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May 4, 2010

Docket Nos.: 50-321

NL-10-0664

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Edwin I. Hatch Nuclear Plant-Unit 1
Cycle 25 Version 1 Core Operating Limits Report

Ladies and Gentlemen:

In accordance with Technical Specification 5.6.5.d., Southern Nuclear Operating Company (SNC) submits the enclosed Core Operating Limits Report (COLR) for Edwin I. Hatch Nuclear Plant-Unit 1 Cycle 25 Version 1.

This letter contains no NRC commitments. If there are any questions, please contact Mr. N. J. Stringfellow at 205-992-7037.

Respectfully submitted,

Mark J Ajluni

M. J. Ajluni
Manager - Nuclear Licensing

MJA /PAH/

Enclosure: Core Operating Limits Report HNP Unit 1 Cycle 25 Version 1

cc: Southern Nuclear Operating Company
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Edwin I. Hatch Nuclear Plant - Unit 1
Cycle 25 Core Operating Limits Report

Enclosure

CORE Operating Limits Report Unit 1 Cycle 25, Version 1

SOUTHERN NUCLEAR OPERATING COMPANY
EDWIN I. HATCH NUCLEAR PLANT

Unit 1 Cycle 25
CORE OPERATING LIMITS REPORT

Version 1

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

Edwin I. Hatch Nuclear Plant
Unit 1 Cycle 25 Core Operating Limits Report

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FIGURES

1.0 INTRODUCTION

The Core Operating Limits Report (COLR) for Plant Hatch Unit 1 Cycle 25 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 through 6). Results from the reload analyses for the fuel in Unit 1 Cycle 25 are documented in References 3 through 5.

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 1 operation.

TABLE 1-1

Equipment-Out-of-Service Limitations

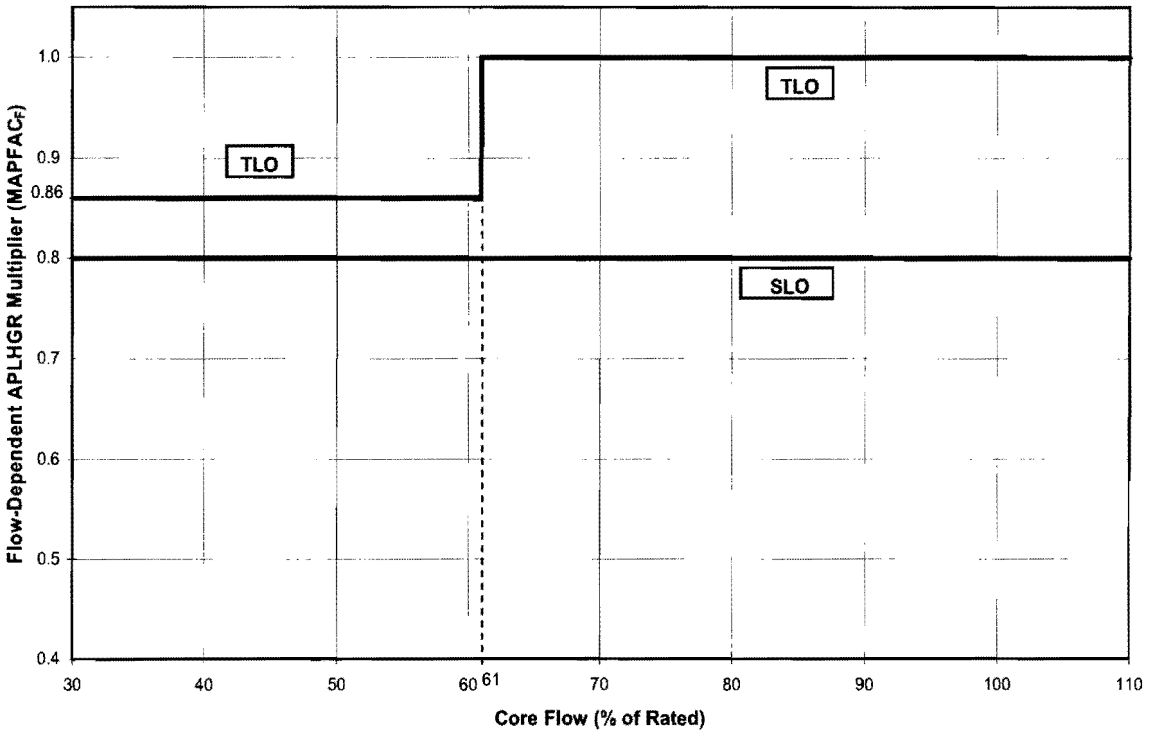
Equipment / Condition	Limitation
EOC-RPT Out of Service and Turbine Bypass Valves Inoperable Simultaneously	Option B scram speeds must be met (in place) at CTP ≥ 45% RTP
Main Turbine Pressure Regulator System in TLCO 3.3.13.c	Option B scram speeds must be met (in place) at CTP ≥ 45% RTP
Single-Loop Operation (SLO)	• CTP ≤ 2000 MWth • Core Flow ≤ 56% of Rated

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).

The power distribution limits in this report apply to plant operation with all equipment in service, unless otherwise specified.

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 multiplied by the flow-dependent multiplier, $MAPFAC_F$, from Figure 2-1.



Operating Conditions		
F	SLO / TLO	MAPFAC$_F$
30 ≤ F ≤ 61	TLO	0.86
61 < F	TLO	1.00
30 ≤ F	SLO	0.80

F = Percent of Rated Core Flow

FIGURE 2-1

Flow-Dependent APLHGR Multiplier (MAPFAC$_F$) versus Core Flow

Average Planar Exposure (GWd/st)	APLHGR Limit (kW/ft)
0.00	12.82
14.51	12.82
19.13	12.82
57.61	8.00
63.50	5.00

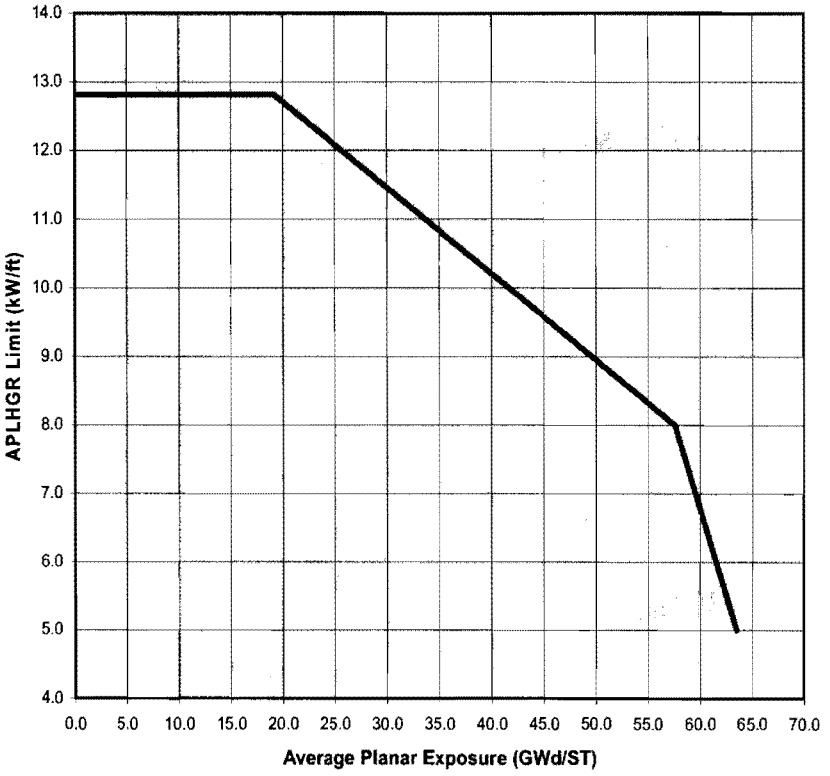


FIGURE 2-2

APLHGR Limit versus Average Planar Exposure

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 the status of the main turbine pressure regulator system.

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

a. For 24% ≤ power < 45%, the power-dependent MCPR limit, $MCPR_P$, as determined by Table 3-1.

b. For power ≥ 45%, 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 OLMCPR, as determined by Table 3-1.

As shown on Figures 3-1A, 3-1B, 3-2, 3-4A, 3-4B, and 3-4C, the OLMCPR with only one recirculation pump in operation (SLO) is equal to the two loop (TLO) OLMCPR plus 0.02.

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

In Figures 3-4A, 3-4B, and 3-4C, 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 OLMCPR corresponds to τ. If τ has not been determined, Option A limits must 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).

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

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

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

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

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

TABLE 3-1

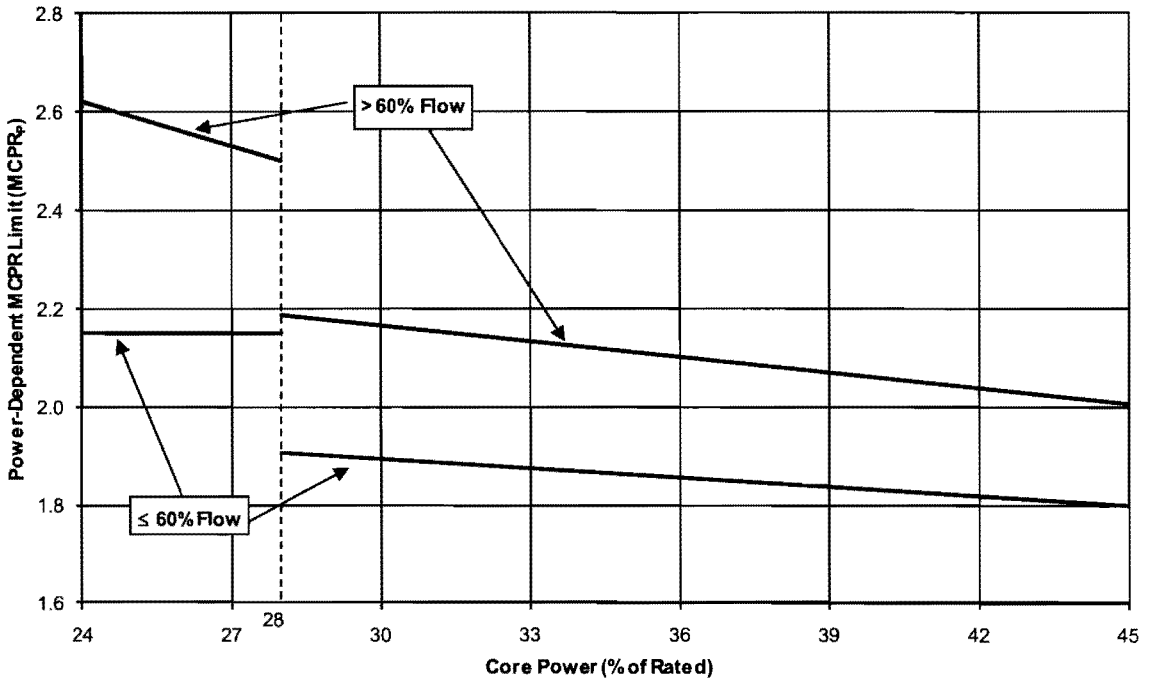
MCPR Operating Flexibility Options

Rated Power OLMCPRs	
BOC to EOR – 4944	Figure 3-4A
EOR – 4944 to EOR – 1444	Figure 3-4B
EOR – 1444 to EOC	Figure 3-4C

$MCPR_P$ from ≥ 24% to < 45% Power	
Turbine Bypass Valves Operable	Figure 3-1A
Turbine Bypass Valves Inoperable	Figure 3-1B

K_P for Power ≥ 45% of Rated			
EOC-RPT System In Service	Turbine Bypass Valves Operable	Main Turbine Pressure Regulator System Status	
Yes	Yes	TLCO 3.3.13.a or b	Figure 3-3A
No	Yes	TLCO 3.3.13.a or b	Figure 3-3A
Yes	No	TLCO 3.3.13.a or b	Figure 3-3A
No	No	TLCO 3.3.13.a or b	Figure 3-3B*
Yes/No	Yes/No	TLCO 3.3.13.c	Figure 3-3C*

EOR = End of rated conditions (100% power, 100% flow, ARO, with nominal feedwater temperature)
* Option B scram speeds must be met (in place) at CTP ≥ 45% RTP



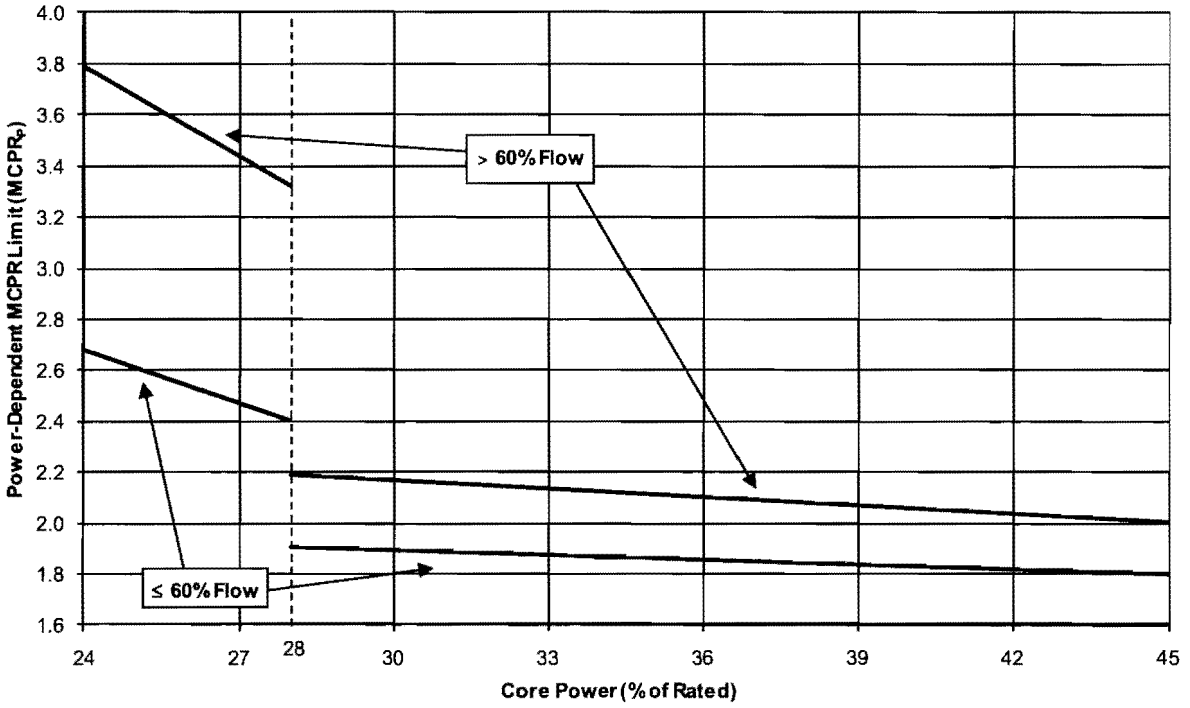
$MCPR_{P(TLO)} = A + B*P$
$MCPR_{P(SLO)} = MCPR_{P(TLO)} + 0.02$

F	P	A	B
≤ 60	24 ≤ P < 28	2.1500	0.00000
> 60	24 ≤ P < 28	3.3400	-0.03000
≤ 60	28 ≤ P < 45	2.0810	-0.00624
> 60	28 ≤ P < 45	2.4861	-0.01067

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

FIGURE 3-1A

Power-Dependent MCPR Limit ($MCPR_P$) versus Core Power from 24% to 45% of Rated Core Power



$MCPR_{P(TLO)} = A + B*P$

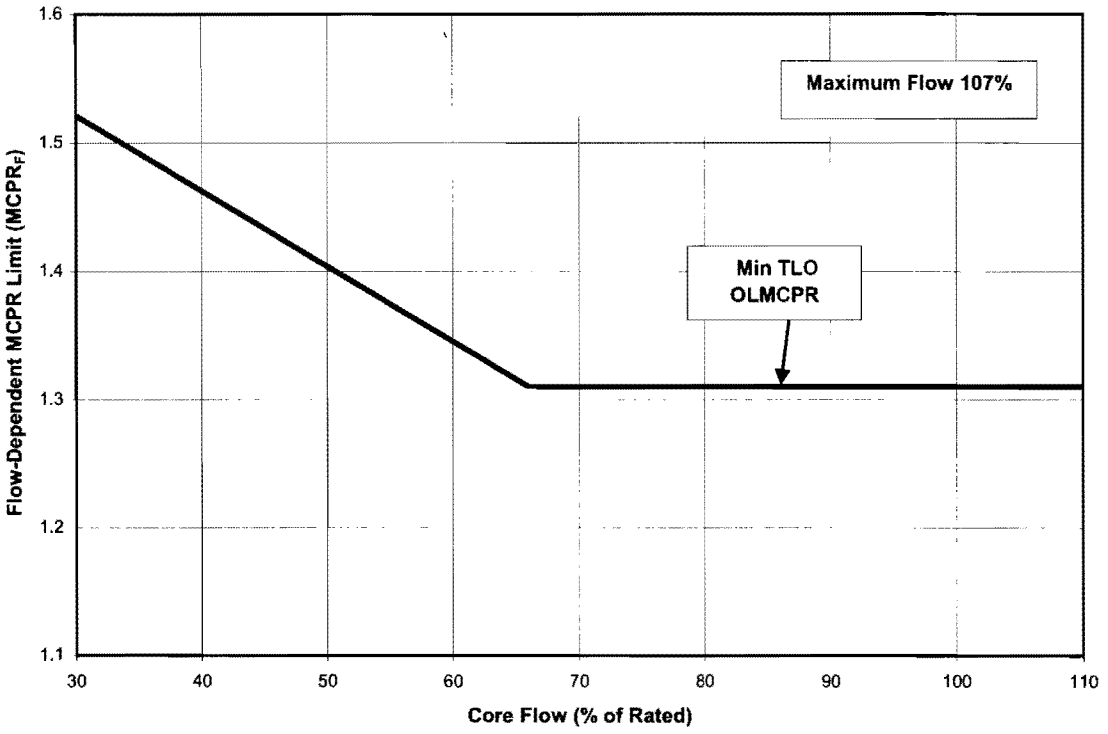
$MCPR_{P(SLO)} = MCPR_{P(TLO)} + 0.02$

F	P	A	B
≤ 60	24 ≤ P < 28	4.3600	-0.07000
> 60	24 ≤ P < 28	6.5876	-0.11670
≤ 60	28 ≤ P < 45	2.0810	-0.00624
> 60	28 ≤ P < 45	2.4861	-0.01067

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

FIGURE 3-1B

Power-Dependent MCPR Limit ($MCPR_P$) versus Core Power from 24% to 45% of Rated Core Power
(Turbine Bypass Valves Inoperable)



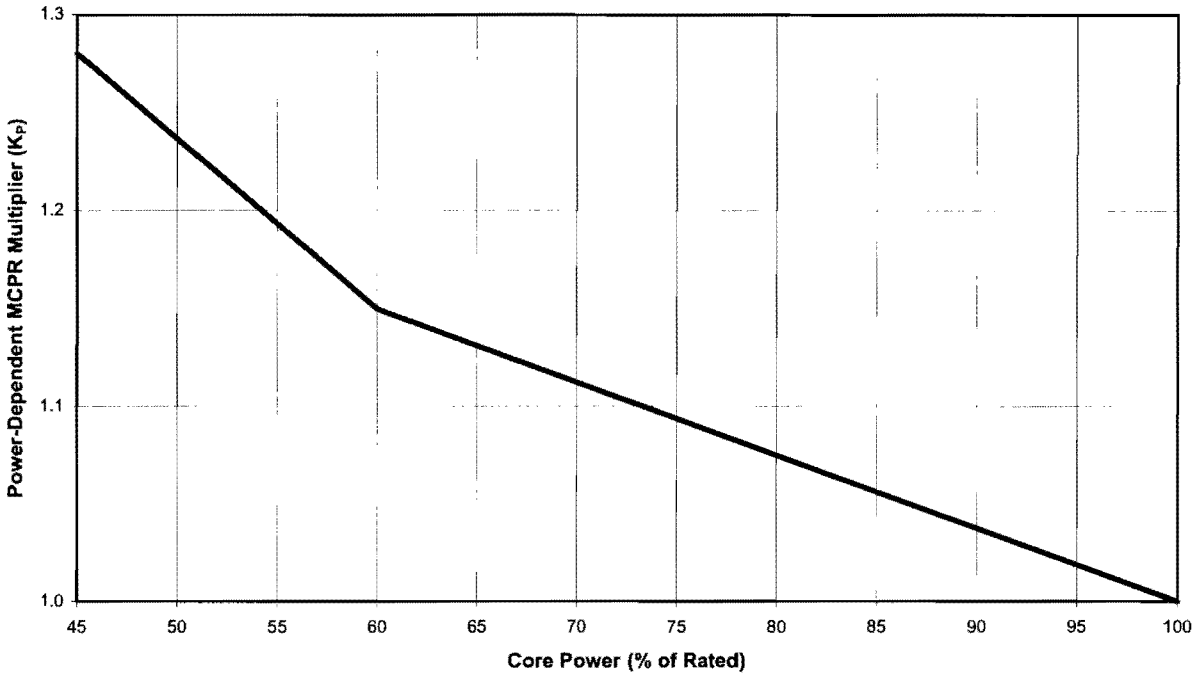
$MCPR_{F(TLO)} = A + B*F$
$MCPR_{F(SLO)} = MCPR_{F(TLO)} + 0.02$

Flow	A	B
$30 \leq F \leq 66.041$	1.697	-0.00586
$66.041 < F$	1.310	0.00000

F = Percent of Rated Core Flow

FIGURE 3-2

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



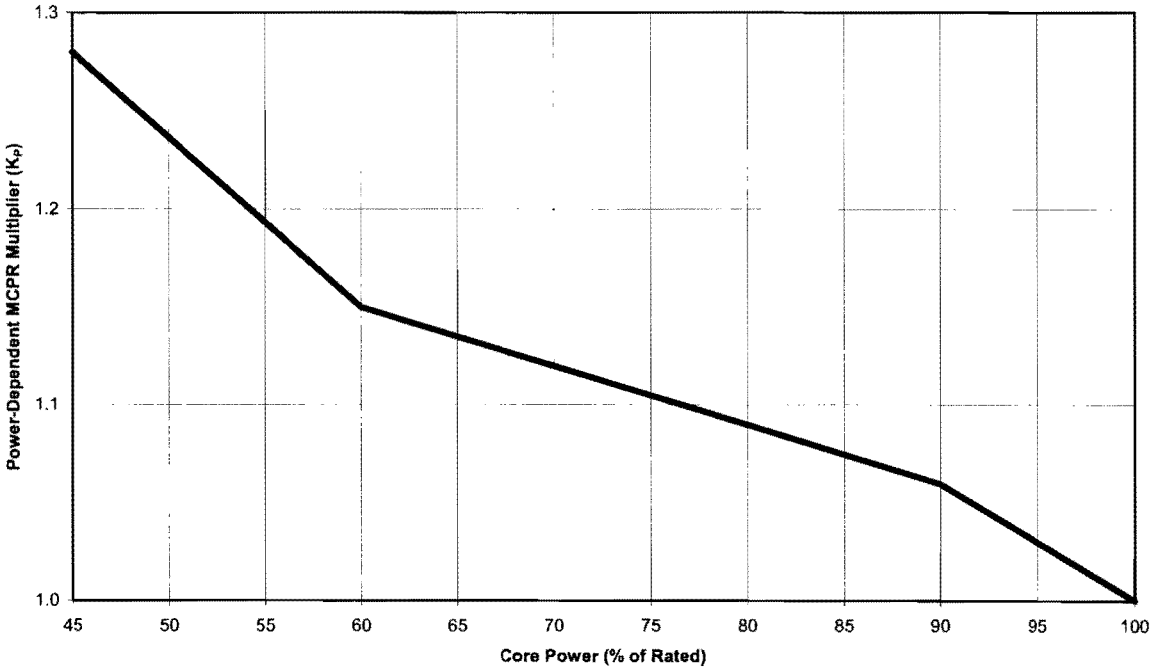
$K_P = A + B*P$

P	A	B
$45 \leq P < 60$	1.6702	-0.00867
$60 \leq P$	1.3750	-0.00375

P = Percent of Rated Core Power

FIGURE 3-3A

Power-Dependent MCPR Multiplier (K_P) versus Core Power



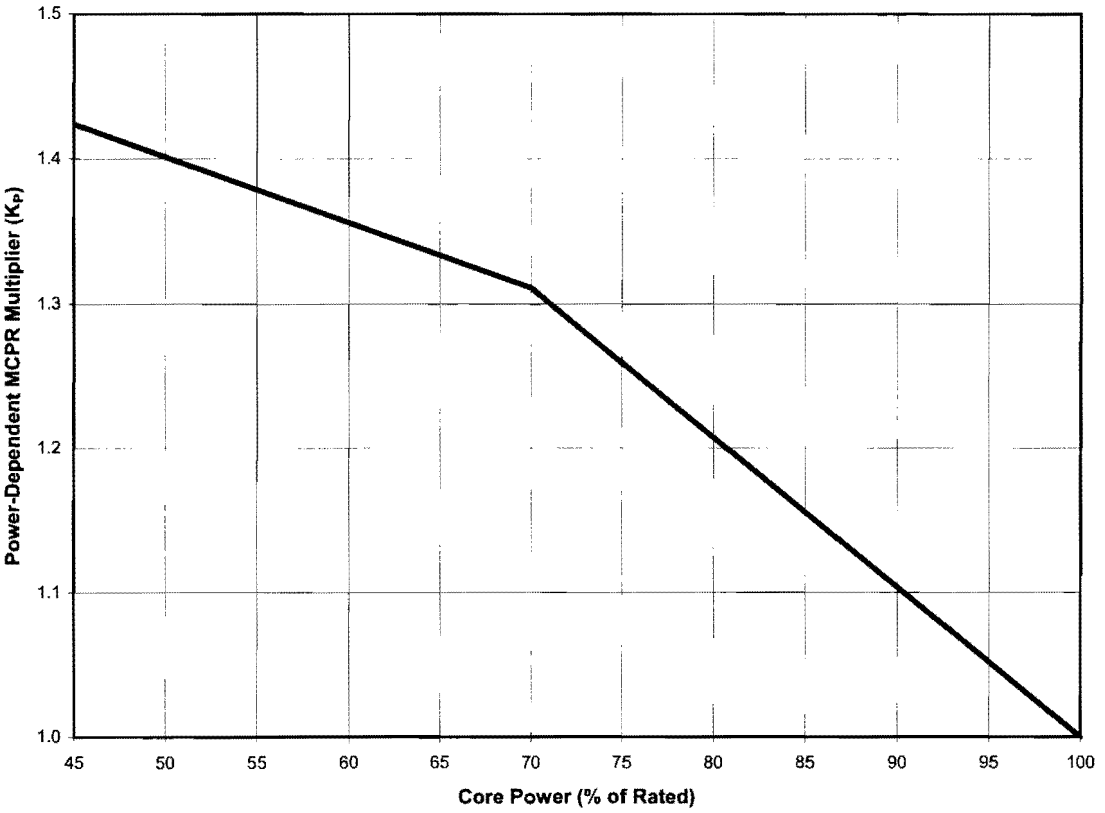
$K_P = A + B*P$

P	A	B
$45 \leq P < 60$	1.6702	-0.00867
$60 \leq P < 90$	1.3308	-0.00301
$90 \leq P$	1.5961	-0.00596

P = Percent of Rated Core Power

FIGURE 3-3B

Power-Dependent MCPR Multiplier (K_P) versus Core Power
(EOC-RPT System Out of Service and
Turbine Bypass Valves Inoperable Simultaneously)



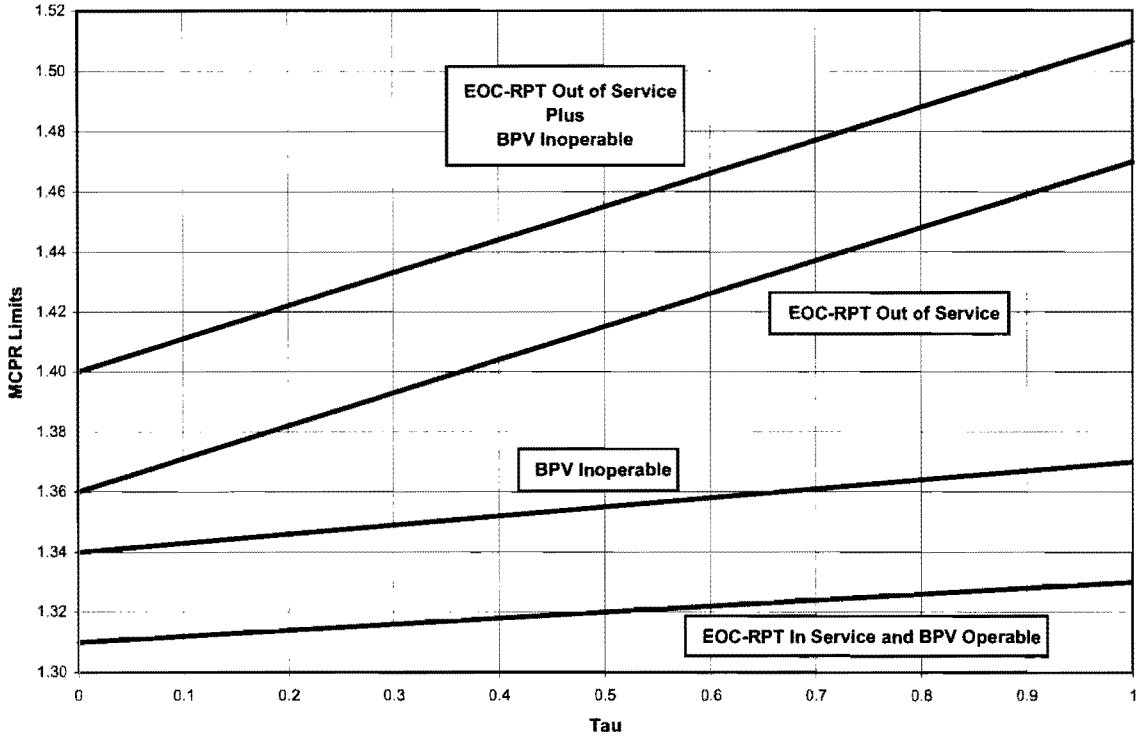
$K_P = A + B*P$

P	A	B
$45 \leq P < 70$	1.6268	-0.00451
$70 \leq P$	2.0367	-0.01037

P = Percent of Rated Core Power

FIGURE 3-3C

Power-Dependent MCPR Multiplier (K_P) versus Core Power
(Main Turbine Pressure Regulator System in TLCO 3.3.13.c)

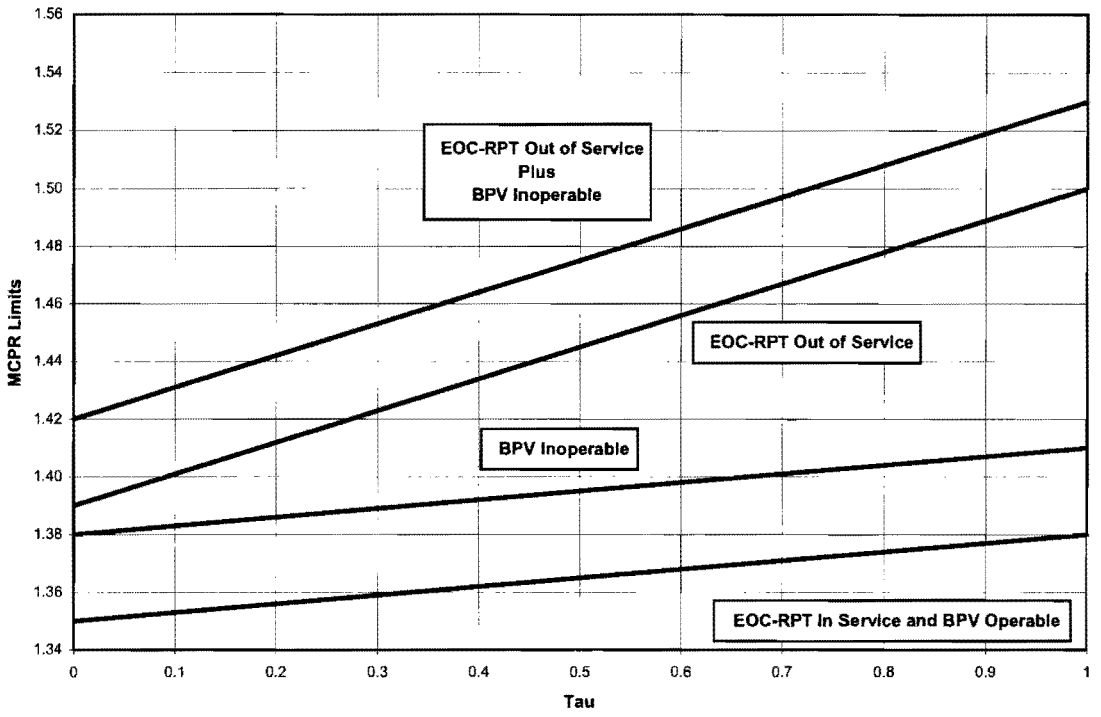


Operating Conditions		OLMCPR(TLO)	
EOC-RPT	**Bypass Valves**	**τ = 0.0**	**τ = 1.0**
In Service	Operable	1.31	1.33
Out of Service	Operable	1.36	1.47
In Service	Inoperable	1.34	1.37
Out of Service	Inoperable	1.40	1.51

OLMCPR(SLO) = OLMCPR(TLO) + 0.02

FIGURE 3-4A

MCPR Limits versus Average Scram Time
(BOC to EOR - 4944 MWd/st)

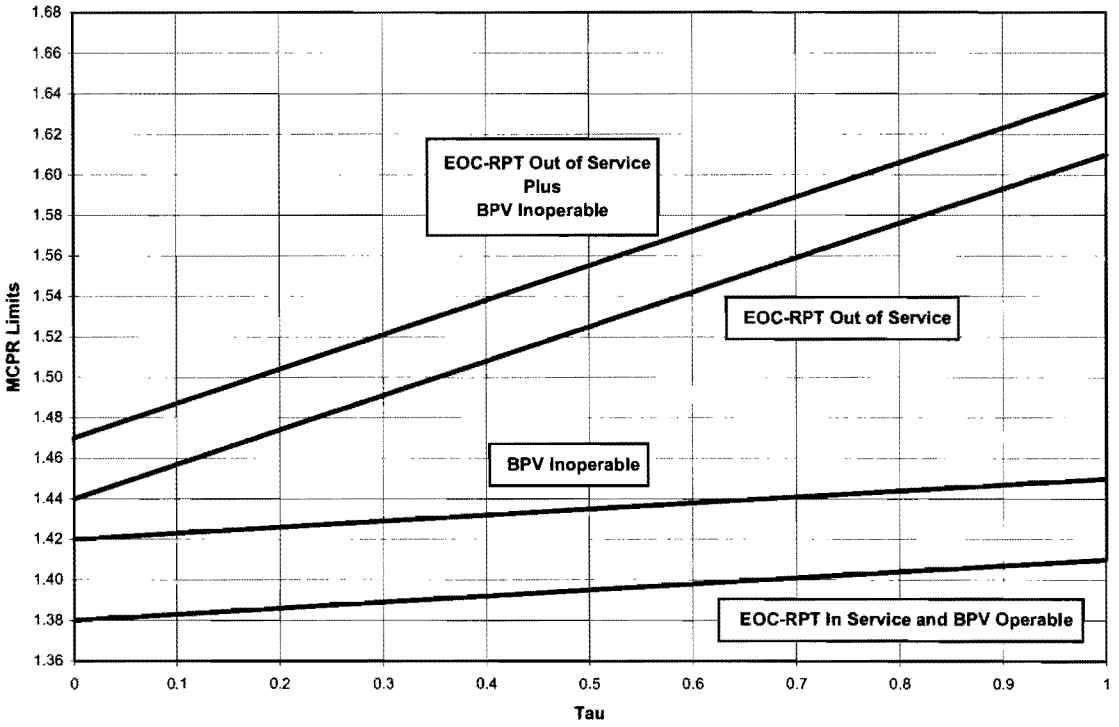


Operating Conditions		OLMCPR(TLO)	
EOC-RPT	**Bypass Valves**	**τ = 0.0**	**τ = 1.0**
In Service	Operable	1.35	1.38
Out of Service	Operable	1.39	1.50
In Service	Inoperable	1.38	1.41
Out of Service	Inoperable	1.42	1.53

OLMCPR(SLO) = OLMCPR(TLO) + 0.02

FIGURE 3-4B

MCPR Limits versus Average Scram Time
(EOR – 4944 MWd/st to EOR – 1444 MWd/st)



Operating Conditions		OLMCPR(TLO)	
EOC-RPT	**Bypass Valves**	**τ = 0.0**	**τ = 1.0**
In Service	Operable	1.38	1.41
Out of Service	Operable	1.44	1.61
In Service	Inoperable	1.42	1.45
Out of Service	Inoperable	1.47	1.64

OLMCPR(SLO) = OLMCPR(TLO) + 0.02

FIGURE 3-4C

MCPR Limits versus Average Scram Time
(EOR - 1444 MWd/st to EOC)

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 Table 4-2 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.

Table 4-2 shows the exposure-dependent LHGR limits for all fuel types in the core, including the UO_2 rods which contain no gadolinium. The LHGR limit is based on initial Gd content in a six inch segment of a fuel rod and the maximum initial Gd content anywhere in the same rod. The first column in Table 4-2 shows the segment Gd concentration and the second column shows the maximum Gd concentration for each fuel type. For exposures between the values shown in Table 4-2, the LHGR limit is based on linear interpolation. For illustration purposes, Figures 4-3 shows the LHGR limits for UO_2 rods and for the most limiting (7.0 w/o) Gd rods in the core.

TABLE 4-1

LHGR Operating Flexibility Options

$LHGRFAC_P$	
Main Turbine Pressure Regulator System Status	
TLCO 3.3.13.a or b	Figure 4-2A
TLCO 3.3.13.c	Figure 4-2B*

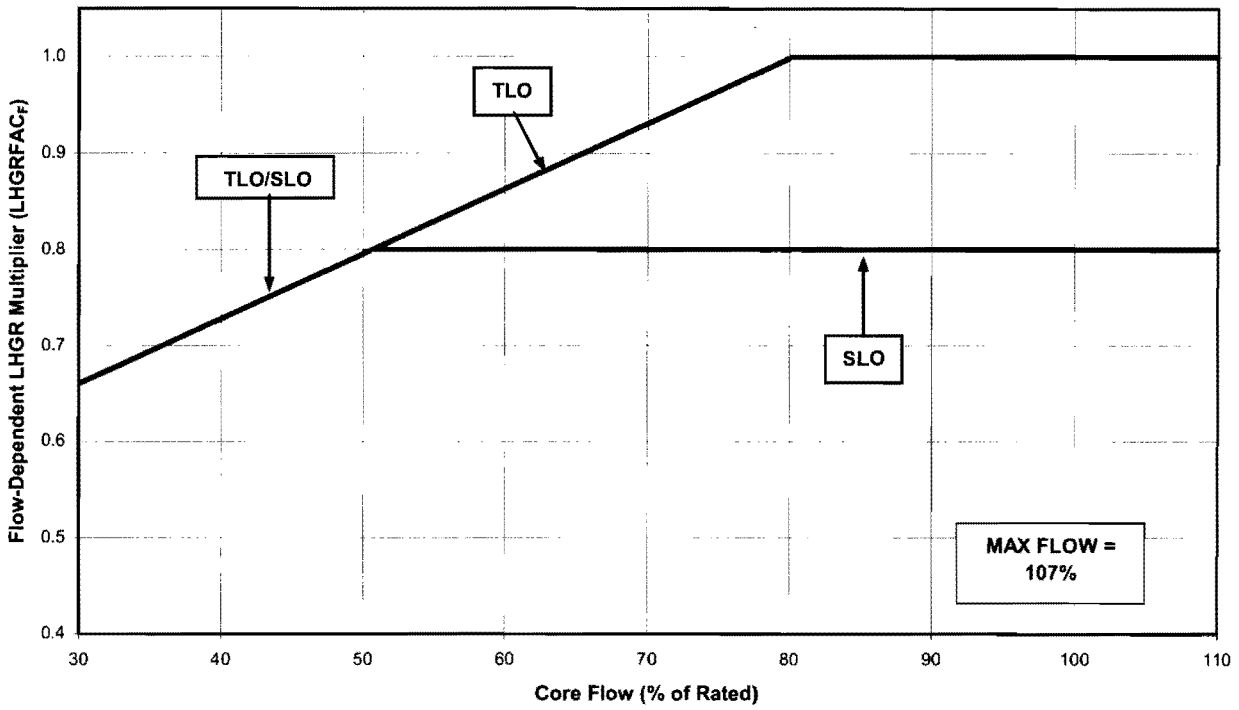
* Option B scram speeds must be met (in place) at CTP ≥ 45% RTP

TABLE 4-2

LHGR limit versus Peak Pellet Exposure

Six Inch Segment Gd (w/o)	Rod Maximum Gd (w/o)	LHGR limit at BOL (kW/ft)	LHGR limit at Knee 1 (kW/ft)	Exp. at Knee 1 (GWd/st)	LHGR limit at Knee 2 (kW/ft)	Exp. at Knee 2 (GWd/st)	LHGR limit at EOL (kW/ft)	Exp. at EOL (GWd/st)
0.00	0.00	13.400	13.400	14.515	8.000	57.607	5.000	63.504
0.00	5.00	13.100	13.100	14.190	7.821	56.317	4.888	62.082
5.00	5.00	12.521	12.521	12.389	7.475	55.443	4.672	61.335
6.00	6.00	12.255	12.255	12.276	7.316	54.999	4.572	60.845
5.00	7.00	12.300	12.300	12.132	7.343	54.424	4.590	60.212
6.00	7.00	12.100	12.100	12.095	7.224	54.275	4.515	60.047
7.00	7.00	12.000	12.000	12.174	7.164	54.589	4.478	60.394

BOL = Beginning of Life (zero exposure)
EOL = End of Life (maximum licensed pellet exposure)



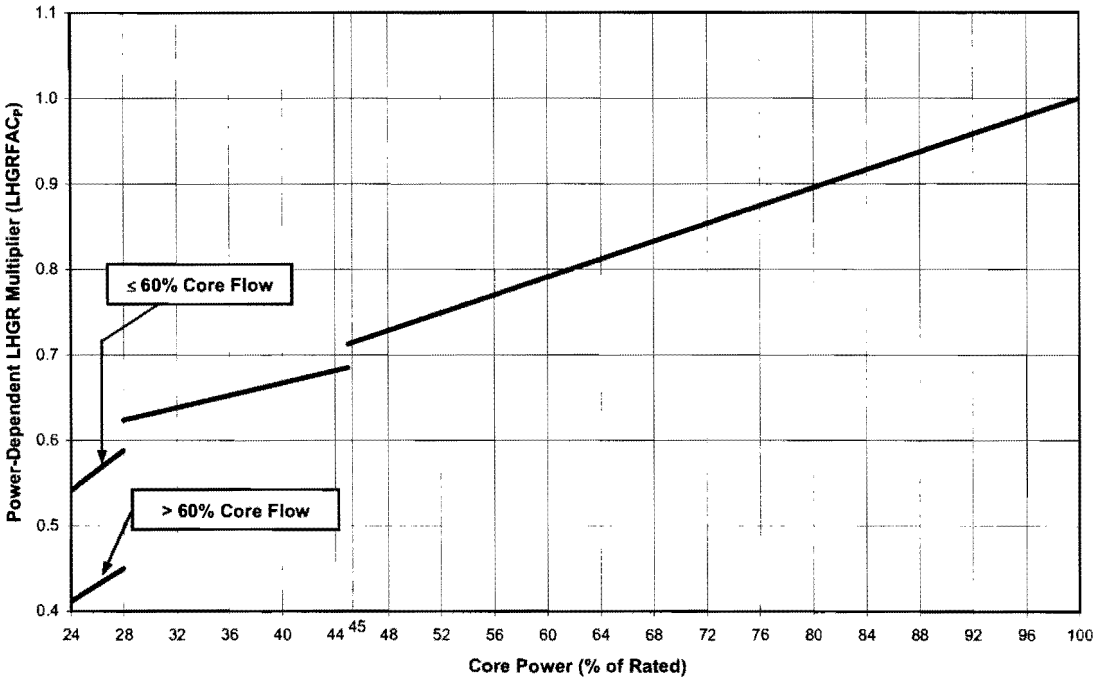
LHGRFAC$_F$ = A + B*F

Operating Conditions		Values of Variables	
F	**SLO / TLO**	**A**	**B**
30 ≤ F < 50.70	SLO / TLO	0.4574	0.006758
50.70 ≤ F < 80.29	TLO	0.4574	0.006758
50.70 ≤ F	SLO	0.8000	0.000000
80.29 ≤ F	TLO	1.0000	0.000000

F = Percent of Rated Core Flow

FIGURE 4-1

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



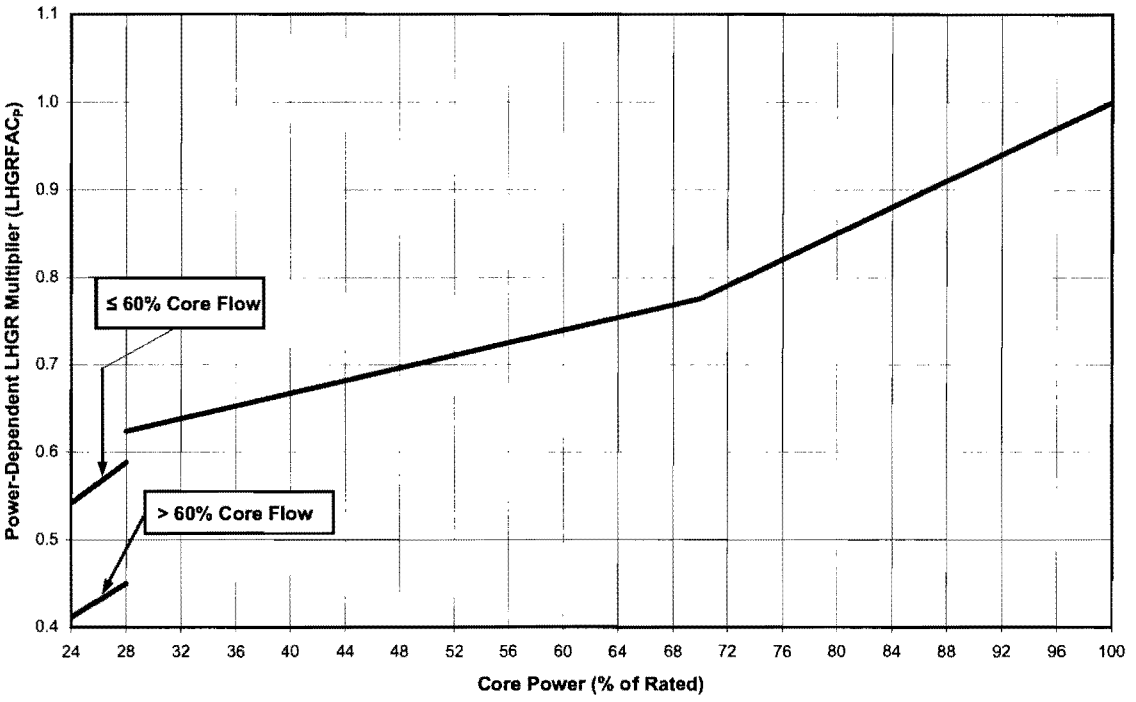
LHGRFAC$_P$ = A + B*P

Operating Conditions		Values of Variables	
P	F	A	B
24 ≤ P < 28	F > 60	0.17924	0.009670
24 ≤ P < 28	F ≤ 60	0.26124	0.011670
28 ≤ P < 45	All	0.52261	0.003617
45 ≤ P	All	0.47760	0.005224

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

FIGURE 4-2A

Power-Dependent LHGR Multiplier (LHGRFAC$_P$) versus Core Power



LHGRFAC$_P$ = A + B*P

Operating Conditions		Values of Variables	
P	F	A	B
24 ≤ P < 28	F > 60	0.17924	0.009670
24 ≤ P < 28	F ≤ 60	0.26124	0.011670
28 ≤ P < 70	All	0.52261	0.003617
70 ≤ P	All	0.25270	0.007473

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

FIGURE 4-2B

Power-Dependent LHGR Multiplier (LHGRFAC$_P$) versus Core Power
(Main Turbine Pressure Regulator System in TLCO 3.3.13.c)

UO2 Rods	
Peak Pellet Exposure (GWd/st)	LHGR (kW/ft)
0.000	13.400
14.515	13.400
57.607	8.000
63.504	5.000

Limiting Gd Rods	
Peak Pellet Exposure (GWd/st)	LHGR (kW/ft)
0.000	12.000
12.174	12.000
54.589	7.164
60.394	4.478

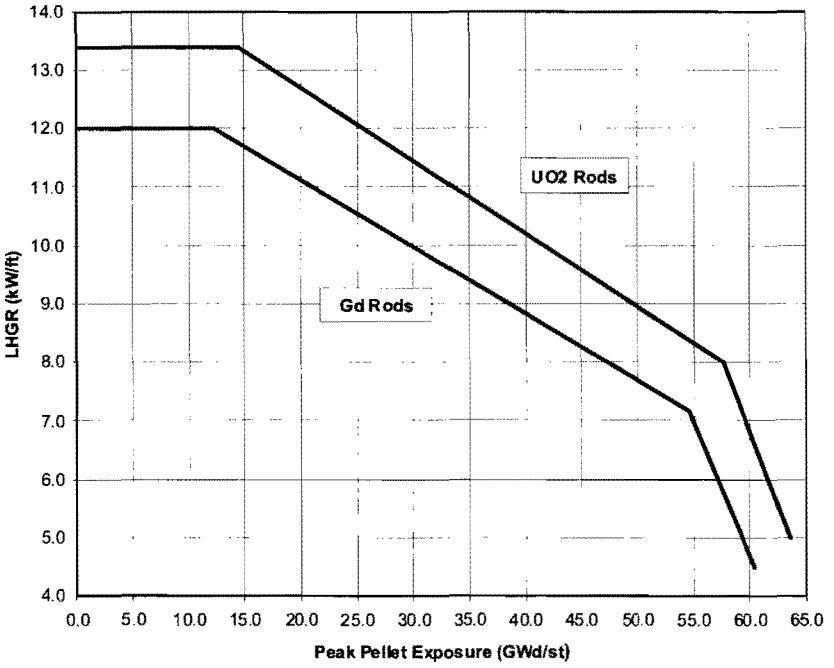


FIGURE 4-3

LHGR versus Peak Pellet Exposure

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 1C51K615 A, B, C, and D.

TABLE 5-1

OPRM Setpoint

OLMCPR	OPRM Setpoint
≥ 1.31	1.15

6.0 REFERENCES

1. "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-16, October 2007, and the US Supplement, NEDE-24011-P-A-16-US, October 2007.

2. GNF letter MJM-SNC-HT1-09-077.DOC, "H1 R24 SRLR and FBIR," M. Mneimneh to S. Hoxie-Key, November 19, 2009.

3. Global Nuclear Fuel document 0000-0099-0707-SRLR, "Supplemental Reload Licensing Report for Edwin I. Hatch Nuclear Power Plant Unit 1, Reload 24 Cycle 25," Revision 0, November 2009.

4. Global Nuclear Fuel document 0000-0099-0707-FBIR, "Fuel Bundle Information Report for Edwin I. Hatch Nuclear Power Plant Unit 1, Reload 24 Cycle 25," Revision 0, November 2009.

5. SNC Nuclear Fuel Document NF-10-013, "Hatch-1 Cycle 25 Reload Licensing Analysis Report," Version 1, February 2010.

6. GNF Document DB-0012.03, "Fuel-Rod Thermal-Mechanical Performance Limits for GE14C," Rev. 2, September 2006.