



FirstEnergy Nuclear Operating Company

Perry Nuclear Power Plant  
10 Center Road  
Perry, Ohio 44081

John K. Wood  
Vice President, Nuclear

440-280-5224  
Fax: 440-280-8029

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United States Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555

Perry Nuclear Power Plant  
Docket No. 50-440  
Submission of Core Operating Limits Report

Ladies and Gentlemen:

Enclosed is a copy of the revised Cycle 9 Core Operating Limits Report (COLR) for Unit 1 of the Perry Nuclear Power Plant (PNPP). The COLR is submitted in accordance with Technical Specification Section 5.6.5, "Core Operating Limits Report."

If you have questions or require additional information, please contact Mr. Gregory A. Dunn, Manager - Regulatory Affairs, at (440) 280-5305.

Very truly yours,

Enclosure

cc: NRC Project Manager  
NRC Resident Inspector  
NRC Region III

1001

PDB-F0001  
Page: i  
Rev.: 8

INFORMATION  
ONLY

PERRY OPERATIONS MANUAL

Plant Data Book Entry

TITLE: CORE OPERATING LIMITS REPORT FOR THE PERRY NUCLEAR POWER PLANT UNIT 1  
CYCLE 9 (RELOAD 8)

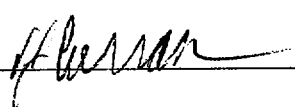
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<sub>8/2/01</sub>

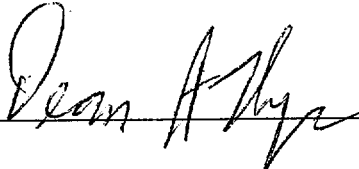
SUMMARY OF LAST CHANGE: \_\_\_\_\_

This incorporates the core thermal limits for Cycle 9.

REFERENCES: PY-CEI-NRR-1104 L; PY-CEI-NRR-1157 L; PY-CEI-NRR-0529;  
PY-CEI-NRR-2420 L

COMMITMENTS: L01462, L01960, L02362

PREPARED BY: Patrick J. Curran  1-19-01  
Date

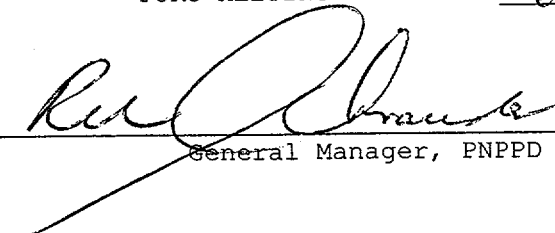
REVIEWED BY: Dean A. Thayer  2/14/01

APPROVED BY: Jamie M. Linckel 2/18/01  
Responsible Manager/Director Date

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PORC MEETING NUMBER: 01-008 2-22-01  
Date

APPROVED BY:  3-2-01  
General Manager, PNPPD Date

## Plant Data Book Entry

PREPARED BY: Patrick J. Curran 1-19-01  
Date

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## UNIT 1 CORE OPERATING LIMITS REPORT

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## INTRODUCTION AND REFERENCES

### INTRODUCTION

This Core Operating Limits Report for PNPP Unit 1 Cycle 9 is prepared in accordance with the requirements of PNPP Technical Specification Administrative Controls 5.6.5. The core operating limits presented were developed using NRC-approved methods (Reference 2). Results from the reload analysis for the General Electric fuel in PNPP Unit 1 for Cycle 9 are documented in References 3, 4, 19, and 20.

The cycle-specific core operating limits for the following PNPP Unit 1 Technical Specifications are included in this report:

1. Average Planar Linear Heat Generation Rate (APLHGR) Limits for each fuel/lattice type, including the power and flow dependent MAPFAC curves with the single loop MAPLHGR reduction factor. (Technical Specification 3.2.1)
2. Minimum Critical Power Ratio Operating Limit including the power and flow dependent MCPR curves for Two Loop Operation and Single Loop Operation. (Technical Specification 3.2.2) For Single Loop Operation the MCPR operating limits are increased by 0.01. (Reference 3)
3. Linear Heat Generation Rate (LHGR) Limit for each fuel type. (Technical Specification 3.2.3)
4. The simulated thermal power time constant. (Technical Specification 3.3.1.1, SR 3.3.1.1.14)
5. Oscillation Power Range Monitor (OPRM) Instrumentation. (Technical Specification 3.3.1.3)

### REFERENCES

1. Perry Nuclear Power Plant Updated Safety Analysis Report, Unit 1, Appendix 15B-Reload Safety Analysis.
2. "General Electric Standard Application for Reactor Fuel-GESTAR II", NEDE-24011-P-A-14 and NEDE-24011-P-A-14-US (US Supplement), June 2000.
3. "Supplement Reload Licensing Report for Perry Nuclear Power Plant Unit 1 Reload 8 Cycle 9", GE Document J11-03754SRLR Rev. 0 (January 2001)
4. "Lattice Dependent MAPLHGR Report for Perry Nuclear Power Plant Unit 1 Reload 7 Cycle 8", GE Document J11-03371MAP Rev. 0 (January 1999)
5. J. B. Hopkins (USNRC) to R. A. Stratman (Centerior), Amendment No. 61 to Facility Operating License NPF - 58, June 2, 1994. NRRCEI0719L <L01960>

6. M. D. Lyster (CEI) to USNRC, Core Operating Limits Report Submittal (Cycle 4), May 22, 1992. CEINRR1495L <L01462>
7. Technical Specification 3.2.1, Average Planar Linear Heat Generation Rate
8. Technical Specification 3.2.2, Minimum Critical Power Ratio
9. Technical Specification 3.2.3, Linear Heat Generation Rate
10. Technical Specification 3.3.1.1, Reactor Protection System Instrumentation
11. Technical Specification 5.6.5, Core Operating Limits Report
12. Technical Specification 2.1.1.2, Safety Limit MCPR
13. GE Design Basis document -- DB-0004.1, "Nuclear Design Basis - Core Design", Rev. 0, dated October 1999.
14. Howard W. Bergendahl (FENOC) to USNRC, "License Amendment Request Pursuant to 10CFR50.90: Implementation of Power Uprate," PY-CEI-NRR-2420L, September 9, 1999.
15. N. Amrhein (GE) to E. M. Root (CEI), "Revision 1 to Final G1-08 ACN: Power Uprate Transient Analysis," GE-PAIP-453, August 4, 1999.
16. F. T. Bolger (GE) "Task G1-08: Power Uprate Transient Analysis," GE-NE-A2200084-08-01-R1, Revision 1, August 1999.
17. D. V. Pickett (USNRC) to J. K. Wood (FENOC), Amendment 112 to Facility Operating License NPF-58, June 1, 2000.
18. R. Kingston to P. J. Curran, REK:00-006 (January 10, 2001), Off-Rated Limits for GE14, Perry Cycle 9.
19. "Lattice Dependent MAPLHGR Report for Perry Nuclear Power Plant Unit 1, Reload 6 Cycle 7, GE Document J11-03060MAP, Rev. 0, August 1997.
20. "Lattice Dependent MAPLHGR Report for Perry Nuclear Power Plant Unit 1, Reload 8 Cycle 9, GE Document J11-03754MAP, Rev. 0, January 2001.

AVERAGE PLANAR LINEAR HEAT GENERATION RATE (TS 3.2.1)

All AVERAGE PLANAR LINEAR HEAT GENERATION RATES (APLHGRs) shall not exceed the result obtained from multiplying the applicable MAPLHGR values\* by the smaller of either the flow dependent MAPLHGR factor (MAPFAC<sub>f</sub>) Figure 3.2.1-1 or the power dependent MAPLHGR factor (MAPFAC<sub>p</sub>) Figure 3.2.1-2.

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\* These applicable MAPLHGR values are:

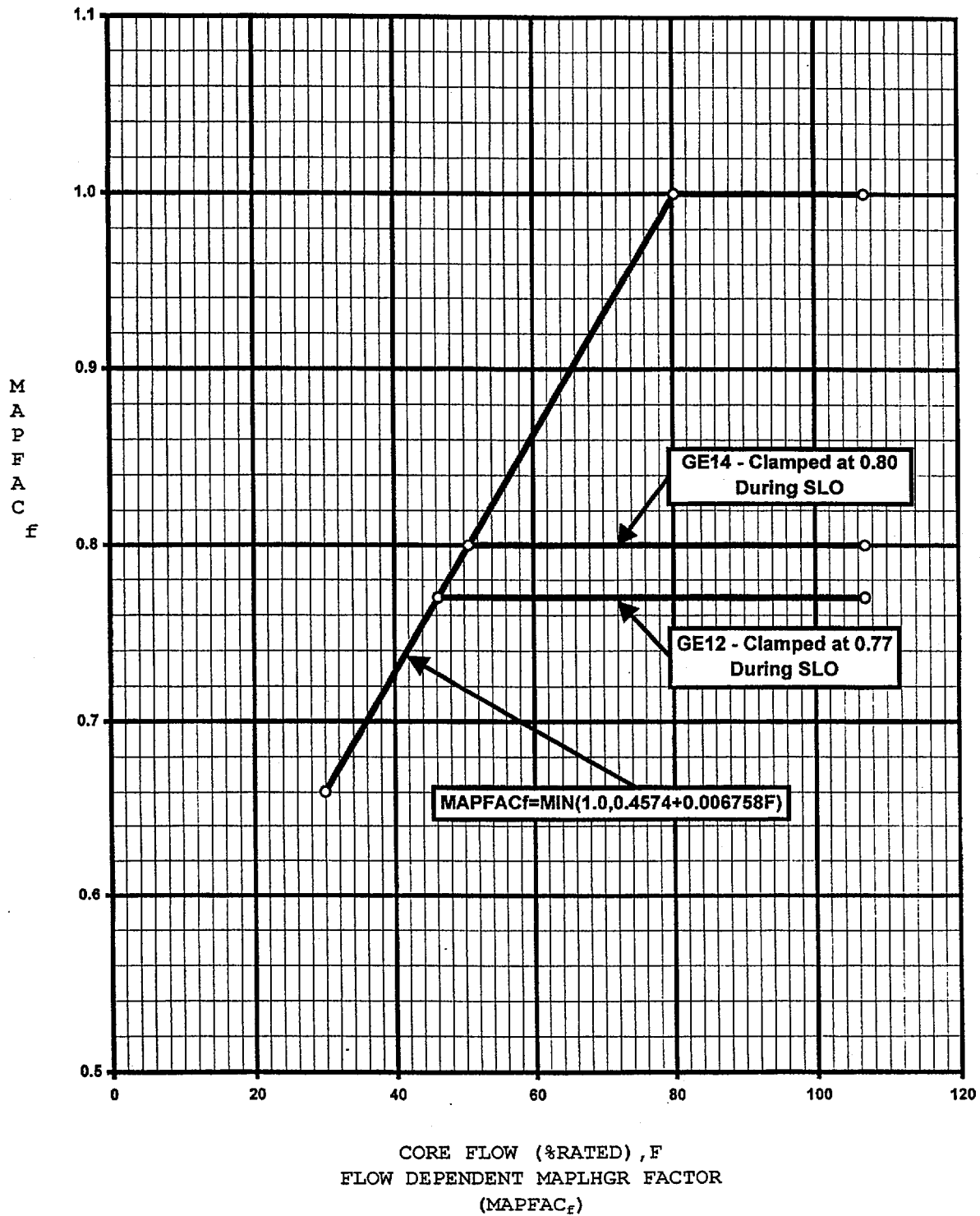
1. Those for the respective fuel and lattice type as a function of the average planar exposure (as described by the NRC approved methodology described in GESTAR-II)

or,

2. When hand calculations are required, the MAPLHGR as a function of the average planar exposure for the most limiting lattice shown in Figures 3.2.1-3 through Figure 3.2.1-10 for the applicable type of fuel.



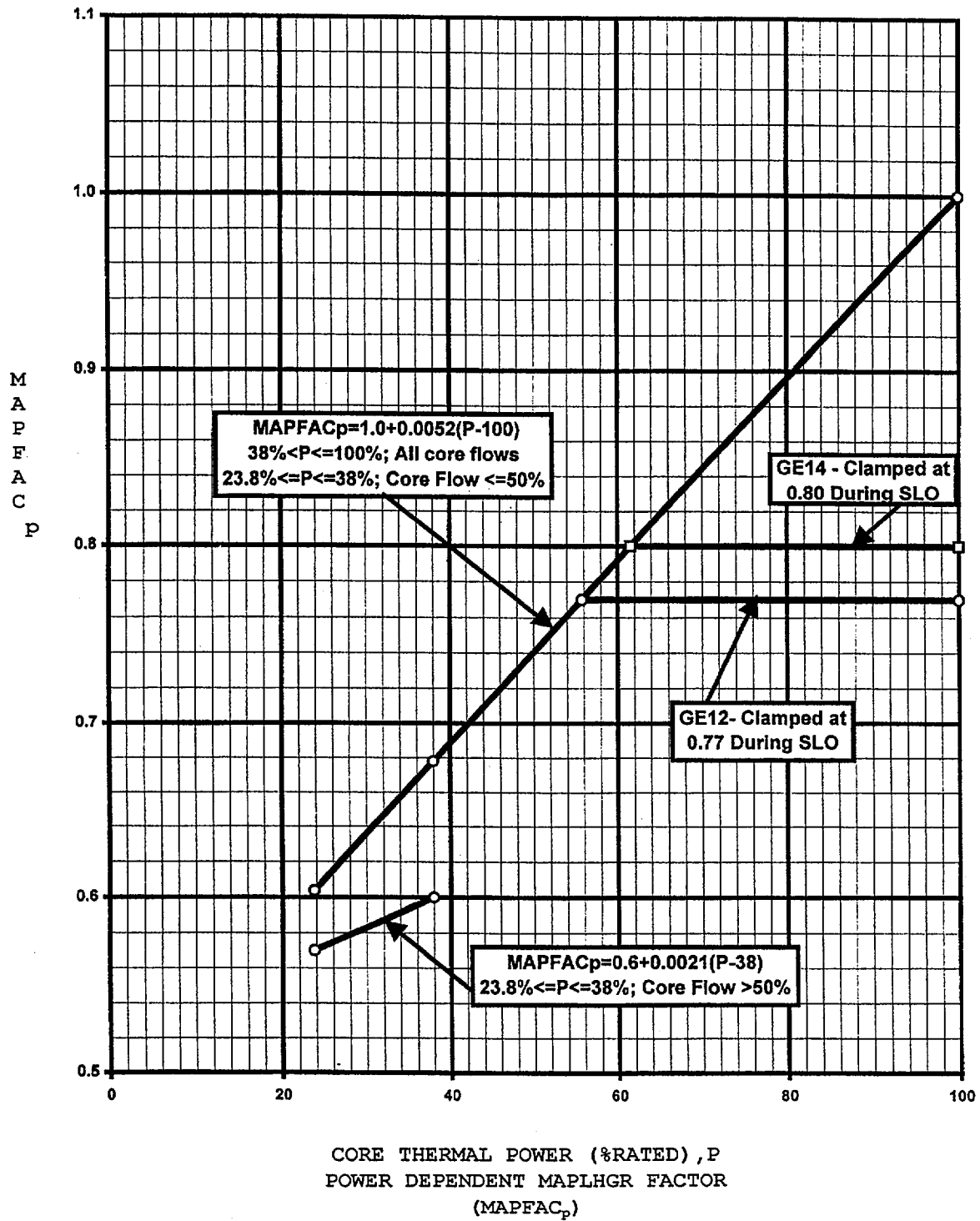
Flow Dependent MAPLHGR Factor (MAPFAC<sub>f</sub>), Fuel Types GE12 and GE14



FUEL TYPES: GE12 and GE14

Figure 3.2.1-1

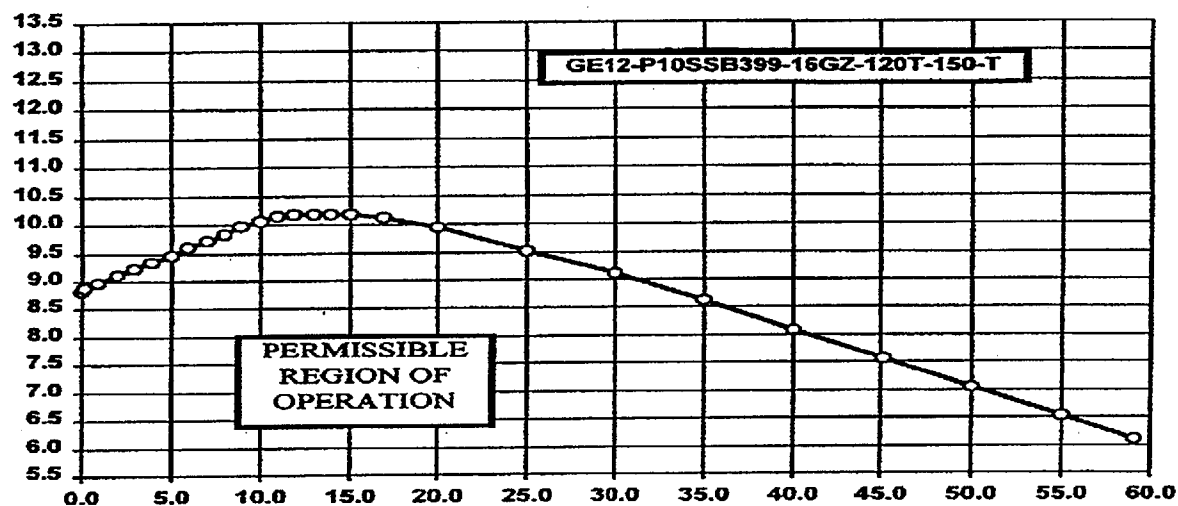
Power Dependent MAPLHGR Factor (MAPFAC<sub>p</sub>), Fuel Types GE12 and GE14



FUEL TYPES: GE12 and GE14

Figure 3.2.1-2

MAPLHGR Versus Average Planar Exposure, Fuel Type GE12-P10SSB399-16GZ-120T-150-T



AVERAGE PLANAR EXPOSURE (Gwd/ST)

MAXIMUM AVERAGE PLANAR LINEAR HEAT  
GENERATION RATE (MAPLHGR) VERSUS  
AVERAGE PLANAR EXPOSURE

FUEL TYPE GE12-P10SSB399-16GZ-120T-150-T

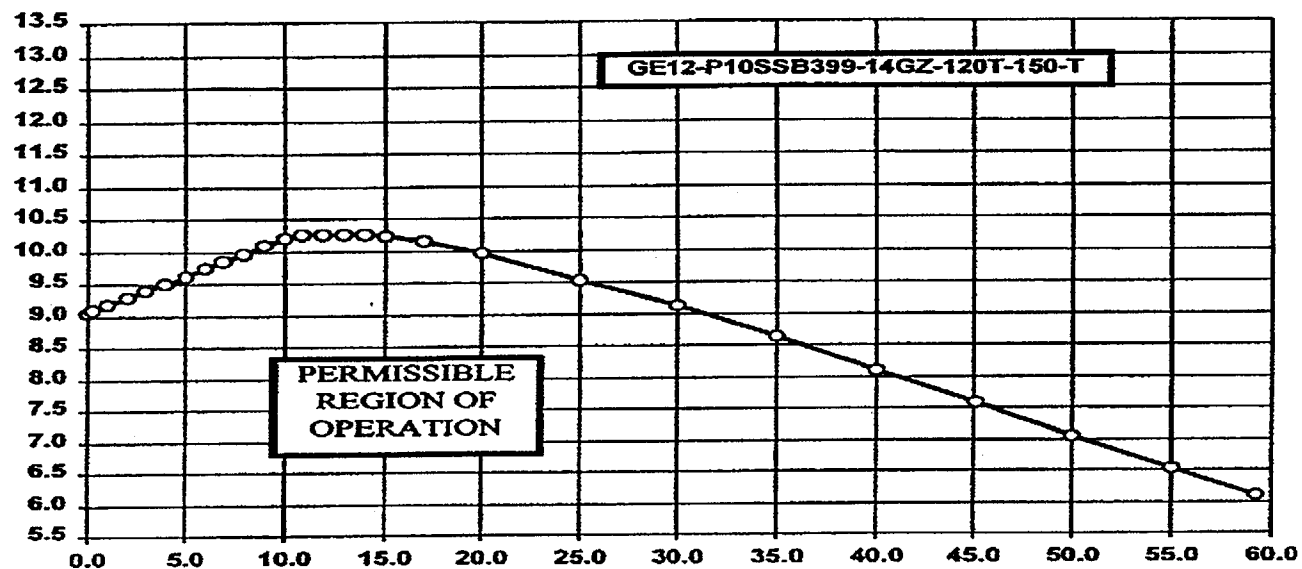
Average Planar Exposure (Gwd/ST)	MAPLHGR Most Limiting (kw/ft)
0.00	8.84
0.20	8.89
1.00	8.98
2.00	9.10
3.00	9.22
4.00	9.34
5.00	9.46
6.00	9.59
7.00	9.71
8.00	9.84
9.00	9.96
10.00	10.07
11.00	10.15
12.00	10.16
13.00	10.17
14.00	10.17
15.00	10.17
17.00	10.13
20.00	9.94
25.00	9.52
30.00	9.10
35.00	8.63
40.00	8.09
45.00	7.56
50.00	7.04
55.00	6.52
59.07	6.10

Notes:

- Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
- This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 4.

Figure 3.2.1-3

MAPLHGR Versus Average Planar Exposure, Fuel Type GE12-P10SSB399-14GZ-120T-150-T



AVERAGE PLANAR EXPOSURE (Gwd/ST)

MAXIMUM AVERAGE PLANAR LINEAR HEAT  
GENERATION RATE (MAPLHGR) VERSUS  
AVERAGE PLANAR EXPOSURE

FUEL TYPE GE12-P10SSB339-14GZ-120T-150-T

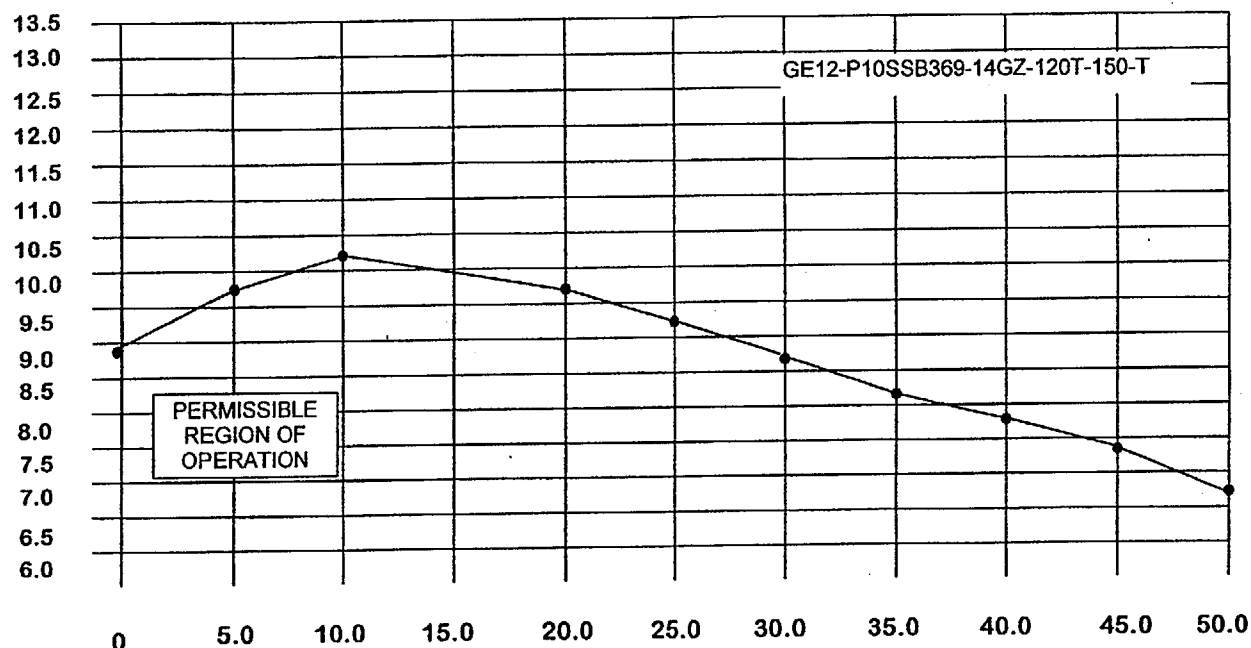
Average Planar Exposure (Gwd/ST)	MAPLHGR Most Limiting (kw/ft)
0.00	9.05
0.20	9.10
1.00	9.18
2.00	9.29
3.00	9.40
4.00	9.51
5.00	9.62
6.00	9.74
7.00	9.86
8.00	9.97
9.00	10.09
10.00	10.19
11.00	10.27
12.00	10.27
13.00	10.27
14.00	10.26
15.00	10.24
17.00	10.16
20.00	9.95
25.00	9.53
30.00	9.11
35.00	8.64
40.00	8.10
45.00	7.57
50.00	7.05
55.00	6.53
59.18	6.09

Notes:

- Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
- This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 4.

Figure 3.2.1-4

MAPLHGR Versus Average Planar Exposure, Fuel Type GE12-P10SSB369-14GZ-120T-150-T



AVERAGE PLANAR EXPOSURE (GWd/t)

MAXIMUM AVERAGE PLANAR LINEAR HEAT  
GENERATION RATE (MAPLHGR) VERSUS  
AVERAGE PLANAR EXPOSURE

FUEL TYPE GE12-P10SSB369-14GZ-120T-150-T

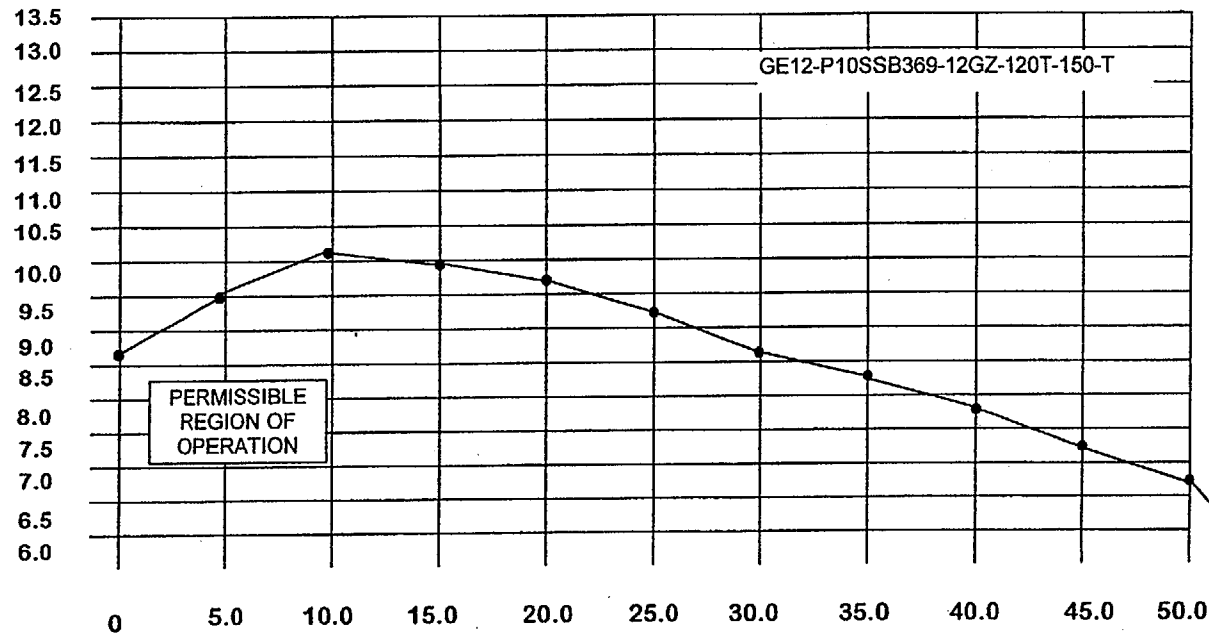
Average Planar Exposure (GWd/ST)	MAPLHGR (kW/ft) Most Limiting
0.00	9.00
0.20	9.04
1.00	9.12
2.00	9.23
3.00	9.36
4.00	9.50
5.00	9.65
6.00	9.77
7.00	9.89
8.00	10.01
9.00	10.14
10.00	10.26
11.00	10.36
12.00	10.33
13.00	10.28
14.00	10.21
15.00	10.14
17.00	9.97
20.00	9.72
25.00	9.29
30.00	8.86
35.00	8.43
40.00	7.99
45.00	7.52
50.00	7.04
55.00	6.53
58.24	6.19

## Notes:

- Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
- This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 19.

Figure 3.2.1-5

MAPLHGR Versus Average Planar Exposure, Fuel Type GE12-P10SSB369-12GZ-120T-150-T



AVERAGE PLANAR EXPOSURE (GWd/t)

MAXIMUM AVERAGE PLANAR LINEAR HEAT  
GENERATION RATE (MAPLHGR) VERSUS  
AVERAGE PLANAR EXPOSURE

FUEL TYPE GE12-P10SSB369-12GZ-120T-150-T

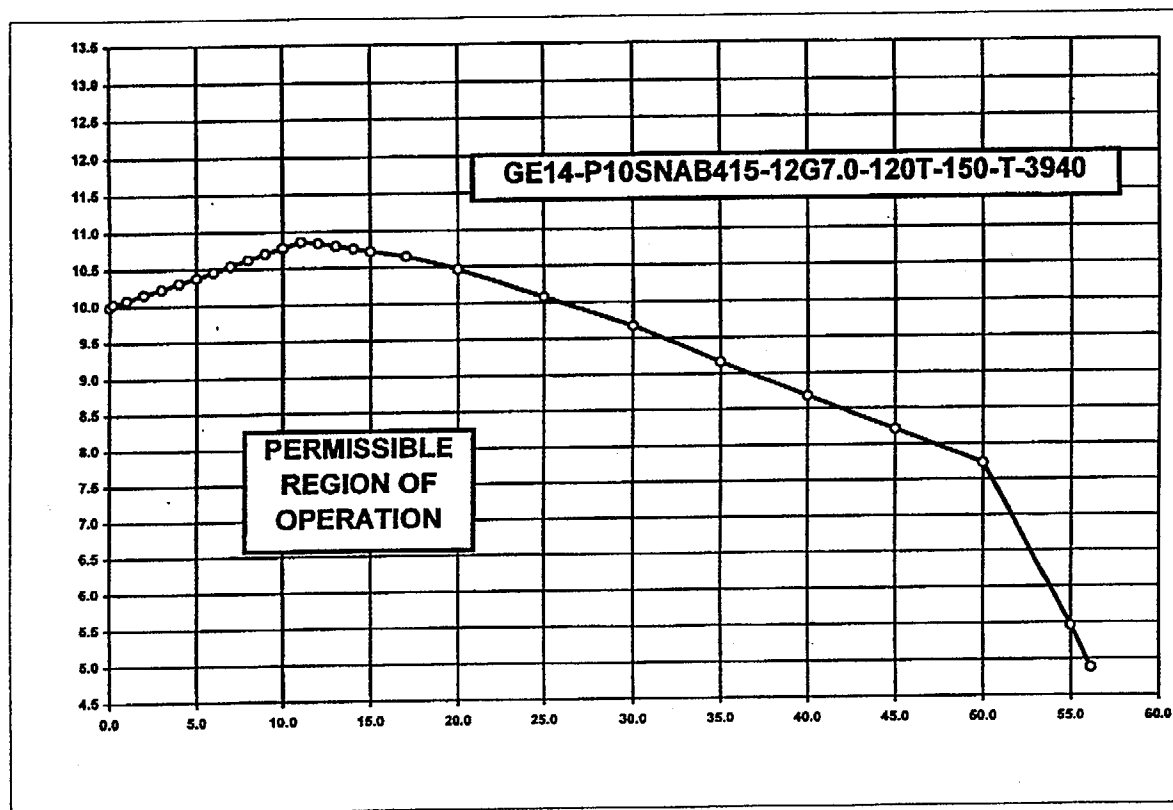
Average Planar Exposure (GWd/ST)	MAPLHGR (kW/ft) Most Limiting
0.00	8.89
0.20	8.94
1.00	9.05
2.00	9.19
3.00	9.32
4.00	9.46
5.00	9.61
6.00	9.75
7.00	9.90
8.00	10.05
9.00	10.19
10.00	10.33
11.00	10.41
12.00	10.38
13.00	10.32
14.00	10.25
15.00	10.17
17.00	10.00
20.00	9.74
25.00	9.31
30.00	8.88
35.00	8.45
40.00	8.00
45.00	7.54
50.00	7.05
55.00	6.54
58.22	6.20

Notes:

- Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
- This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 19.

Figure 3.2.1-6

MAPLHGR Versus Average Planar Exposure, Fuel Type GE14-P10SNAB415-12G7.0-120T-150-T-3940



Average Planar Exposure (Gwd/ST)	MAPLHGR Most Limiting (kw/ft)
0.00	9.99
0.20	10.03
1.00	10.08
2.00	10.16
3.00	10.23
4.00	10.31
5.00	10.38
6.00	10.46
7.00	10.54
8.00	10.62
9.00	10.70
10.00	10.78
11.00	10.86
12.00	10.84
13.00	10.80
14.00	10.76
15.00	10.72
17.00	10.65
20.00	10.47
25.00	10.08
30.00	9.67
35.00	9.16
40.00	8.68
45.00	8.21
50.00	7.73
55.00	5.48
56.15	4.88

AVERAGE PLANAR EXPOSURE (Gwd/ST)

MAXIMUM AVERAGE PLANAR LINEAR HEAT  
GENERATION RATE (MAPLHGR) VERSUS  
AVERAGE PLANAR EXPOSURE

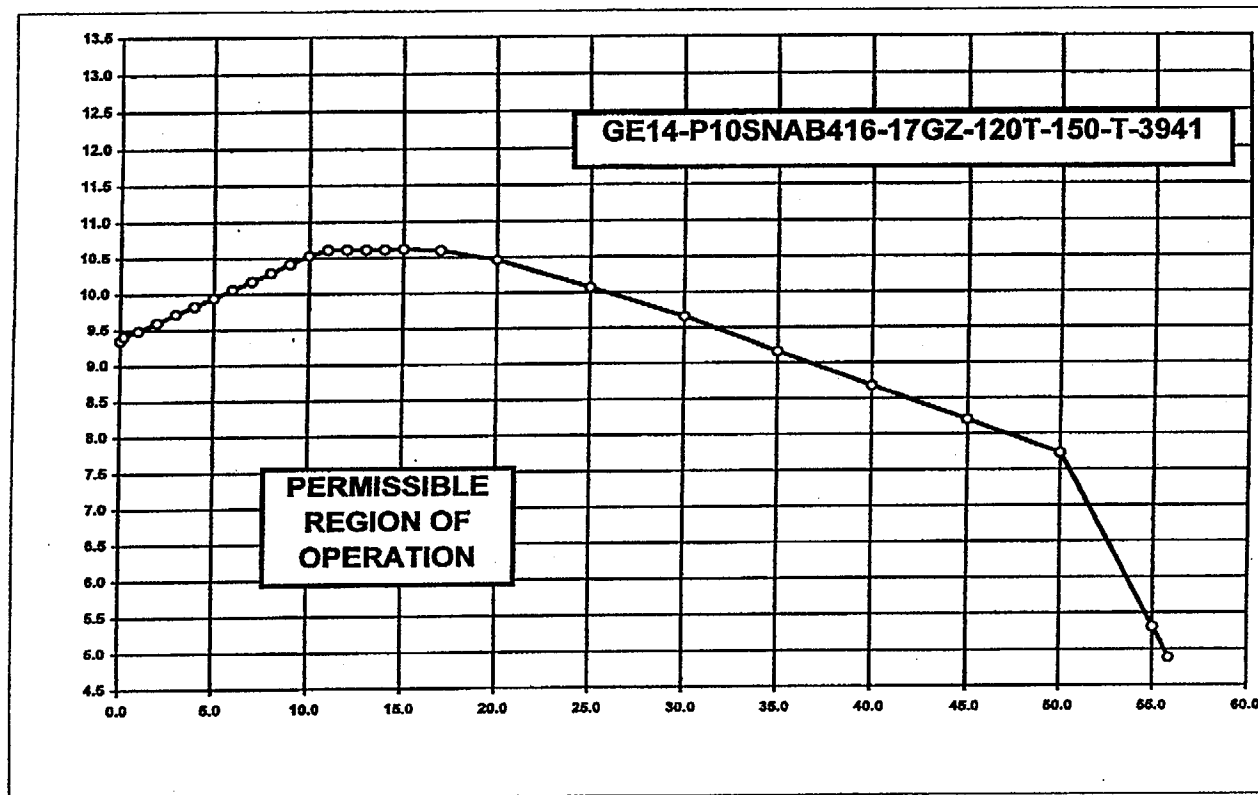
FUEL TYPE GE14-P10SNAB415-120G7.0-120T-150-T-3940

Notes:

- Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
- This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 20.

Figure 3.2.1-7

MAPLHGR Versus Average Planar Exposure, Fuel Type GE14-P10SNAB416-17GZ-120T-150-T-3941



Average Planar Exposure (Gwd/ST)	MAPLHGR Most Limiting (kw/ft)
0.00	9.35
0.20	9.41
1.00	9.49
2.00	9.60
3.00	9.72
4.00	9.83
5.00	9.84
6.00	10.06
7.00	10.17
8.00	10.29
9.00	10.41
10.00	10.53
11.00	10.61
12.00	10.61
13.00	10.61
14.00	10.61
15.00	10.62
17.00	10.60
20.00	10.46
25.00	10.07
30.00	9.66
35.00	9.16
40.00	8.68
45.00	8.20
50.00	7.73
55.00	5.31
55.86	4.88

AVERAGE PLANAR EXPOSURE (Gwd/ST)

MAXIMUM AVERAGE PLANAR LINEAR HEAT  
GENERATION RATE (MAPLHGR) VERSUS  
AVERAGE PLANAR EXPOSURE

FUEL TYPE GE14-P10SNAB416-17GZ-120T-150-T-3941

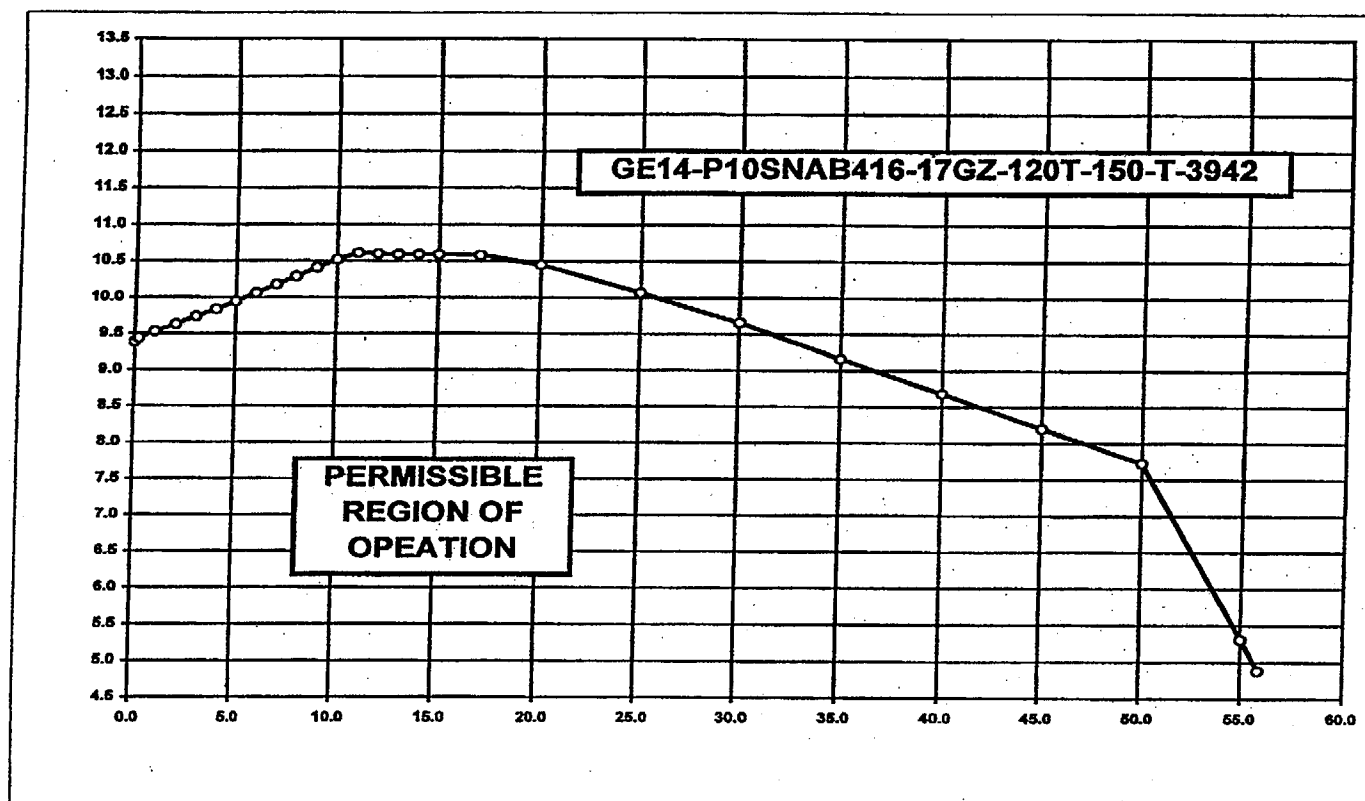
Notes:

- Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
- This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 20.

Figure 3.2.1-8



MAPLHGR Versus Average Planar Exposure, Fuel Type GE14-P10SNAB416-17GZ-120T-150-T-3942



Average Planar Exposure (GWd/ST)	MAPLHGR Most Limiting (kw/ft)
0.00	9.39
0.20	9.44
1.00	9.53
2.00	9.63
3.00	9.74
4.00	9.84
5.00	9.95
6.00	10.06
7.00	10.18
8.00	10.29
9.00	10.41
10.00	10.52
11.00	10.61
12.00	10.60
13.00	10.59
14.00	10.59
15.00	10.59
17.00	10.58
20.00	10.45
25.00	10.07
30.00	9.66
35.00	9.16
40.00	8.68
45.00	8.20
50.00	7.73
55.00	5.31
55.85	4.88

AVERAGE PLANAR EXPOSURE (GWd/ST)

MAXIMUM AVERAGE PLANAR LINEAR HEAT  
GENERATION RATE (MAPLHGR) VERSUS  
AVERAGE PLANAR EXPOSURE

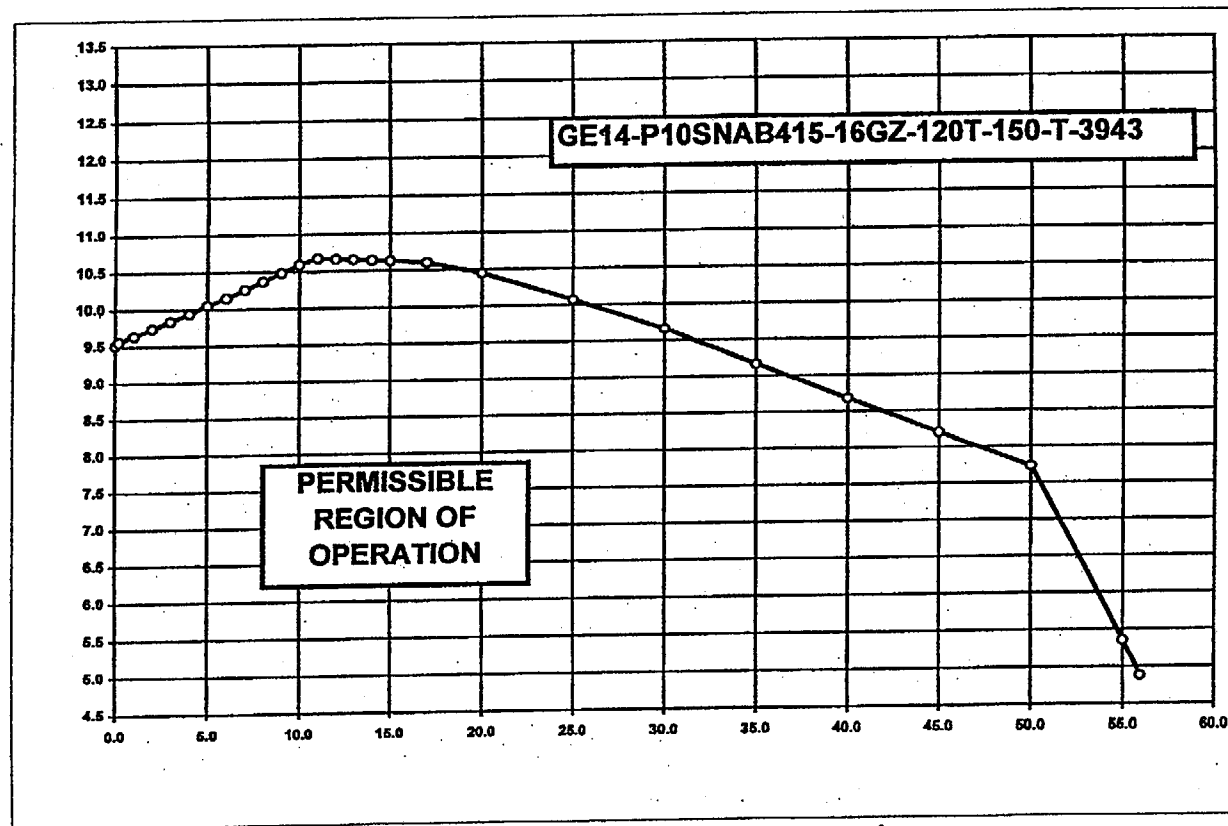
FUEL TYPE GE14-P10SNAB416-17GZ-120T-150-T-3942

Notes:

- Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
- This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 20.

Figure 3.2.1-9

MAPLHGR Versus Average Planar Exposure, Fuel Type GE14-P10SNAB415-16GZ-120T-150-T-3943



Average Planar Exposure (GWd/ST)	MAPLHGR Most Limiting (kw/ft)
0.00	9.51
0.20	9.56
1.00	9.64
2.00	9.74
3.00	9.84
4.00	9.94
5.00	10.05
6.00	10.15
7.00	10.26
8.00	10.37
9.00	10.48
10.00	10.59
11.00	10.67
12.00	10.66
13.00	10.65
14.00	10.64
15.00	10.63
17.00	10.60
20.00	10.45
25.00	10.07
30.00	9.66
35.00	9.16
40.00	8.68
45.00	8.20
50.00	7.73
55.00	6.35
55.93	4.88

AVERAGE PLANAR EXPOSURE (GWd/ST)

MAXIMUM AVERAGE PLANAR LINEAR HEAT  
GENERATION RATE (MAPLHGR) VERSUS  
AVERAGE PLANAR EXPOSURE

FUEL TYPE GE14-P10SNAB415-16GZ-120T-150-T-3943

Notes:

- Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
- This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 20.

Figure 3.2.1-10

MINIMUM CRITICAL POWER RATIO (TS 3.2.2)

The MINIMUM CRITICAL POWER RATIO (MCPR) shall be equal to or greater than the higher of the  $MCPR_f$  and  $MCPR_p$  limits at the indicated core flow, THERMAL POWER, and  $\Delta T^*$  as specified in Figures 3.2.2-1 and 3.2.2-2 for Two Loop Operation and Figures 3.2.2-3 and 3.2.2-4 for Single Loop Operation.

The MCPR Safety Limit for Cycle 9 is 1.10. The MCPR Safety Limit for Single Loop Operation is 1.11 <TECHNICAL SPECIFICATIONS 2.1.1.2>. During Single Loop Operation, the Maximum Fraction of Limiting Critical Power Ratio (MFLCPR) shall be equal to or less than 0.99. Use FTI-B12 Single Loop Operation implements this revised MFLCPR.

NOTE 1: For Cycle 9 no change to MCPR limits is required for planned reduction of feedwater temperature to as low as 325.5°F. Final feedwater temperature may be reduced to 255.5°F after all control rods are withdrawn at the end of cycle.

NOTE 2: Planned reduction of rated feedwater temperature from nominal rated feedwater temperature is not permitted during plant operation with the reactor recirculation system in Single Loop Operation.

NOTE 3: Figures 3.2.2-1, 3.2.2-1a, and 3.2.2-2, depict the limiting fuel type for Two Loop Operation. Figures 3.2.2-3, 3.2.2-3a, and 3.2.2-4 depict the limiting fuel type for Single Loop operation. For fuel type specific values, consult Reference 3.

Attachment 1 illustrates the limiting transient for each fuel type. The thermal limits calculation uses whichever is highest ( $MCPR_f$  or  $MCPR_p$ ) for the given power and flow condition.

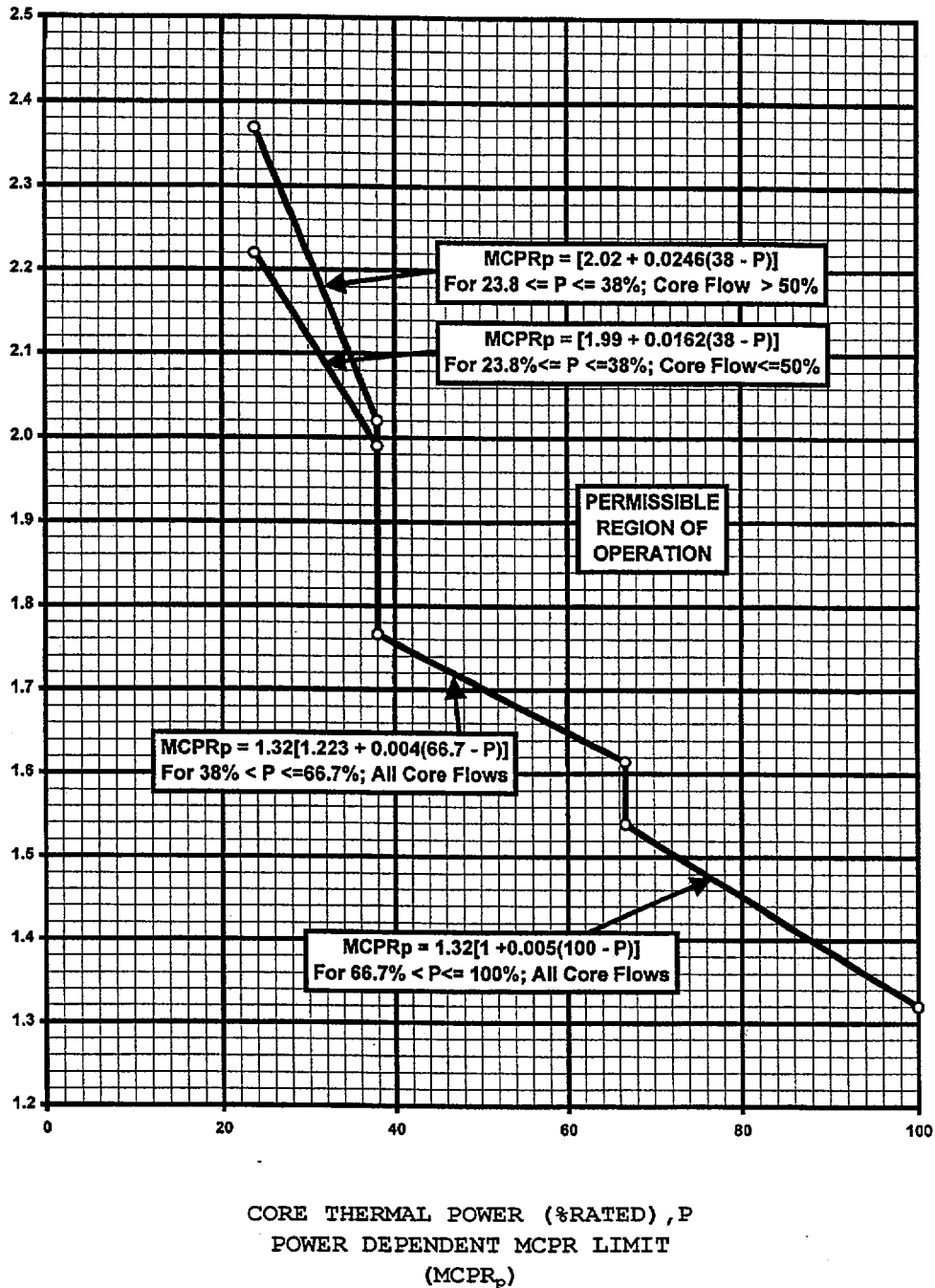
NOTE 4: There are a total of 19 safety/relief valves, the two lowest setpoint valves are assumed to be out-of-service in the transient analysis.

NOTE 5: The MCPR operating limit is increased 0.01 to account for the increase in the single loop MCPR safety limit with the reactor recirculation system in single loop operation.

---

\* This  $\Delta T$  refers to the planned reduction of rated feedwater temperature from nominal rated feedwater temperature (425.5°F), such as prolonged removal of feedwater heater(s) from service.

Power Dependent MCPR Limit (MCPR<sub>p</sub>),  
Fuel Type GE12 (Two Loop Operation) \*

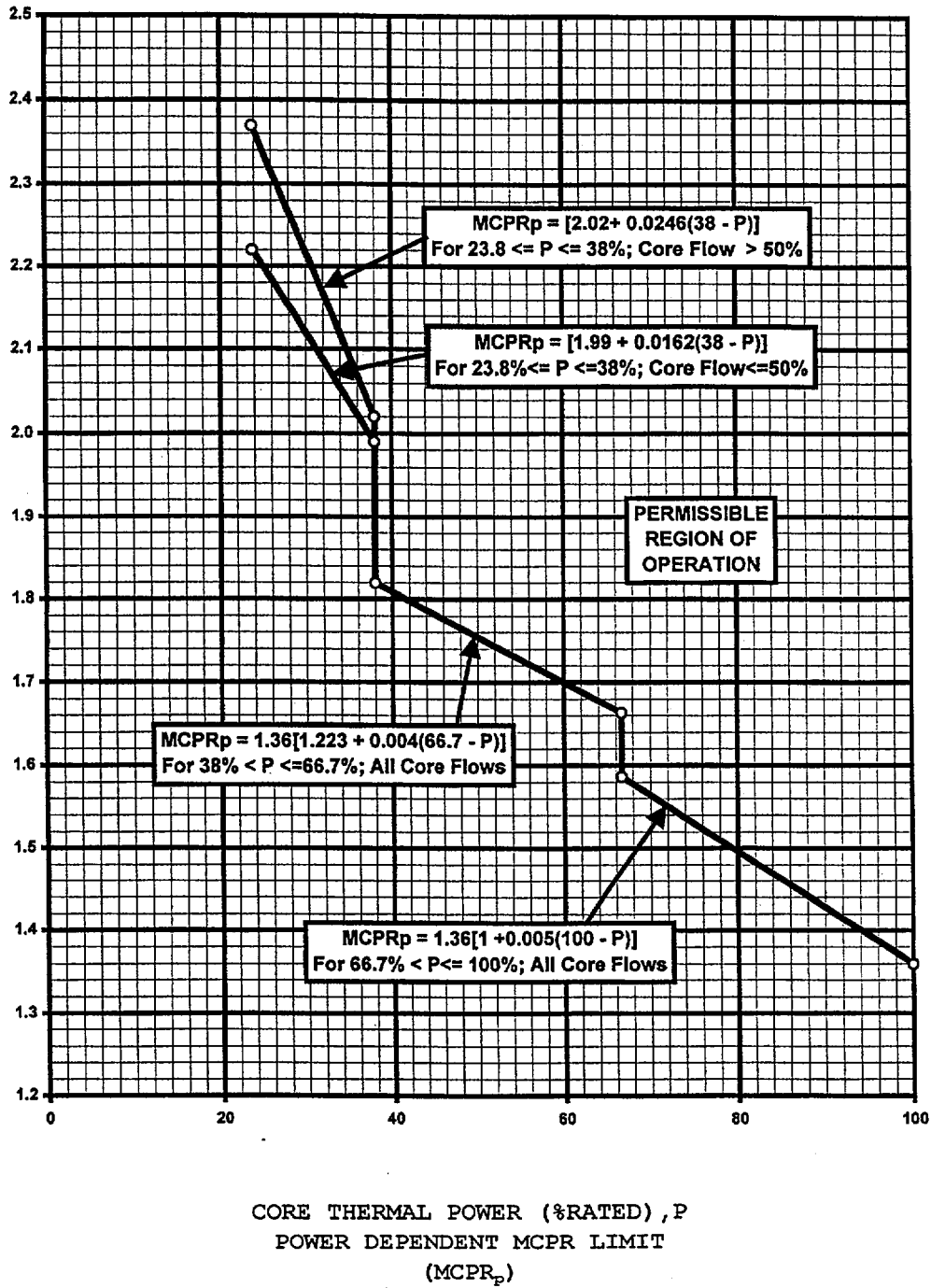


FUEL TYPE GE12 (TWO LOOP OPERATION)

\* Refer to NOTE 3 on Page 16

Figure 3.2.2-1

Power Dependent MCPR Limit (MCPR<sub>p</sub>),  
Fuel Type GE14 (Two Loop Operation)\*



FUEL TYPE GE14 (TWO LOOP OPERATION)

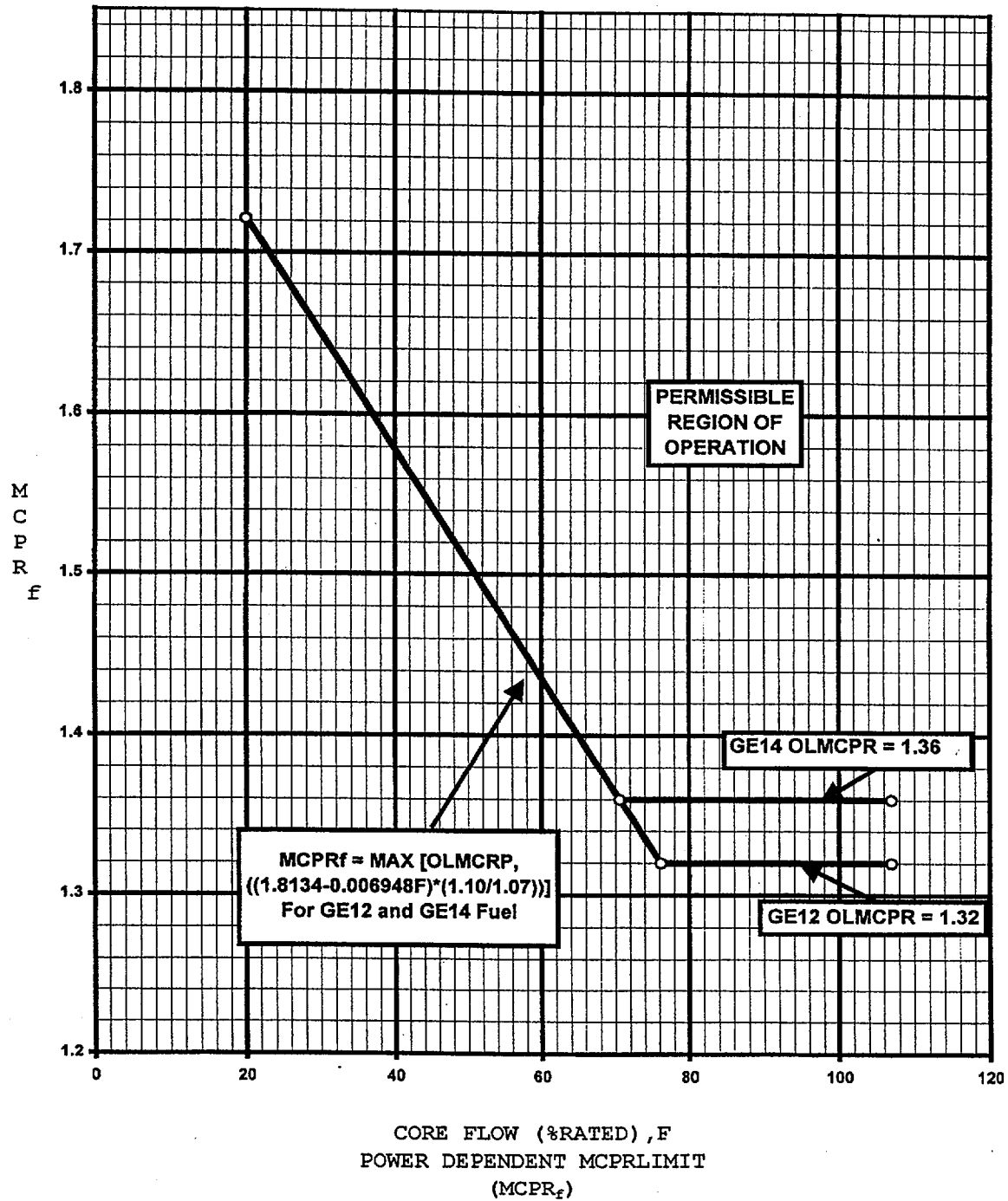
\* Refer to NOTE 3 on Page 16

Figure 3.2.2-1a

PERRY UNIT 1

CYCLE 9  
CORE OPERATING  
LIMITS REPORT

Flow Dependent MCPR Limit (MCPR<sub>f</sub>),  
Fuel Type GE12 and GE14 (Two Loop Operation)\*

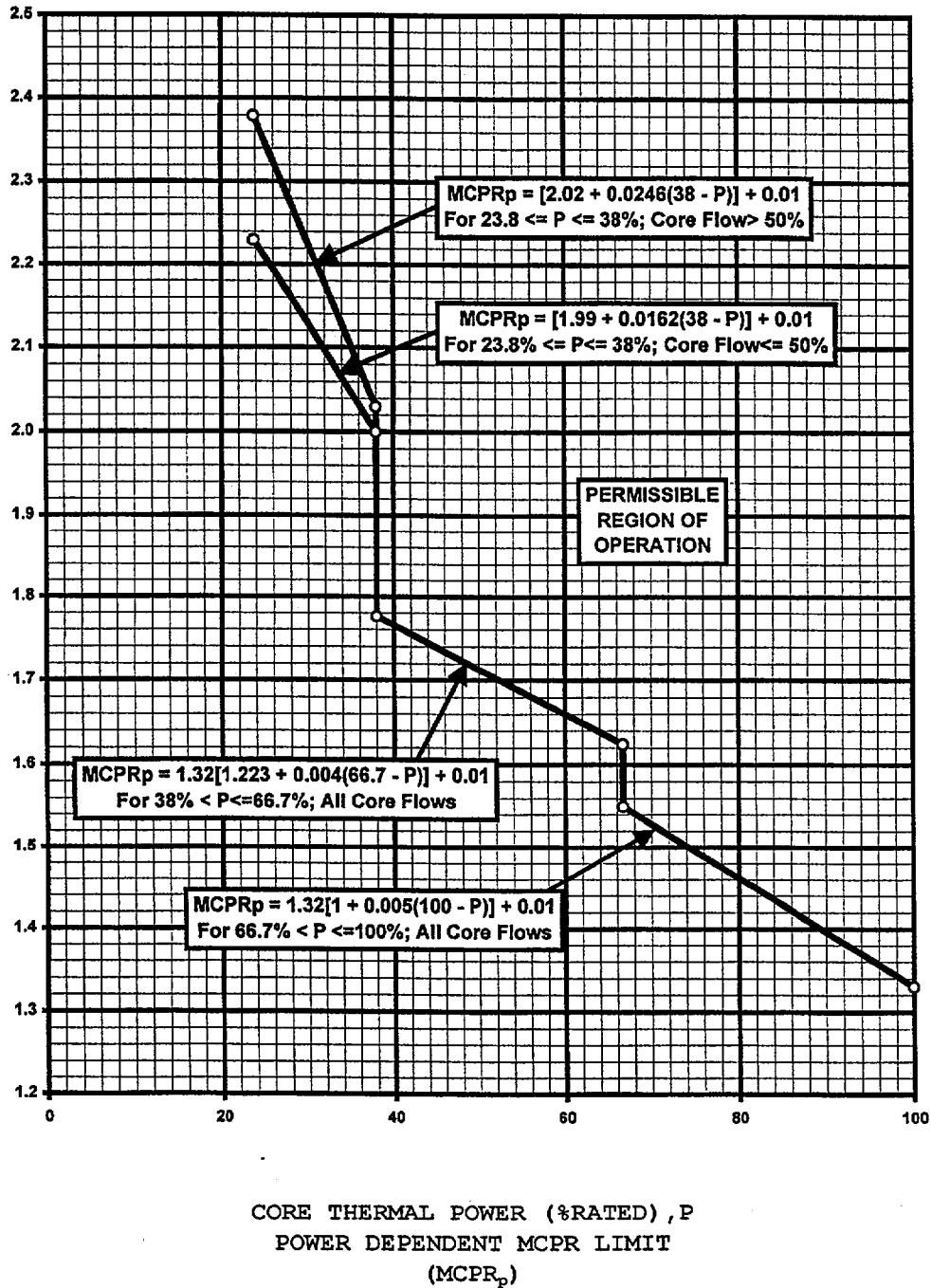


FUEL TYPE GE12 and GE14 (TWO LOOP OPERATION)

\* Refer to NOTE 3 on Page 16

Figure 3.2.2-2

Power Dependent MCPR Limit (MCPR<sub>p</sub>),  
Fuel Type GE12 (Single Loop Operation) \*

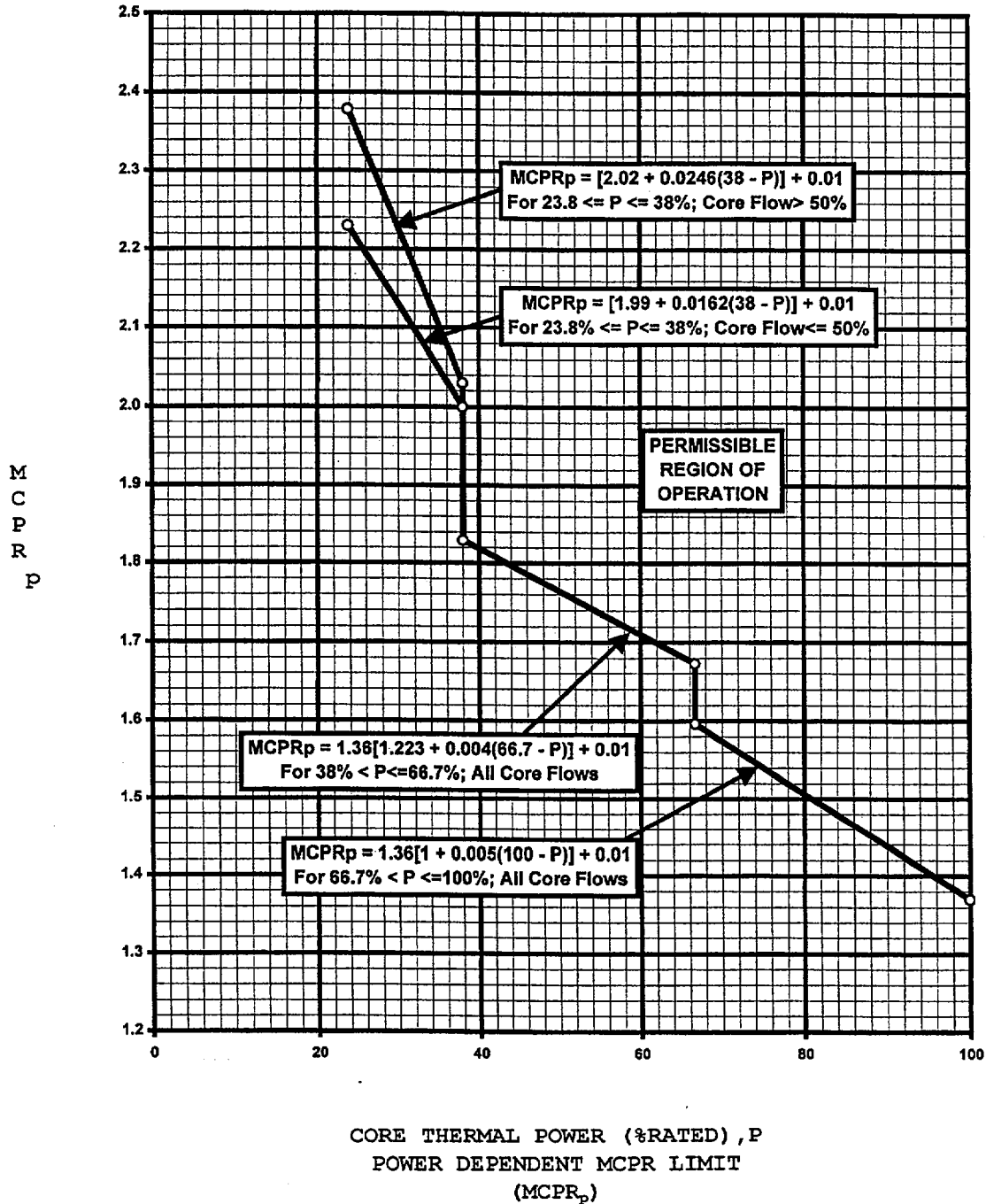


FUEL TYPE GE12 (SINGLE LOOP OPERATION)

\* Refer to NOTE 3 and NOTE 5 on Page 16

Figure 3.2.2-3

Power Dependent MCPR Limit (MCPR<sub>p</sub>)  
Fuel Type GE14 (Single Loop Operation) \*



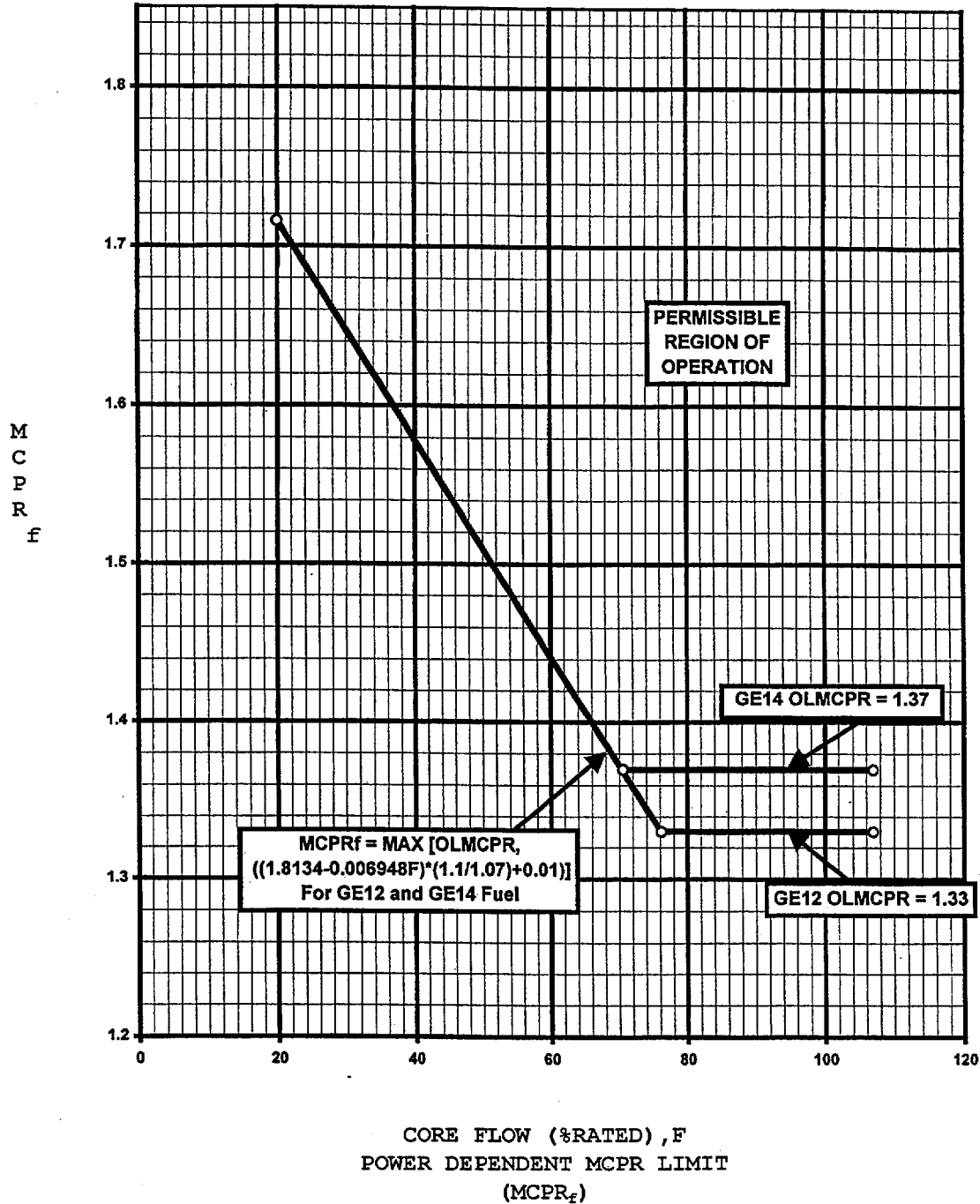
FUEL TYPE GE14 (SINGLE LOOP OPERATION)

\* Refer to NOTE 3 and NOTE 5 on Page 16

Figure 3.2.2-3a



Flow Dependent MCPR Limit ( $MCPR_f$ ),  
Fuel Type GE12 and GE14 (Single Loop Operation) \*



FUEL TYPE GE12 and GE14 (SINGLE LOOP OPERATION) \*

\* Refer to NOTE 3 and NOTE 5 on Page 16

Figure 3.2.2-4

LINEAR HEAT GENERATION RATE (TS 3.2.3)

The LINEAR HEAT GENERATION RATE (LHGR) shall not exceed:

a. 13.4 kw/ft. for the following fuel types:

- |    |  |        |
|----|--|--------|
| 1. | GE14-P10SNAB415-12G7.0-120T-150-T-3940 | (GE14) |
| 2. | GE14-P10SNAB416-17GZ-120T-150-T-3941   | (GE14) |
| 3. | GE14-P10SNAB416-17GZ-120T-150-T-3942   | (GE14) |
| 4. | GE14-P10SNAB415-16GZ-120T-150-T-3943   | (GE14) |

b. 11.8 kw/ft. for the following fuel types:

- |    |                                |        |
|----|--------------------------------|--------|
| 1. | GE12-P10SSB399-16GZ-120T-150-T | (GE12) |
| 2. | GE12-P10SSB399-14GZ-120T-150-T | (GE12) |
| 3. | GE12-P10SSB369-14GZ-120T-150-T | (GE12) |
| 4. | GE12-P10SSB369-12GZ-120T-150-T | (GE12) |

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REACTOR PROTECTION SYSTEM INSTRUMENTATION (TS 3.3.1.1)

The simulated thermal power time constant shall be  $6 \pm 0.6$  seconds.

OSCILATION POWER RANGE MONITOR (OPRM) INSTRUMENTATION (TS 3.3.1.3)

1. Confirmation Count Setpoint ( $N_p = N_2$ ): 12
2. Amplitude Setpoint (Sp): 1.09

Reference: Calculation: FM12, Revision 0

Cycle 9 MCPR Limits