FENOC

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May 08, 2008

L-08-163

Technical Specification 5.6.3

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

SUBJECT:
Beaver Valley Power Station, Unit No. 2
Docket No. 50-412, License No. NPF-73
Core Operating Limits Report, Cycle 14

FirstEnergy Nuclear Operating Company (FENOC) hereby submits a revision of the Core Operating Limits Report (COLR) for Beaver Valley Power Station (BVPS) Unit No. 2 as required by Section 5.6.3 of the BVPS Technical Specifications. The BVPS Unit No. 2 COLR 14, effective on April 24, 2008, is enclosed.

No regulatory commitments are contained in this submittal. If there are questions, or additional information is required, please contact Mr. Thomas A. Lentz, Manager – FENOC Fleet Licensing, at 330-761-6071.

Sincerely,

Peter P. Sena III

Enclosure:
Beaver Valley Power Station Unit No. 2 Core Operating Limits Report, COLR-14

cc: Mr. S. J. Collins, NRC Region I Administrator
Mr. D. L. Werkheiser, NRC Senior Resident Inspector
Ms. N. S. Morgan, NRR Project Manager
Mr. D. J. Allard, Director BRP/DEP
Mr. L. E. Ryan (BRP/DEP)

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NRR

L-08-163 Enclosure

Beaver Valley Power Station

Unit No. 2

Core Operating Limits Report

COLR 14

5.0 ADMINISTRATIVE CONTROLS

5.1 Core Operating Limits Report

This Core Operating Limits Report provides the cycle specific parameter limits developed in accordance with the NRC approved methodologies specified in Technical Specification Administrative Control 5.6.3.

5.1.1 SL 2.1.1 Reactor Core Safety Limits

See Figure 5.1-1.

5.1.2 SHUTDOWN MARGIN (SDM)

a. In MODES 1, 2, 3, and 4, SHUTDOWN MARGIN shall be ≥ 1.77% Δk/k.(1)

b. Prior to manually blocking the Low Pressurizer Pressure Safety Injection Signal, the Reactor Coolant System shall be borated to ≥ the MODE 5 boron concentration and shall remain ≥ this boron concentration at all times when this signal is blocked.

c. In MODE 5, SHUTDOWN MARGIN shall be ≥ 1.0% Δk/k.

5.1.3 LCO 3.1.3 Moderator Temperature Coefficient (MTC)

a. Upper Limit - MTC shall be maintained within the acceptable operation limit specified in Technical Specification Figure 3.1.3-1.

b. Lower Limit - MTC shall be maintained less negative than -4.29×10^{-4} Δk/k/°F at RATED THERMAL POWER.

c. 300 ppm Surveillance Limit: (- 35 pcm/°F)

d. 60 ppm Surveillance Limit: (- 41 pcm/°F)

5.1.4 LCO 3.1.5 Shutdown Bank Insertion Limits

The Shutdown Banks shall be withdrawn to at least 225 steps.(2)

5.1.5 LCO 3.1.6 Control Bank Insertion Limits

a. Control Banks A and B shall be withdrawn to at least 225 steps.(2)

b. Control Banks C and D shall be limited in physical insertion as shown in Figure 5.1-2.(2)

c. Sequence Limits - The sequence of withdrawal shall be A, B, C and D bank, in that order.

d. Overlap Limits(2) - Overlap shall be such that step 129 on banks A, B, and C corresponds to step 1 on the following bank. When C bank is fully withdrawn, these limits are verified by confirming D bank is withdrawn at least to a position equal to the all-rods-out position minus 128 steps.

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(1) The MODE 1 and MODE 2 with $k_{eff} \geq 1.0$ SDM requirements are included to address SDM requirements (e.g., MODE 1 Required Actions to verify SDM) that are not within the applicability of LCO 3.1.1, SHUTDOWN MARGIN (SDM).

(2) As indicated by the group demand counter

5.1 Core Operating Limits Report

5.1.6 LCO 3.2.1 Heat Flux Hot Channel Factor ($F_Q(Z)$)

The Heat Flux Hot Channel Factor - $F_Q(Z)$ limit is defined by:

$$F_Q(Z) \le \left[\frac{CFQ}{P}\right] * K(Z) \qquad \text{for } P > 0.5$$

$$F_Q(Z) \le \left[\frac{CFQ}{0.5}\right] * K(Z) \qquad \text{for } P \le 0.5$$

Where: CFQ = 2.40 $P = \dfrac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$

K(Z) = the function obtained from Figure 5.1-3.

$$F_Q^C(Z) = F_Q^M(Z) * 1.0815$$

$$F_Q^W(Z) = F_Q^C(Z) * W(Z)$$

W(Z) values are provided in Table 5.1-1.

The $F_Q(Z)$ penalty function, applied when the analytic $F_Q(Z)$ function increases from one monthly measurement to the next, is provided in Table 5.1-2.

5.1.7 LCO 3.2.2 Nuclear Enthalpy Rise Hot Channel Factor ($F_{\Delta H}^N$)

$$F_{\Delta H}^N \le CF_{\Delta H} * (1 + PF_{\Delta H}(1 - P))$$

Where: $CF_{\Delta H}$ = 1.62

$PF_{\Delta H}$ = 0.3

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

5.1.8 LCO 3.2.3 Axial Flux Difference (AFD)

The AFD acceptable operation limits are provided in Figure 5.1-4.

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5.1.9 LCO 3.3.1 Reactor Trip System Instrumentation - Overtemperature and Overpower ΔT Parameter Values from Table Notations 3 and 4

a. Overtemperature ΔT Setpoint Parameter Values:

Parameter	Value
Overtemperature ΔT reactor trip setpoint	$K1 \leq 1.239$
Overtemperature ΔT reactor trip setpoint Tavg coefficient	$K2 \geq 0.0183/°F$
Overtemperature ΔT reactor trip setpoint pressure coefficient	$K3 \geq 0.001/psia$
Tavg at RATED THERMAL POWER	$T' \leq 574.2°F$(1)
Nominal pressurizer pressure	$P' \geq 2250$ psia
Measured reactor vessel ΔT lead/lag time constants (* The response time is toggled off to meet the analysis value of zero.)	$\tau_1 = 0$ sec* $\tau_2 = 0$ sec*
Measured reactor vessel ΔT lag time constant	$\tau_3 \leq 6$ secs
Measured reactor vessel average temperature lead/lag time constants	$\tau_4 \geq 30$ secs $\tau_5 \leq 4$ secs
Measured reactor vessel average temperature lag time constant	$\tau_6 \leq 2$ secs

f (ΔI) is a function of the indicated difference between top and bottom detectors of the power-range nuclear ion chambers; with gains to be selected based on measured instrument response during plant startup tests such that:

(i) For $q_t - q_b$ between -37% and +15%, $f_1(\Delta I) = 0$, where q_t and q_b are percent RATED THERMAL POWER in the top and bottom halves of the core respectively, and $q_t + q_b$ is total THERMAL POWER in percent of RATED THERMAL POWER.

(1) T' represents the cycle-specific Full Power Tavg value used in core design.

5.1 Core Operating Limits Report

(ii) For each percent that the magnitude of $(q_t - q_b)$ exceeds -37%, the ΔT trip setpoint shall be automatically reduced by 2.52% of its value at RATED THERMAL POWER.

(iii) For each percent that the magnitude of $(q_t - q_b)$ exceeds +15%, the ΔT trip setpoint shall be automatically reduced by 1.47% of its value at RATED THERMAL POWER.

b. Overpower ΔT Setpoint Parameter Values:

Parameter	Value
Overpower ΔT reactor trip setpoint	$K4 \leq 1.094$
Overpower ΔT reactor trip setpoint Tavg rate/lag coefficient	$K5 \geq 0.02/°F$ for increasing average temperature $K5 = 0/°F$ for decreasing average temperature
Overpower ΔT reactor trip setpoint Tavg heatup coefficient	$K6 \geq 0.0021/°F$ for $T > T''$ $K6 = 0/°F$ for $T \leq T''$
Tavg at RATED THERMAL POWER	$T'' \leq 574.2°F$(1)
Measured reactor vessel ΔT lead/lag time constants	$\tau_1 = 0$ sec* $\tau_2 = 0$ sec*

(* The response time is toggled off to meet the analysis value of zero.)

Parameter	Value
Measured reactor vessel ΔT lag time constant	$\tau_3 \leq 6$ secs
Measured reactor vessel average temperature lag time constant	$\tau_6 \leq 2$ secs
Measured reactor vessel average temperature rate/lag time constant	$\tau_7 \geq 10$ secs

(1) T" represents the cycle-specific Full Power Tavg value used in core design.

5.1 Core Operating Limits Report

5.1.10 LCO 3.4.1, RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits

Parameter	Indicated Value
Reactor Coolant System Tavg	Tavg ≤ 577.8°F(1)
Pressurizer Pressure	Pressure ≥ 2214 psia(2)
Reactor Coolant System Total Flow Rate	Flow ≥ 267,300 gpm(3)

(1) The Reactor Coolant System (RCS) indicated Tavg value is determined by adding the appropriate allowances for rod control operation and verification via control board indication (3.6°F) to the cycle specific full power Tavg used in the core design.

(2) The pressurizer pressure value includes allowances for pressurizer pressure control operation and verification via control board indication.

(3) The RCS total flow rate includes allowances for normalization of the cold leg elbow taps with a beginning of cycle precision RCS flow calorimetric measurement and verification on a periodic basis via control board indication.

5.1 Core Operating Limits Report

5.1.11 LCO 3.9.1 Boron Concentration (MODE 6)

The boron concentration of the Reactor Coolant System, the refueling canal, and the refueling cavity shall be maintained ≥ 2400 ppm. This value includes a 50 ppm conservative allowance for uncertainties.

5.1 Core Operating Limits Report

5.1.12 References

1. WCAP-9272-P-A, "WESTINGHOUSE RELOAD SAFETY EVALUATION METHODOLOGY," July 1985 (Westinghouse Proprietary).

2. WCAP-8745-P-A, "Design Bases for the Thermal Overtemperature ΔT and Thermal Overpower ΔT Trip Functions," September 1986.

3. WCAP-12945-P-A, Volume 1 (Revision 2) and Volumes 2 through 5 (Revision 1), "Code Qualification Document for Best Estimate LOCA Analysis," March 1998 (Westinghouse Proprietary).

4. WCAP-10216-P-A, Revision 1A, "Relaxation of Constant Axial Offset Control-F_Q Surveillance Technical Specification," February 1994.

5. WCAP-14565-P-A, "VIPRE-01 Modeling and Qualification for Pressurized Water Reactor Non-LOCA Thermal-Hydraulic Safety Analysis," October 1999.

6. WCAP-12610-P-A, "VANTAGE+ Fuel Assembly Reference Core Report," April 1995 (Westinghouse Proprietary).

7. WCAP-15025-P-A, "Modified WRB-2 Correlation, WRB-2M, for Predicating Critical Heat Flux in 17x17 Rod Bundles with Modified LPD Mixing Vane Grids," April 1999.

8. Caldon, Inc. Engineering Report-80P, "Improving Thermal Power Accuracy and Plant Safety While Increasing Operating Power Level Using the LEFM√™ System," Revision 0, March 1997.

9. Caldon, Inc. Engineering Report-160P, "Supplement to Topical Report ER-80P: Basis for a Power Uprate With the LEFM√™ System," Revision 0, May 2000.

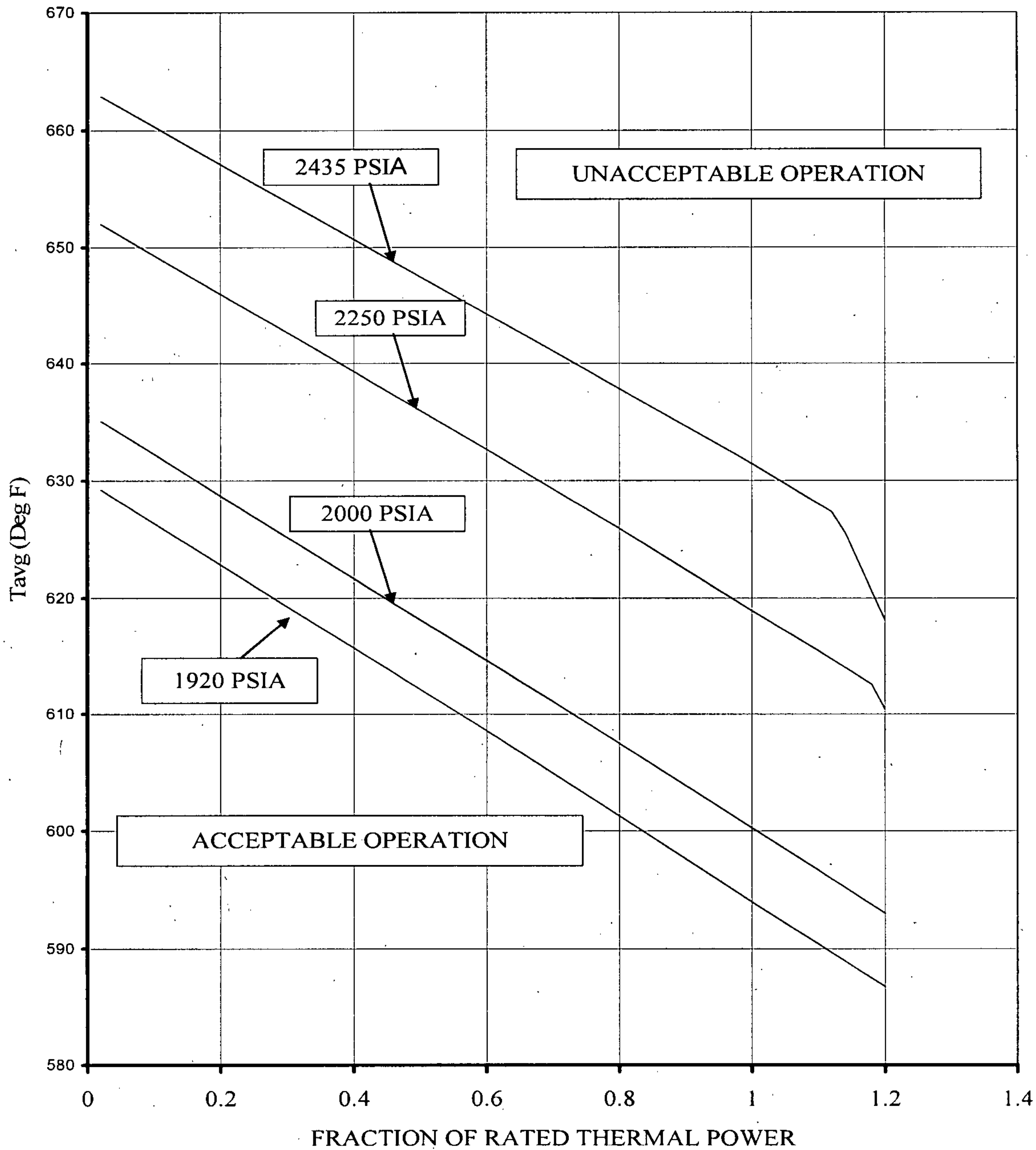

Figure 5.1-1 (Page 1 of 1)

REACTOR CORE SAFETY LIMIT
THREE LOOP OPERATION

(Technical Specification Safety Limit 2.1.1)

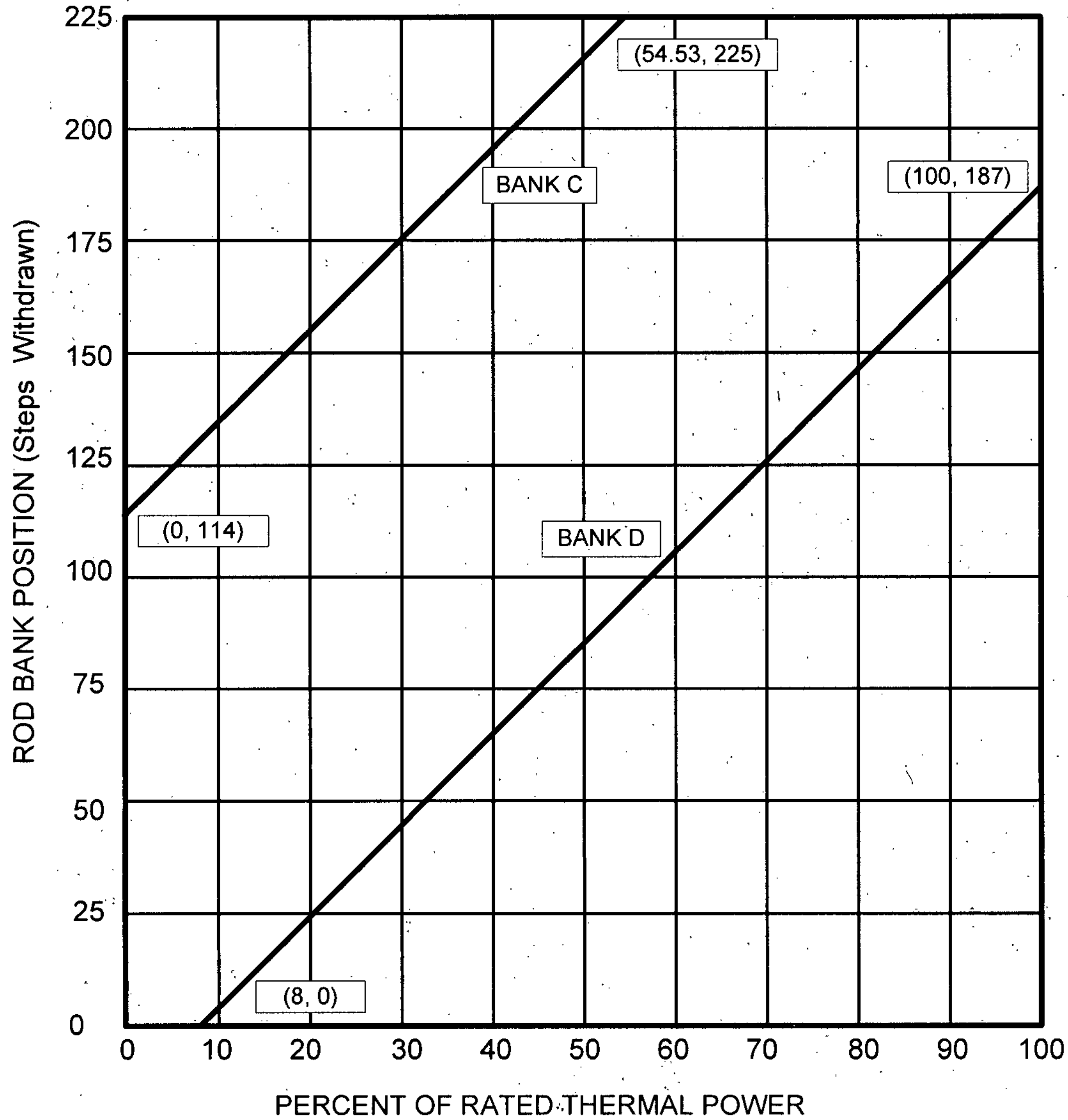

Figure 5.1-2 (Page 1 of 1)

CONTROL ROD INSERTION LIMITS AS A

FUNCTION OF RATED POWER LEVEL

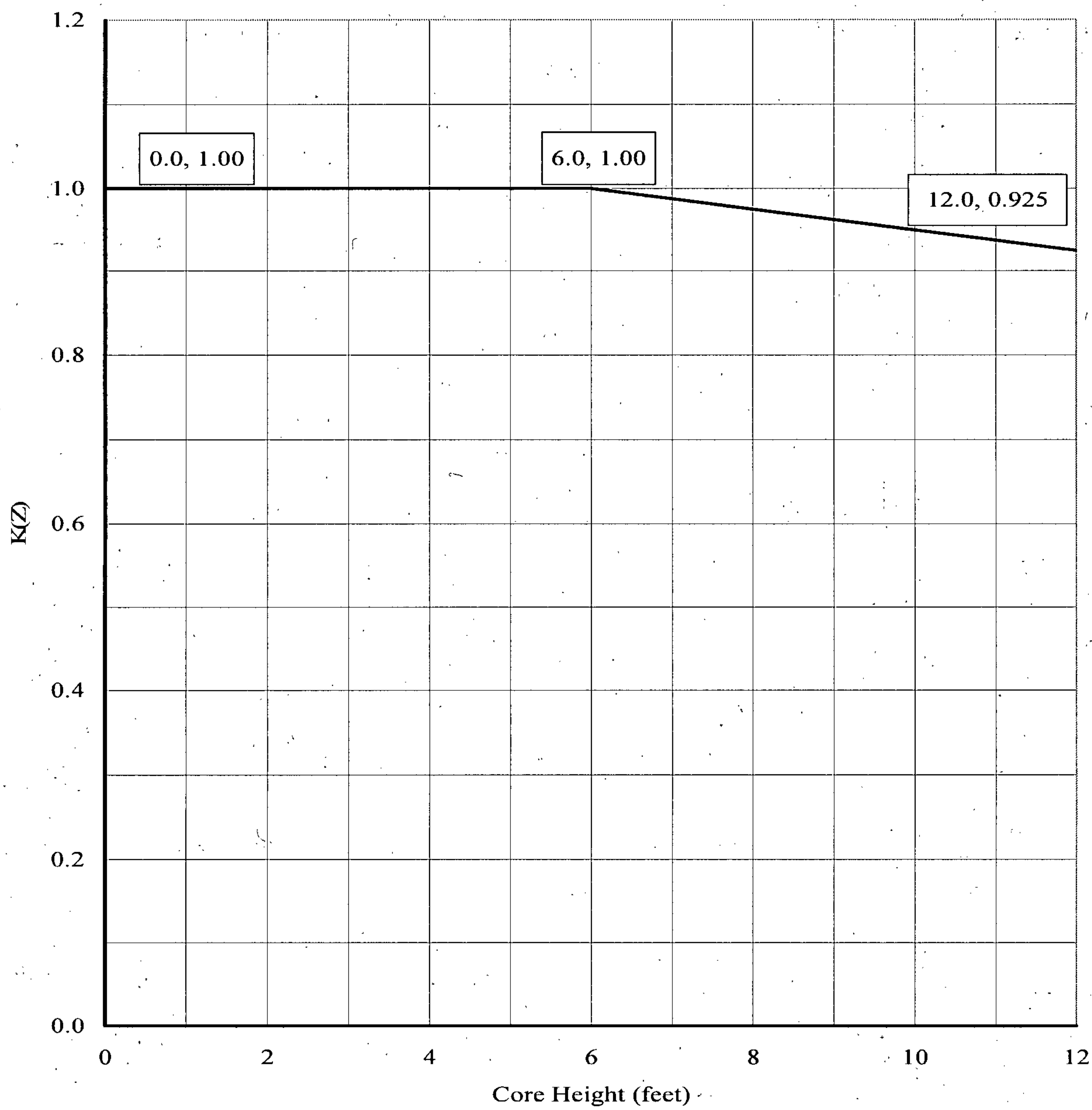

Figure 5.1-3 (Page 1 of 1)

F_QT NORMALIZED OPERATING ENVELOPE, K(Z)

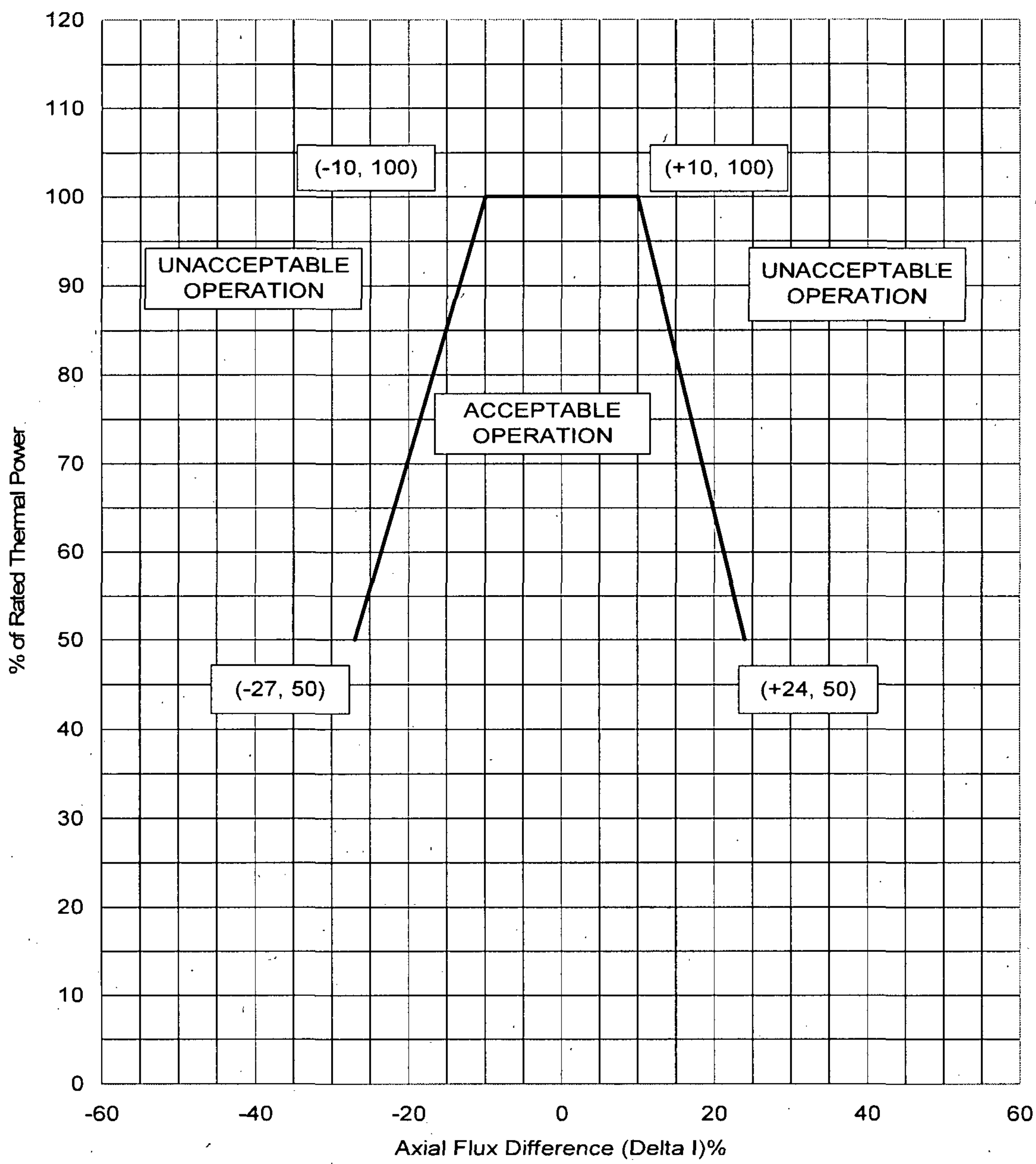

Figure 5.1-4 (Page 1 of 1)

AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF

PERCENT OF RATED THERMAL POWER FOR RAOC

Table 5.1-1 (Page 1 of 2)
F_Q Surveillance W(Z) Function versus Burnup

Exclusion Zone	Axial Point	Elevation (feet)	150 MWD/MTU	3000 MWD/MTU	10000 MWD/MTU	16000 MWD/MTU
*	1	12.0	1.0000	1.0000	1.0000	1.0000
*	2	11.8	1.0000	1.0000	1.0000	1.0000
*	3	11.6	1.0000	1.0000	1.0000	1.0000
*	4	11.4	1.0000	1.0000	1.0000	1.0000
*	5	11.2	1.0000	1.0000	1.0000	1.0000
*	6	11.0	1.0000	1.0000	1.0000	1.0000
*	7	10.8	1.0000	1.0000	1.0000	1.0000
	8	10.6	1.1811	1.2116	1.2624	1.2602
	9	10.4	1.1705	1.2034	1.2492	1.2368
	10	10.2	1.1578	1.1942	1.2367	1.2170
	11	10.0	1.1463	1.1843	1.2275	1.2124
	12	9.8	1.1408	1.1741	1.2171	1.2128
	13	9.6	1.1391	1.1620	1.2063	1.2130
	14	9.4	1.1386	1.1553	1.1947	1.2162
	15	9.2	1.1355	1.1534	1.1848	1.2216
	16	9.0	1.1301	1.1500	1.1810	1.2235
	17	8.8	1.1365	1.1572	1.1921	1.2266
	18	8.6	1.1491	1.1688	1.2071	1.2370
	19	8.4	1.1601	1.1782	1.2184	1.2501
	20	8.2	1.1687	1.1851	1.2272	1.2590
	21	8.0	1.1753	1.1898	1.2333	1.2651
	22	7.8	1.1800	1.1925	1.2370	1.2686
	23	7.6	1.1829	1.1934	1.2384	1.2696
	24	7.4	1.1840	1.1925	1.2375	1.2680
	25	7.2	1.1833	1.1897	1.2344	1.2640
	26	7.0	1.1809	1.1852	1.2289	1.2574
	27	6.8	1.1767	1.1789	1.2212	1.2484
	28	6.6	1.1710	1.1710	1.2115	1.2370
	29	6.4	1.1638	1.1616	1.1998	1.2237
	30	6.2	1.1552	1.1509	1.1865	1.2086
	31	6.0	1.1456	1.1387	1.1715	1.1903
	32	5.8	1.1340	1.1269	1.1556	1.1778

Note: Top and Bottom 10% Excluded

TABLE 5.1-1 (Page 2 of 2)
F_Q Surveillance W(Z) Function versus Burnup

Exclusion Zone	Axial Point	Elevation (feet)	150 MWD/MTU	3000 MWD/MTU	10000 MWD/MTU	16000 MWD/MTU
	33	5.6	1.1286	1.1216	1.1403	1.1709
	34	5.4	1.1354	1.1224	1.1291	1.1625
	35	5.2	1.1423	1.1269	1.1257	1.1558
	36	5.0	1.1484	1.1311	1.1233	1.1507
	37	4.8	1.1540	1.1346	1.1199	1.1452
	38	4.6	1.1590	1.1376	1.1162	1.1392
	39	4.4	1.1636	1.1402	1.1120	1.1349
	40	4.2	1.1676	1.1426	1.1072	1.1311
	41	4.0	1.1714	1.1443	1.1040	1.1268
	42	3.8	1.1744	1.1468	1.1045	1.1221
	43	3.6	1.1779	1.1517	1.1080	1.1172
	44	3.4	1.1847	1.1582	1.1109	1.1122
	45	3.2	1.1933	1.1650	1.1130	1.1105
	46	3.0	1.2071	1.1748	1.1169	1.1120
	47	2.8	1.2252	1.1875	1.1248	1.1213
	48	2.6	1.2423	1.1994	1.1373	1.1360
	49	2.4	1.2592	1.2105	1.1531	1.1532
	50	2.2	1.2758	1.2258	1.1693	1.1705
	51	2.0	1.2916	1.2457	1.1849	1.1871
	52	1.8	1.3067	1.2669	1.2000	1.2032
	53	1.6	1.3208	1.2873	1.2143	1.2186
	54	1.4	1.3326	1.3060	1.2275	1.2330
*	55	1.2	1.0000	1.0000	1.0000	1.0000
*	56	1.0	1.0000	1.0000	1.0000	1.0000
*	57	0.8	1.0000	1.0000	1.0000	1.0000
*	58	0.6	1.0000	1.0000	1.0000	1.0000
*	59	0.4	1.0000	1.0000	1.0000	1.0000
*	60	0.2	1.0000	1.0000	1.0000	1.0000
*	61	0.0	1.0000	1.0000	1.0000	1.0000

Note: Top and Bottom 10% Excluded

Table 5.1-2 (Page 1 of 1)
$F_Q(Z)$ Penalty Factor versus Burnup

Cycle Burnup (MWD/MTU)	$F_Q(Z)$ Penalty Factor
0 to 1350	1.0376
1351 to EOL	1.02

Note: The Penalty Factor, to be applied to $F_Q(Z)$ in accordance with Technical Specification Surveillance Requirement (SR) 3.2.1.2, is the maximum factor by which $F_Q(Z)$ is expected to increase over a 39 Effective Full Power Day (EFPD) interval (surveillance interval of 31 EFPD plus the maximum allowable extension not to exceed 25% of the surveillance interval per Technical Specification SR 3.0.2) starting from the burnup at which the $F_Q(Z)$ was determined.