# GEORGIA POWER COMPANY
# EDWIN I. HATCH NUCLEAR PLANT

## UNIT 2 FUEL CYCLE 13
## CORE OPERATING LIMITS REPORT

## REVISION 0

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**EDWIN I. HATCH NUCLEAR PLANT**
**UNIT 2 FUEL CYCLE 13**
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# EDWIN I. HATCH NUCLEAR PLANT
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# CORE OPERATING LIMITS REPORT

## 1.0 INTRODUCTION

The CORE OPERATING LIMITS REPORT (COLR) for Plant Hatch Unit 2 Cycle 13 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 2 Cycle 13 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 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 ≥ 29% and < 90% of RATED THERMAL POWER, and the MCPR is < 1.70,

or

b. THERMAL POWER is ≥ 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., GE13-LUA or GE9B-P8DWB330-10GZ-80M-150-T) fuel must be less than or equal to the APLHGR limits shown in Figure 3-6 or Figure 3-7. 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 either Figure 3-6 or 3-7.

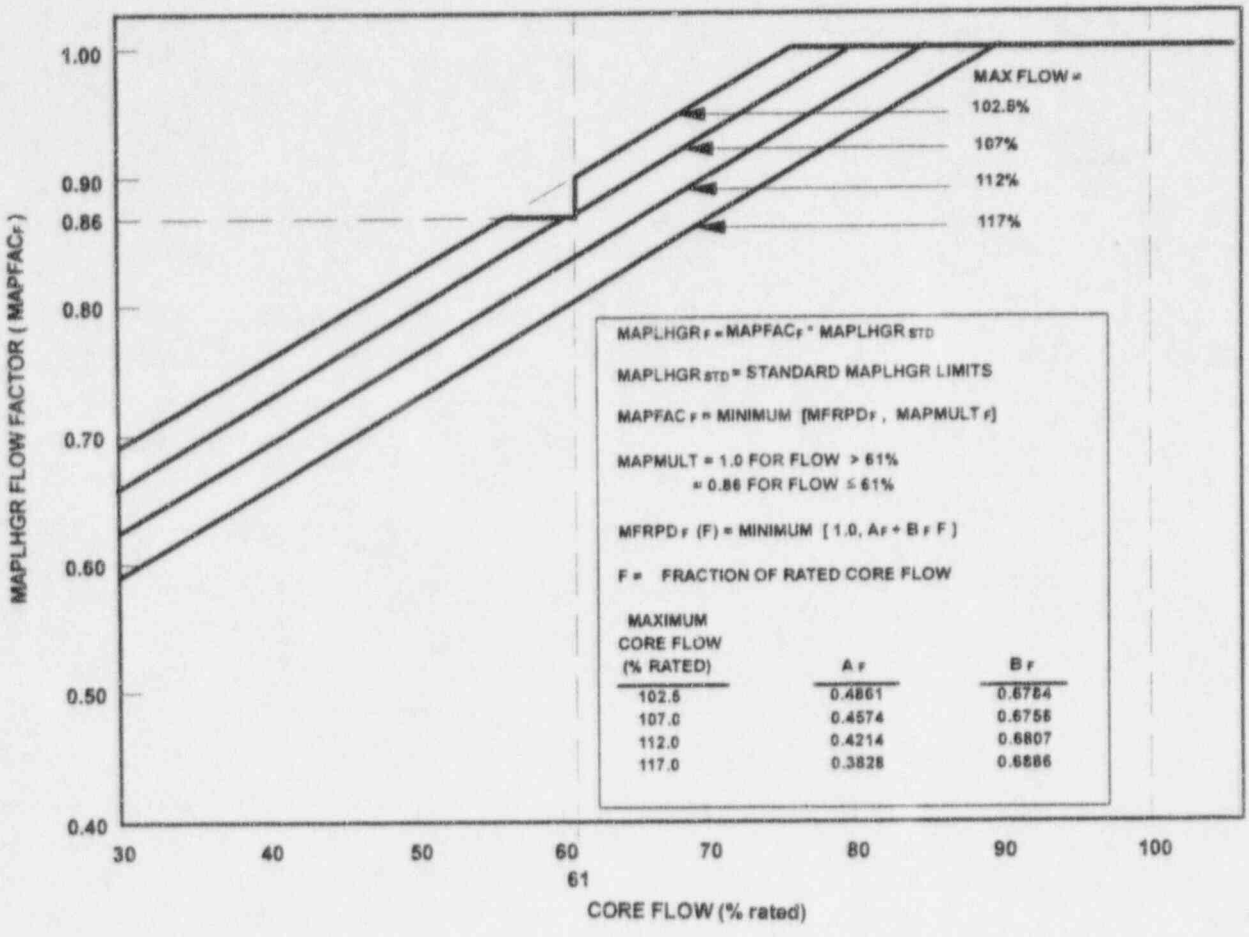



**FIGURE 3-1**

**$MAPFAC_F$**

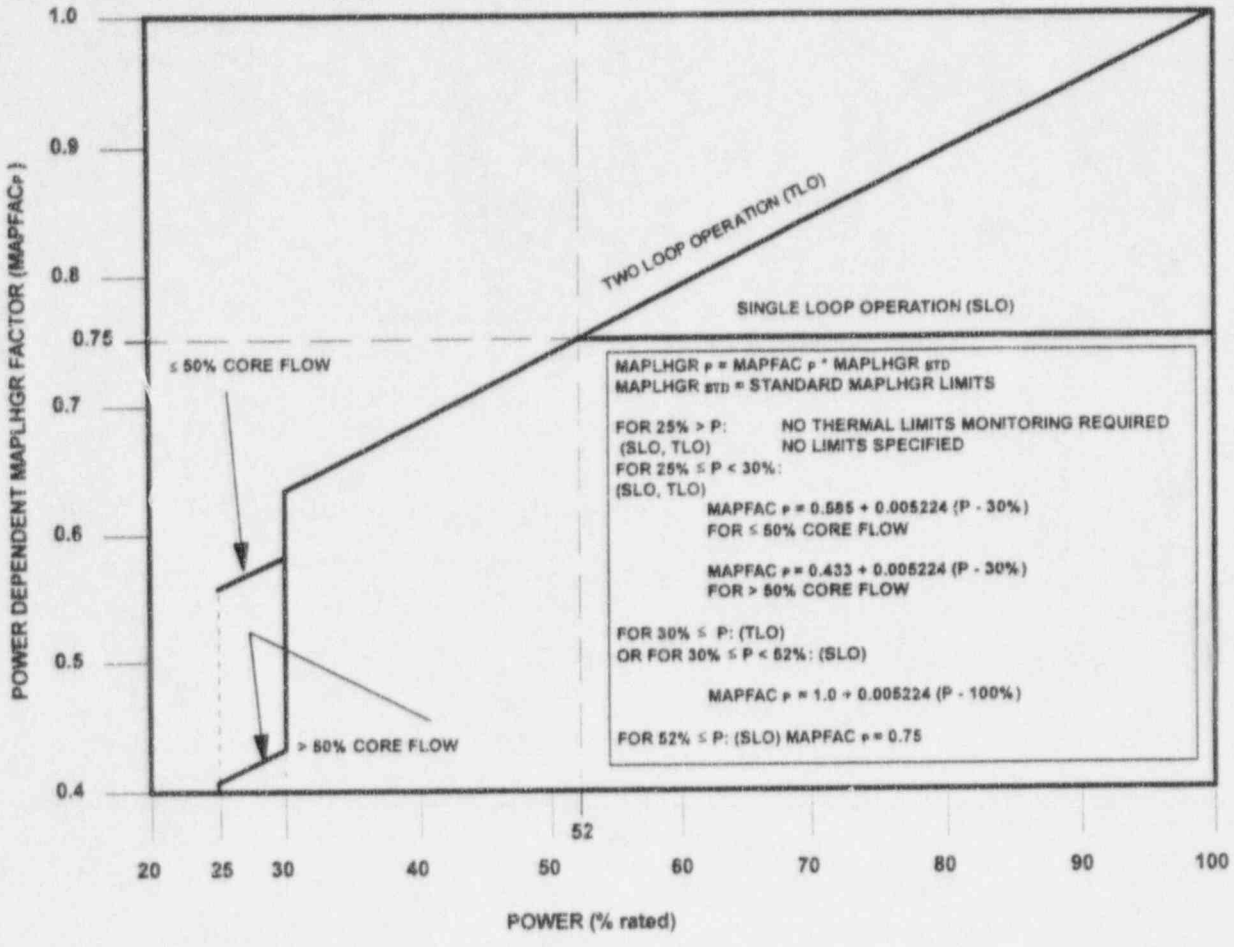



**FIGURE 3-2**

**$MAPFAC_P$**

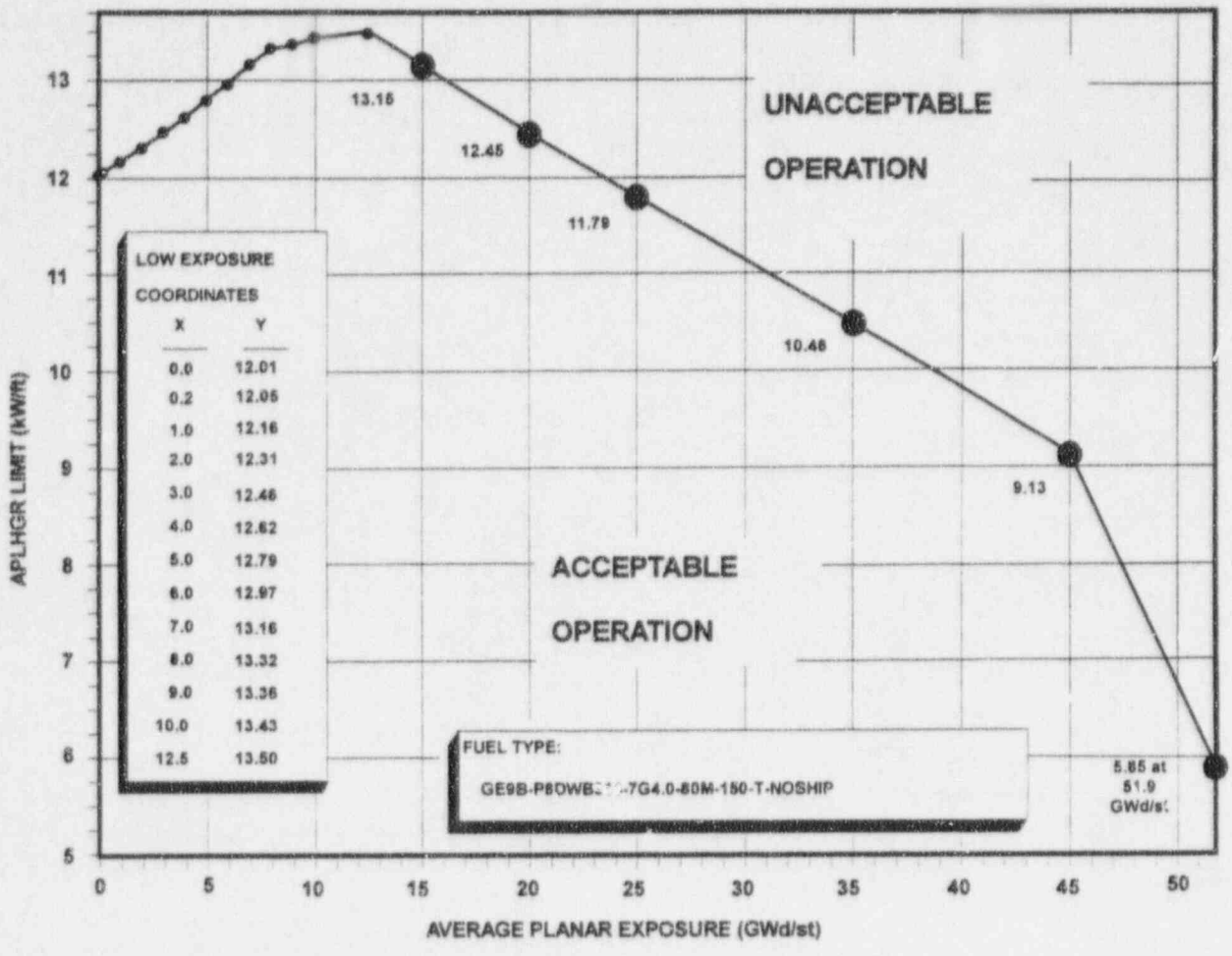



**FIGURE 3-3**

**AVERAGE PLANAR LINEAR HEAT GENERATION RATE**
**VERSUS**
**AVERAGE PLANAR EXPOSURE**
***(Fuel Type: GE9B-P8DWB314-7G4.0-80M-150-T-NOSHIP)***

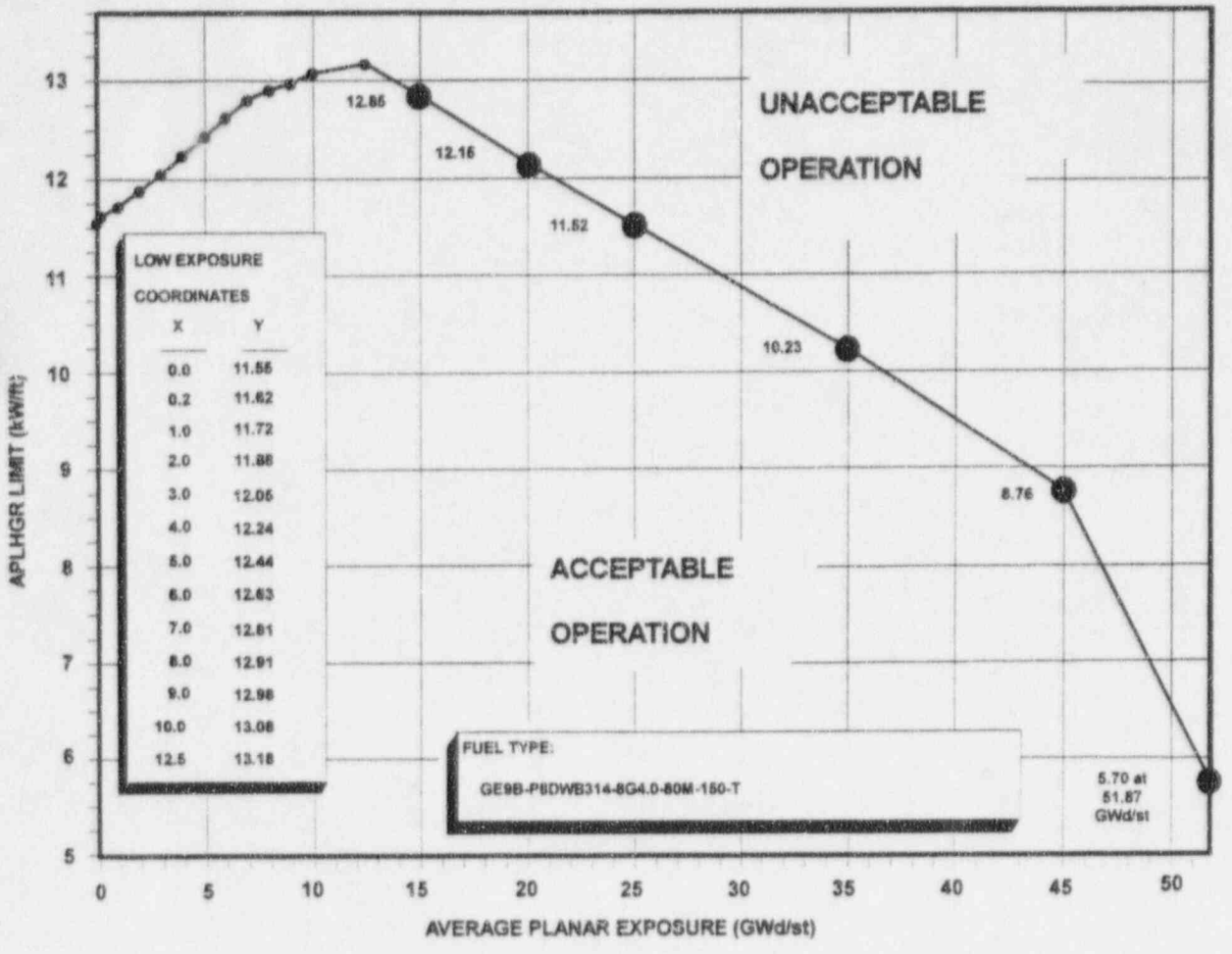



**FIGURE 3-4**

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

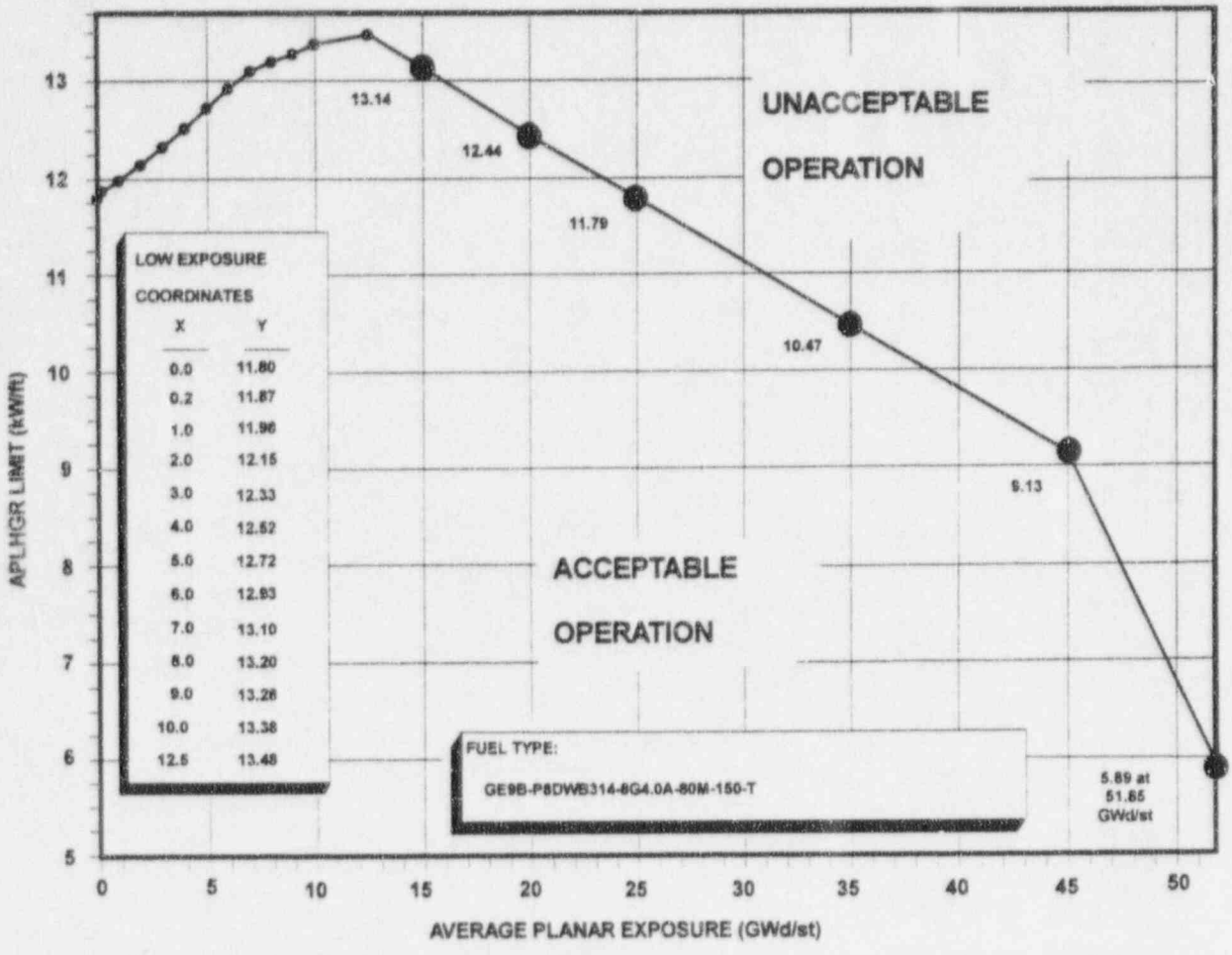



**FIGURE 3-5**

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

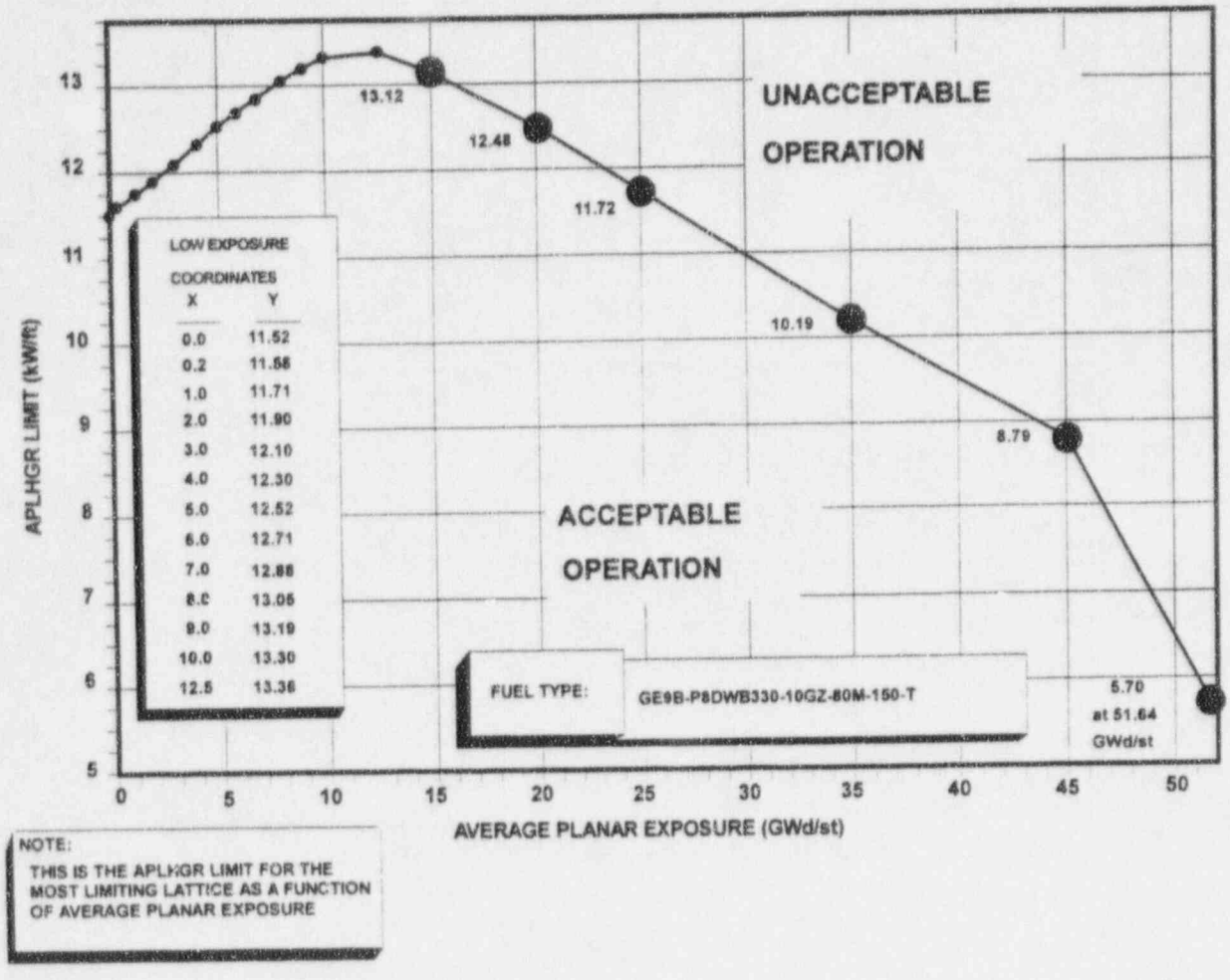



**FIGURE 3-6**

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

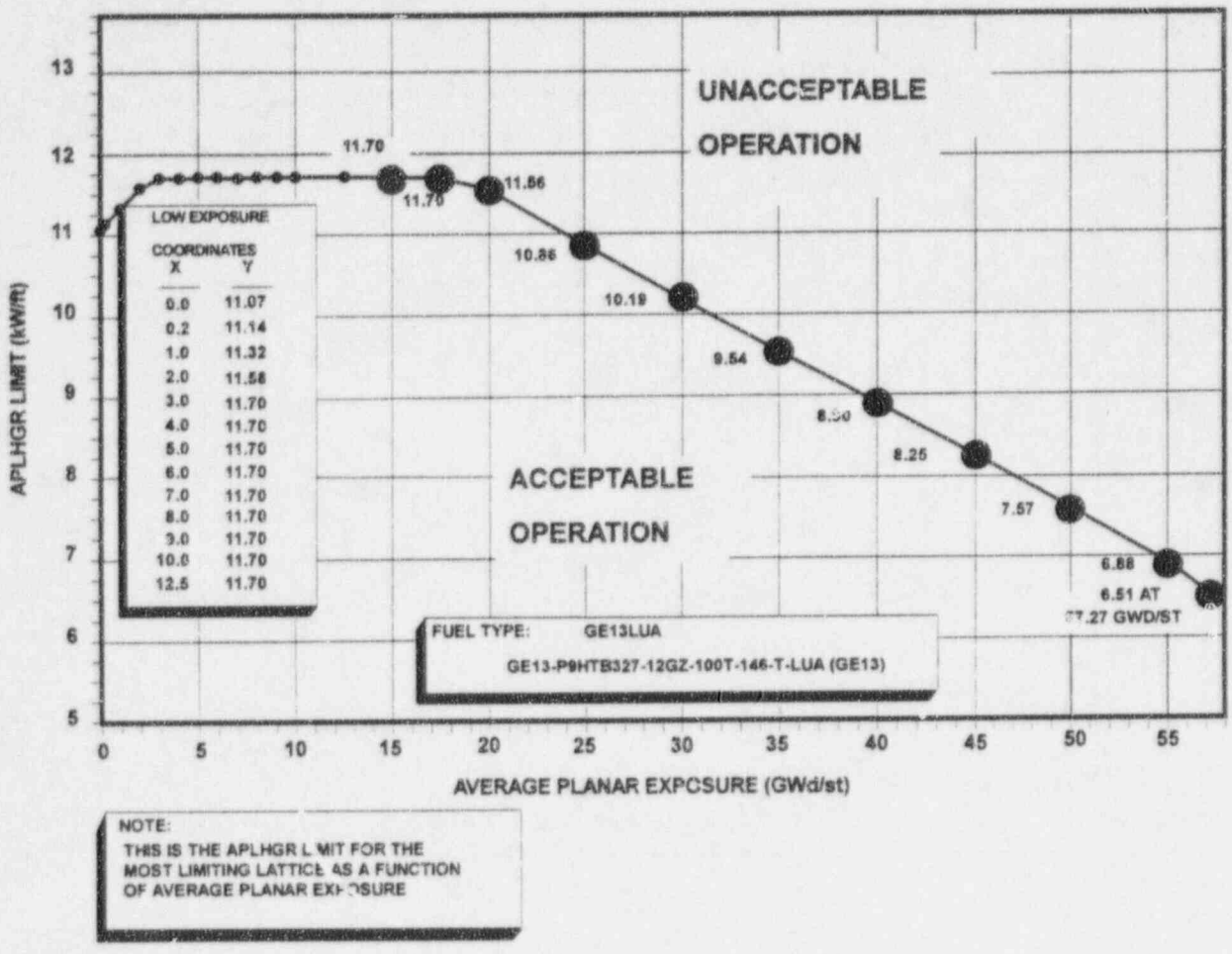



**FIGURE 3-7**

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

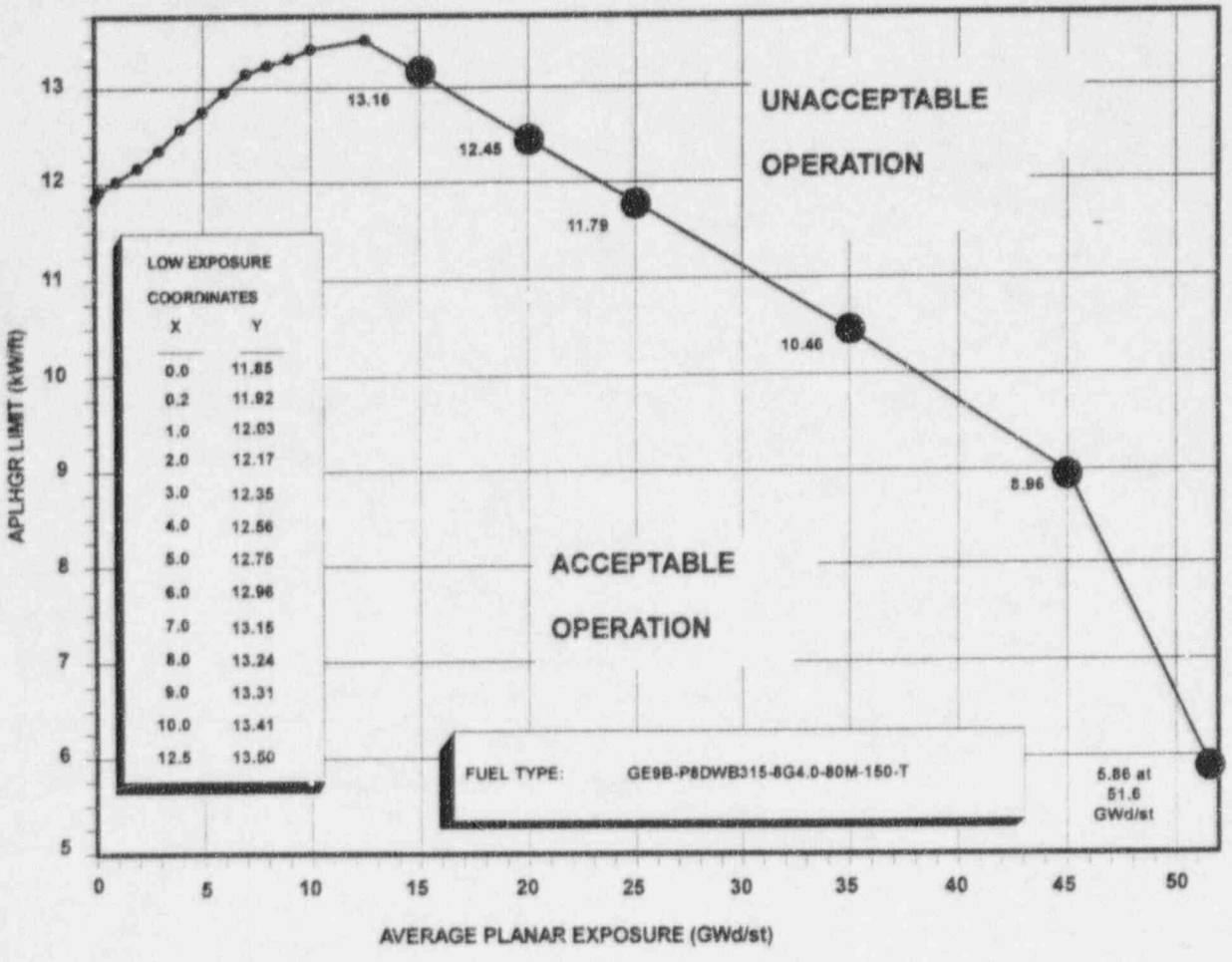



**FIGURE 3-8**

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

## 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 operablity, scram times, core flow and core power is determined as follows:

For 25% ≤ power < 30%, the OLMCPR is given in Figure 4-1.

For power ≥ 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 $\tau$ is determined from scram time measurements performed in accordance with Technical Specifications 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 $\tau$. If $\tau$ 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, $\tau$, 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)

$$\tau_B = \mu + 1.65 * \sigma * \left[ \frac{N_i}{\sum_{i=1}^{n} N_i} \right]^{1/2}$$

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

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

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

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

$N_i$ = number of active control rods measured in the *ith* surveillance test

$\tau_i$ = average scram time to notch 36 of all rods in the *ith* surveillance test

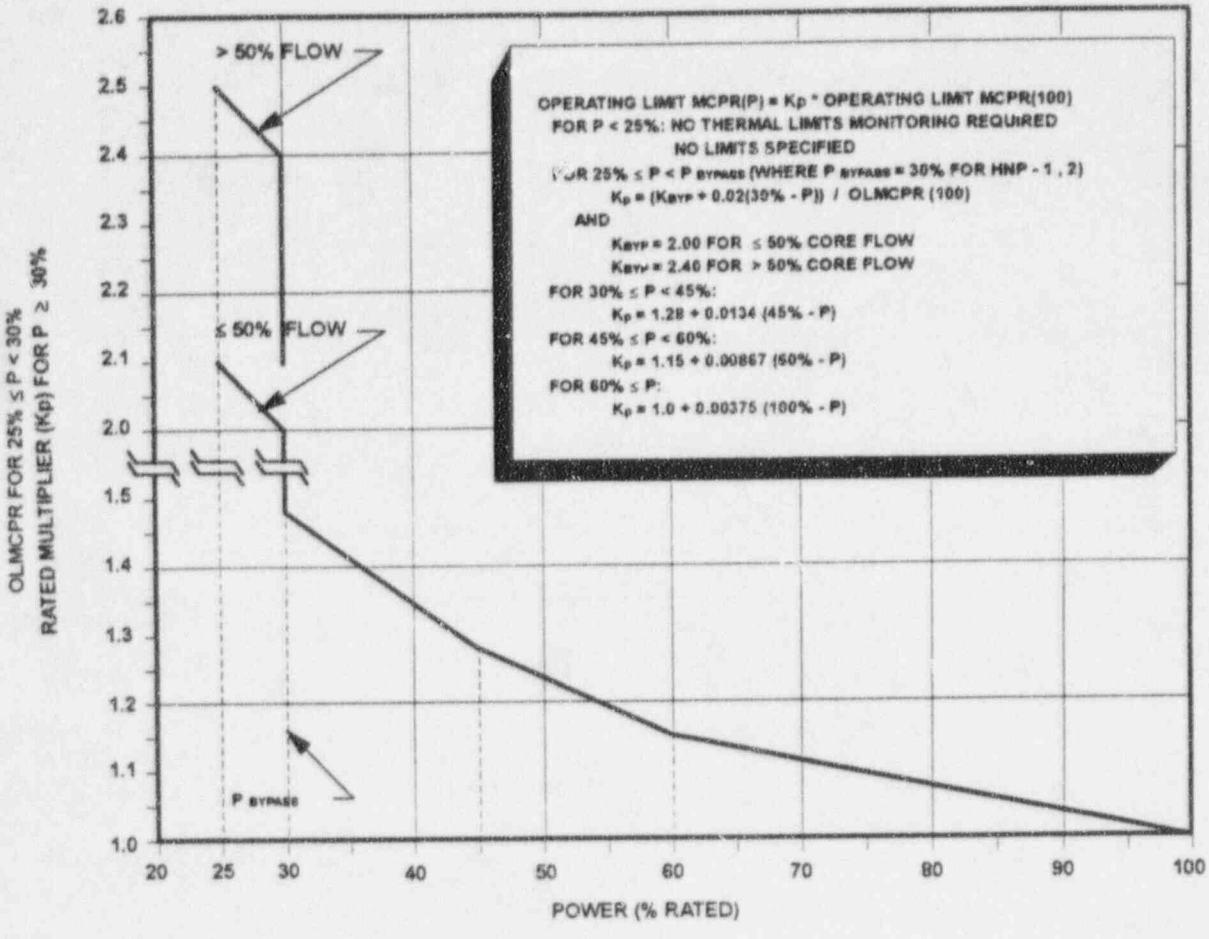
$N_1$ = total number of active rods measured in Technical Specifications Surveillance Requirement 3.1.4.1.

## TABLE 4-1

## OPERATING FLEXIBILITY OPTIONS APPLICABILITY

| WITH: | | USE: |
|---|---|---|
| EOC RPT | Turbine Bypass Valves | |
| OPERABLE | OPERABLE | Figure 4-3 |
| Inoperable | 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 ($K_P$)

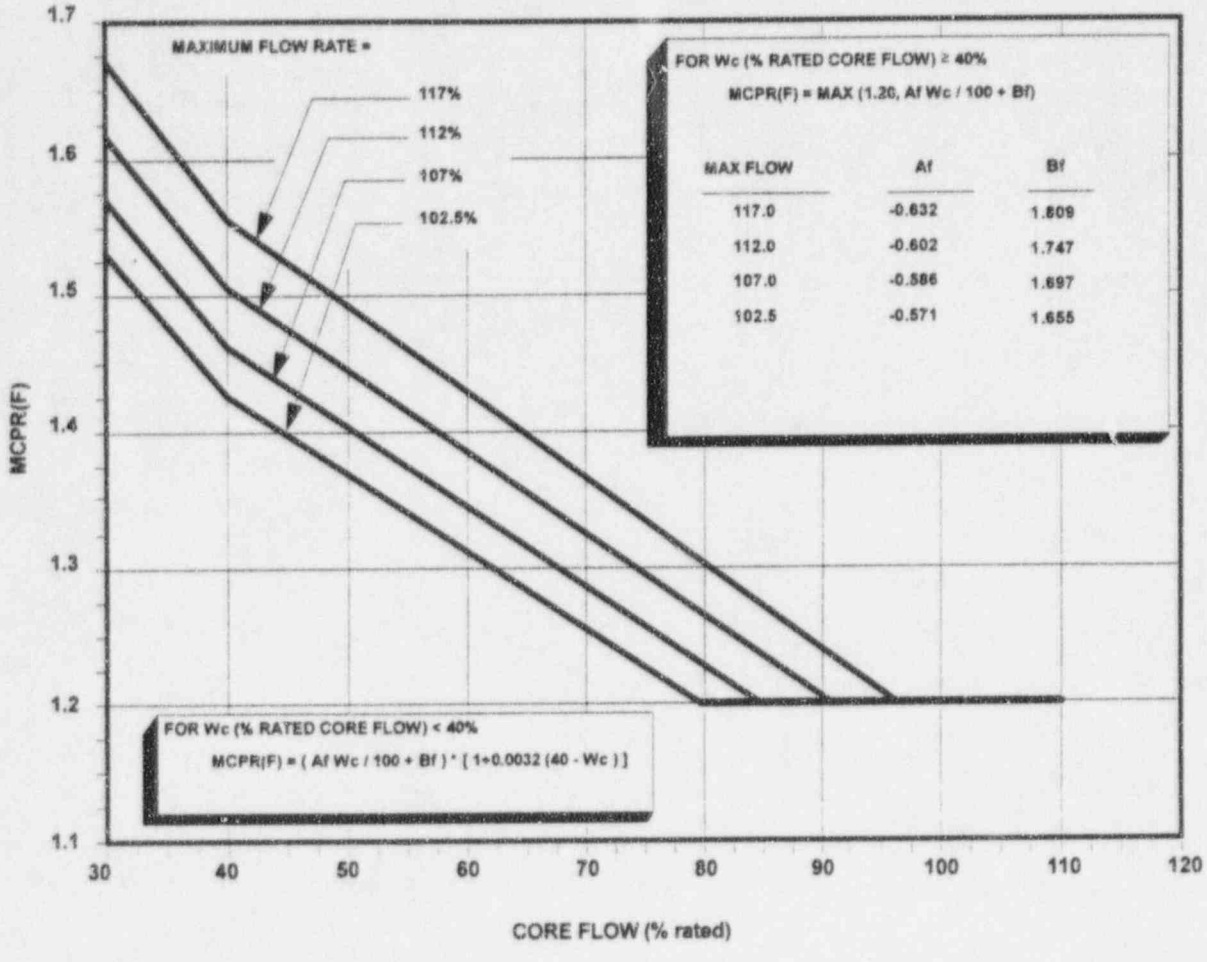
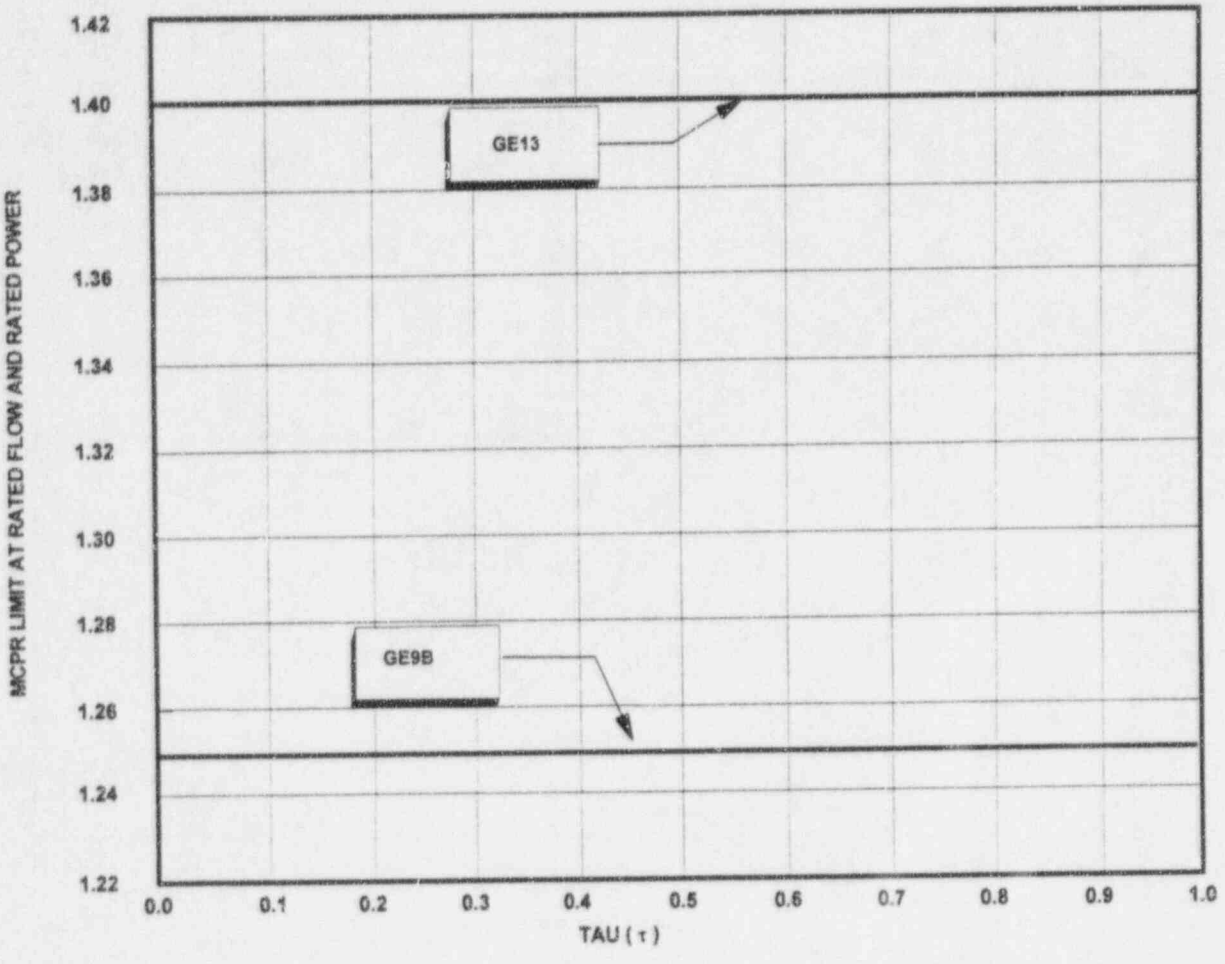



**FIGURE 4-2**

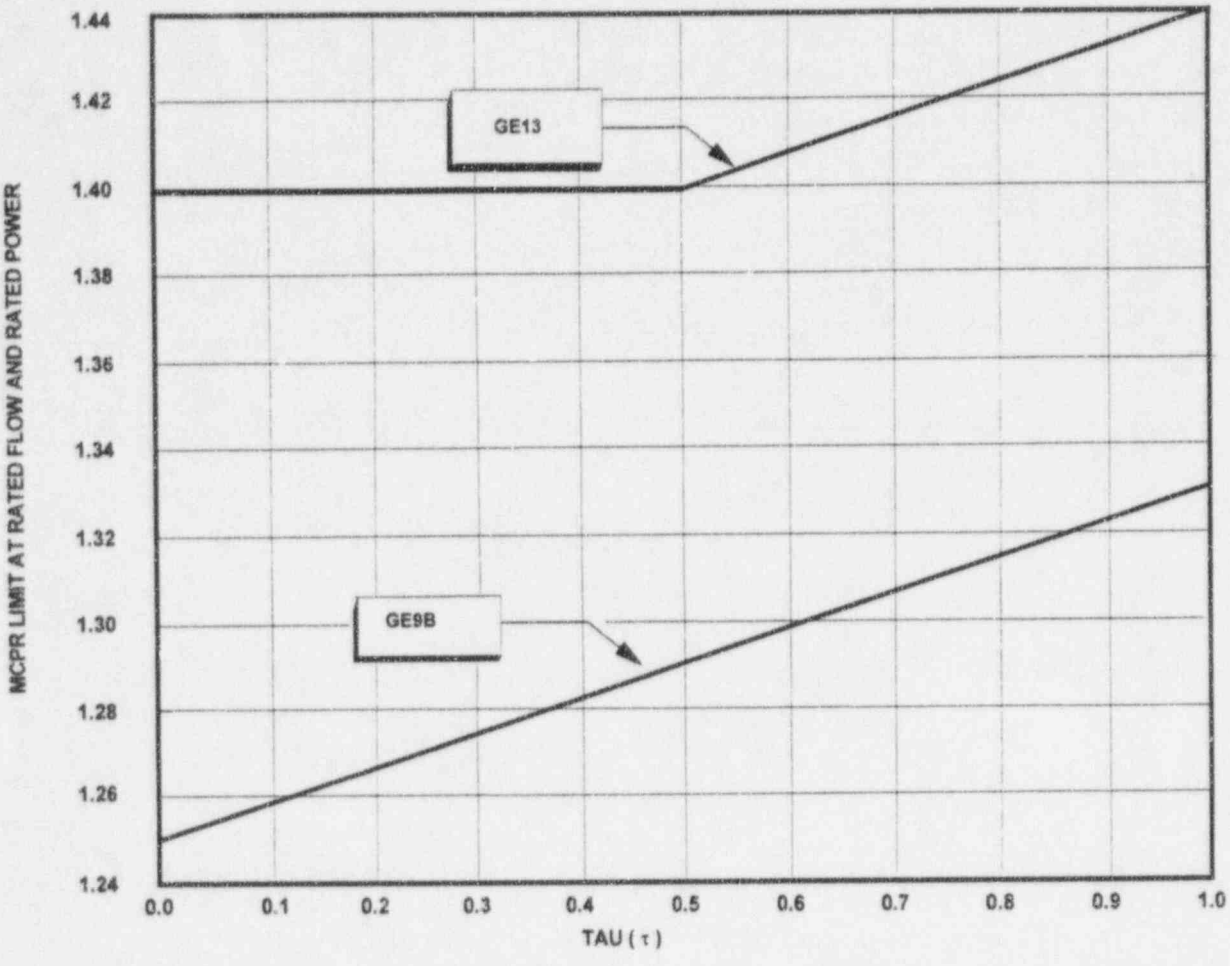
**FLOW-DEPENDENT MCPR LIMITS, MCPR(F)**




**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 EOC-RPT System OPERABLE)***




**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)***

## 5.0 APRM SIMULATED THERMAL POWER MONITOR TIME CONSTANT (Surveillance Requirement 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 2, Reload 12 Cycle 13," General Electric Document 24A5186, Revision 0, September 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.