

# AmerGen

An Exelon/British Energy Company

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## Clinton Power Station

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10CFR50.36

U-603484

8E.100c

May 9, 2001

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

Clinton Power Station, Unit 1  
Facility Operating License No. NPF-62  
NRC Docket No. 50-461

Subject: Clinton Power Station Core Operating Limits Report  
For Reload 7/Cycle 8, Revision 1

Reference: AmerGen Letter U-603433, "Clinton Power Station Core Operating Limits  
Report for Reload 7/Cycle 8, Revision 0," dated November 6, 2000

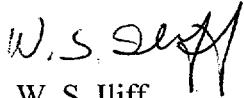
Attached is a copy of the Clinton Power Station (CPS) Core Operating Limits Report (COLR) for Reload 7/Cycle 8, Rev. 1. The Clinton Power Station (CPS) Core Operating Limits Report (COLR) for Reload 7/Cycle 8, Rev. 0 was issued in the above reference letter. In contrast to the above reference, the attached COLR has updated Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) limits for the GE10 fuel type, has exposure dependent Linear Heat Generation Rate (LHGR) limits for all fuel types in the reactor core, and has power dependent and flow dependent multipliers for LHGR. In accordance with CPS Technical Specification 5.6.5, the analytical methods used to determine these core operating limits were previously reviewed and approved by the Nuclear Regulatory Commission (NRC). These methods are documented in General Electric Standard Application for Reactor Fuel (GESTAR), NEDE-24011-P-A-US, as amended, and the Maximum Extended Operating Domain and Feedwater Heater Out-of-Service Analysis for Clinton Power Station, NEDC-31546P, dated August 1988.

The exposure dependent LHGR limits which are being implemented in Clinton Power Station Cycle 8 are considered Global Nuclear Fuel (GNF) proprietary. For this reason only the maximum LHGR values are listed in the COLR. The exposure dependent LHGR values are therefore provided via a GNF Reference in the COLR. The exclusion of specific thermal limit values is not consistent with CPS's previous COLRs, and this changes the CPS commitment under Generic Letter 88-16 that calls for providing all thermal limits in the COLR.

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May 9, 2001  
U. S. Nuclear Regulatory Commission  
Page 2

Respectfully,



W. S. Iliff  
Manager - Regulatory Assurance

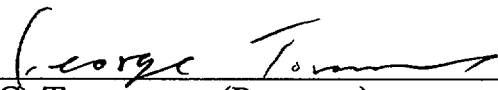
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Attachment

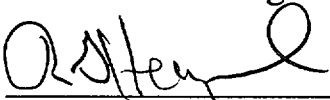
cc: NRC Senior Resident Inspector – Clinton Power Station  
Regional Administrator, Region III, USNRC  
Office of Nuclear Facility Safety – Illinois Department of Nuclear Safety

**CLINTON POWER STATION  
CORE OPERATING LIMITS REPORT**

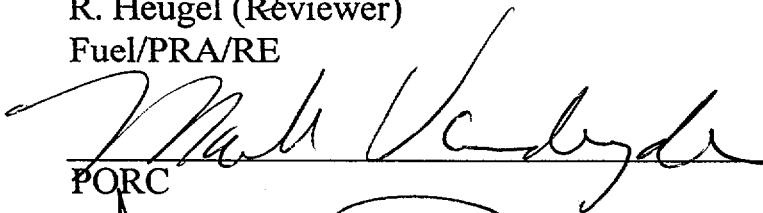
**FOR  
RELOAD 7  
CYCLE 8  
REVISION 1**

  
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G. Touvanas (Preparer)  
NFM/BWR Design Engineer

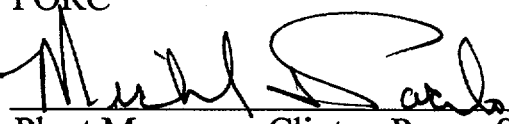
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R. Heugel (Reviewer)  
Fuel/PRA/RE


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Plant Manager - Clinton Power Station

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Manager - Regulatory Assurance

5/9/01  
Date

**ISSUANCE OF CHANGES SUMMARY**

<b>Affected Section</b>	<b>Affected Pages</b>	<b>Summary of Changes</b>	<b>Date</b>
All	All	Original Issue	10/00
2.0 3.0 6.0	2-5 to 2-10 3-1 6-1	Update Exposure Dependent MAPLHGR Limits and Include Exposure Dependent LHGR Limits	5/01

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## 1.0 INTRODUCTION AND SUMMARY

The CORE OPERATING LIMITS REPORT (Reference 1) is the Clinton-specific document that provides the values of the AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR) limits, the LINEAR HEAT GENERATION RATE (LHGR) limits, the core flow-dependent MINIMUM CRITICAL POWER RATIO (MCPR) limits (MCPR<sub>f</sub>), the core thermal power-dependent MCPR limits (MCPR<sub>p</sub>), and the simulated thermal power time constant for the current operating reload cycle. These cycle-specific core operating limits are determined for each reload cycle in accordance with Technical Specification 5.6.5. Per the Technical Specification, these values have been determined using NRC-approved methodology (References 2, 3) and are established such that all applicable limits of the plant safety analysis are met. Plant operation within these operating limits is addressed in the applicable Technical Specifications.

## 2.0 AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)

### 2.1 TECHNICAL SPECIFICATION REFERENCE:

LCO 3.2.1 Power Distribution Limits

### 2.2 DESCRIPTION:

All AVERAGE PLANAR LINEAR HEAT GENERATION RATES (APLHGR's) for each type of fuel as a function of axial location and AVERAGE PLANAR EXPOSURE shall not exceed limits based on applicable MAPLHGR limit values which have been approved for the particular fuel bundle type and bundle axial region (lattice). The MAPLHGR limits for each fuel bundle type and lattice are contained in Reference 4; the associated MAPLHGR multipliers can be found in Figures 2-1, 2-2, and 2-3 which are consistent with Reference 3.

When manual calculations are required, all APLHGR's for each fuel bundle type as a function of AVERAGE PLANAR EXPOSURE shall not exceed the limits as determined below:

a. During two - recirculation loop operation -

The limits shown in Figures 2-4 through 2-9 (Reference 5) multiplied by the smaller of either the core flow-dependent MAPLHGR factor (MAPFAC<sub>f</sub>) of Figure 2-1, or the core thermal power-dependent MAPLHGR factor (MAPFAC<sub>p</sub>) in either Figure 2-2 or Figure 2-3.

b. During single recirculation loop operation -

the limits shown in Figures 2-4 through 2-9 multiplied by the smallest of MAPFAC<sub>f</sub>, MAPFAC<sub>p</sub>, or a factor of 0.75 for GE10 or 0.76 for GE14 fuel types (Reference 5).



FIGURE 2-1

Flow - Dependent MAPLHGR/LHGR Factors (MAPFAC<sub>f</sub>)

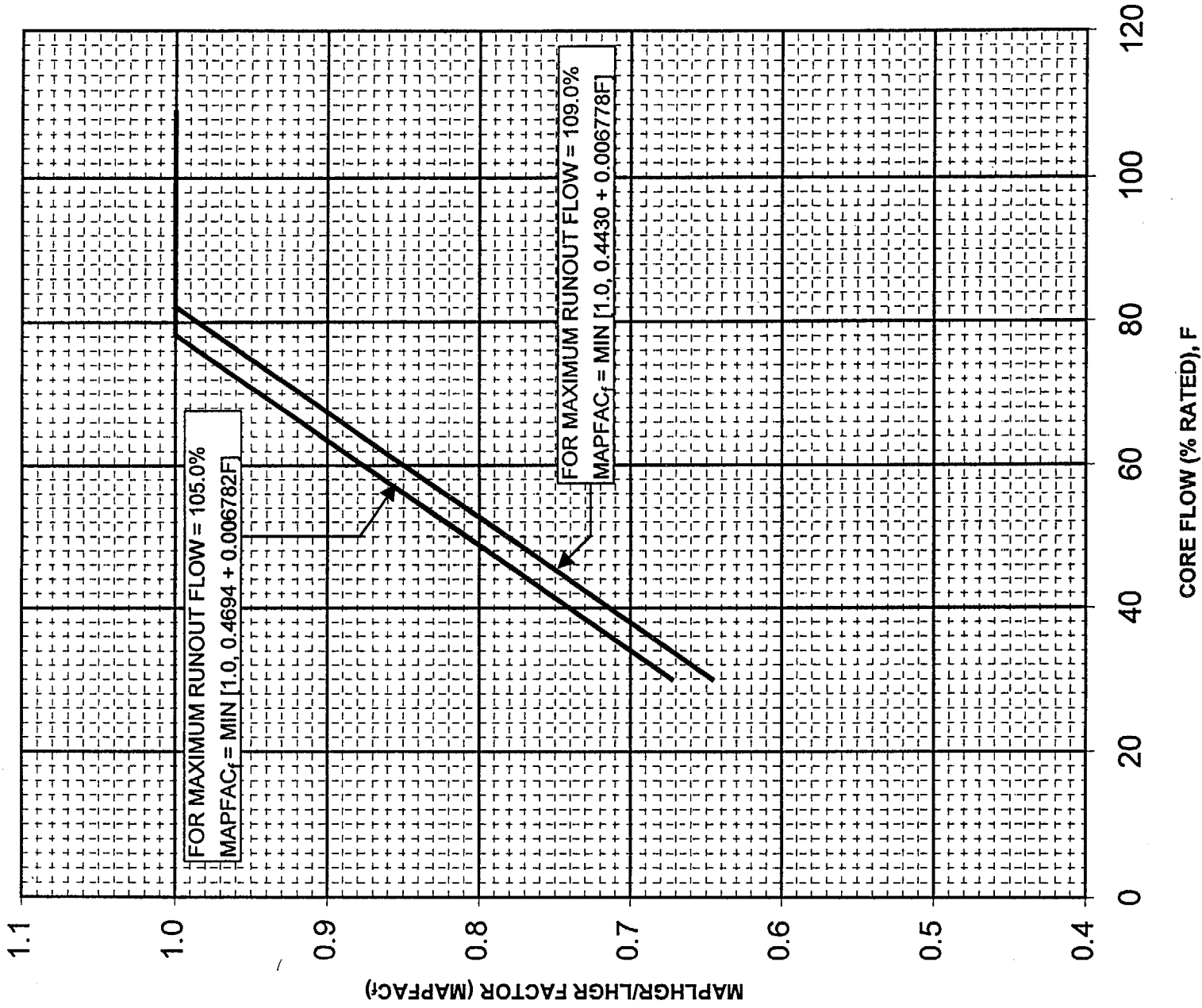


FIGURE 2-2

Power - Dependent MAPLHGR/LHGR Factors (MAPFACp)

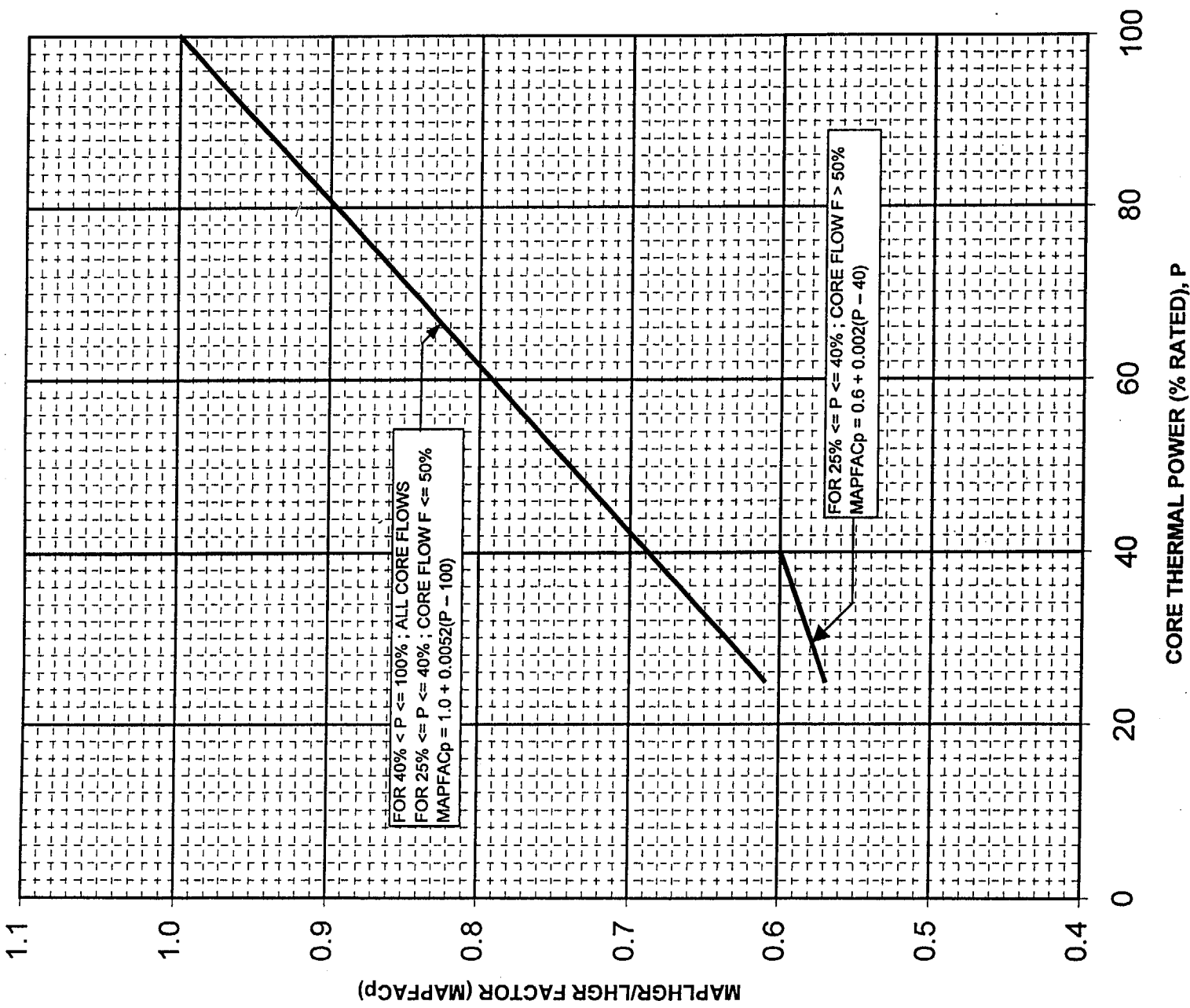


FIGURE 2-3

Power - Dependent MAPLHGR/LHGR Factors (MAPFACp) With Pressure Regulator Out of Service

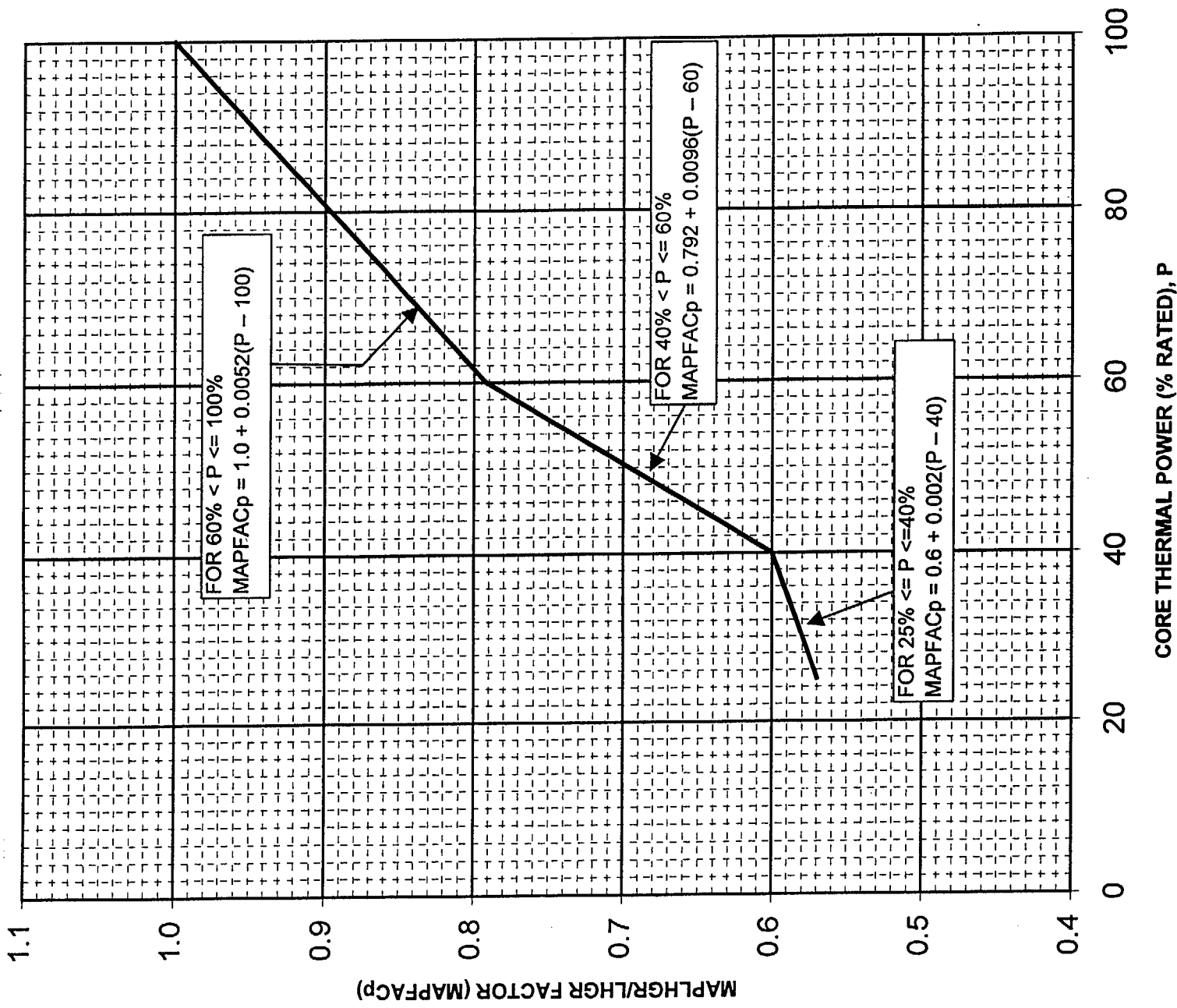
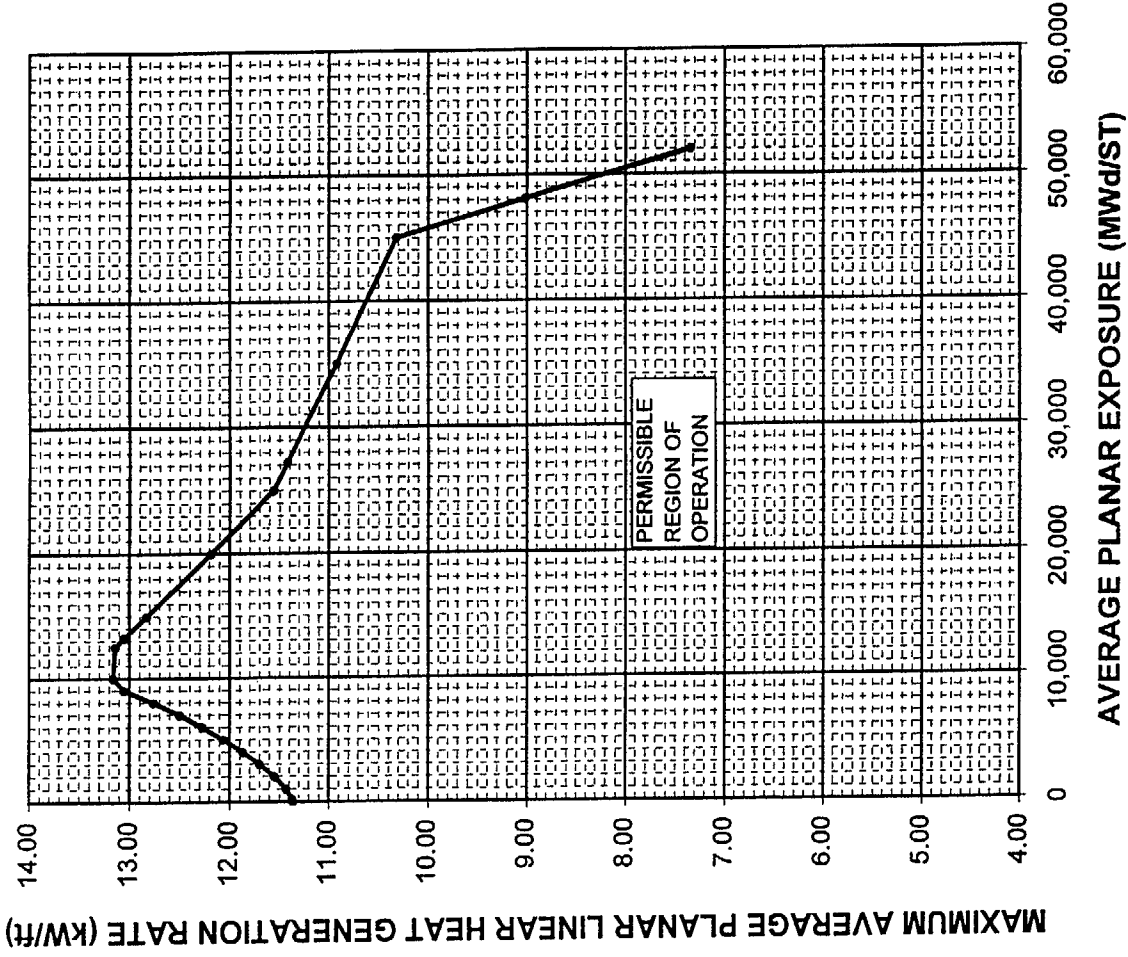


FIGURE 2-4

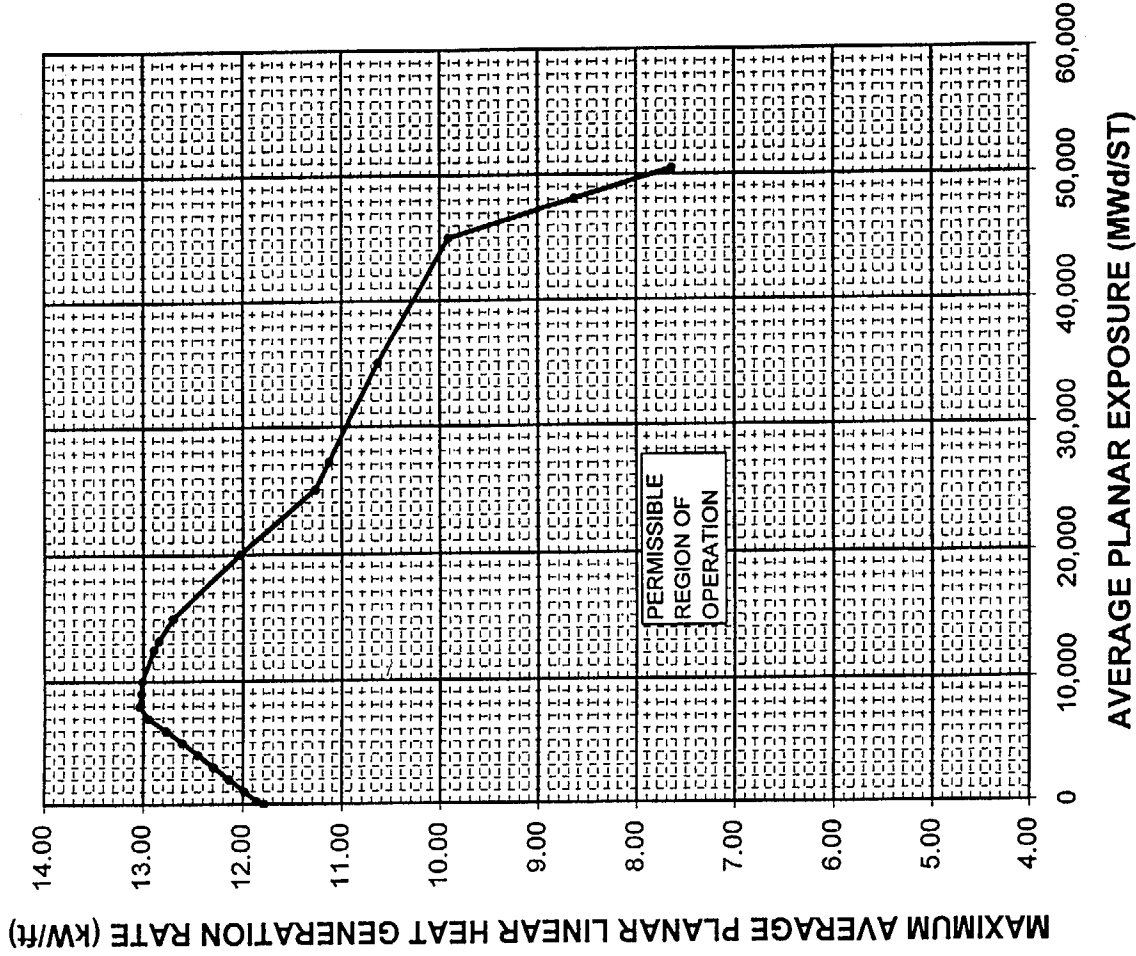
MAPLHGR vs. Average Planar Exposure for GE10-P8SXB322-10GZ-120M-150-T



Average Planar Exposure (GWD/ST)	MAPLHGR (KW/ft)	Average Planar Exposure (GWD/ST)	MAPLHGR (KW/ft)	Average Planar Exposure (GWD/ST)	MAPLHGR (KW/ft)
0.00	11.36	8.00	12.76	35.00	10.92
0.20	11.37	9.00	13.05	45.00	10.32
1.00	11.43	10.00	13.16	48.08	9.02
2.00	11.55	12.50	13.14	52.01	7.34
3.00	11.70	13.24	13.05		
4.00	11.87	15.00	12.83		
5.00	12.06	20.00	12.18		
6.00	12.27	25.00	11.56		
7.00	12.50	27.22	11.42		

FIGURE 2-5

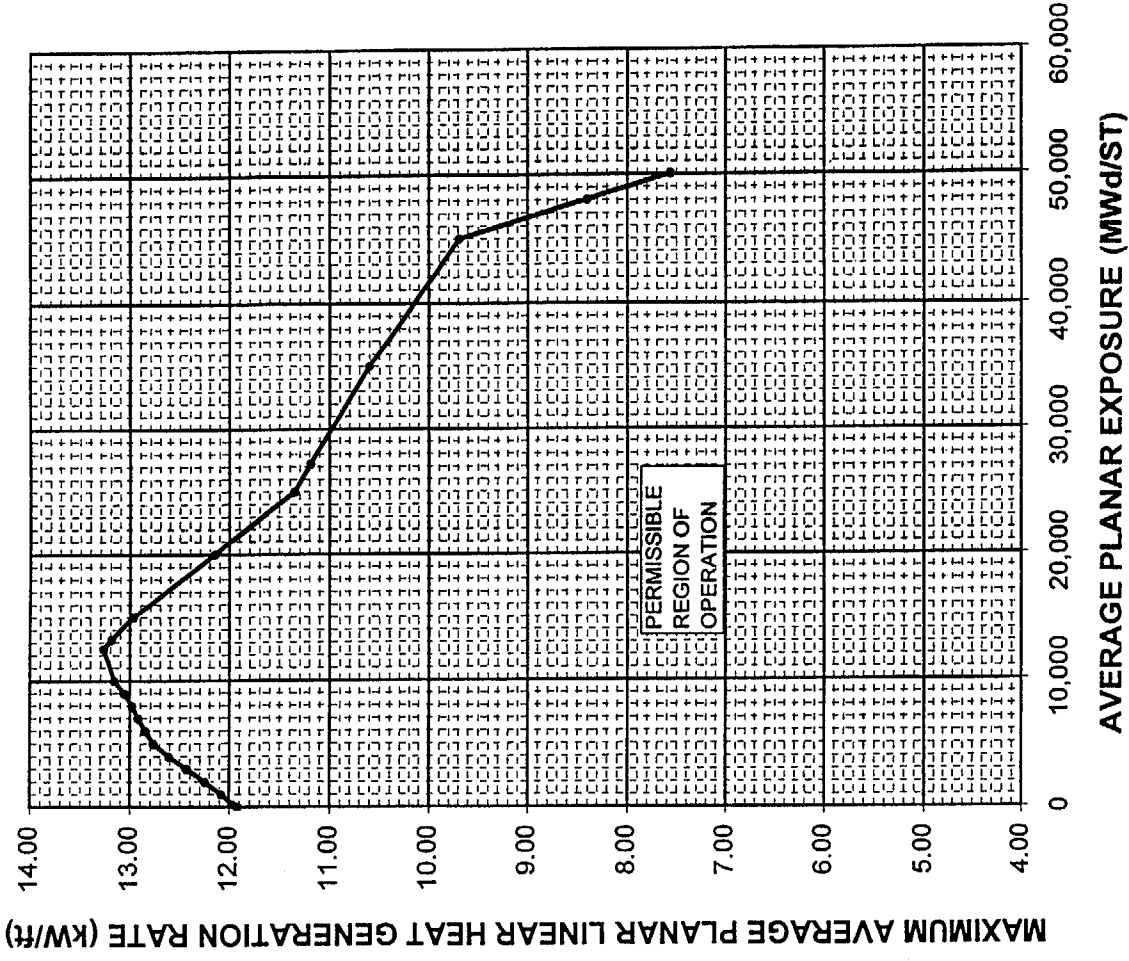
MAPLHGR vs. Average Planar Exposure for GE10-P8SXB346-10GZ-120M-150-T



Average Planar Exposure (GWD/ST)	MAPLHGR (KW/R)	Average Planar Exposure (GWD/ST)	MAPLHGR (KW/R)	Average Planar Exposure (GWD/ST)	MAPLHGR (KW/R)
0.00	11.79	8.00	13.04	35.00	10.63
0.20	11.86	9.00	13.02	45.00	9.91
1.00	11.98	10.00	13.01	48.08	8.64
2.00	12.14	12.50	12.89	50.49	7.64
3.00	12.29	13.24	12.84		
4.00	12.45	15.00	12.70		
5.00	12.61	20.00	12.03		
6.00	12.77	25.00	11.27		
7.00	12.95	27.22	11.13		

FIGURE 2-6

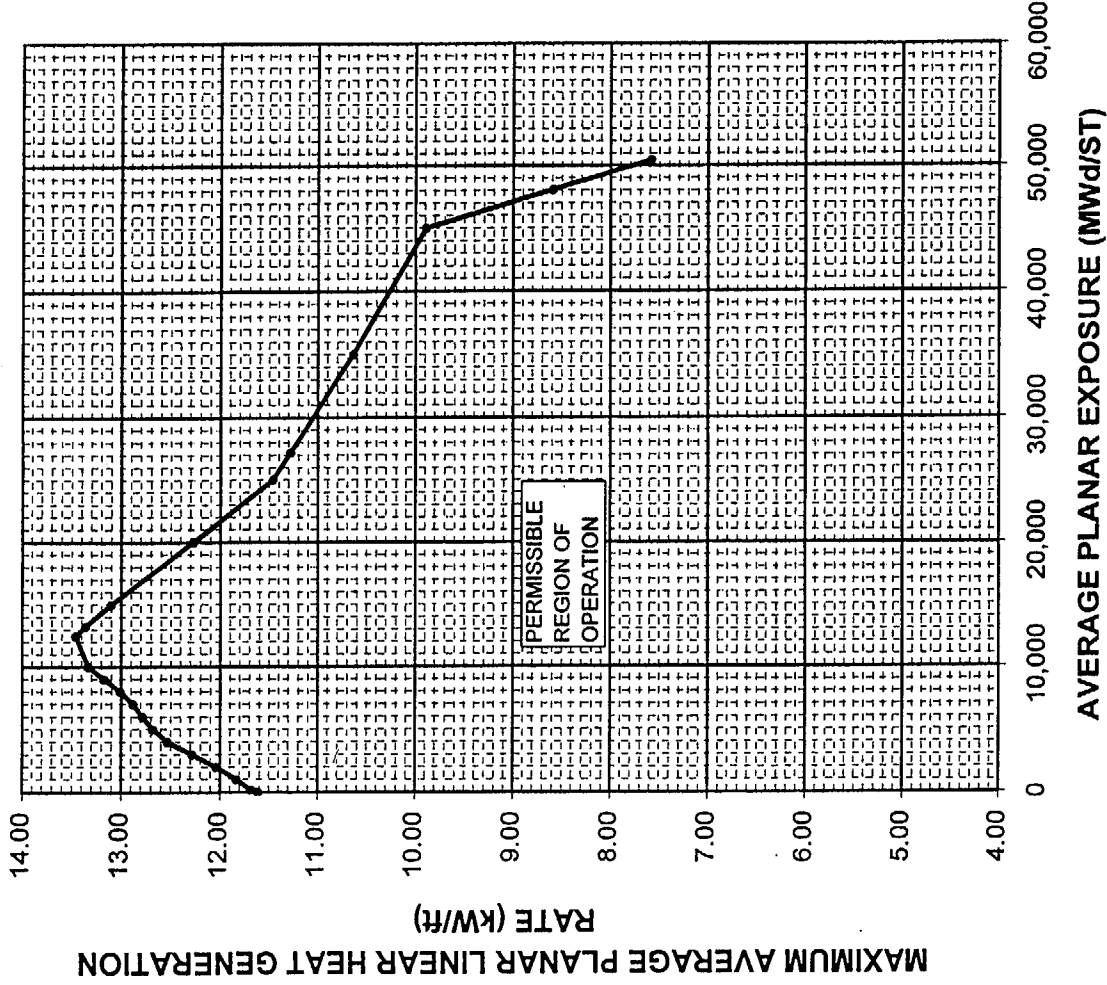
MAPLHGR vs. Average Planar Exposure for GE10-P8SXB348-10GZ-120M-150-T



Average Planar Exposure (GWD/ST)	MAPLHGR (KW/ft)	Average Planar Exposure (GWD/ST)	MAPLHGR (KW/ft)	Average Planar Exposure (GWD/ST)	MAPLHGR (KW/ft)
0.00	11.92	8.00	12.98	35.00	10.60
0.20	11.97	9.00	13.06	45.00	9.69
1.00	12.08	10.00	13.16	48.08	8.40
2.00	12.25	12.50	13.27	50.06	7.56
3.00	12.43	13.24	13.19		
4.00	12.61	15.00	12.97		
5.00	12.77	20.00	12.15		
6.00	12.85	25.00	11.35		
7.00	12.92	27.22	11.19		

FIGURE 2-7

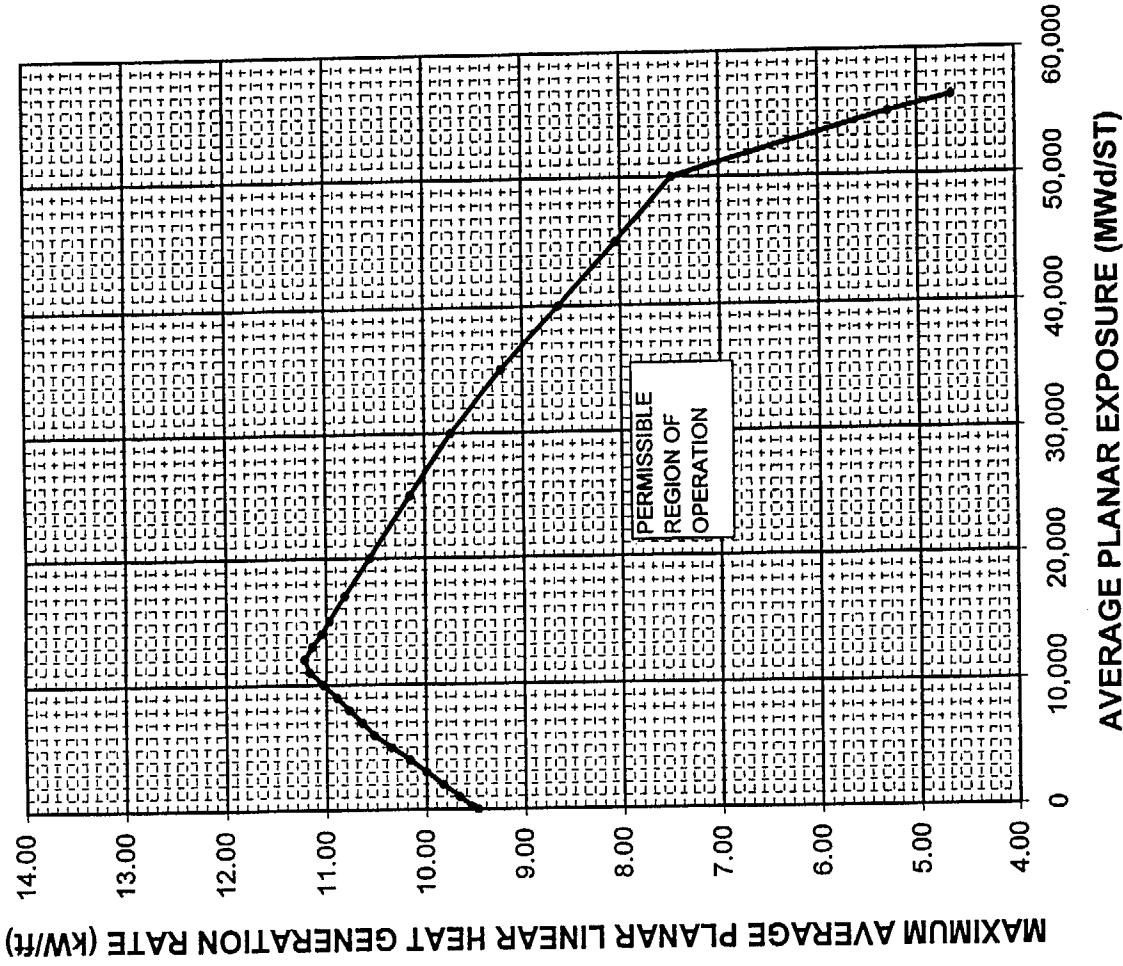
MAPLHGR vs. Average Planar Exposure for GE10-P8SXB353-12GZ-120T-150-T



Average Planar Exposure (GWD/ST)	MAPLHGR (KW/ft)	Average Planar Exposure (GWD/ST)	MAPLHGR (KW/ft)	Average Planar Exposure (GWD/ST)	MAPLHGR (KW/ft)
0.00	11.61	8.00	13.01	35.00	10.64
0.20	11.68	9.00	13.17	45.00	9.89
1.00	11.83	10.00	13.33	48.08	8.59
2.00	12.04	12.50	13.46	50.45	7.58
3.00	12.28	13.24	13.36		
4.00	12.53	15.00	13.10		
5.00	12.68	20.00	12.27		
6.00	12.78	25.00	11.46		
7.00	12.88	27.22	11.28		

FIGURE 2-8

MAPLHGR vs. Average Planar Exposure for GE14-P10SNAB353-13GZ-120T-150-T-2412

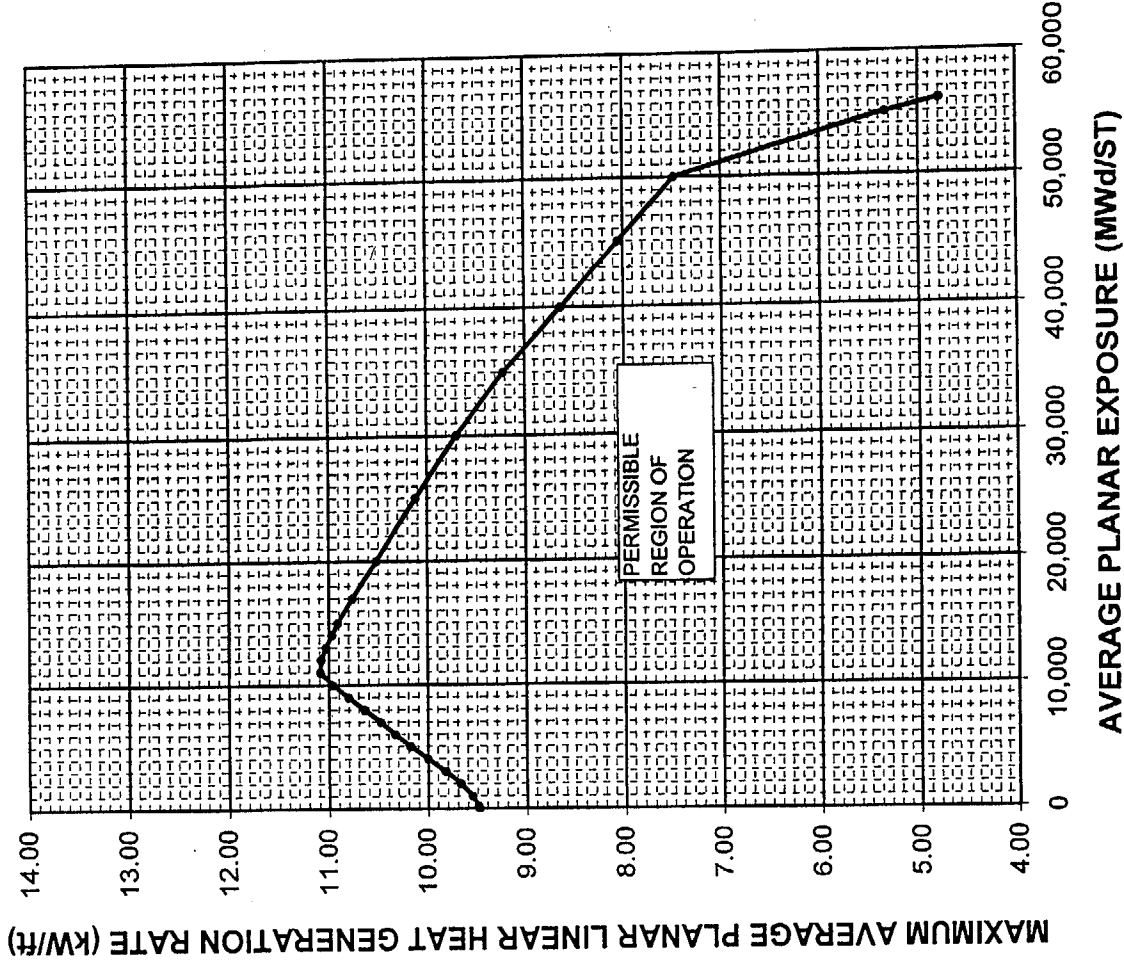


Average Planar Exposure (GWD/ST)	MAPLHGR (KW/ft)	Average Planar Exposure (GWD/ST)	MAPLHGR (KW/ft)	Average Planar Exposure (GWD/ST)	MAPLHGR (KW/ft)
0.00	9.48	8.00	10.77	20.00	10.56
0.20	9.54	9.00	10.89	25.00	10.15
1.00	9.67	10.00	11.03	30.00	9.73
2.00	9.83	11.00	11.17	35.00	9.22
3.00	10.00	12.00	11.22	40.00	8.63
4.00	10.17	13.00	11.14	45.00	8.05
5.00	10.35	14.00	11.05	50.00	7.48
6.00	10.52	15.00	10.97	55.00	5.30
7.00	10.64	17.00	10.81	56.30	4.65



FIGURE 2-9

MAPLHGR vs. Average Planar Exposure for GE14-P10SNAB354-15GZ-120T-150-T-2413



Average Planar Exposure (GWD/ST)	MAPLHGR (KW/ft)	Average Planar Exposure (GWD/ST)	MAPLHGR (KW/ft)
0.00	9.48	8.00	10.64
0.20	9.49	9.00	10.80
1.00	9.55	10.00	10.96
2.00	9.67	11.00	11.09
3.00	9.82	12.00	11.08
4.00	10.00	13.00	11.03
5.00	10.18	14.00	10.97
6.00	10.33	15.00	10.91
7.00	10.48	17.00	10.76
		20.00	10.52
		25.00	10.12
		30.00	9.70
		35.00	9.22
		40.00	8.63
		45.00	8.05
		50.00	7.48
		55.00	5.34
		56.09	4.79

### 3.0 LINEAR HEAT GENERATION RATE (LHGR)

#### 3.1 TECHNICAL SPECIFICATION REFERENCE:

LCO 3.2.3 Power Distribution Limits

#### 3.2 DESCRIPTION

The Linear Heat Generation Rate (LHGR) limit is an exposure dependent value. The maximum LHGR shall not exceed the zero exposure limit of 14.4 kW/ft for the following fuel bundles types (References 6, 7):

GE10-P8SXB322-10GZ-120M-150-T  
GE10-P8SXB346-10GZ-120M-150-T  
GE10-P8SXB348-10GZ-120M-150-T  
GE10-P8SXB353-12GZ-120T-150-T

The maximum LHGR shall not exceed the zero exposure limit of 13.4 kW/ft for the following fuel bundles types:

GE14-P10SNAB353-13GZ-120T-150-T-2412  
GE14-P10SNAB354-15GZ-120T-150-T-2413

**NOTE:** Due to the proprietary nature of the LHGR values only the maximum LHGR for each fuel bundle type is shown above. The exposure dependent LHGR limit data is listed in Reference 11 (GNF proprietary); the associated LHGR multipliers can be found in Figures 2-1, 2-2, and 2-3 which are consistent with Reference 3.

When manual calculations are required, all LHGR's for each fuel bundle type as a function of NODAL EXPOSURE shall not exceed the limits shown in Reference 11 multiplied by the smaller of either the core flow-dependent LHGR factor (MAPFAC<sub>f</sub>\*) of Figure 2-1, or the core thermal power-dependent LHGR factor (MAPFAC<sub>p</sub>\*) in either Figure 2-2 or Figure 2-3.

\* **NOTE:** The core flow dependent LHGR factor (MAPFAC<sub>f</sub>) and the core thermal power dependent LHGR factor (MAPFAC<sub>p</sub>) are identical to the MAPLHGR factor MAPFAC<sub>f</sub> (Figure 2-1) and MAPFAC<sub>p</sub> (Figure 2-2 and 2-3) respectively.

#### 4.0 MINIMUM CRITICAL POWER RATIO (MCPR)

##### 4.1 TECHNICAL SPECIFICATION REFERENCE:

LCO 3.2.2 Power Distribution Limits

##### 4.2 DESCRIPTION

The MINIMUM CRITICAL POWER RATIO (MCPR) shall be equal to or greater than both the  $MCPR_f$  limits at indicated core flow and core THERMAL POWER and the  $MCPR_p$  limits at indicated core flow and core THERMAL POWER for each fuel bundle type. These MCPR limits are consistent with Reference 5.

a. During two - recirculation loop operation -

the  $MCPR_f$  limits are in Figures 4-1 through 4-2, and

the  $MCPR_p$  limits are in Figures 4-3 through 4-6.

b. During single - recirculation loop operation -

the MCPR operating limit is 0.03 greater than the two - recirculation loop value.

FIGURE 4-1

CPS C8 Flow - Dependent MCPR Limits for GE10 Fuel Types

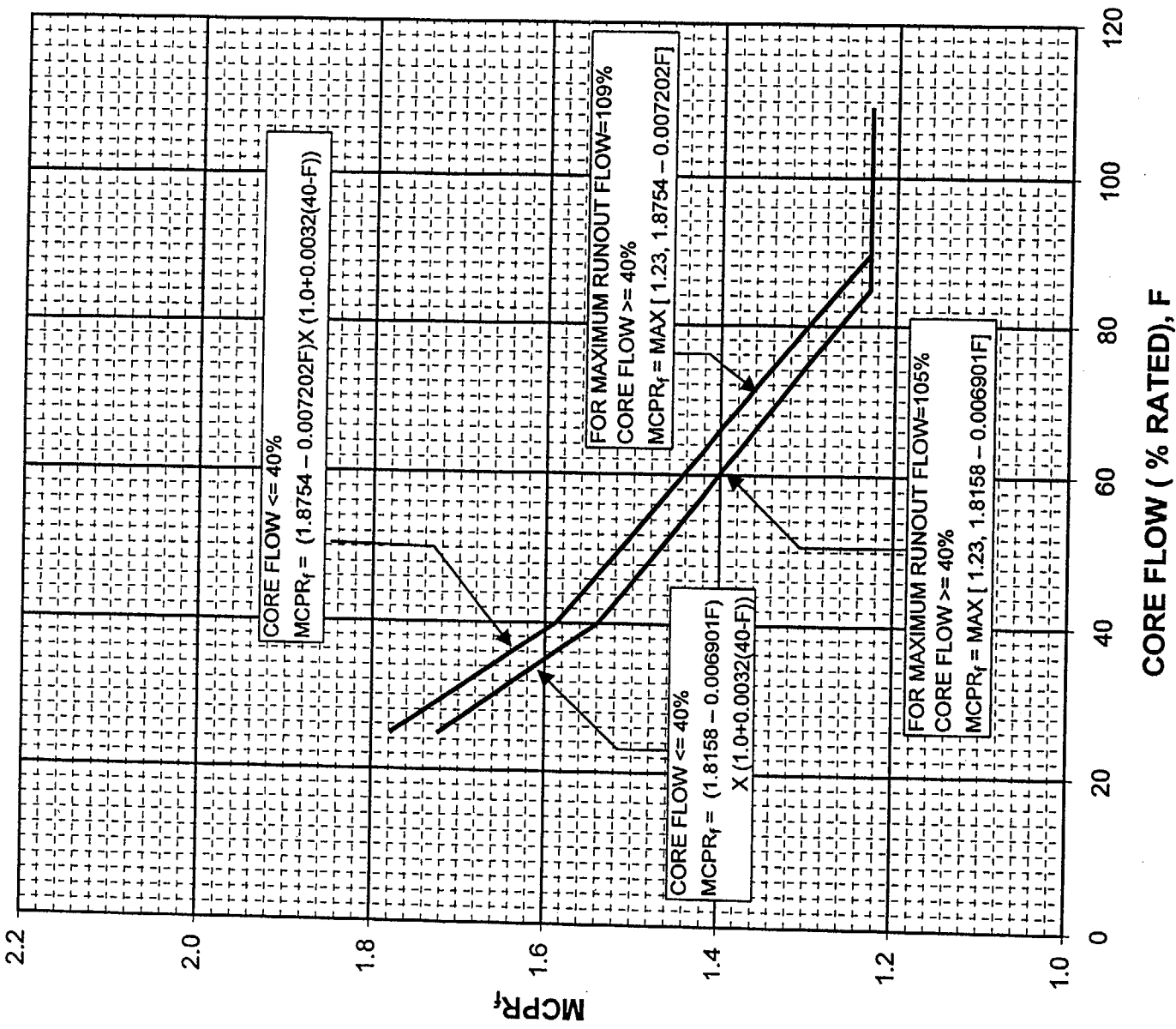


FIGURE 4-2  
 CPS C8 Flow - Dependent MCPR Limits for GE14 Fuel Types

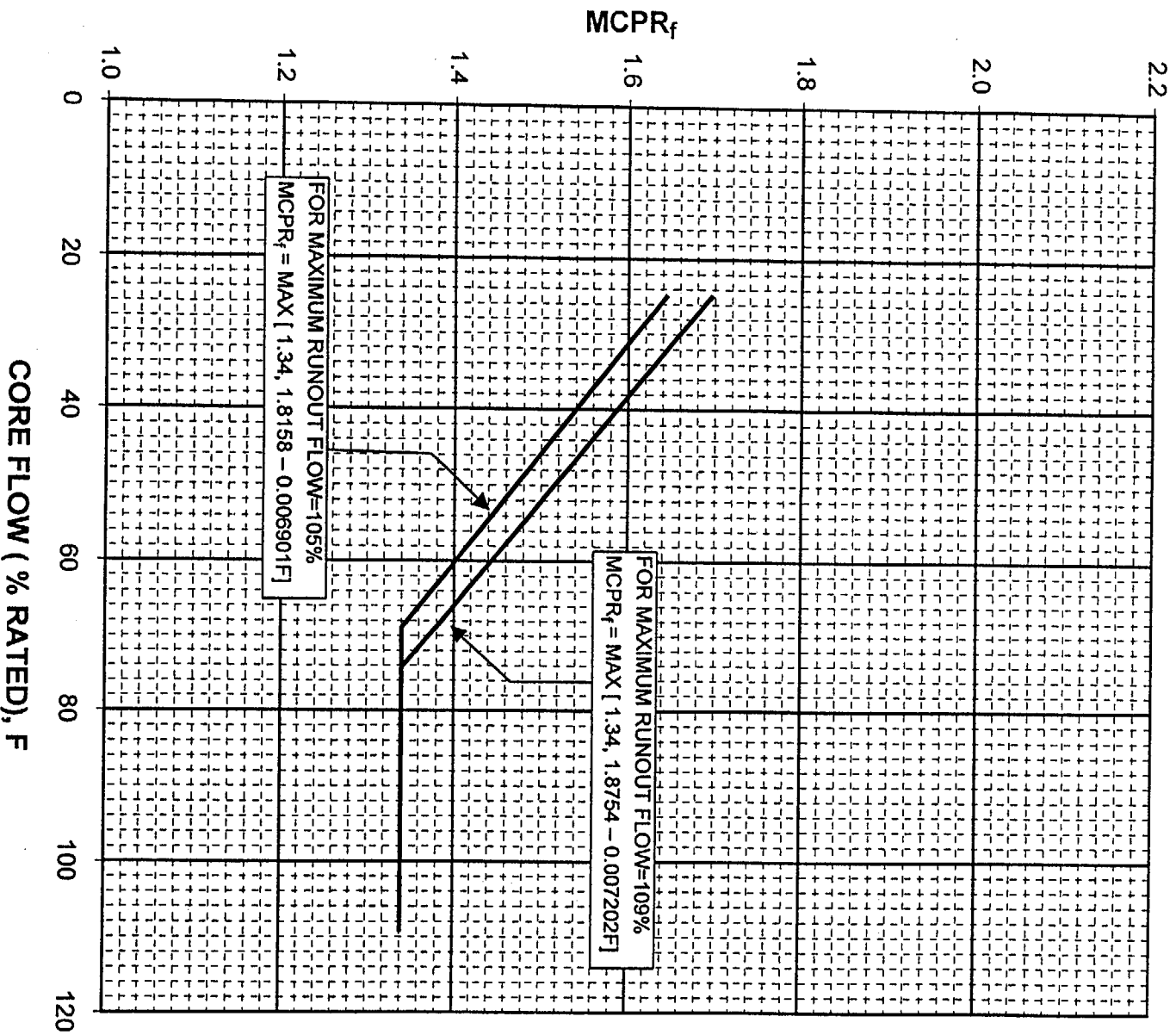


FIGURE 4-3

CPS C8 Power - Dependent MCPR Limits for GE10 Fuel Types

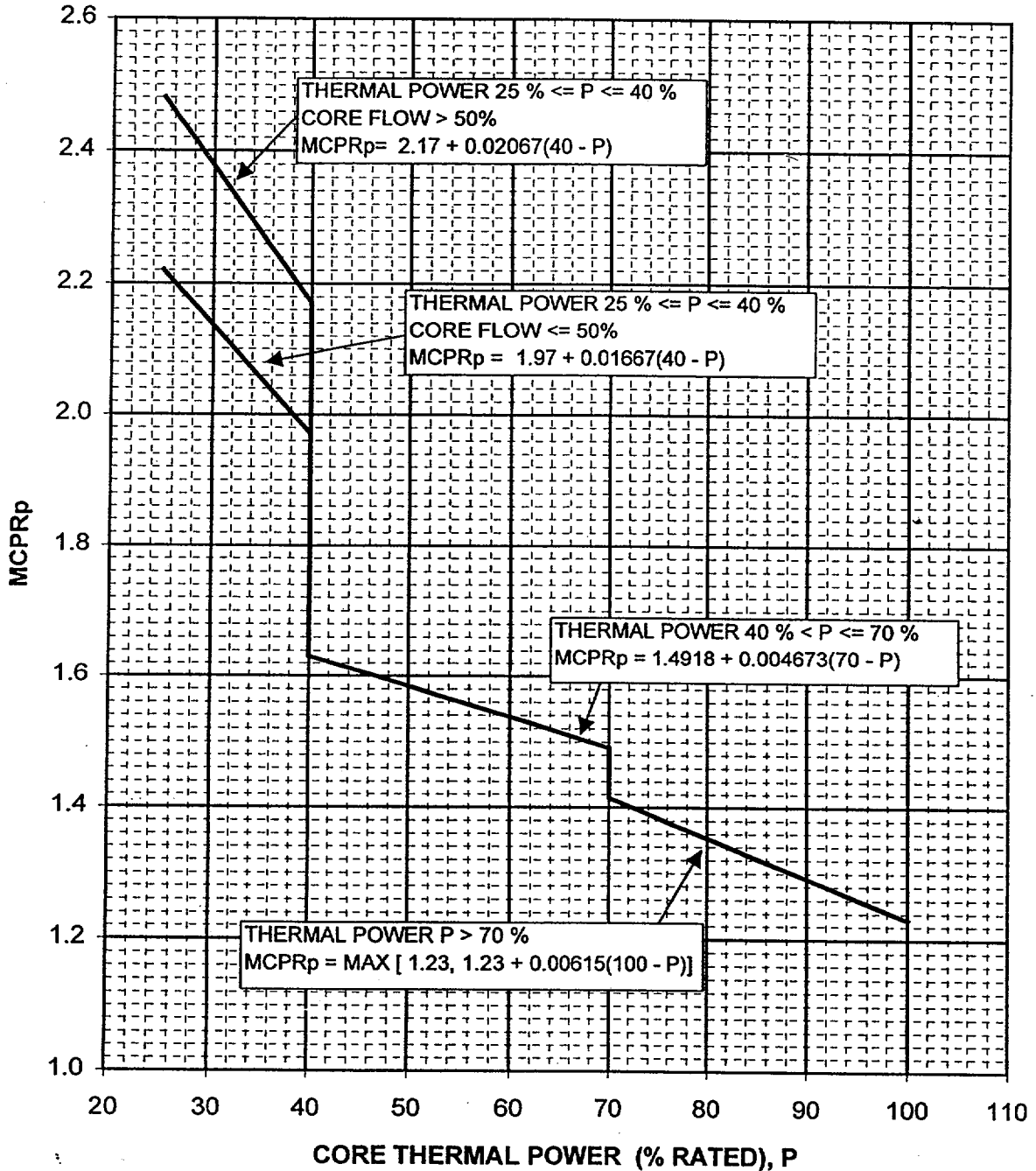


FIGURE 4-4

CPS C8 Power - Dependent MCPR Limits for GE14 Fuel Types

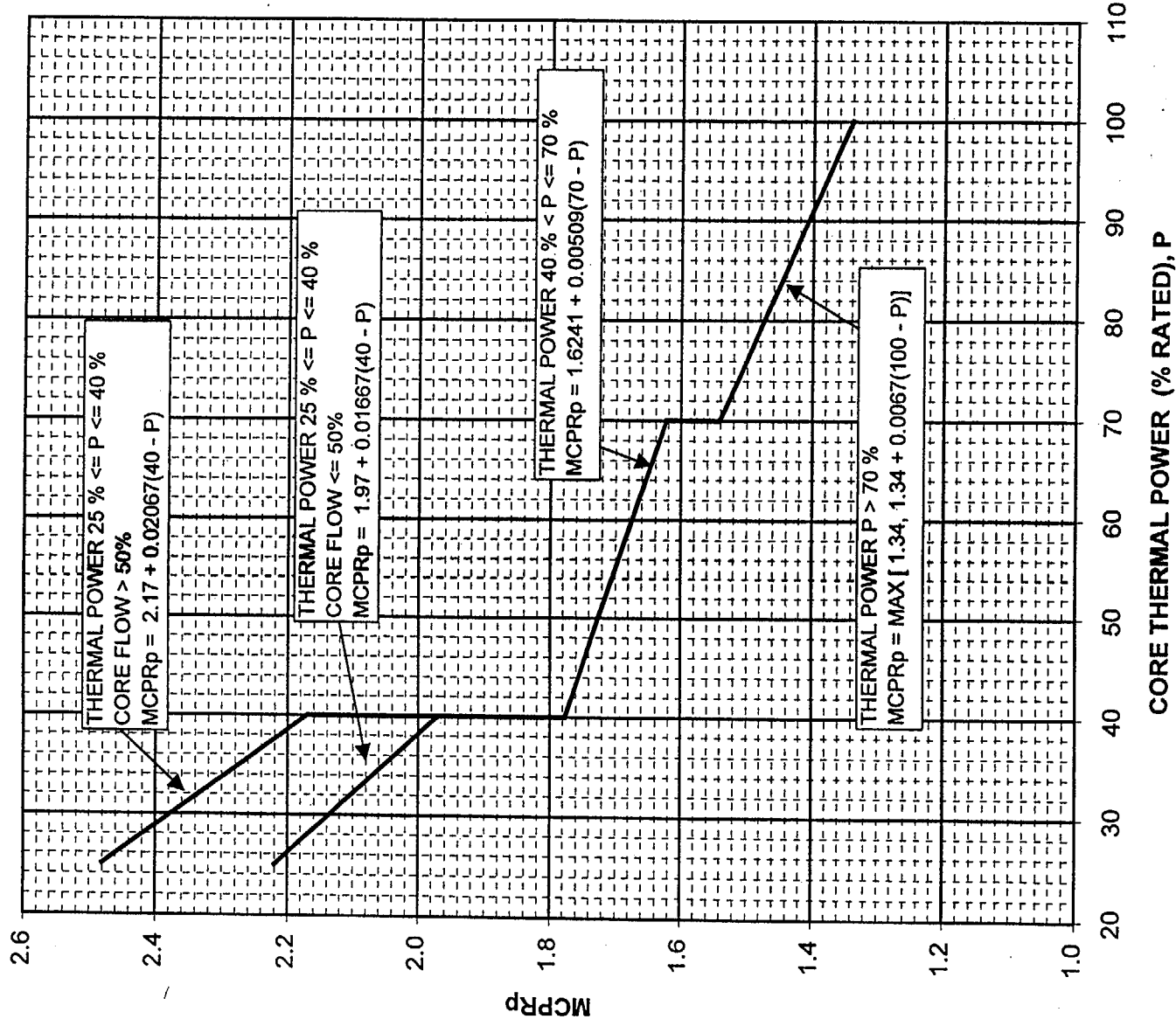


FIGURE 4-5

CPS C8 Power - Dependent MCPR Limits for GE10 Fuel Types with Pressure Regulator Out of Service

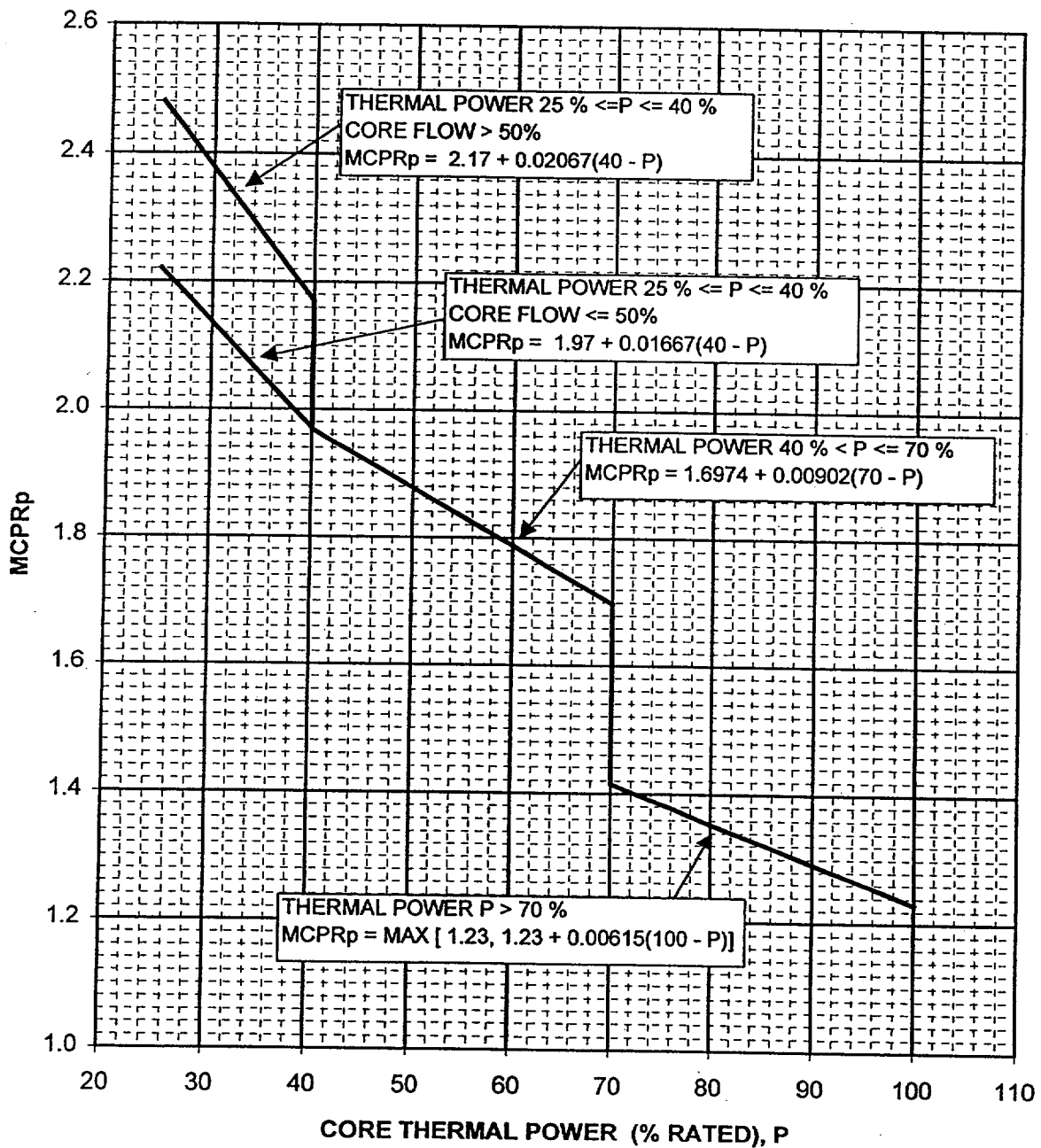
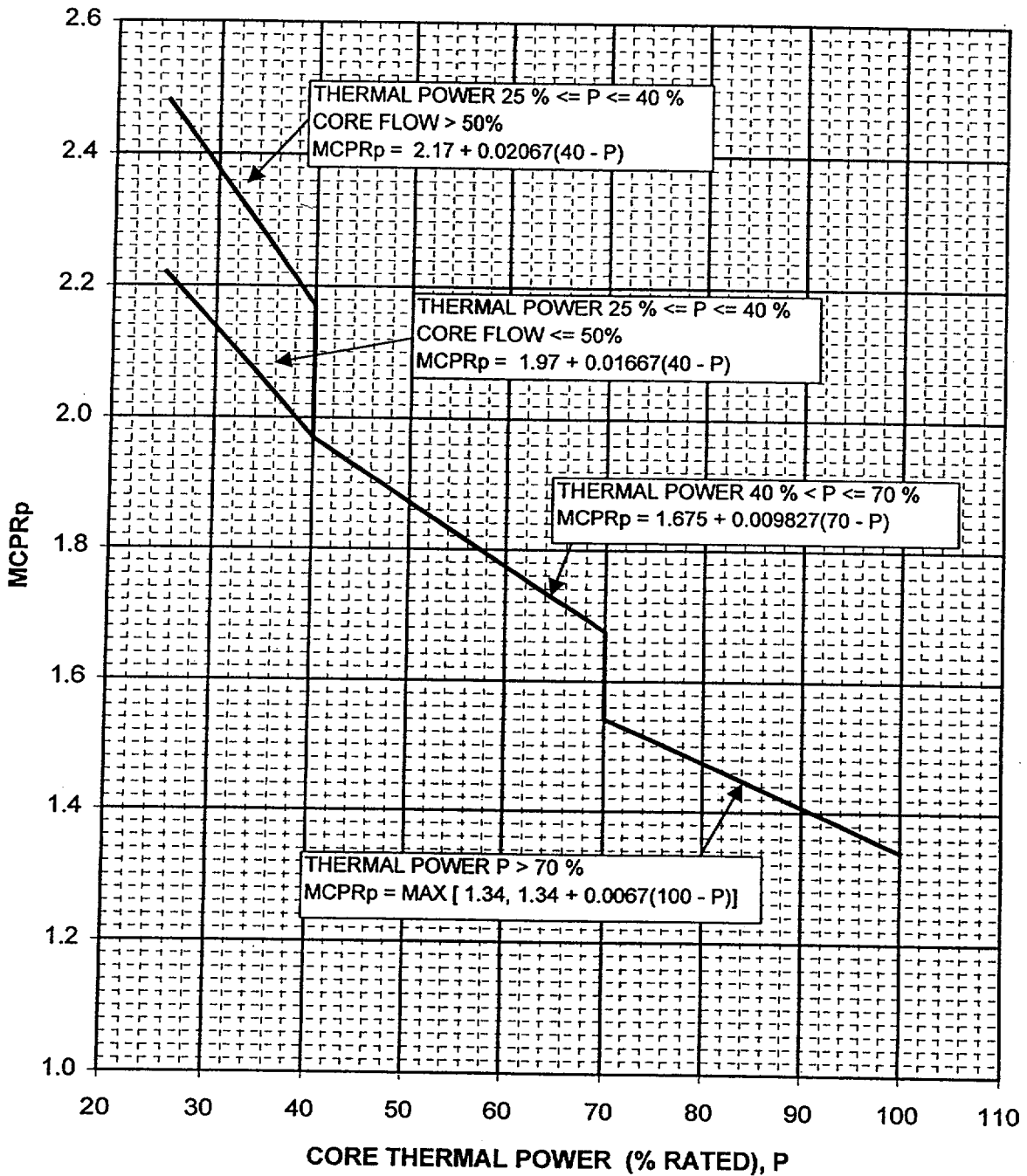




FIGURE 4-6

CPS C8 Power - Dependent MCPR Limits for GE14 Fuel Types with Pressure Regulator Out of Service



**5.0 SIMULATED THERMAL POWER TIME CONSTANT**

**5.1 TECHNICAL SPECIFICATION REFERENCE:**

LCO 3.3.1.1 Power Distribution Limits

**5.2 DESCRIPTION**

The Average Power Range Monitor (APRM) simulated thermal power time constant (References 8, 9) shall be between 5.4 seconds and 6.6 seconds (Reference 10).

## 6.0 REFERENCES

1. CPS Technical Specification 5.6.5, CORE OPERATING LIMITS REPORT (COLR).
2. "General Electric Standard Application for Reactor Fuel" (GESTAR II), GE Licensing Topical Report NEDE-24011-P-A, as amended (latest approved version).
3. "Maximum Extended Operating Domain and Feedwater Heater Out-of-Service Analysis for Clinton Power Station," GE Report NEDC-31546P, August 1988.
- 4.A. "Lattice-Dependent MAPLHGR Report for Clinton Power Station Unit 1 Reload 4, Cycle 5," GE Document 23A7213AA, Revision 0, October 1993.
- 4.B. "Lattice-Dependent MAPLHGR Report for Clinton Power Station Unit 1 Reload 5, Cycle 6," GE Document DRF J11-02425MAP, Revision 0, February 1995.
- 4.C. "Lattice-Dependent MAPLHGR Report for Clinton Power Station Unit 1 Reload 6, Cycle 7," GE Document DRF J11-02920MAP, Revision 1, November 1998.
- 4.D. "Lattice-Dependent MAPLHGR Report for Clinton Power Station Unit 1 Reload 7, Cycle 8," GE Document DRF J11-03753MAPL, Revision 1, April 2001, DG01-000329.
- 5.A. "Supplemental Reload Licensing Report for Clinton Power Station Unit 1 Reload 4, Cycle 5," GE Document 23A7213, Revision 0, October 1993.
- 5.B. "Supplemental Reload Licensing Report for Clinton Power Station Unit 1 Reload 5, Cycle 6," GE Document DRF J11-02425SRLR, Revision 0, February 1995.
- 5.C. "Supplemental Reload Licensing Report for Clinton Power Station Unit 1 Reload 6, Cycle 7," GE Document DRF J11-02920SRLR, Revision 2, November 1998.
- 5.D. "Supplemental Reload Licensing Report for Clinton Power Station Unit 1 Reload 7, Cycle 8," GE Document DRF J11-03753SRLR, Revision 1, April 2001, DG01-000329.
6. Letter to J. S. Charnley (GE) from C. O. Thomas (NRC), "Acceptance for Referencing of Licensing Topical Report NEDE-24011-P-A-6, Amendment 10, 'General Electric Standard Application for Reactor Fuel'," MFN-082-85, May 28, 1985.
7. Letter to J. S. Charnley (GE) from A. C. Thadani (NRC), "Acceptance for Referencing of Amendment 18 to General Electric Licensing Topical Report NEDE-24011-P-1, 'General Electric Standard Application for Reactor Fuel'," May 12, 1988.
8. Letter to Nuclear Regulatory Commission from J. S. Perry (IP), "Clinton Power Station Proposed Amendment of Facility Operating License No. NPF-62," U-602085 [LS-92-004], February 11, 1993.
9. Letter to F. A. Spangenberg (IP) from D. V. Pickett (NRC), "Issuance of Amendment [No. 75] (TAC No. M85816)," May 25, 1993.
10. Letter to J. A. Miller (IP) from J. T. Worthington (GE), "Time Constant for Simulated Thermal Power Monitor," JTW:93-128, September 1, 1993.
11. Letter to Edward McVey (Exelon) from Cheryl Collins (GNF), CPC:01-035, "Clinton Improved Thermal-Mechanical Curves for GE10 Fuel, April 26, 2001, DG01-000329.