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

Tel 205.992.5000

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

Edwin I. Hatch Nuclear Plant
Unit 1 Cycle 24 Core Operating Limits Report – Version 2
Unit 2 Cycle 20 Core Operating Limits Report – Version 2

Ladies and Gentlemen:

In accordance with Units 1 and 2 Technical Specifications 5.6.5.d, Southern Nuclear Operating Company hereby submits the mid-cycle revisions to the Edwin I. Hatch Nuclear Plant Units 1 and 2 Core Operating Limits Reports (COLR).

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

Sincerely,

Mark J Ajluni

M. J. Ajluni
Manager, Nuclear Licensing

MJA/PAH/daj

Enclosures: 1. HNP Core Operating Limits Report Unit 1 – Cycle 24, Version 2
2. HNP Core Operating Limits Report Unit 2 – Cycle 20, Version 2

cc: Southern Nuclear Operating Company
Mr. J. T. Gasser, Executive Vice President
Mr. D. R. Madison, Vice President – Hatch
Mr. D. H. Jones, Vice President – Engineering
RTYPE: CHA02.004

U. S. Nuclear Regulatory Commission
Mr. L. A. Reyes, Regional Administrator
Mr. R. E. Martin, NRR Project Manager – Hatch
Mr. J. A. Hickey, Senior Resident Inspector – Hatch

Edwin I. Hatch Nuclear Plant – Units 1 and 2

Enclosure 1

Unit 1 Cycle 24 Core Operating Limits Report – Version 2

Edwin I. Hatch Nuclear Plant
Unit 1 Cycle 24 Core Operating Limits Report

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FIGURES

1.0 INTRODUCTION

The Core Operating Limits Report (COLR) for Plant Hatch Unit 1 Cycle 24 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 8). Results from the reload analyses for the fuel in Unit 1 Cycle 24 are documented in References 3 through 8.

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

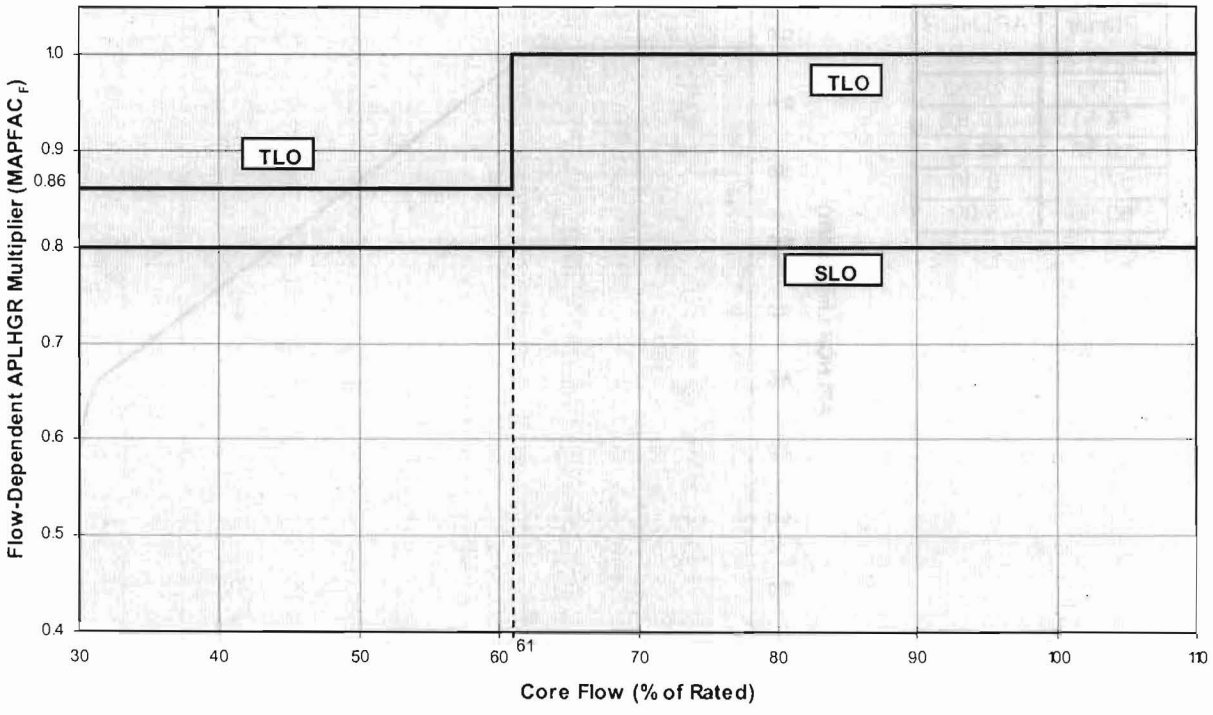
Equipment Out-of-Service Limitations

Equipment / Condition	Limitation
EOC-RPT Out of Service and Turbine Bypass Valves Inoperable Simultaneously	Option B scram speeds must be met (in place)
Only One Main Turbine Pressure Regulator Functional	Option B scram speeds must be met (in place)
Single-Loop Operation (SLO)	• CTP ≤ 2000 MWth • Core Flow ≤ 56% of Rated

Also included in this report are the maximum allowable scram setpoint 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 multiplied by the flow-dependent multiplier, $MAPFAC_F$, from Figure 2-1.



Operating Conditions		$MAPFAC_F$
F	SLO / TLO	
$30 \leq F \leq 61$	TLO	0.86
$61 < F$	TLO	1.00
$30 \leq F$	SLO	0.80

F = Percent of Rated Core Flow

FIGURE 2-1

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

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

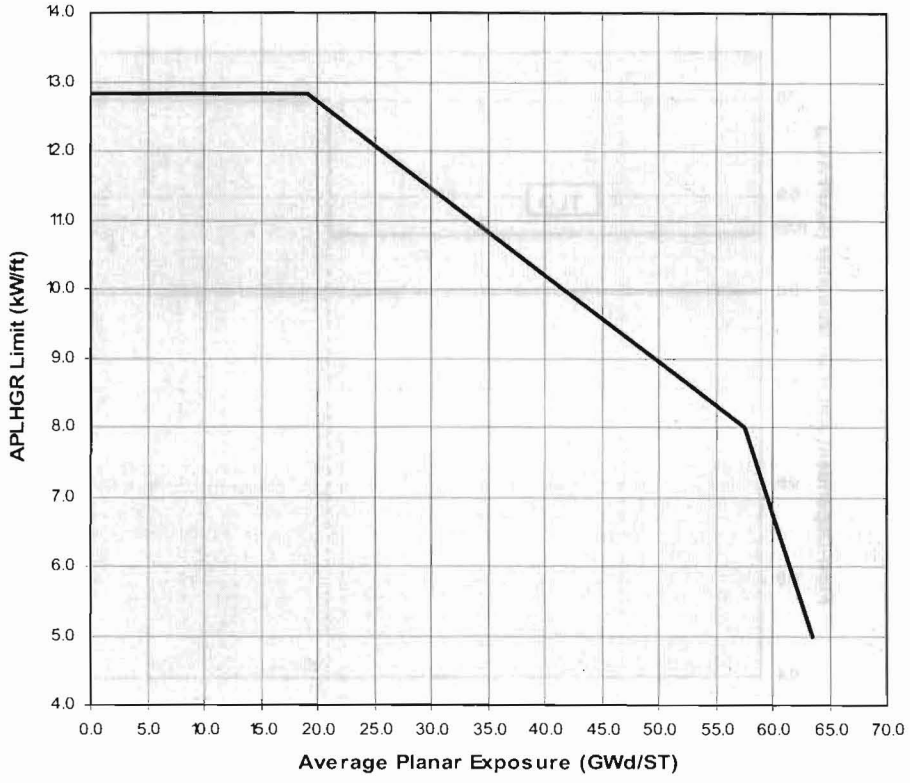


FIGURE 2-2

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 number of pressure regulators that are functional.

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.

As shown on Figures 3-1A, 3-1B, 3-2, 3-4A and 3-4B, 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 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

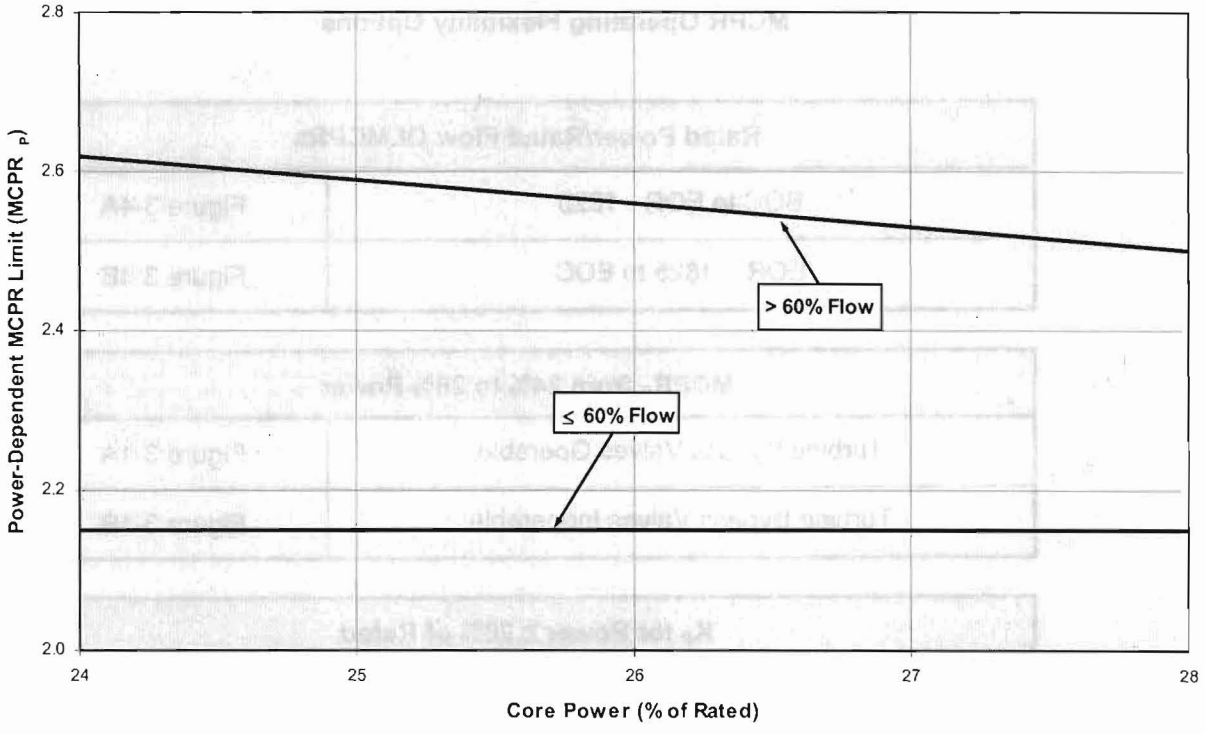
MCPR Operating Flexibility Options

Rated Power/Rated Flow OLMCPRs	
BOC to EOR - 1825	Figure 3-4A
EOR – 1825 to EOC	Figure 3-4B

$MCPR_P$ from 24% to 28% Power	
Turbine Bypass Valves Operable	Figure 3-1A
Turbine Bypass Valves Inoperable	Figure 3-1B

K_P for Power ≥ 28% of Rated			
EOC-RPT System In Service	Turbine Bypass Valves Operable	More than one Pressure Regulator Functional	
Yes	Yes	Yes	Figure 3-3A
No	Yes	Yes	Figure 3-3A
Yes	No	Yes	Figure 3-3A
No	No	Yes	Figure 3-3B*
Yes/No	Yes/No	No	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)



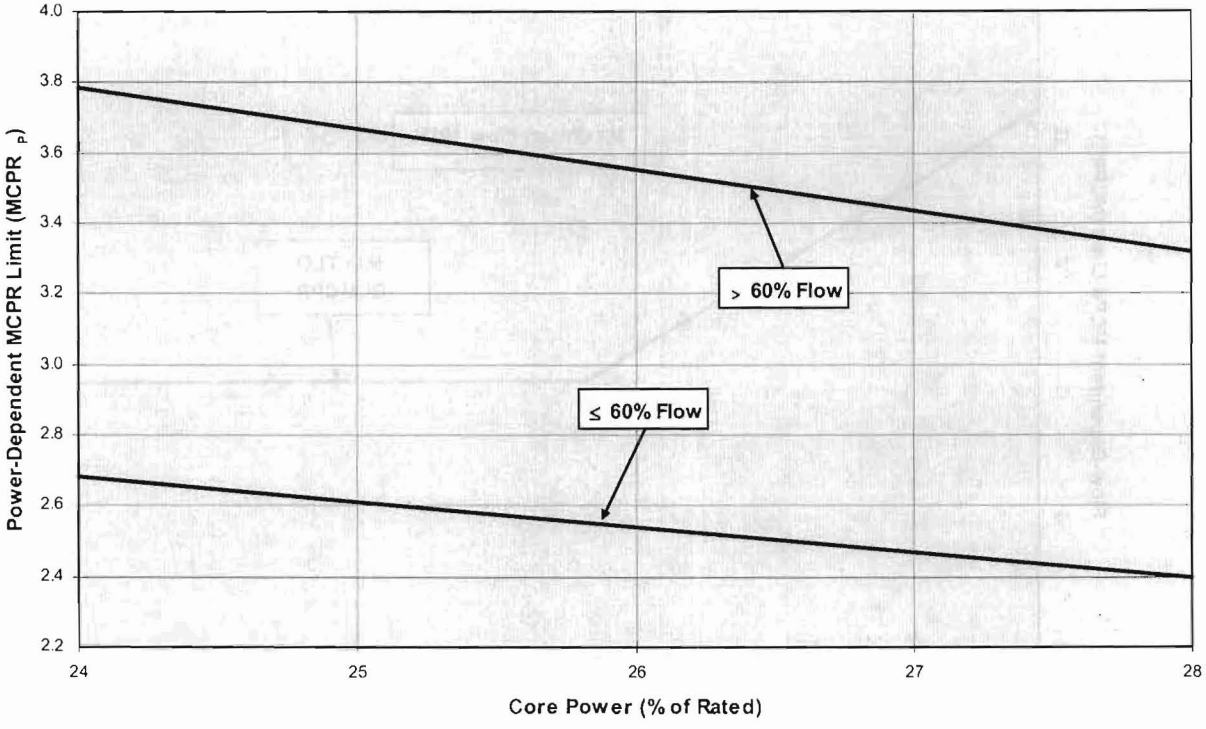
$MCPR_{P(TLO)} = A + B*P$
$MCPR_{P(SLO)} = MCPR_{P(TLO)} + 0.02$

F	A	B
F ≤ 60	2.15	0.00
F > 60	3.340	-0.0300

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 28% of Rated Core Power
(Turbine Bypass Valves Operable)



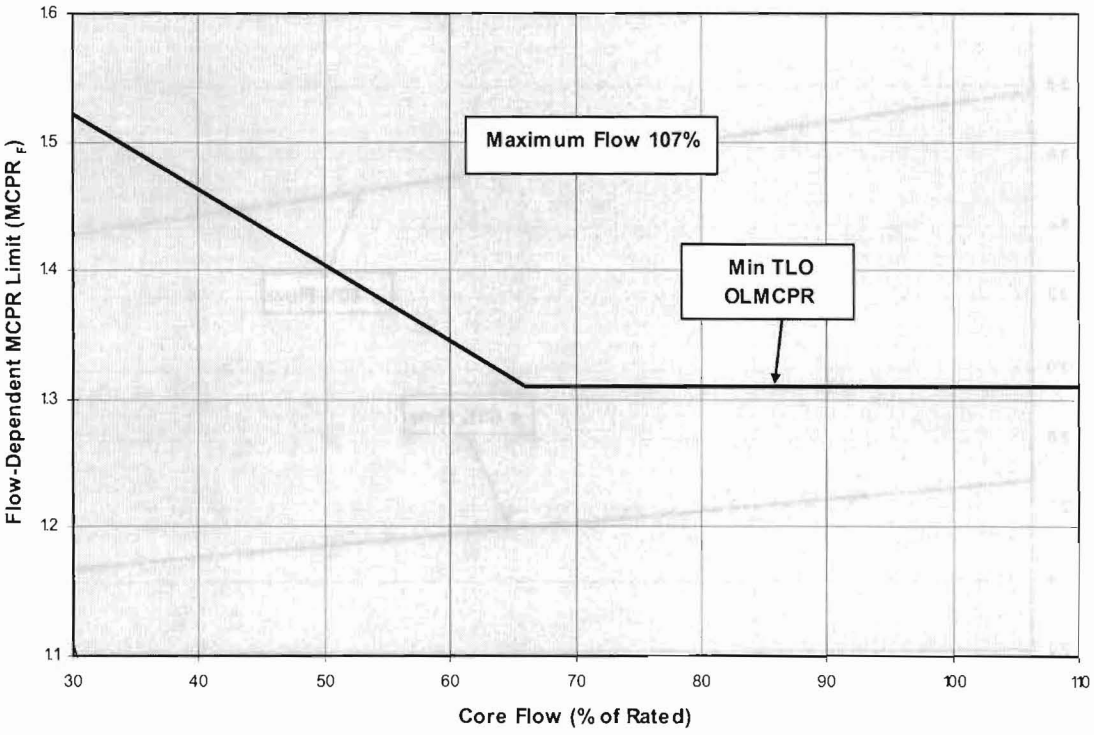
$MCPR_{P(TLO)} = A + B*P$
$MCPR_{P(SLO)} = MCPR_{P(TLO)} + 0.02$

F	A	B
F ≤ 60	4.360	-0.0700
F > 60	6.588	-0.1167

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 28% of Rated Core Power
(Turbine Bypass Valves Inoperable)



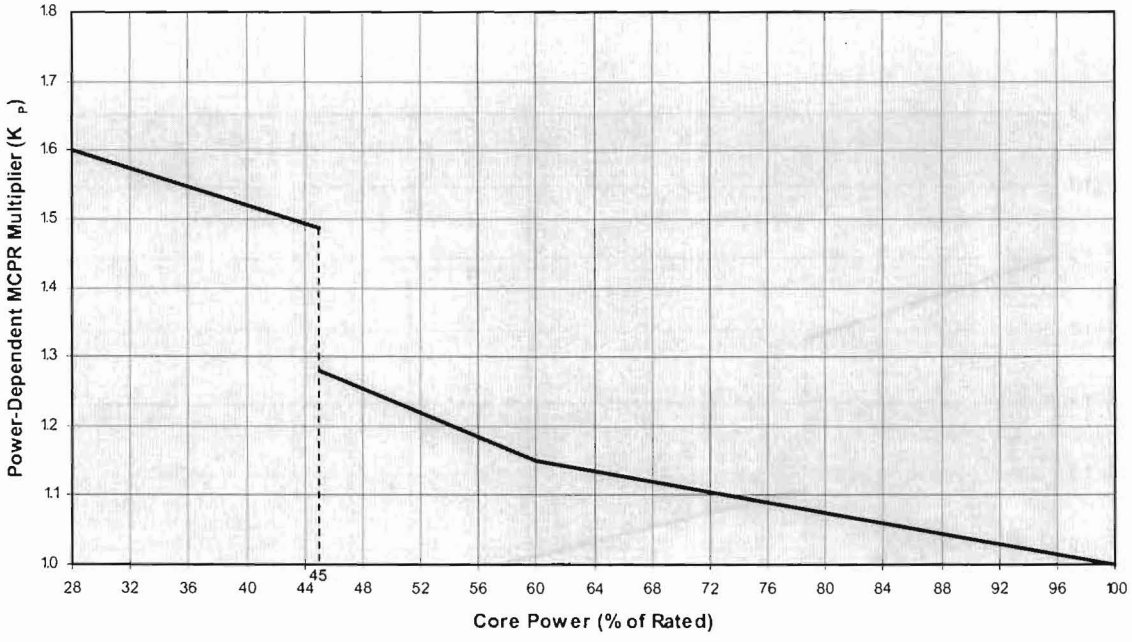
$MCPR_{F(TLO)}$ = Maximum [1.31, (A + B*F)]
$MCPR_{F(SLO)}$ = $MCPR_{F(TLO)}$ + 0.02

Operating Conditions	Values of Variables	
Maximum Core Flow (% of Rated)	A	B
107.0	1.697	-0.00586

F = Percent of Rated Core Flow

FIGURE 3-2

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



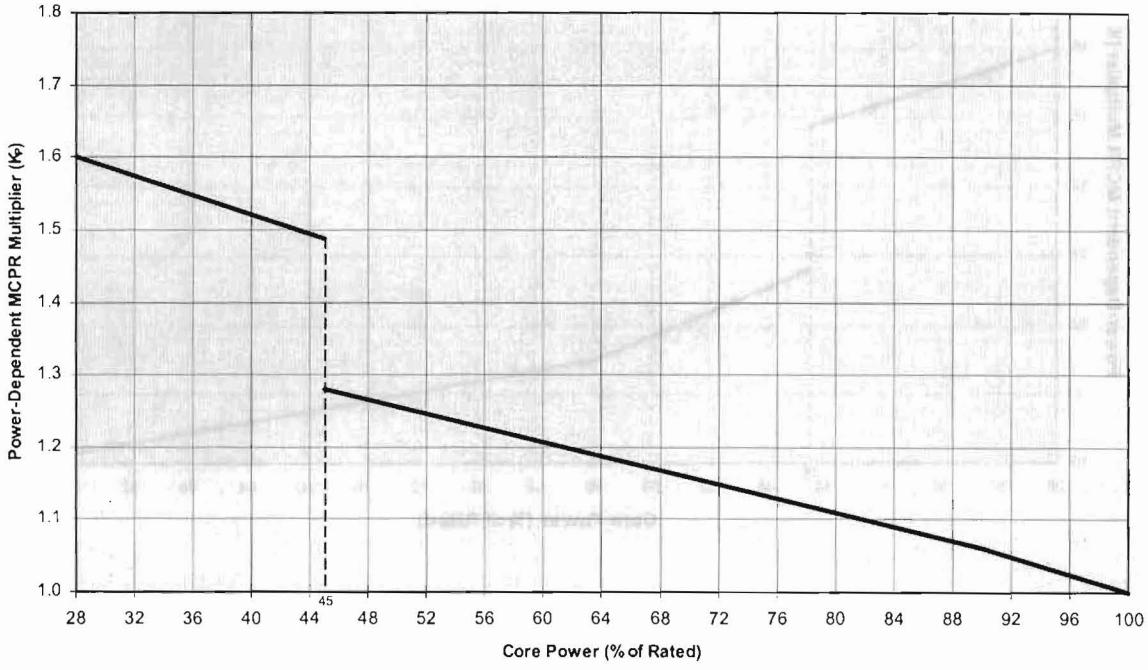
$K_P = A + B*P$

P	A	B
$28 \leq P < 45$	1.7871	-0.00666
$45 \leq P < 60$	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
(More than One Pressure Regulator Functional)



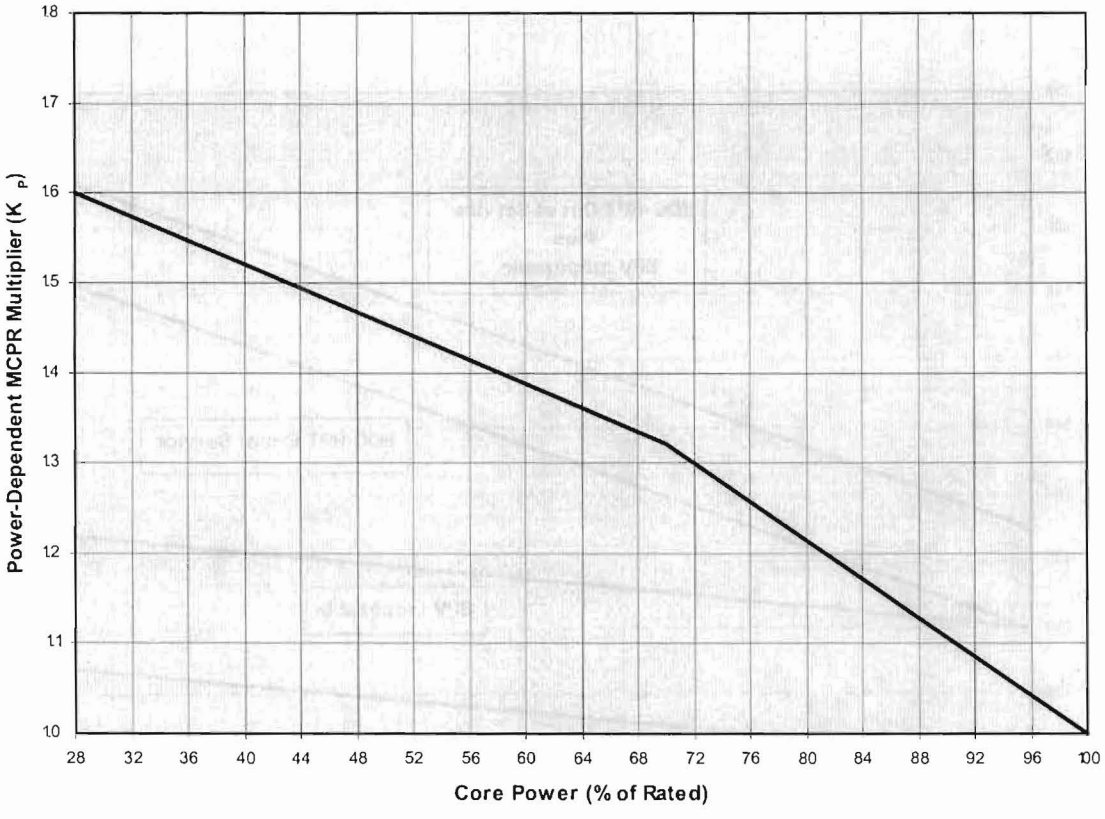
$K_P = A + B*P$

P	A	B
$28 \leq P < 45$	1.7871	-0.00666
$45 \leq P < 90$	1.5005	-0.00490
$90 \leq P$	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, with
More than One Pressure Regulator Functional)



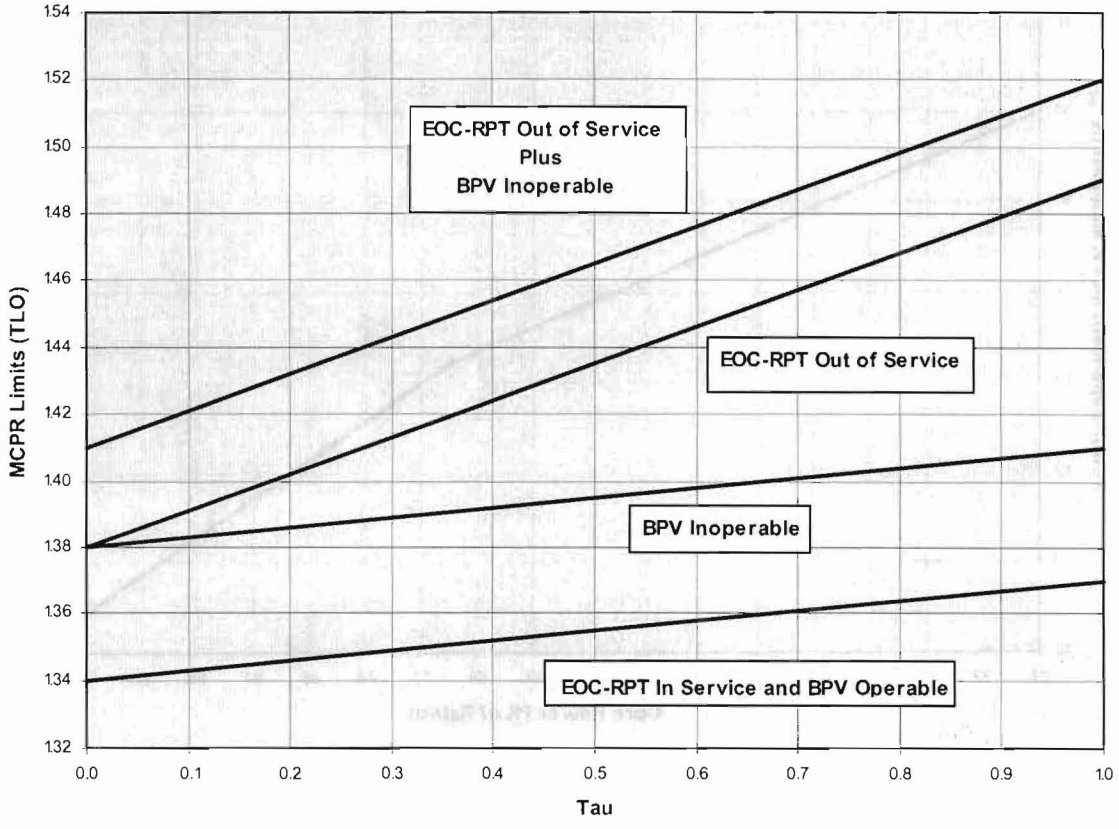
$K_P = A + B*P$

P	A	B
$28 \leq P < 70$	1.7871	-0.00666
$70 \leq P$	2.0693	-0.01069

P = Percent of Rated Core Power

FIGURE 3-3C

Power-Dependent MCPR Multiplier (K_P) versus Core Power
(Only One Pressure Regulator Functional)

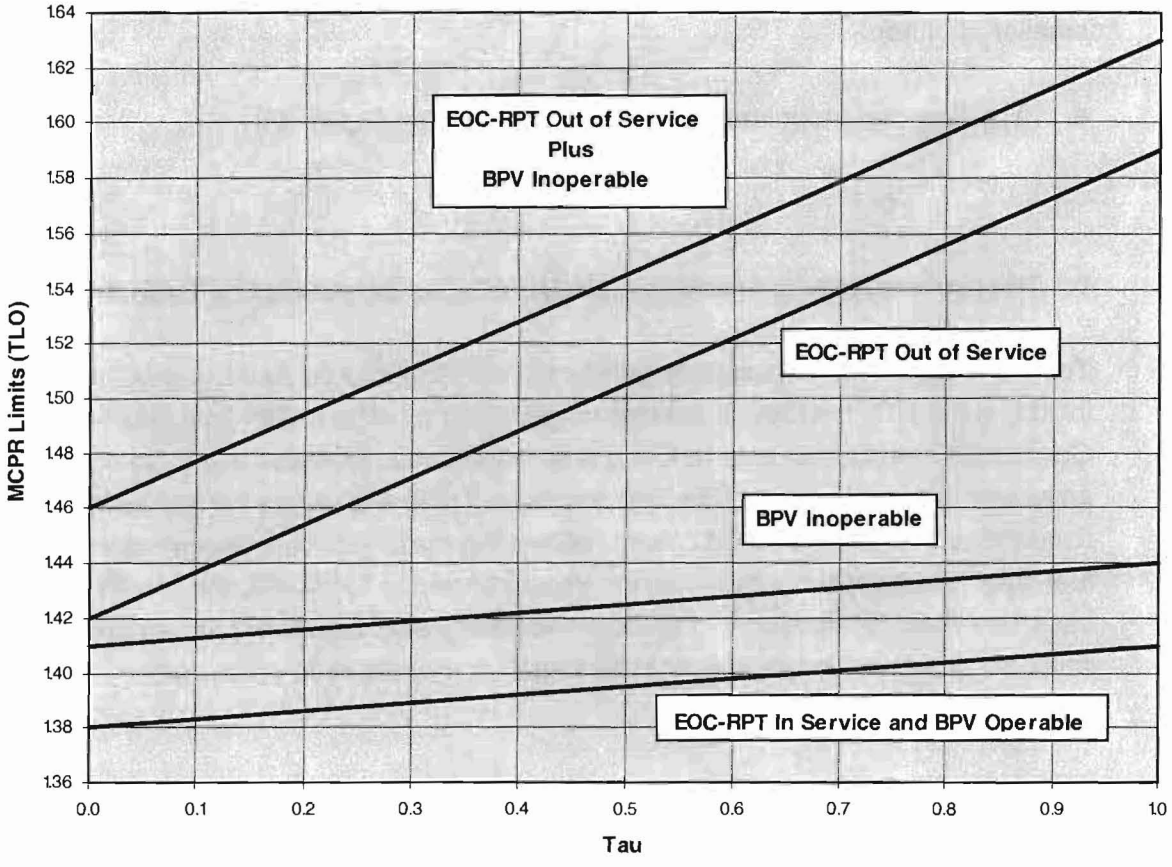


Operating Conditions		OLMCPR(TLO)	
EOC-RPT	**Bypass Valves**	**τ = 0.0**	**τ = 1.0**
In Service	Operable	1.34	1.37
Out of Service	Operable	1.38	1.49
In Service	Inoperable	1.38	1.41
Out of Service	Inoperable	1.41	1.52

OLMCPR(SLO) = OLMCPR(TLO) + 0.02

FIGURE 3-4A

MCPR Limits versus Average Scram Time
(BOC to EOR-1825 MWd/st)



Operating Conditions		OLMCPR(TLO)	
EOC-RPT	**Bypass Valves**	**$\tau = 0.0$**	**$\tau = 1.0$**
In Service	Operable	1.38	1.41
Out of Service	Operable	1.42	1.59
In Service	Inoperable	1.41	1.44
Out of Service	Inoperable	1.46	1.63

OLMCPR(SLO) = OLMCPR(TLO) + 0.02

FIGURE 3-4B

MCPR Limits versus Average Scram Time
(EOR-1825 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, Figure 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

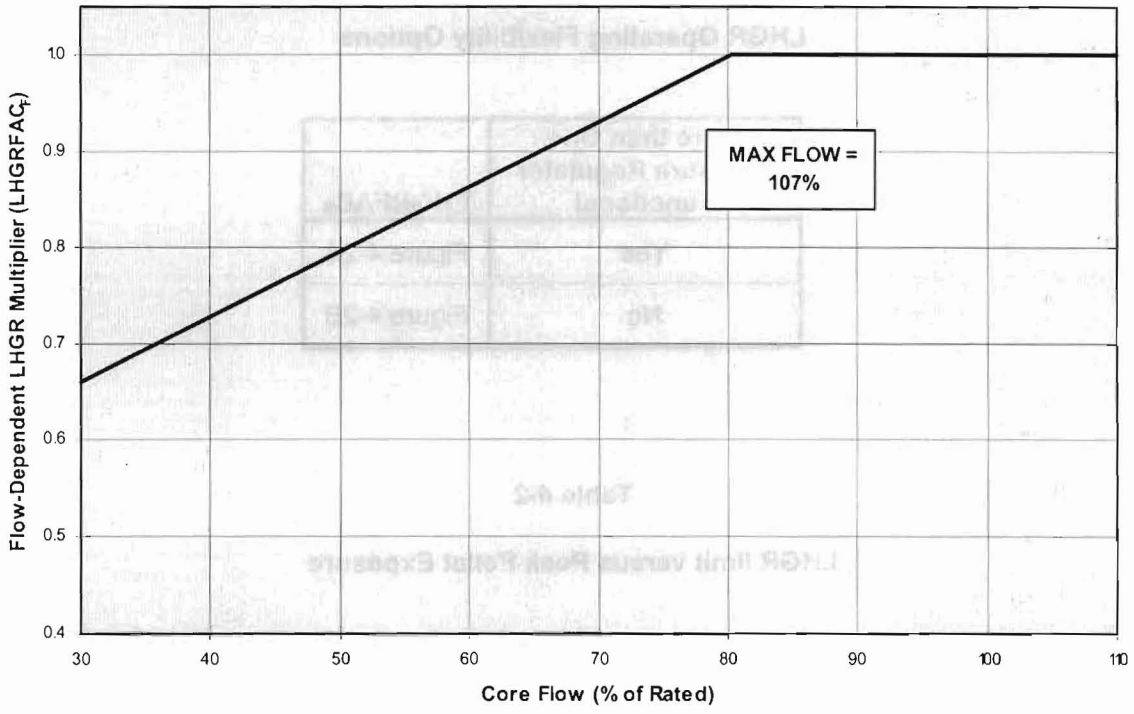
LHGR Operating Flexibility Options

More than One Pressure Regulator Functional	$LHGRFAC_P$
Yes	Figure 4-2A
No	Figure 4-2B

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
2.00	2.00	13.093	13.093	12.449	7.816	55.681	4.885	61.597
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
0.00	7.00	13.200	13.200	14.298	7.881	56.747	4.925	62.556
2.00	7.00	13.093	13.093	12.449	7.816	55.681	4.885	61.597
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



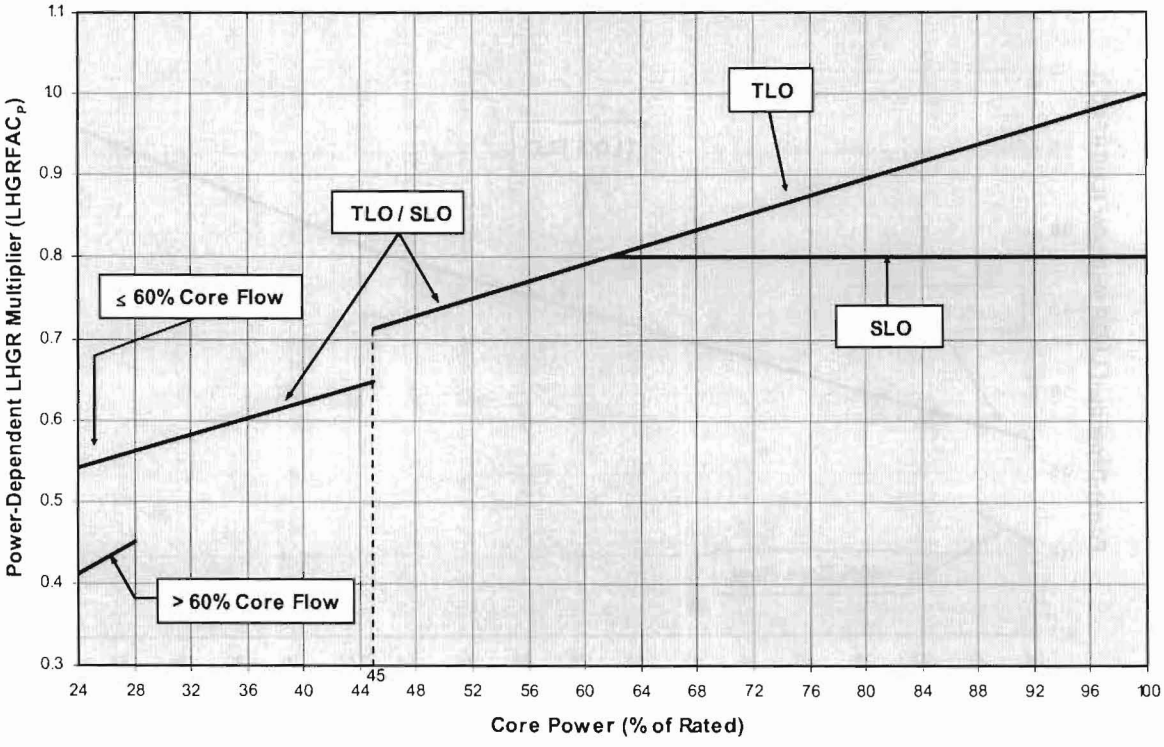
LHGRFAC$_F$ = Minimum [1.0, (A + B*F)]

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



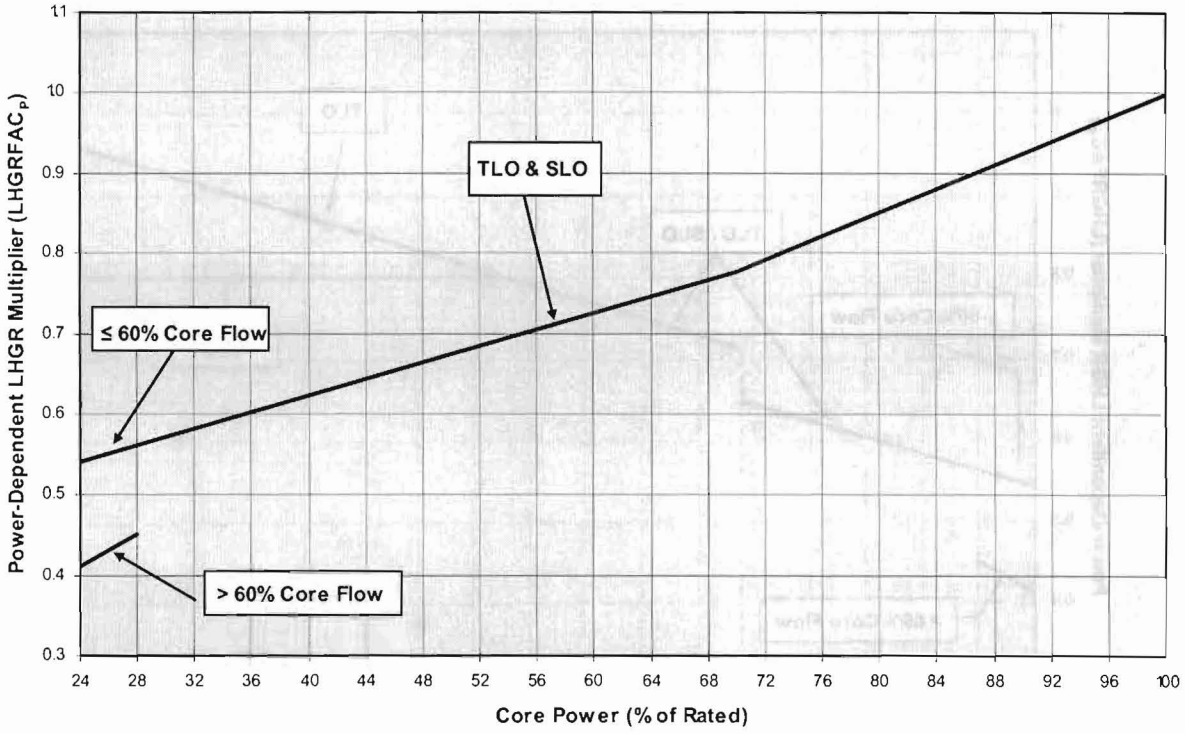
LHGRFAC$_P$ = A + B*P

Operating Conditions			Values of Variables	
P	F	SLO/ TLO	A	B
24 ≤ P < 28	F > 60	SLO / TLO	0.17924	0.00967
24 ≤ P < 28	F ≤ 60	SLO / TLO	0.41897	0.00510
28 ≤ P < 45	All	SLO / TLO	0.41897	0.00510
45 ≤ P < 61.72	All	SLO / TLO	0.4776	0.005224
61.72 ≤ P	All	TLO	0.4776	0.005224
61.72 ≤ P	All	SLO	0.800	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
(More than One Pressure Regulator Functional)



$LHGRFAC_P = A + B*P$

Operating Conditions		Values of Variables	
P	F	A	B
$24 \leq P < 28$	$F > 60$	0.17924	0.00967
$24 \leq P < 28$	$F \leq 60$	0.41897	0.0051
$28 \leq P < 70$	All	0.41897	0.0051
$70 \leq P$	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
(Only One Pressure Regulator Functional)

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

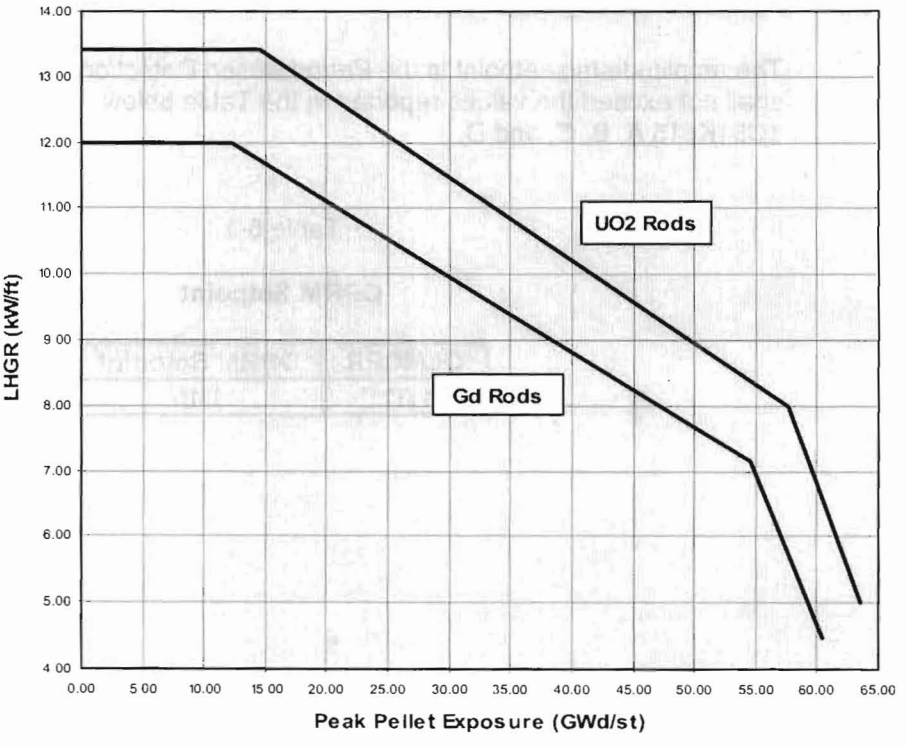


FIGURE 4-3

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-15, September 2005, and the US Supplement, NEDE-24011-P-A-15-US, September 2005.

2. GNF letter MJM-SNC-HT1-07-098-Rev1, "Hatch 1 Cycle 24 SRLR and FBIR," M. Mneimneh to R. Cocherell, December 8, 2007.

3. Global Nuclear Fuel document 0000-0067-2863-SRLR, "Supplemental Reload Licensing Report for Edwin I. Hatch Nuclear Power Plant Unit 1, Reload 23 Cycle 24," Revision 0, December 2007.

4. Global Nuclear Fuel document 0000-0067-2863-FBIR, "Fuel Bundle Information Report for Edwin I. Hatch Nuclear Power Plant Unit 1, Reload 23 Cycle 24," Revision 0, December 2007.

5. SNC Nuclear Fuel Document NF-07-125, "Hatch-1 Cycle 24 Reload Licensing Analysis Report," Version 1, February 2008.

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

7. GNF Letter RA-SNC-06-015, Rev. 2, "GE14 LHGR Curves," R. Augi to W. Mertz, February 13, 2006.

8. SNC Memo CAH-NF-2668, "Generic RPTOOS + BPVOOS ARTS Analysis," W. R. Mertz to K. S. Folk, October 16, 2008.

Edwin I. Hatch Nuclear Plant – Units 1 and 2

Enclosure 2

Unit 2 Cycle 20 Core Operating Limits Report – Version 2

Edwin I. Hatch Nuclear Plant
Unit 2 Cycle 20 Core Operating Limits Report

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TABLES

FIGURES

1.0 INTRODUCTION

The Core Operating Limits Report (COLR) for Plant Hatch Unit 2 Cycle 20 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, 3, 4, 5 and 8). Results from the reload analyses for the fuel in Unit 2 Cycle 20 are documented in References 3, 4, 5, 6 and 8.

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.

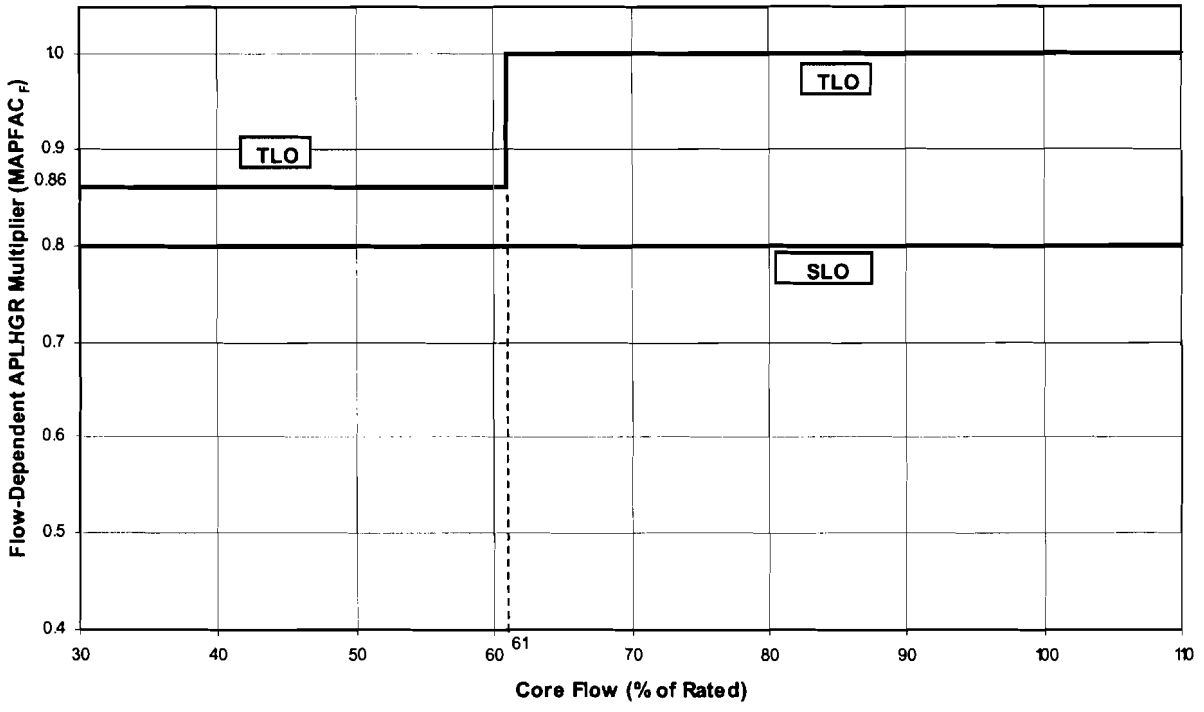
Table 1-1
Equipment Out-of-Service Limitations

Equipment / Condition	Limitation
EOC-RPT Out of Service and Turbine Bypass Valves inoperable simultaneously	Option B scram speeds must be met (in place)
Only One Pressure Regulator Functional	Option B scram speeds must be met (in place)
Single-Loop Operation (SLO)	• CTP ≤ 2000 MWt • Core Flow ≤ 56% of Rated
High Pressure Feedwater Heater(s) Out of Service and Only One Pressure Regulator Functional simultaneously	No Core Operating Limits (enter TS RAS 3.2.2 and 3.2.3)

Also included in this report is the maximum allowable scram setpoint 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, multiplied by the flow-dependent multiplier, $MAPFAC_F$, from Figure 2-1.



Operating Conditions		
Flow	**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	APLHGR Limit
0.00	12.82
14.51	12.82
19.13	12.82
57.61	8.00
63.50	5.00

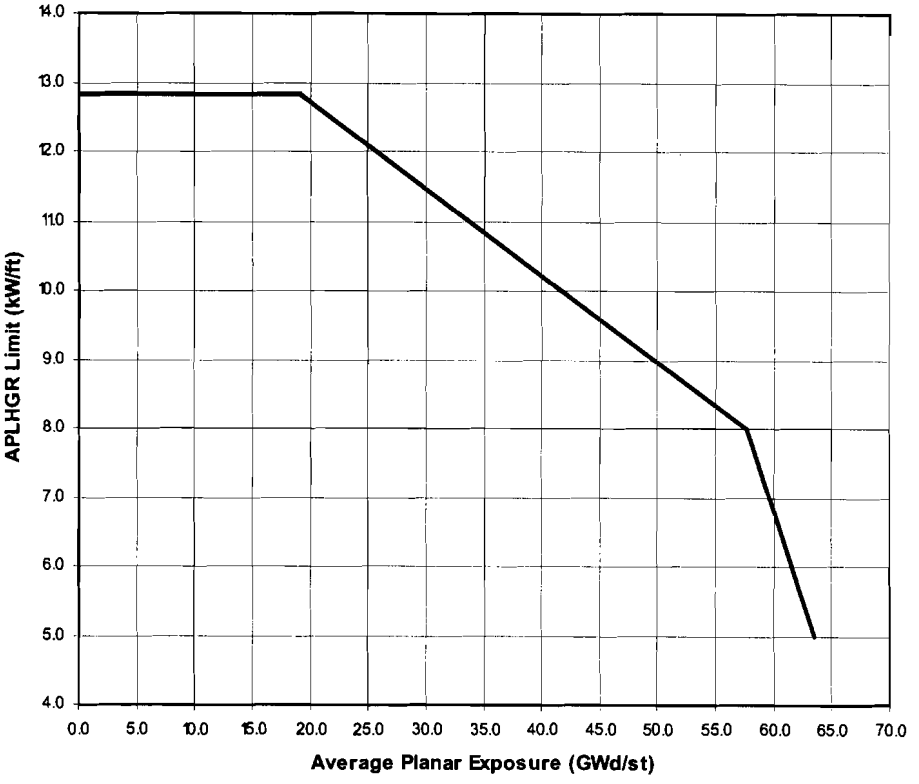


FIGURE 2-2

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 number of pressure regulators that are functional.

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, 3-2, 3-4A, 3-4B, and 3-4C must be increased by 0.02.

These limits apply to operation with intermittent 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, 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

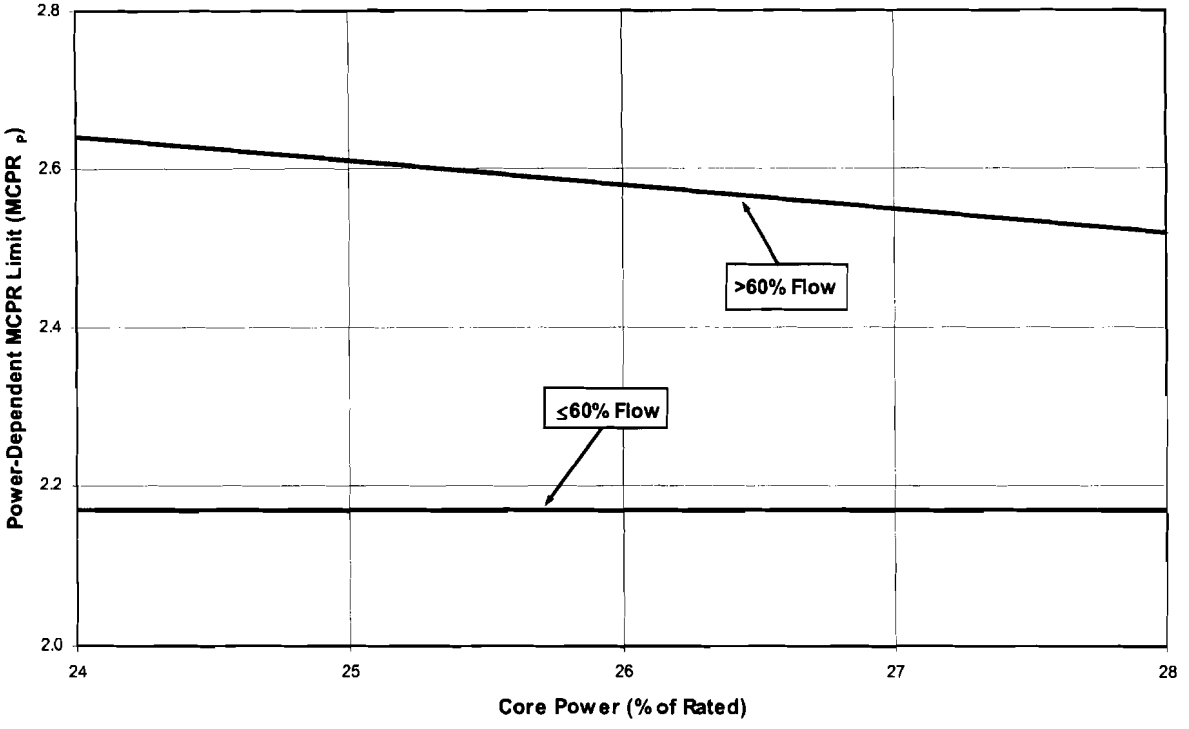
MCPR Operating Flexibility Options

Rated Power/Rated Flow OLMCPRs	
BOC to EOR - 4700	Figure 3-4A
EOR – 4700 to EOR – 2200	Figure 3-4B
EOR – 2200 to EOC	Figure 3-4C

$MCPR_P$ from 24% to 28% Power	
Turbine Bypass Valves Operable	Figure 3-1A
Turbine Bypass Valves Inoperable	Figure 3-1B

K_P for Power ≥ 28% of Rated			
EOC-RPT System In Service	Turbine Bypass Valves Operable	More than one Pressure Regulator Functional	
Yes	Yes	Yes	Figure 3-3A
No	Yes	Yes	Figure 3-3A
Yes	No	Yes	Figure 3-3A
No	No	Yes	Figure 3-3B*
Yes/No	Yes/No	No	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)



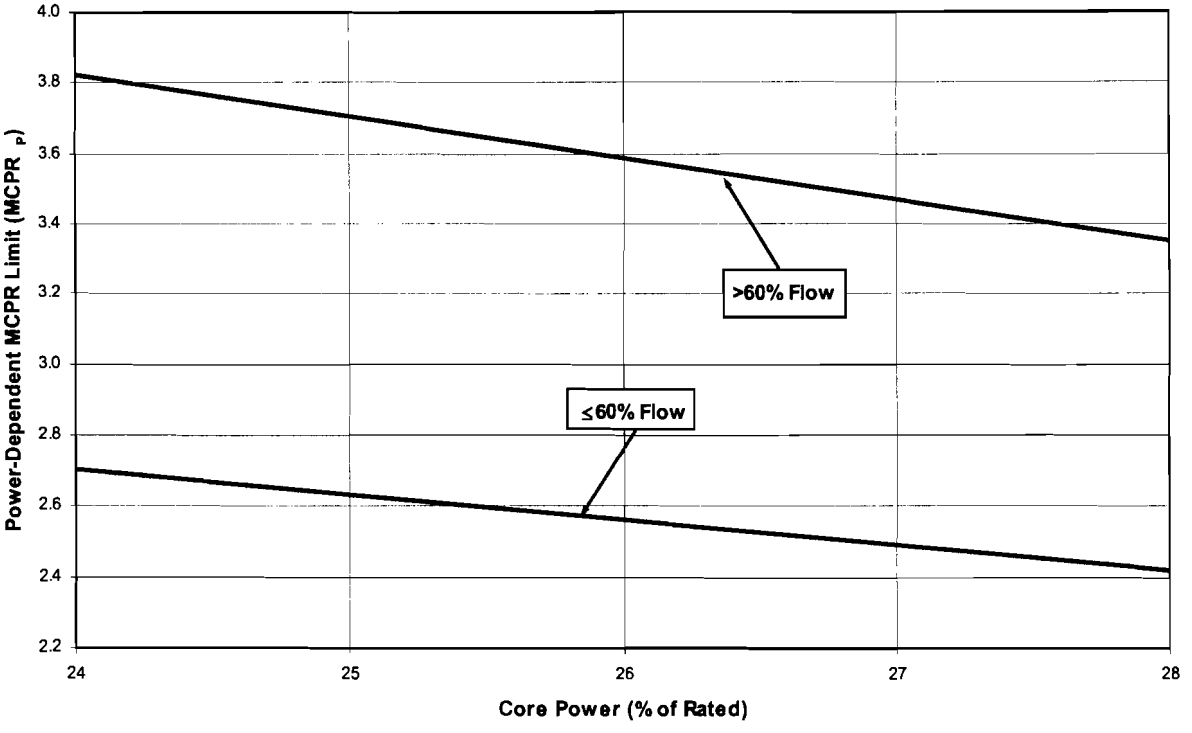
$MCPR_{P(TLO)} = A + B*P$
$MCPR_{P(SLO)} = MCPR_{P(TLO)} + 0.02$

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

FIGURE 3-1A

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



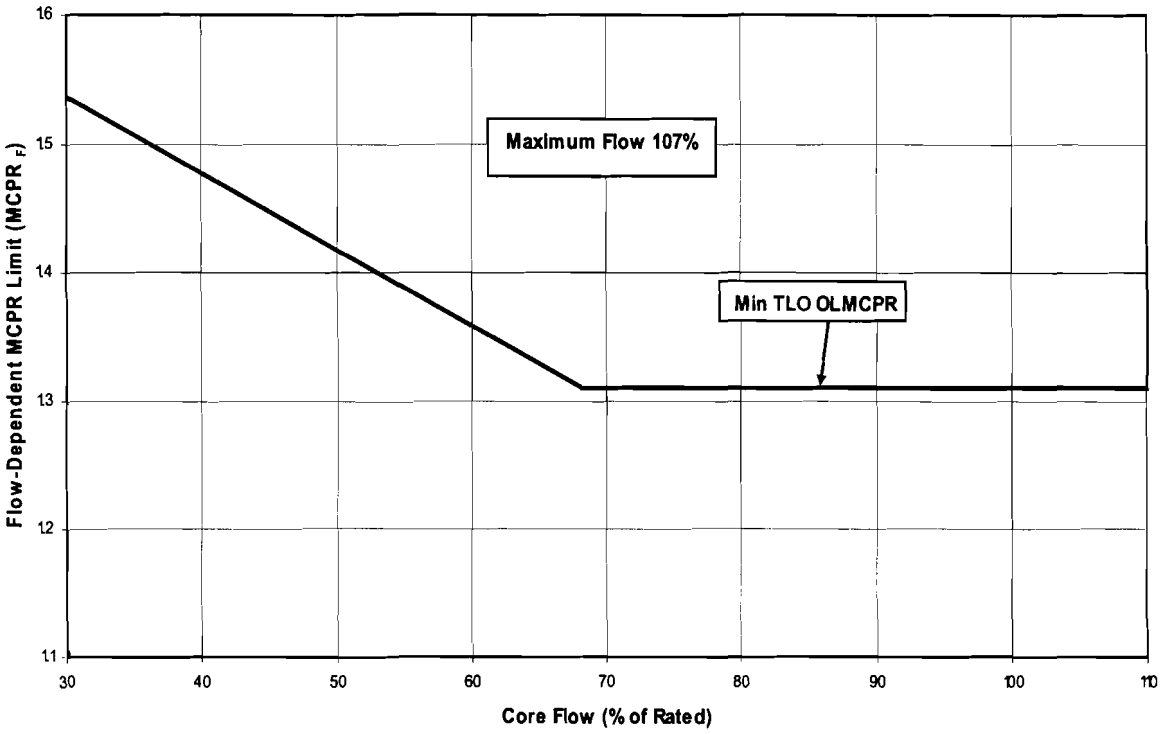
$MCPR_{P(TLO)} = A + B*P$
$MCPR_{P(SLO)} = MCPR_{P(TLO)} + 0.02$

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

FIGURE 3-1B

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



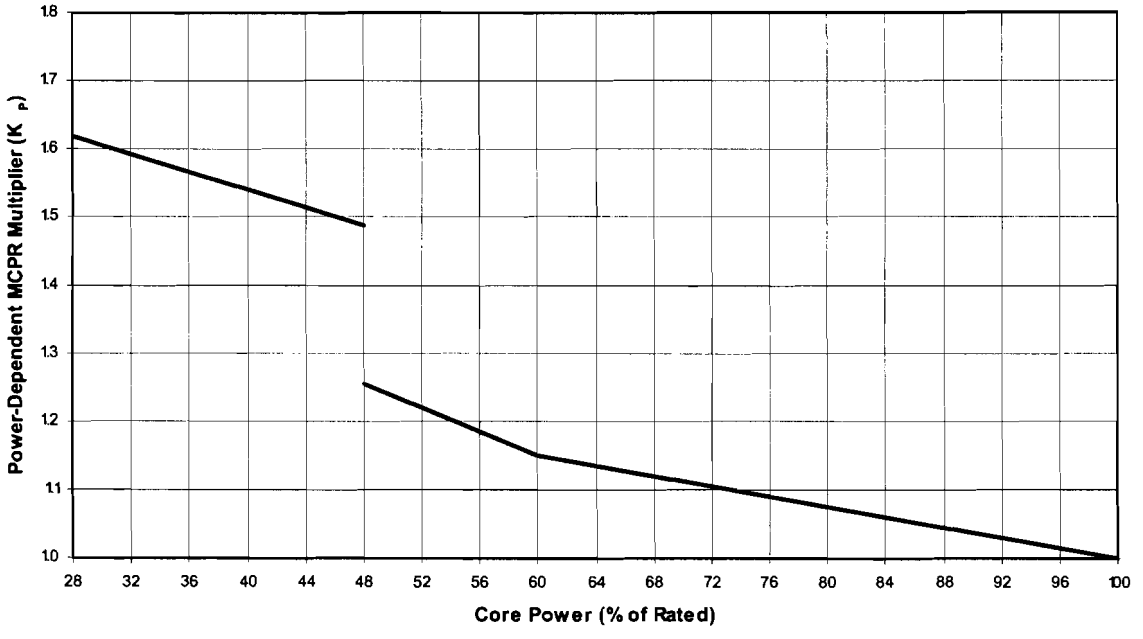
$MCPR_{F(TLO)}$ = Maximum [1.31, (A + B*F)]
$MCPR_{F(SLO)}$ = $MCPR_{F(TLO)}$ + 0.02

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



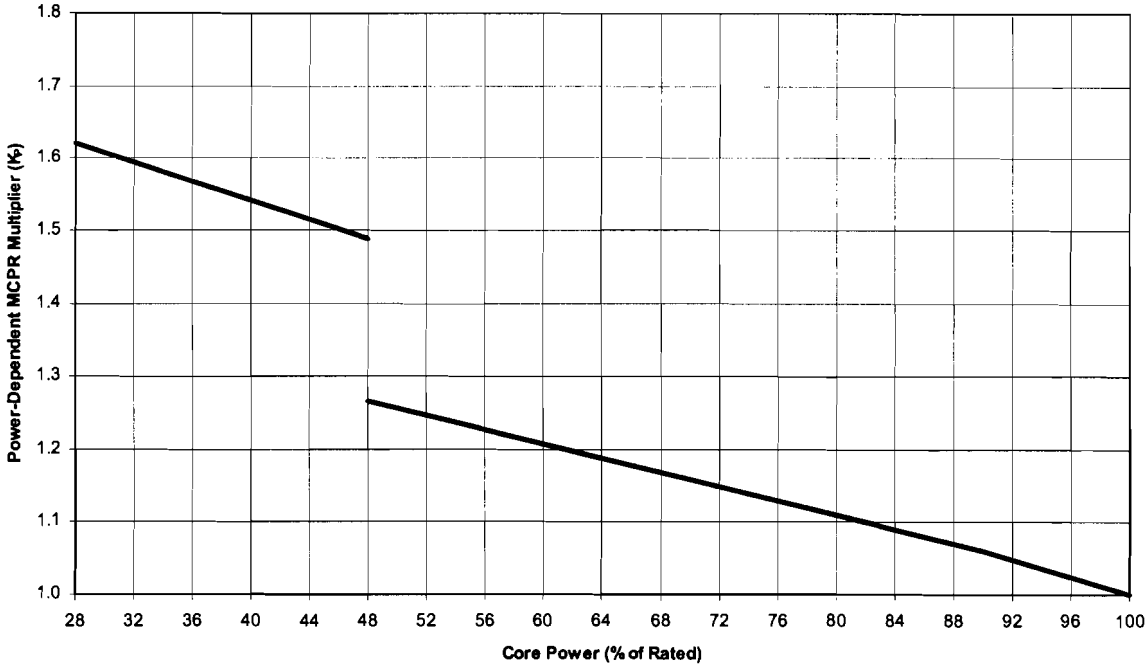
$K_P = A + B*P$

P	A	B
$28 \leq P < 48$	1.8044	-0.00659
$48 \leq P < 60$	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
(More than One Pressure Regulator Functional)



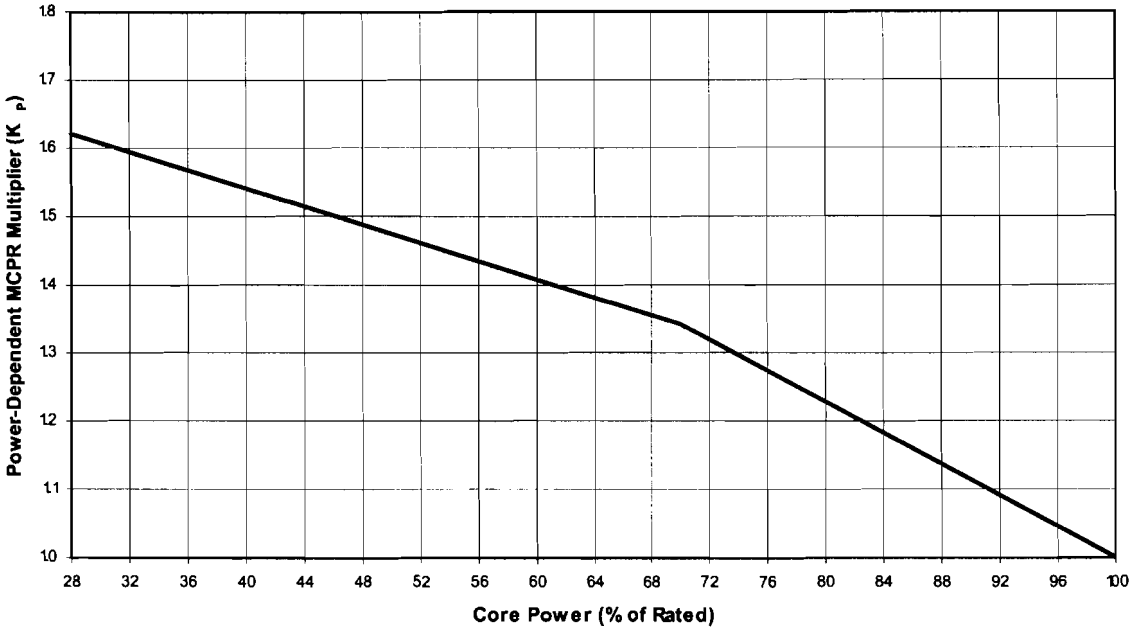
$K_P = A + B*P$

P	A	B
$28 \leq P < 48$	1.8044	-0.00659
$48 \leq P < 90$	1.5005	-0.00490
$90 \leq P$	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, with
More than One Pressure Regulator Functional)



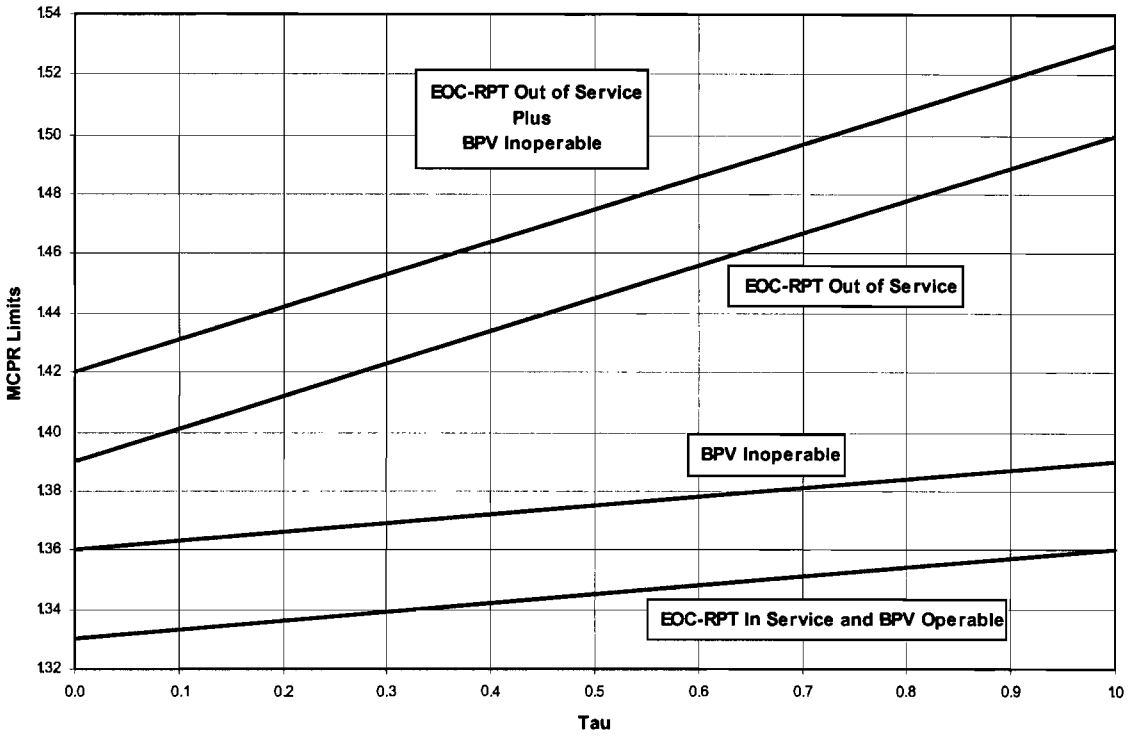
$K_P = A + B*P$

P	A	B
$28 \leq P < 70$	1.8044	-0.00659
$70 \leq P$	2.1439	-0.01144

P = Percent of Rated Core Power

FIGURE 3-3C

Power-Dependent MCPR Multiplier (K_P) versus Core Power
(Only One Pressure Regulator Functional)

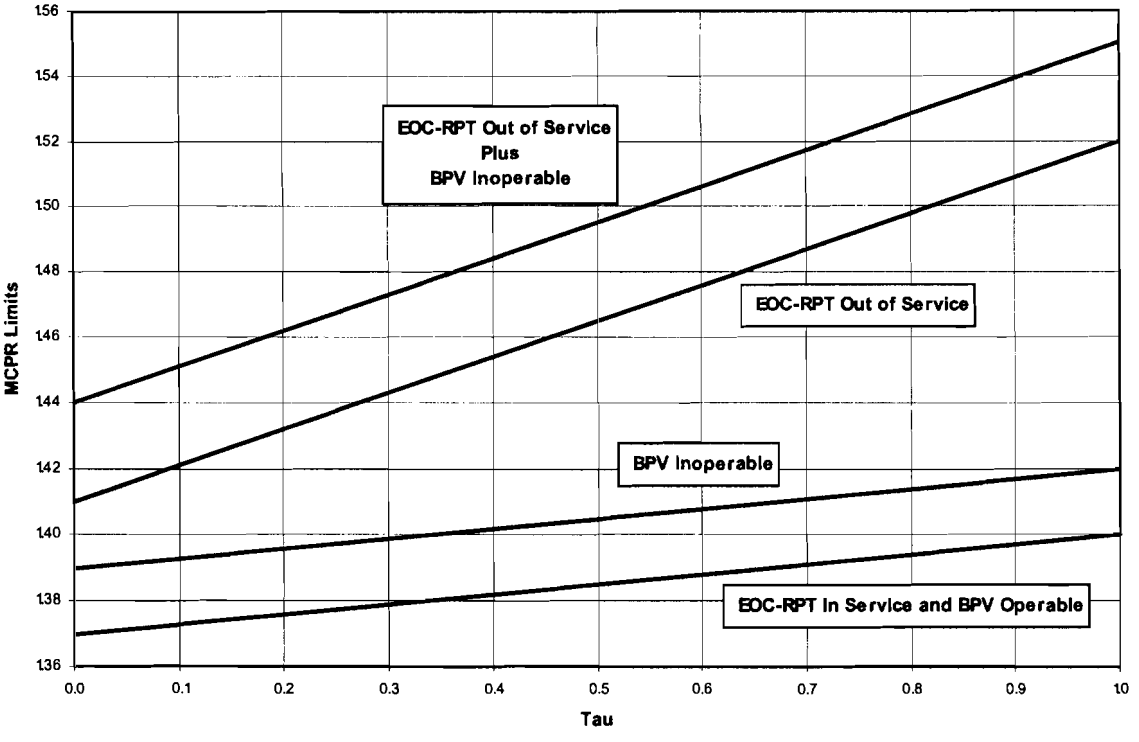


Operating Conditions		OLMCPR(TLO)	
EOC-RPT	**Bypass Valves**	**τ = 0.0**	**τ = 1.0**
In Service	Operable	1.33	1.36
Out of Service	Operable	1.39	1.50
In Service	Inoperable	1.36	1.39
Out of Service	Inoperable	1.42	1.53

OLMCPR(SLO) = OLMCPR(TLO) + 0.02

FIGURE 3-4A

MCPR Limits versus Average Scram Time
(BOC to EOR-4700 MWd/st)

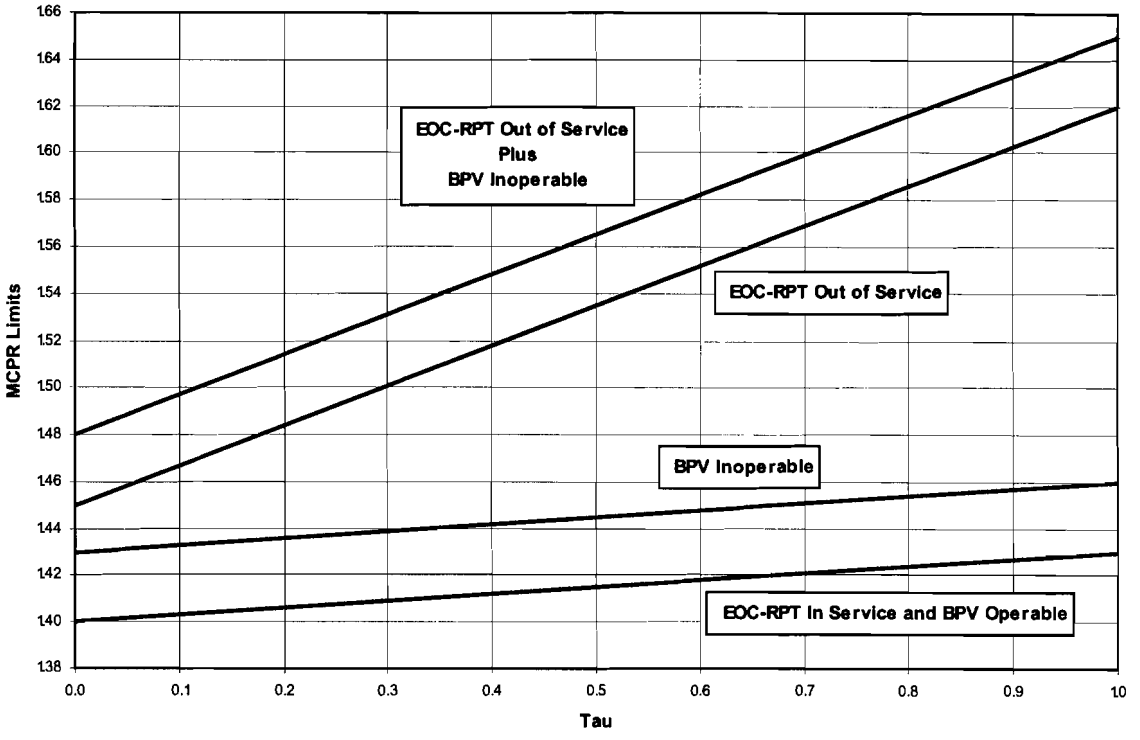


Operating Conditions		OLMCPR(TLO)	
EOC-RPT	**Bypass Valves**	**$\tau = 0.0$**	**$\tau = 1.0$**
In Service	Operable	1.37	1.40
Out of Service	Operable	1.41	1.52
In Service	Inoperable	1.39	1.42
Out of Service	Inoperable	1.44	1.55

OLMCPR(SLO) = OLMCPR(TLO) + 0.02

FIGURE 3-4B

MCPR Limits versus Average Scram Time
(EOR-4700 MWd/st to EOR-2200 MWd/st)



Operating Conditions		OLMCPR(TLO)	
EOC-RPT	**Bypass Valves**	**$\tau = 0.0$**	**$\tau = 1.0$**
In Service	Operable	1.40	1.43
Out of Service	Operable	1.45	1.62
In Service	Inoperable	1.43	1.46
Out of Service	Inoperable	1.48	1.65

OLMCPR(SLO) = OLMCPR(TLO) + 0.02

FIGURE 3-4C

MCPR Limits versus Average Scram Time
(EOR-2200 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, Figure 4-3 shows the LHGR limits for UO_2 rods and for the most limiting (7.0 w%) Gd rods in the core.

Table 4-1

LHGR Operating Flexibility Options

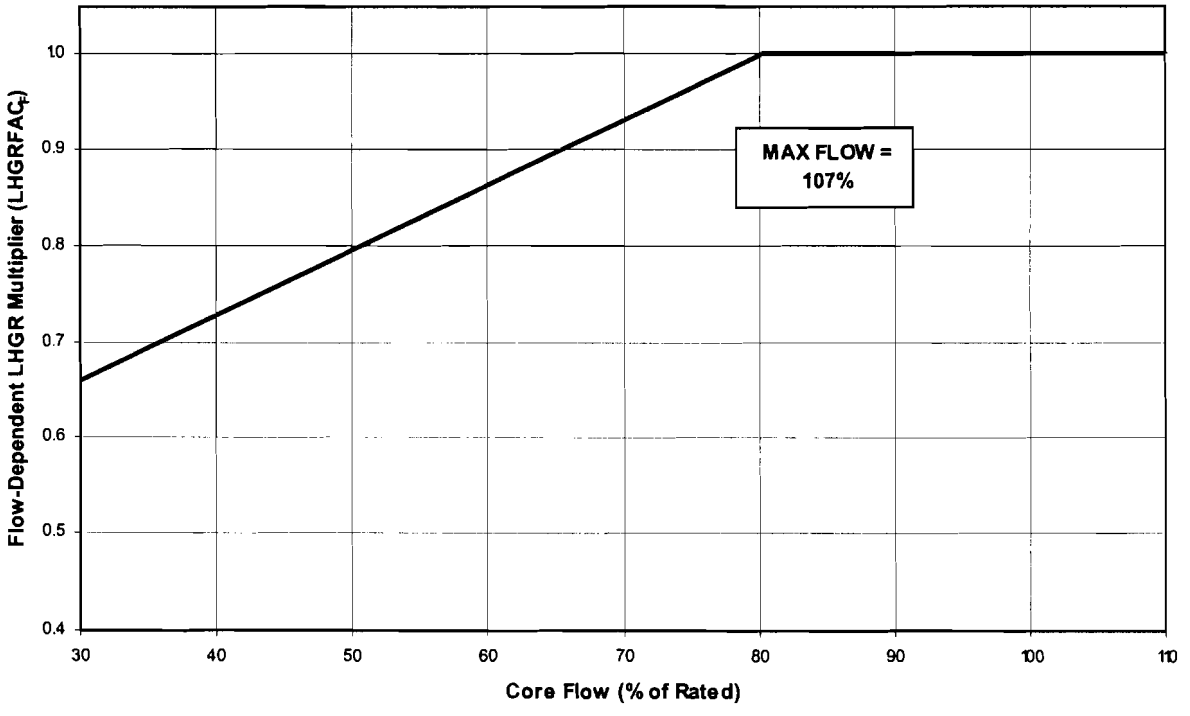
More than One Pressure Regulator Functional	High Pressure Feedwater Heaters	$LHGRFAC_P$
Yes	In Service	Figure 4-2A
No	In Service	Figure 4-2B
Yes	Out of Service	Figure 4-2C

Table 4-2

LHGR Limits versus Peak Pellet Exposure

Six Inch Segment Gd (w%)	Rod Maximum Gd (w%)	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	2.00	12.800	12.800	13.866	7.642	55.028	4.776	60.660
2.00	2.00	13.093	13.093	12.449	7.816	55.681	4.885	61.597
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
0.00	6.00	13.100	13.100	14.190	7.821	56.317	4.888	62.082
6.00	6.00	12.255	12.255	12.276	7.316	54.999	4.572	60.845
0.00	7.00	13.200	13.200	14.298	7.881	56.747	4.925	62.556
2.00	7.00	13.093	13.093	12.449	7.816	55.681	4.885	61.597
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)



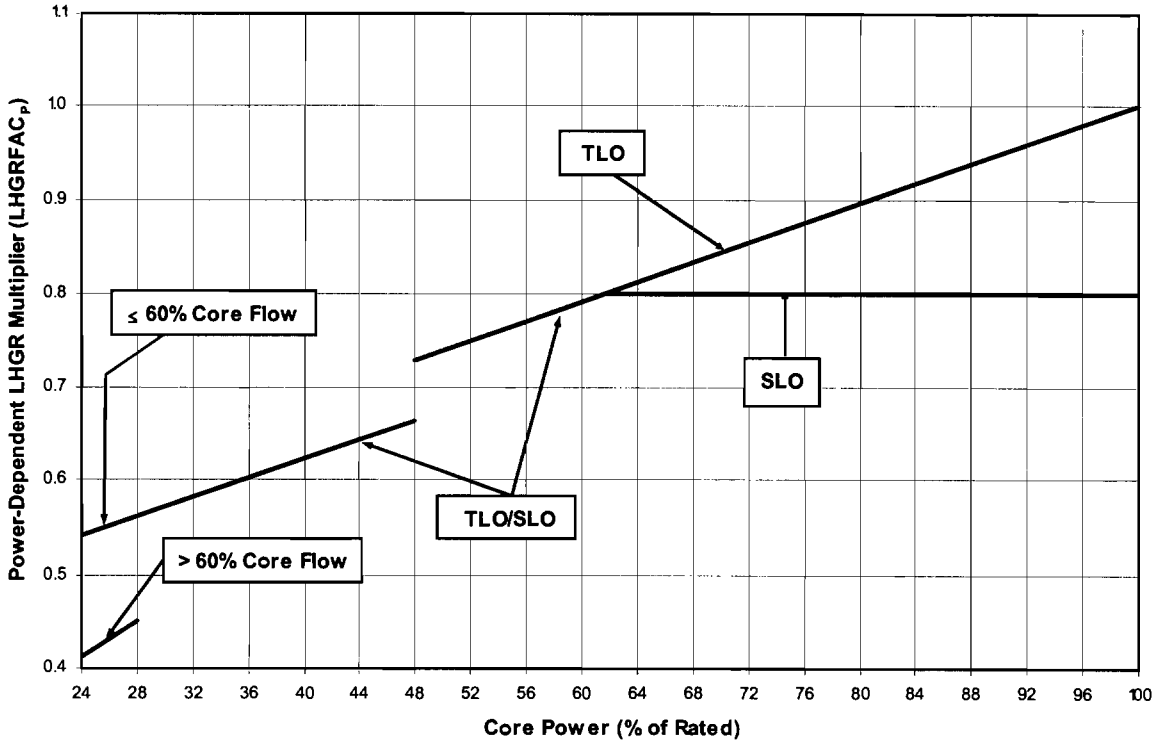
LHGRFAC$_F$ = Minimum [1.0, (A + B*F)]

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



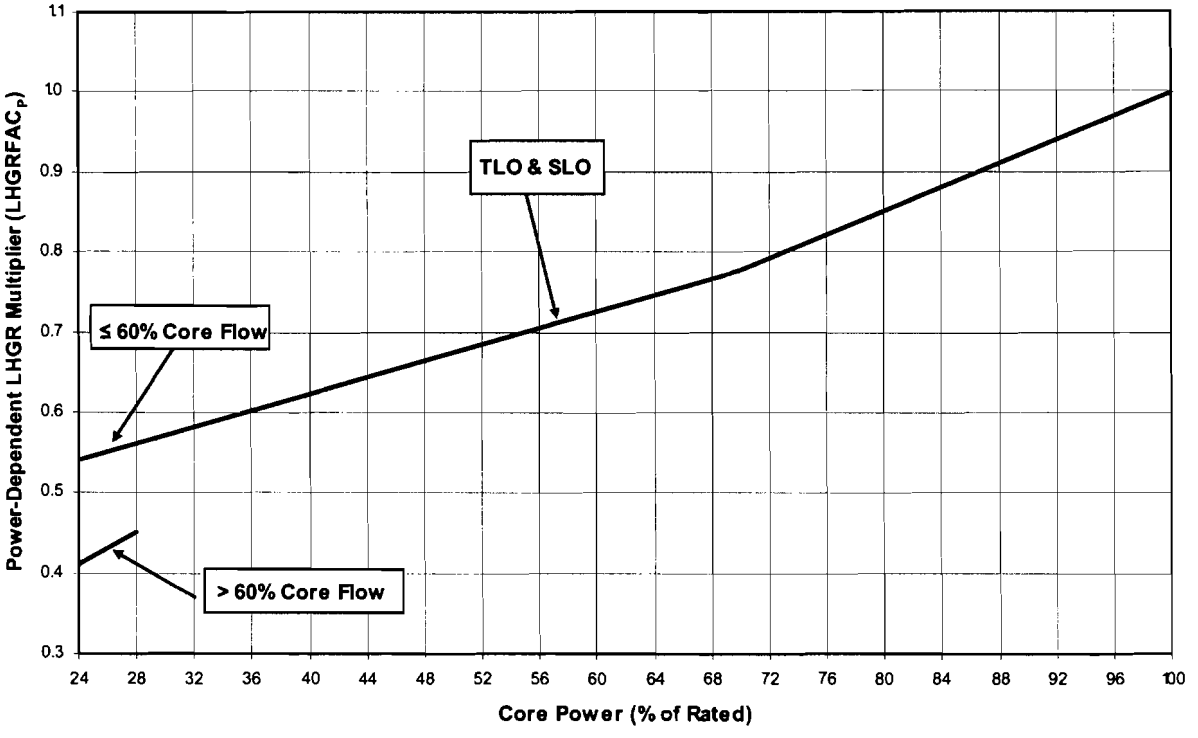
LHGRFAC$_P$ = A + B*P

Operating Conditions			Values of Variables	
P	F	SLO/ TLO	A	B
24 ≤ P < 28	F > 60	SLO / TLO	0.17924	0.00967
24 ≤ P < 28	F ≤ 60	SLO / TLO	0.41897	0.00510
28 ≤ P < 48	All	SLO / TLO	0.41897	0.00510
48 ≤ P < 61.72	All	SLO / TLO	0.4776	0.005224
61.72 ≤ P	All	TLO	0.4776	0.005224
61.72 ≤ P	All	SLO	0.800	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
(More than One Pressure Regulator Functional and High Pressure Heaters In Service)



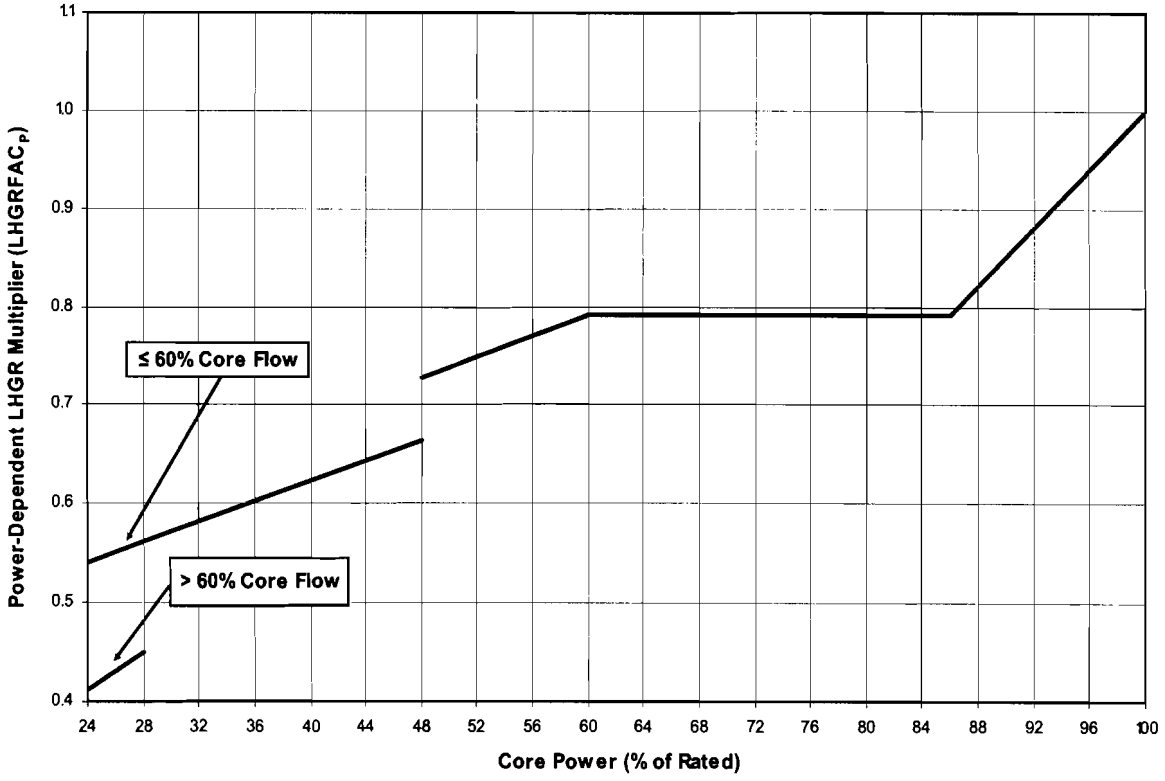
$LHGRFAC_P = A + B*P$

Operating Conditions			Values of Variables	
P	F	SLO/ TLO	A	B
$24 \le P < 28$	$F > 60$	SLO / TLO	0.17924	0.00967
$24 \le P < 28$	$F \le 60$	SLO / TLO	0.41897	0.00510
$28 \le P < 70$	All	SLO / TLO	0.41897	0.00510
$70 \le P$	All	SLO / TLO	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
(Only One Pressure Regulator Functional and High Pressure Heaters In Service)



LHGRFAC$_P$ = A + B*P

Operating Conditions			Values of Variables	
P	**F**	**SLO/TLO**	**A**	**B**
24 ≤ P < 28	F > 60	SLO / TLO	0.17924	0.00967
24 ≤ P < 28	F ≤ 60	SLO / TLO	0.41897	0.00510
28 ≤ P < 48	All	SLO / TLO	0.41897	0.00510
48 ≤ P < 60.04	All	SLO / TLO	0.4776	0.005224
60.04 ≤ P < 86.06	All	SLO / TLO	0.791	0.000
86.06 ≤ P	All	TLO	-0.498	0.01498

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

FIGURE 4-2C

Power-Dependent LHGR Multiplier (LHGRFAC$_P$) versus Core Power
(More than One Pressure Regulator Functional and High Pressure Heaters Out of Service)

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

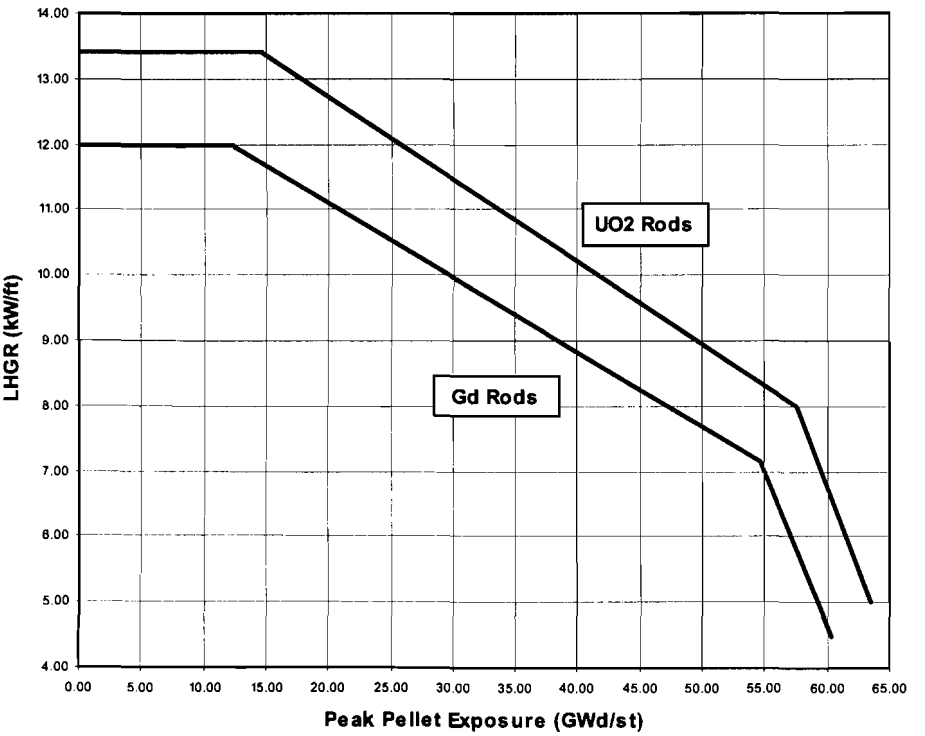


FIGURE 4-3

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 2C51K615 A, B, C, and D.

Table 5-1

OPRM Setpoint

OLMCPR	OPRM Setpoint
≥ 1.33	1.15

6.0 REFERENCES

1. "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-15, September 2005, and the US Supplement, NEDE-24011-P-A-15-US, September 2005.

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 0000-0045-1586-SRLR, "Supplemental Reload Licensing Report for Edwin I. Hatch Nuclear Power Plant Unit 2, Reload 19 Cycle 20," Revision 0, December 2006.

4. 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.

5. SNC Letter CAH-NF-2599, "H2C20 SNC Reload Licensing Analyses," W. R. Mertz to K. S. Folk, January 16, 2007.

6. Global Nuclear Fuel document 0000-0045-1586-FBIR, "Fuel Bundle Information Report for Edwin I. Hatch Nuclear Power Plant Unit 2, Reload 19 Cycle 20," Revision 0, December 2006.

7. GNF Design Basis Document DB-0012.03, "Fuel-Rod Thermal-Mechanical Performance Limits for GE14C," Revision 2, September 2006.

8. SNC Letter CAH-NF-2668, "Generic RPTOOS + BPVOOS ARTS Analysis," W. R. Mertz to K. S. Folk, October 16, 2008.