

CORE OPERATING LIMITS REPORT
FOR
PEACH BOTTOM ATOMIC POWER STATION UNIT 3
RELOAD 10, CYCLE 11

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INTRODUCTION AND SUMMARY

This report provides the following cycle-specific parameter limits for Peach Bottom Atomic Power Station Unit 3 Cycle 11 (Reload 10):

- Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)
- ARTS MAPLHGR thermal limit multipliers
- Single Loop Operation (SLO) MAPLHGR multipliers
- Minimum Critical Power Ratio (MCPR)
- ARTS MCPR thermal limit adjustments and multipliers
- Single Loop Operation (SLO) MCPR adjustment
- Rod Block Monitor (RBM) Setpoints
- Linear Heat Generation Rate (LHGR)

These values have been determined using NRC-approved methodology and are established such that all applicable limits of the plant safety analysis are met.

This report provides the means for calculating the Operating Limit MCPR and MAPLHGR thermal limits for the following conditions:

- all points in the operating region of the power/flow (105% rated power, 3458 MWt) map including Maximum Extended Load Line Limit (MELLL) down to 81% of rated core flow during full power operation
- Increased Core Flow (ICF), up to 110% of rated core flow
- End-of-Cycle Power Coastdown (minimum power level of 40%) and intermediate points
- Feedwater Temperature Reduction (FWTR), to a temperature reduction of 55 °F between EOR and EOC
- Feedwater Heaters Out of Service (FWHOOS), to a 55 °F reduction at any time during the cycle.

This report contains all thermal limit parameters related to the implementation of the ARTS Improvement Program and Maximum Extended Load Line Limit Analyses (ARTS/MELLLA) for Peach Bottom Unit 3 Cycle 11.

NOTE: Until the Peach Bottom Unit 3 Cycle 11 cycle-specific ARTS curves are developed and validated, the generic ARTS curves, as reported in Reference (8), will be used.

This report is submitted in accordance with Technical Specification 6.9.1.e of Reference (1). Preparation of this report was performed in accordance with PECO Energy Fuel and Services Division Procedure FM-300, "Reload Core Licensing".

MAPLHGR LIMITS

The standard limiting MAPLHGR value for the most limiting lattice (excluding natural uranium) of each fuel type as a function of average planar exposure is provided in Figures 1 through 5. These figures are used when hand calculations are required as specified in Technical Specification 3.5.I. These values were obtained from References (3), (4), (5), (6), (13) and (14). The Siemens Power Corporation (SPC) Lead Fuel Assemblies (LFAs) will be monitored to the modified GE9B-P8DWB320-10GZ (Peach Bottom 2 Reload 8 bundle) MAPLHGR limits per References (6) and (13). No reduction in the standard MAPLHGR limits is required under ARTS during single loop operation (SLO MAPLHGR multiplier = 1.0). The ARTS-based MAPLHGR power-dependent multipliers (MAPFAC(P)) are provided in Figures 6 and 7. Figure 6 is valid for seven or more (of nine) Turbine Bypass Valves (TBVs) In-Service and Two Loop Recirculation Flow while Figure 7 is valid for three or more (of nine) TBVs Out-of-Service (OOS) or Single Loop Recirculation Flow. The flow-dependent multipliers (MAPFAC(F)) are provided in Figures 8 and 9 as a function of the number of recirculation loops in operation only.

MCPR LIMITS

The Operating Limit MCPR (OLMCPR) for use in Technical Specification 3.5.K for each fuel type is given in Table 1. These values are determined by the cycle-specific fuel reload analyses in Reference (2). The OLMCPR is increased by 0.01 when operating in SLO (due to the safety limit increase).

NOTE: At times when the surveillance requirement of specification 4.5.K.2 is not performed, the OLMCPR value corresponding to Tau=1, Opt. A in Table 1, must be used.

Separate MCPR values are presented herein for the following domains:

- Core Flow Less Than or Equal to 100% of Rated
- Core Flow Greater Than 100% of Rated, up to 110% of Rated
- Core Flow Less Than or Equal to 100% of Rated With FWHOOS/FWTR
- Turbine Bypass Valves Out-of-Service (TBVOOS), 3 or more out-of-service

The OLMCPR values are documented in Reference (2) for the GE9B and GE11 fuel designs and References (13) and (14) for the SPC LFAs.

The ARTS-based power-dependent MCPR limits, OLMCPR(P), for use in Technical Specification 3.5.K are provided in Figures 10 and 11. Figure 10 is valid for seven or more TBVs In-Service while Figure 11 is valid for three or more TBVOOS. The flow-dependent MCPR limits, OLMCPR(F), are provided in Figure 12. The OLMCPR(P) values below the turbine scram bypass power are documented in Reference (9). The values are conservatively based on a 10 inch increase (actual 6 inch) in the analytical limit for the high (L8) water level feedwater and main turbine trip setpoint.

Note that in the aforementioned OLMCPR table the term "EOR" refers to the cycle exposure at which operation at "rated conditions" is no longer possible (i.e., the cycle exposure at which cycle extension begins) based on the actual EOR point as documented in the current revision of the Cycle Management Report.

OVERALL GOVERNING MCPR AND MAPLHGR LIMITS

ARTS provides for power- and flow-dependent thermal limit adjustments and multipliers which allow for a more reliable administration of the MCPR and MAPLHGR thermal limits. At any given power/flow (P/F) state, all four limits are to be determined: MAPFAC(P), MAPFAC(F), OLMCPR(P), and OLMCPR(F) from Figures 6 through 12, inclusive [per Reference (8)]. The most limiting MCPR and the most limiting MAPLHGR [maximum of OLMCPR(P) and OLMCPR(F) and minimum of MAPLHGR(P) and MAPLHGR(F)] for a given (P,F) condition will be the governing limits. The OLMCPR for each fuel type is determined by the cycle-specific fuel reload analyses in Reference (2). Rated MAPLHGR values are a composite of results obtained from bundle-specific thermal-mechanical and emergency core cooling system analyses. Supporting documentation for the ARTS-based limits is provided in References (8), (9) and (12).

ROD BLOCK MONITOR SETPOINTS

The RBM power-biased setpoints for use in Technical Specification 3.2.C is given in Table 2 per References (8) and (10) with supporting documentation in Reference (2).

LINEAR HEAT GENERATION RATES

The LHGR value for use in Technical Specification 3.5.J for each fuel type is given in Table 3. These values are documented in References (7) and (13).

STEAM BYPASS SYSTEM OPERABILITY

The operability requirements for the steam bypass system are governed by site administrative controls as discussed in Reference (11). If the requirements cannot be met, the appropriate power/flow-dependent limits for TBVOOS must be used (Figures 7 and 11). The minimum number of bypass valves to maintain system operability is seven as per References (2) and (11).

TECHNICAL SPECIFICATIONS

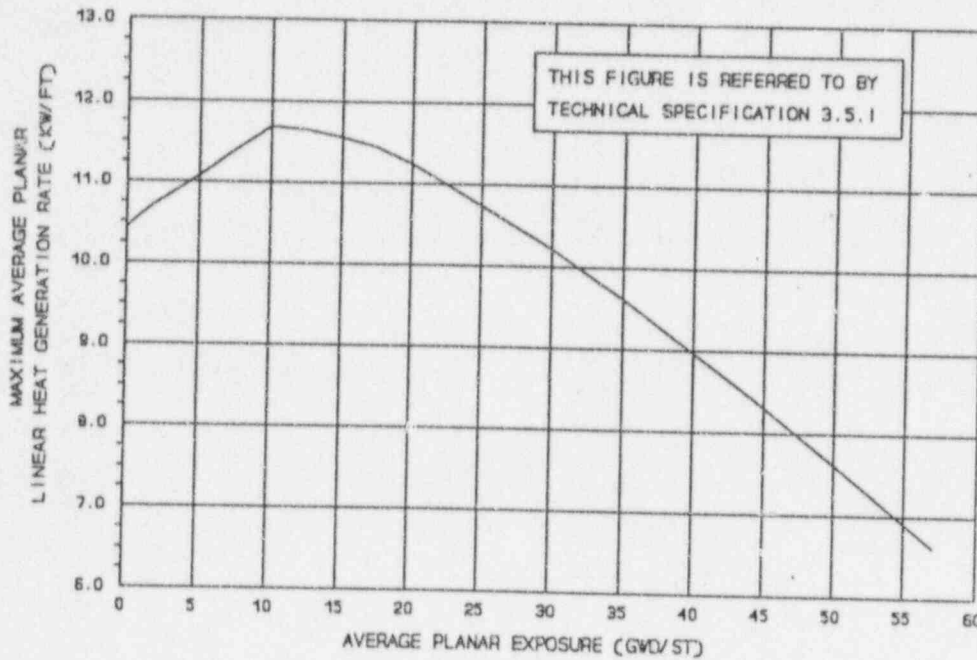
During the operation of Peach Bottom Unit 3 Cycle 11 (approximately January 1996), a change will be made from the current Technical Specifications (CTS), Reference (1), to Improved Technical Specifications (ITS), Reference (15). The reload licensing for this cycle, Reference (2), was performed based on ITS. It is documented in Reference (16) that the licensing is bounding for the use of CTS until ITS is implemented. When ITS is implemented this COLR will be revised. All references to CTS will be replaced with the appropriate ITS references. This will be considered an editorial change since the licensing for PBAPS Unit 3 Cycle 11 was based on ITS.

REFERENCES

- 1) "Technical Specifications and Bases for Peach Bottom Atomic Power Station Unit 3", Docket No. 50-278, Appendix A to License No. DPR-56.
- 2) "Supplemental Reload Licensing Report for Peach Bottom Atomic Power Station Unit 3, Reload 10, Cycle 11", General Electric Company Document No. 24A5175, Rev. 0, September 1995.
- 3) "Lattice Dependent MAPLHGR Report for Peach Bottom Atomic Power Station Unit 3 Reload 10 Cycle 11", 24A5175AA, Revision 0, September 1995.
- 4) "Lattice Dependent MAPLHGR Report for Peach Bottom Atomic Power Station Unit 3 Reload 9 Cycle 10", 23A7215AA, Revision 0, October 1993.
- 5) "Loss-of-Coolant Accident Analyses for Peach Bottom Atomic Power Station Unit 3", Supplement 1, NEDE-24082-P-2, January 1988 (amended).
- 6) "Loss-of-Coolant Accident Analysis for Peach Bottom Atomic Power Station Unit 2 Supplement 1", NEDE-24081-P-2, E&A No. 1, February 1991.
- 7) "General Electric Standard Application for Reactor Fuel", NEDE-24011-P-A-10, February 1991; and NEDE-24011-P-A-10-US, March 1991.
- 8) "Maximum Extended Load Line Limit and ARTS Improvement Program Analyses for Peach Bottom Atomic Power Station Unit 2 and 3", NEDC-32162P, Revision 2, March 1995.
- 9) "Level 8 Analytical Limit Increase Engineering Report for Peach Bottom 2 & 3", NEDC-32231P, August 1993.
- 10) Letter, G. V. Kumar to H. J. Ryan, "Justification for Reduction of Rod Block Monitor System Downscale Trip Setpoint For Peach Bottom Atomic Power Station", May 23, 1994.
- 11) Letter from G. V. Kumar to G. C. Storey, "PBAPS Evaluation of Turbine Bypass Surveillance Requirements", January 19, 1995.
- 12) Letter from G. V. Kumar to A. M. Olson, "PECO Rerate Project, ARTS Thermal Limits", June 27, 1995.
- 13) Siemens Power Corporation Report EMF-93-115(P), "Peach Bottom Unit 3 9x9-A Lead Fuel Assembly Safety Analysis Report", July 7, 1993.
- 14) PECO Energy Company, Reload Licensing Design Record File #2311.
- 15) Peach Bottom Atomic Power Station Unit 3 Improved Technical Specifications and Bases, Amendment No. 214, August 30, 1995.
- 16) Letter from D. B. Waltermire to J. M. Carmody, "Licensing Basis for Peach Bottom-3 Cycle 11", September 20, 1995.

FIGURE 1

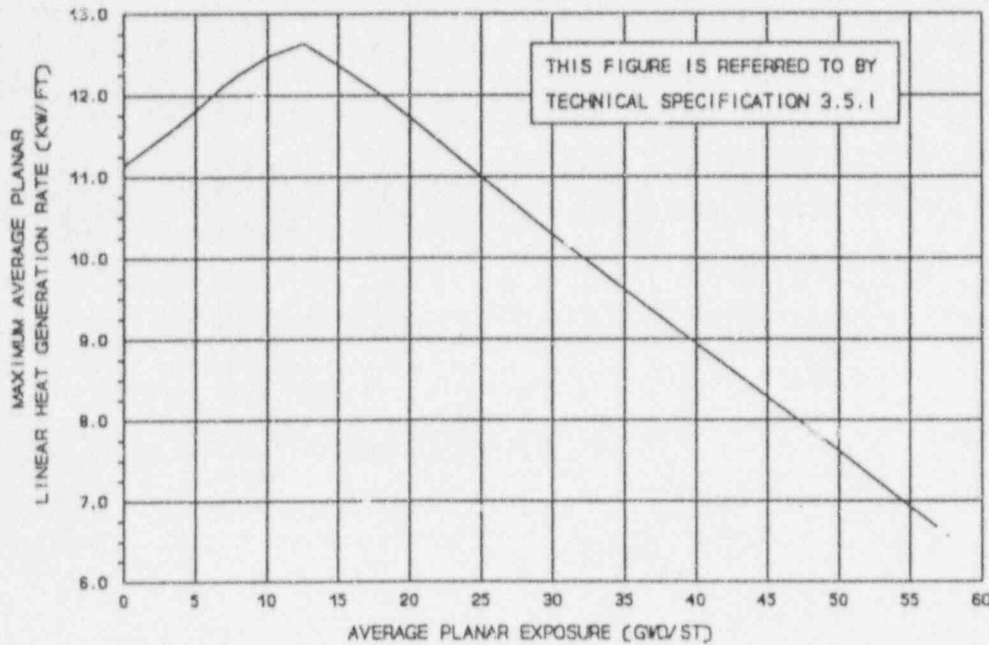
MAXIMUM AVERAGE PLANAR LINEAR HEAT
GENERATION RATE (MAPLHGR) VERSUS
AVERAGE PLANAR EXPOSURE
FUEL TYPE GE11-P9HUB405-13GZ1-100T-146-T



<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>	<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>	<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>
0.0	10.42	7.0	11.33	25.0	10.74
0.2	10.48	8.0	11.45	30.0	10.22
1.0	10.59	9.0	11.57	35.0	9.62
2.0	10.73	10.0	11.69	40.0	8.97
3.0	10.84	12.5	11.65	45.0	8.31
4.0	10.96	15.0	11.56	50.0	7.62
5.0	11.08	17.5	11.44	55.0	6.91
6.0	11.20	20.0	11.24	57.01	6.62

FIGURE 2

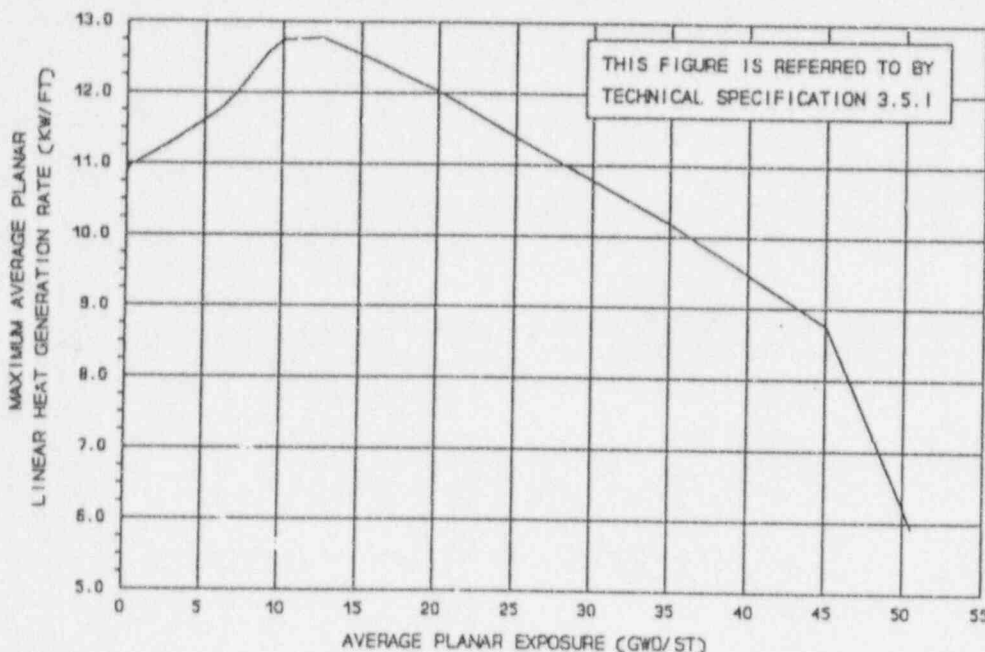
MAXIMUM AVERAGE PLANAR LINEAR HEAT
GENERATION RATE (MAPLHGR) VERSUS
AVERAGE PLANAR EXPOSURE
FUEL TYPE GE11-P9HUB367-11GZ-100M-146-T



<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>	<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>	<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>
0.0	11.14	7.0	12.13	25.0	11.00
0.2	11.18	8.0	12.26	30.0	10.29
1.0	11.27	9.0	12.36	35.0	9.61
2.0	11.40	10.0	12.48	40.0	8.94
3.0	11.53	12.5	12.64	45.0	8.28
4.0	11.67	15.0	12.37	50.0	7.62
5.0	11.82	17.5	12.07	55.0	6.93
6.0	11.97	20.0	11.73	57.64	6.56

FIGURE 3

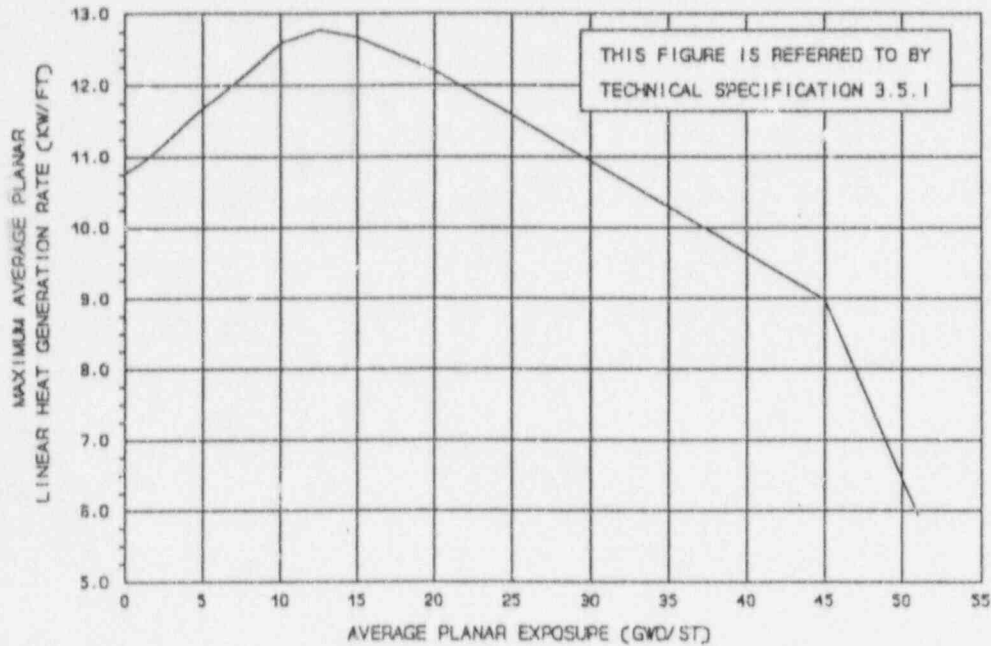
MAXIMUM AVERAGE PLANAR LINEAR HEAT
GENERATION RATE (MAPLHGR) VERSUS
AVERAGE PLANAR EXPOSURE
FUEL TYPE GE9B-P8DWB328-11GZ-80M-150-T



<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>	<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>	<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>
0.0	10.89	6.0	11.77	15.0	12.55
0.2	10.97	7.0	11.99	20.0	12.03
1.0	11.06	8.0	12.28	25.0	11.39
2.0	11.19	9.0	12.56	35.0	10.18
3.0	11.33	10.0	12.75	45.0	8.75
4.0	11.47	12.5	12.78	50.56	5.93
5.0	11.62				

FIGURE 4

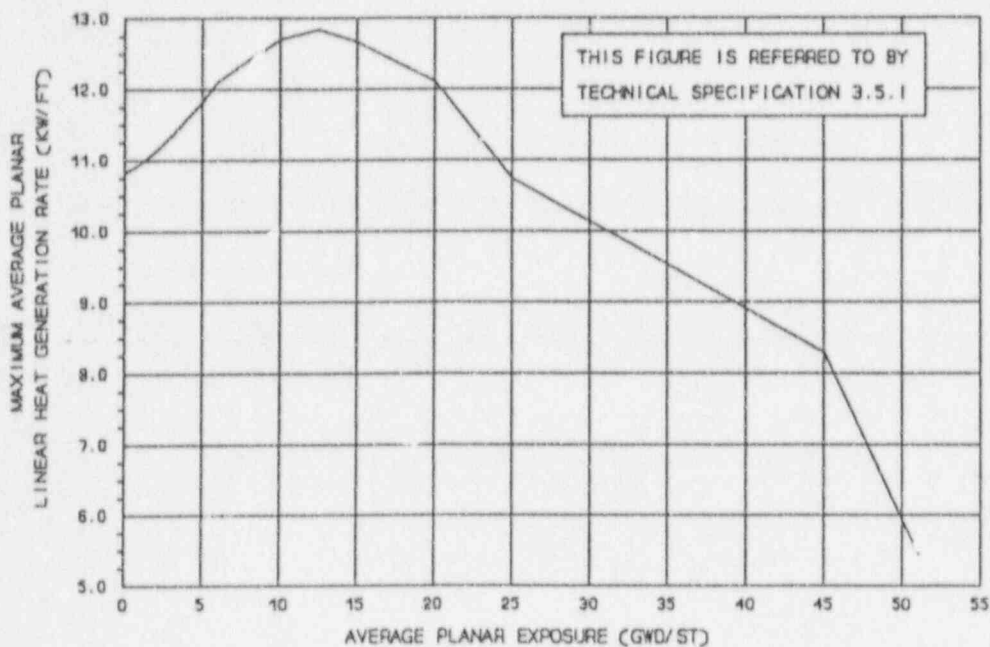
MAXIMUM AVERAGE PLANAR LINEAR HEAT
GENERATION RATE (MAPLHGR) VERSUS
AVERAGE PLANAR EXPOSURE
FUEL TYPE GE9B-P8DWB324-10GZ1-80M-150-T



<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>	<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>	<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>
0.0	10.77	6.0	11.85	15.0	12.68
0.2	10.80	7.0	12.02	20.0	12.21
1.0	10.91	8.0	12.21	25.0	11.58
2.0	11.09	9.0	12.40	35.0	10.29
3.0	11.29	10.0	12.60	45.0	8.98
4.0	11.50	12.5	12.78	50.99	5.95
5.0	11.69				

FIGURE 5

MAXIMUM AVERAGE PLANAR LINEAR HEAT
GENERATION RATE (MAPLHGR) VERSUS
AVERAGE PLANAR EXPOSURE
FUEL TYPE SPC 9x9-A (LFA)



<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>	<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>	<u>Avg Plan Exposure (GWd/ST)</u>	<u>MAPLHGR (kW/ft)</u>
0.0	10.82	6.0	12.11	15.0	12.67
0.2	10.85	7.0	12.26	20.0	12.11
1.0	10.95	8.0	12.42	25.0	10.74
2.0	11.13	9.0	12.56	35.0	9.53
3.0	11.34	10.0	12.71	45.0	8.29
4.0	11.58	12.5	12.85	51.06	5.45
5.0	11.83				

FIGURE 6

POWER DEPENDENT MAPLHGR MULTIPLIER MAPFAC(P)
 THIS FIGURE IS REFERRED TO BY TECHNICAL SPECIFICATION 3.5.1

THIS FIGURE IS VALID FOR 7 OR MORE TBVs IN-SERVICE AND 2 LOOP RECIRC FLOW

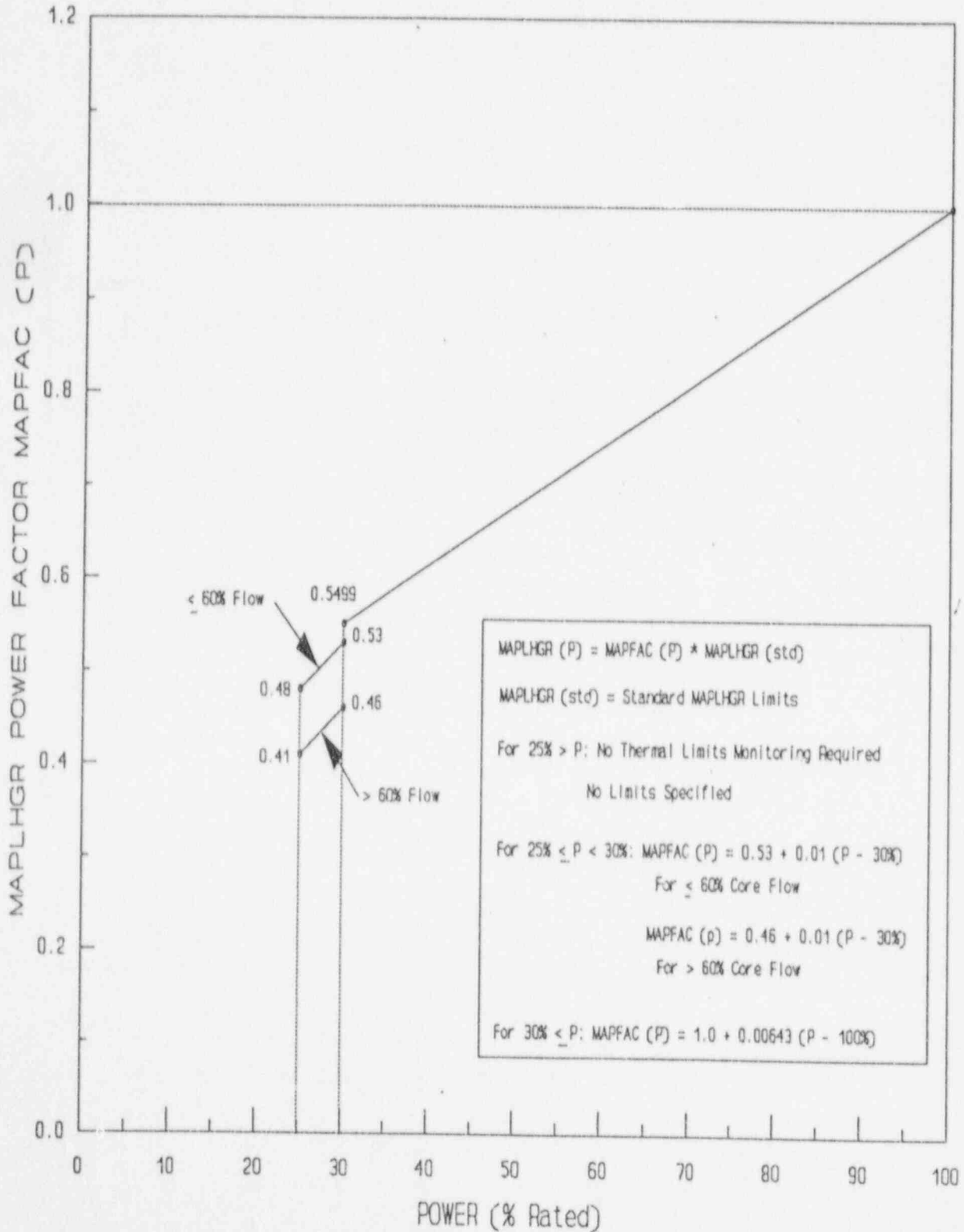


FIGURE 7

POWER DEPENDENT MAPLHGR MULTIPLIER MAPFAC(P)
 THIS FIGURE IS REFERRED TO BY TECHNICAL SPECIFICATION 3.5.1

THIS FIGURE IS VALID FOR 3 OR MORE TBVs OOS OR SINGLE LOOP RECIRC FLOW

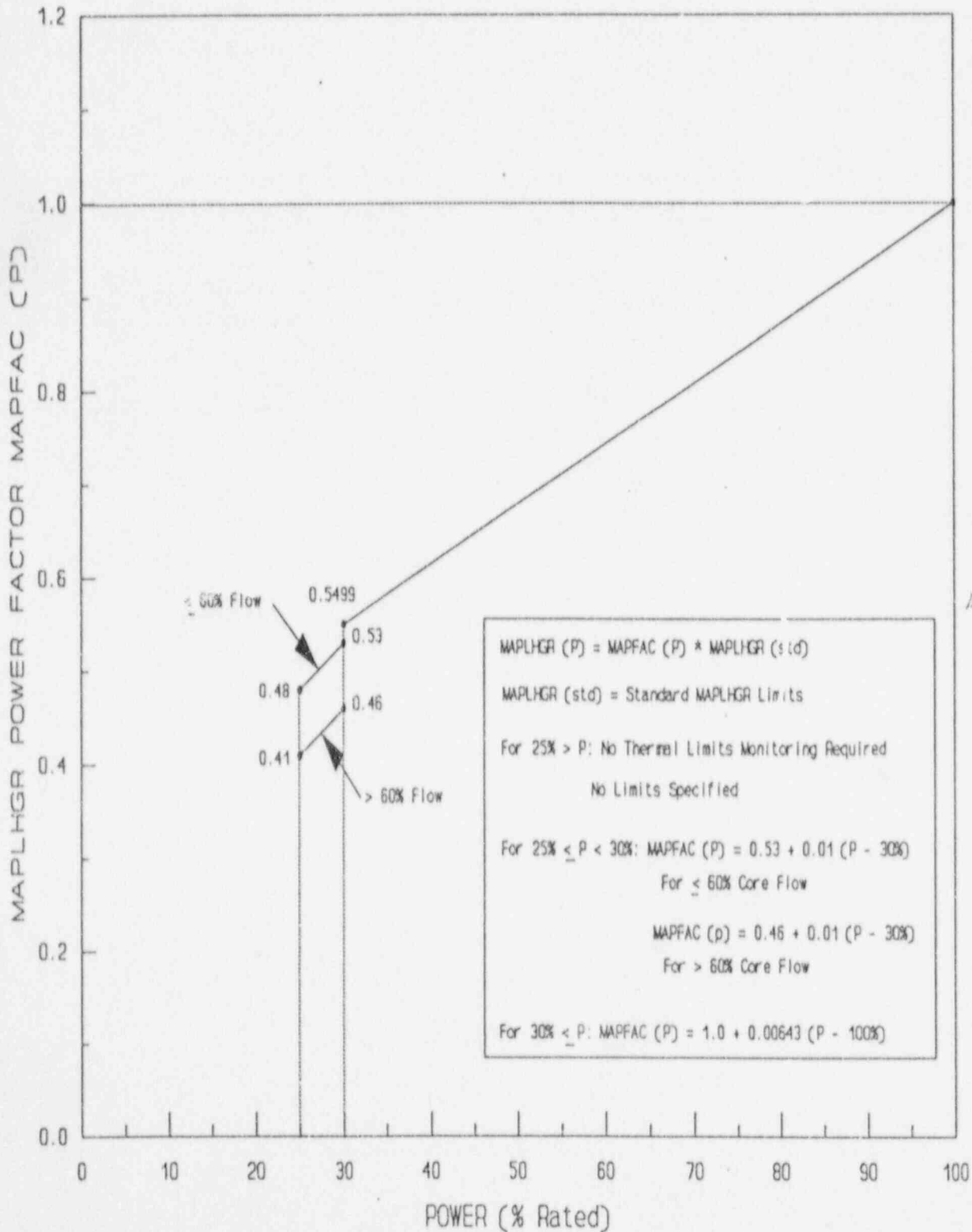


FIGURE 8

FLOW DEPENDENT MAPLHGR MULTIPLIER MAPFAC(F)
THIS FIGURE IS REFERRED TO BY TECHNICAL SPECIFICATION 3.5.1

THIS FIGURE IS VALID FOR TWO LOOP RECIRC FLOW

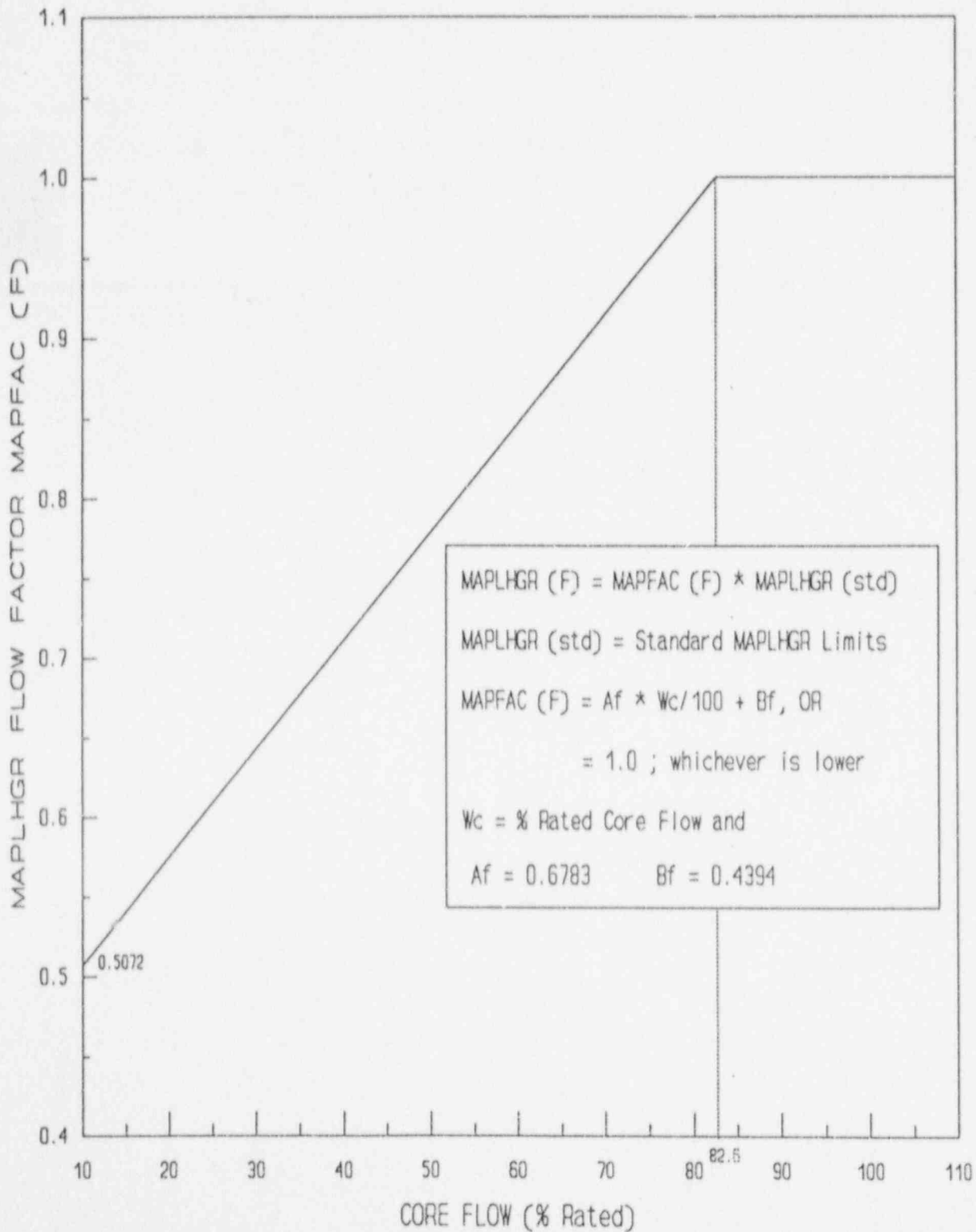


FIGURE 9

FLOW DEPENDENT MAPLHGR MULTIPLIER MAPFAC(F)
THIS FIGURE IS REFERRED TO BY TECHNICAL SPECIFICATION 3.5.1

THIS FIGURE IS VALID FOR SINGLE LOOP RECIRC FLOW

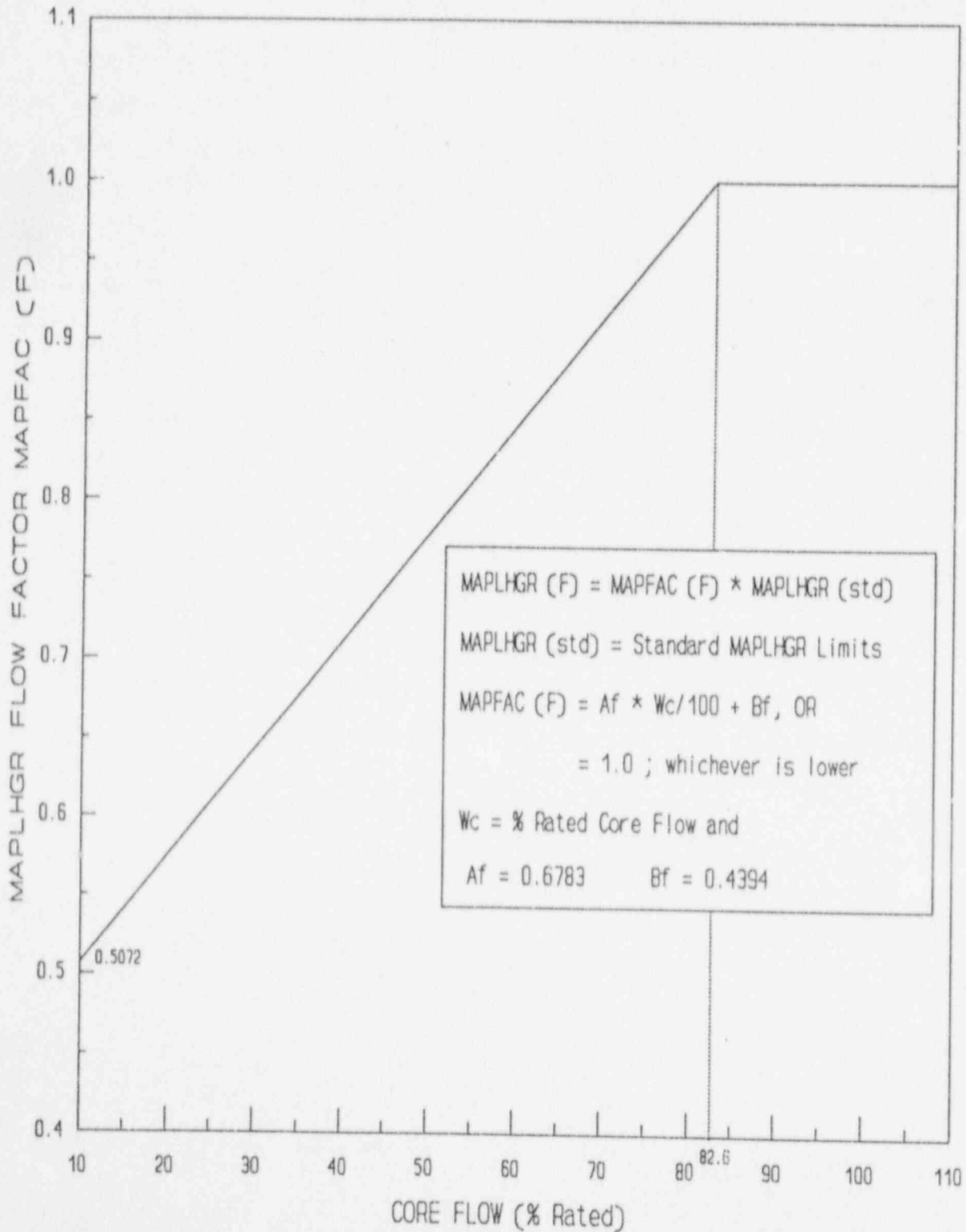


TABLE 1

OPERATING LIMIT MINIMUM CRITICAL POWER RATIO (OLMCPR)

Use in conjunction with Figures 10, 11 and 12
 Add 0.01 to the OLMCPR when in Single Loop Operation

This Table is Referred to by Technical Specification 3.5.K

		CORE FLOW LESS THAN OR EQUAL TO 100% OF RATED		CORE FLOW GREATER THAN 100% OF RATED		CORE FLOW LESS THAN OR EQUAL TO 100% OF RATED WITH FWHOOS/FWTR		TBVOOS (3 OR MORE TBVs OOS)	
		Opt. B	Opt. A	Opt. B	Opt. A	Opt. B	Opt. A	Opt. B	Opt. A
GE9B & GE11	EOC	1.33	1.41	1.35	1.43	1.34	1.42	1.41	1.49
	MOC	1.30	1.35	1.31	1.36	1.30	1.35	1.37	1.42
SPC	EOC	1.37	1.45	1.39	1.47	1.38	1.46	1.45	1.53
	MOC	1.34	1.39	1.35	1.40	1.34	1.39	1.41	1.46

- NOTES: 1) Opt. B: Tau=0.0
 2) Opt. A: Tau=1.0
 3) When Tau does not equal 0.0 or 1.0 use linear interpolation.
 4) MOC: Cycle exposure from BOC to EOR-2000 MWd/st
 5) EOC: Cycle exposure from EOR-2000 MWd/st to EOC
 6) FWHOOS/FWTR: Feedwater Heater Out-of-Service/Feedwater Temperature Reduction
 7) TBVOOS: Turbine Bypass Valves Out-of-Service

FIGURE 10

POWER DEPENDENT MCPR LIMIT ADJUSTMENTS AND MULTIPLIERS
THIS FIGURE IS REFERRED TO BY TECHNICAL SPECIFICATION 3.5.K

THIS FIGURE IS VALID FOR 7 OR MORE TBVs IN-SERVICE

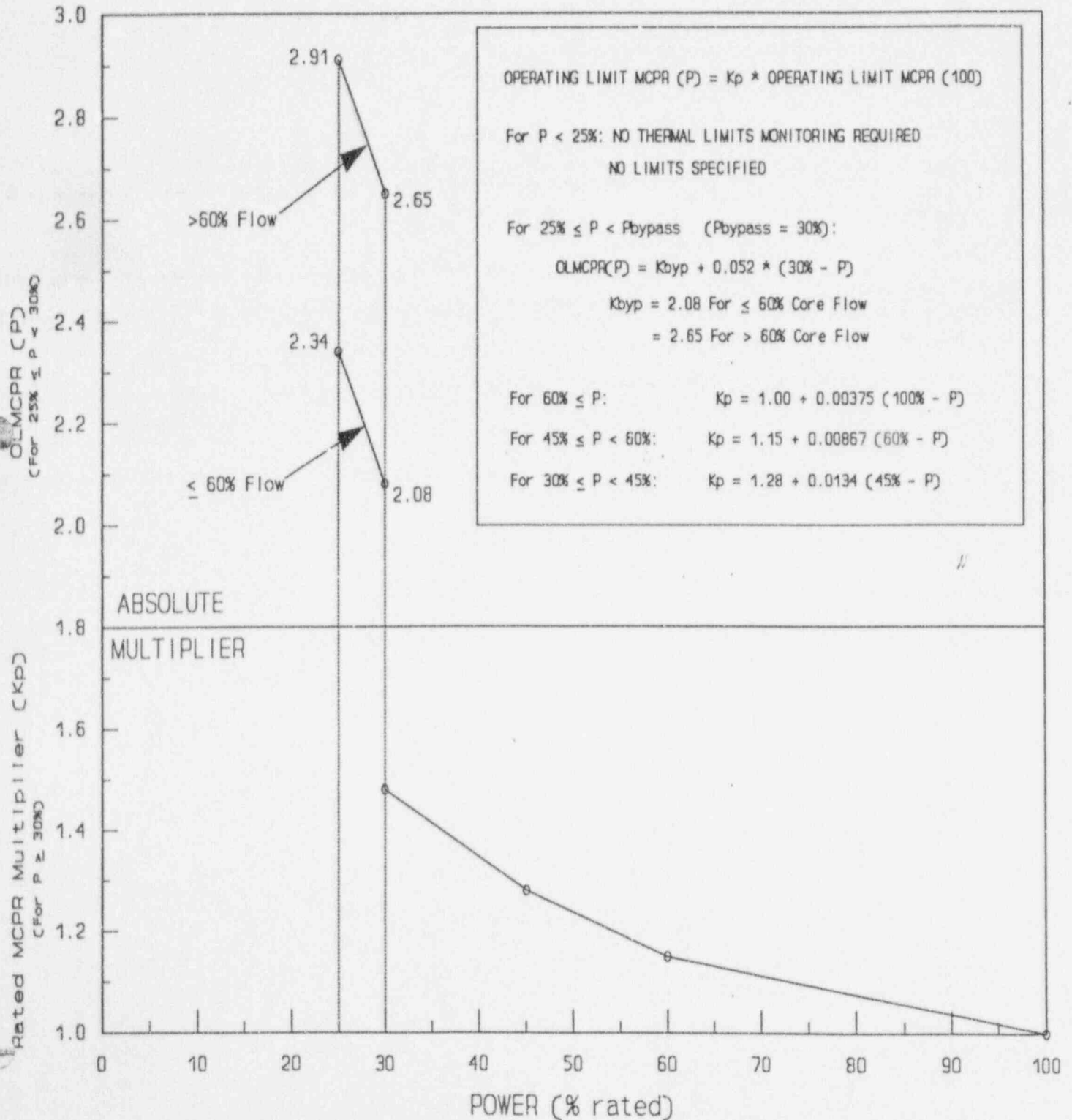


FIGURE 11

POWER DEPENDENT MCPR LIMIT ADJUSTMENTS AND MULTIPLIERS
 THIS FIGURE IS REFERRED TO BY TECHNICAL SPECIFICATION 3.5.K

THIS FIGURE IS VALID FOR 3 OR MORE TBVS OUT-OF-SERVICE (OOS)

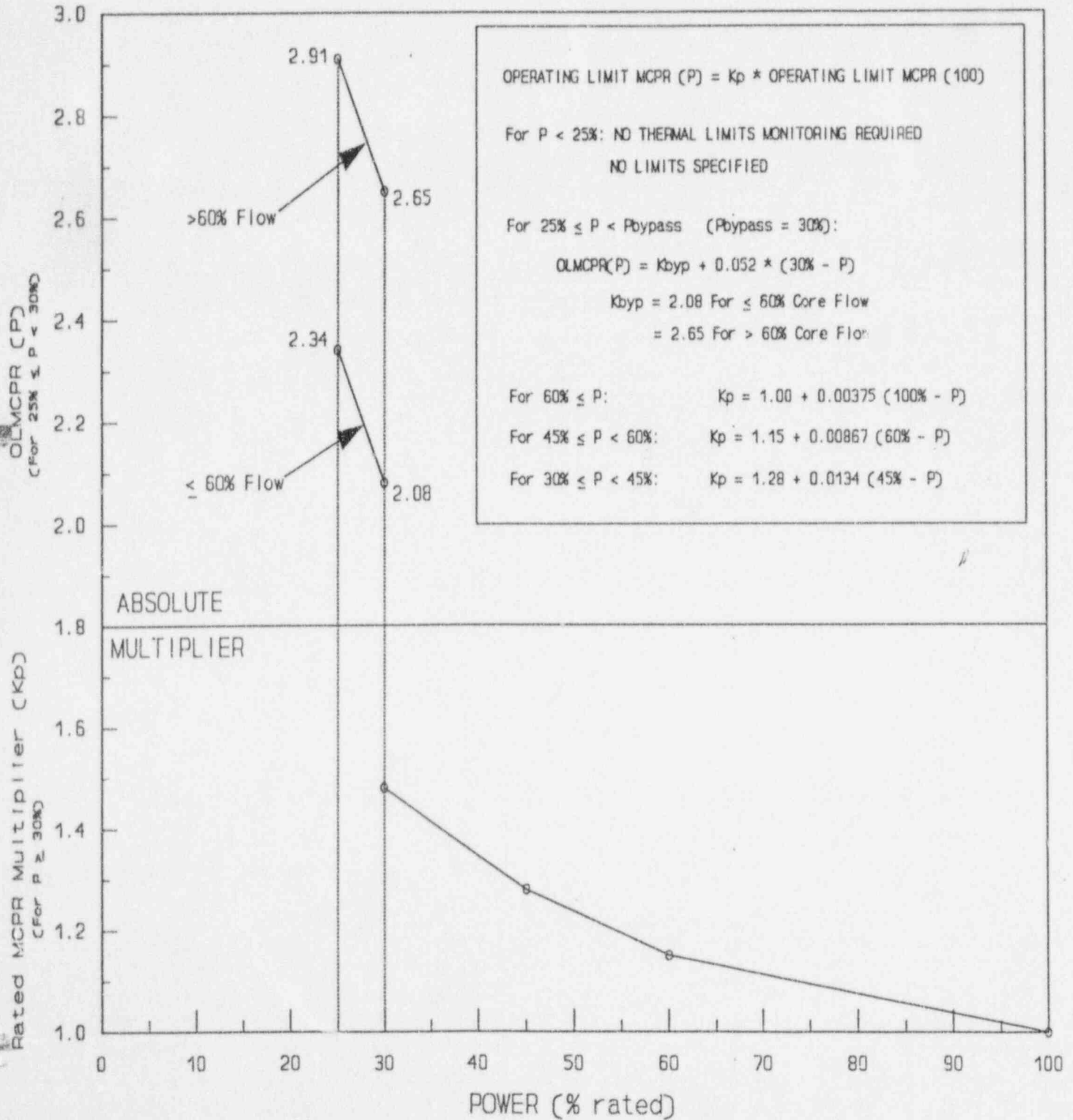


FIGURE 12

FLOW DEPENDENT MCPR LIMITS OLMCPR(F)
THIS FIGURE IS REFERRED TO BY TECHNICAL SPECIFICATION 3.5.K

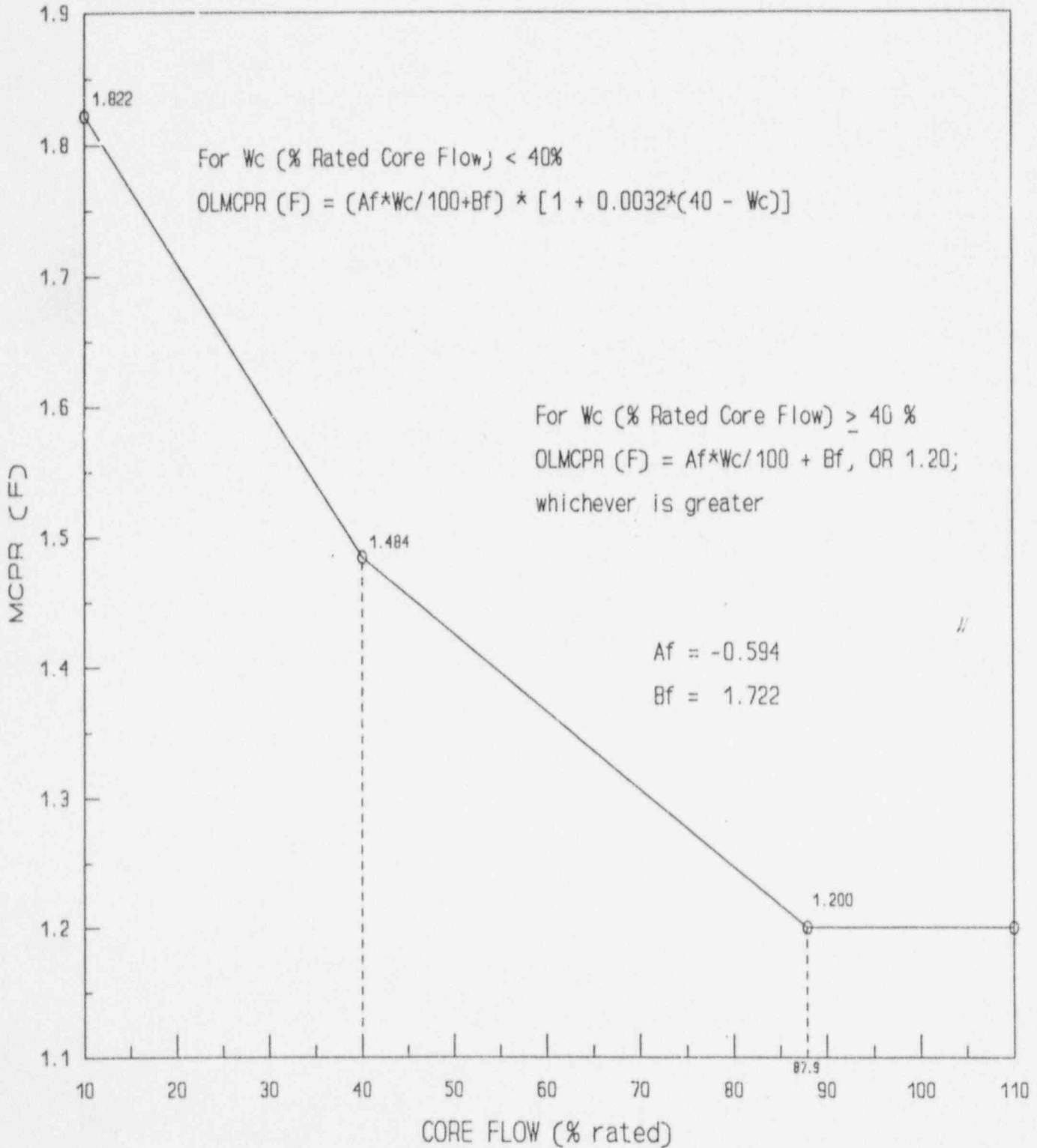


TABLE 2

ROD BLOCK MONITOR SETPOINTS

Low Trip Setpoint (LTSP)	≤ 123.0%
Intermediate Trip Setpoint (ITSP)	≤ 118.0%
High Trip Setpoint (HTSP)	≤ 113.2%
Downscale Trip Setpoint (DTSP)	≥ 1.0%

These Trip Level Settings (with RBM filter) are based on a MCPDR limit of 1.30 and are consistent with an RBM filter time constant between 0.1 seconds and 0.55 seconds.

TABLE 3

DESIGN LINEAR HEAT GENERATION RATE LIMITS

<u>FUEL TYPE</u>	<u>LHGR LIMIT</u>
GE9B	14.4 kW/ft
GE11	14.4 kW/ft
SPC 9x9-A (LFA)	14.4 kW/ft