FENOC

FirstEnergy Nuclear Operating Company

James H. Lash
Site Vice President

724-682-5234
Fax: 724-643-8069

November 6, 2006
L-06-155

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, Revision 13

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 6.9.5 of the BVPS Technical Specifications. Revision 13 of the COLR is enclosed.

Revision 13 of the COLR is associated with the implementation of License Amendments Nos. 155 (Relaxed Axial Offset Control) and 156 (Extended Power Uprate) and the reload for Cycle 13 with a 3% power uprate, effective October 20, 2006.

There are no regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Gregory A. Dunn, Manager - FENOC Fleet Licensing, at (330) 315-7243.

Sincerely,

James H. Lash

Enclosure:

Beaver Valley Power Station Unit No. 2, Core Operating Limits Report, Revision 13

c: Mr. T. G. Colburn, NRR Senior Project Manager
Mr. P. C. Cataldo, NRC Senior Resident Inspector
Mr. S. J. Collins, NRC Region I Administrator
Mr. D. A. Allard, Director BRP/DEP
Mr. L. E. Ryan (BRP/DEP)

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L-06-155 Enclosure

Beaver Valley Power Station

Unit No. 2

Core Operating Limits Report

Revision 13

4.1 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 6.9.5.

Specification 3.1.3.5 Shutdown Rod Insertion Limits

The shutdown rods shall be withdrawn to at least 225 steps.(1)

Specification 3.1.3.6 Control Rod Insertion Limits

Control Banks A and B shall be withdrawn to at least 225 steps.(1)

Control Banks C and D shall be limited in physical insertion as shown in Figure 4.1-1.(1)

Specification 3.2.1 Axial Flux Difference

The Axial Flux Difference (AFD) acceptable operation limits are provided in Figure 4.1-2.

Specification 3.2.2 Heat Flux Hot Channel Factor - $F_Q(Z)$ Limits

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

K(Z) = the function obtained from Figure 4.1-3.

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

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

The W(Z) values are provided in Table 4.1-1.

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 4.1-2.

(1) As indicated by the group demand counter

Specification 3.2.3 Nuclear Enthalpy Rise Hot Channel Factor - $F^N_{\Delta H}$

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

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

$PF_{\Delta H} = 0.3$

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

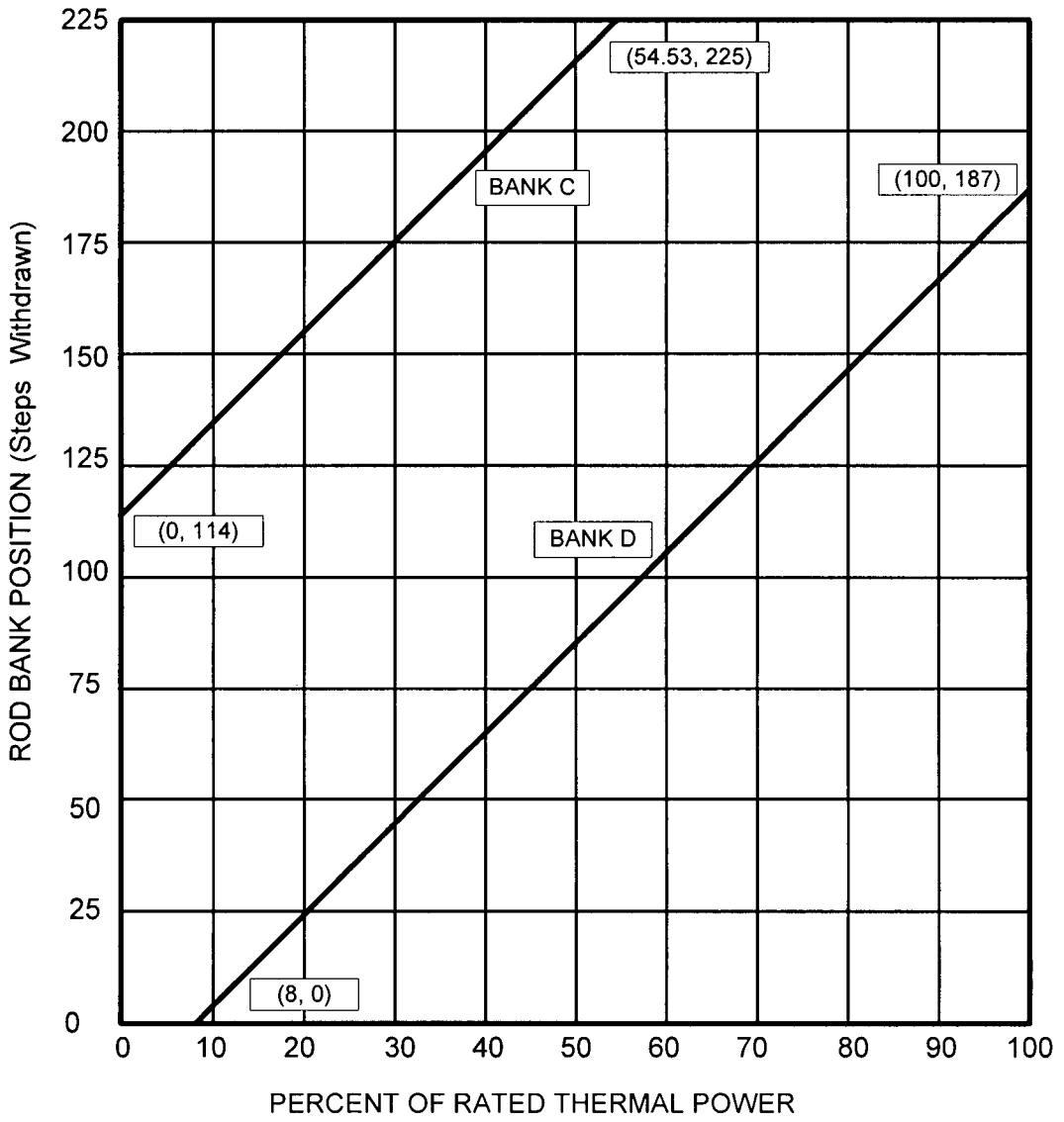

FIGURE 4.1-1

CONTROL ROD INSERTION LIMITS AS A

FUNCTION OF RATED POWER LEVEL

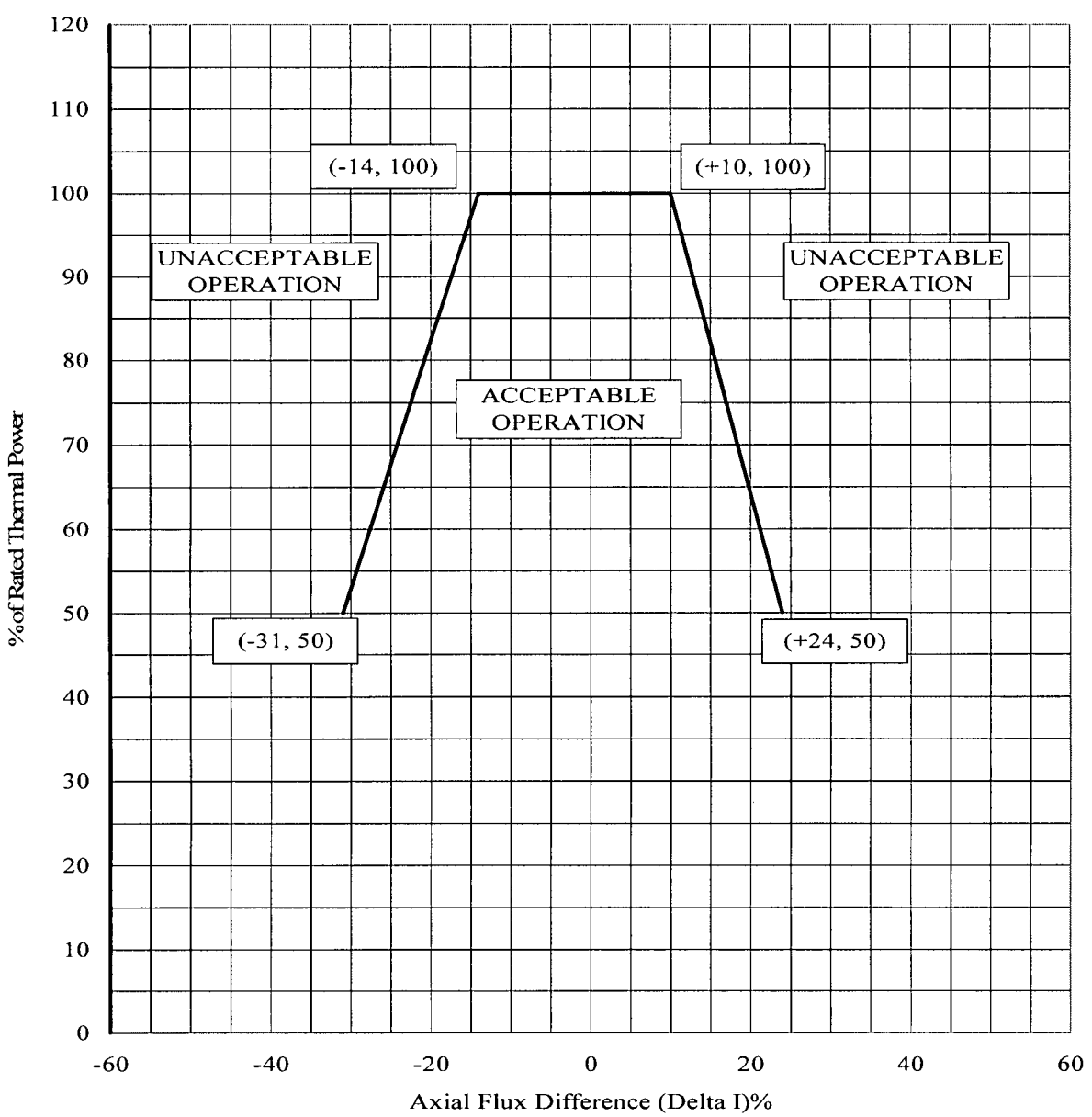

FIGURE 4.1-2
AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF PERCENT OF RATED THERMAL POWER FOR RAOC

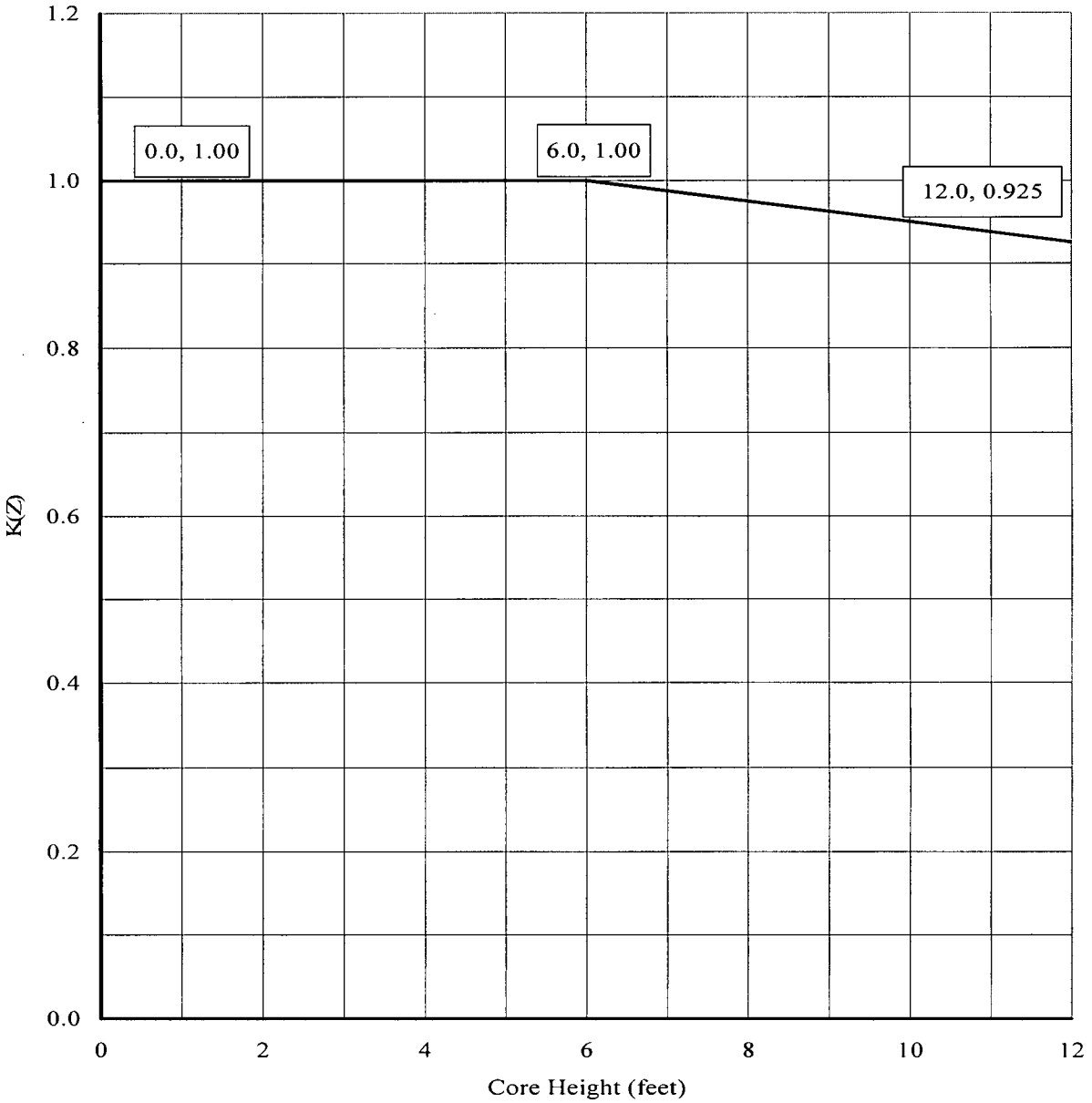

FIGURE 4.1-3
F_QT NORMALIZED OPERATING ENVELOPE, K(Z)

Specification 3.3.1.1 Reactor Trip System Instrumentation Setpoints, Table 3.3-1 Table Notations A and B

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	$T' \leq 580.0°F$(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 percent and +15 percent, 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.

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

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

(1) T' represents the cycle-specific Full Power Tavg value used in core design (576.2 °F).

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	$T'' \leq 580.0°F$(1)
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 lag time constant	$\tau_6 \leq 2$ secs
Measured reactor vessel average temperature rate/lag time constant	$\tau_7 \geq 10$ secs

Specification 3.2.5 DNB Parameters

Parameter	Indicated Value
Reactor Coolant System Tavg	$Tavg \leq 583.6°F$(2)
Pressurizer Pressure	Pressure ≥ 2214 psia(3)
Reactor Coolant System Total Flow Rate	Flow ≥ 267,300 gpm(4)

(1) T'' represents the cycle-specific Full Power Tavg value used in core design (576.2 °F).

(2) The Reactor Coolant System (RCS) T_{avg} value includes allowances for rod control operation and verification via control board indication.

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

(4) 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.

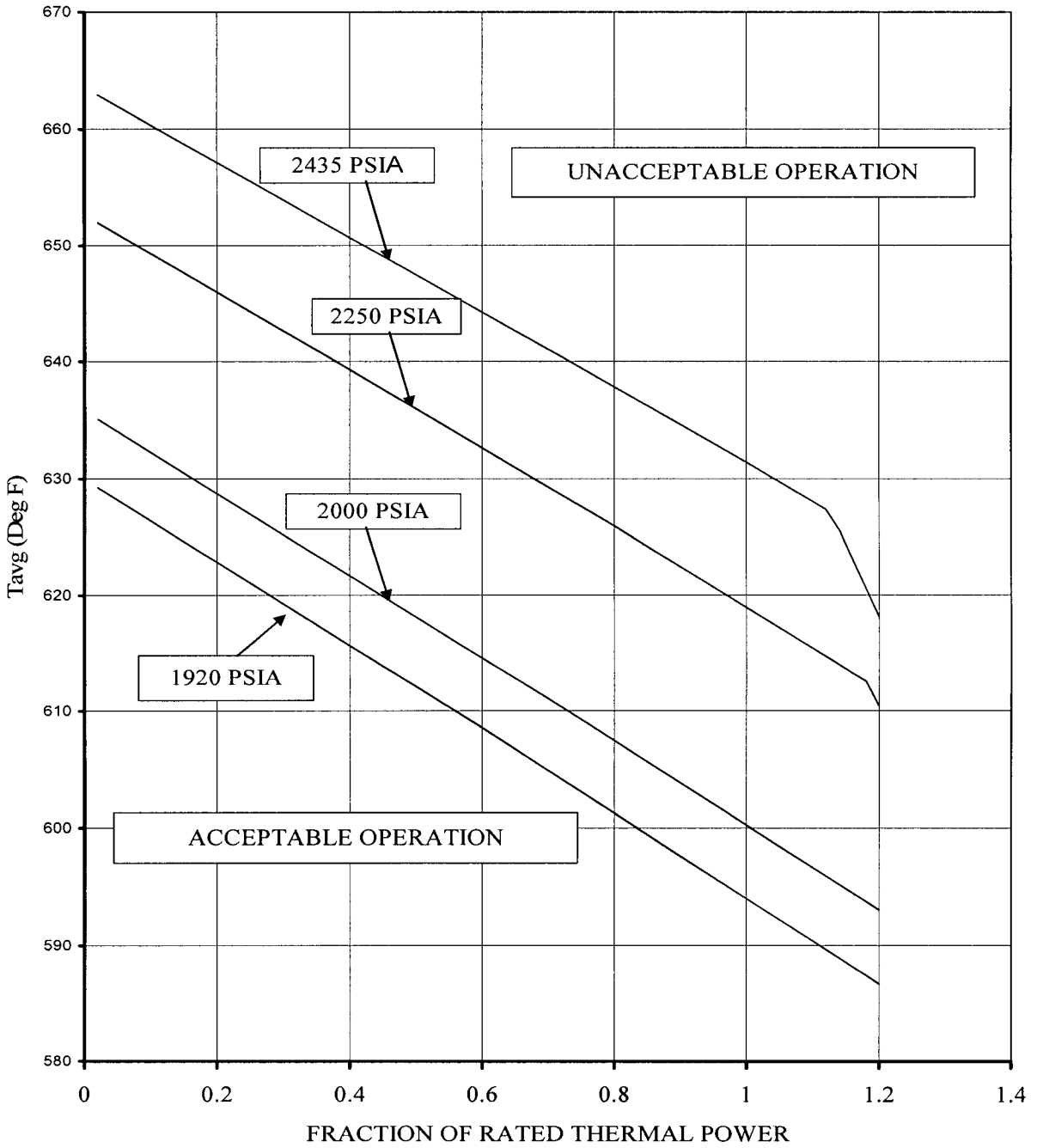

Figure 4.1-5
REACTOR CORE SAFETY LIMIT
THREE LOOP OPERATION
(Technical Specification Safety Limit 2.1.1)

Table 4.1-1 (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	12.00	1.0000	1.0000	1.0000	1.0000
*	2	11.80	1.0000	1.0000	1.0000	1.0000
*	3	11.60	1.0000	1.0000	1.0000	1.0000
*	4	11.40	1.0000	1.0000	1.0000	1.0000
*	5	11.20	1.0000	1.0000	1.0000	1.0000
*	6	11.00	1.0000	1.0000	1.0000	1.0000
*	7	10.80	1.0000	1.0000	1.0000	1.0000
	8	10.60	1.2425	1.3243	1.2957	1.2379
	9	10.40	1.2294	1.3089	1.2830	1.2268
	10	10.20	1.2157	1.2912	1.2681	1.2233
	11	10.00	1.2036	1.2737	1.2535	1.2178
	12	9.80	1.1934	1.2603	1.2420	1.2115
	13	9.60	1.1827	1.2557	1.2312	1.2033
	14	9.40	1.1730	1.2534	1.2205	1.1992
	15	9.20	1.1706	1.2464	1.2083	1.1985
	16	9.00	1.1782	1.2374	1.1962	1.2000
	17	8.80	1.1847	1.2348	1.1974	1.2021
	18	8.60	1.1913	1.2342	1.2073	1.2098
	19	8.40	1.1978	1.2317	1.2176	1.2209
	20	8.20	1.2017	1.2267	1.2245	1.2300
	21	8.00	1.2037	1.2194	1.2290	1.2364
	22	7.80	1.2039	1.2152	1.2311	1.2402
	23	7.60	1.2020	1.2110	1.2307	1.2416
	24	7.40	1.1986	1.2045	1.2280	1.2405
	25	7.20	1.1946	1.1972	1.2231	1.2372
	26	7.00	1.1908	1.1905	1.2162	1.2316
	27	6.80	1.1856	1.1825	1.2074	1.2240
	28	6.60	1.1787	1.1728	1.1968	1.2147
	29	6.40	1.1704	1.1619	1.1847	1.2033
	30	6.20	1.1607	1.1498	1.1712	1.1903
	31	6.00	1.1499	1.1362	1.1564	1.1805
	32	5.80	1.1380	1.1237	1.1408	1.1712

Note: Top and Bottom 10% Excluded

TABLE 4.1-1 (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	5.60	1.1301	1.1129	1.1274	1.1618
	34	5.40	1.1282	1.1062	1.1201	1.1561
	35	5.20	1.1340	1.1099	1.1188	1.1565
	36	5.00	1.1402	1.1145	1.1198	1.1563
	37	4.80	1.1451	1.1176	1.1218	1.1561
	38	4.60	1.1497	1.1206	1.1229	1.1575
	39	4.40	1.1538	1.1232	1.1237	1.1584
	40	4.20	1.1568	1.1260	1.1242	1.1584
	41	4.00	1.1625	1.1303	1.1241	1.1576
	42	3.80	1.1715	1.1353	1.1252	1.1559
	43	3.60	1.1816	1.1395	1.1310	1.1539
	44	3.40	1.1910	1.1435	1.1360	1.1516
	45	3.20	1.1988	1.1471	1.1387	1.1483
	46	3.00	1.2112	1.1579	1.1485	1.1511
	47	2.80	1.2315	1.1786	1.1675	1.1675
	48	2.60	1.2560	1.2033	1.1874	1.1862
	49	2.40	1.2801	1.2281	1.2074	1.2047
	50	2.20	1.3037	1.2527	1.2271	1.2229
	51	2.00	1.3268	1.2769	1.2462	1.2406
	52	1.80	1.3488	1.3001	1.2647	1.2576
	53	1.60	1.3694	1.3220	1.2819	1.2736
	54	1.40	1.3878	1.3418	1.2975	1.2883
*	55	1.20	1.0000	1.0000	1.0000	1.0000
*	56	1.00	1.0000	1.0000	1.0000	1.0000
*	57	0.80	1.0000	1.0000	1.0000	1.0000
*	58	0.60	1.0000	1.0000	1.0000	1.0000
*	59	0.40	1.0000	1.0000	1.0000	1.0000
*	60	0.20	1.0000	1.0000	1.0000	1.0000
*	61	0.00	1.0000	1.0000	1.0000	1.0000

Note: Top and Bottom 10% Excluded

TABLE 4.1-2
$F_Q(Z)$ Penalty Factor versus Burnup

Cycle Burnup MWD/MTU	$F_Q(Z)$ Penalty Factor
0 to 4300	1.02
4300 to 5000	1.0205
5000 to EOL	1.02

Note:

The Penalty Factor, to be applied to $F_Q(Z)$ in accordance with Technical Specification Surveillance Requirement 4.2.2.3, 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 Surveillance Requirement 4.0.2) starting from the burnup at which the $F_Q(Z)$ was determined.