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October 25, 2007
L-07-137

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

Subject: Beaver Valley Power Station, Unit No. 1
Docket No. 50-334, License No. DPR-66
Core Operating Limits Report, COLR 19 and COLR 19-1

FirstEnergy Nuclear Operating Company (FENOC) hereby submits two revisions of the Core Operating Limits Report (COLR) for Beaver Valley Power Station (BVPS) Unit No. 1, as required by Section 5.6.3 of the BVPS Technical Specifications. The BVPS Unit No. 1 COLR 19 and COLR 19-1 are enclosed. Unit No. 1 COLR 19, effective October 5, 2007, was issued to reflect the original Unit 1 Cycle 19 core design. Unit No. 1 COLR 19-1, effective October 20, 2007, reflects the replacement of four fuel assemblies in the original Cycle 19 core design.

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

Sincerely,

Peter P. Sena III

Enclosures:
A Beaver Valley Power Station Unit No. 1, Core Operating Limits Report, COLR 19
B Beaver Valley Power Station Unit No. 1, Core Operating Limits Report, COLR 19-1

A001
NRR

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

L-07-137 Enclosure A

Beaver Valley Power Station

Unit No. 1

Core Operating Limits Report

COLR 19

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 - 4.4 x 10^{-4} Δk/k/°F at RATED THERMAL POWER.

c. 300 ppm Surveillance Limit: (- 37 pcm/°F)

d. 60 ppm Surveillance Limit: (- 43 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} ≥ 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.

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

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

The 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 Core Operating Limits Report

5.1.8 LCO 3.2.3 Axial Flux Difference (AFD)

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

5.1.9 LCO 3.3.1 Reactor Trip System Instrumentation - Overtemperature and Overpower ΔT Parameter Values from Table Notations 1 and 2

a. Overtemperature ΔT Setpoint Parameter Values:

Parameter	Value
Overtemperature ΔT reactor trip setpoint	$K1 \leq 1.242$
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	$T' \leq 577.9°F$(1)
Nominal pressurizer pressure	$P' \geq 2250$ psia
Measured reactor vessel average temperature lead/lag time constants	$\tau_1 \geq 30$ secs $\tau_2 \leq 4$ secs
Measured reactor vessel ΔT lag time constant	$\tau_4 \leq 6$ secs
Measured reactor vessel average temperature lag time constant	$\tau_5 \leq 2$ 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(ΔI) = 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).

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(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 ≤ 1.085
Overpower ΔT reactor trip setpoint Tavg rate/lag coefficient	K5 ≥ 0.02/°F for increasing average temperature K5 = 0/°F for decreasing average temperature
Overpower ΔT reactor trip setpoint Tavg heatup coefficient	K6 ≥ 0.0021/°F for T > T" K6 = 0/°F for T ≤ T"
Tavg at RATED THERMAL POWER	T" ≤ 577.9°F(2)
Measured reactor vessel average temperature rate/lag time constant	τ_3 ≥ 10 secs
Measured reactor vessel ΔT lag time constant	τ_4 ≤ 6 secs
Measured reactor vessel average temperature lag time constant	τ_5 ≤ 2 secs

(2) 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 ≤ 581.5°F(1)
Pressurizer Pressure	Pressure ≥ 2218 psia(2)
Reactor Coolant System Total Flow Rate	Flow ≥ 267,300 gpm(3)

(1) The Reactor Coolant System (RCS) indicated T_{avg} 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 T_{avg} 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.

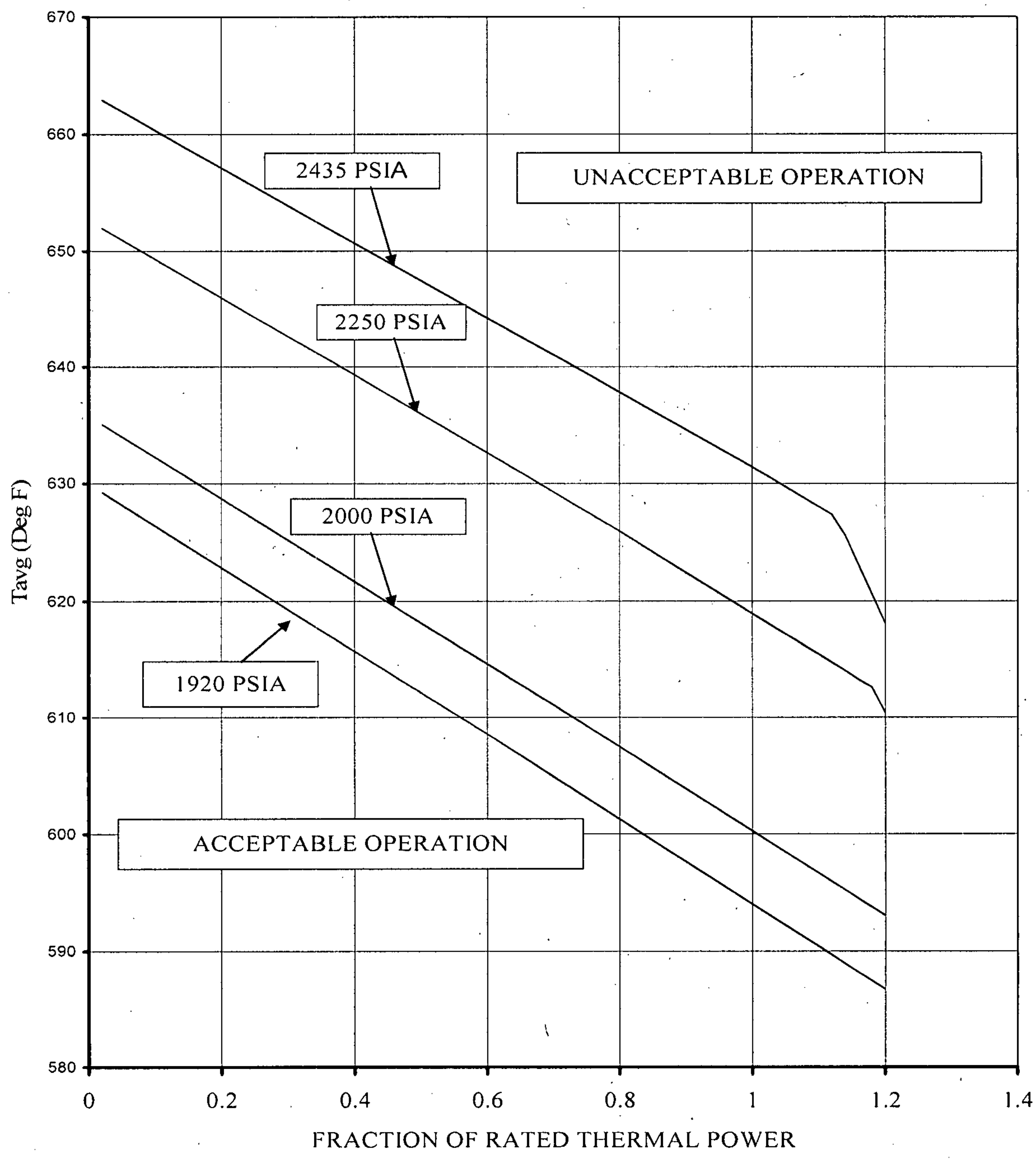

Figure 5.1-1 (Page 1 of 1)

REACTOR CORE SAFETY LIMIT
THREE LOOP OPERATION
(Technical Specification Safety Limit 2.1.1)

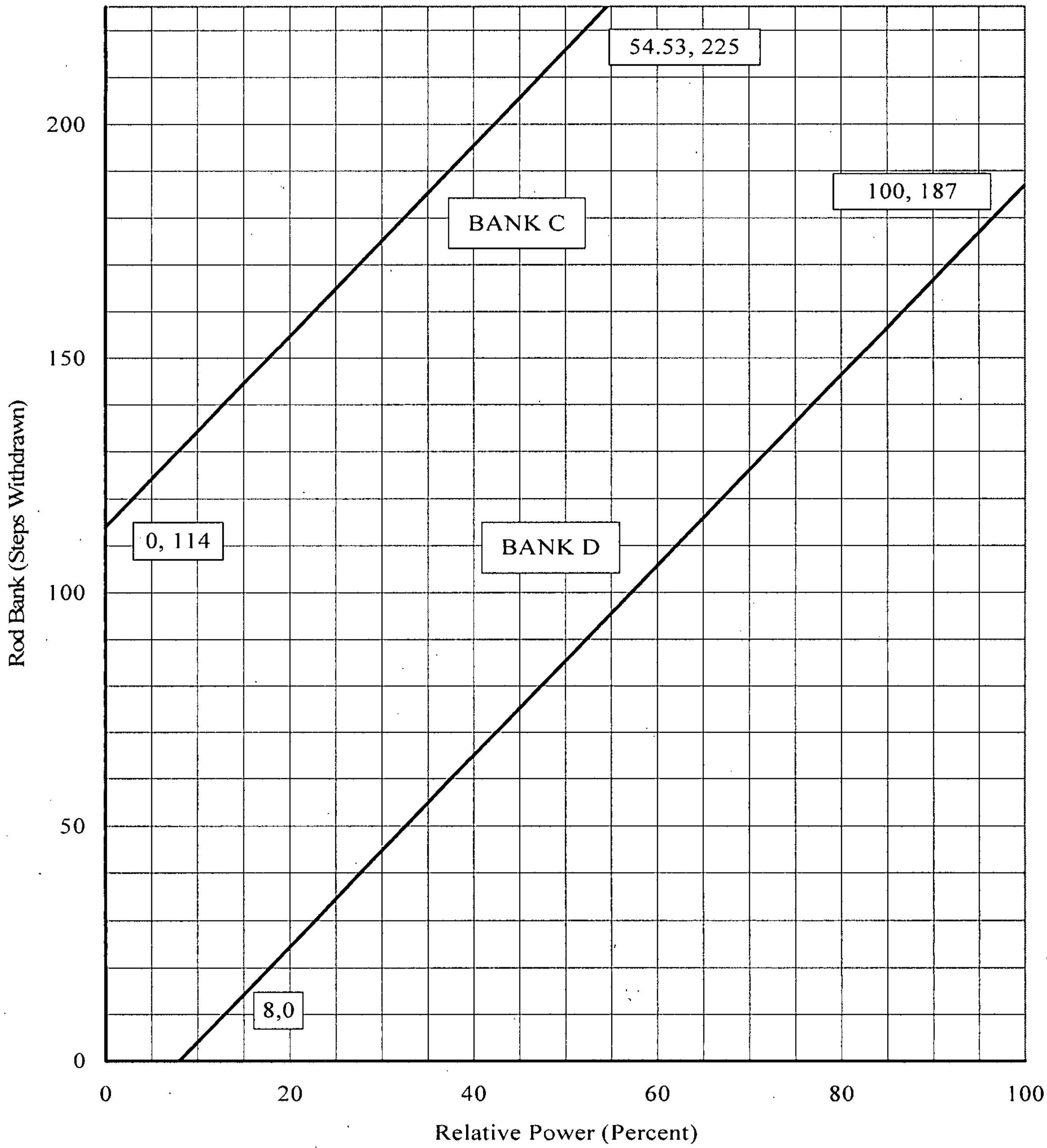

Figure 5.1-2 (Page 1 of 1)

CONTROL ROD INSERTION LIMITS

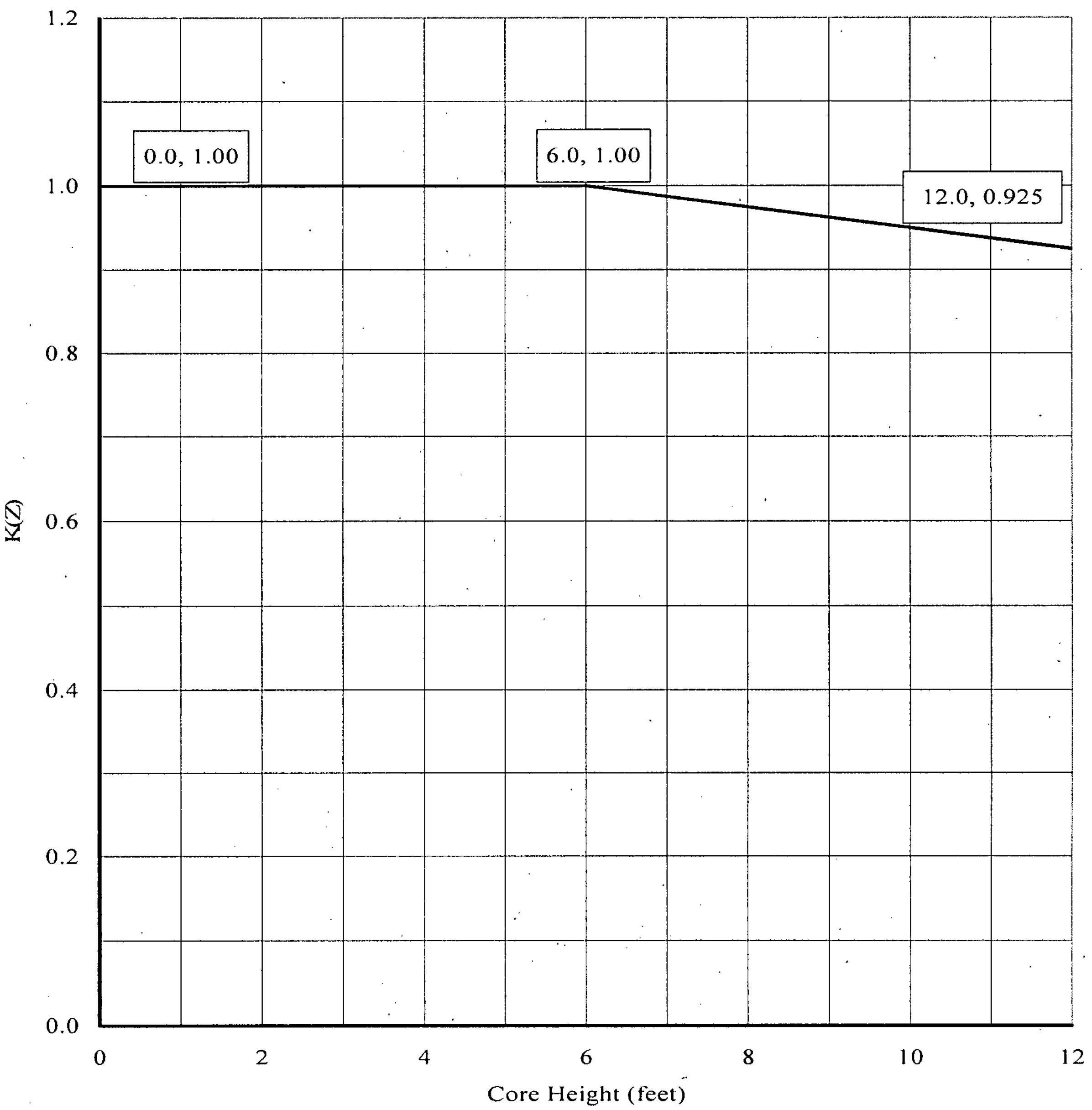

Figure 5.1-3 (Page 1 of 1)

F_QT NORMALIZED OPERATING ENVELOPE, K(Z)

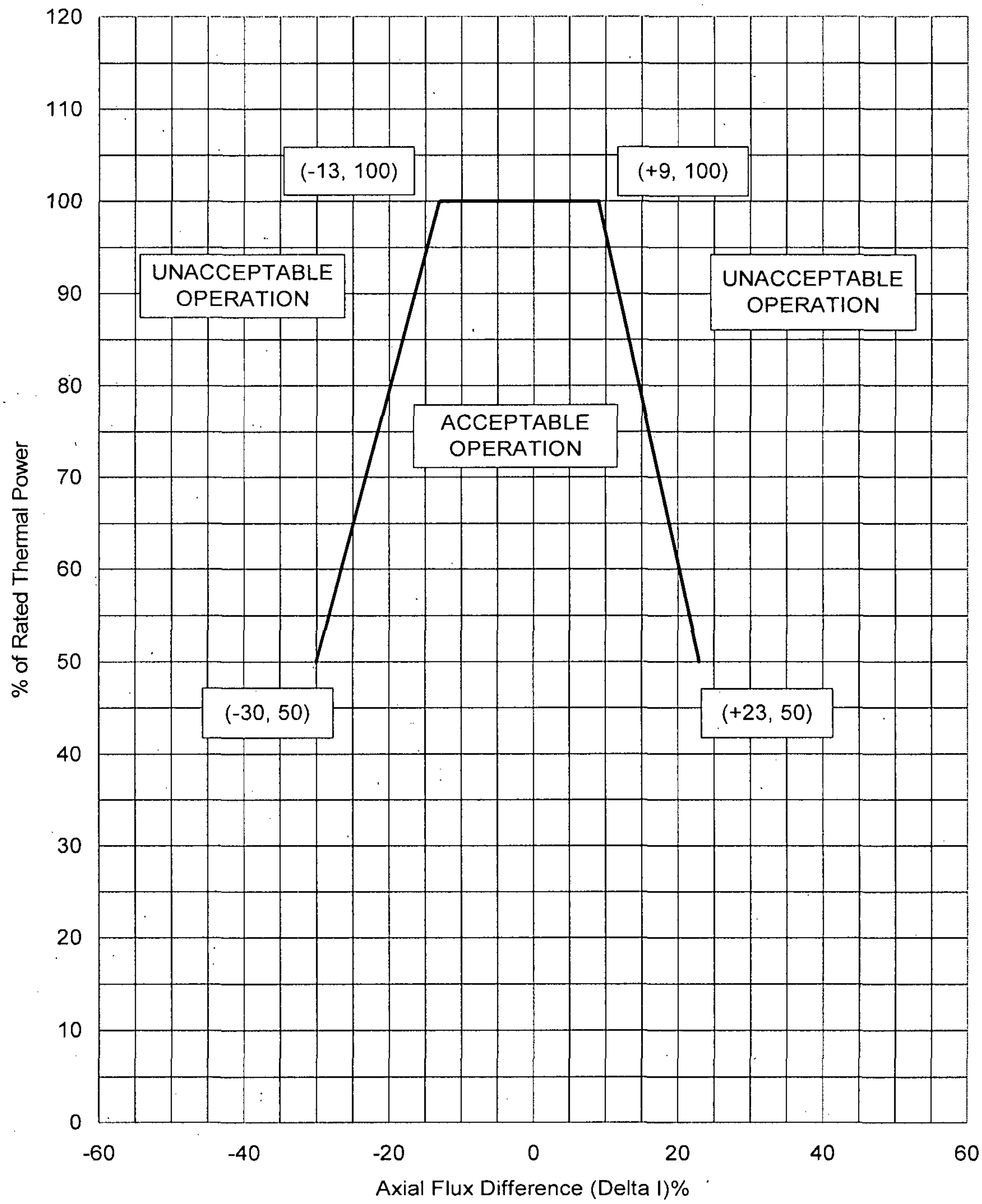

Figure 5.1-4 (Page 1 of 1)

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	18000 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	1.1989	1.2524	1.2759	1.2468
	9	10.4	1.1850	1.2495	1.2651	1.2279
	10	10.2	1.1714	1.2401	1.2521	1.2103
	11	10.0	1.1596	1.2292	1.2393	1.2023
	12	9.8	1.1497	1.2190	1.2265	1.2035
	13	9.6	1.1378	1.2091	1.2119	1.2080
	14	9.4	1.1341	1.1994	1.2028	1.2136
	15	9.2	1.1349	1.1889	1.1983	1.2183
	16	9.0	1.1332	1.1783	1.1923	1.2207
	17	8.8	1.1441	1.1770	1.1993	1.2259
	18	8.6	1.1583	1.1795	1.2108	1.2329
	19	8.4	1.1685	1.1842	1.2191	1.2413
	20	8.2	1.1770	1.1863	1.2251	1.2505
	21	8.0	1.1832	1.1868	1.2287	1.2566
	22	7.8	1.1872	1.1857	1.2299	1.2599
	23	7.6	1.1891	1.1829	1.2288	1.2607
	24	7.4	1.1891	1.1788	1.2256	1.2590
	25	7.2	1.1872	1.1745	1.2203	1.2549
	26	7.0	1.1835	1.1700	1.2131	1.2484
	27	6.8	1.1783	1.1643	1.2041	1.2399
	28	6.6	1.1715	1.1571	1.1935	1.2292
	29	6.4	1.1634	1.1487	1.1814	1.2171
	30	6.2	1.1541	1.1391	1.1680	1.2060

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	18000 MWD/MTU
	31	6.0	1.1440	1.1289	1.1532	1.1965
	32	5.8	1.1317	1.1166	1.1386	1.1863
	33	5.6	1.1274	1.1112	1.1263	1.1742
	34	5.4	1.1380	1.1187	1.1175	1.1650
	35	5.2	1.1472	1.1246	1.1128	1.1660
	36	5.0	1.1552	1.1295	1.1129	1.1674
	37	4.8	1.1631	1.1342	1.1144	1.1664
	38	4.6	1.1702	1.1383	1.1148	1.1649
	39	4.4	1.1767	1.1420	1.1149	1.1622
	40	4.2	1.1826	1.1446	1.1145	1.1587
	41	4.0	1.1880	1.1496	1.1147	1.1544
	42	3.8	1.1923	1.1563	1.1173	1.1492
	43	3.6	1.1967	1.1619	1.1225	1.1438
	44	3.4	1.2047	1.1669	1.1270	1.1400
	45	3.2	1.2148	1.1743	1.1294	1.1387
	46	3.0	1.2240	1.1839	1.1381	1.1427
	47	2.8	1.2340	1.1997	1.1553	1.1581
	48	2.6	1.2504	1.2251	1.1744	1.1768
	49	2.4	1.2752	1.2504	1.1935	1.1951
	50	2.2	1.3012	1.2752	1.2123	1.2128
	51	2.0	1.3257	1.2999	1.2306	1.2300
	52	1.8	1.3495	1.3236	1.2481	1.2465
	53	1.6	1.3718	1.3460	1.2646	1.2621
	54	1.4	1.3919	1.3664	1.2797	1.2767
*	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 - 900	1.0202
901 - 4950	1.02
4951 - 5550	1.0225
> 5550	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.

L-07-137 Enclosure B

Beaver Valley Power Station

Unit No. 1

Core Operating Limits Report

COLR 19-1

5.0 ADMINISTRATIVE CONTROLS

5.1 Core Operating Limits Report

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5.1.1 SL 2.1.1 Reactor Core Safety Limits

See Figure 5.1-1.

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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.

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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} ≥ 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:

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

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

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

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

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

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

The 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 ($F_{\Delta H}^N$)

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

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

$PF_{\Delta H}$ = 0.3

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

5.1 Core Operating Limits Report

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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a. Overtemperature ΔT Setpoint Parameter Values:

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Overtemperature ΔT reactor trip setpoint pressure coefficient	$K3 \geq 0.001/psia$
Tavg at RATED THERMAL POWER	$T' \leq 577.9°F$[1]
Nominal pressurizer pressure	$P' \geq 2250$ psia
Measured reactor vessel average temperature lead/lag time constants	$\tau_1 \geq 30$ secs $\tau_2 \leq 4$ secs
Measured reactor vessel ΔT lag time constant	$\tau_4 \leq 6$ secs
Measured reactor vessel average temperature lag time constant	$\tau_5 \leq 2$ 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(ΔI) = 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 ≤ 1.085
Overpower ΔT reactor trip setpoint Tavg rate/lag coefficient	K5 ≥ 0.02/°F for increasing average temperature K5 = 0/°F for decreasing average temperature
Overpower ΔT reactor trip setpoint Tavg heatup coefficient	K6 ≥ 0.0021/°F for T > T" K6 = 0/°F for T ≤ T"
Tavg at RATED THERMAL POWER	T" ≤ 577.9°F[(2)]
Measured reactor vessel average temperature rate/lag time constant	τ_3 ≥ 10 secs
Measured reactor vessel ΔT lag time constant	τ_4 ≤ 6 secs
Measured reactor vessel average temperature lag time constant	τ_5 ≤ 2 secs

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

5.1 Core Operating Limits Report

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(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

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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

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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.

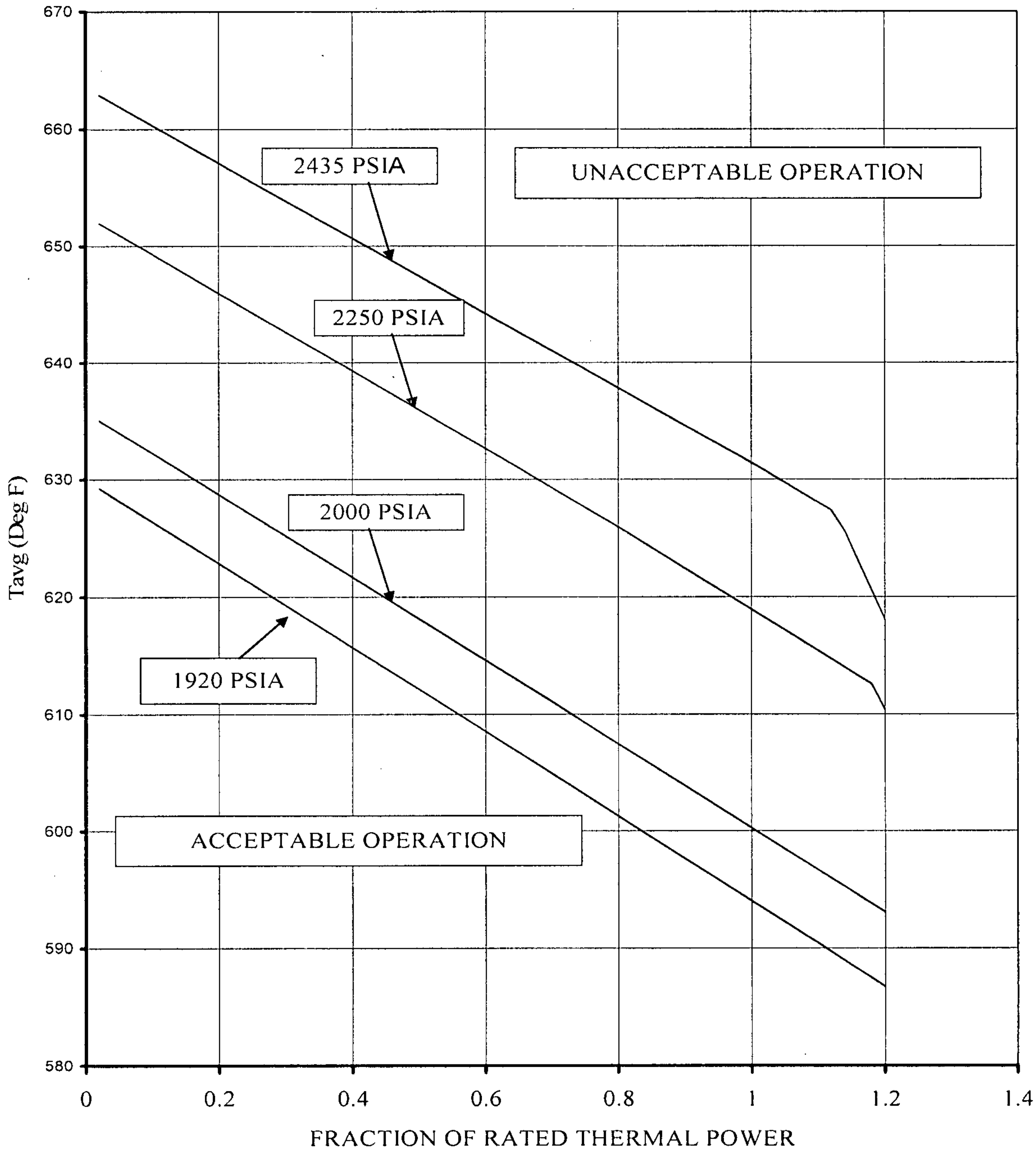

Figure 5.1-1 (Page 1 of 1)

REACTOR CORE SAFETY LIMIT
THREE LOOP OPERATION
(Technical Specification Safety Limit 2.1.1)

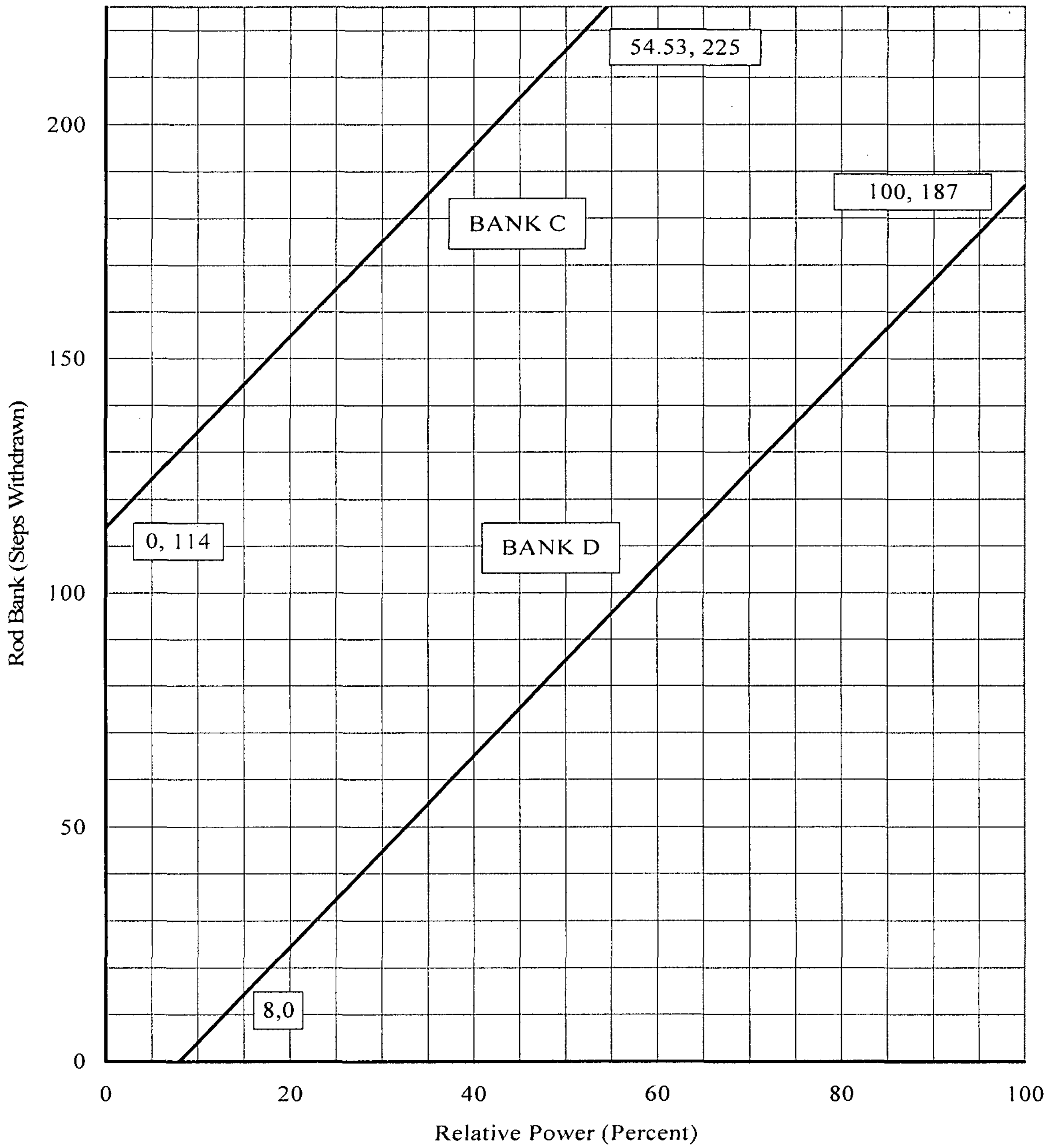

Figure 5.1-2 (Page 1 of 1)

CONTROL ROD INSERTION LIMITS

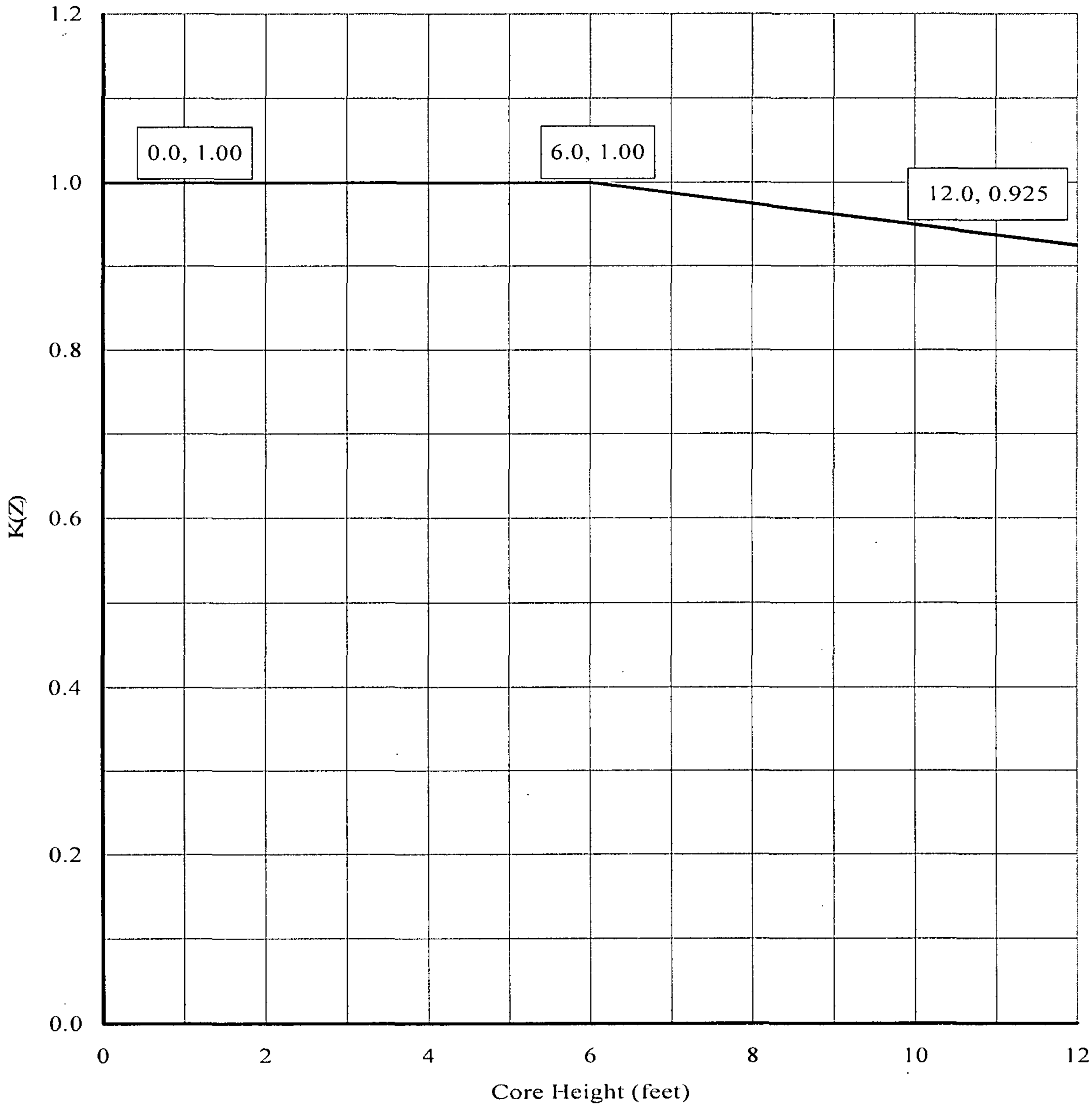

Figure 5.1-3 (Page 1 of 1)

$F_Q T$ NORMALIZED OPERATING ENVELOPE, K(Z)

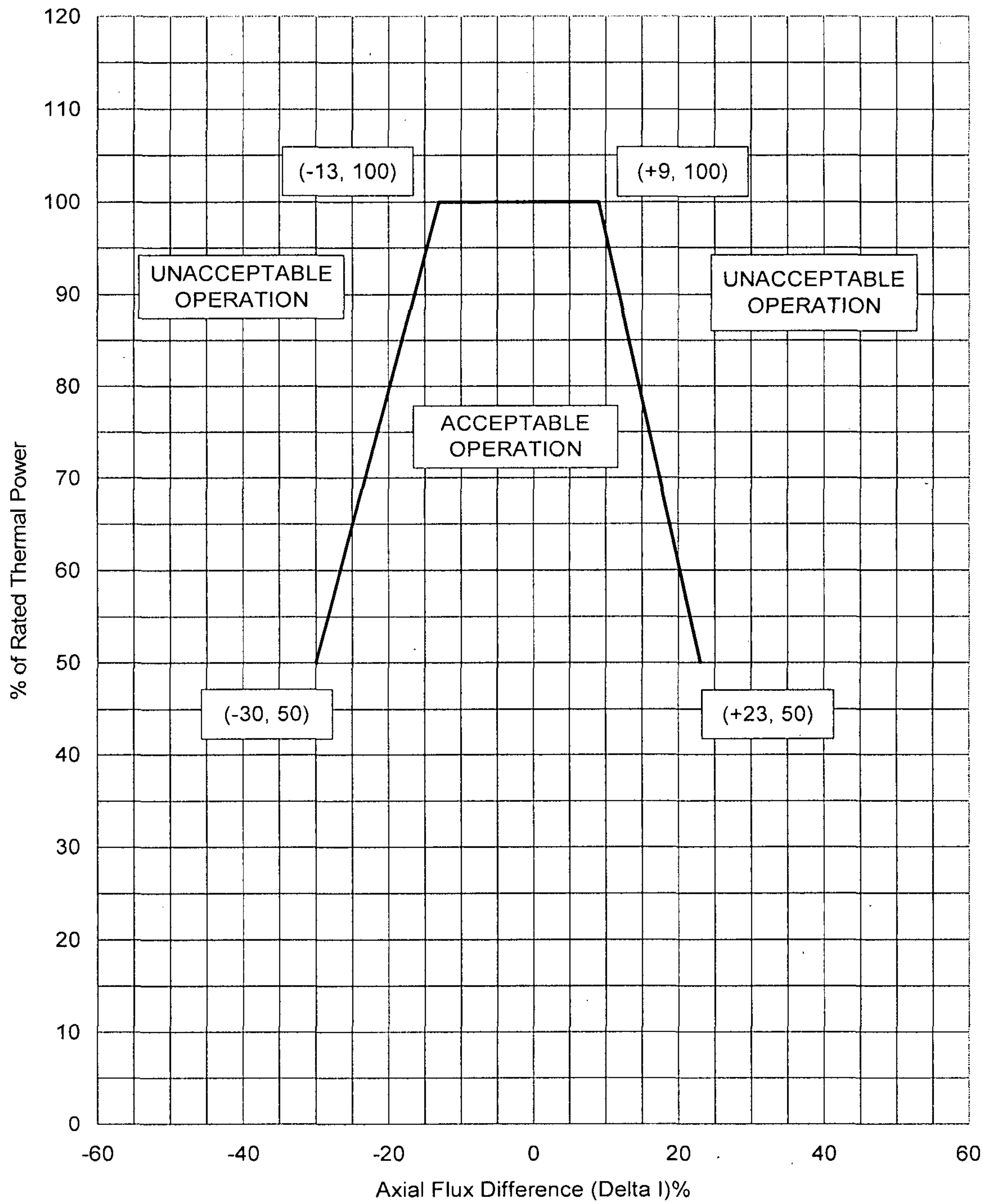

Figure 5.1-4 (Page 1 of 1)

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	18000 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	1.1633	1.1809	1.2302	1.2354
	9	10.4	1.1504	1.1709	1.2240	1.2152
	10	10.2	1.1384	1.1588	1.2172	1.1948
	11	10.0	1.1299	1.1482	1.2094	1.1826
	12	9.8	1.1272	1.1458	1.2044	1.1845
	13	9.6	1.1237	1.1435	1.1981	1.1863
	14	9.4	1.1201	1.1395	1.1909	1.1856
	15	9.2	1.1180	1.1344	1.1820	1.1857
	16	9.0	1.1173	1.1292	1.1729	1.1885
	17	8.8	1.1260	1.1331	1.1823	1.1884
	18	8.6	1.1368	1.1430	1.1961	1.1931
	19	8.4	1.1447	1.1531	1.2051	1.2044
	20	8.2	1.1513	1.1605	1.2124	1.2142
	21	8.0	1.1561	1.1659	1.2172	1.2217
	22	7.8	1.1591	1.1693	1.2195	1.2269
	23	7.6	1.1603	1.1707	1.2194	1.2298
	24	7.4	1.1600	1.1702	1.2170	1.2304
	25	7.2	1.1589	1.1681	1.2126	1.2289
	26	7.0	1.1587	1.1646	1.2064	1.2254
	27	6.8	1.1576	1.1597	1.1987	1.2224
	28	6.6	1.1549	1.1536	1.1894	1.2192
	29	6.4	1.1511	1.1463	1.1788	1.2142
	30	6.2	1.1461	1.1379	1.1668	1.2074

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	18000 MWD/MTU
	31	6.0	1.1406	1.1282	1.1533	1.1987
	32	5.8	1.1319	1.1188	1.1397	1.1885
	33	5.6	1.1280	1.1181	1.1269	1.1764
	34	5.4	1.1360	1.1296	1.1167	1.1658
	35	5.2	1.1449	1.1394	1.1139	1.1653
	36	5.0	1.1530	1.1481	1.1163	1.1654
	37	4.8	1.1607	1.1566	1.1223	1.1644
	38	4.6	1.1677	1.1643	1.1271	1.1626
	39	4.4	1.1741	1.1713	1.1315	1.1597
	40	4.2	1.1800	1.1778	1.1353	1.1560
	41	4.0	1.1847	1.1837	1.1387	1.1509
	42	3.8	1.1906	1.1888	1.1417	1.1487
	43	3.6	1.2000	1.1938	1.1443	1.1519
	44	3.4	1.2115	1.2014	1.1465	1.1538
	45	3.2	1.2222	1.2130	1.1487	1.1549
	46	3.0	1.2335	1.2273	1.1504	1.1579
	47	2.8	1.2477	1.2436	1.1573	1.1658
	48	2.6	1.2641	1.2626	1.1749	1.1802
	49	2.4	1.2801	1.2844	1.1921	1.1978
	50	2.2	1.2948	1.3088	1.2088	1.2155
	51	2.0	1.3108	1.3338	1.2256	1.2328
	52	1.8	1.3304	1.3577	1.2424	1.2502
	53	1.6	1.3515	1.3805	1.2592	1.2669
	54	1.4	1.3707	1.4013	1.2746	1.2825
*	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 - 450	1.02
451 - 1650	1.0309
1651 - 4200	1.02
4201 - 5100	1.0225
> 5100	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.