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NINE MILE POINT NUCLEAR STATION

P.O. Box 63
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May 30, 2012

U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

ATTENTION: Document Control Desk

SUBJECT: Nine Mile Point Nuclear Station
Unit No. 1; Docket No. 50-220
Core Operating Limits Report

Enclosed is a copy of the Core Operating Limits Report, COLR1-20, Revision 1 for Nine Mile Point Unit 1 (NMP1). This report is being submitted pursuant to NMP1 Technical Specification 6.6.5.d.

Should you have any questions regarding the information in this submittal, please contact John J. Dosa, Licensing Director, at (315) 349-5219.

Very truly yours,

Paul M. Swift
Manager, Engineering Services

PMS/MHS

Enclosure: Nine Mile Point Unit 1 Core Operating Limits Report

cc: NRC Regional Administrator, Region I
NRC Project Manager
NRC Senior Resident Inspector

A001
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ENCLOSURE

Nine Mile Point Unit 1
Core Operating Limits Report

Nine Mile Point Nuclear Station, LLC
May 30, 2012

**NINE MILE POINT UNIT 1
CORE OPERATING LIMITS REPORT**

Document No.: COLR1-20

Revision 01

	<u>Name</u>	<u>Title</u>	<u>Date</u>
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This Controlled Document provides cycle specific core operating limits for use in conjunction with the Nine Mile Point Unit 1 Technical Specifications. Document pages may only be changed through a reissue of the entire document.

TERMS AND DEFINITIONS**Average Planar Linear Heat Generation Rate (APLHGR)**

The Average Planar Linear Heat Generation Rate (APLHGR) shall be applicable to a specific planar height and is equal to the sum of the heat generation rate per unit length of fuel rod for all fuel rods in the specified bundle at the specified height, divided by the number of fuel rods in the fuel bundle at that height

BOC

Beginning of Cycle

Maximum Fraction of Limiting Power Density (MFLPD)

The highest value of the fraction of limiting power density which exists in the core

EOR

End of Rated Conditions (i.e. cycle exposure at 100% power, 100% flow, all rods-out, all feedwater heaters in service and equilibrium xenon)

K(f)

MCPR flow dependent multiplier

K(P)

MCPR power dependent multiplier

LHGRFAC(P)

Power dependent LHGR correction factor

Linear Heat Generation Rate (LHGR)

The heat generation per unit length of fuel rod. It is the integral of the heat flux over the heat transfer area associated with the fuel length

MAPLHGR

Maximum Average Planar Linear Heat Generation Rate

Minimum Critical Power Ratio (MCPR)

The minimum in-core critical power ratio

RSLD

Reload Specific Lattice Data Document

MDFWP

Motor driven feedwater pump

TDFWP

Turbine driven feedwater pump

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1.0 AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)**1.1 Limits for Technical Specification 3.1.7.a**

During power operations, the APLHGR(s) for each fuel type as a function of AVERAGE PLANAR EXPOSURE shall not exceed the limiting values shown for GE11 in Table 1a, 1b, 1c, and 1d, or the limiting values shown for GNF2 in Table 1e and 1f.

1.2 Limits for Technical Specification 3.1.7.e

During partial loop operation with four recirculation loops in operation, the APLHGR as a function of average planar exposure shall not exceed 98 percent of the limiting values shown for GE11 in Table 1a, 1b, 1c, and 1d and 99 percent of the limiting values shown for GNF2 in Table 1e and 1f.

During partial loop operation with three recirculation loops in operation, the APLHGR as a function of average planar exposure shall not exceed 98 percent of the limiting values shown for GE11 in Table 1a, 1b, 1c, and 1d and 99 percent of the limiting values shown for GNF2 in Table 1e and 1f.

Table 1a

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE

Average Planar Exposure GWd/ST	MAPLHGR Limits (kW/ft) (1)	
	Bundle 2586	Bundle 2831
0.00	9.63	9.51
0.20	9.63	9.51
1.00	9.60	9.48
5.00	9.40	9.35
10.00	9.37	9.20
15.00	9.24	9.07
20.00	8.76	8.60
25.00	8.34	8.15
35.00	8.10	8.05
45.00	8.03	8.06
55.00	8.02	8.11
65.00	6.18	8.20

(1) These MAPLHGRs are not lattice dependent, therefore the values shown also correspond to the limiting value for the most limiting lattice for use when hand calculations are required.

Bundle TypeID

GE11-P9DUB376-12GZ-100T-145-T6-2586
GE11-P9DUB382-13GZ-100T-145-T6-2831

2586
2831

Table 1b

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE
Bundle Type: GE11-P9DUB381-13GZ-100T-145-T6-2945 (GE11)

Average Planar Exposure GWd/ST	MAPLHGR Limits ⁽¹⁾ (kw/ft)						Most Limiting
	Lattice 7433	Lattice 7434	Lattice 7435	Lattice 7436	Lattice 7437	Lattice 7438	
0.00	9.61	9.61	9.57	9.57	9.57	9.57	9.57
0.20	9.61	9.61	9.57	9.57	9.57	9.57	9.57
1.00	9.57	9.57	9.56	9.56	9.56	9.56	9.56
5.00	9.42	9.42	9.46	9.46	9.46	9.46	9.42
10.00	9.37	9.37	9.34	9.34	9.34	9.34	9.34
15.00	9.22	9.22	9.23	9.23	9.23	9.23	9.22
20.00	9.18	9.18	9.19	9.19	9.19	9.19	9.18
25.00	8.50	8.50	8.47	8.47	8.47	8.47	8.47
35.00	8.19	8.19	8.28	8.28	8.28	8.28	8.19
45.00	8.27	8.27	8.27	8.27	8.27	8.27	8.27
55.00	8.31	8.31	8.31	8.31	8.31	8.31	8.31
65.00	8.38	8.38	8.38	8.38	8.38	8.38	8.38

(1) These MAPLHGR are lattice dependent. The values shown in the Most Limiting Column correspond to the limiting value for the most limiting lattice for use when hand calculations are required. Lattice descriptions are contained in the FBIR.

Table 1c

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE
Bundle Type: GE11-P9DUB381-14GZ-100T-145-T6-2946 (GE11)

Average Planar Exposure GWd/ST	MAPLHGR Limits ⁽¹⁾ (kw/ft)						Most Limiting
	Lattice 7433	Lattice 7439	Lattice 7440	Lattice 7441	Lattice 7442	Lattice 7443	
0.00	10.24	10.24	10.19	10.19	10.19	10.19	10.19
0.20	10.24	10.24	10.19	10.19	10.19	10.19	10.19
1.00	10.20	10.20	10.19	10.19	10.19	10.19	10.19
5.00	9.91	9.91	9.85	9.85	9.85	9.85	9.85
10.00	9.42	9.42	9.34	9.34	9.34	9.34	9.34
15.00	9.22	9.22	9.19	9.19	9.19	9.19	9.19
20.00	9.18	9.18	9.19	9.19	9.19	9.19	9.18
25.00	8.64	8.64	8.63	8.63	8.63	8.63	8.63
35.00	8.08	8.08	8.08	8.08	8.08	8.08	8.08
45.00	8.02	8.02	7.99	7.99	7.99	7.99	7.99
55.00	8.00	8.00	7.99	7.99	7.99	7.99	7.99
65.00	7.97	7.97	7.96	7.96	7.96	7.96	7.96

(1) These MAPLHGR are lattice dependent. The values shown in the Most Limiting Column correspond to the limiting value for the most limiting lattice for use when hand calculations are required. Lattice descriptions are contained in the FBIR.

Table 1d

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE
Bundle Type: GE11-P9DUB380-13GZ-100T-145-T6-2948 (GE11)

Average Planar Exposure GWd/ST	MAPLHGR Limits ⁽¹⁾ (kw/ft)						Most Limiting
	Lattice 7433	Lattice 7449	Lattice 7450	Lattice 7451	Lattice 7447	Lattice 7448	
0.00	9.71	9.71	9.69	9.69	9.69	9.69	9.69
0.20	9.71	9.71	9.69	9.69	9.69	9.69	9.69
1.00	9.68	9.68	9.67	9.67	9.67	9.67	9.67
5.00	9.56	9.56	9.50	9.50	9.50	9.50	9.50
10.00	9.38	9.38	9.32	9.32	9.32	9.32	9.32
15.00	9.23	9.23	9.24	9.24	9.24	9.24	9.23
20.00	9.28	9.28	9.31	9.31	9.31	9.31	9.28
25.00	8.43	8.43	8.45	8.45	8.45	8.45	8.43
35.00	8.09	8.09	8.09	8.09	8.09	8.09	8.09
45.00	7.98	7.98	8.02	8.02	8.02	8.02	7.98
55.00	7.97	7.97	7.98	7.98	7.98	7.98	7.97
65.00	7.91	7.91	7.93	7.93	7.93	7.93	7.91

(1) These MAPLHGR are lattice dependent. The values shown in the Most Limiting Column correspond to the limiting value for the most limiting lattice for use when hand calculations are required. Lattice descriptions are contained in the FBIR.

Table 1e

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE
Bundle Type: GNF2-P10DG2B384-16GZ-100T2-145-T6-3351 (GNF2)

Average Planar Exposure	MAPLHGR Limits (kW/ft) (1)
GWd/ST	KW/ft
0.00	8.17
0.20	8.17
1.00	8.14
5.00	8.05
10.00	7.97
15.00	8.03
20.00	7.10
25.00	6.75
35.00	6.61
45.00	6.41
55.00	6.28
65.00	6.19

(1) These MAPLHGRs are not lattice dependent, therefore the values shown also correspond to the limiting value for the most limiting lattice for use when hand calculations are required.

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Table 1f

MAPLHGR VERSUS AVERAGE PLANAR EXPOSURE
Bundle Type: GNF2-P10DG2B386-13GZ-100T2-145-T6-3352 (GNF2)

Average Planar Exposure	MAPLHGR Limits (kW/ft) (1)
GWd/ST	KW/ft
0.00	8.16
0.20	8.16
1.00	8.12
5.00	8.03
10.00	7.99
15.00	8.10
20.00	7.16
25.00	6.78
35.00	6.62
45.00	6.40
55.00	6.26
65.00	6.18

(1) These MAPLHGRs are not lattice dependent, therefore the values shown also correspond to the limiting value for the most limiting lattice for use when hand calculations are required.

2.0 MINIMUM CRITICAL POWER RATIO (MCPR)**2.1 Limits for Technical Specification 3.1.7.c**

During power operation, the operating MCPR shall be greater than or equal to the Operating Limit MCPR determined as the maximum of either:

A) the appropriate MCPR⁽¹⁾ from Figure (2a thru 2d)^(2,3,5) times the K(f) shown in Figure 2e,

Or,

B) the appropriate MCPR(P)⁽⁴⁾ from Figure 2f.

Additional MCPR(P) limits are required for operations without a backup pressure regulator. These limits are shown in Figure 2g.

2.2 Limits for Technical Specification 3.1.7.e

During 3 loop operation, the Operating Limit MCPR shall be increased by 0.02. No adjustment is needed during 4 loop operation.

NOTES:

1 Based on a 1.07 MCPR Safety Limit (SLCPR)

2 For Figures 2a thru 2d tau (τ) defined as follows:

$$\tau = (\tau_{ave} - \tau_B) / (\tau_A - \tau_B)$$

τ_A = 0.868 seconds, control rod average scram insertion time limit to notch 39

$$\tau_B = .672 + 1.65 \times \left[N_1 / \sum_{i=1}^n N_i \right]^{1/2} \times .016$$

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

n = number of surveillance tests performed in cycle

N_i = number of active control rods measured in the i^{th} surveillance test

τ_i = average scram time to notch 39 of all rods measured in the i^{th} surveillance test

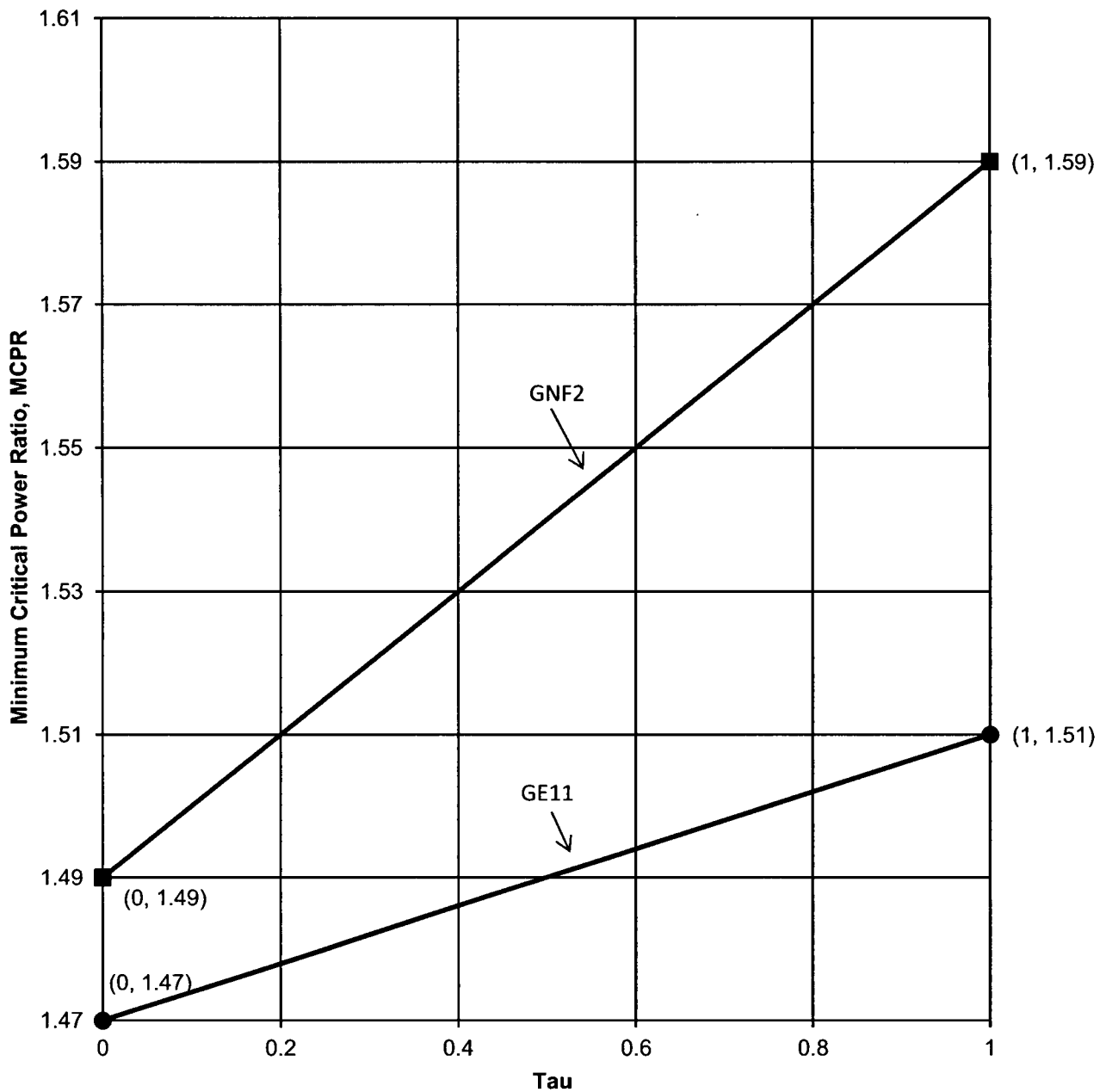
N_1 = total number of active rods measured

3 For the current exposure and feedwater pump configuration. "Pump Combinations" are also described in operating procedure N1-OP-16, attachment 13

4 Introduction of the GNF2 fuel type requires use of power dependent MCPR limits for all off-rated conditions, including operations without a backup pressure regulator. When power is greater than 45%, the K(P) multiplier from Figure 2f is applied to the applicable rated condition MCPR limits from Figures 2a thru 2d. At less than or equal to 45% power, the MCPR(P) limits in Figure 2f are applied directly. This discussion also applies to Figure 2g. Figure 2f and 2g are applicable to both GE11 and GNF2 fuel.

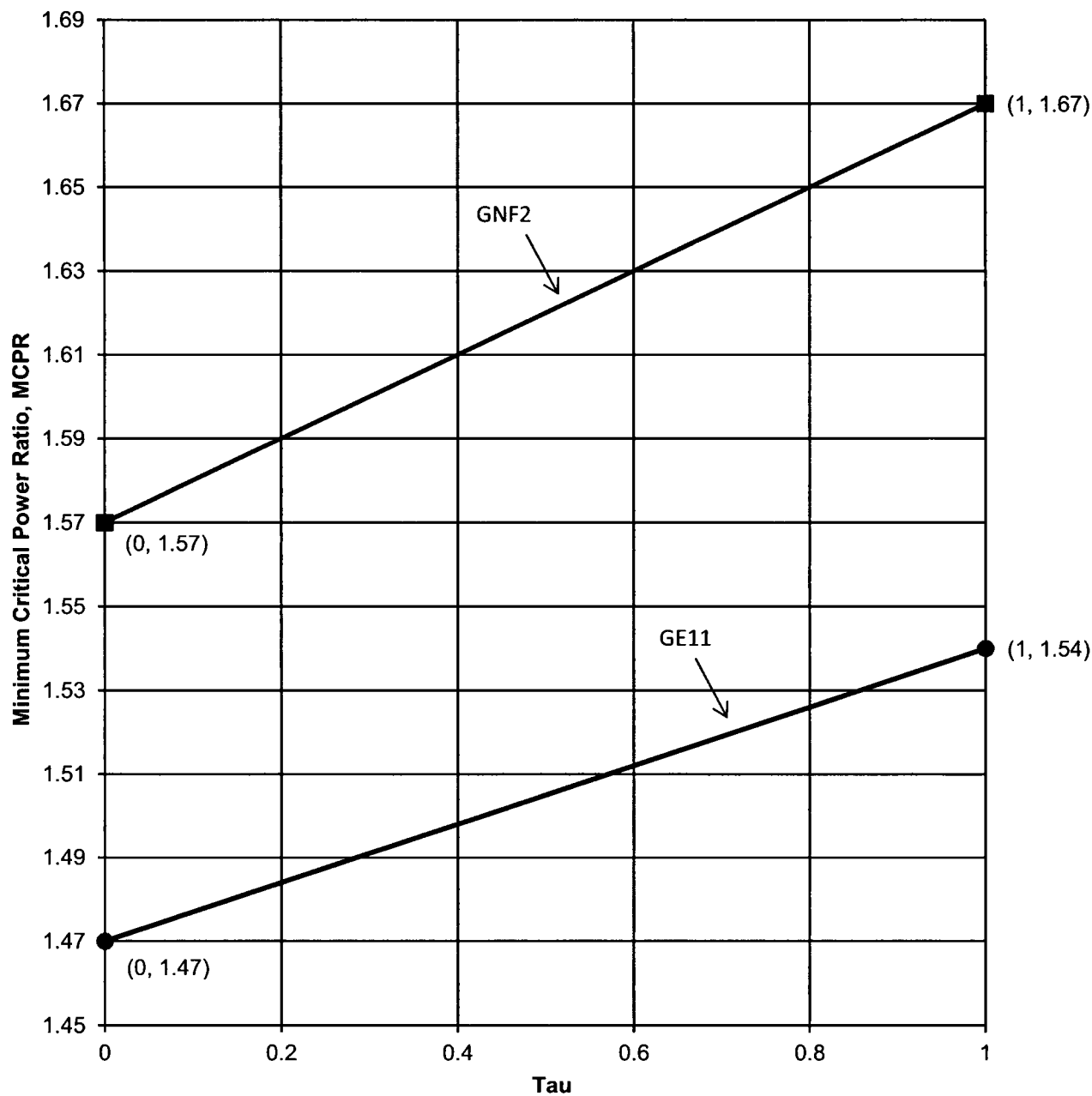
5 Option B OLMCPR limits for GE11 in Figures 2a-2c are set by the Detect and Suppress (Stability) Evaluation for Reload 21.

Figure 2a
M CPR Operating Limits
for Feedwater Pump Combination 1 maximum flows
Beginning Of Cycle to EOR*-1448 MWd/ST
(Bounds TDFWP+MDFWP, TDFWP only, MDFWP only, two MDFWPs)



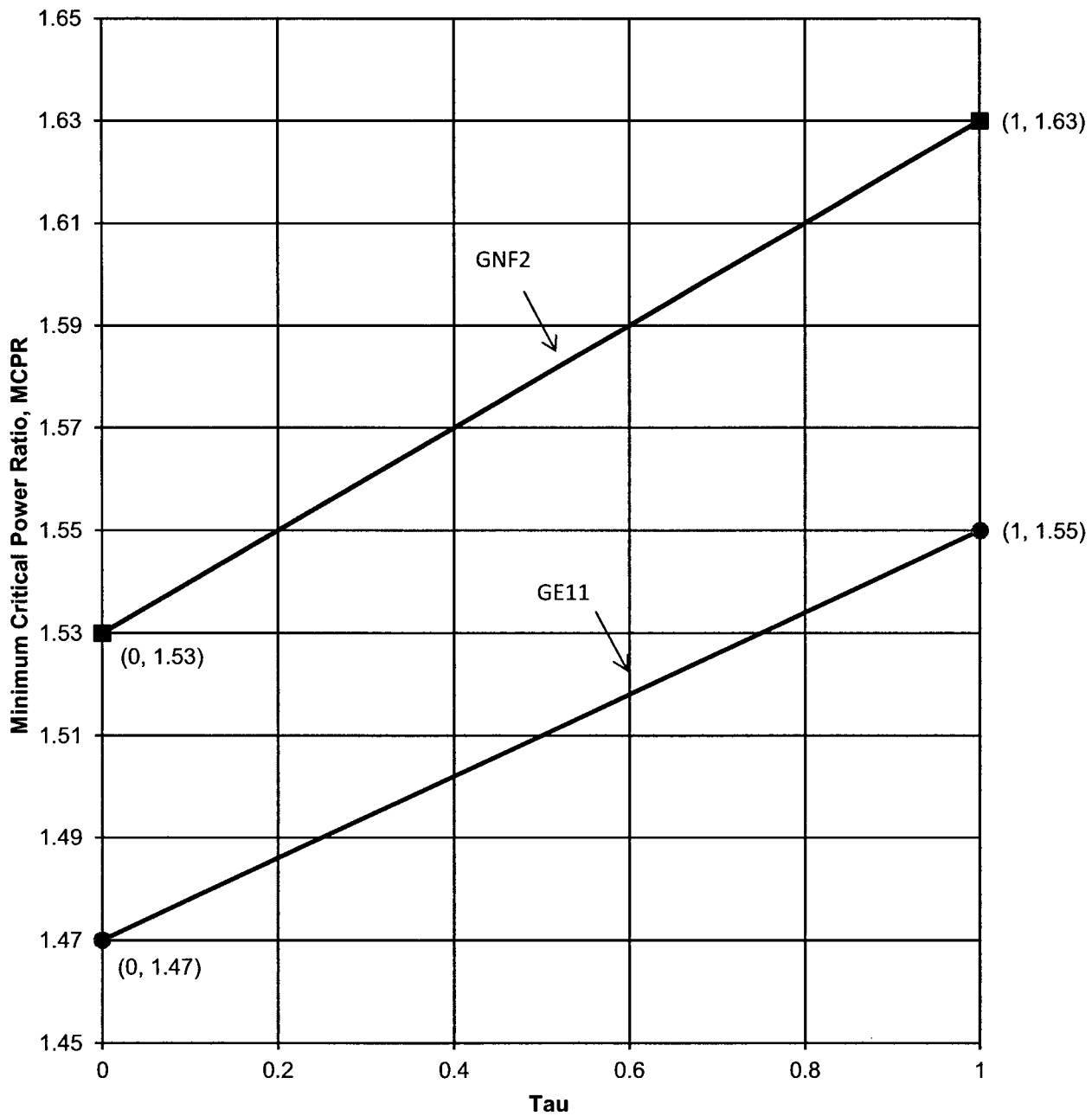
* EOR is the end of rated exposure as defined in the Cycle Management Report

Figure 2b
MCPR Operating Limits
for Feedwater Pump Combination 1 maximum flows
EOR*-1448 MWd/ST to End Of Cycle
(Bounds TDFWP+MDFWP, TDFWP only, MDFWP only, two MDFWPs)



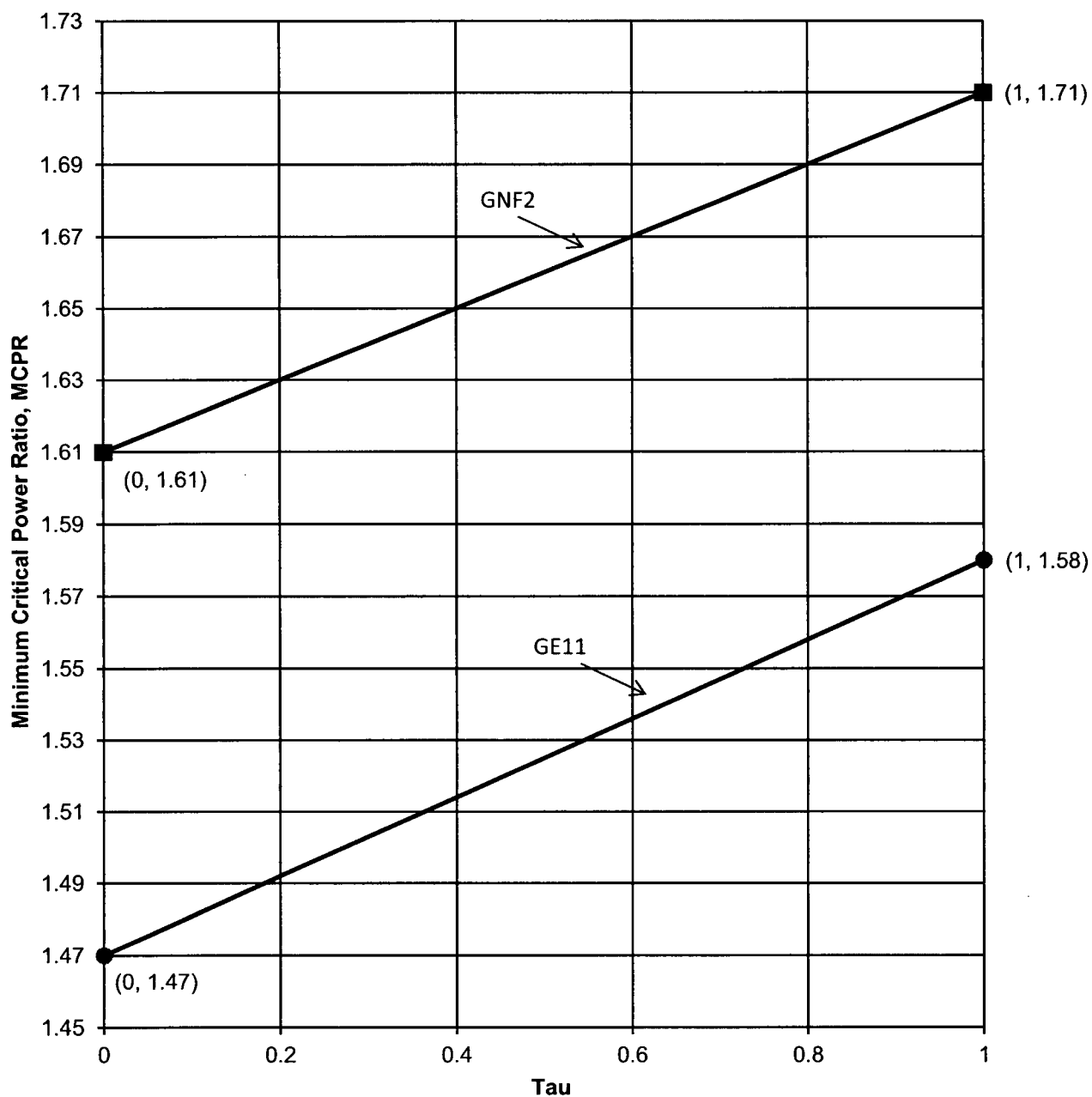
* EOR is the end of rated exposure as defined in the Cycle Management Report

Figure 2c
MCPR Operating Limits
for Feedwater Pump Combination 2 maximum flows
Beginning of Cycle to EOR*-1448 MWd/ST
(Bounds TDFWP+ two MDFWPs)



* EOR is the end of rated exposure as defined in the Cycle Management Report

Figure 2d
MCPR Operating Limits
for Feedwater Pump Combination 2 maximum flows
EOR*-1448 MWd/ST to End Of Cycle
(Bounds TDFWP+ two MDFWPs)



* EOR is the end of rated exposure as defined in the Cycle Management Report

Figure 2e NMP-1 K(f) Curve for MCPR

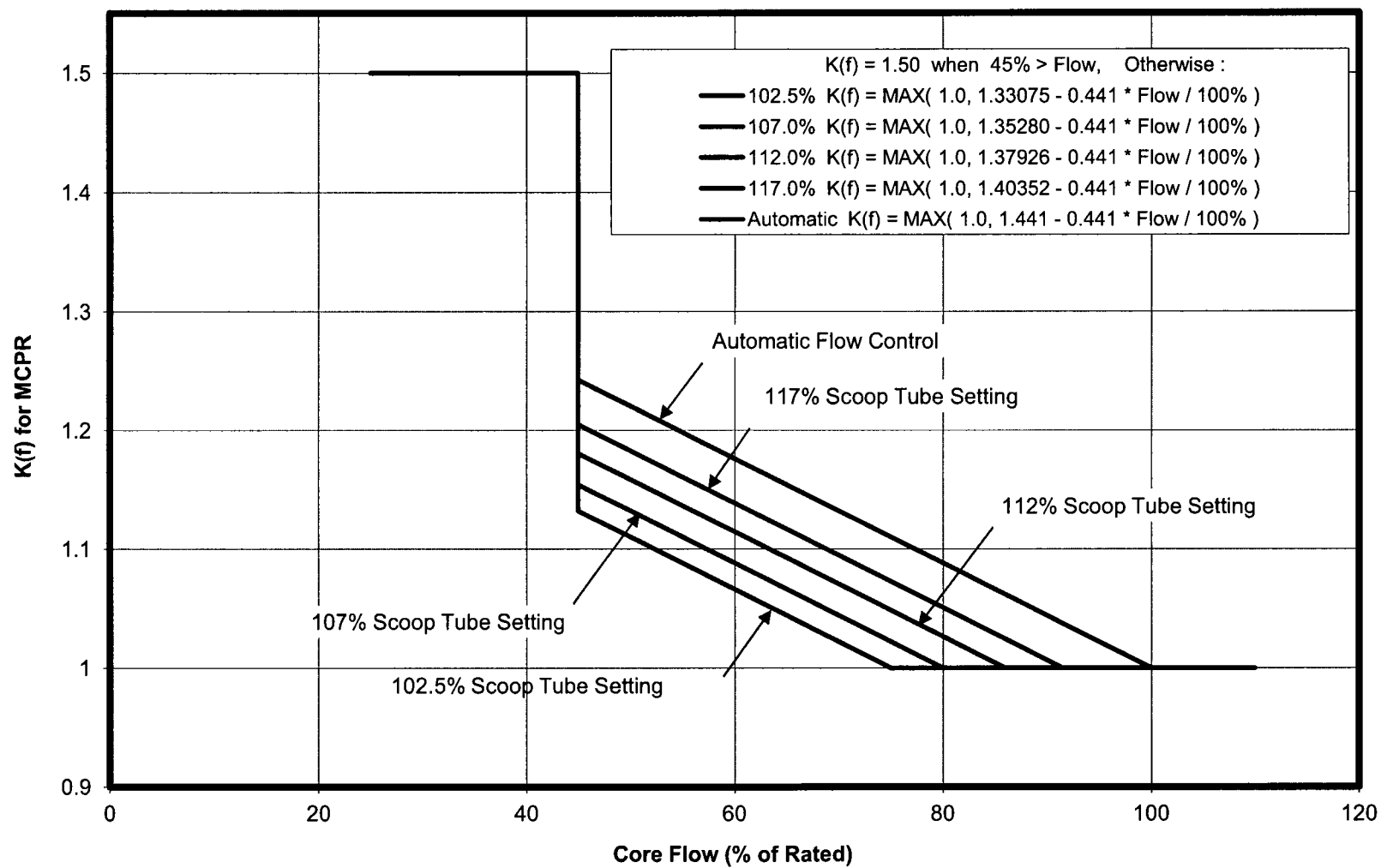


Figure 2f
MCPR(P) Limits for Normal Operation

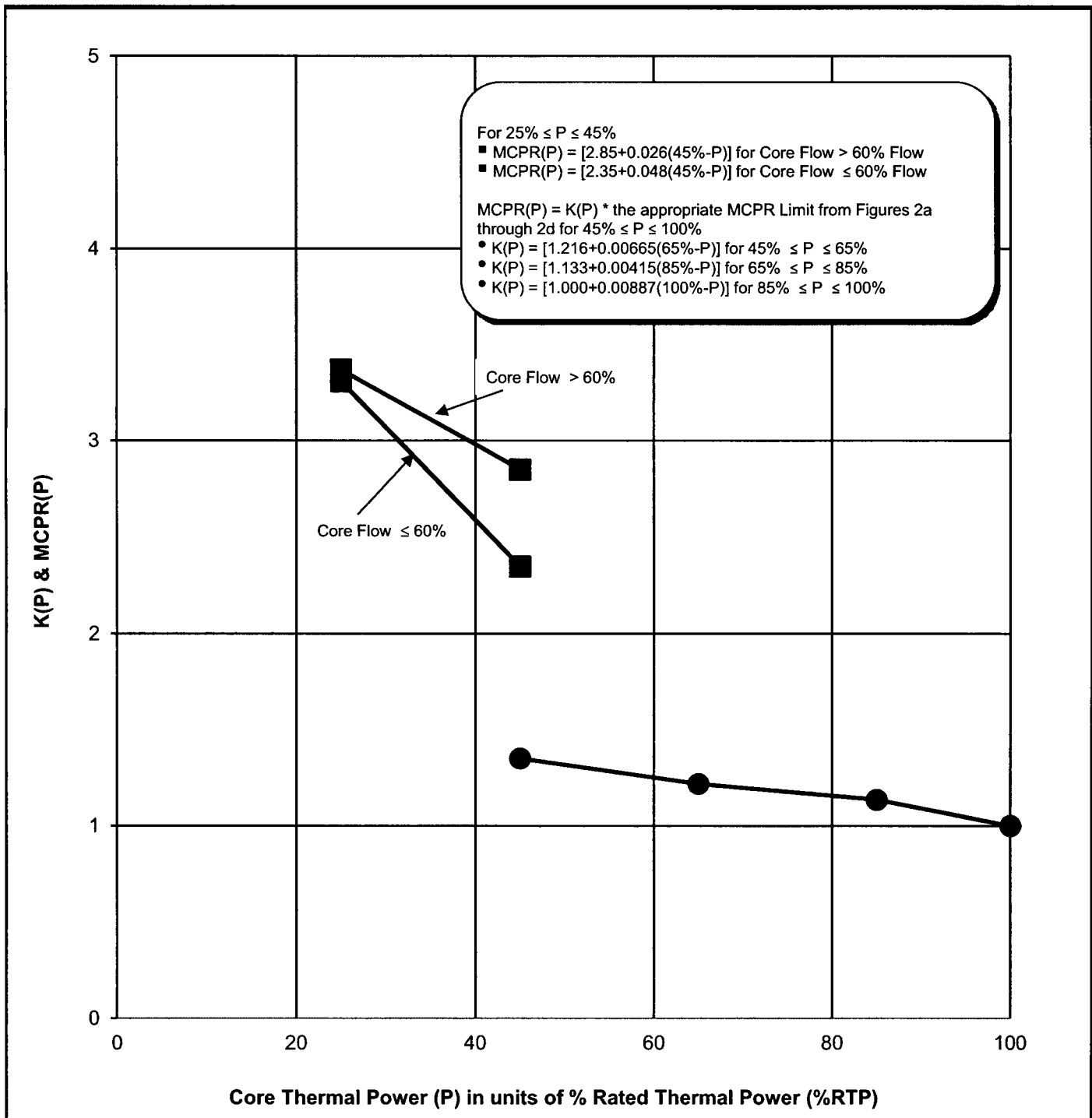
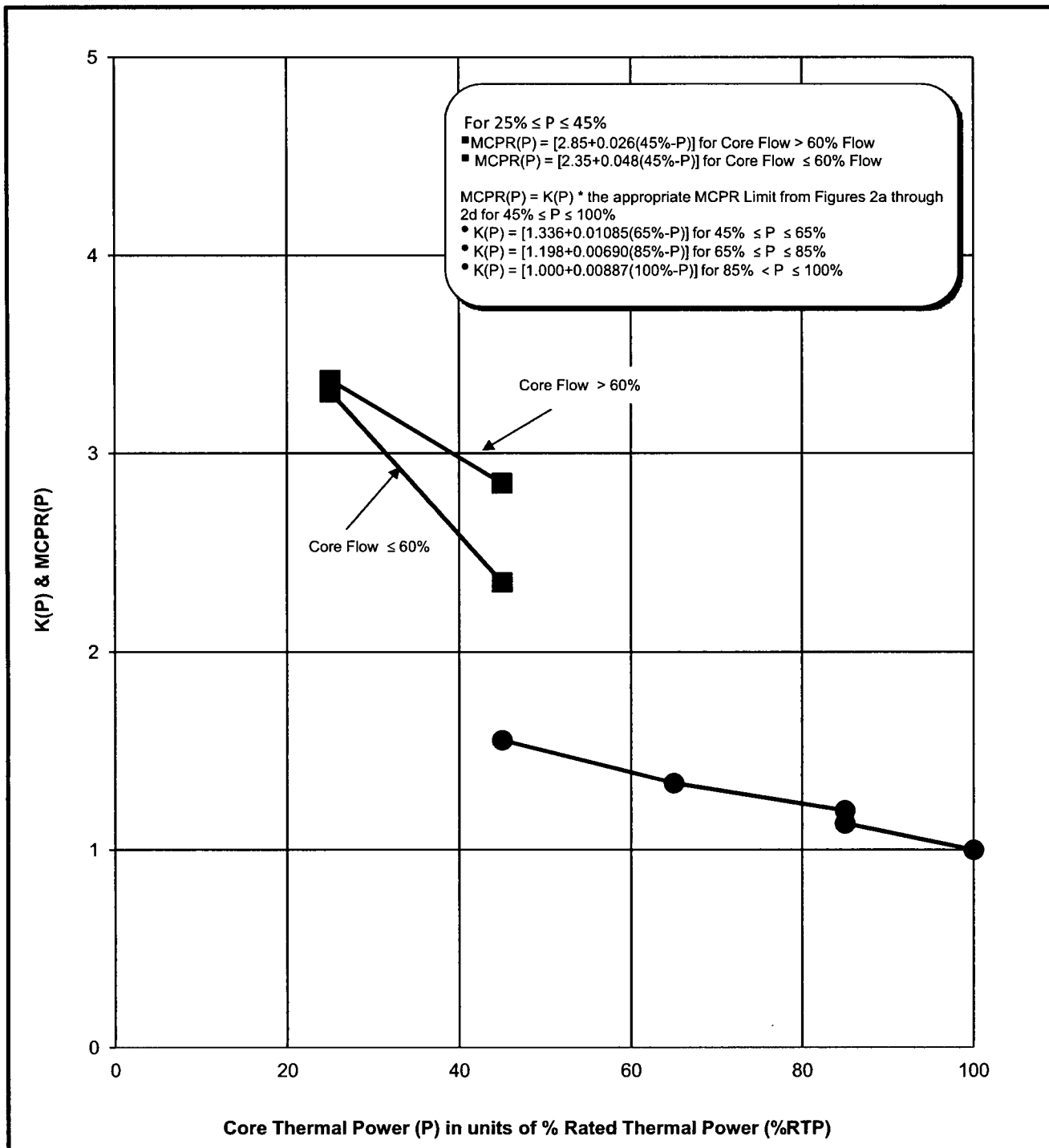


Figure 2g
MCPR(P) Limits for Operation Without Backup Pressure Regulator



3.0 LINEAR HEAT GENERATION RATE (LHGR)

3.1 Limits for Technical Specification 3.1.7.b

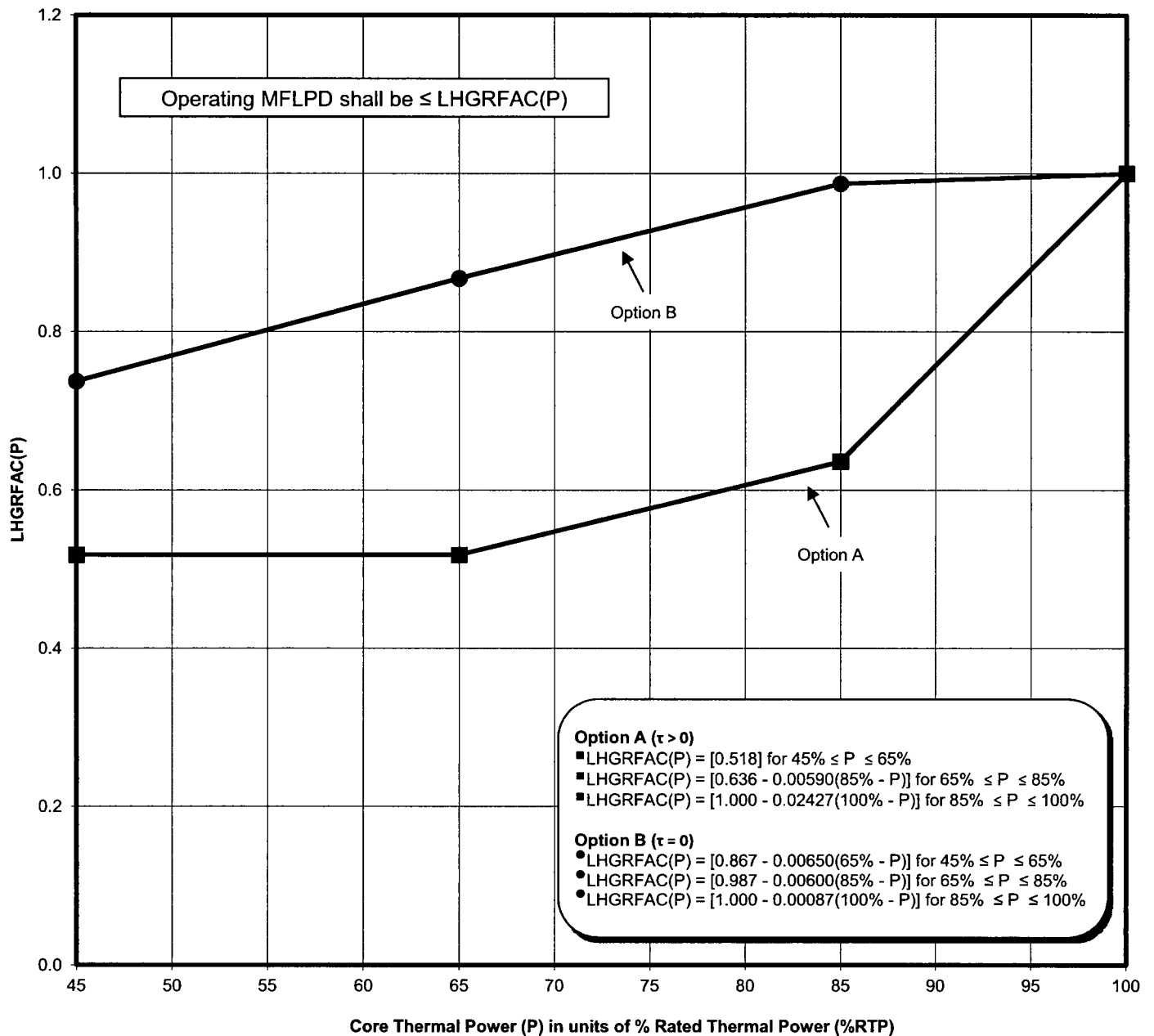
During power operation, the Linear Heat Generation Rate (LHGR) of any rod in any fuel assembly at any axial location shall not exceed the maximum of $11.0 \text{ kW/ft}^{(1)}$ or the limiting values shown in FBIR1-20, Revision 0, "Nine Mile Point Unit 1 Fuel Bundle Information Report". This document contains the LHGR limits for both UO₂ rods (which contain no gadolinium) and the most limiting gadolinium-bearing rods. Other gadolinium-bearing rods have LHGR limits which lie between these two curves. Compliance with these limits will be monitored by the plant's process computer.

For power operations between 45% and 100% RTP⁽²⁾ without a backup pressure regulator, operating MFLPD shall be $\leq \text{LHGRFAC(P)}^{(3)}$.

NOTE:

- 1 PLHGR shall be maintained below 11.0 kW/ft during plant operating to assure the PCT remains below 1500°F under steam cooling mitigation strategies specified in the EOPs.
- 2 Introduction of the GNF2 fuel type requires use of a power dependent LHGR Correction Factor, or LHGRFAC(P) for power operations without a backup pressure regulator at greater than or equal to 45% RTP. Below 45% RTP, no additional limits are required. Figure 3 is applicable to both GE11 and GNF2 fuel types.
- 3 LHGRFAC(P) limits are provided for option B and option A scram times. If scram times are slower than option B (i.e. $\tau > 0$), then option A limits must be applied.

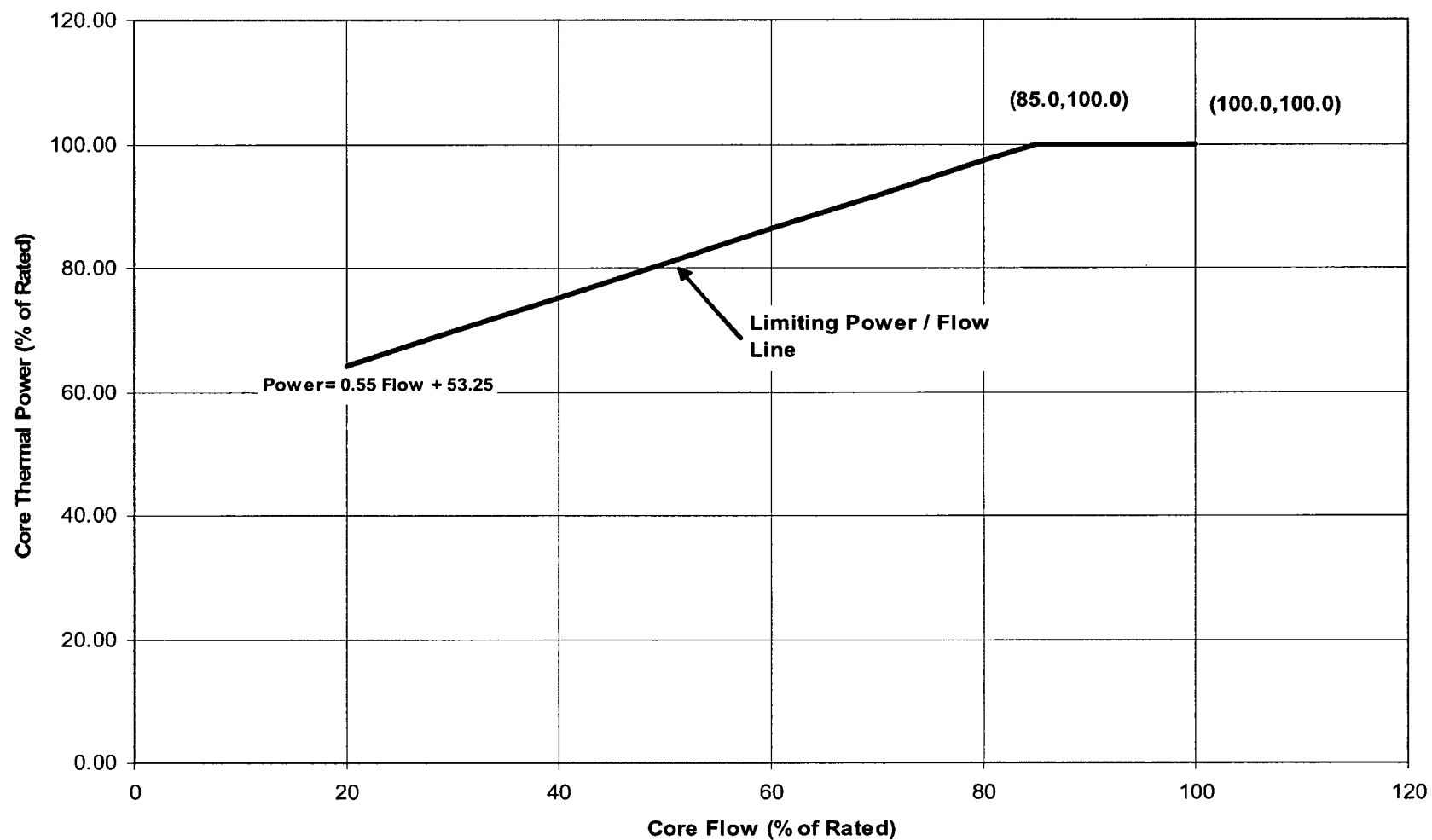
Figure 3
LHGRFAC(P) Limits for Operation Without Backup Pressure Regulator



4.0 POWER/FLOW RELATIONSHIP DURING OPERATION**4.1 Limits for Technical Specification 3.1.7.d and e**

The power/flow relationship shall not exceed the limiting values shown in Figure 4.

Figure 4 Limiting Power / Flow Line



5.0 REFERENCE FOR TECHNICAL SPECIFICATIONS**Technical Specification 6.6.5b:**

NEDE 24011-P-A-17, "General Electric Standard Application for Reactor Fuel," September 2010 and the U.S. Supplement, NEDE-24011-P-A-17-US, September 2010.

6.0 SOURCE DOCUMENTS

The Core Operating Limits contained in this report were obtained from the following documents:

CORE OPERATING LIMITS	REFERENCES
<u>APLHGR Limits (Section 1)</u> Table 1 and corresponding 3 and 4 loop multipliers	0000-0108-3371-SRLR, Revision 0, February 2011, Supplemental Reload Licensing Report for Nine Mile Point 1, Reload 21, Cycle 20 MEF-NMP-EA11-049, Transmittal of Exposure-dependent GE11 and GNF2 Fuel MAPLHGR Limits for Cycle 22, April 15, 2011 MEF-NMP-12-065, Transmittal of Revised Exposure-dependent GNF2 Fuel MAPLHGR Limits for Nine Mile Point Unit 1 Cycle 22, May 9, 2012
Lattice Descriptions	0000-0108-3371-FBIR, Revision 0, February 2011 Fuel Bundle Information Report for Nine Mile Point 1, Reload 21, Cycle 20
<u>MCPR Limits (Section 2)</u>	0000-0108-3371-SRLR, Revision 0, February 2011, Supplemental Reload Licensing Report for Nine Mile Point 1, Reload 21, Cycle 20 0000-0130-4605-R1, Nine Mile Point 1 Cycle 22 Revised Operated Power Dependent Limits Below Pbypass with Turbine Bypass, April 5, 2011 0000-0131-9552-R0, Nine Mile Point 1 Cycle 22 GNF2 NFI PROOS Off-rated Limits with Option B Scram, April 12, 2011
EOR Definition	NMP1CMR, Revision 20, Nine Mile Point Unit 1, Cycle 20, Cycle Management Report, April 2011
<u>LHGR Limits (Section 3)</u>	0000-0108-3371-FBIR, Revision 0, February 2011 Fuel Bundle Information Report for Nine Mile Point 1, Reload 21, Cycle 20 0000-0108-3371-SRLR, Revision 0, February 2011, Supplemental Reload Licensing Report for Nine Mile Point 1, Reload 21, Cycle 20 0000-0131-9552-R0, Nine Mile Point 1 Cycle 22 GNF2 NFI PROOS Off-rated Limits with Option B Scram, April 12, 2011
<u>Power/Flow Relationship (Section 4)</u>	NMP1 Technical Specification Amendment 92, Figure 3.1.7.a