INFORMATION ONLY

PLANT DATA BOOK ENTRY SUBMITTAL SHEET

TITLE: CORE OPERATING LIMITS REPORT FOR THE PERRY NUCLEAR POWER PLANT, UNIT 1 CYCLE 5 (RELOAD 4)

PDB - F0001 /Rev. 2 EFFECTIVE DATE: 7-2-94

MPL: J11

SCOPE OF CHANGE: Incorporate new fuel type information for Cycle 5 including MCPR limits which are fuel type dependent and delta T dependent.

REFERENCE: PY-CEI-NRR-1104 L
PY-CEI-NRR-1157 L
PY-NRR/CEI-0529 L

PREPARED BY: J. M. Rinckel Joanne M. Rinckel 5-2-94
Date

REVIEWED BY: Paul h Giles 5-12-94
Date

APPROVED BY: N/A
Manager - Sponsoring Group Date

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TAB E, F, AND G USE ONLY

PORC MEETING NUMBER: 94-093 MB5 26 May 94
Date

APPROVED BY: David P. Boyd 6/10/94
General Manager, PNPPD Date

UNIT 1 CORE OPERATING LIMITS REPORT

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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 5 is prepared in accordance with the requirements of PNPP Technical Specification 6.9.1.9. The core operating limits presented were developed using NRC-approved methods (Reference 2). Results from the reload analyses for the General Electric fuel in PNPP Unit 1 for Cycle 5 are documented in References 3, 4, 5 and 6.

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. (Technical Specification 3/4.2.1)

2. Minimum Critical Power Ratio Operating Limit including the power and flow dependent MCPR curves. (Technical Specification 3/4.2.2)

3. Linear Heat Generation Rate (LHGR) Limit for each fuel type. (Technical Specification 3/4.2.3)

4. The simulated thermal power time constant. (Technical Specification 3/4.3.1)

REFERENCES

1. J.R. Hall (USNRC) to M.D. Lyster (CEI), Amendment No. 33 to Facility Operating License No. NPF-58, September 13, 1990.

2. "General Electric Standard Application for Reactor Fuel-GESTAR II," NEDE-24011-P-A-10 and NEDE-24011-P-A-10-US (US Supplement), April 1991.

3. "Supplemental Reload Licensing Report for the Perry Nuclear Power Plant Unit 1, Reload 4, Cycle 5," GE Document 23A7227 Rev. 0 (April 1994).

4. "Supplement 1 to the Supplemental Reload Licensing Submittal for the Perry Nuclear Power Plant Unit 1, Reload 1, Cycle 2," GE Document 23A5948AA Rev. 0 (October 1988).

5. "Supplement 1 to the Supplemental Reload Licensing Submittal for the Perry Nuclear Power Plant Unit 1, Reload 2, Cycle 3," GE Document 23A6492AA Rev. 0 (September 1990).

6. "Supplement 1 to the Supplemental Reload Licensing Submittal for the Perry Nuclear Power Plant Unit 1, Reload 3, Cycle 4," GE Document 23A7147AA, Rev. 0 (January 1992).

7. Perry Nuclear Power Plant Updated Safety Analysis Report, Unit 1, Appendix 15B-Reload Safety Analysis.

8. R.J. Stransky (USNRC) to R.A. Stratman (CEI), Amendment No. 48 to Facility Operating License NPF-58, May 28, 1993.

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 ($MAPFAC_f$) Figure 3.2.1-1, or the power dependent MAPLHGR factor ($MAPFAC_p$) 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 ($MAPFAC_f$)

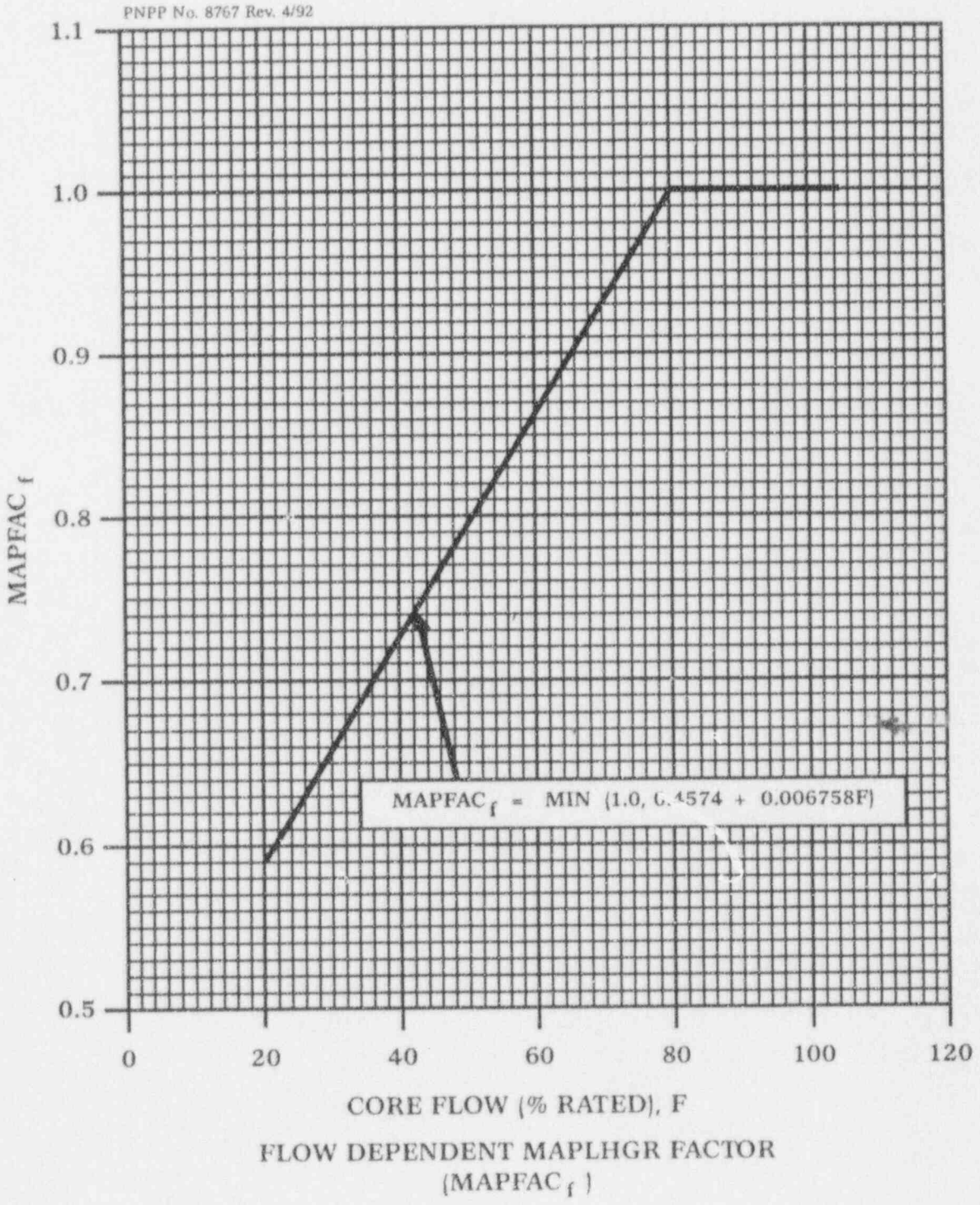


Figure 3.2.1-1

Power Dependent MAPLHGR Factor ($MAPFAC_p$)

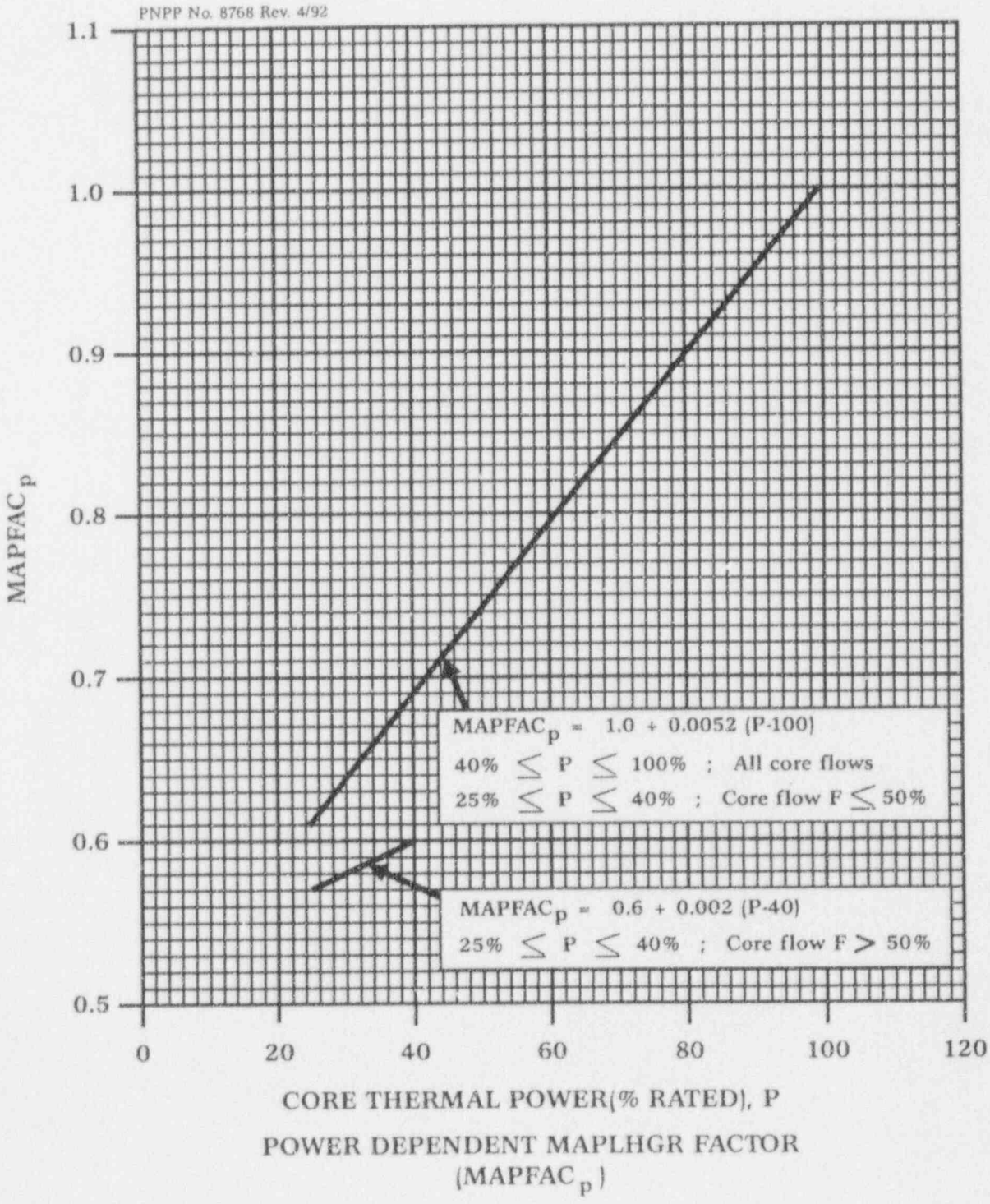
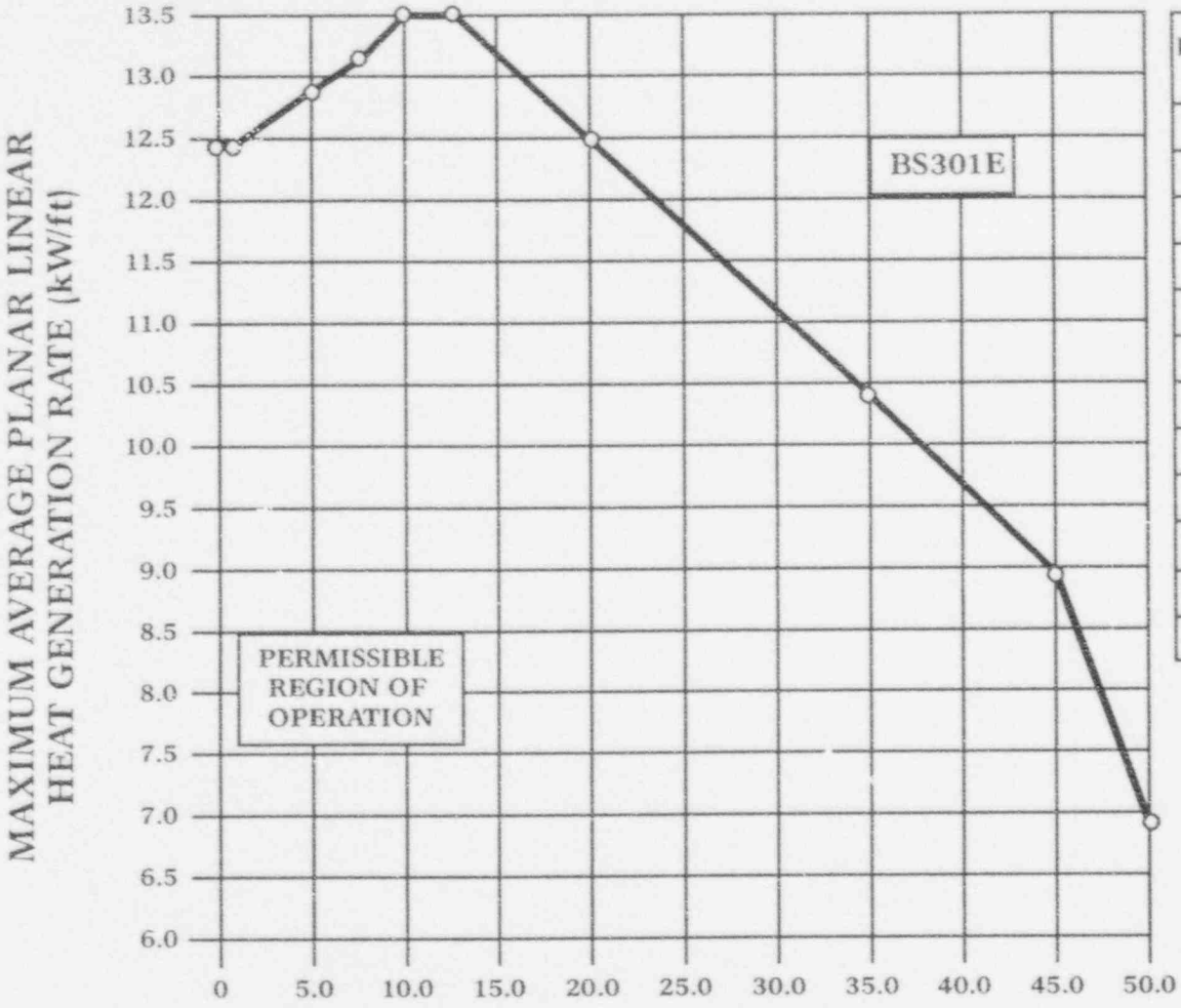


Figure 3.2.1-2

PNPP No 8771 Rev. 4/94



EXPOSURE (GWd/t)	MAPLHGR (kW/ft)
0.0	12.4
1.0	12.4
5.0	12.8
7.0	-
8.0	13.2
10.0	13.5
12.5	13.5
20.0	12.5
25.0	-
35.0	10.4
45.0	8.9
50.0	6.9

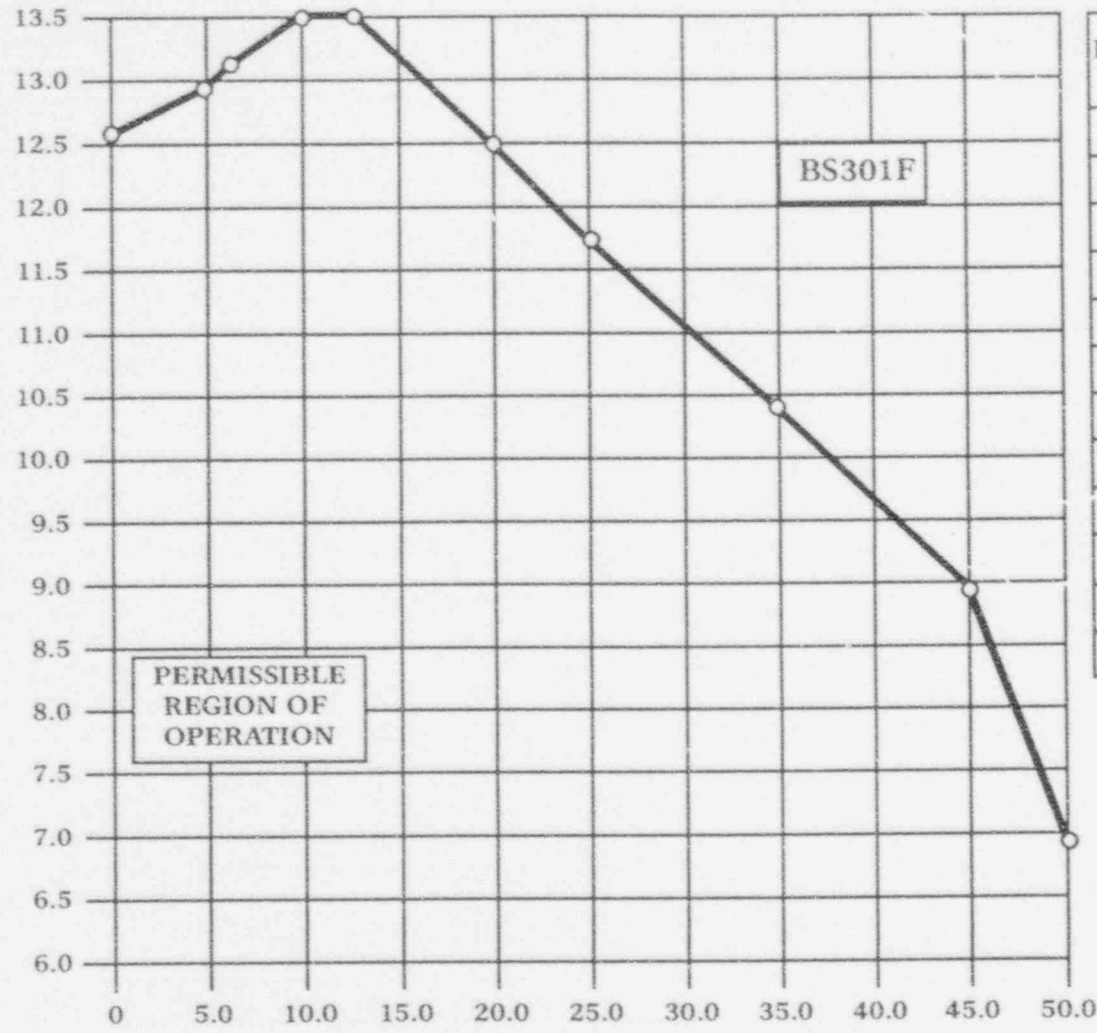
Figure 3.2.1-3

MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (MAPLHGR) VERSUS AVERAGE PLANAR EXPOSURE, GE8x8EB

FUEL TYPE BS301E

Note: 1. Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
2. This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 4.

MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (kW/ft)

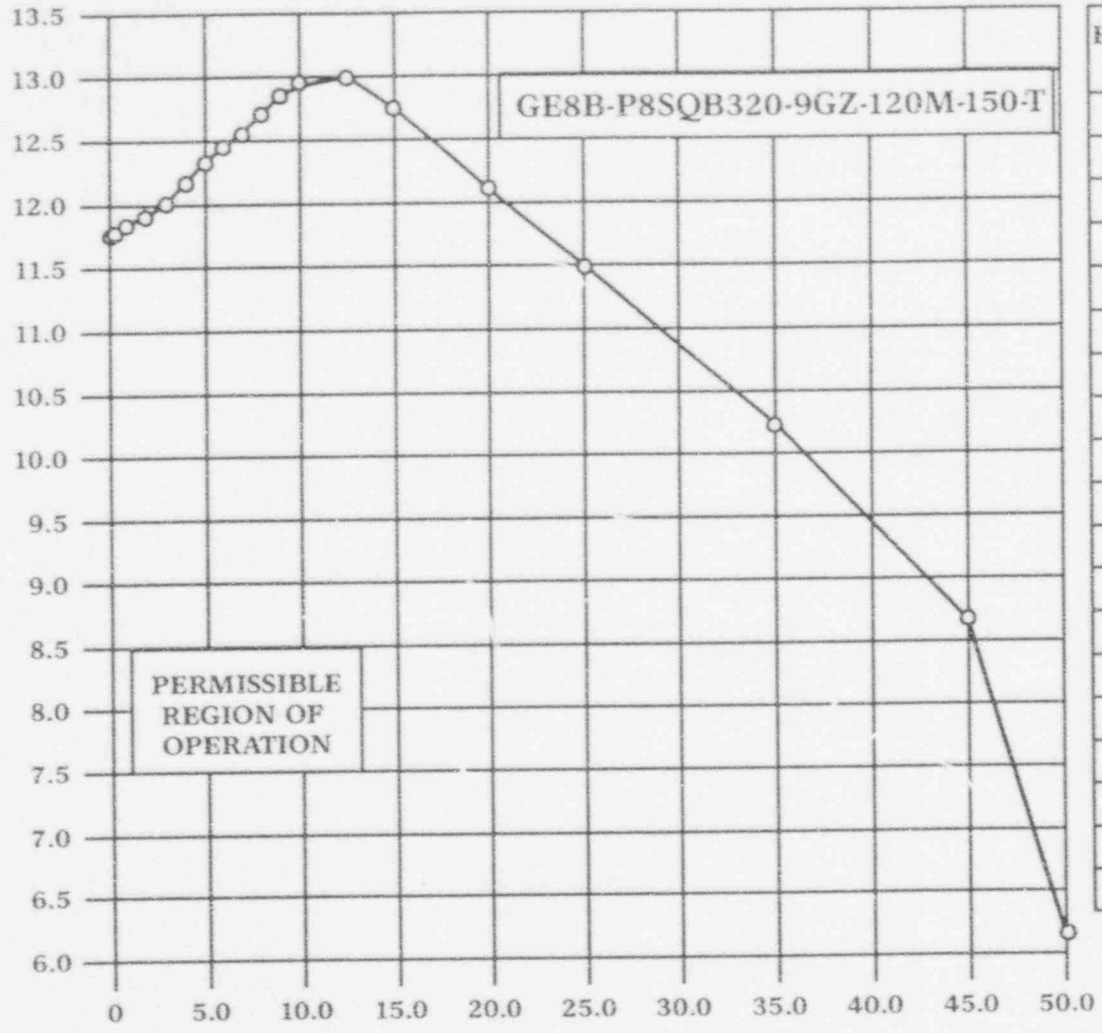


EXPOSURE (GWd/t)	MAPLHGR (kW/ft)
0.0	12.6
1.0	-
5.0	12.9
7.0	13.2
8.0	-
10.0	13.5
12.5	13.5
20.0	12.5
25.0	11.8
35.0	10.4
45.0	8.9
50.0	6.9

MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (MAPLHGR) VERSUS AVERAGE PLANAR EXPOSURE, GE8x8EB

FUEL TYPE BS301F

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



MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (kW/ft)

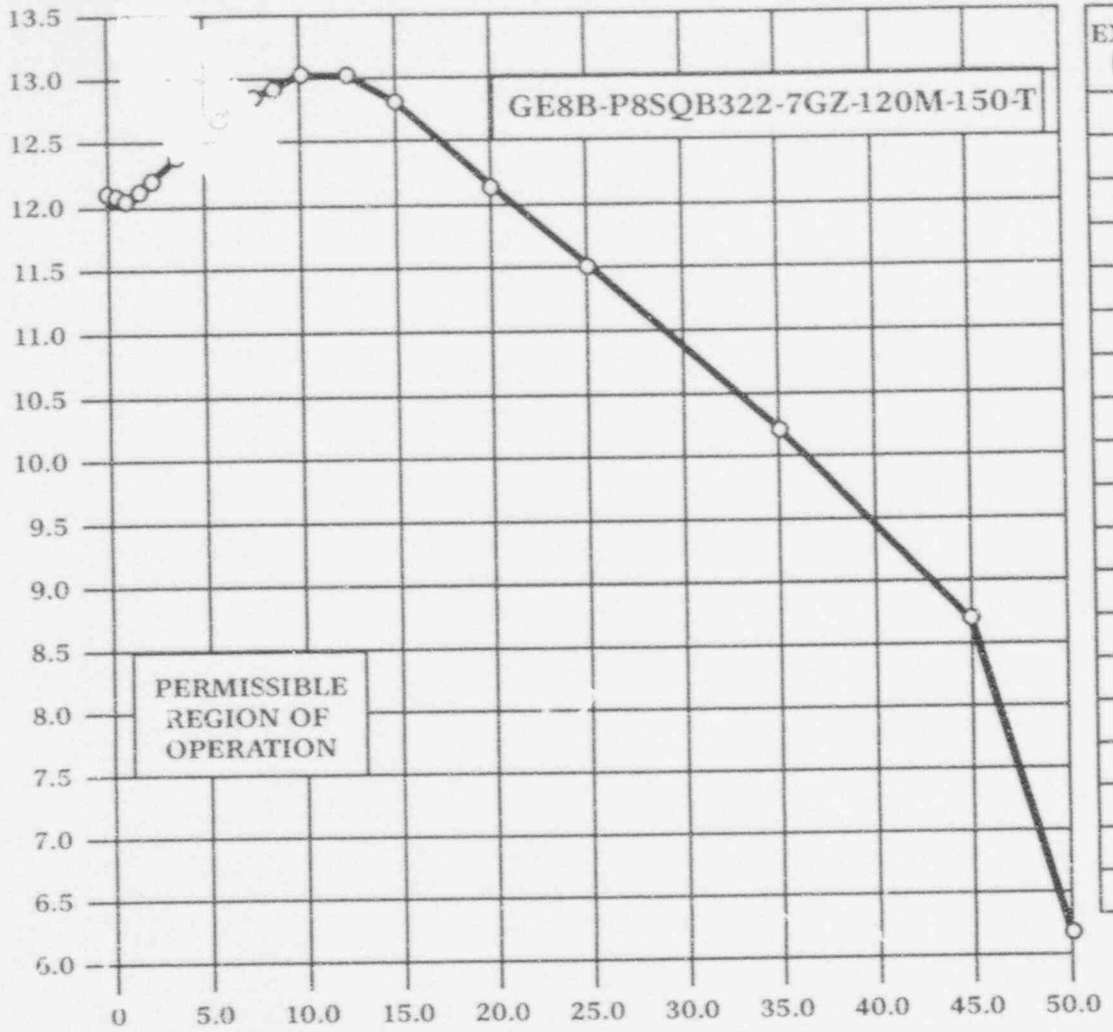
AVERAGE PLANAR EXPOSURE (GWd/t)

EXPOSURE (GWd/t)	MAPLHGR (kW/ft)
0.0	11.75
0.2	11.78
1.0	11.83
2.0	11.91
3.0	12.02
4.0	12.17
5.0	12.32
6.0	12.44
7.0	12.56
8.0	12.70
9.0	12.84
10.0	12.97
12.5	13.00
15.0	12.73
20.0	12.10
25.0	11.48
35.0	10.23
45.0	8.66
50.0	6.16

MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (MAPLHGR) VERSUS AVERAGE PLANAR EXPOSURE, GE8x8EB

FUEL TYPE GE8B-P8SQB320-9GZ-120M-150-T

Notes:
1. Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
2. This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 5.

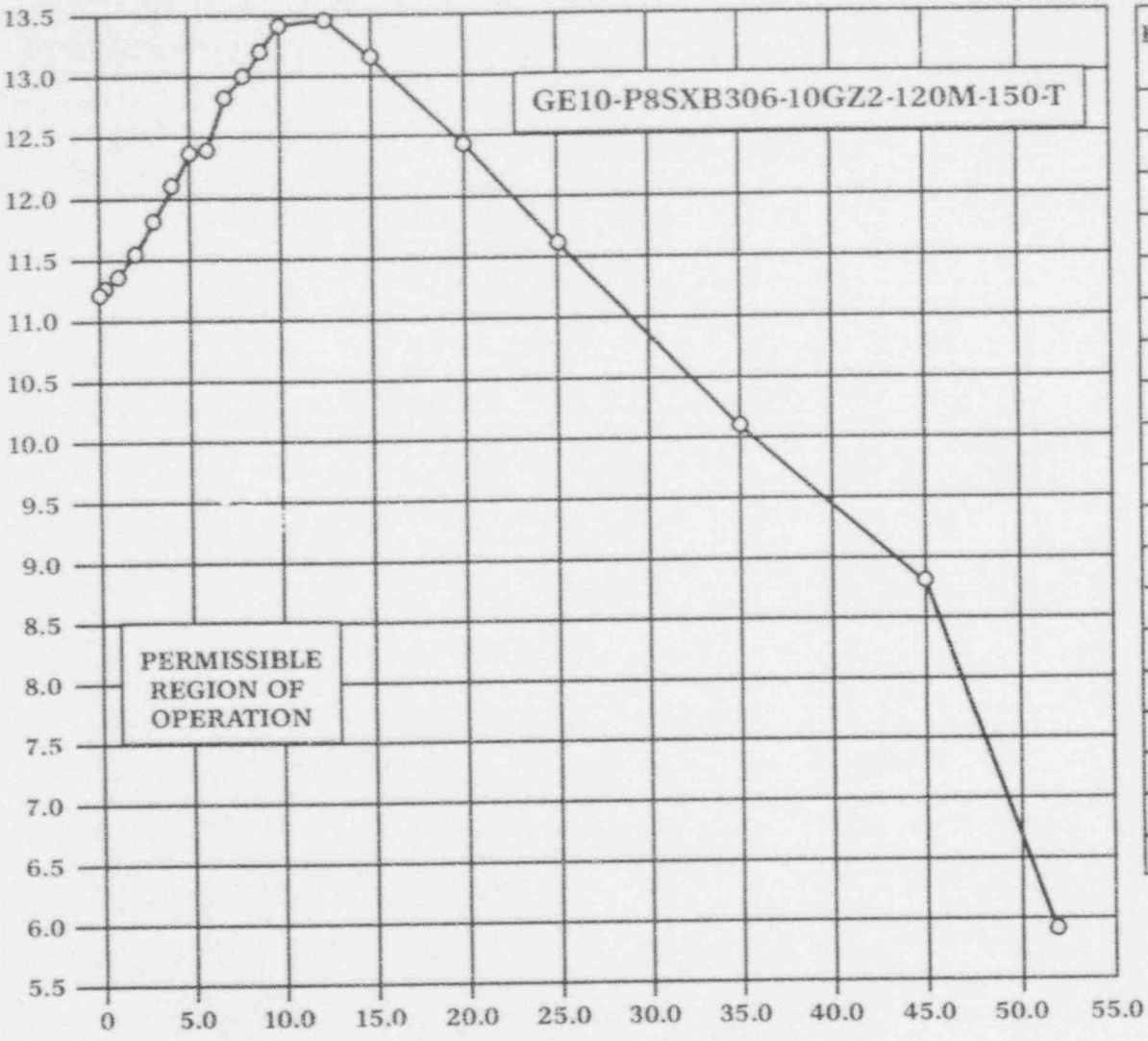


EXPOSURE (GWd/t)	MAPLHGR (kW/ft)
0.0	12.11
0.2	12.10
1.0	12.09
2.0	12.16
3.0	12.28
4.0	12.42
5.0	12.58
6.0	12.67
7.0	12.75
8.0	12.83
9.0	12.92
10.0	13.02
12.5	13.07
15.0	12.79
20.0	12.19
25.0	11.56
35.0	10.29
45.0	8.77
50.0	6.27

MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (MAPLHGR) VERSUS AVERAGE PLANAR EXPOSURE, GE8x8EB

FUEL TYPE GE8B-P8SQB322-7GZ-120M-150-T

Notes:
1. Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
2. This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 5.



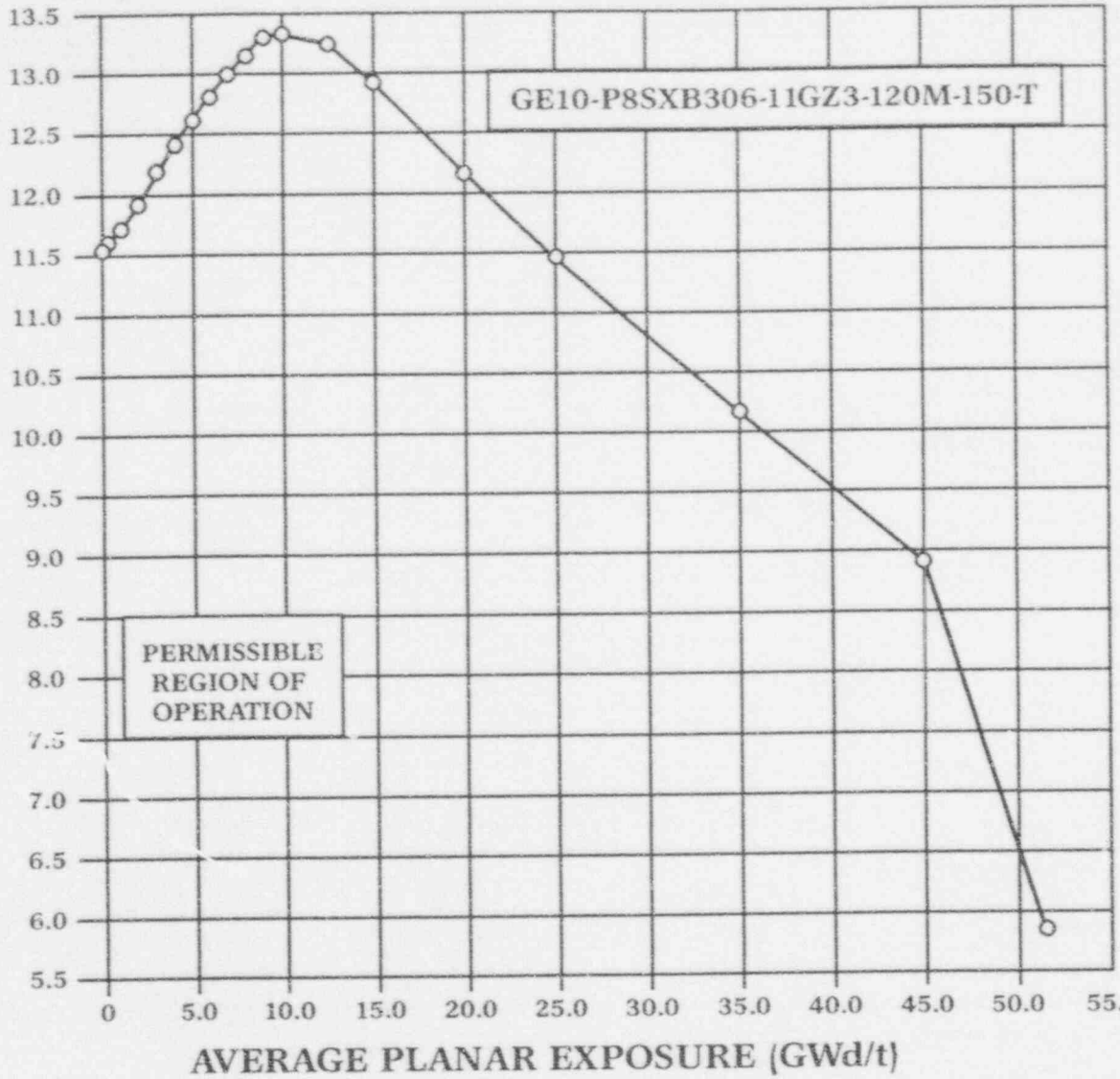
EXPOSURE (GWd/ST)	MAPLHGR (kW/ft)
0.0	11.21
0.2	11.26
1.0	11.36
2.0	11.56
3.0	11.81
4.0	12.08
5.0	12.35
6.0	12.57
7.0	12.80
8.0	13.00
9.0	13.20
10.0	13.37
12.5	13.45
15.0	13.14
20.0	12.40
25.0	11.61
35.0	10.12
45.0	8.83
52.1	5.87

Figure 3.2.1-7

MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (MAPLHGR) VERSUS AVERAGE PLANAR EXPOSURE, GE8x8NB-1

FUEL TYPE GE10-P8SXB306-10GZ2-120M-150T

Notes:
1. Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
2. This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 6.



EXPOSURE (GWd/ST)	MAPLHGR (kW/ft)
0.0	11.55
0.2	11.61
1.0	11.71
2.0	11.92
3.0	12.17
4.0	12.41
5.0	12.61
6.0	12.81
7.0	12.99
8.0	13.16
9.0	13.31
10.0	13.34
12.5	13.23
15.0	12.92
20.0	12.16
25.0	11.44
35.0	10.14
45.0	8.90
51.7	5.87

MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (MAPLHGR) VERSUS AVERAGE PLANAR EXPOSURE, GE8x8NB-1

FUEL TYPE GE10-P8SXB306-11GZ3-120M-150T

Notes:
1. Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
2. This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 6.

MINIMUM CRITICAL POWER RATIO (TS 3.2.2)

The MINIMUM CRITICAL POWER RATIO (MCPR) shall be equal to or greater than the $MCPR_f$, $MCPR_p$, and OLMCPR limits at the indicated core flow, THERMAL POWER, delta T* and core average exposure compared to the End of Cycle Exposure (EOCE)** as specified in Figures 3.2.2-1 through 3.2.2-7.

NOTE: MCPR limits are fuel type dependent and delta T dependent. The $MCPR_f$ and $MCPR_p$ limits are applicable for all core average exposures, nominal rated feedwater temperature (420°F), and all core flows less than or equal to 105% core flow. For planned reduction of rated feedwater temperature from rated feedwater temperature (420°F), increase the appropriate OLMCPR limits by the following:

FW Temperature ***	GE8X8EB	GE8X8NB-1
420 to 370°F	0.0	0.0
420 to 320°F	0.0	0.0
420 to 250°F	0.0	0.0

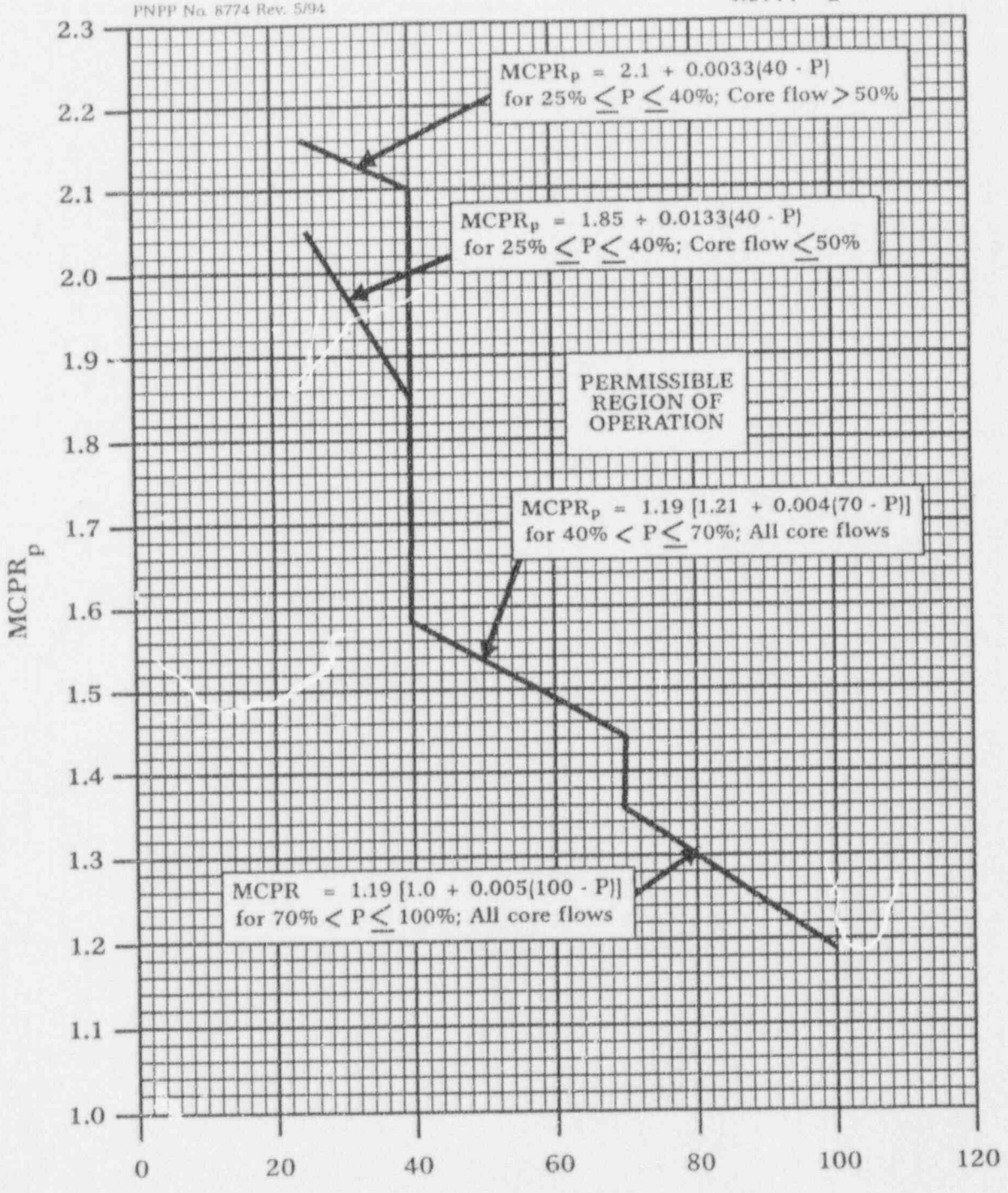
OLMCPR, operating limit MCPR	
GE8B-P8SQB301-5GZ-120M-150-T	1.19
GE8B-P8SQB301-7GZ-120M-150-T	1.19
GE8B-P8SQB320-9GZ-120M-150-T	1.19
GE8B-P8SQB322-7GZ-120M-150-T	1.19
GE10-P8SXB306-10GZ2-120M-150-T	1.22
GE10-P8SXB306-11GZ3-120M-150-T	1.22

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

* This delta T refers to the planned reduction of rated feedwater temperature from nominal rated feedwater temperature (420°F), such as prolonged removal of feedwater heater(s) from service.

** End of Cycle Exposure (EOCE), is defined as 1) the core average exposures at which there is no longer sufficient reactivity to achieve RATED THERMAL POWER with rated core flow, all control rods withdrawn, all feedwater heaters in service and equilibrium Xenon, or 2) as specified by the fuel vendor.

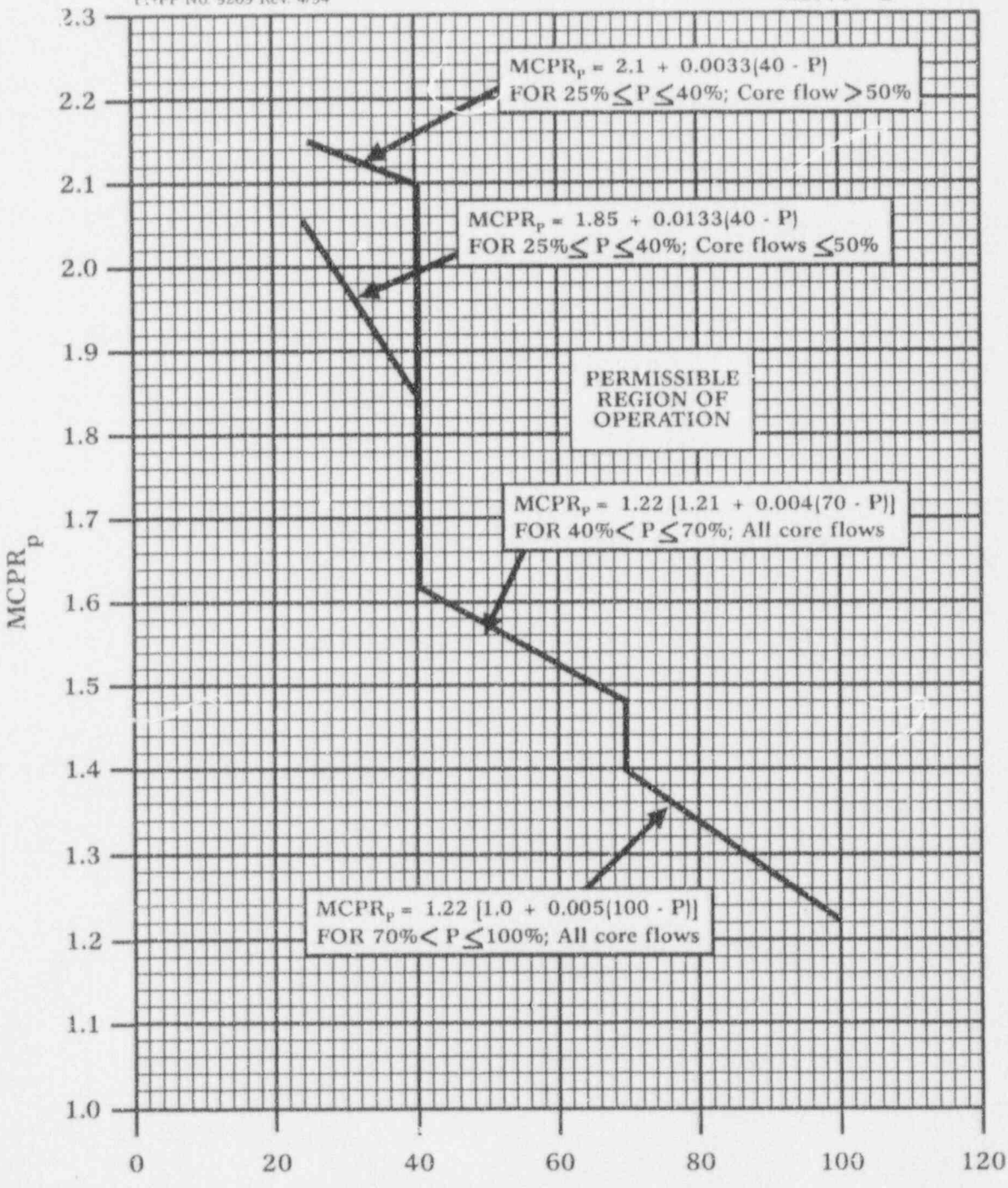
*** Partial feedwater heating to 320°F during the cycle with final feedwater temperature reduction to 250°F after ALL RODS OUT at end of cycle.



POWER DEPENDENT MCPR LIMIT
(MCPR$_p$)
FUEL TYPE GE8X8EB

Figure 3.2.2-1

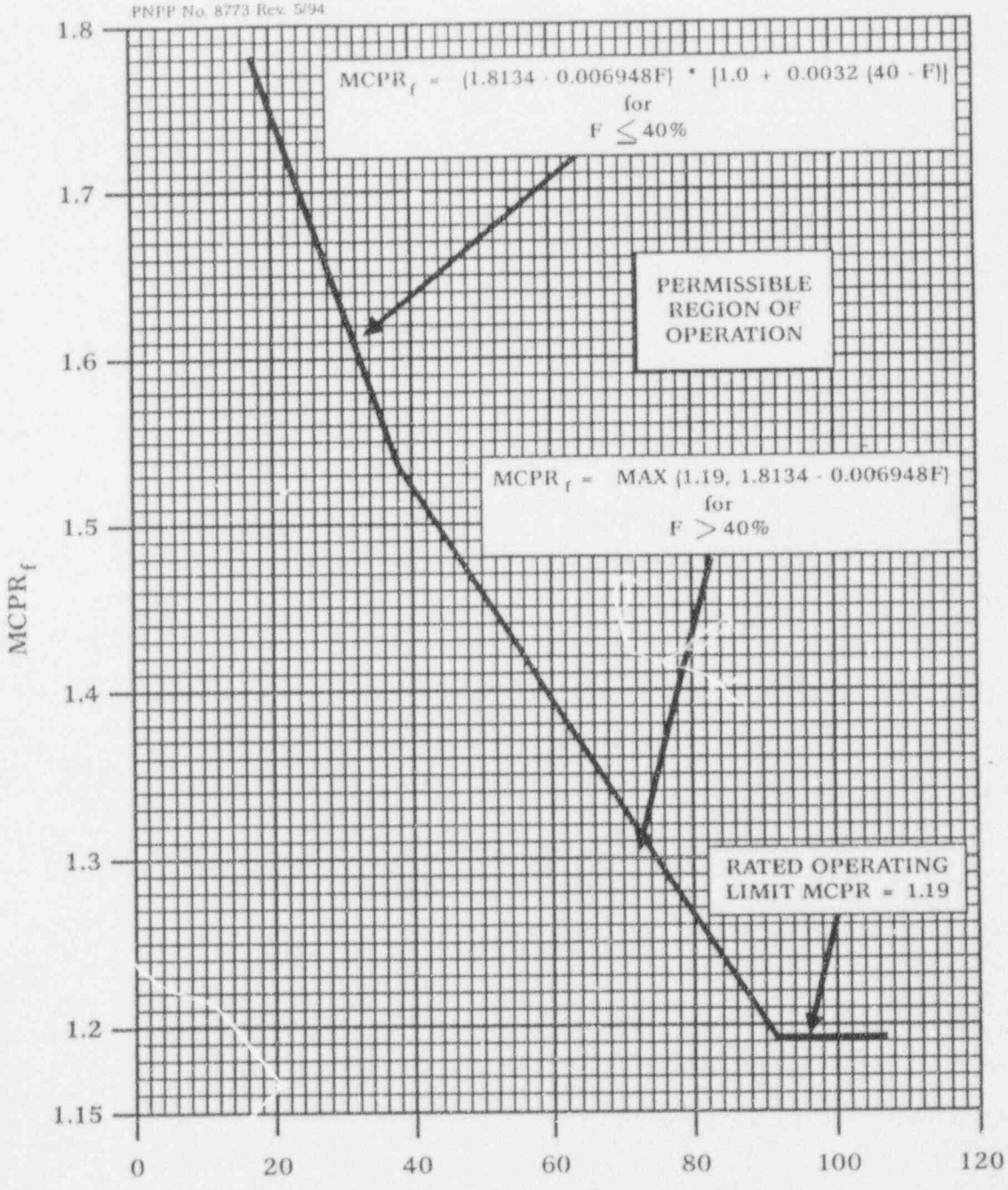
(See Note Page 13)



POWER DEPENDENT MCPR LIMIT
(MCPR$_p$)
FUEL TYPE: GE8 x 8NB - 1

Figure 3.2.2-2

(See Note Page 13)



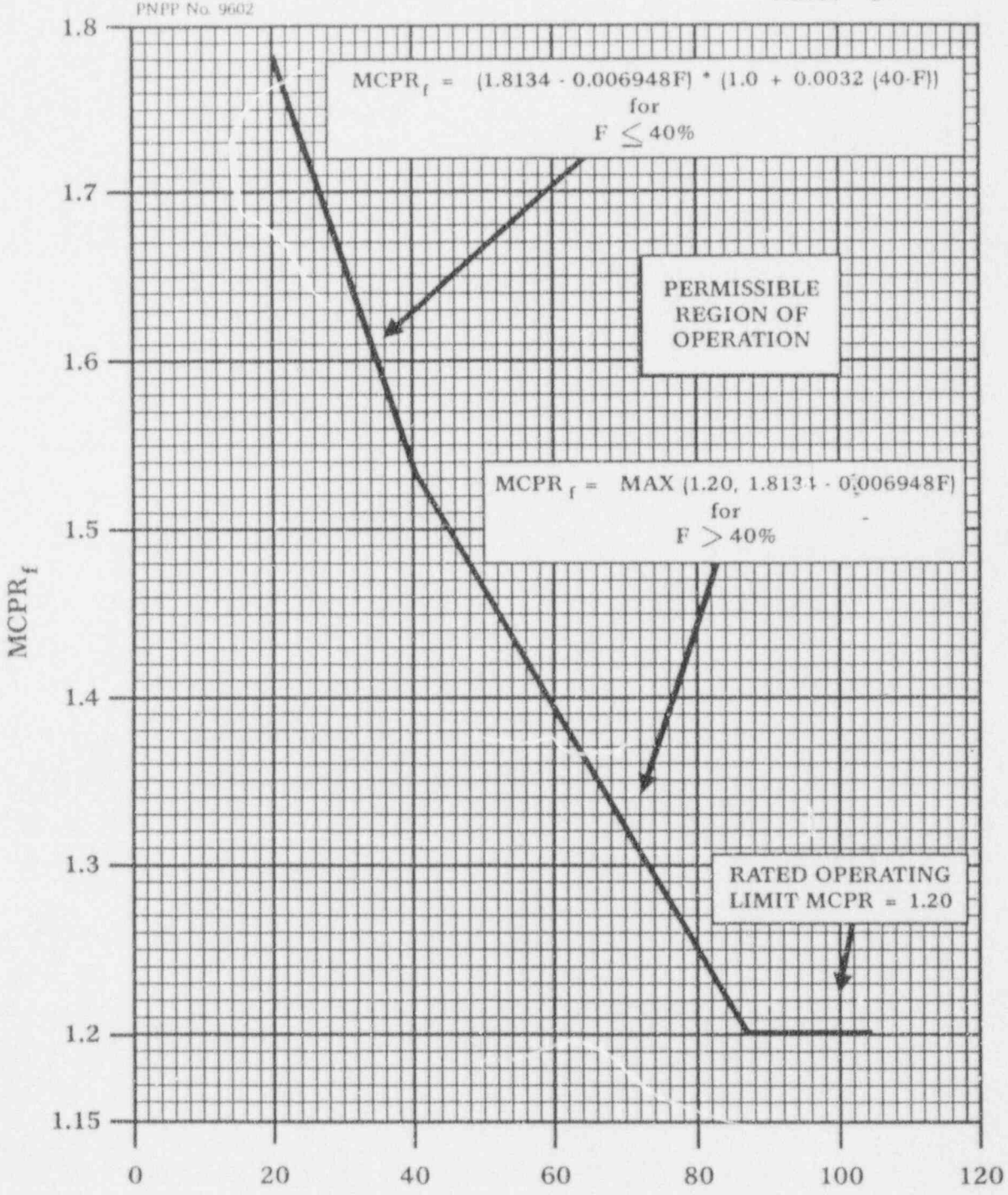
FLOW DEPENDENT MCPR LIMIT
(MCPR$_f$)

FUEL TYPE GE8B-P8SQB301-5GZ-120M-150T

Figure 3.2.2-3

(See Note Page 13)
Includes Rotated Bundle Analysis results.

PNPP No. 9602

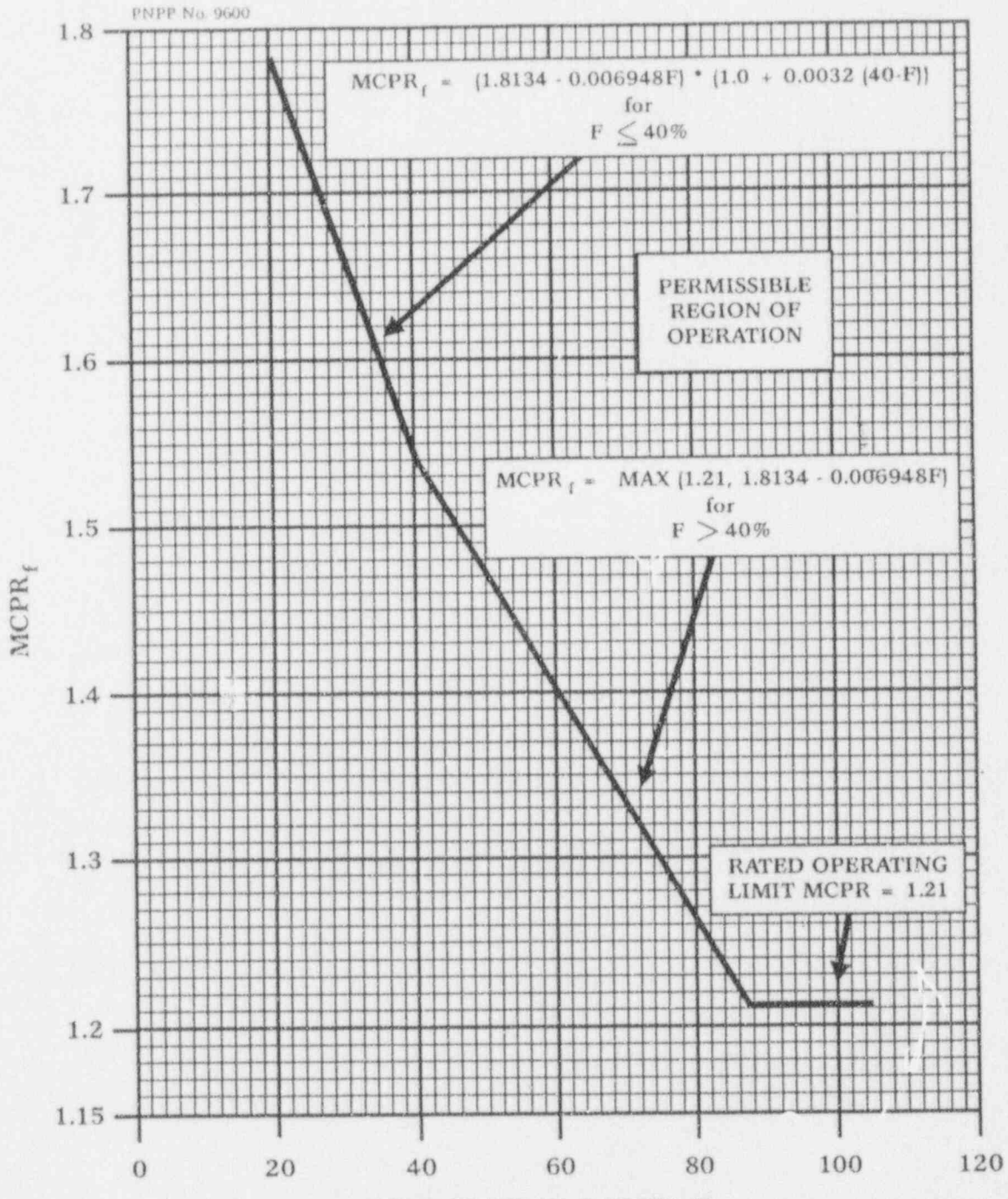


FLOW DEPENDENT MCPR LIMIT
(MCPR$_f$)

FUEL TYPE: GE8-P8SQB301-7GZ-120M-150T

Figure 3.2.2-4

(See Note Page 13)
Includes Rotated Bundle Analysis results.



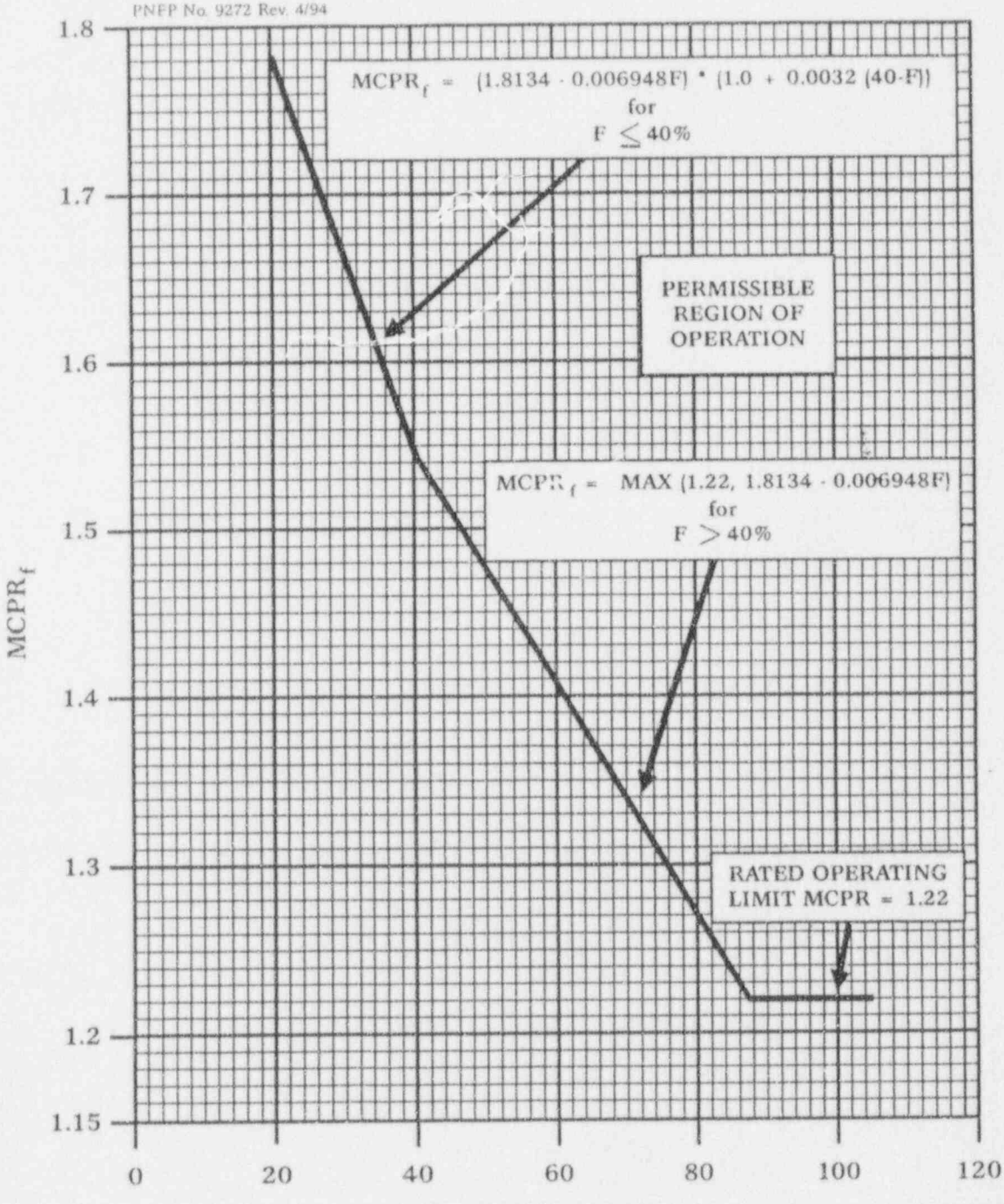
FLOW DEPENDENT MCPR LIMIT
(MCPR$_f$)

FUEL TYPE: GE8B-P8SQB320-9GZ-120M-150T
GE8B-P8SQB322-7GZ-120M-150T

Figure 3.2.2-5

(See Note Page 13)
Includes Rotated Bundle Analysis results.

PNFP No. 9272 Rev. 4/94

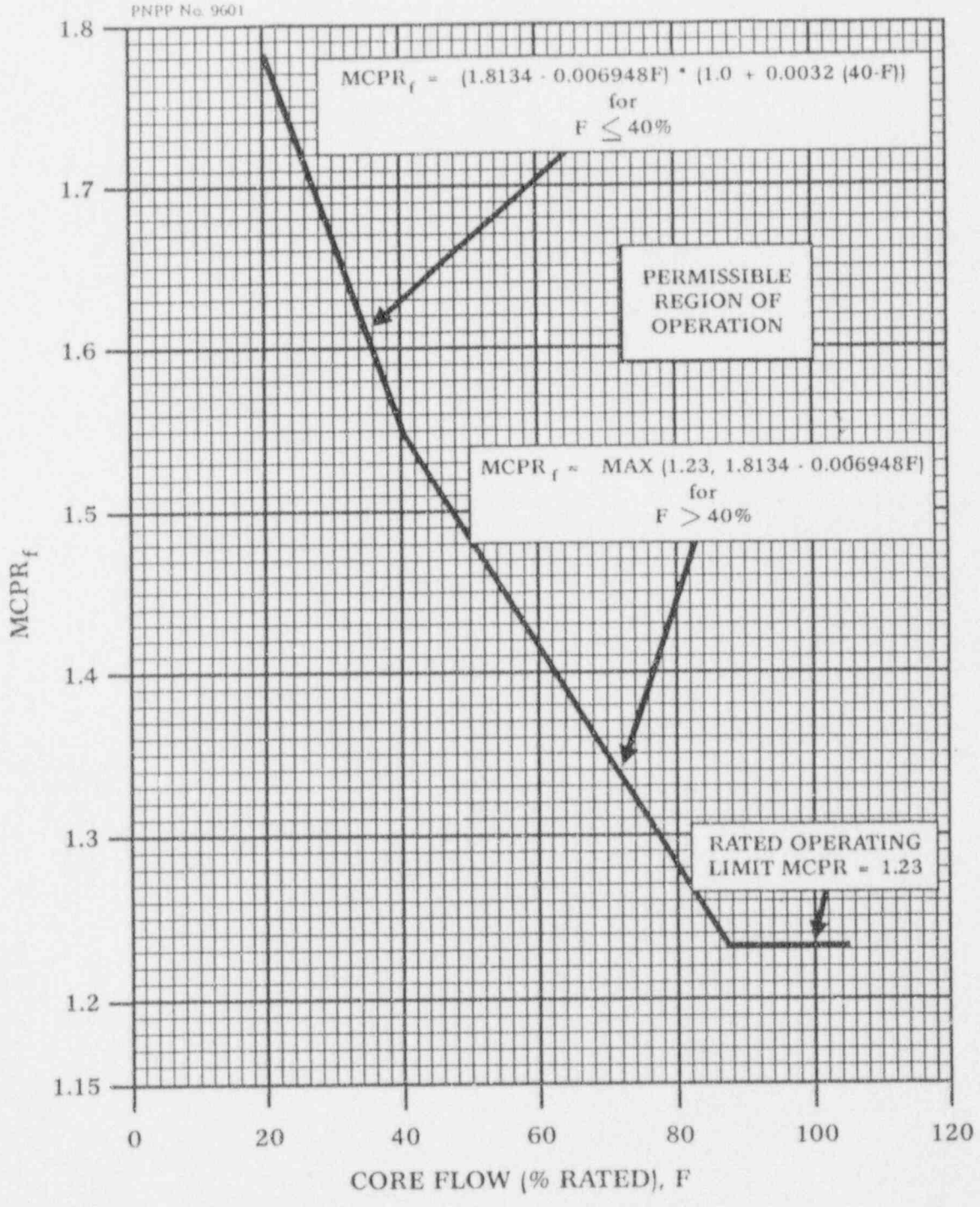


FLOW DEPENDENT MCPR LIMIT
(MCPR$_f$)

FUEL TYPE: GE10-P8SXB306-10GZ2-120M-150T

Figure 3.2.2-6

(See Note Page 13)
Includes Rotated Bundle Analysis results.



FLOW DEPENDENT MCPR LIMIT
(MCPR$_f$)

FUEL TYPE: GE10-P8SXB306-11GZ3-120M-150T

Figure 3.2.2-7

(See Note Page 13)
Includes Rotated Bundle Analysis results.

LINEAR HEAT GENERATION RATE (TS 3.2.3)

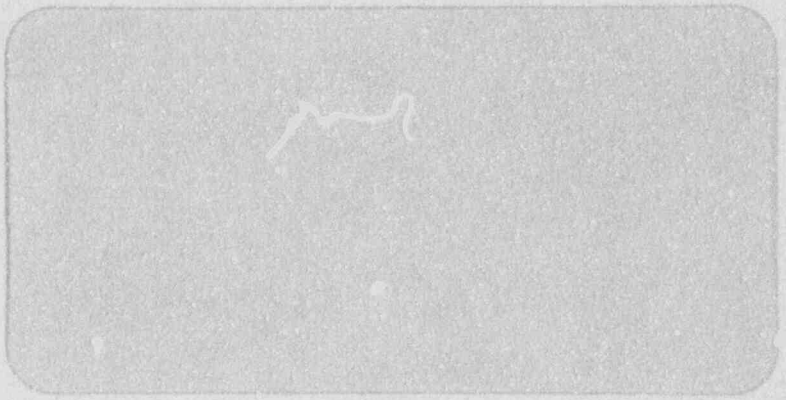
The LINEAR HEAT GENERATION RATE (LHGR) shall not exceed:

a. 14.4 kw/ft. for the following fuel types:

1. GE8B-P8SQB301-7GZ-120M-150-T (BS301E) (GE8X8EB)
2. GE8B-P8SQB301-5GZ-120M-150-T (BS301F) (GE8X8EB)
3. GE8B-P8SQB320-9GZ-120M-150-T (GE8X8EB)
4. GE8B-P8SQB322-7GZ-120M-150-T (GE8X8EB)
5. GE10-P8SXB306-10GZ2-120M-150-T (GE8X8NB-1)
6. GE10-P8SXB306-11GZ3-120M-150-T(GE8X8NB-1)

REACTOR PROTECTION SYSTEM INSTRUMENTATION (TS 3.3.1)

The simulated thermal power time constant shall be 6±0.6 seconds.



Enclosure 1

Supplemental Reload Licensing Report for the

Perry Nuclear Power Plant Unit 1 (23A7227 Rev. 0) Reload 4, Cycle 5