

BRUNSWICK UNIT 1, CYCLE 8  
CORE OPERATING LIMITS REPORT  
FEBRUARY 1991

Controlled Copy 01

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LIST OF EFFECTIVE PAGES

<u>Page(s)</u>	<u>Revision</u>
1-15	0

### INTRODUCTION AND SUMMARY

This report provides the values of the power distribution limits and control rod withdrawal block instrumentation setpoints for Brunswick Unit 1, Cycle 8 as required by Technical Specification 6.9.3.1. The values of the AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR) limits, along with associated core flow and core power adjustment factors are provided as required by Technical Specification 6.9.3.1.a. The values of the MINIMUM CRITICAL POWER RATIO (MCPR) limits, along with associated core flow and core power adjustment factors are provided as required by Technical Specifications 6.9.3.1.b and 6.9.3.1.c. The control rod block upscale trip setpoints and allowable values are provided as required by Technical Specification 6.9.3.1.d.

Per Technical Specifications 6.9.3.2 and 6.9.3.3, these values have been determined using NRC-approved methodology and are established such that all applicable limits of the plant safety analysis are met.

Preparation of this report was performed in accordance with CP&L Nuclear Fuel Section Quality Assurance requirements as is documented in Reference 1.

### APLHGR LIMITS

The limiting APLHGR value for the most limiting lattice (excluding natural uranium) of each fuel type as a function of planar average exposure is given in Figures 1, 2, 3, 4, and 5. These values were determined with the SAFER/GESTR LOCA methodology described in GESTAR-II (Reference 2). Figures 1, 2, 3, 4, and 5 are used when hand calculations are required as specified in Technical Specification 3.2.1.

The core flow and core power adjustment factors for use in Technical Specification 3.2.1 are presented in Figures 6 and 7. For any given flow/power state the minimum of MAPLHGR(F) determined from Figure 6 and MAPLHGR(P) determined from Figure 7 is used to determine the core flow and power adjusted governing limit.

### MCPR LIMITS

The ODYN OPTION A, ODYN OPTION B, and non-pressurization transient MCPR limits for use in Technical Specifications 3.2.2.1 and 3.2.2.2 for each fuel type as a function of cycle average exposure are given in Table 1. These values were determined with the GEMINI methodology and GEXL-PLUS critical power ratio correlation described in GESTAR-II (Reference 2) and are consistent with the Safety Limit MCPR of 1.07 specified by Technical Specification 2.1.2.

The core flow and core power adjustment factors for use in Technical Specification 3.2.2.1 are presented in Figures 8 and 9. For any given flow/power state the maximum of MCPR(F) determined from Figure 8 and MCPR(P) determined from Figure 9 is used to determine the core flow and power adjusted governing limit.

### ROD BLOCK INSTRUMENTATION SETPOINTS

The nominal trip setpoints and allowable values of the control rod withdrawal block instrumentation for use in Technical Specification 3.3.4 (Table 3.3.4-2) are presented in Table 2. These values were determined consistent with the bases of the ARTS program and the determination of MCPR limits with the GEMINI methodology and GEXL-PLUS critical power ratio correlation described in GESTAR-II (Reference 2).

### REFERENCE(s)

- 1) CP&L Nuclear Fuel Section Quality Assurance File NF 2491.0006, "Preparation of the Brunswick Unit 1, Cycle 8 Core Operating Limits Report", February 1991.
- 2) NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel" (latest approved version).

Figure 1

FUEL TYPE BP8DRB299 (BP8X8R)  
AVERAGE PLANAR LINEAR HEAT  
GENERATION RATE (APLHGR) LIMIT  
VERSUS AVERAGE PLANAR EXPOSURE

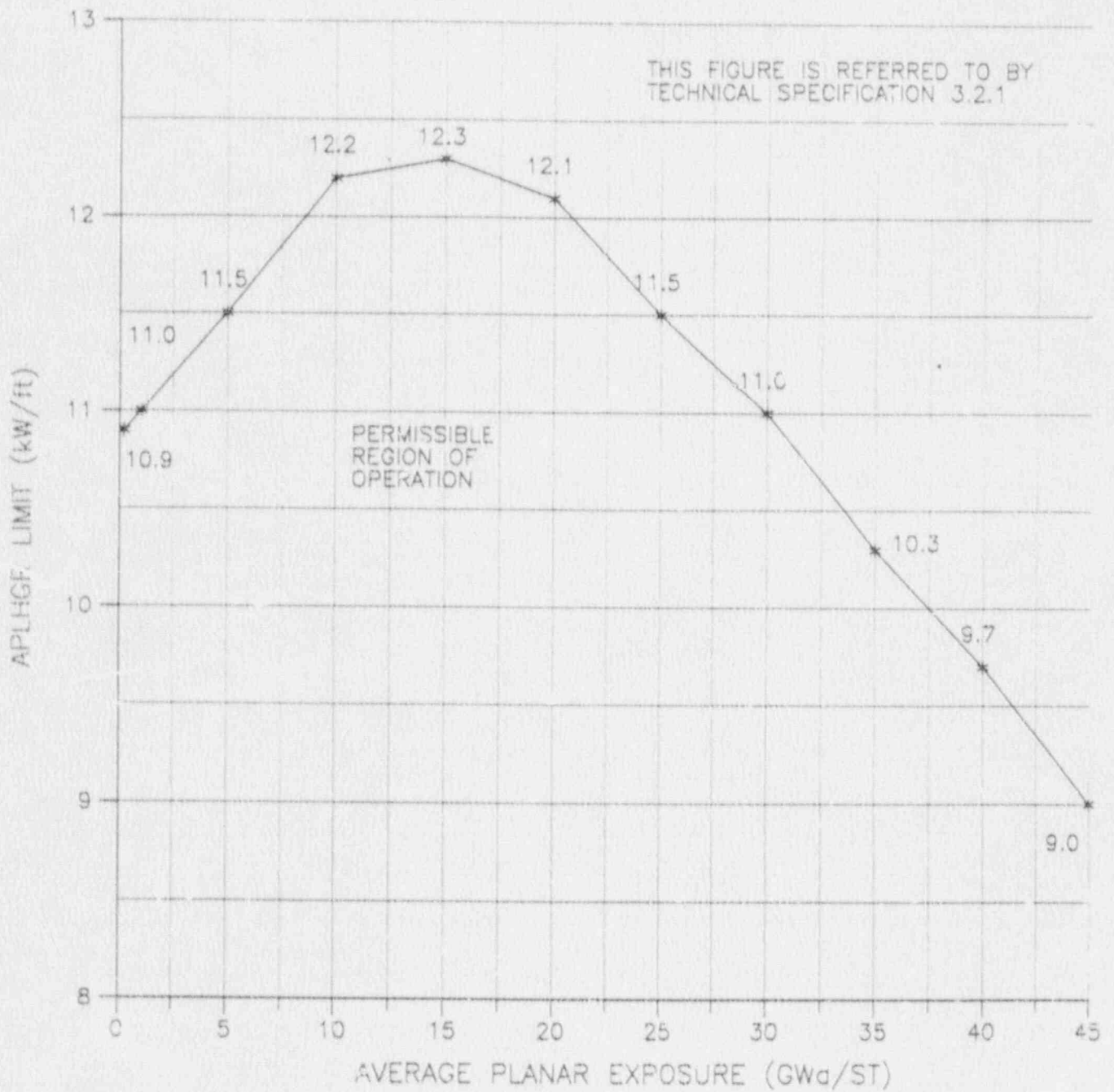


Figure 2

FUEL TYPE BD323B (GE8X8EB)  
AVERAGE PLANAR LINEAR HEAT  
GENERATION RATE (APLHGR) LIMIT  
VERSUS AVERAGE PLANAR EXPOSURE

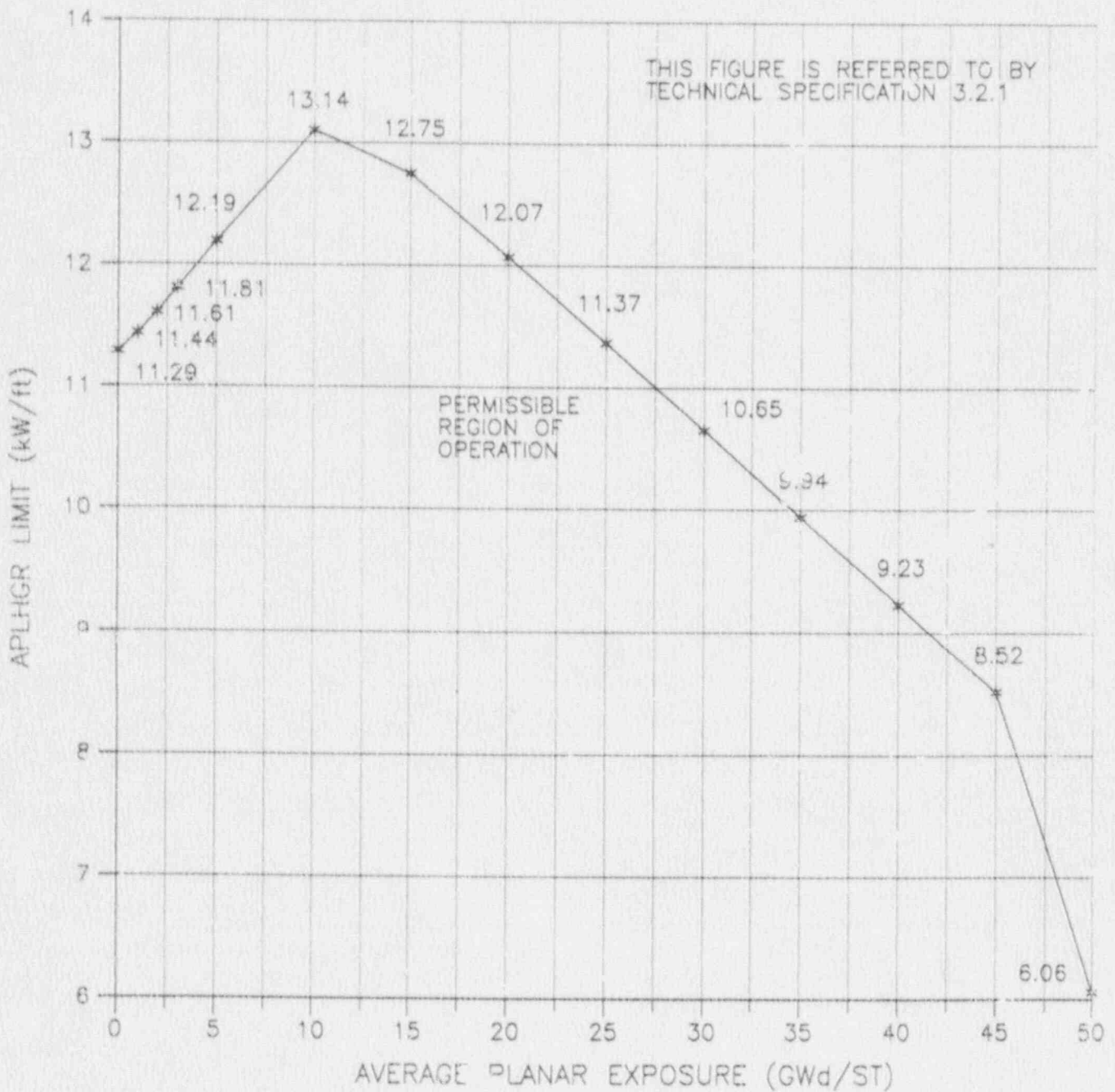


Figure 3

FUEL TYPE BD339A (GE8X8EB)  
AVERAGE PLANAR LINEAR HEAT  
GENERATION RATE (APLHGR) LIMIT  
VERSUS AVERAGE PLANAR EXPOSURE

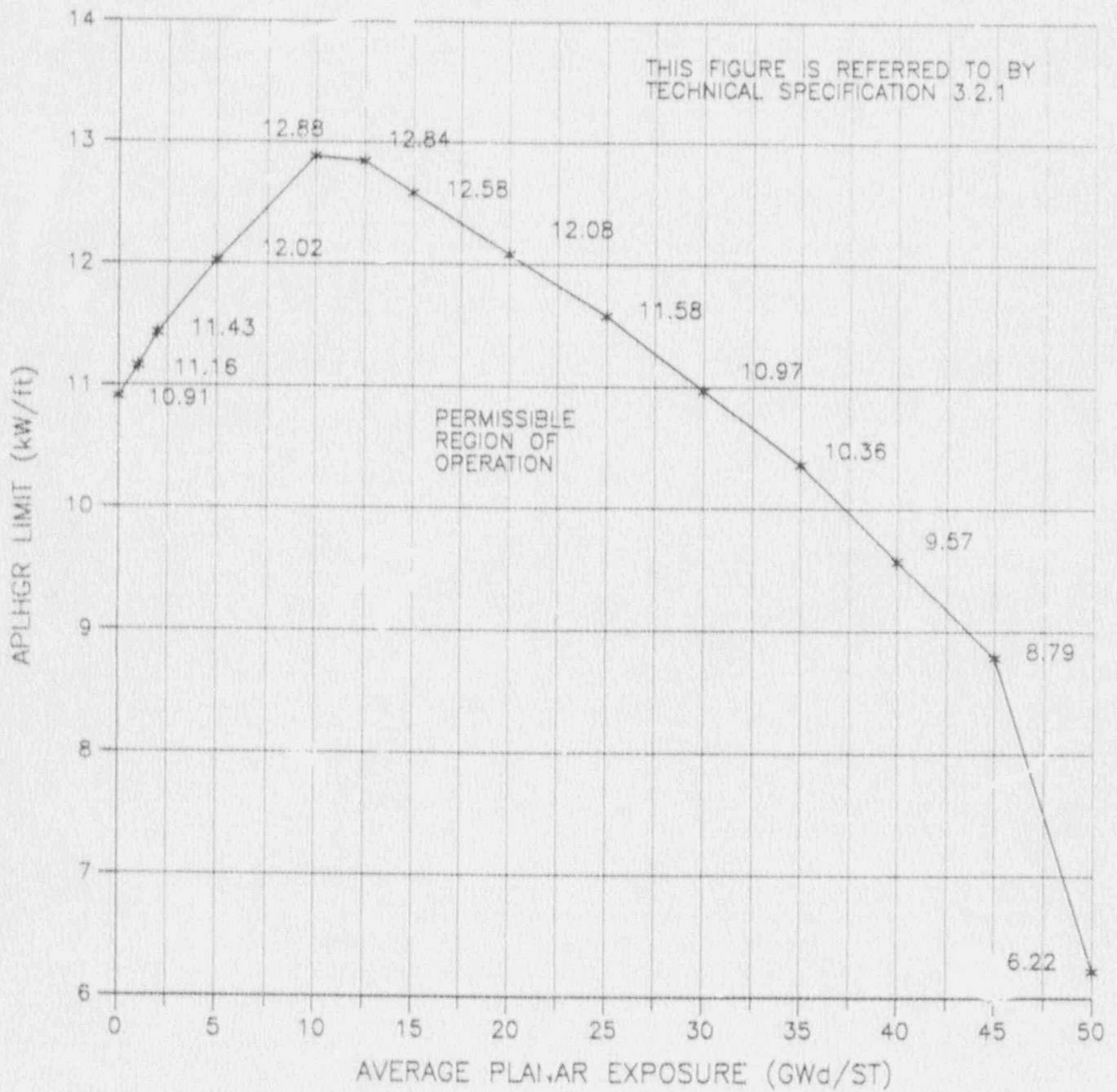


Figure 4

FUEL TYPE GE10-PBHXB322-11GZ-70M-150-T (GE8X8NB-3)  
 AVERAGE PLANAR LINEAR HEAT  
 GENERATION RATE (APLHGR) LIMIT  
 VERSUS AVERAGE PLANAR EXPOSURE

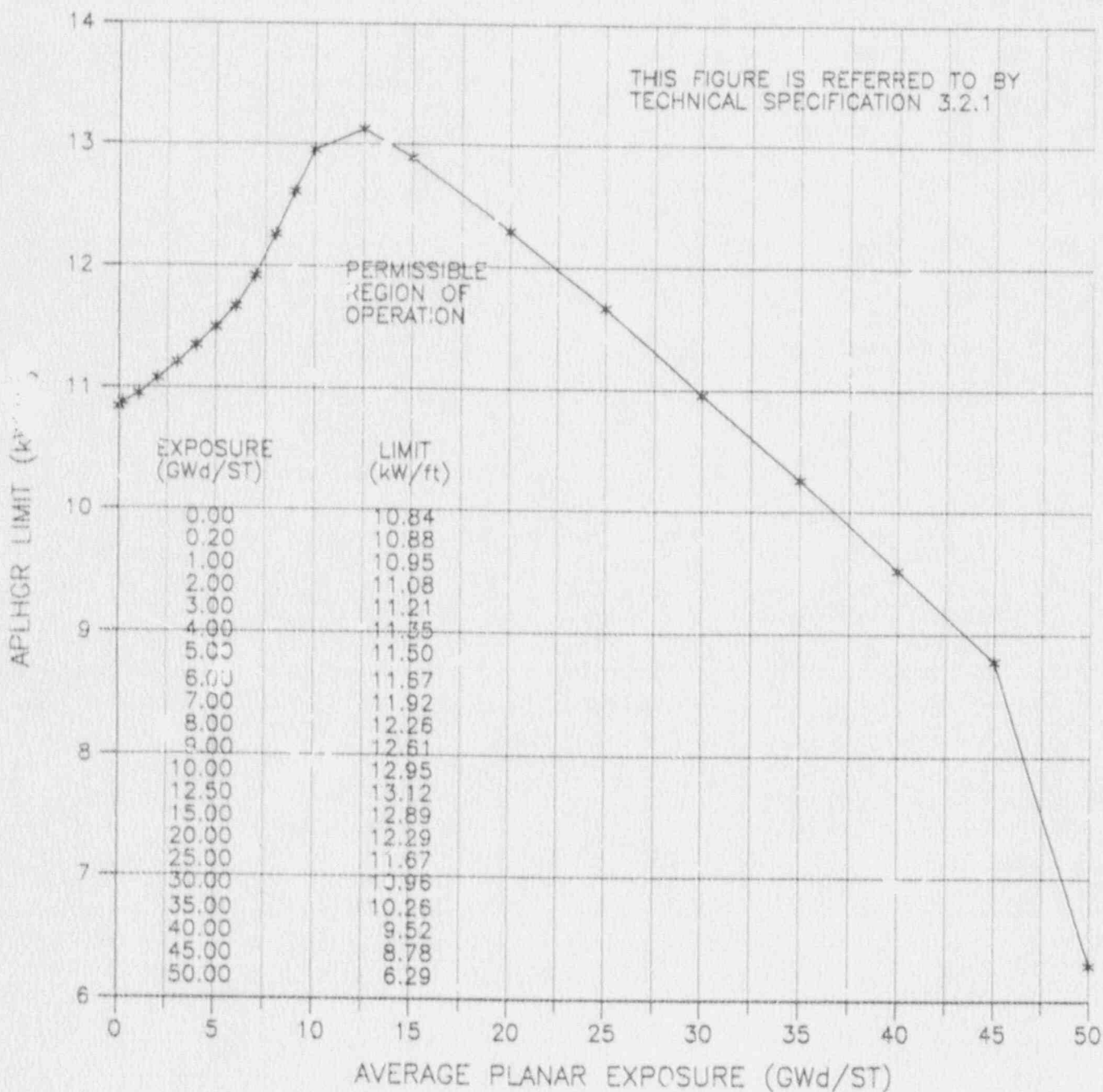




Figure 5

FUEL TYPE GE10-P8HXB324-12GZ-70M-150-T (GE8X8NB-3)  
 AVERAGE PLANAR LINEAR HEAT  
 GENERATION RATE (APLHGR) LIMIT  
 VERSUS AVERAGE PLANAR EXPOSURE

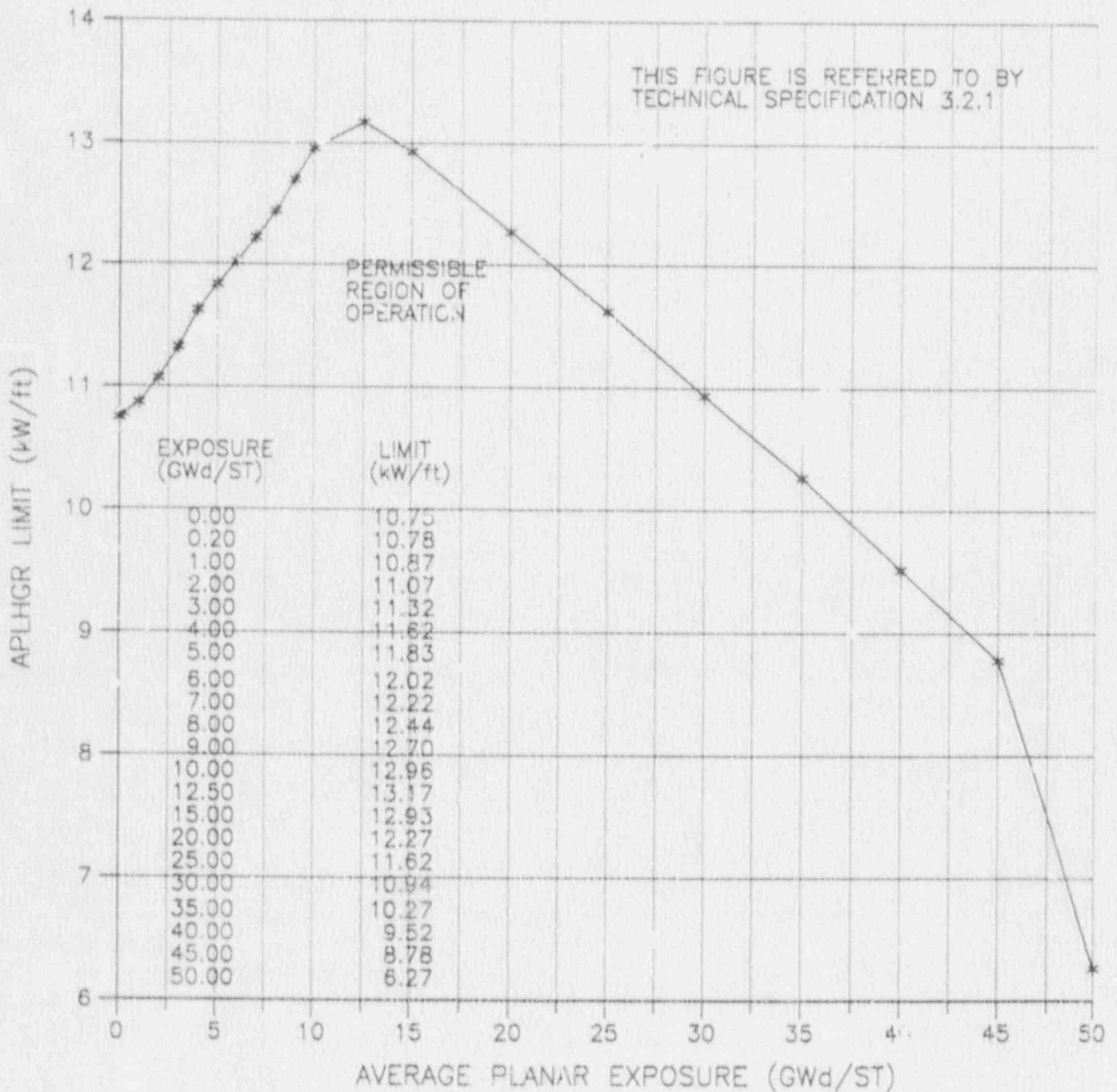
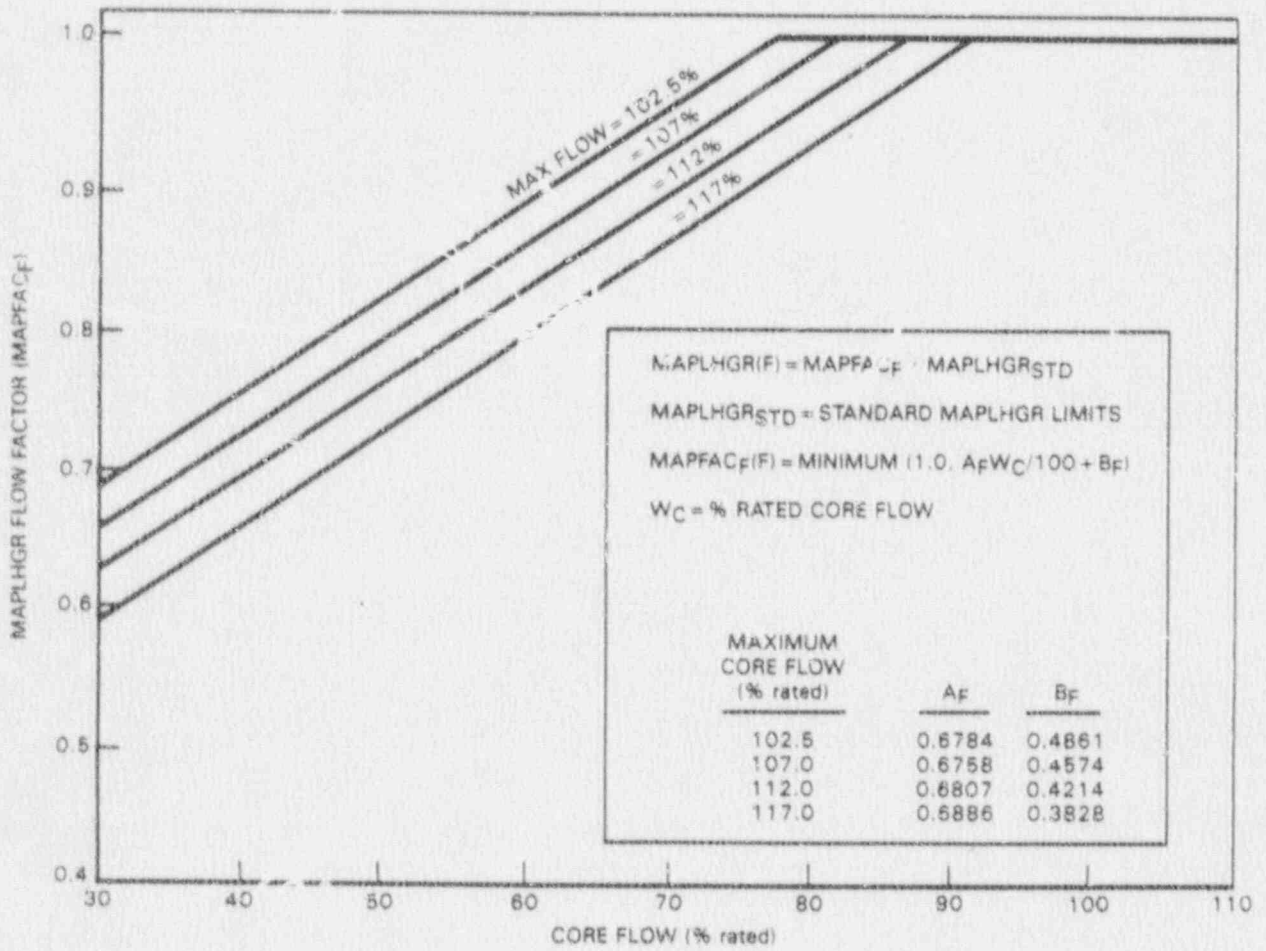


Figure 6

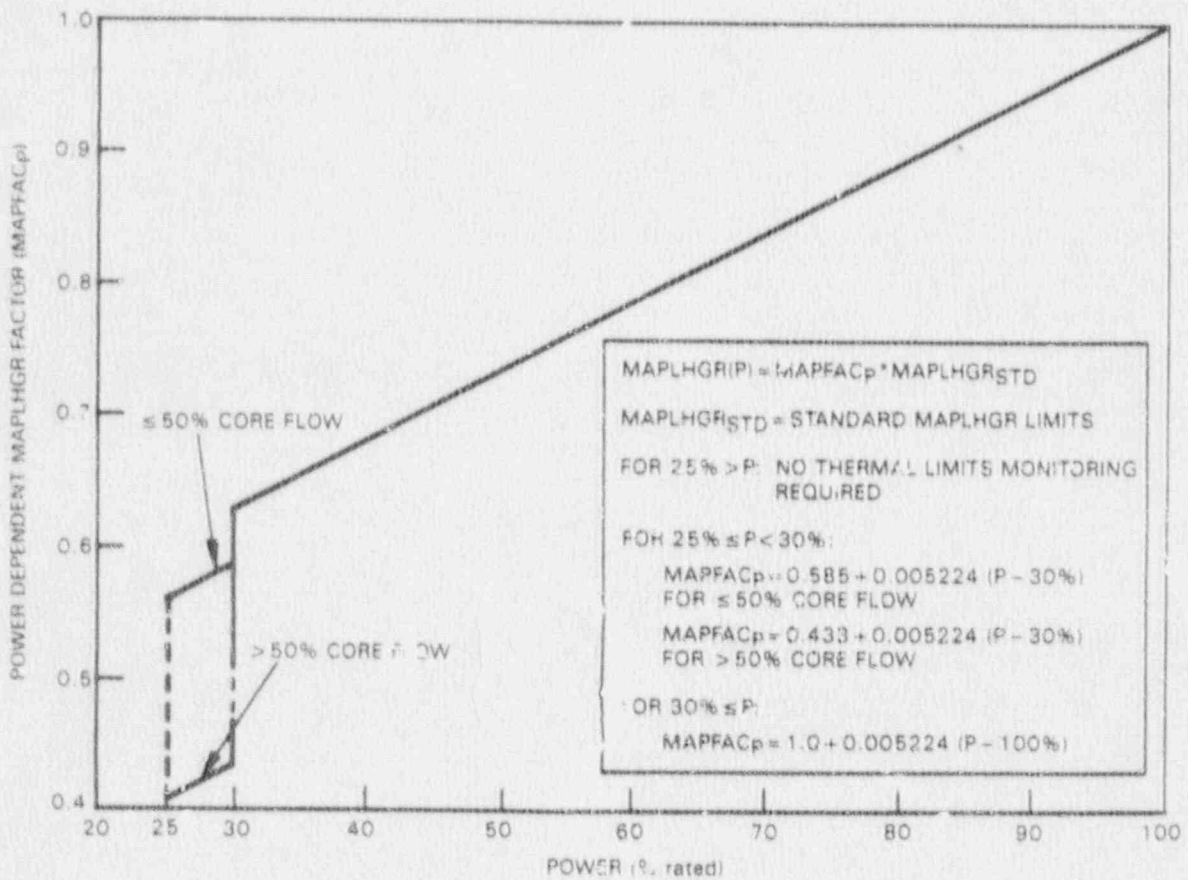
Flow - Dependent MAPLHGR Limit, MAPLHGR (F)



This figure is referred to by  
 Technical Specification 3.2.1

Figure 7

Power - Dependent MAPLHGR Limit, MAPLHGR (P)



This figure is referred to by  
Technical Specification 3.2.1

TABLE 1

M CPR LIMITS

Non-Pressurization Transient M CPR = 1.27  
 (GE8X8NB-3, GE8X8EB, and BP8X8R fuel types)

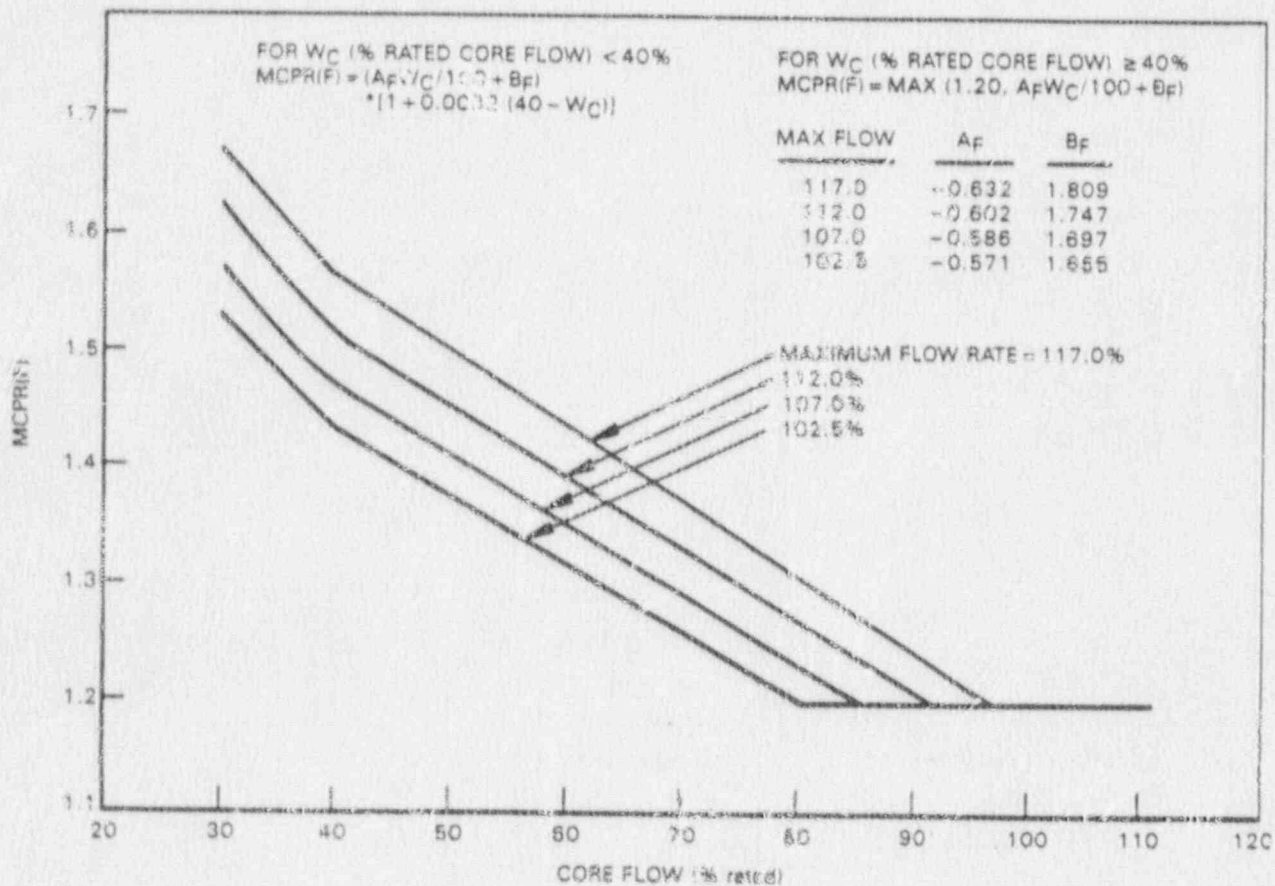
Pressurization Transient M CPR

<u>Exposure Range</u>	<u>M CPR</u> <u>Option A</u> <u>Fuel Type</u>			<u>M CPR</u> <u>Option B</u> <u>Fuel Type</u>		
	<u>GE8X8NB-3</u>	<u>GE8X8EB</u>	<u>BP8X8R</u>	<u>GE8X8NB-3</u>	<u>GE8X8EB</u>	<u>BP8X8R</u>
BOC8 to EOC8-2000 MWD/ST	1.34	1.34	1.34	1.27	1.27	1.27
EOC8-2000 MWD/ST to EOC8	1.39	1.38	1.38	1.35	1.34	1.34

This table is referred to by  
 Technical Specifications  
 3.2.2.1 and 3.2.2.2

Figure 8

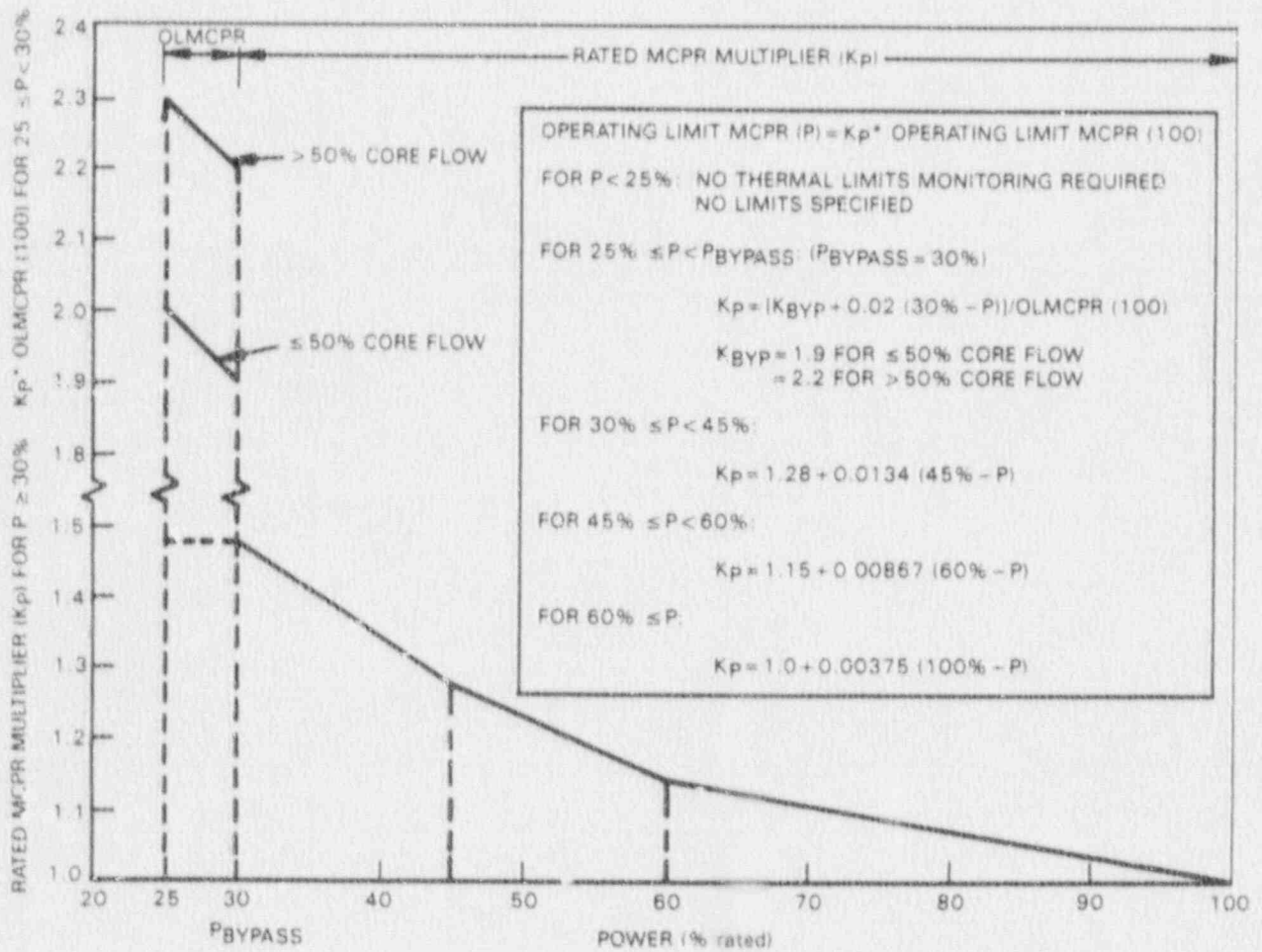
Flow - Dependent MCPR Limit, MCPR(F)



This figure is referred to by  
 Technical Specification 3.2.2.1

Figure 9

Power - Dependent MCPR Limit, MCPR(P)



This figure is referred to by  
 Technical Specification 3.2.2.1

TABLE 2  
RBM SYSTEM SETPOINTS

<u>Setpoint</u>	<u>Trip Setpoint</u>	<u>Allowable Value</u>
Low Power Setpoint (LPSP <sup>a</sup> )	27.0	≤ 29.0
Intermediate Power Setpoint (IPSP <sup>a</sup> )	62.0	≤ 64.0
High Power Setpoint (HPSP <sup>a</sup> )	82.0	≤ 84.0
Low Trip Setpoint (LTSP <sup>b</sup> )	≤ 115.1	≤ 115.5
Intermediate Trip Setpoint (ITSP <sup>b</sup> )	≤ 109.3	≤ 109.7
High Trip Setpoint (HTSP <sup>b</sup> )	≤ 105.5	≤ 105.9
$t_{d2}$	≤ 2.0 seconds	≤ 2.0 seconds

<sup>a</sup> Setpoints in percent of Rated Thermal Power.

<sup>b</sup> Setpoints relative to a full scale reading of 125. For example, ≤ 115.1 means ≤ 115.1/125.0 of full scale.

This table is referred to by  
Technical Specification  
3.3.4 (Table 3.3.4-2)