to the analytical limit of 595.2 °F which is bounded by that used in the safety analysis with allowance for measurement uncertainty. These uncertainties are based on the use of control board indications and the number of available channels.

2.12.4 SR 3.4.1.3

The RCS total flow rate shall be ≥ 408,000 gpm.

2.12.5 SR 3.4.1.4

The RCS total flow rate based on precision heat balance shall be ≥ 408,000 gpm.

The required RCS flow, based on an elbow tap differential pressure instrument measurement prior to MODE 1 after the refueling outage, shall be greater than 327,000 gpm.

2.13 BORON CONCENTRATION (LCO 3.9.1)

2.13.1 The required refueling boron concentration is ≥ 1894 ppm.

3.0 REFERENCES

Technical Specification 5.6.5.

Table 1
$F_Q(Z)$ MARGIN DECREASES IN EXCESS OF 2% PER 31 EFPD

Cycle Burnup (MWD/MTU)	Maximum Decrease In $F_Q(Z)$ MARGIN (Percent)
150	2.00
365	3.56
581	3.88
796	3.66
1011	3.32
1226	2.89
1442	2.44
1657	2.21
1872	2.17
2087	2.12
2303	2.04
2518	2.00

Note: All cycle burnups outside the range of the table shall use a constant 2% decrease in $F_Q(Z)$ margin for compliance with Surveillance Requirement 3.2.1.2, Note a. Linear interpolation is acceptable to determine the $F_Q(Z)$ margin decrease for cycle burnups which fall between the specified burnups.

Figure 1
Reactor Core Safety Limits

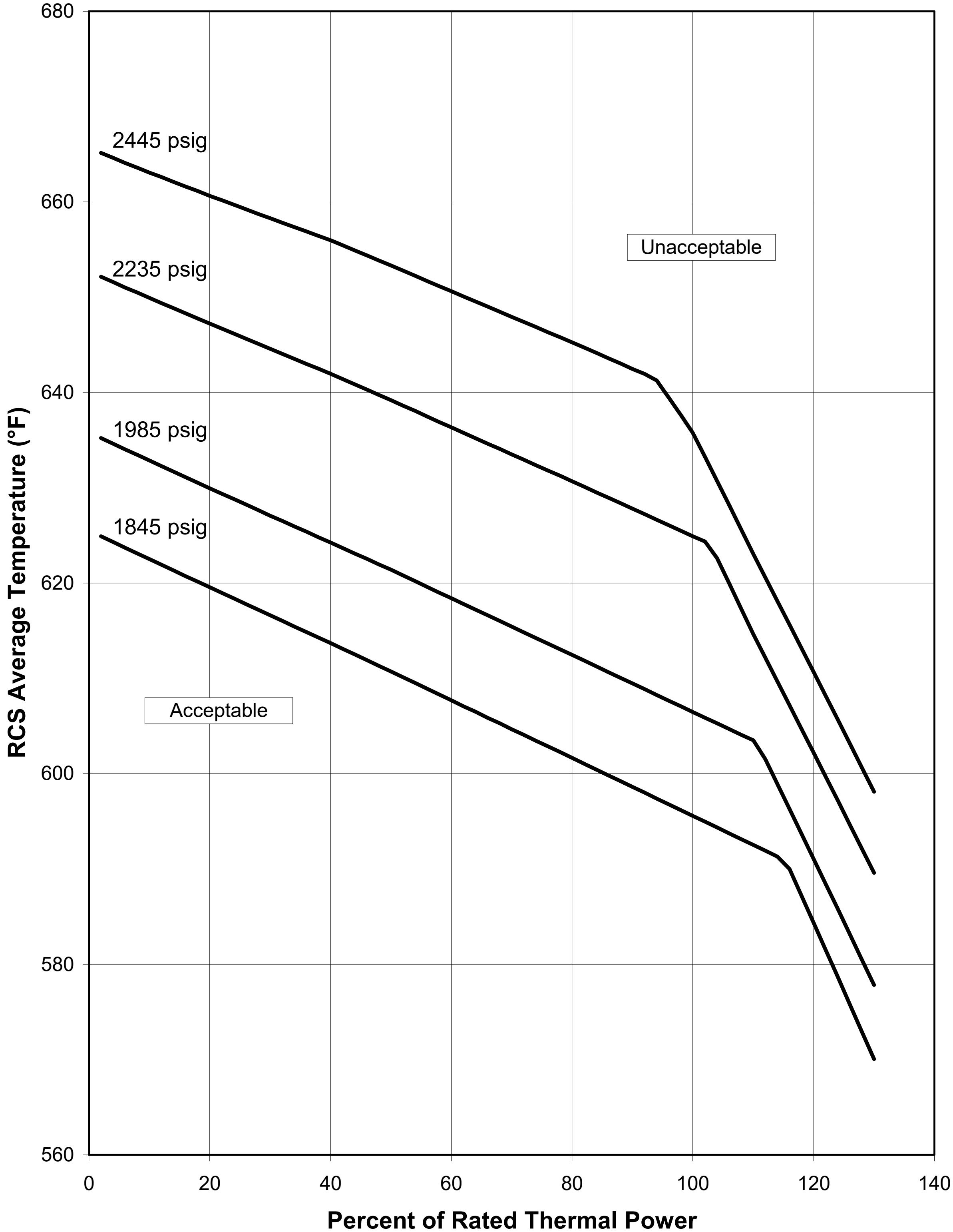
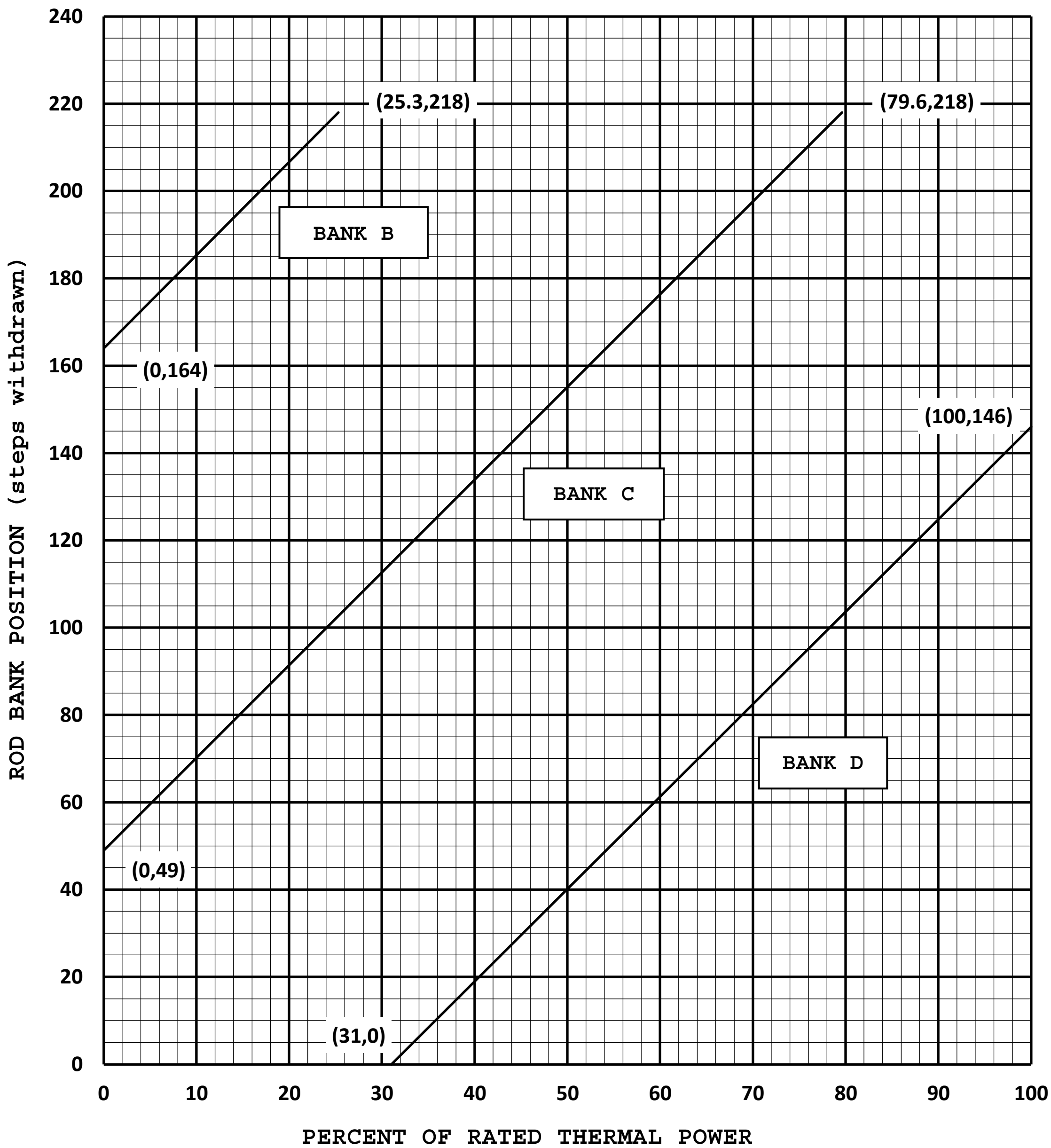


FIGURE 2

ROD BANK INSERTION LIMITS VERSUS THERMAL POWER



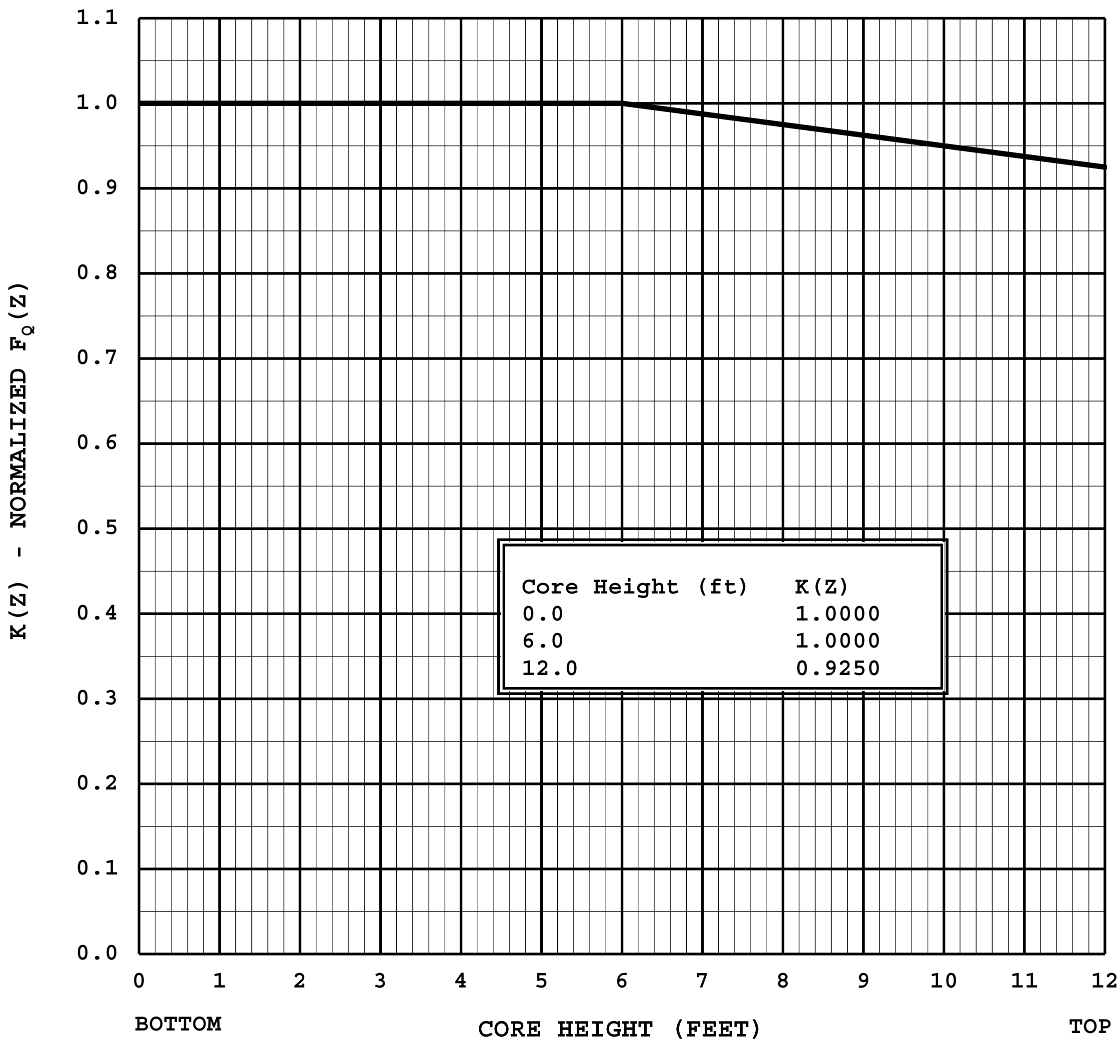
NOTES:

1. Fully withdrawn shall be the condition where control rods are at a position within the interval of 218 and 231 steps withdrawn, inclusive.

2. Control Bank A shall be fully withdrawn.

FIGURE 3

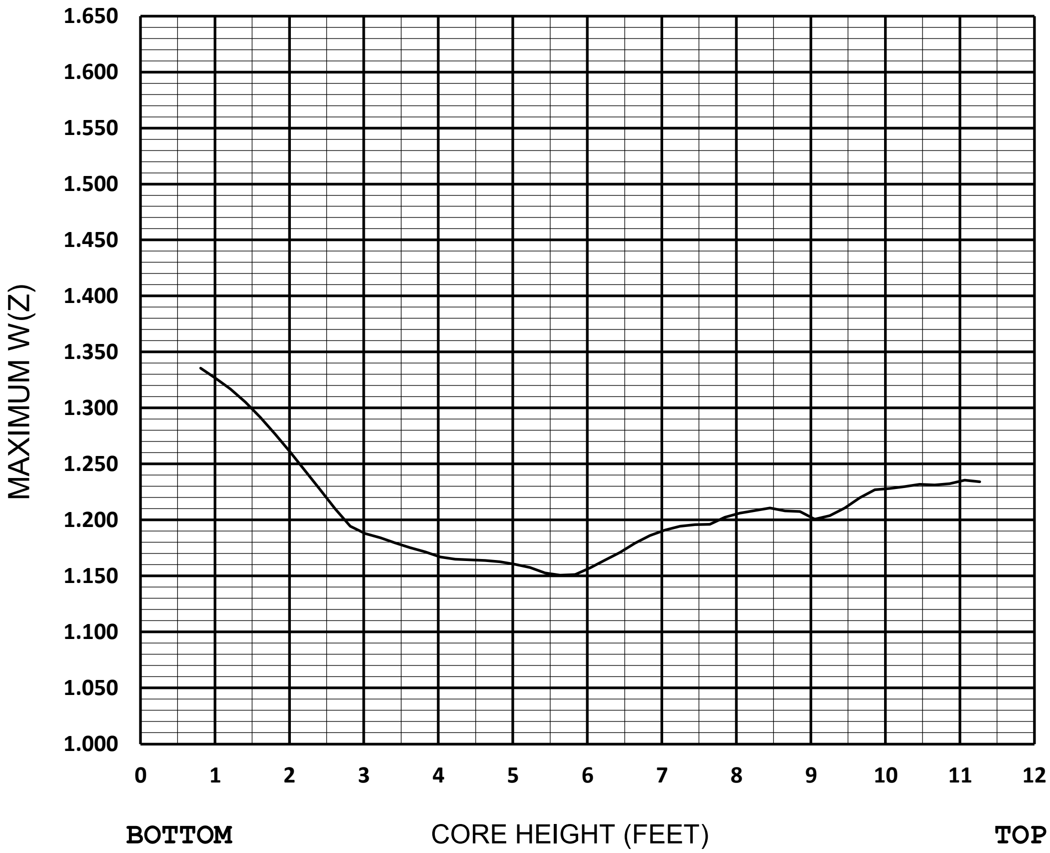
K(Z) - NORMALIZED $F_Q(Z)$ AS A FUNCTION OF CORE HEIGHT



Core Height (ft)	K(Z)
0.0	1.0000
6.0	1.0000
12.0	0.9250

FIGURE 4

W(Z) AS A FUNCTION OF CORE HEIGHT
(150 MWD/MTU)

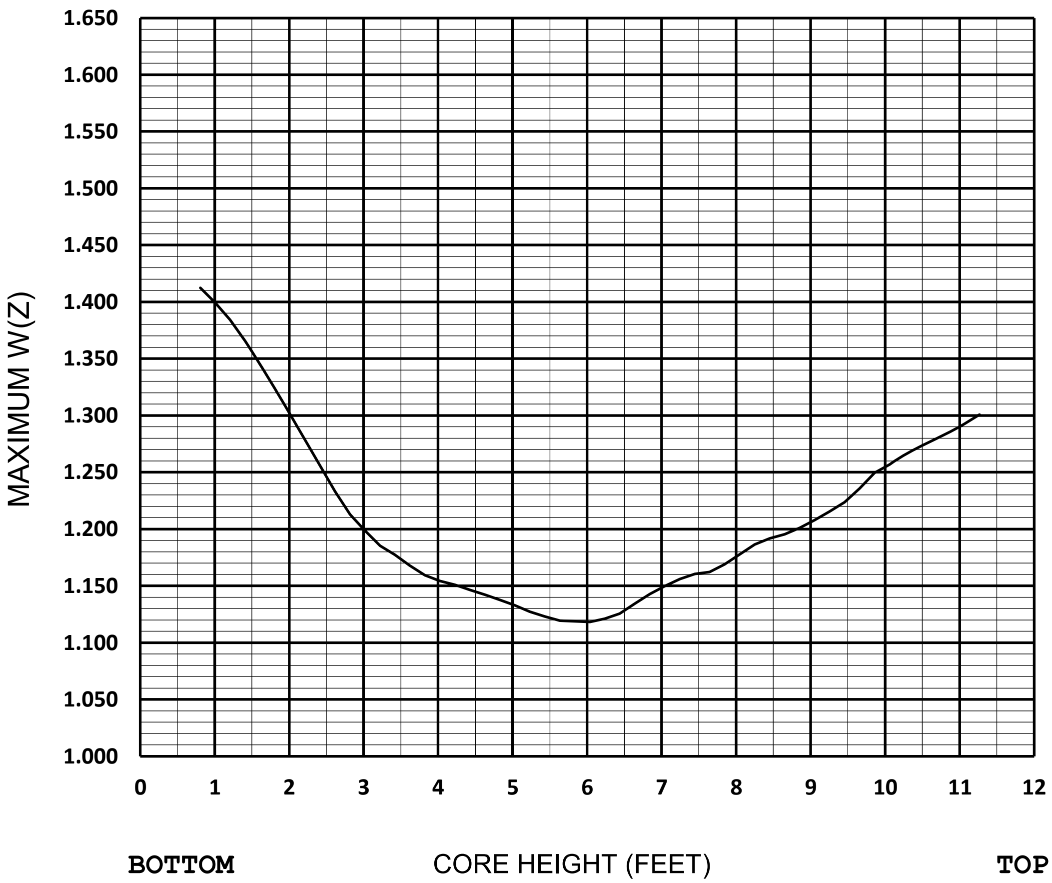


Axial Node	W(Z)	Axial Node	W(Z)	Axial Node	W(Z)	Axial Node	W(Z)
58 - 61	---	44	1.2082	30	1.1511	16	1.1879
57	1.2340	43	1.2106	29	1.1507	15	1.1943
56	1.2356	42	1.2084	28	1.1526	14	1.2098
55	1.2323	41	1.2062	27	1.1574	13	1.2270
54	1.2312	40	1.2024	26	1.1604	12	1.2439
53	1.2319	39	1.1961	25	1.1626	11	1.2606
52	1.2297	38	1.1959	24	1.1637	10	1.2767
51	1.2282	37	1.1943	23	1.1644	9	1.2915
50	1.2270	36	1.1910	22	1.1648	8	1.3052
49	1.2198	35	1.1862	21	1.1668	7	1.3171
48	1.2107	34	1.1792	20	1.1716	6	1.3268
47	1.2037	33	1.1710	19	1.1752	5	1.3356
46	1.2007	32	1.1642	18	1.1794	1 - 4	---
45	1.2076	31	1.1573	17	1.1841		

Core Height (ft) = (Node - 1) * 0.2012

FIGURE 5

W(Z) AS A FUNCTION OF CORE HEIGHT
(5,000 MWD/MTU)

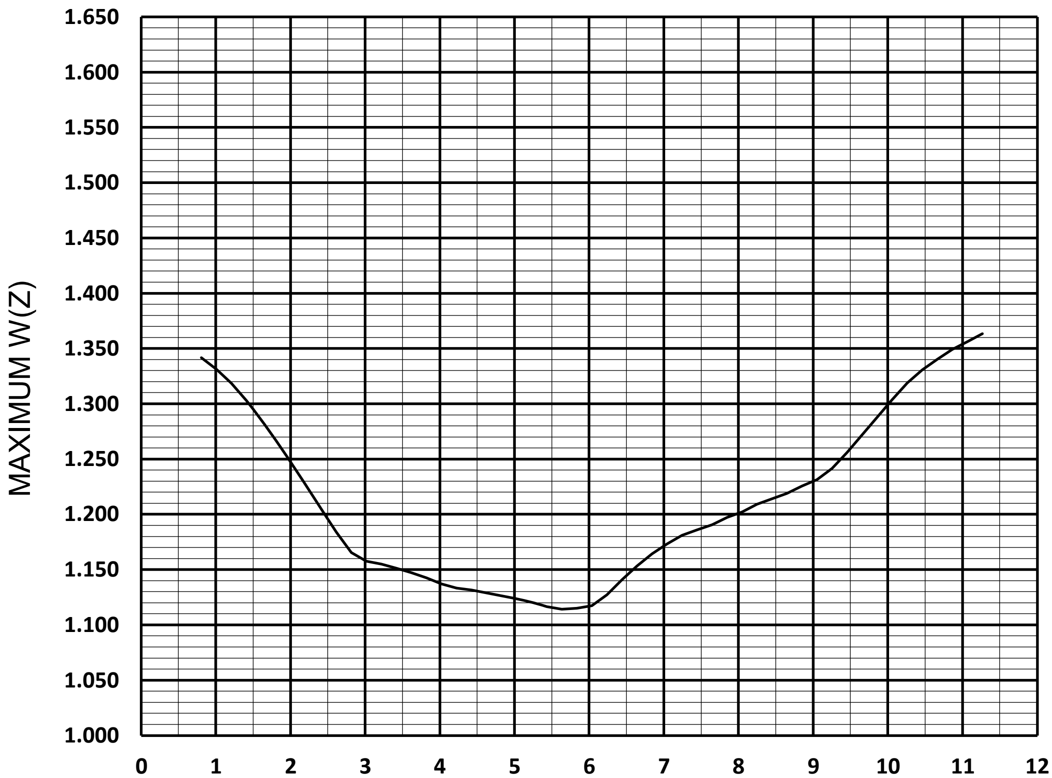


Axial Node	W(Z)	Axial Node	W(Z)	Axial Node	W(Z)	Axial Node	W(Z)
58 - 61	---	44	1.1953	30	1.1187	16	1.1984
57	1.3008	43	1.1918	29	1.1193	15	1.2129
56	1.2926	42	1.1865	28	1.1231	14	1.2332
55	1.2854	41	1.1778	27	1.1274	13	1.2558
54	1.2787	40	1.1689	26	1.1330	12	1.2788
53	1.2722	39	1.1622	25	1.1378	11	1.3014
52	1.2653	38	1.1605	24	1.1421	10	1.3235
51	1.2568	37	1.1559	23	1.1465	9	1.3446
50	1.2495	36	1.1498	22	1.1509	8	1.3655
49	1.2357	35	1.1428	21	1.1544	7	1.3841
48	1.2237	34	1.1342	20	1.1593	6	1.3995
47	1.2153	33	1.1256	19	1.1679	5	1.4124
46	1.2077	32	1.1211	18	1.1774	1 - 4	---
45	1.2012	31	1.1184	17	1.1854		

Core Height (ft) = (Node - 1) * 0.2012

FIGURE 6

W(Z) AS A FUNCTION OF CORE HEIGHT
(8,000 MWD/MTU)



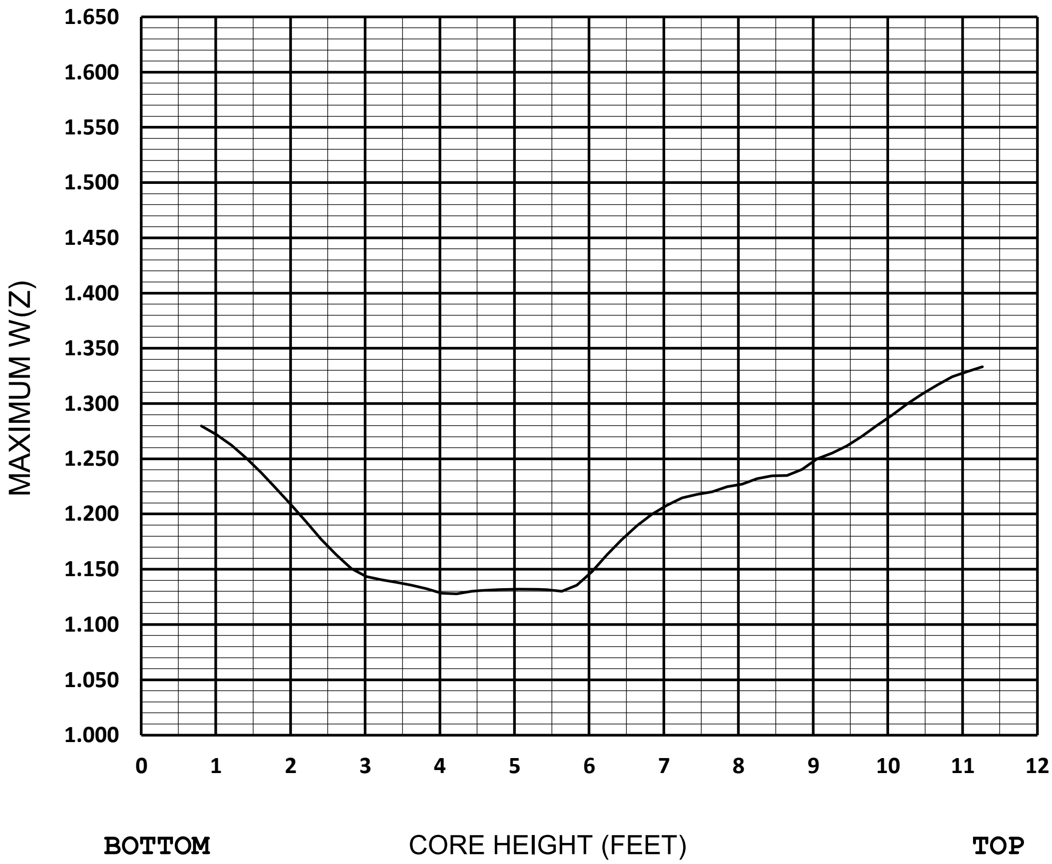
BOTTOM CORE HEIGHT (FEET) **TOP**

Axial Node	W(Z)	Axial Node	W(Z)	Axial Node	W(Z)	Axial Node	W(Z)
58 - 61	---	44	1.2190	30	1.1150	16	1.1576
57	1.3634	43	1.2141	29	1.1144	15	1.1653
56	1.3562	42	1.2092	28	1.1165	14	1.1838
55	1.3492	41	1.2022	27	1.1205	13	1.2047
54	1.3402	40	1.1973	26	1.1235	12	1.2259
53	1.3306	39	1.1905	25	1.1262	11	1.2465
52	1.3187	38	1.1859	24	1.1289	10	1.2665
51	1.3039	37	1.1810	23	1.1316	9	1.2853
50	1.2878	36	1.1732	22	1.1334	8	1.3029
49	1.2718	35	1.1642	21	1.1370	7	1.3184
48	1.2561	34	1.1533	20	1.1426	6	1.3312
47	1.2414	33	1.1409	19	1.1472	5	1.3417
46	1.2315	32	1.1272	18	1.1512	1 - 4	---
45	1.2256	31	1.1173	17	1.1549		

Core Height (ft) = (Node - 1) * 0.2012

FIGURE 7

W(Z) AS A FUNCTION OF CORE HEIGHT
(11,000 MWD/MTU)

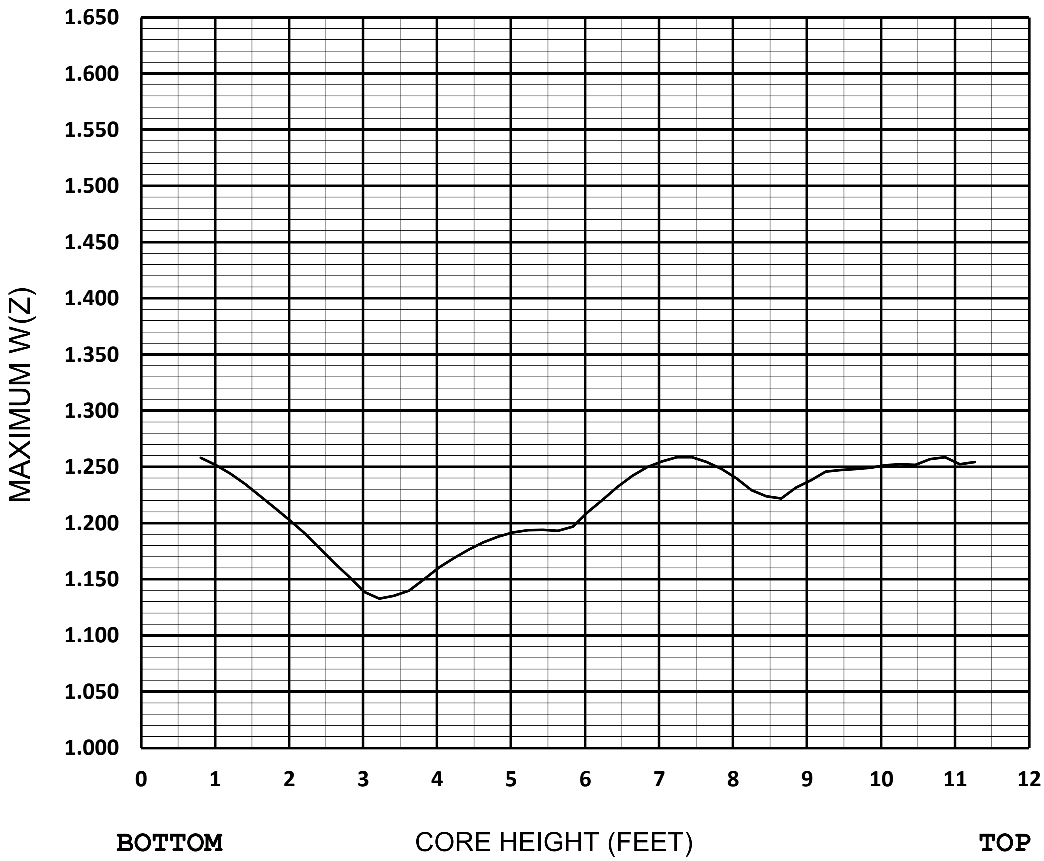


Axial Node	W(Z)	Axial Node	W(Z)	Axial Node	W(Z)	Axial Node	W(Z)
58 - 61	---	44	1.2350	30	1.1355	16	1.1433
57	1.3334	43	1.2345	29	1.1302	15	1.1507
56	1.3290	42	1.2319	28	1.1315	14	1.1632
55	1.3243	41	1.2271	27	1.1320	13	1.1771
54	1.3168	40	1.2246	26	1.1318	12	1.1930
53	1.3088	39	1.2200	25	1.1316	11	1.2082
52	1.2997	38	1.2177	24	1.1311	10	1.2229
51	1.2897	37	1.2145	23	1.1300	9	1.2371
50	1.2803	36	1.2079	22	1.1280	8	1.2504
49	1.2704	35	1.1997	21	1.1284	7	1.2623
48	1.2617	34	1.1893	20	1.1323	6	1.2719
47	1.2552	33	1.1771	19	1.1356	5	1.2796
46	1.2500	32	1.1631	18	1.1383	1 - 4	---
45	1.2403	31	1.1478	17	1.1406		

Core Height (ft) = (Node - 1) * 0.2012

FIGURE 8

W(Z) AS A FUNCTION OF CORE HEIGHT
(18,000 MWD/MTU)



Axial Node	W(Z)	Axial Node	W(Z)	Axial Node	W(Z)	Axial Node	W(Z)
58 - 61	---	44	1.2217	30	1.1969	16	1.1386
57	1.2542	43	1.2237	29	1.1932	15	1.1518
56	1.2523	42	1.2291	28	1.1940	14	1.1644
55	1.2586	41	1.2399	27	1.1936	13	1.1775
54	1.2568	40	1.2481	26	1.1916	12	1.1908
53	1.2516	39	1.2543	25	1.1880	11	1.2023
52	1.2523	38	1.2587	24	1.1828	10	1.2132
51	1.2514	37	1.2585	23	1.1762	9	1.2240
50	1.2491	36	1.2549	22	1.1686	8	1.2346
49	1.2481	35	1.2497	21	1.1604	7	1.2440
48	1.2471	34	1.2421	20	1.1499	6	1.2518
47	1.2456	33	1.2321	19	1.1397	5	1.2581
46	1.2380	32	1.2207	18	1.1354	1 - 4	---
45	1.2315	31	1.2096	17	1.1327		

Core Height (ft) = (Node - 1) * 0.2012

FIGURE 9

AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF RATED THERMAL POWER