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Edwin I. Hatch Nuclear Plant
Unit 2 Cycle 19 Core Operating Limits Report (COLR), Version 1

Ladies and Gentlemen:

In accordance with Technical Specification 5.6.5, Southern Nuclear Operating Company (SNC) hereby submits the Edwin I. Hatch Nuclear Plant Unit 2 Cycle 19 Core Operating Limits Report, Version 1.

This letter contains no NRC commitments. If you have any questions, please advise.

Sincerely,

H. L. Sumner, Jr.

HLS/ifl/daj

Enclosure: Unit 2 Cycle 19 Core Operating Limits Report (COLR), Version 1

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SOUTHERN NUCLEAR OPERATING COMPANY
EDWIN I. HATCH NUCLEAR PLANT

Unit 2 Cycle 19
CORE OPERATING LIMITS REPORT

Version 1

Southern Nuclear Operating Company
Post Office Box 1295
Birmingham, Alabama 35201

Edwin I. Hatch Nuclear Plant
Unit 2 Cycle 19 Core Operating Limits Report

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1.0 INTRODUCTION

The Core Operating Limits Report (COLR) for Plant Hatch Unit 2 Cycle 19 is prepared in accordance with the requirements of Technical Specification 5.6.5. The core operating limits presented herein were developed using NRC-approved methods (References 1, 2, 3, 4, and 5). Results from the reload analyses for the fuel in Unit 2 Cycle 19 are documented in References 3, 4, 5, 6, and 7.

The following core operating limits are included in this report:

a. Average Planar Linear Heat Generation Rate (APLHGR) – Technical Specification 3.2.1

b. Minimum Critical Power Ratio (MCPR) – Technical Specification 3.2.2

c. Linear Heat Generation Rate (LHGR) – Technical Specification 3.2.3

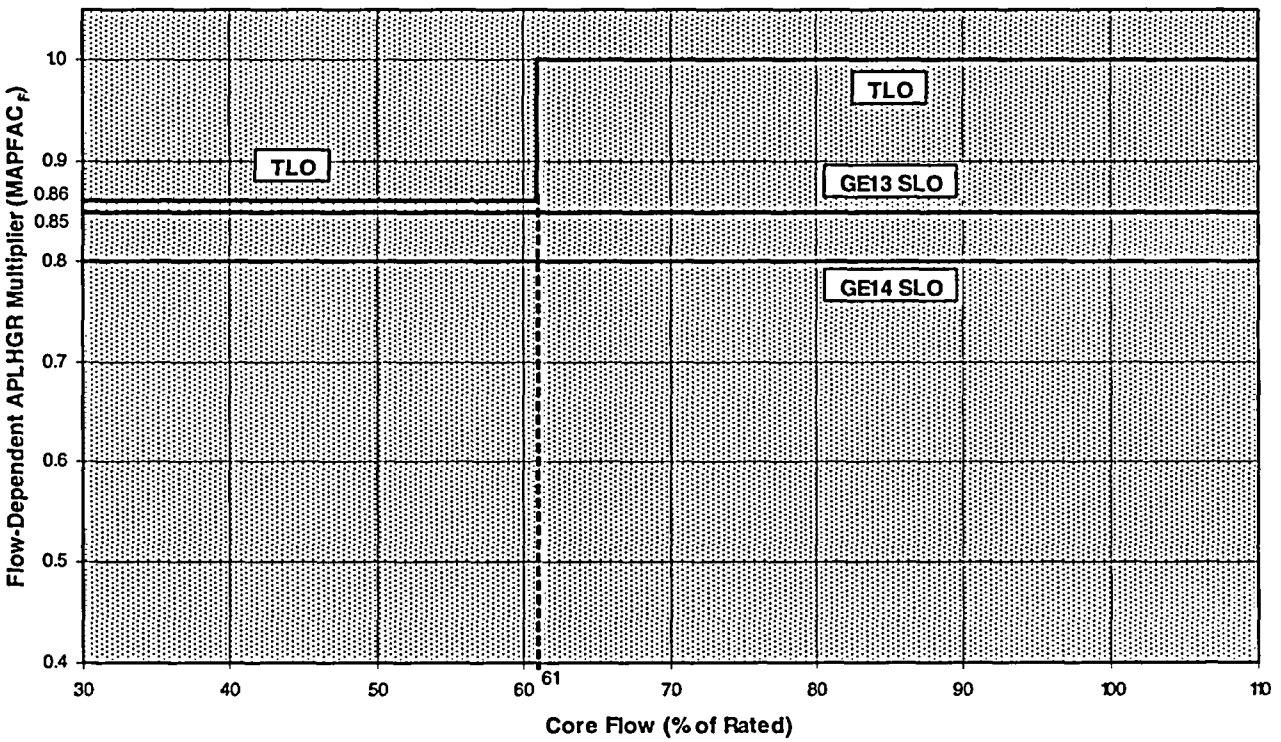
From a fuel thermal limits perspective, the following limitations are placed on Unit 2 operation.

Equipment / Condition	Limitation
EOC-RPT Out of Service AND Turbine Bypass Valves Inoperable Simultaneously	Not analyzed
High Pressure Feedwater Heater(s) Out of Service AND Pressure Regulator Inoperable Simultaneously	Not analyzed
Single-Loop Operation (SLO)	• ≤ 2000 MWt • ≤ 56% Core Flow
Pressure Regulator Inoperable	Option B Scram Speeds Met (in place)

Also included in this report are the maximum allowable scram setpoints for the Period Based Detection Algorithm (PBDA) in the Oscillation Power Range Monitor (OPRM).

2.0 APLHGR LIMITS (Technical Specification 3.2.1)

The APLHGR limit for each six inch axial segment of each fuel assembly in the core is the applicable APLHGR limit taken from Figure 2-2 or 2-3, multiplied by the flow-dependent multiplier, $MAPFAC_F$, from Figure 2-1.



Operating Conditions			$MAPFAC_F$
Flow	SLO / TLO	Fuel Type	
$30 \le F \le 61$	TLO	All	0.86
$61 < F$	TLO	All	1.00
$30 \le F$	SLO	GE13	0.85
$30 \le F$	SLO	GE14	0.80

F = Percent of Rated Core Flow

FIGURE 2-1

Flow-Dependent APLHGR Multiplier ($MAPFAC_F$) versus Core Flow

Average Planar Exposure	APLHGR Limit
0.00	13.42
24.40	13.42
32.66	12.70
56.70	9.00
63.50	6.40

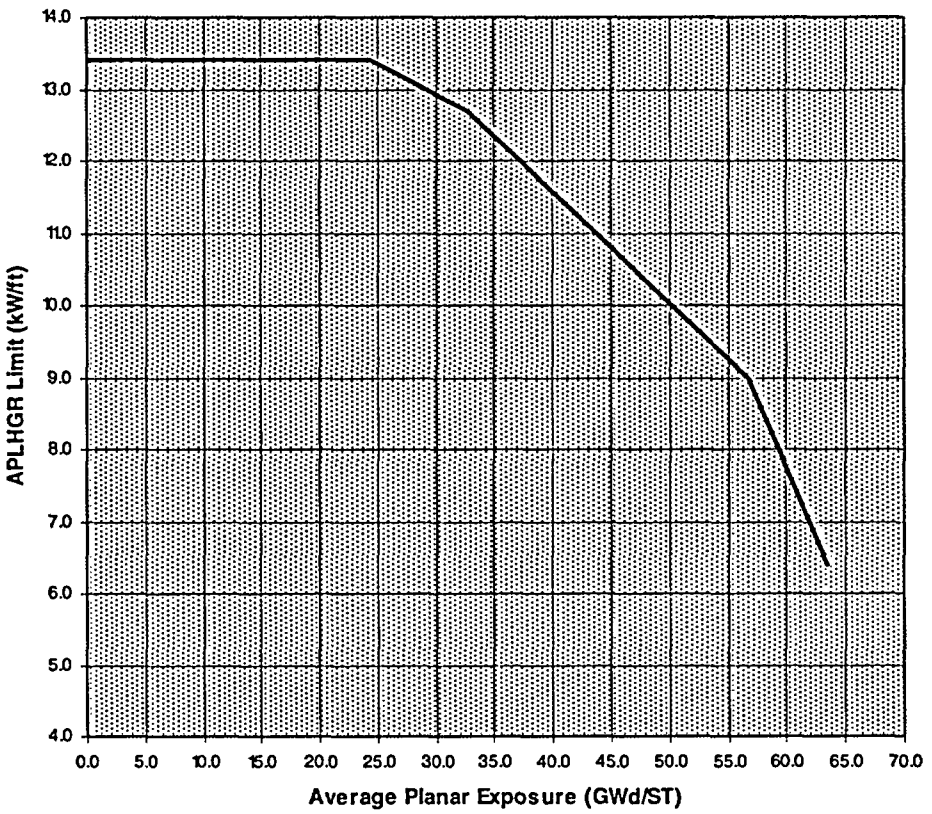


FIGURE 2-2

APLHGR Limit versus Average Planar Exposure
(Fuel Type: GE13)

Average Planar Exposure	APLHGR Limit
0.00	12.82
14.51	12.82
19.13	12.82
57.61	8.00
63.50	5.00

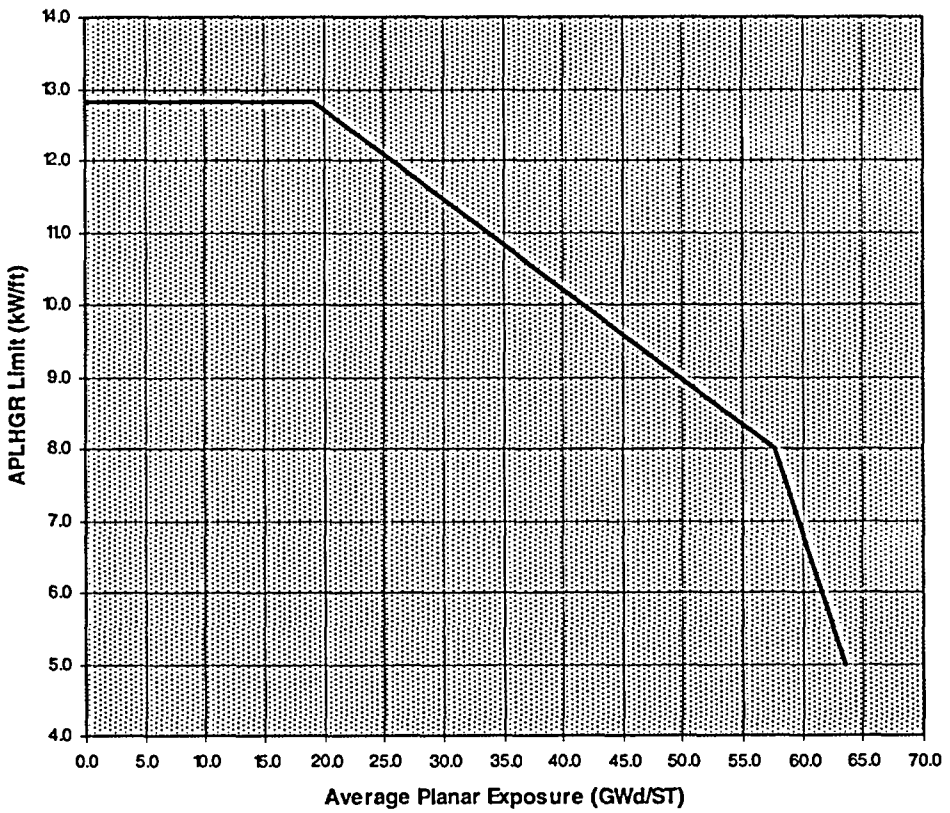


FIGURE 2-3

APLHGR Limit versus Average Planar Exposure
(Fuel Type: GE14)

3.0 MCPR OPERATING LIMITS (Technical Specification 3.2.2)

The MCPR operating limit (OLMCPR) is a function of core power, core flow, average scram time, number of operating recirculation loops, EOC-RPT system status, operability of the turbine bypass valves, and whether both pressure regulators are operable.

With both recirculation pumps in operation (TLO), the OLMCPR is determined as follows:

a. For 24% ≤ power < 28%, the power-dependent MCPR limit, $MCPR_P$, as determined by Table 3-1.

b. For power ≥ 28%, the OLMCPR is the greater of either:

   1) The flow-dependent MCPR limit, $MCPR_F$, from Figure 3-2,

      or

   2) The product of the power-dependent multiplier, K_P, and the rated-power, rated-flow OLMCPR, as determined by Table 3-1.

With only one recirculation pump in operation (SLO), the OLMCPRs in Figures 3-1A, 3-1B, 3-4A and 3-4B must be increased by 0.02.

These limits apply to all modes of operation with intermittent feedwater temperature reduction, as well as operation with normal feedwater temperatures.

In Figures 3-4A and 3-4B, Option A scram time OLMCPRs correspond to $\tau = 1.0$, where τ is determined from scram time measurements performed in accordance with Technical Specifications Surveillance Requirements 3.1.4.1 and 3.1.4.2. Option B values correspond to $\tau = 0.0$. For scram times between Option A and Option B, the rated-power, rated-flow OLMCPR corresponds to τ. If τ has not been determined, Option A limits are to be used.

The average scram time of the control rods, τ, is defined as:

$$\tau = 0, \text{ or } \frac{\tau_{ave} - \tau_B}{\tau_A - \tau_B}, \text{ whichever is greater.}$$

where: τ_A = 1.08 sec (Technical Specification 3.1.4, Table 3.1.4-1, scram time limit to notch 36).

$$\tau_B = \mu + 1.65 * \sigma * \left[\frac{N_1}{\sum_{i=1}^{n} N_i}\right]^{1/2}$$

where: μ = 0.822 sec (mean scram time used in the transient analysis).

σ = 0.018 sec (standard deviation of μ).

$$\tau_{ave} = \frac{\sum_{i=1}^{n} Ni\tau_i}{\sum_{i=1}^{n} Ni}$$

where: n = number of surveillance tests performed to date in the cycle.

N_i = number of active control rods measured in the *ith* surveillance test.

τ_i = average scram time to notch 36 of all rods in the *ith* surveillance test.

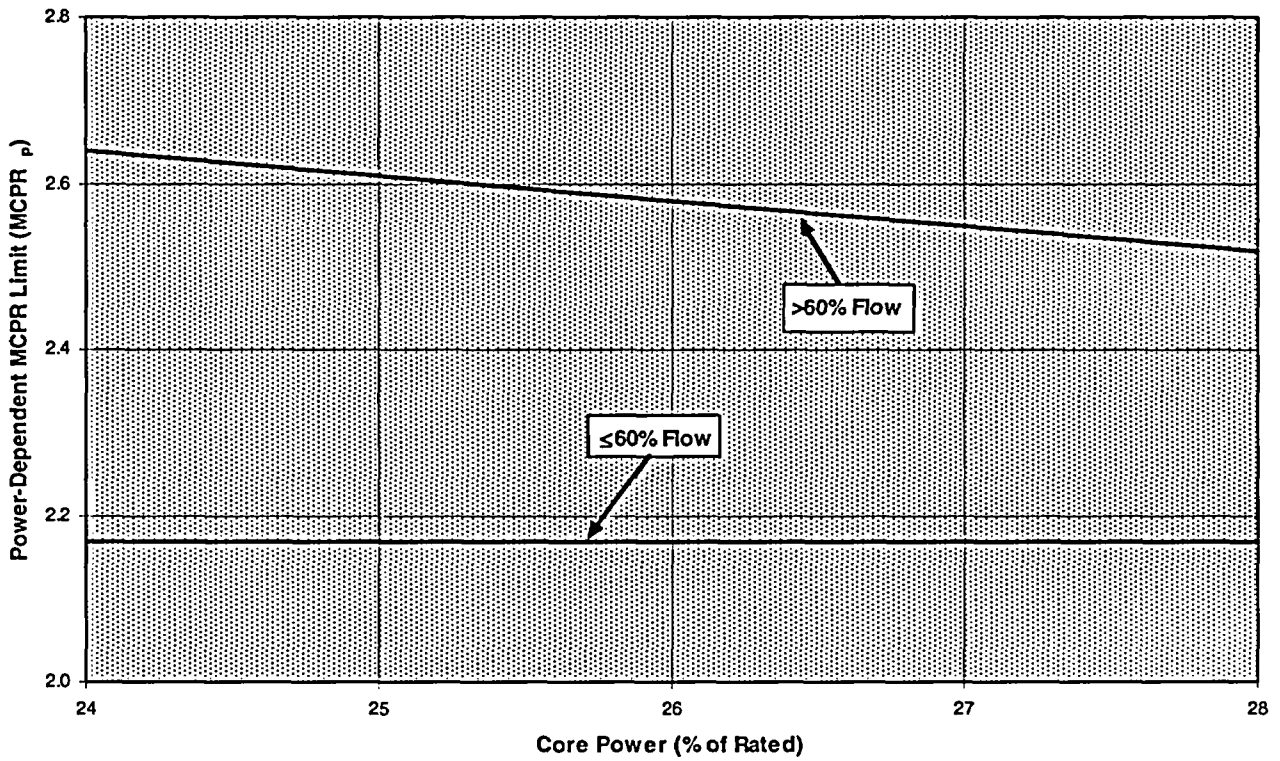
N_1 = total number of active rods measured in Technical Specifications Surveillance Requirement 3.1.4.1.

TABLE 3-1

MCPR Operating Flexibility Options

Cycle Average Exposure	Turbine Bypass Valves	$MCPR_P$ Curve	Pressure Regulator	Kp Curve	Rated-Power, Rated-Flow OLMCPRs
BOC to EOR-1400	Operable	Figure 3-1A	Operable	Figure 3-3A	Figure 3-4A
			Inoperable	Figure 3-3B	
	Inoperable	Figure 3-1B	Operable	Figure 3-3A	
			Inoperable	Figure 3-3B	
EOR-1400 to EEOC	Operable	Figure 3-1A	Operable	Figure 3-3A	Figure 3-4B
			Inoperable	Figure 3-3B	
	Inoperable	Figure 3-1B	Operable	Figure 3-3A	
			Inoperable	Figure 3-3B	

BOC = Beginning of Cycle
EOR = End of rated conditions (100% power, 100% flow, ARO, with nominal feedwater temp.)
EEOC = Extended End of Cycle (beyond EOR, 100% power, 105% flow, with reduced feedwater temp.)



$MCPR_P = A + B*P$

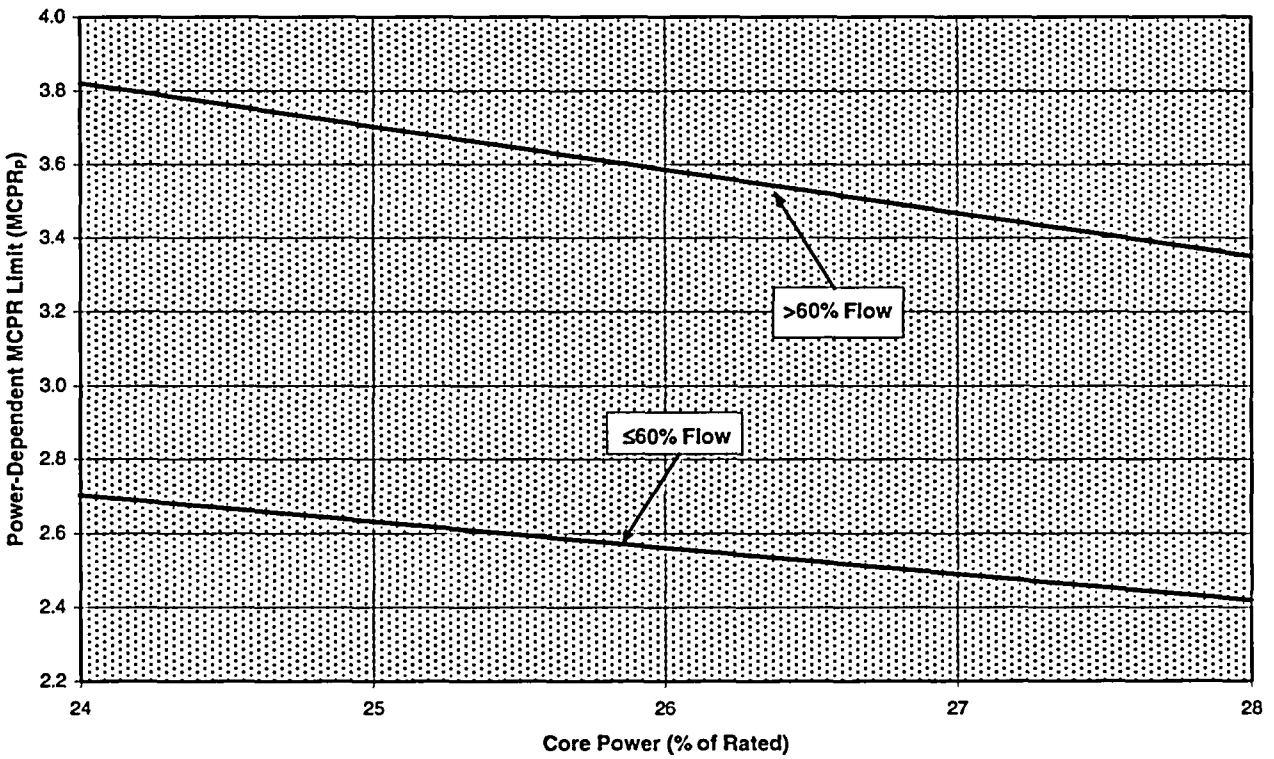
F	A	B
F ≤ 60	2.17	0.00
F > 60	3.360	-0.0300

P = Percent of Rated Core Power
F = Percent of Rated Core Flow

NOTE: For SLO, increase the value of A by 0.02.

FIGURE 3-1A

Power-Dependent MCPR Limit ($MCPR_P$) versus Core Power from 24% to 28% of Rated Core Power
(Turbine Bypass Valves Operable)



$MCPR_P = A + B*P$

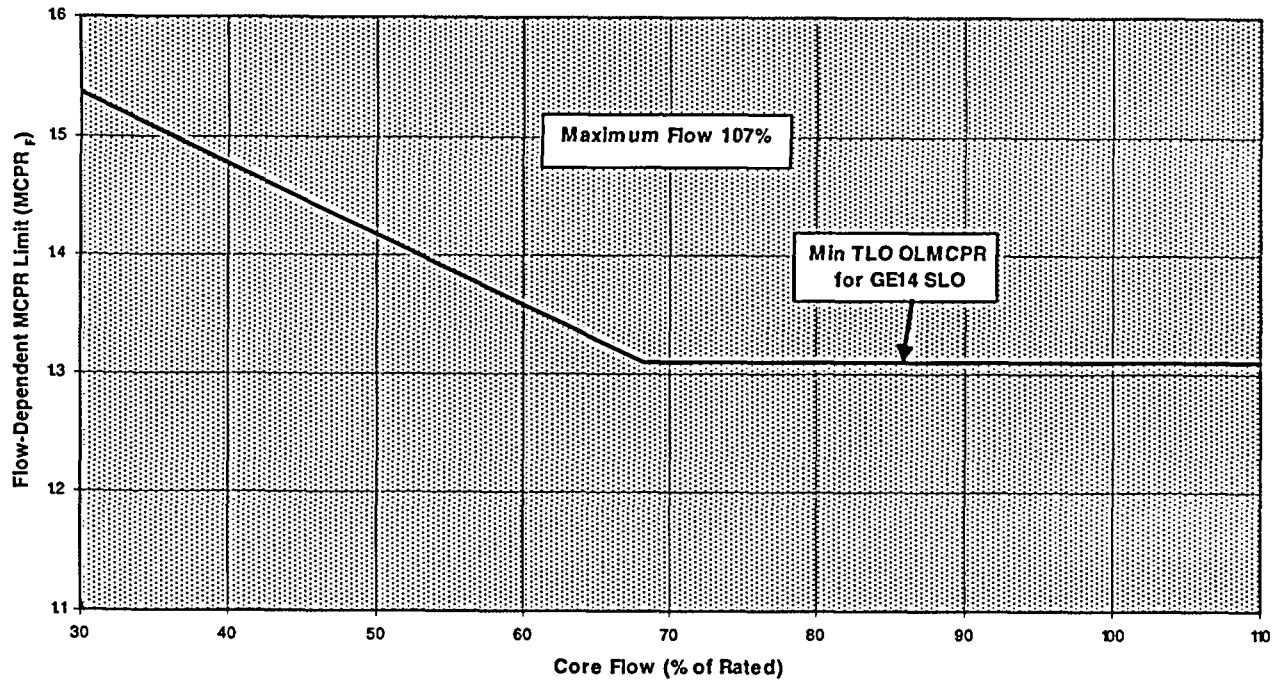
F	A	B
F ≤ 60	4.400	-0.0707
F > 60	6.648	-0.1178

P = Percent of Rated Core Power
F = Percent of Rated Core Flow

NOTE: For SLO, increase the value of A by 0.02.

FIGURE 3-1B

Power-Dependent MCPR Limit ($MCPR_P$) versus Core Power from 24% to 28% of Rated Core Power
(Turbine Bypass Valves Inoperable)



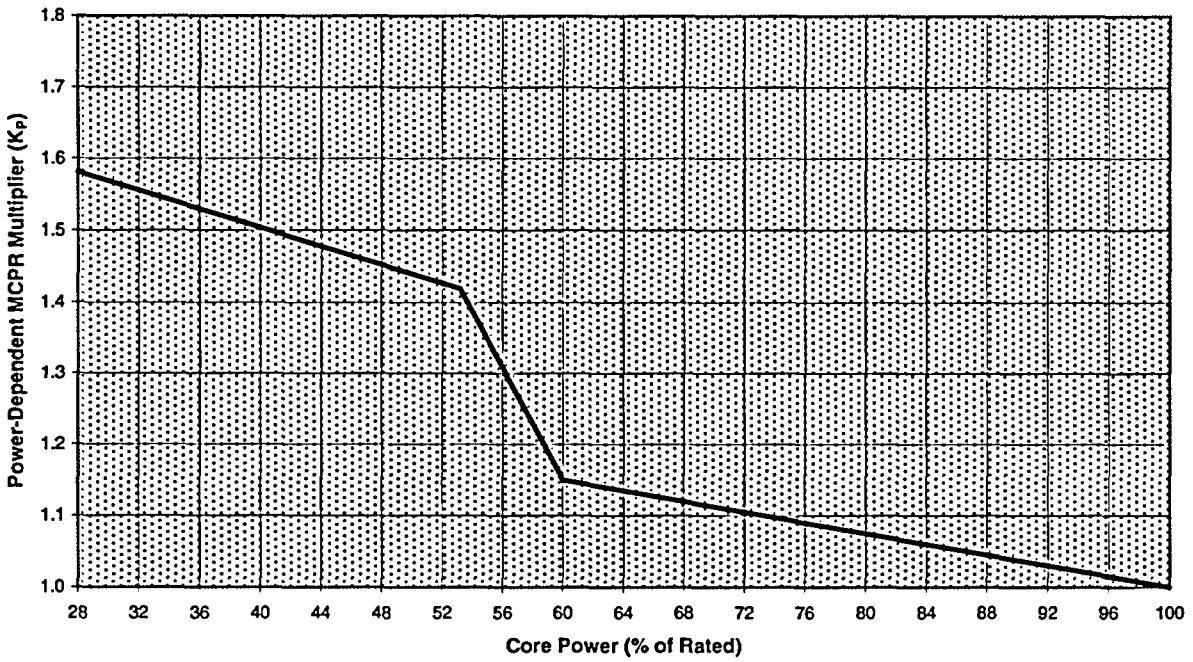
$MCPR_F$ = Maximum [1.31, (A + B*F)]

Operating Conditions	Values of Variables	
Maximum Core Flow (% of Rated)	A	B
107.0	1.713	-0.00591

F = Percent of Rated Core Flow

FIGURE 3-2

Flow-Dependent MCPR Limit ($MCPR_F$) versus Core Flow



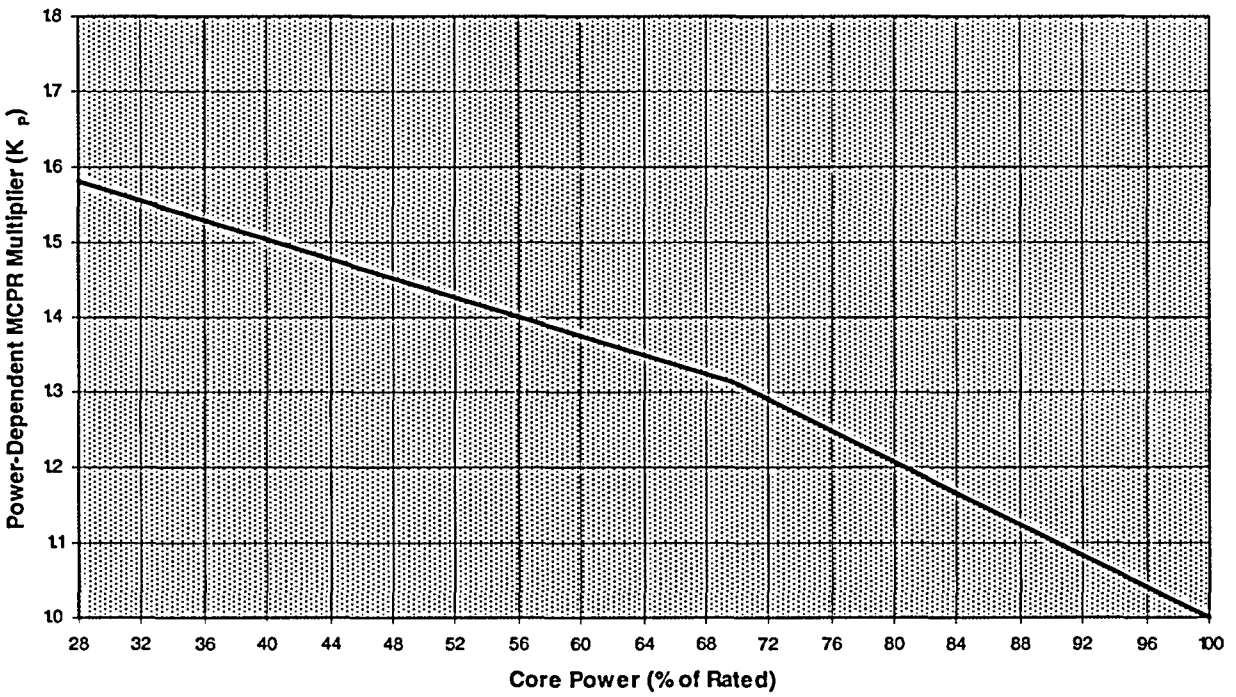
$K_P = A + B*P$

P	A	B
$28 \leq P < 53.2$	1.7612	-0.00643
$53.2 \leq P < 60$	3.5240	-0.03957
$60 \leq P$	1.3750	-0.00375

P = Percent of Rated Core Power

FIGURE 3-3A

Power-Dependent MCPR Multiplier (K_P) versus Core Power
(Pressure Regulator Operable)



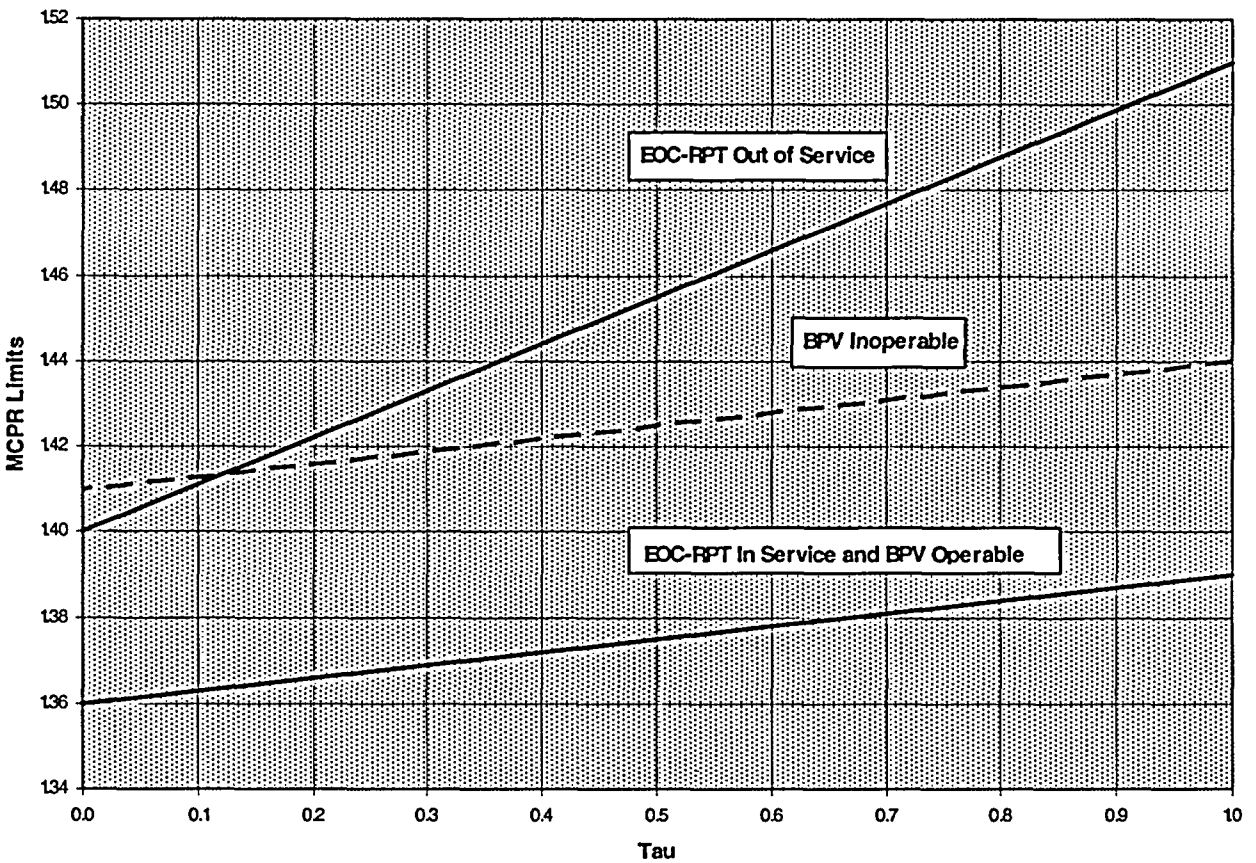
$K_P = A + B*P$

P	A	B
$28 \leq P < 70$	1.7612	-0.00643
$70 \leq P$	2.0367	-0.01037

P = Percent of Rated Core Power

FIGURE 3-3B

Power-Dependent MCPR Multiplier (K_P) versus Core Power
(Pressure Regulator Inoperable)

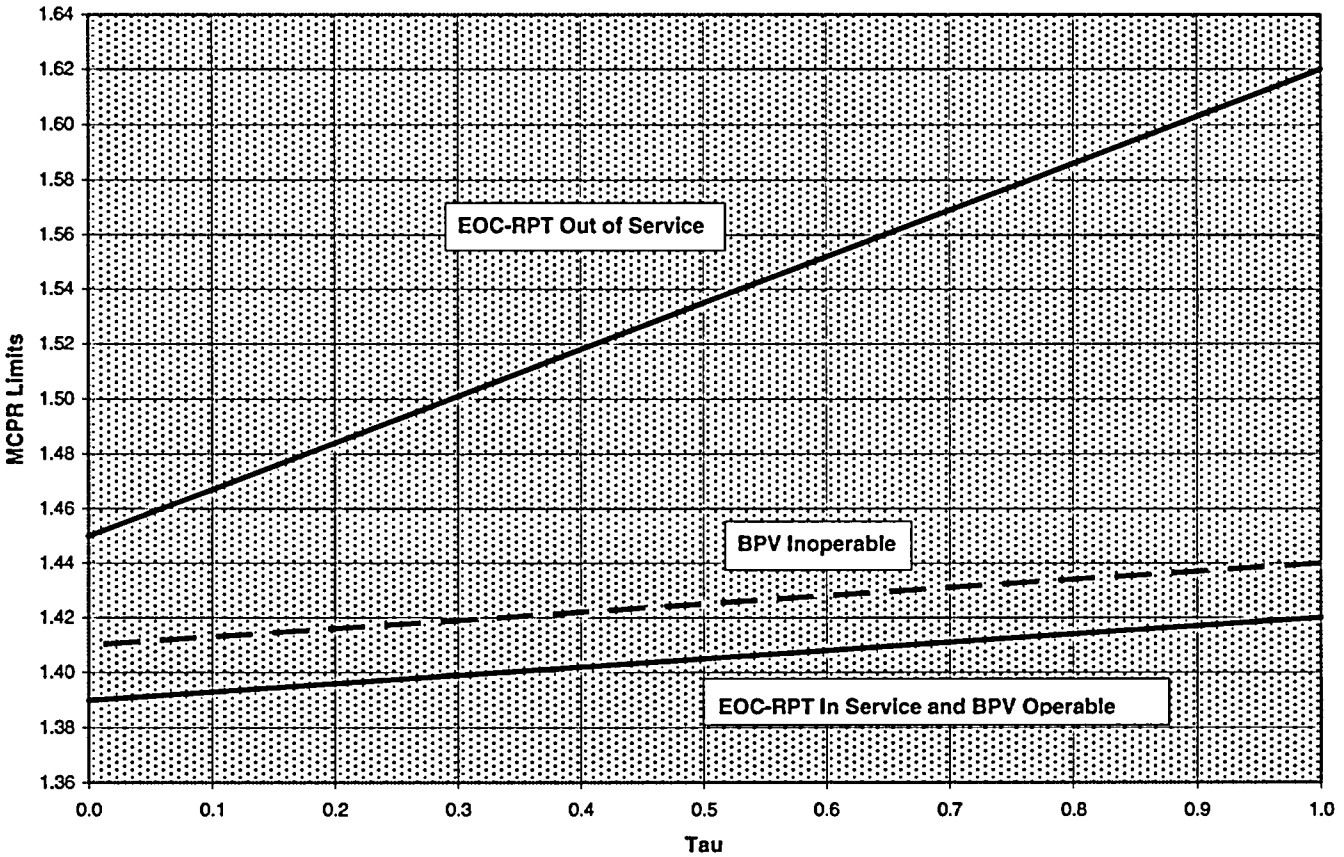


Operating Conditions		OLMCPR	
EOC-RPT	Bypass Valves	$\tau = 0.0$	$\tau = 1.0$
In Service	Operable	1.36	1.39
Out of Service	Operable	1.40	1.51
In Service	Inoperable	1.41	1.44

NOTE: For SLO, increase each OLMCPR by 0.02.

FIGURE 3-4A

MCPR Limits versus Average Scram Time
(BOC to EOR-1400 MWd/st)



Operating Conditions		OLMCPR	
EOC-RPT	Bypass Valves	$\tau = 0.0$	$\tau = 1.0$
In Service	Operable	1.39	1.42
Out of Service	Operable	1.45	1.62
In Service	Inoperable	1.41	1.44

NOTE: For SLO, increase each OLMCPR by 0.02.

FIGURE 3-4B

MCPR Limits versus Average Scram Time
(EOR-1400 MWd/st to EEOC)

4.0 LHGR LIMITS (Technical Specification 3.2.3)

The LHGR limit for each six inch axial segment of each fuel rod in the core is the applicable rated-power, rated-flow LHGR limit taken from Figure 4-3 or 4-4, multiplied by the smaller of either:

a. The flow-dependent multiplier, $LHGRFAC_F$, from Figure 4-1,

or

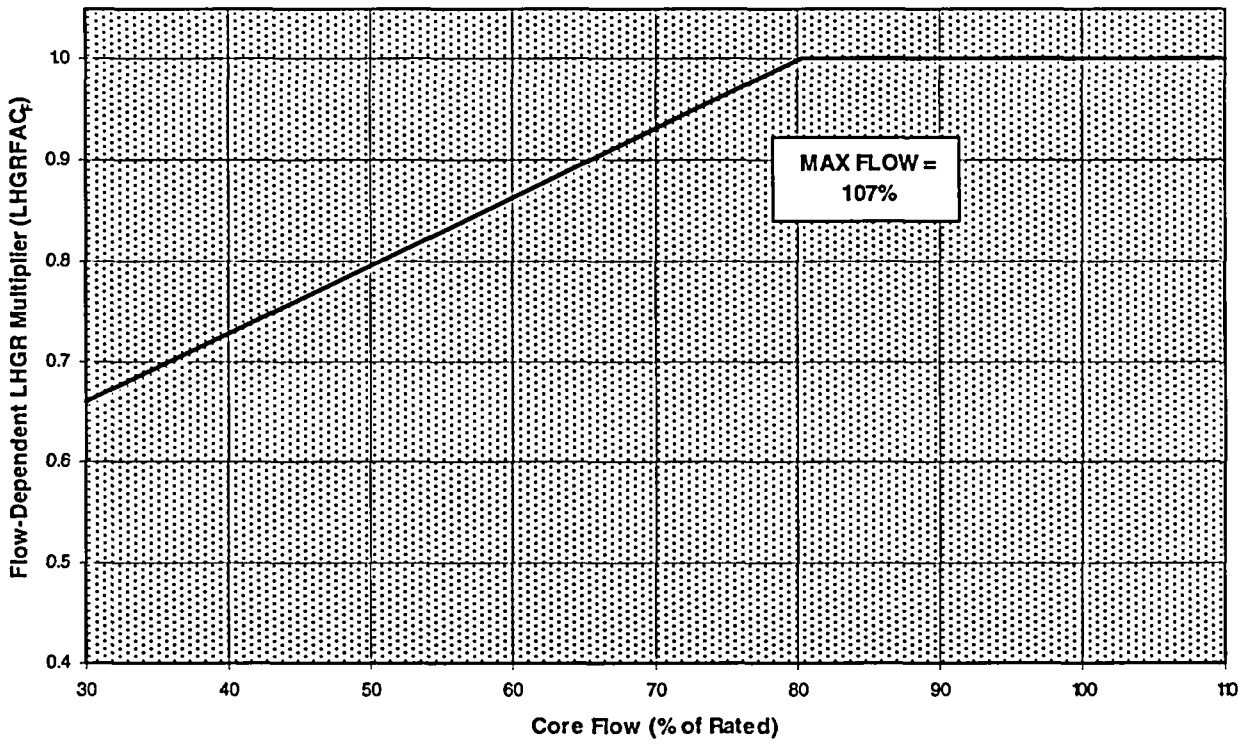
b. The power-dependent multiplier, $LHGRFAC_P$, as determined by Table 4-1.

Figures 4-3 and 4-4 show the LHGR limits for both UO_2 rods (which contain no gadolinium) and the most limiting gadolinium-bearing rods for GE13 and GE14 fuel types, respectively. Other gadolinium-bearing rods may have proprietary LHGR limits which lie between these two curves. Compliance with the proprietary limits will be monitored by the plant's process computer, in which case some gadolinium-bearing rods may operate at power levels above the more restrictive limits shown on these curves.

Table 4-1

LHGR Operating Flexibility Options

Pressure Regulator	High Pressure Feedwater Heaters	$LHGRFAC_P$
Operable	In Service	Figure 4-2A
Inoperable	In Service	Figure 4-2B
Operable	Out of Service	Figure 4-2C



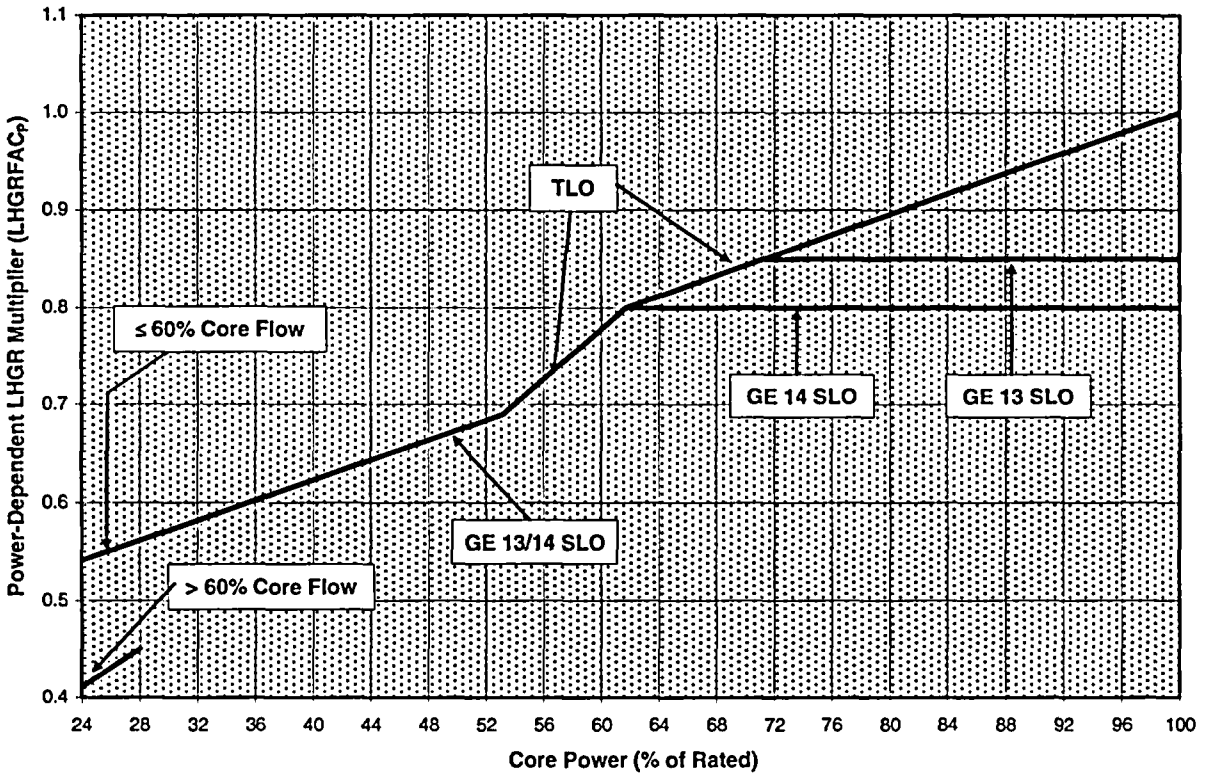
LHGRFAC$_F$ = Minimum [1.0, (A + B*F)]

Maximum Core Flow (% of Rated)	A	B
107.0	0.4574	0.006758

F = Percent of Rated Core Flow

FIGURE 4-1

Flow-Dependent LHGR Multiplier (LHGRFAC$_F$) versus Core Flow



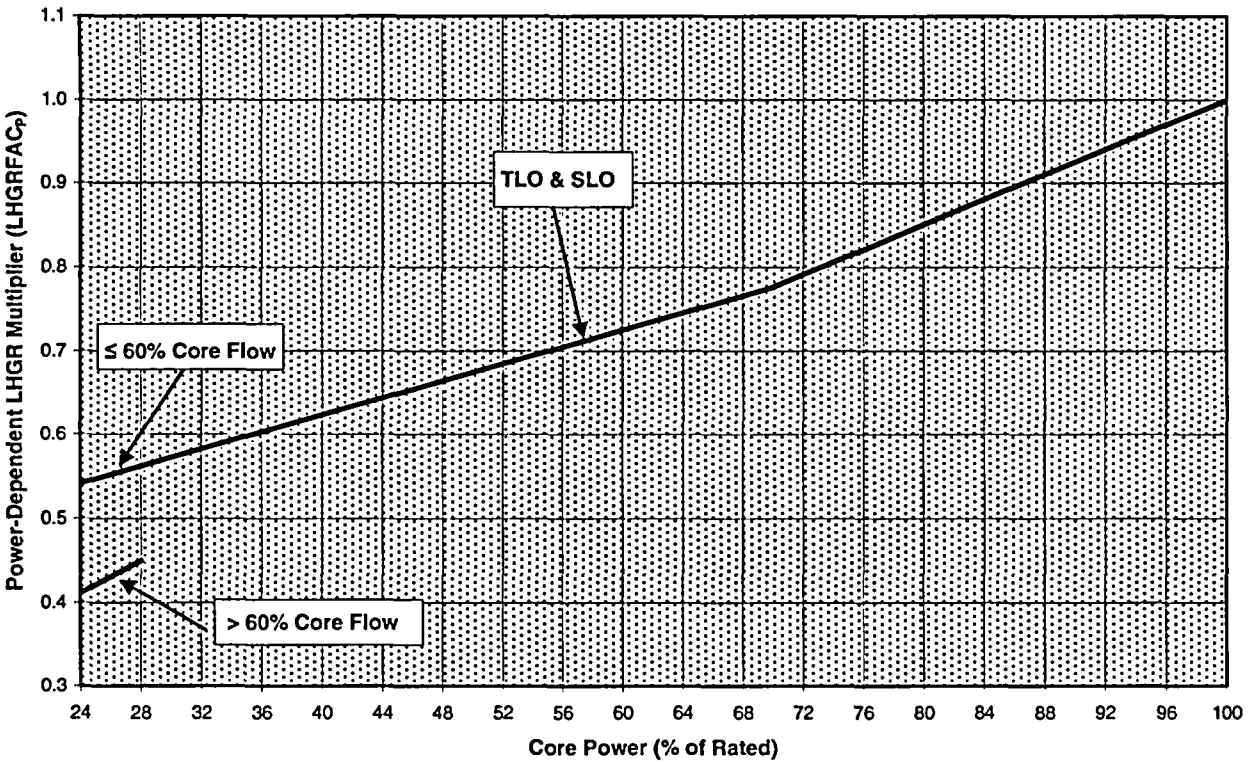
LHGRFAC$_P$ = A + B*P

Operating Conditions				Values of Variables	
P	F	SLO/ TLO	Fuel Type	A	B
24 ≤ P < 28	F > 60	SLO / TLO	All	0.17924	0.00967
24 ≤ P < 28	F ≤ 60	SLO / TLO	All	0.41897	0.00510
28 ≤ P < 53.2	All	SLO / TLO	All	0.41897	0.00510
53.2 ≤ P < 61.72	All	SLO / TLO	All	0.00509	0.01288
61.72 ≤ P	All	TLO	All	0.4776	0.005224
61.72 ≤ P	All	SLO	GE14	0.80	0.000
61.72 ≤ P < 71.28	All	SLO	GE13	0.4776	0.005224
71.28 ≤ P	All	SLO	GE13	0.85	0.000

P = Percent of Rated Core Power
F = Percent of Rated Core Flow

FIGURE 4-2A

Power-Dependent LHGR Multiplier (LHGRFAC$_P$) versus Core Power
(Pressure Regulator Operable and High Pressure Heaters In Service)



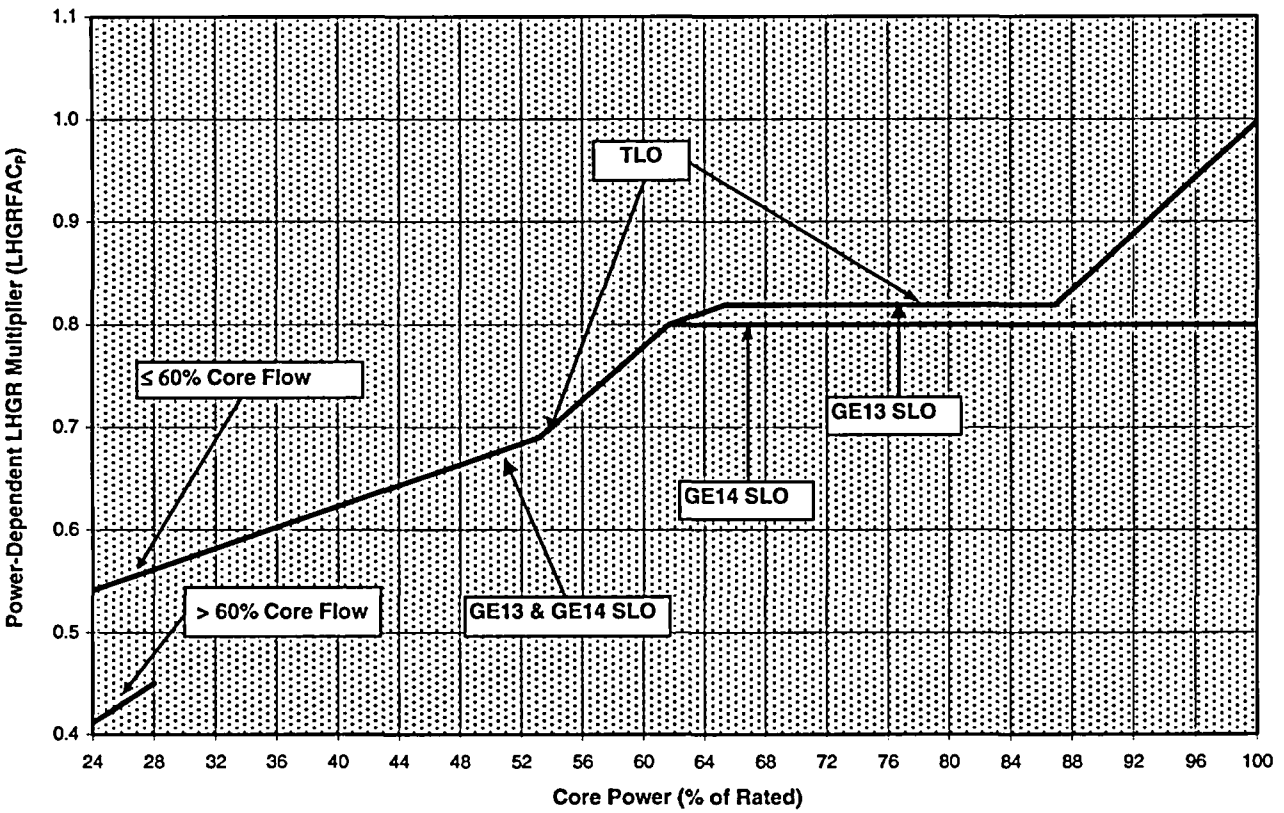
LHGRFAC$_P$ = A + B*P

Operating Conditions				Values of Variables	
P	F	SLO/ TLO	Fuel Type	A	B
24 ≤ P < 28	F > 60	SLO / TLO	All	0.17924	0.00967
24 ≤ P < 28	F ≤ 60	SLO / TLO	All	0.41897	0.0051
28 ≤ P < 70	All	SLO / TLO	All	0.41897	0.0051
70 ≤ P	All	SLO / TLO	All	0.25253	0.00747

P = Percent of Rated Core Power
F = Percent of Rated Core Flow

FIGURE 4-2B

Power-Dependent LHGR Multiplier (LHGRFAC$_P$) versus Core Power
(Pressure Regulator Inoperable and High Pressure Heaters In Service)



$LHGRFAC_P = A + B*P$

Operating Conditions				Values of Variables	
P	F	SLO/TLO	Fuel Type	A	B
24 ≤ P < 28	F > 60	SLO / TLO	All	0.17924	0.00967
24 ≤ P < 28	F ≤ 60	SLO / TLO	All	0.41897	0.00510
28 ≤ P < 53.2	All	SLO / TLO	All	0.41897	0.00510
53.2 ≤ P < 61.72	All	SLO / TLO	All	0.00509	0.01288
61.72 ≤ P < 65.35	All	TLO	All	0.4776	0.005224
65.35 ≤ P < 86.91	All	TLO	All	0.819	0.000
86.91 ≤ P	All	TLO	All	-0.3630	0.01360
61.72 ≤ P	All	SLO	GE14	0.800	0.000
61.72 ≤ P < 65.35	All	SLO	GE13	0.4776	0.005224
65.35 ≤ P	All	SLO	GE13	0.819	0.000

P = Percent of Rated Core Power
F = Percent of Rated Core Flow

FIGURE 4-2C

Power-Dependent LHGR Multiplier ($LHGRFAC_P$) versus Core Power
(Pressure Regulator Operable and High Pressure Heaters Out of Service)

UO2 Rods	
Peak Pellet Exposure	LHGR
0.00	14.40
13.24	14.40
32.66	12.70
56.70	9.00
63.50	6.40

Limiting Gd Rods	
Peak Pellet Exposure	LHGR
0.00	13.21
10.88	13.21
29.92	11.65
53.50	8.26
60.18	5.87

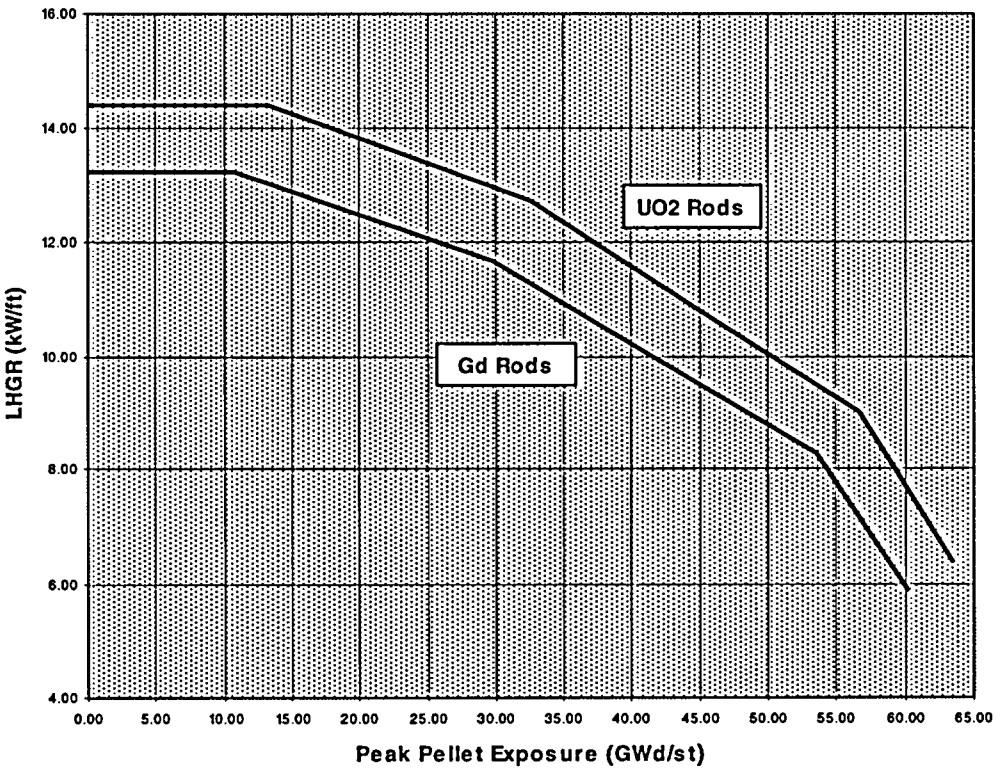


FIGURE 4-3

LHGR versus Peak Pellet Exposure
(Fuel Type: GE13)

UO2 Rods	
Peak Pellet Exposure	LHGR
0.00	13.40
14.51	13.40
57.61	8.00
63.50	5.00

Limiting Gd Rods	
Peak Pellet Exposure	LHGR
0.00	12.00
12.17	12.00
54.59	7.16
60.39	4.48

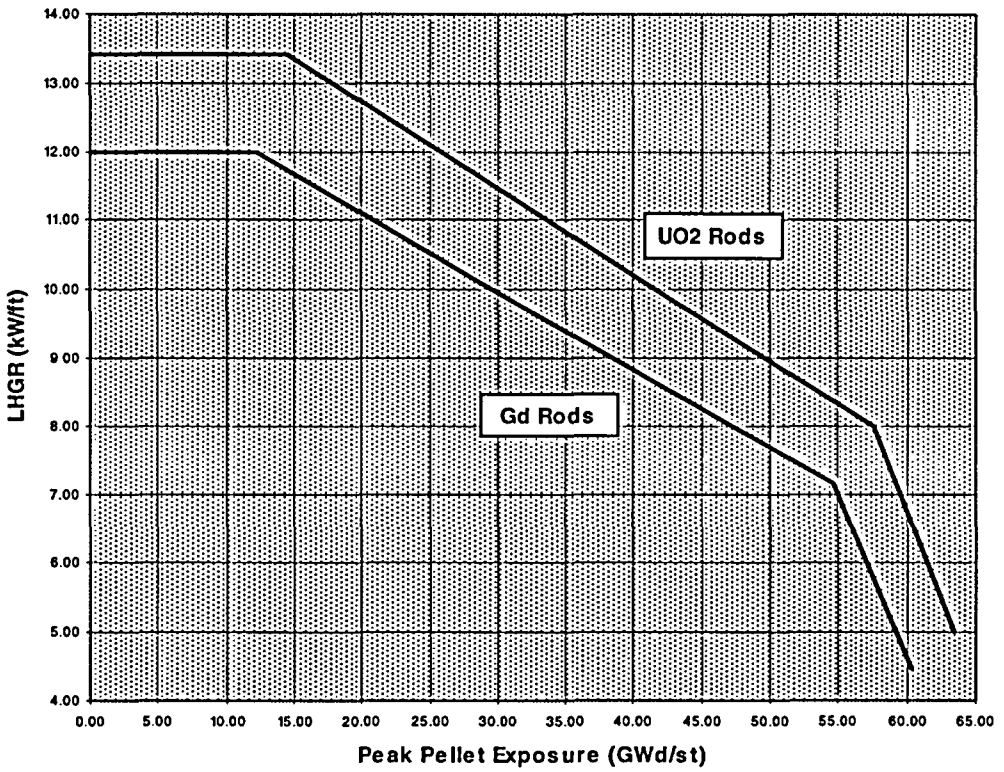


FIGURE 4-4

LHGR versus Peak Pellet Exposure
(Fuel Type: GE14)

5.0 PBDA AMPLITUDE SETPOINTS

The amplitude trip setpoint in the Period Based Detection Algorithm in the OPRM system shall not exceed the values reported in the Table below. This applies to instruments 2C51K615 A, B, C, and D. Projected Figure of Merit (FOM) value(s) throughout the cycle will be supplied by the Hatch Core Analysis Group.

OLMCPR	0.0 ≤ FOM ≤ 92.1	92.1 < FOM ≤ 96.9	96.9 < FOM ≤ 102.4	102.4 < FOM ≤ 108.0
1.35	1.15	1.14	1.12	1.11
1.36	1.15	1.14	1.12	1.11
1.37	1.15	1.14	1.12	1.11
1.38	1.15	1.15	1.12	1.11
1.39	1.15	1.15	1.13	1.12
1.40	1.15	1.15	1.13	1.12
1.41	1.15	1.15	1.13	1.12
1.42	1.15	1.15	1.13	1.12
1.43	1.15	1.15	1.13	1.12
1.44	1.15	1.15	1.14	1.13
1.45	1.15	1.15	1.14	1.13

6.0 REFERENCES

1. "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-14, June 2000, and the US Supplement, NEDE-24011-P-A-14-US, June 2000.

2. GNF Letter "Plant Hatch Technical Specification Modification to include LHGR," M. E. Harding (GNF) to E. B. Gibson, January 22, 2004.

3. Global Nuclear Fuel document 0000-0030-0566-SRLR, "Supplemental Reload Licensing Report for Edwin I. Hatch Nuclear Power Plant Unit 2, Reload 18 Cycle 19," Revision 1, February 2005.

4. SNC Letter CAH-NF-2501, "H2C19 SNC Reload Licensing Analyses," W. R. Mertz to K. S. Folk, February 16, 2005.

5. SNC Letter CAH-NF-2502, "Generic Pressure Regulator Failure Downscale (PRFDS) Analysis," W. R. Mertz to K. S. Folk, February 16, 2005.

6. SNC Letter CAH-NF-2410, "H2C18 SNC ARTS Analyses," W. R. Mertz to K. S. Folk, March 11, 2003.

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