

**GEORGIA POWER COMPANY
EDWIN I. HATCH NUCLEAR PLANT**

**UNIT 1 FUEL CYCLE 16
CORE OPERATING LIMITS REPORT**

REVISION 2

Southern Nuclear Operating Company
Post Office Box 1295
Birmingham, Alabama 35201

9512050012 95112B
PDR ADCK 05000321
P PDR

**EDWIN I. HATCH NUCLEAR PLANT
UNIT 1 FUEL CYCLE 16
CORE OPERATING LIMITS REPORT**

EFFECTIVE PAGE LIST

Unless noted otherwise, all pages are Revision 1.

<u>Page Number</u>	<u>Revision</u>
16	2

EDWIN I. HATCH NUCLEAR PLANT
UNIT 1 FUEL CYCLE 16
CORE OPERATING LIMITS REPORT

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
1.0	Introduction	1
2.0	Rod Block Monitor	1
3.0	APLHGR Limit	2
4.0	MCPR Limit	11
5.0	APRM Simulated Thermal Power Monitor Time Constant	18
6.0	References	18

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

<u>Figure No.</u>	<u>Title</u>	<u>Page</u>
3-1	MAPFAC _F	3
3-2	MAPFAC _P	4
3-3	APLHGR Versus Average Planar Exposure (BP8DRB284H)	5
3-4	APLHGR Versus Average Planar Exposure (GE9B-P8DWB330-10GZ-80M-150-T)	6
3-5	APLHGR Versus Average Planar Exposure (GE9B-P8DWB315-8G4.0-80M-150-T)	7
3-6	APLHGR Versus Average Planar Exposure (GE9B-P8DWB314-8G4.0-80M-150-T)	8
3-7	APLHGR Versus Average Planar Exposure (GE9B-P8DWB331-10GZ-80M-150-T)	9
3-8	APLHGR Versus Average Planar Exposure (GE13-P9HTB327-12GZ-100M-146-T-RECON)	10
4-1	Power-Dependent MCPR Multiplier (K _P)	14
4-2	Flow-Dependent MCPR Limits (MCPR _F)	15
4-3	MCPR Limit as Function of Average Scram Time (with Turbine Bypass Valves Operable and with either EOC-RPT System Operable or with EOC-RPT System Inoperable up to EOC - 2,000 MWd/st)	16
4-4	MCPR Limit as Function of Average Scram Time (with Turbine Bypass Valves Operable and with EOC-RPT System Inoperable during the last 2,000 MWd/st of the Operating Cycle)	17

TABLE OF CONTENTS (Continued)

LIST OF TABLES

<u>Table No.</u>	<u>Title</u>	<u>Page</u>
4-1	TABLE OF OPERATING FLEXIBILITY OPTIONS APPLICABILITY	13

**EDWIN I. HATCH NUCLEAR PLANT
UNIT 1 FUEL CYCLE 16
CORE OPERATING LIMITS REPORT**

1.0 INTRODUCTION

The Core Operating Limits Report (COLR) for Plant Hatch Unit 1 Cycle 16 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 and 2). Results from the fuel vendor's reload analyses for the fuel in Unit 1 Cycle 16 are documented in References 3 and 4.

The following cycle-specific core operating limits are included in this report:

- a. **Control Rod Block Instrumentation** - Technical Specification 3.3.2.1.
- b. **Average Planar Linear Heat Generation Rate (APLHGR)** - Technical Specification 3.2.1.
- c. **Minimum Critical Power Ratio (MCPR)** - Technical Specification 3.2.2. and 3.3.2.1.
- d. **APRM Flow Biased Simulated Thermal Power - High, time constant** - Technical Specifications Surveillance Requirement SR 3.3.1.1.14.

2.0 ROD BLOCK MONITOR (Technical Specification 3.3.2.1)

Both Rod Block Monitor (RBM) channels shall be operable as specified in Technical Specification 3.3.2.1 and when:

- a. THERMAL POWER is $\geq 29\%$ and $< 90\%$ of RATED THERMAL POWER, and the MCPR is < 1.70 .

or

- b. THERMAL POWER is $\geq 90\%$ of RATED THERMAL POWER and the MCPR is < 1.40 .

3.0 APLHGR LIMIT (Technical Specification 3.2.1)

The APLHGR limit for each fuel type is given by the applicable rated-power, rated-flow APLHGR limit taken from Figures 3-3 through 3-8, multiplied by the smaller of either:

- a. The flow dependent multiplier, $MAPFAC_F$ from Figure 3-1,

or

- b. The power dependent multiplier, $MAPFAC_P$ from Figure 3-2.

For the fuel types whose APLHGR limits are shown in Figures 3-3 through 3-8, the APLHGR limit shall be applied to each axial location in the fuel assembly.

As required by GESTAR (Reference 1), the hand-calculated APLHGR values for a multi-lattice (i.e., GE9-330, GE9-331, and GE13-LUA) fuel must be less than or equal to the APLHGR limits shown in Figures 3-4, 3-7 and 3-8, respectively. When APLHGR values are determined by the process computer, the lattice-dependent APLHGR limits are used. Under these conditions, some axial locations may have APLHGR values exceeding the values shown in Figures 3-4, 3-7, and 3-8.

Plant Hatch Unit 1 Fuel Cycle 16
 Core Operating Limits Report

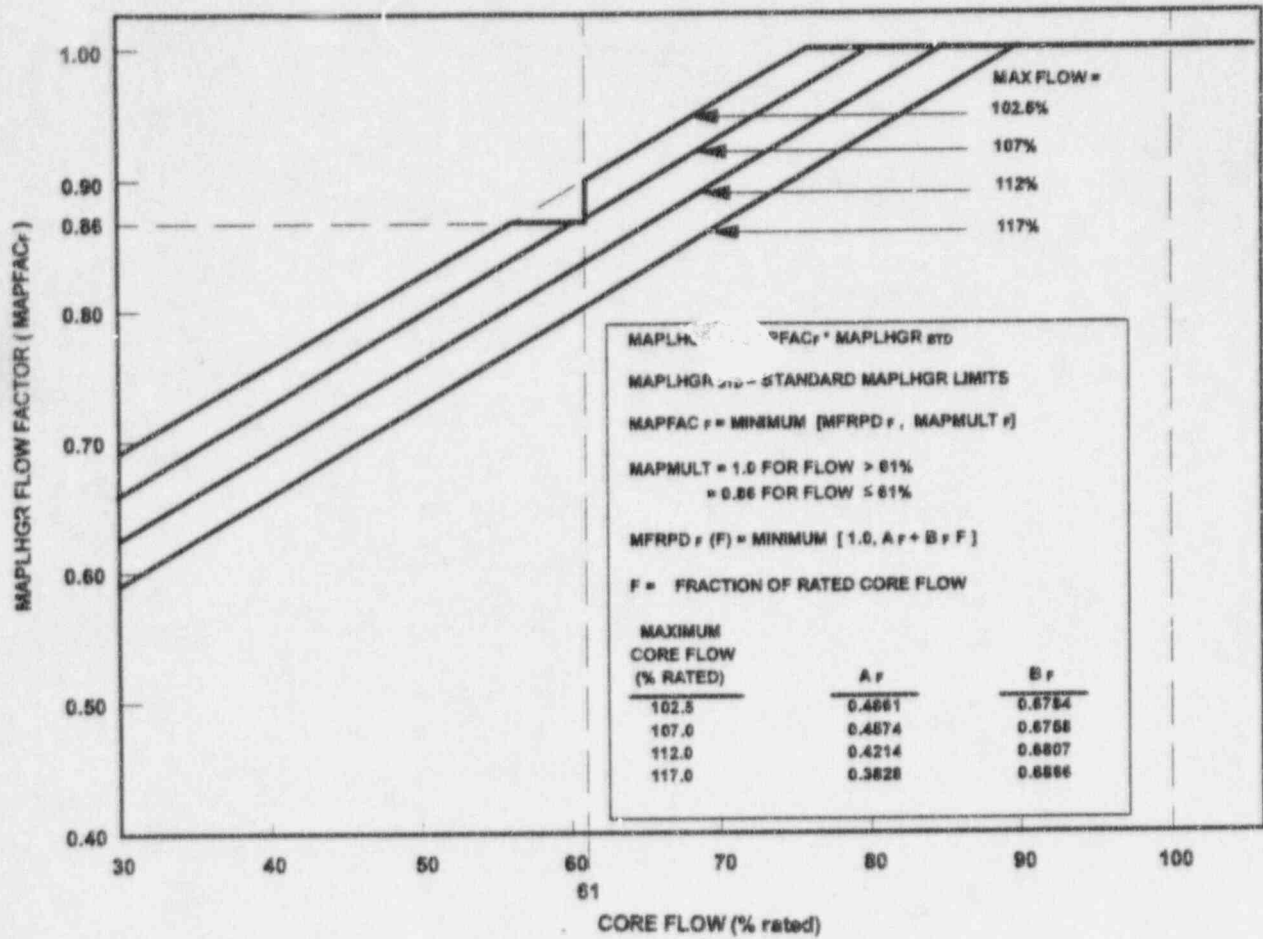


FIGURE 3-1

MAPFAC_F

Plant Hatch Unit 1 Fuel Cycle 16
 Core Operating Limits Report

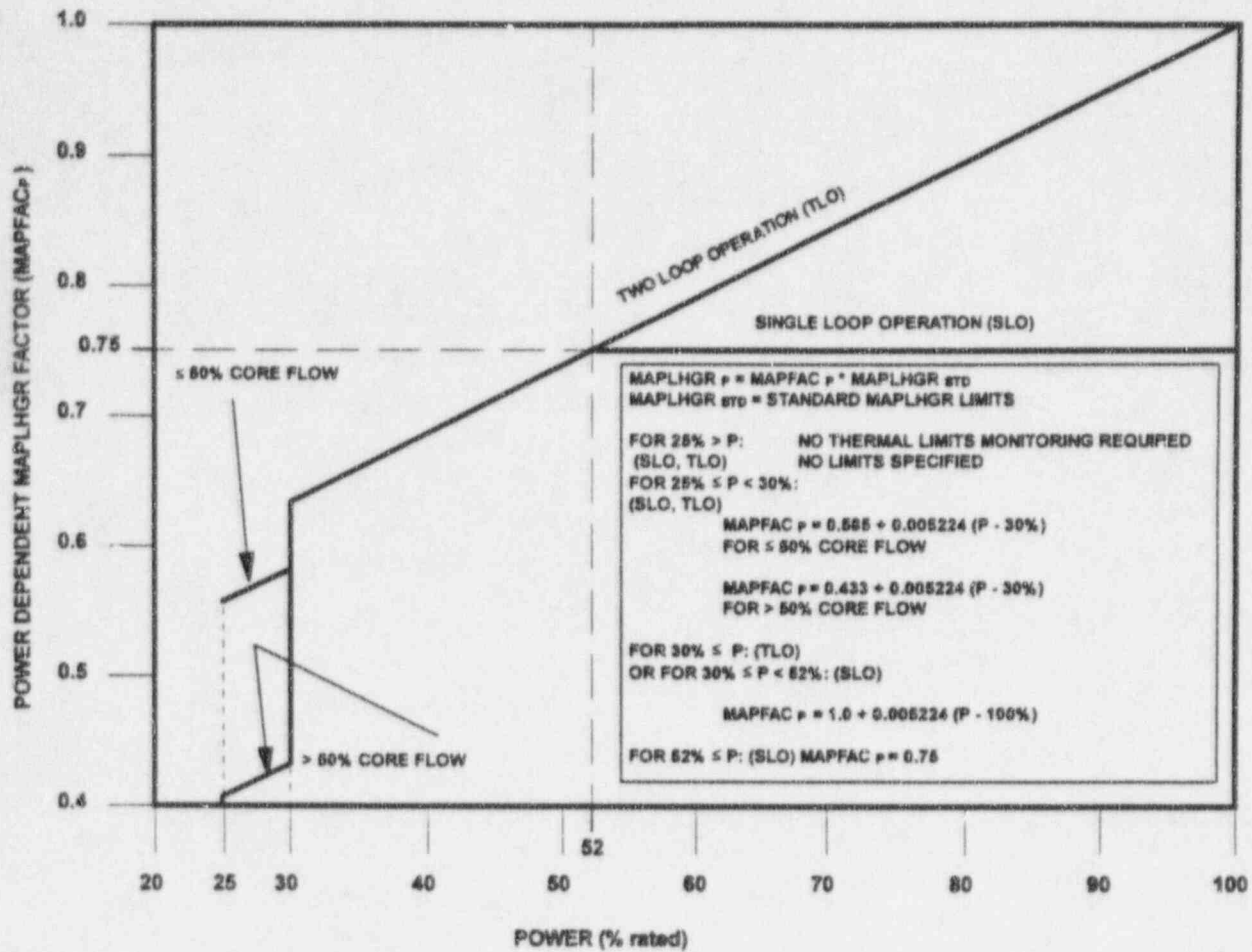


FIGURE 3-2

MAPFAC_p

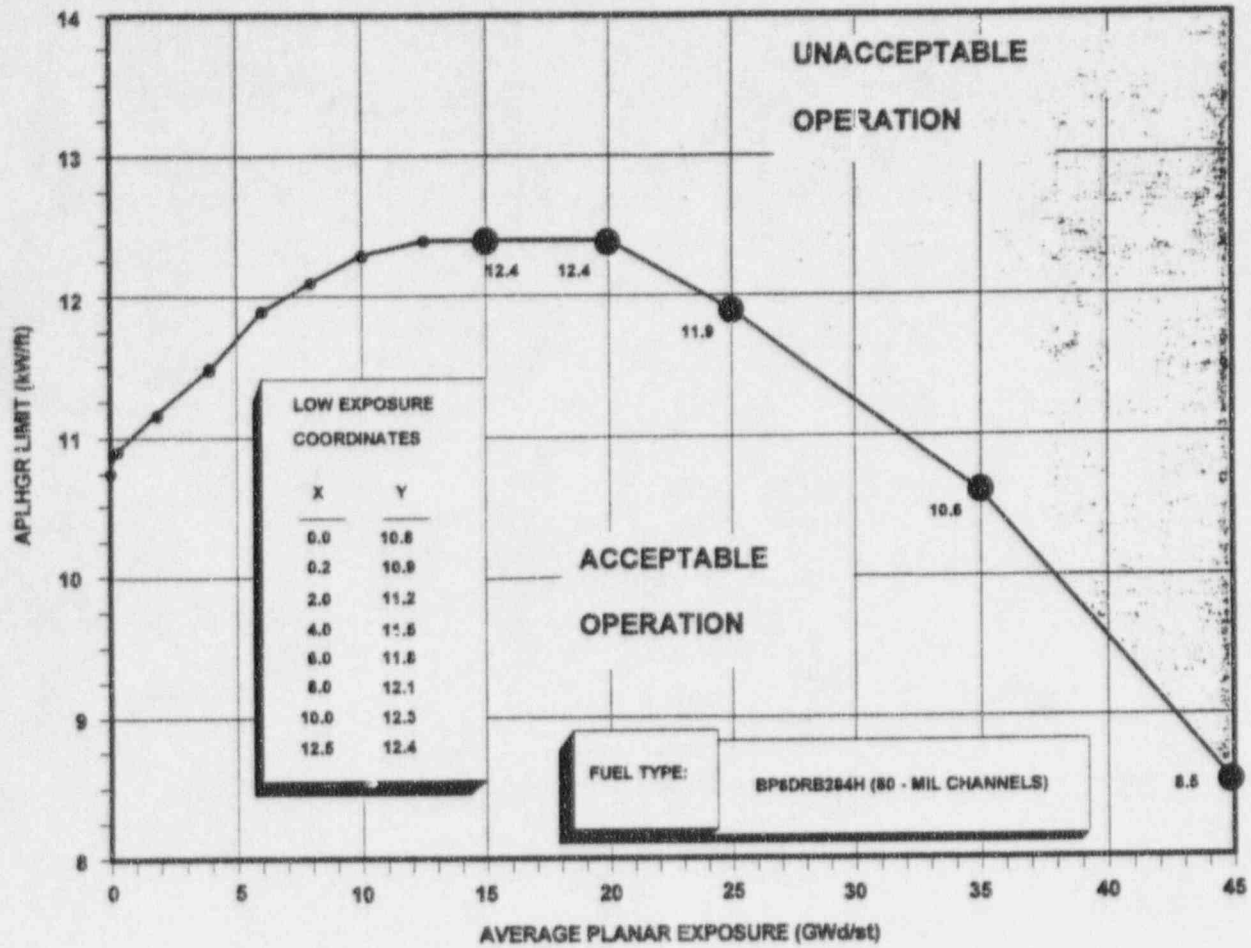


FIGURE 3-3
 AVERAGE PLANAR LINEAR HEAT GENERATION RATE
 VERSUS
 AVERAGE PLANAR EXPOSURE
 (Fuel Type: BP8DRB284H)

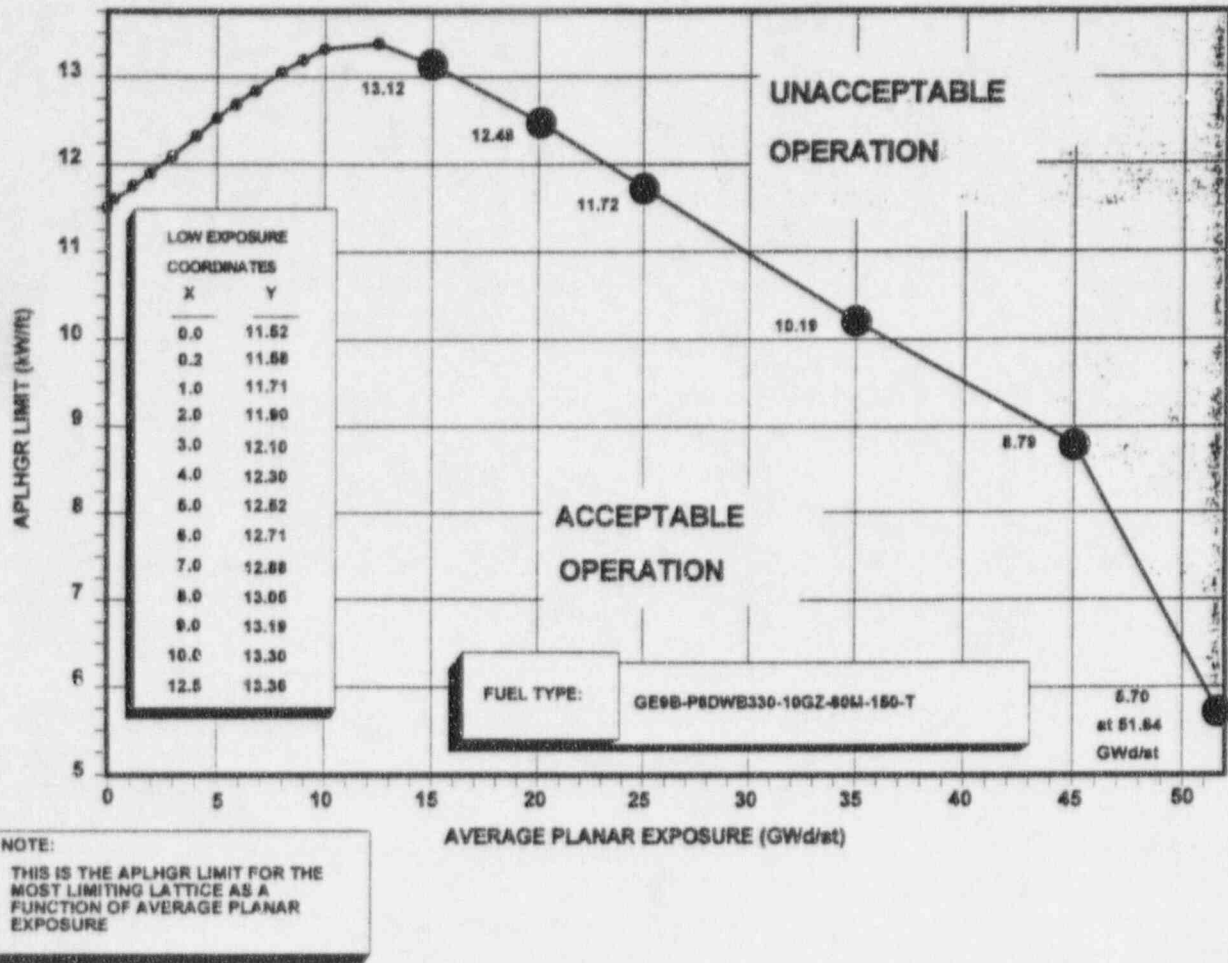


FIGURE 3-4

AVERAGE PLANAR LINEAR HEAT GENERATION RATE
 VERSUS
 AVERAGE PLANAR EXPOSURE
 (Fuel Type: GE9B-P8DWB330-10GZ-80M-150-T)

Plant Hatch Unit 1 Fuel Cycle 16
 Core Operating Limits Report

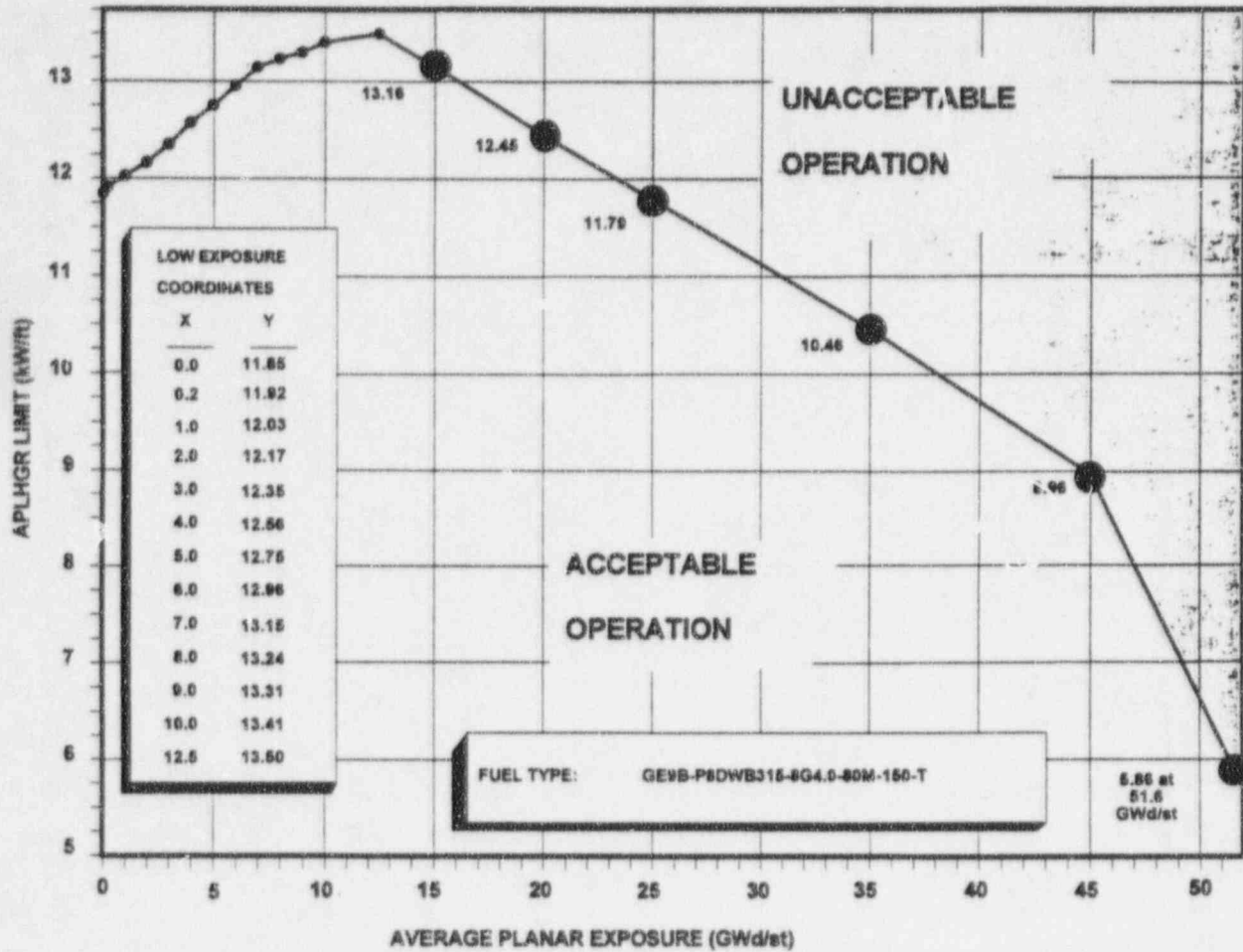


FIGURE 3-5

AVERAGE PLANAR LINEAR HEAT GENERATION RATE
 VERSUS
 AVERAGE PLANAR EXPOSURE
 (Fuel Type: GE9B-P8DWB315-8G4.0-80M-150-T)

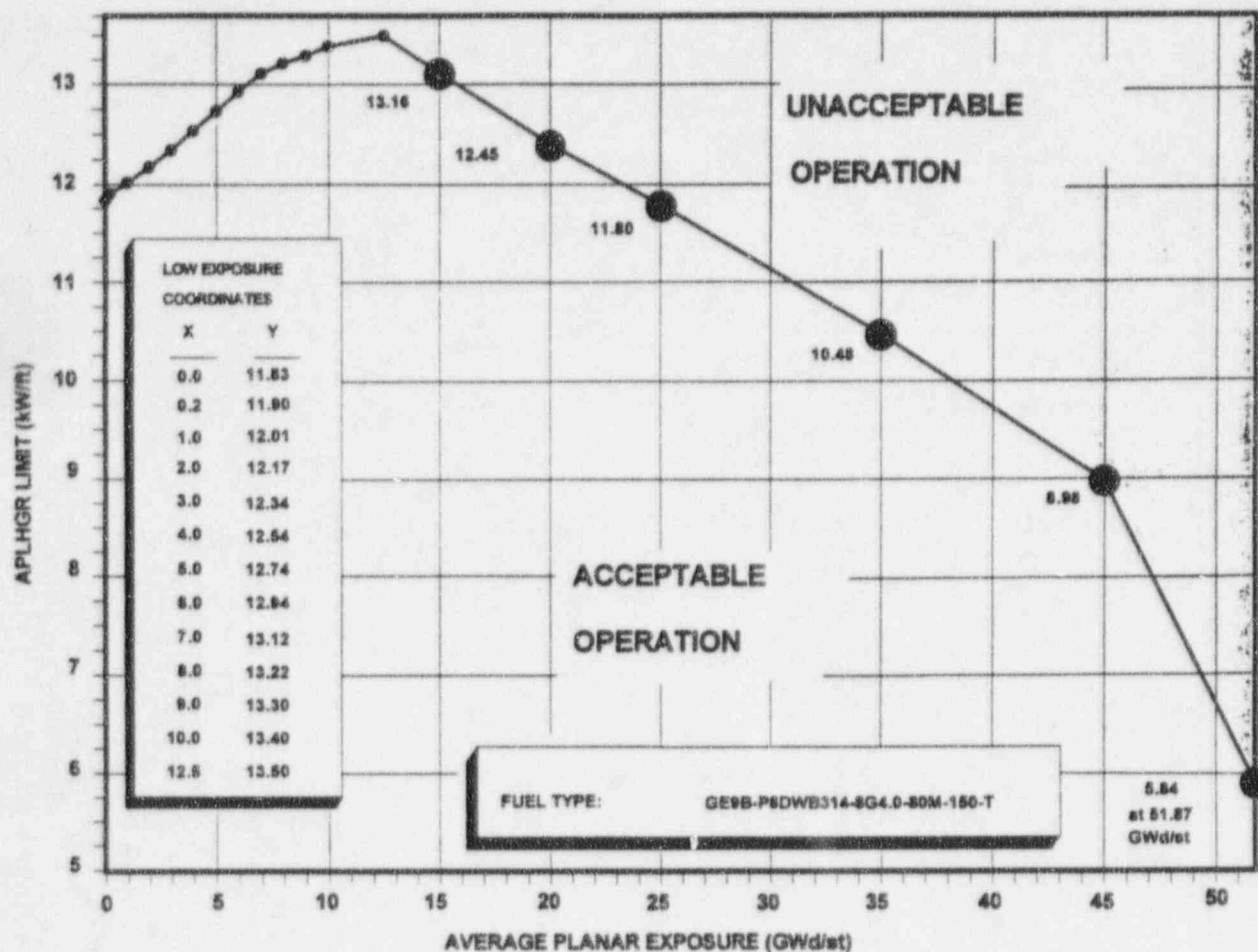


FIGURE 3-6

AVERAGE PLANAR LINEAR HEAT GENERATION RATE
 VERSUS
 AVERAGE PLANAR EXPOSURE
 (Fuel Type: GE9B-P8DWB314-8G4.0-80M-150-T)

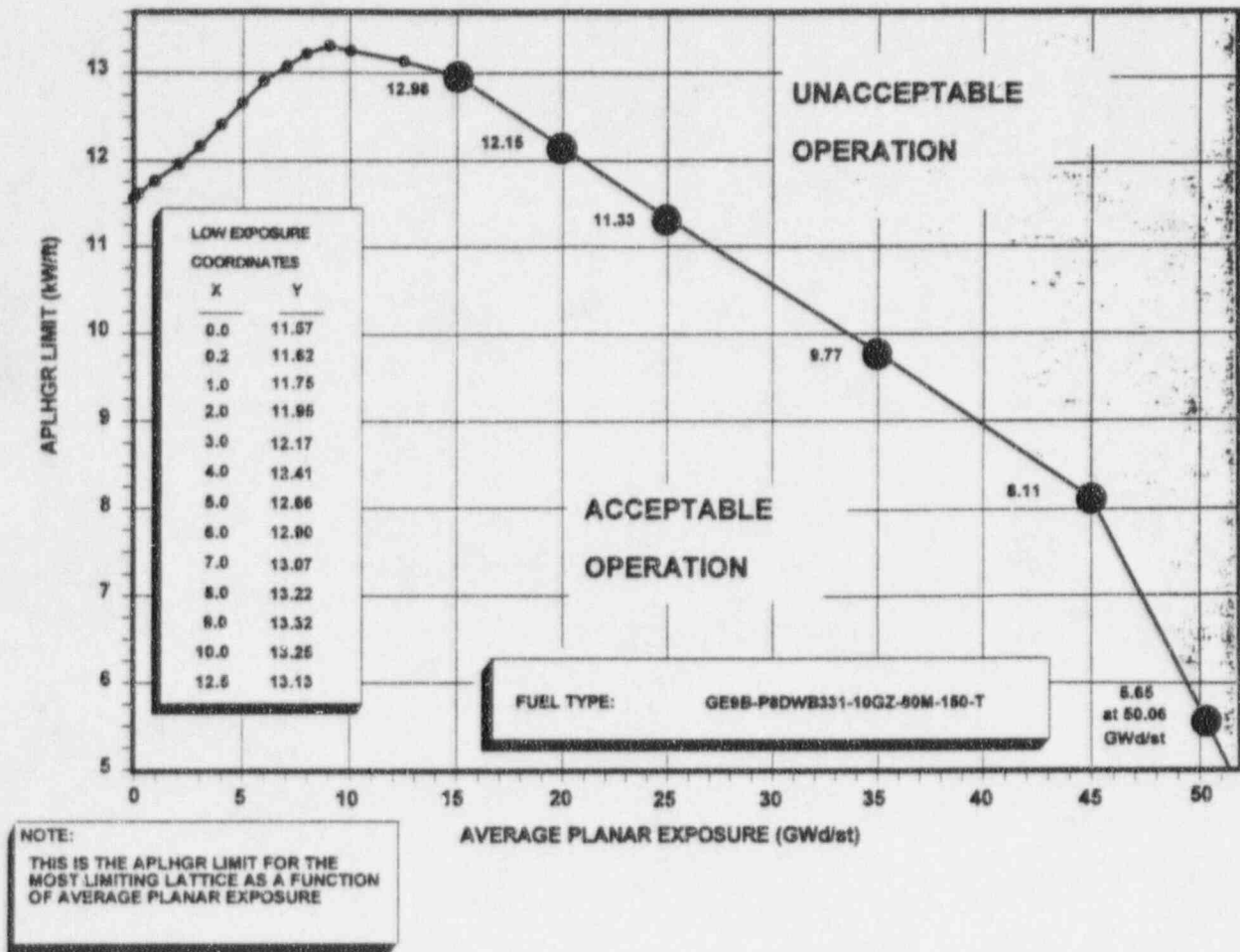


FIGURE 3-7

AVERAGE PLANAR LINEAR HEAT GENERATION RATE
 VERSUS
 AVERAGE PLANAR EXPOSURE
 (Fuel Type: GE9B-P8DWB331-10GZ-80M-150-T)

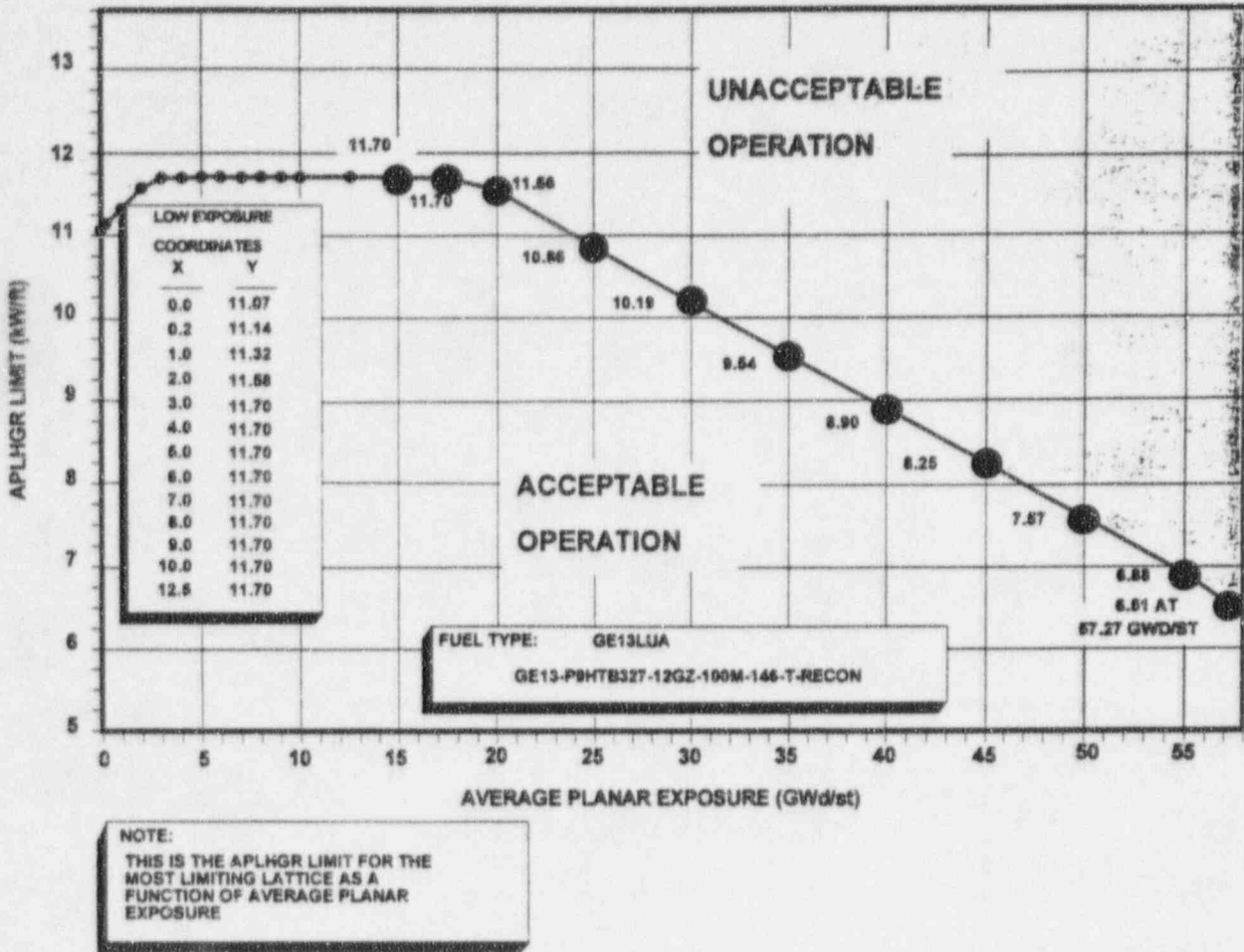


FIGURE 3-8

**AVERAGE PLANAR LINEAR HEAT GENERATION RATE
 VERSUS
 AVERAGE PLANAR EXPOSURE**
(Fuel Type: GE13-P9HTB327-12GZ-100M-146-T-RECON)

4.0 MCPR LIMIT (Technical Specification 3.2.2)

The MCPR operating limit (OLMCPR) is a function of core power, core flow, average scram time, fuel type, number of operating recirculation loops, operability of end-of-cycle recirculation pump trip (EOC-RPT) system, and operability of turbine bypass valves.

With both recirculation pumps in operation (TLO), the OLMCPR for each fuel type with various combinations of equipment operability, scram times, core flow and core power is determined as follows:

For $25\% \leq \text{power} < 30\%$, the OLMCPR is given in Figure 4-1.

For power $\geq 30\%$, the OLMCPR is the greater of either:

A) The flow-dependent MCPR limit determined from the applicable maximum core flow limit line of Figure 4-2,

or

B) The product of the values from Figures 4-1 and the applicable Figure 4-3 through 4-4 as determined by Table 4-1.

As stated in the note on Figures 4-3 through 4-4, with one recirculation pump operating (SLO), the calculated operating limit MCPR determined above, is increased by 0.01.

In Figures 4-3 through 4-4, Option A scram time MCPR limits correspond to $\tau = 1.0$, where τ is determined from scram time measurements performed in accordance with Technical Specification SR 3.1.4.1 and SR 3.1.4.2. Option B values correspond to $\tau = 0.0$. For scram times between Option A and Option B, the MCPR limit for each fuel type corresponds to τ . If τ has not been determined, Option A limits are to be used. Refer to Table 4-1 to determine the applicable set of fuel-type dependent curves.

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: $\tau_A = 1.084$ 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: $\mu = 0.822$ sec (mean scram time used in the transient analysis)

$\sigma = 0.018$ sec (standard deviation of μ)

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

where: n = number of surveillance tests performed to date in the cycle

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

τ_i = average scram time to notch 36 of all rods in the i th surveillance test

N_1 = total number of active rods measured in Technical Specifications Surveillance Requirement SR 3.1.4.1.

TABLE 4-1

TABLE OF OPERATING FLEXIBILITY OPTIONS APPLICABILITY

EOC RPT	WITH: Turbine Bypass Valves	USE:
Operable	Operable	Figure 4-3
Inoperable, BOC to EOC - 2000	Operable	Figure 4-3
Inoperable, EOC - 2000 to extended EOC	Operable	Figure 4-4
Operable	Inoperable	Not licensed for this operating cycle.
Inoperable	Inoperable	Not licensed for this operating cycle.

NOTE:

Operation within the licensed power / flow region with a single recirculation loop and intermittent operation with reduced feedwater temperature are included in the MCPR limits presented in Figures 4-3 through 4-4.

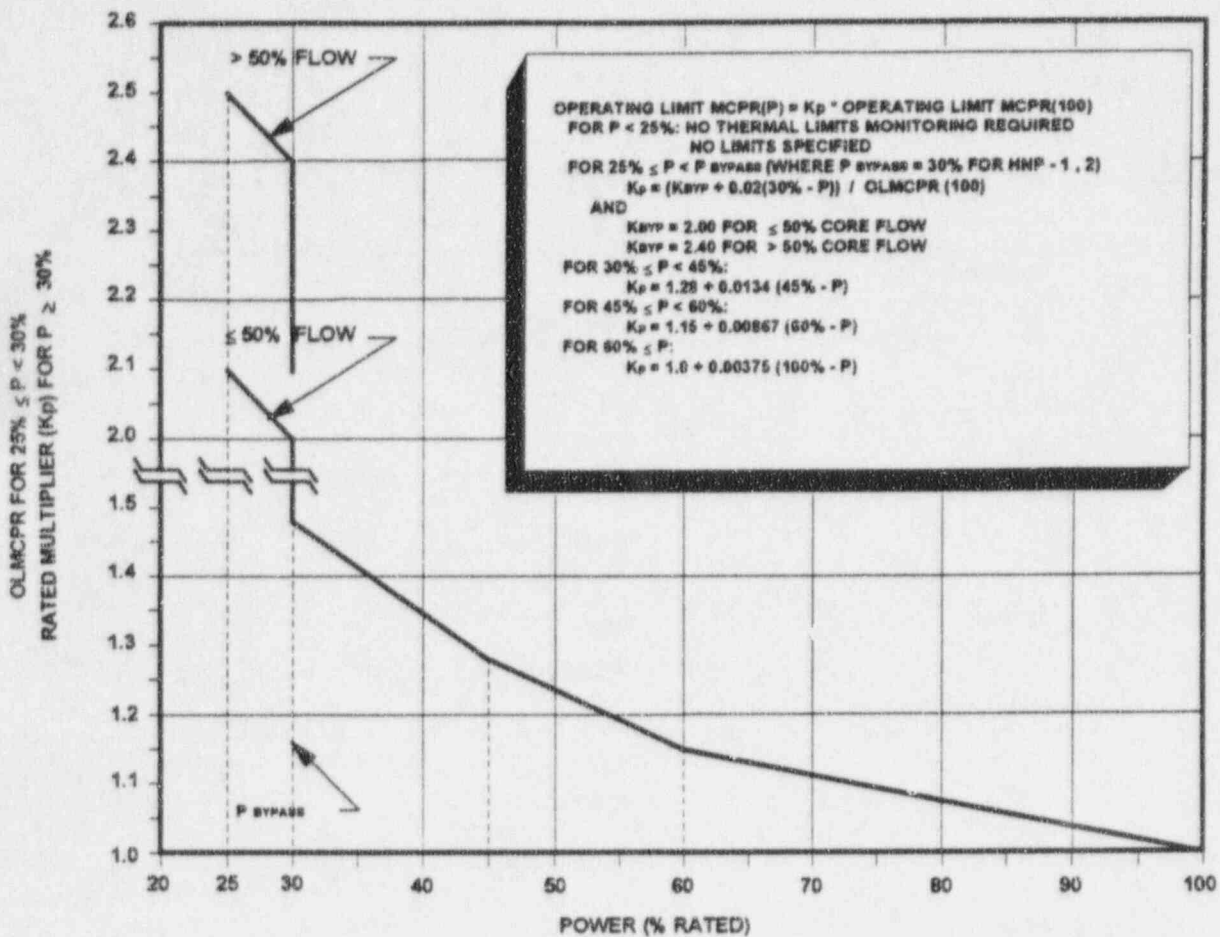


FIGURE 4-1

POWER-DEPENDENT MCPR MULTIPLIER (K_p)

Plant Hatch Unit 1 Fuel Cycle 16
 Core Operating Limits Report

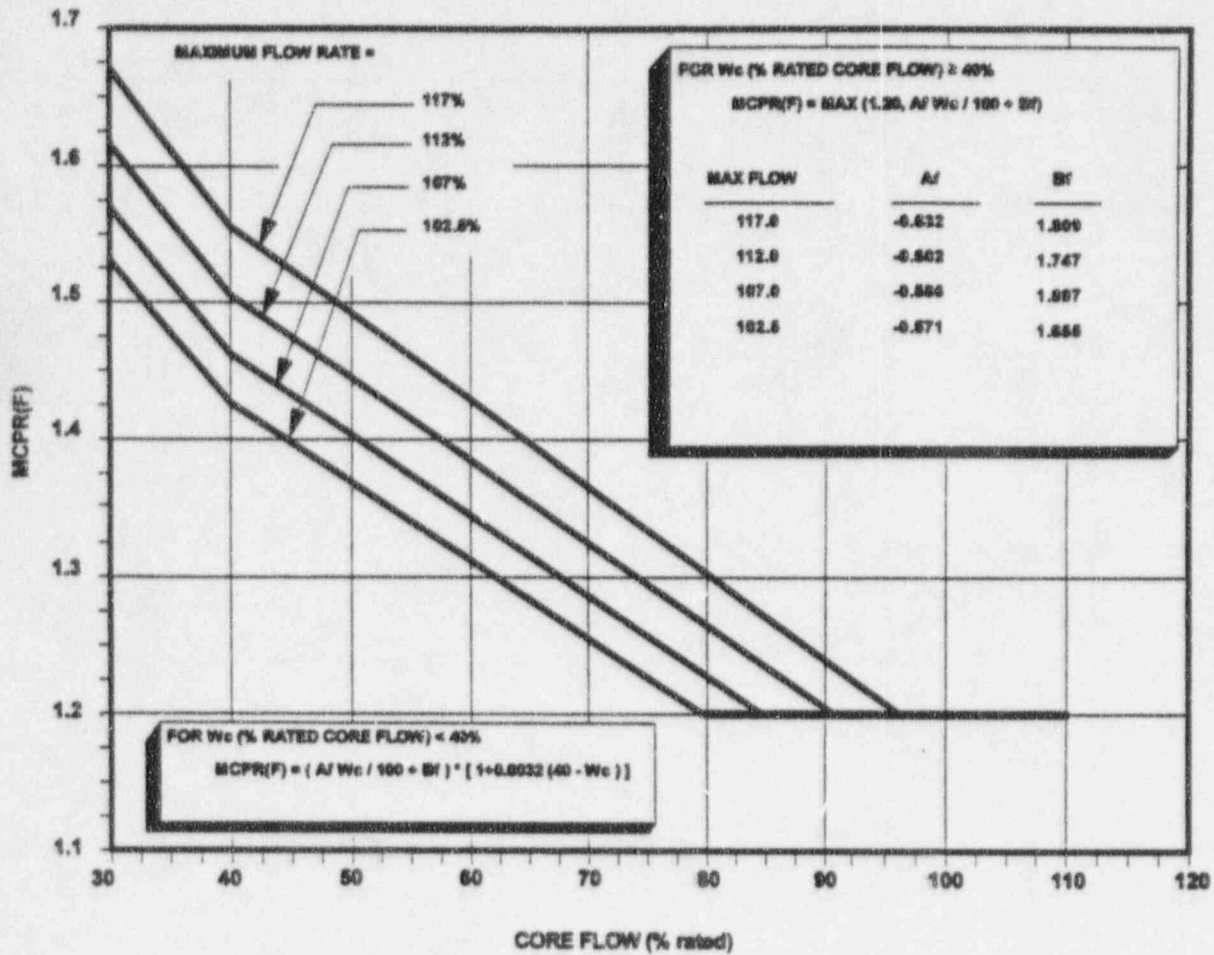
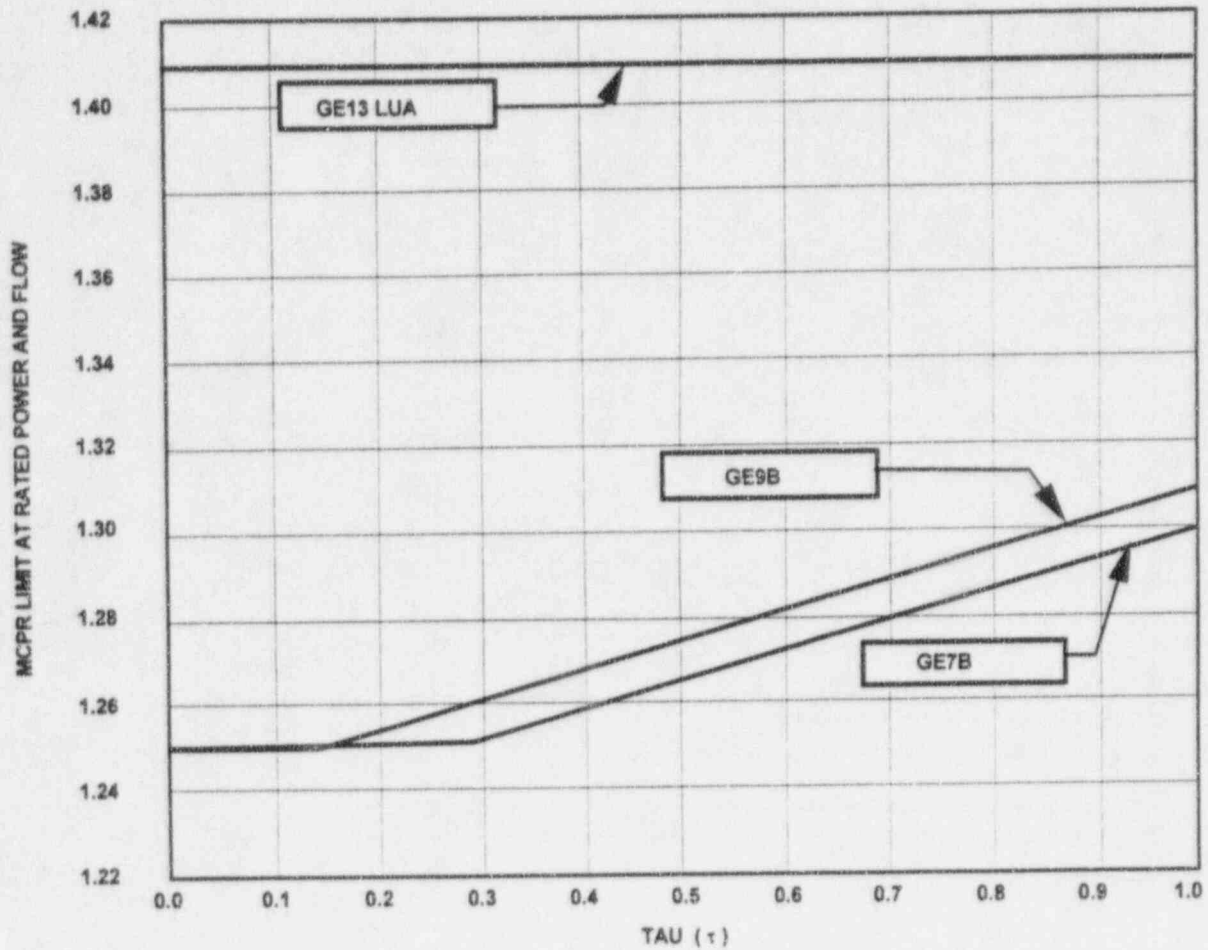


FIGURE 4-2

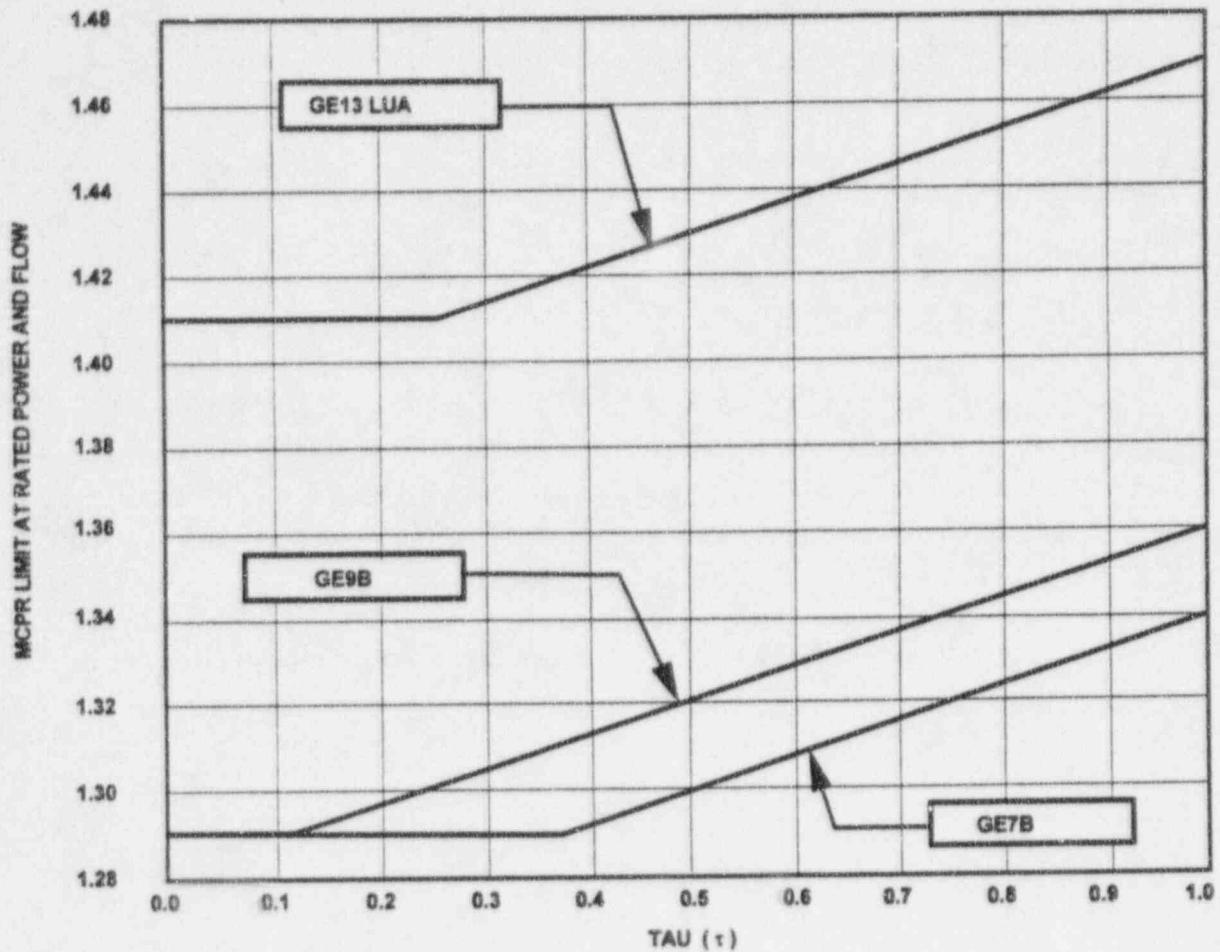
FLOW-DEPENDENT MCPR LIMITS, MCPR(F)



Note: For SLO, increase the MCPR Limit obtained from this figure by 0.01.

FIGURE 4-3

MCPR LIMIT AS FUNCTION OF AVERAGE SCRAM TIME
*(with Turbine Bypass Valves Operable and with either EOC-RPT
System Operable or with EOC-RPT System Inoperable up to EOC -
2,000 MWd/st)*



Note: For SLO, increase the MCPR Limit obtained from this figure by 0.01.

FIGURE 4-4

MCPR LIMIT AS FUNCTION OF AVERAGE SCRAM TIME
(with Turbine Bypass Valves Operable and with EOC-RPT System
Inoperable during the last 2,000 MWd/st of the Operating Cycle)

5.0 APRM SIMULATED THERMAL POWER MONITOR TIME CONSTANT (Surveillance Requirement SR 3.3.1.1.14)

The allowable value for the APRM Simulated Thermal Power Monitor Time Constant is ≤ 7.0 seconds.

6.0 REFERENCES

1. "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-10-US, March 1991.
2. Letter, L. P. Crocker (NRC) to W. G. Hairston (GPC), "Issuance of Amendment No. 168 to Facility Operating License DPR-57 and Amendment No. 106 to Facility Operating License NPF-5 - Edwin I. Hatch Nuclear Plant Units 1 and 2 (TACS 73614 and 73615)," December 29, 1989.
3. "Supplemental Reload Licensing Submittal for Edwin I. Hatch Nuclear Plant Unit 1, Reload 15, Cycle 16," General Electric Document 24A5156, Revision 1, January 1995.
4. "Edwin I. Hatch Nuclear Plant Units 1 and 2 SAFER/GESTR - LOCA Loss-of Coolant Accident Analysis," NEDC-31376-P, December 1986.
5. "Safety Evaluation by the Office of Nuclear Reactor Regulation Supporting Amendment Nos. 151 and 89 to Facility Operating Licenses DPR-57 and NPF-5," dated January 22, 1988.