L. M. Stinson (Mike)
Vice President

Southern Nuclear Operating Company, Inc.
40 Inverness Center Parkway
Post Office Box 1295
Birmingham, Alabama 35201

Tel 205.992.5181
Fax 205.992.0341

SOUTHERN COMPANY
Energy to Serve Your World℠

May 15, 2006

Docket No.: 50-348

NL-06-0957

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

Joseph M. Farley Nuclear Plant – Unit 1
Cycle 21 Core Operating Limits Report

Ladies and Gentlemen:

In accordance with Technical Specification 5.6.5.d, Southern Nuclear Operating Company submits the enclosed Core Operating Limits Report (COLR) for Farley Nuclear Plant Unit 1 Cycle 21.

This letter contains no NRC commitments. If there are any questions, please advise.

Sincerely,

L. M. Stinson

LMS/CHM/sdl

Enclosure: FNP Core Operating Limits Report Unit 1– Cycle 21, March 2006

cc: Southern Nuclear Operating Company
Mr. J. T. Gasser, Executive Vice President
Mr. J. R. Johnson, General Manager – Plant Farley
RTYPE: CFA04.054; LC# 14434

U. S. Nuclear Regulatory Commission
Dr. W. D. Travers, Regional Administrator
Mr. R. E. Martin, NRR Project Manager – Farley
Mr. C. A. Patterson, Senior Resident Inspector – Farley

Joseph M. Farley Nuclear Plant – Unit 1
Cycle 21 Core Operating Limits Report

Enclosure

FNP Core Operating Limits Report Unit 1– Cycle 21, March 2006

SOUTHERN COMPANY

Energy to Serve Your World®

Joseph M. Farley Nuclear Plant

Core Operating Limits Report

Unit 1 - Cycle 21

March 2006

REVISION 0

APPROVED FOR ISSUE:

A W Wells 4/25/06

OPERATIONS MANAGER / DATE

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for FNP UNIT 1 CYCLE 21 has been prepared in accordance with the requirements of Technical Specification 5.6.5.

The Technical Requirement affected by this report is listed below:

13.1.1 SHUTDOWN MARGIN - MODES 1 and 2 (with $k_{eff} \geq 1$)

The Technical Specifications affected by this report are listed below:

2.1.1 Reactor Core Safety Limits for THERMAL POWER

3.1.1 SHUTDOWN MARGIN - MODES 2 (with $k_{eff} < 1$), 3, 4 and 5

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 - $F_Q(Z)$

3.2.2 Nuclear Enthalpy Rise Hot Channnel Factor - $F_{\Delta H}^N$

3.2.3 Axial Flux Difference

3.3.1 Reactor Trip System Instrumentation Overtemperature ΔT ($OT\Delta T$) and Overpower ΔT ($OP\Delta T$) Setpoint Parameter Values for Table 3.3.1-1

3.4.1 RCS DNB Parameters for Pressurizer Pressure, RCS Average Temperature, and RCS Total Flow Rate

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 NRC-approved methodologies, including those specified in Technical Specification 5.6.5.

2.1 SHUTDOWN MARGIN - MODES 1 and 2 (with $k_{eff} \geq 1.0$) (Technical Requirement 13.1.1)

2.1.1 The SHUTDOWN MARGIN shall be greater than or equal to 1.77 percent $\Delta k/k$.

2.2 SHUTDOWN MARGIN - MODES 2 (with $k_{eff} < 1.0$), 3, 4 and 5 (Specification 3.1.1)

2.2.1 Modes 2 ($k_{eff} < 1.0$), 3 and 4 - The SHUTDOWN MARGIN shall be greater than or equal to 1.77 percent $\Delta k/k$.

2.2.2 Mode 5 - The SHUTDOWN MARGIN shall be greater than or equal to 1.0 percent $\Delta k/k$.

2.3 Moderator Temperature Coefficient (Specification 3.1.3)

2.3.1 The Moderator Temperature Coefficient (MTC) limits are:

The BOL/ARO/HZP-MTC shall be less than or equal to $+0.7 \times 10^{-4}$ $\Delta k/k/°F$ for power levels up to 70 percent RTP with a linear ramp to 0 $\Delta k/k/°F$ at 100 percent RTP.

The EOL/ARO/RTP-MTC shall be less negative than -4.3×10^{-4} $\Delta k/k/°F$.

2.3.2 The MTC Surveillance limits are:

The 300 ppm/ARO/RTP-MTC should be less negative than or equal to -3.65×10^{-4} $\Delta k/k/°F$.

The 100 ppm/ARO/RTP-MTC should be less negative than -4.0×10^{-4} $\Delta k/k/°F$.

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 Shutdown Bank Insertion Limits (Specification 3.1.5)

2.4.1 The shutdown banks shall be withdrawn to a position greater than or equal to 225 steps.

2.5 Control Bank Insertion Limits (Specification 3.1.6)

2.5.1 The control rod banks shall be limited in physical insertion as shown in Figure 1.

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

2.6.1 $F_Q(Z) \le \frac{F_Q^{RTP}}{P} * K(Z)$ for P > 0.5

$F_Q(Z) \le \frac{F_Q^{RTP}}{0.5} * K(Z)$ for P ≤ 0.5

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

2.6.2 $F_Q^{RTP} = 2.50$

2.6.3 K(Z) is provided in Figure 2.

2.6.4 $F_Q(Z) \le \frac{F_Q^{RTP} * K(Z)}{P * W(Z)}$ for P > 0.5

$F_Q(Z) \le \frac{F_Q^{RTP} * K(Z)}{0.5 * W(Z)}$ for P ≤ 0.5

2.6.5 W(Z) values are provided in Table 4.

2.6.6 The $F_Q(Z)$ penalty factors are provided in Table 1.

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

2.7.1 $F_{\Delta H}^{N} \leq F_{\Delta H}^{RTP} * (1 + PF_{\Delta H} * (1 - P))$

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

2.7.2 $F_{\Delta H}^{RTP} = 1.70$

2.7.3 $PF_{\Delta H} = 0.3$

2.8 Axial Flux Difference (Specification 3.2.3)

2.8.1 The Axial Flux Difference (AFD) acceptable operation limits are provided in Figure 3.

2.9 Boron Concentration (Specification 3.9.1)

2.9.1 The boron concentration shall be greater than or equal to 2000 ppm.[1]

2.10 Reactor Core Safety Limits for THERMAL POWER (Specification 2.1.1)

2.10.1 In MODES 1 and 2, the combination of THERMAL POWER, Reactor Coolant System (RCS) highest loop average temperature, and pressurizer pressure shall not exceed the safety limits specified in Figure 4.

2.11 Reactor Trip System Instrumentation Overtemperature ΔT (OTΔT) and Overpower ΔT (OPΔT) Setpoint Parameter Values for Table 3.3.1-1 (Specification 3.3.1)

2.11.1 The Reactor Trip System Instrumentation Overtemperature ΔT (OTΔT) and Overpower ΔT (OPΔT) setpoint parameter values for TS Table 3.3.1-1 are listed in COLR Tables 2 and 3.

---

[1] This concentration bounds the condition of $k_{eff} \leq 0.95$ (all rods in less the most reactive rod) and subcriticality (all rods out) over the entire cycle. This concentration includes additional boron to address uncertainties and B^{10} depletion.

2.12 RCS DNB Parameters for Pressurizer Pressure, RCS Average Temperature, and RCS Total Flow Rate (Specification 3.4.1)

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

a. Pressurizer pressure ≥ 2209 psig;
b. RCS average temperature ≤ 580.3 °F; and
c. The minimum RCS total flow rate shall be ≥ 263,400 GPM when using the precision heat balance method and ≥ 264,200 GPM when using the elbow tap method.

Table 1

$F_Q(Z)$ Penalty Factor

Cycle Burnup (MWD/MTU)	$F_Q(Z)$ Penalty Factor
5051	1.020
5255	1.022
5460	1.025
5664	1.021
5868	1.020

Notes:

1. The Penalty Factor, to be applied to $F_Q(Z)$ in accordance with SR 3.2.1.2, is the maximum factor by which $F_Q(Z)$ is expected to increase over a 39 EFPD interval (surveillance interval of 31 EFPD plus the maximum allowable extension not to exceed 25 % of the surveillance interval per SR 3.0.2) starting from the burnup at which the $F_Q(Z)$ was determined.
2. Linear interpolation is adequate for intermediate cycle burnups.
3. For all cycle burnups outside the range of the table, a penalty factor of 1.020 shall be used.

Table 2

Reactor Trip System Instrumentation - Overtemperature ΔT (OTΔT)
Setpoint Parameter Values

$T' \leq 577.2$ °F	$P' = 2235$ psig	
$K_1 = 1.17$	$K_2 = 0.017$ / °F	$K_3 = 0.000825$ / psi
$\tau_1 \geq 30$ sec	$\tau_2 \leq 4$ sec	
$\tau_4 = 0$ sec	$\tau_5 \leq 6$ sec	$\tau_6 \leq 6$ sec

$f_1(\Delta I) =$	$-2.48 \{23 + (q_t - q_b)\}$	when $(q_t - q_b) \leq -23$ % RTP
	0 % of RTP	when -23 % RTP $< (q_t - q_b) \leq 15$ % RTP
	$2.05 \{(q_t - q_b) - 15\}$	when $(q_t - q_b) > 15$ % RTP

Table 3

Reactor Trip System Instrumentation - Overpower ΔT (OPΔT)
Setpoint Parameter Values

$T'' \leq 577.2$ °F

$K_4 = 1.10$	$K_5 = 0.02$ / °F for increasing T_{avg}	$K_6 = 0.00109$ / °F when $T > T''$
	$K_5 = 0$ / °F for decreasing T_{avg}	$K_6 = 0$ / °F when $T \leq T''$

$\tau_3 \geq 10$ sec
$\tau_4 = 0$ sec
$\tau_5 \leq 6$ sec
$\tau_6 \leq 6$ sec

$f_2(\Delta I) = 0$ % RTP for all ΔI

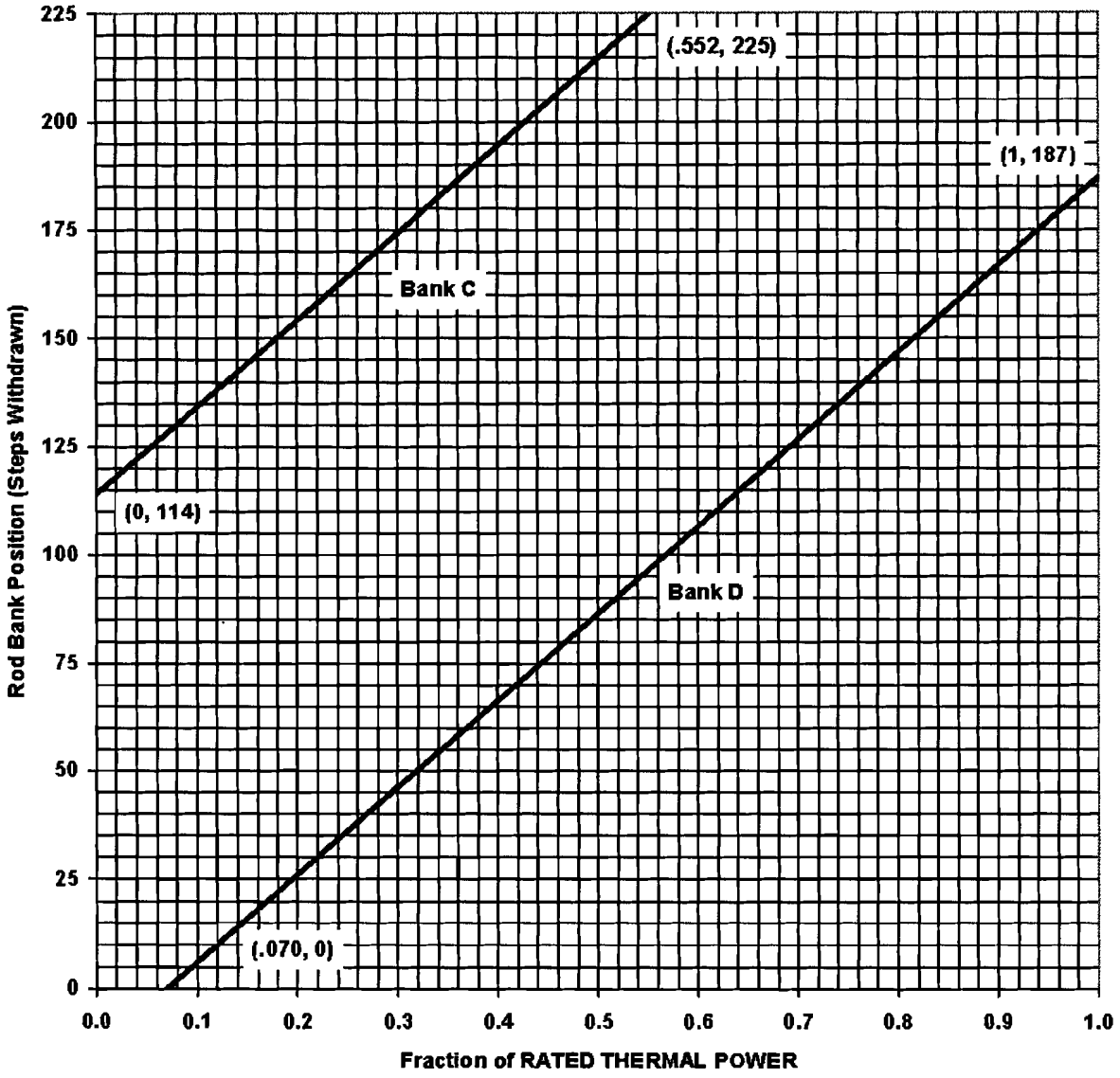
Table 4
RAOC W(Z)

	Axial Point	Elevation (feet)	150 MWD/MTU	4000 MWD/MTU	10000 MWD/MTU	18000 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	1.0000	1.0000	1.0000	1.0000
*	9	10.40	1.0000	1.0000	1.0000	1.0000
*	10	10.20	1.0000	1.0000	1.0000	1.0000
	11	10.00	1.1664	1.2200	1.2327	1.2097
	12	9.80	1.1635	1.2108	1.2339	1.2108
	13	9.60	1.1629	1.2004	1.2374	1.2202
	14	9.40	1.1621	1.1894	1.2396	1.2286
	15	9.20	1.1595	1.1774	1.2397	1.2341
	16	9.00	1.1547	1.1631	1.2398	1.2448
	17	8.80	1.1536	1.1658	1.2462	1.2510
	18	8.60	1.1608	1.1790	1.2576	1.2632
	19	8.40	1.1728	1.1881	1.2684	1.2817
	20	8.20	1.1814	1.1953	1.2759	1.3023
	21	8.00	1.1877	1.2001	1.2804	1.3198
	22	7.80	1.1919	1.2026	1.2821	1.3335
	23	7.60	1.1938	1.2030	1.2809	1.3434
	24	7.40	1.1940	1.2015	1.2772	1.3497
	25	7.20	1.1935	1.1991	1.2713	1.3524
	26	7.00	1.1913	1.1953	1.2642	1.3517
	27	6.80	1.1875	1.1898	1.2553	1.3479
	28	6.60	1.1823	1.1829	1.2442	1.3410
	29	6.40	1.1759	1.1747	1.2313	1.3314
	30	6.20	1.1683	1.1654	1.2170	1.3192
	31	6.00	1.2065	1.2014	1.2513	1.3306
	32	5.80	1.1951	1.1896	1.2393	1.3138
	33	5.60	1.1902	1.1777	1.2258	1.2931
	34	5.40	1.1979	1.1771	1.2160	1.2727
	35	5.20	1.2067	1.1842	1.2164	1.2671
	36	5.00	1.2146	1.1909	1.2167	1.2645
	37	4.80	1.2220	1.1967	1.2149	1.2596
	38	4.60	1.2282	1.2017	1.2123	1.2528
	39	4.40	1.2338	1.2058	1.2084	1.2438
	40	4.20	1.2402	1.2090	1.2034	1.2329
	41	4.00	1.2471	1.2111	1.1970	1.2200
	42	3.80	1.2532	1.2124	1.1906	1.2052
	43	3.60	1.2579	1.2125	1.1849	1.1893
	44	3.40	1.2616	1.2121	1.1796	1.1721
	45	3.20	1.2667	1.2149	1.1748	1.1619
	46	3.00	1.2723	1.2232	1.1746	1.1552
	47	2.80	1.2890	1.2374	1.1755	1.1658
	48	2.60	1.3160	1.2546	1.1787	1.1744
	49	2.40	1.3407	1.2758	1.1877	1.1835
	50	2.20	1.3652	1.2979	1.1967	1.1926
	51	2.00	1.3895	1.3200	1.2059	1.2020
*	52	1.80	1.0000	1.0000	1.0000	1.0000
*	53	1.60	1.0000	1.0000	1.0000	1.0000
*	54	1.40	1.0000	1.0000	1.0000	1.0000
*	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

*** Top and bottom 15% excluded per Technical Specification B 3.2.1.**

Figure 1
Rod Bank Insertion Limits versus Rated Thermal Power

Fully Withdrawn – 225 to 231 steps, inclusive



Fully Withdrawn shall be the condition where control rods are at a position within the interval ≥ 225 and ≤ 231 steps withdrawn.

Note: The Rod Bank Insertion Limits are based on the control bank withdrawal sequence A, B, C, D and a control bank tip-to-tip distance of 128 steps.

Figure 2
K(Z) – Normalized $F_Q(Z)$ as a Function of Core Height

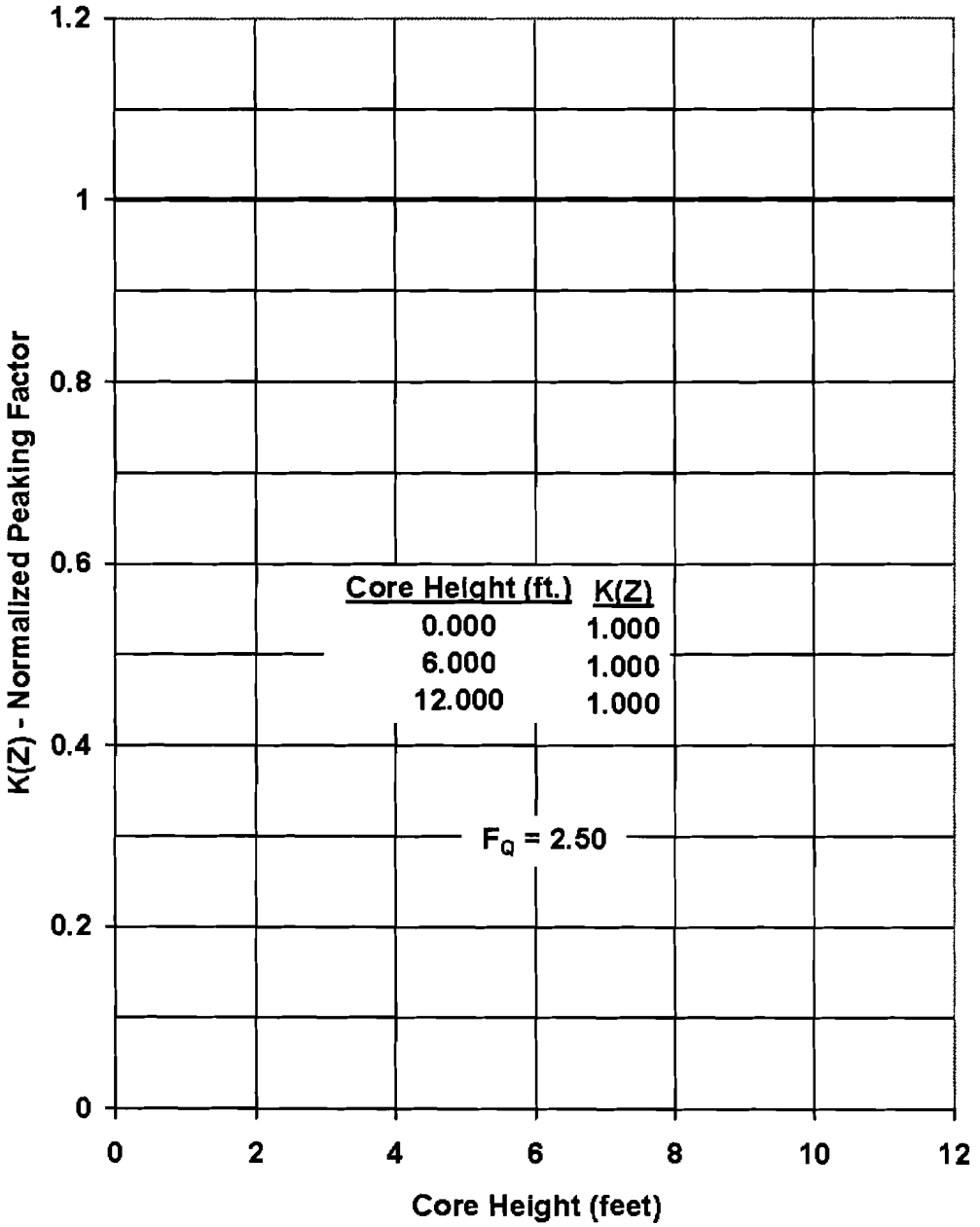


Figure 3
Axial Flux Difference Limits as a Function of
Rated Thermal Power for RAOC

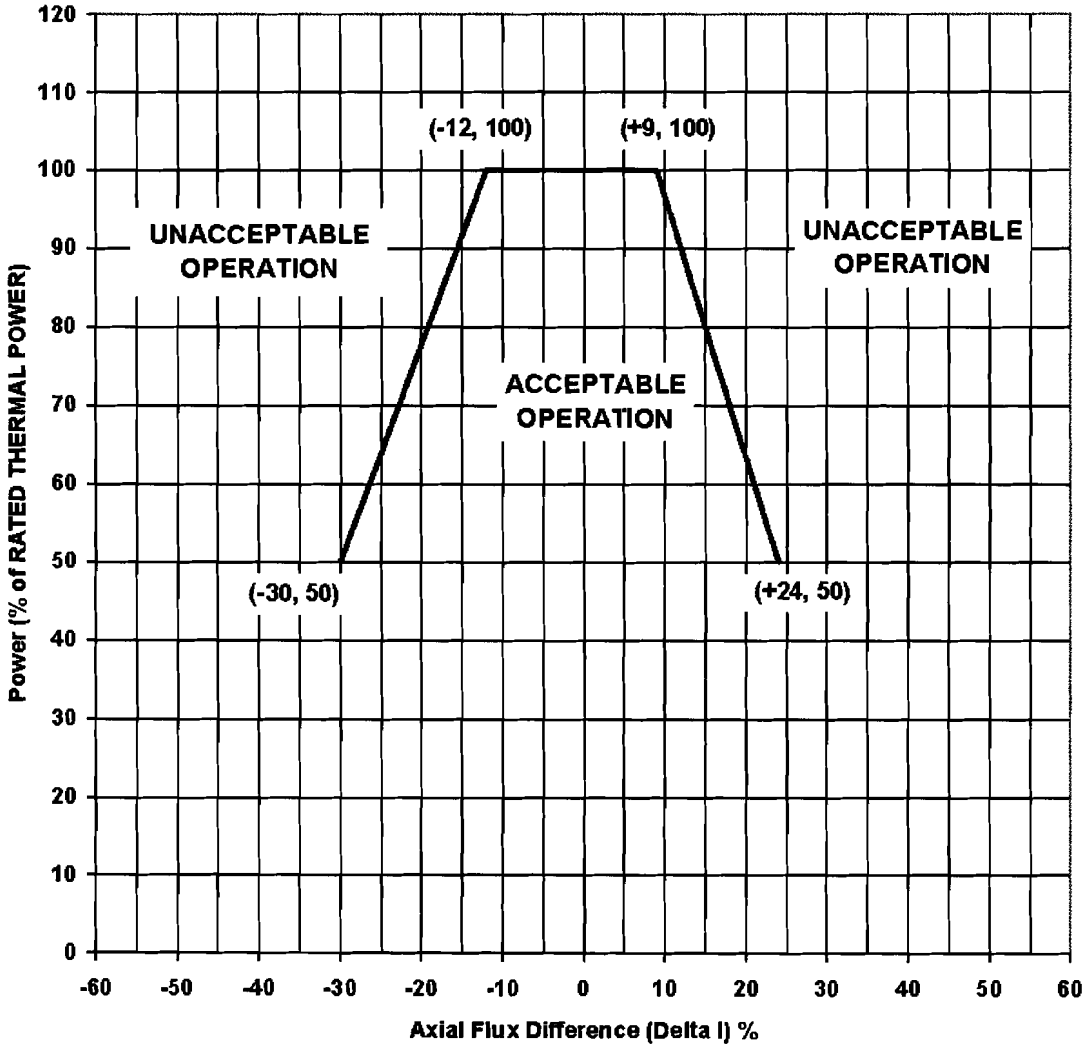


Figure 4
Reactor Core Safety Limits