MONTICELLO NUCLEAR GENERATING PLANT

Core Operating Limits Report

for Cycle 18

Revision 3

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This report provides the values of the limits for Cycle 18 as required by Technical Specification Section 6.7.A.7. These values have been established using NRC approved methodology and are established such that all applicable limits of the plant safety analysis are met.

This COLR incorporates the SLCPR change described in Reference 1. The SLCPR has changed from 1.07 for GE10 and GE11 fuel to 1.08 for all fuel in cycle 18 with the exception of the four GE12 LUA bundles. The SLCPR for the GE12 LUA bundles is not impacted by the Reference 1 analysis. The GE12 results presented in this report are based on a SLCPR of 1.09.

This report complies with the verbal agreement between GE and the NRC with regard to modification of the MCPR operating limits (Reference 1) to reflect the 0.01 change in SLCPR for Monticello Cycle 18. Also, the power and flow dependent MCPR curves (Figure 3 and Figure 4) account for the 0.01 change in SLCPR.

This report includes an additional MCPR penalty for operations with a single recirculation loop (Reference 2).

This revision includes stability exclusion region definition, buffer region definition, and power distribution limits as required by amendment 97 to Monticello's operating license approved by the NRC in Reference 3.

Reference 1: Letter from C. Papandrea (GE Nuclear) to K. S. Schnoebelen (NSP), "Safety Limit MCPR Calculation for Monticello Cycle 18", May 8, 1996.

Reference 2: Letter from David Pribyl (NSP) to Dan Wegener (NSP), " Monticello Cycle 18 - CPR Penalty in Single Loop Operations", May 17, 1996.

Reference 3: Letter from Tae Kim (USNRC) to Roger O. Anderson (NSP), "Monticello Nuclear Generating Plant - Issuance of Amendment Re: Implementation of Boiling Water Reactor Owners Group Option I-D Core Stability Solution (TAC No. M92947)", including enclosures, September 17, 1996.

Rod Block Monitor Operability Requirements

The MCPR limit associated with the Rod Block Monitor operability is:

$MCPR < 1.65$

Whenever the monitored core MCPR is less than 1.65, a limiting control rod pattern exists and the RBM system is required to be operable.

Reference Technical Specification Section 3.2.C.2.a

Rod Block Monitor Upscale Trip Setpoints

Low Trip Setpoint (LTSP)	$\leq$	120/125 of full scale
Intermediate Trip Setpoint (ITSP)	$\leq$	115/125 of full scale
High Trip Setpoint (HTSP)	$\leq$	110/125 of full scale

Reference Technical Specification Sections: Table 3.2.3 Item 4.a, Table 3.2.3 Note 8.

Minimum Critical Power Ratio

The Minimum Critical Power Ratio (MCPR) limit shall be determined for two Recirculation Loop Operation as follows:

If thermal power > 45%, then the MCPR for GE10, GE11, and Siemens Fuel is the greater of:

1.43 * K_P (K_P from Figure 3) or $MCPR_F$ from Figure 4.

If thermal power > 45%, then the MCPR for GE12 Fuel is the greater of:

1.47 * K_P (K_P from Figure 3) or $MCPR_F$ from Figure 4.

If thermal power ≤ 45%, then the MCPR limit is obtained from Figure 3.

If in operation of a single recirculation loop, then the MCPR limit as defined previously by two recirculation loop operation is increased by the following adders:

0.01 ΔMCPR to account for core flow measuring and TIP reading uncertainties.

0.07 ΔMCPR to preclude fuel failures for a 1 out of 2 Pump Seizure Event (Reference 2).

Reference Technical Specification Section: 3.11.C.

Power-Flow Operating Map

The Power-Flow Operating Map based on analysis to support Cycle 18 is shown in Figures 5 & 6.

Approved Analytical Methods

NEDE-24011-P-A	Rev 11	"General Electric Standard Application for Reactor Fuel"
NSPNAD-8608-A	Rev 4	"Reload Safety Evaluation Methods for Application to the Monticello Nuclear Generating Plant"
NSPNAD-8609-A	Rev 3	"Qualification of Reactor Physics Methods for Application to Monticello"
ANF-91-048 (P) (A)	Rev 0	"Advanced Nuclear Fuels Corporation Methodology for Boiling Water Reactors-EXEM BWR Evaluation Model," Siemens Power Corporation
NEDO-31960-A		"BWR Owners' Group Long-Term Stability Solutions Licensing Methodology," June 1991.
NEDO-31960-A, Supplement 1		"BWR Owners' Group Long-Term Stability Solutions Licensing Methodology (Supplement 1)," March 1992.

Maximum Average Linear Heat Generation Rate as a function of exposure

When hand calculations are required, the Maximum Average Linear Heat Generation Rate (MAPLHGR) for each fuel bundle design as a function of average planar exposure shall not exceed the limiting lattice (excluding natural Uranium) provided in Table 1 (based on straight line interpolation between data points) multiplied by the smaller of the two MAPFAC factors determined from Figures 1 and 2.

The MAPLHGR limits in Table 1 are conservative values bounding all fuel lattice types (excluding natural Uranium) in a given fuel bundle design and are intended only for use in hand calculations as described in Technical Specification 3.11.A. No channel bow effects are included in the bounding MAPLHGR values below because there are no reused channels. MAPLHGR limits for each individual fuel lattice design in a bundle design as a function of axial location and average planar exposure, with appropriate channel bow adjustments (no channel bow effects for Cycle 18), are determined based on the approved methodology referenced in Monticello Technical Specification 6.7.A.7.b and loaded in the process computer for use in core monitoring calculations.

The SPC 9x9-IX Qualification Fuel Assemblies (QFAs) will be monitored to the GE10-DXB333-10GZ MAPLHGR and LHGR limits to protect the steady state LHGR limit of the QFAs. When hand calculations are required, the GE10-DXB333-10GZ MAPLHGR and LHGR limits can be used to calculate the appropriate limits for the QFAs.

Reference Technical Specification Section 3.11.A.

Core Stability Requirements

Stability Exclusion Region
The stability exclusion region is shown in Figure 5 and is given in greater detail in Figure 6.

Stability Buffer Region
The stability buffer region is shown in Figure 5 and is given in greater detail in Figure 6.

Power Distribution Controls
Prior to intentionally entering the stability buffer region, the hot channel and core wide decay ratios will be shown to be within the stable portion of Figure 7. While operating in the stability buffer region, the hot channel and core wide decay ratios will be maintained within the stable portion of Figure 7.

Reference Technical Specification Section 3.5.F.

Table 1 MAPLHGR for each fuel type (kW/ft)					
Exposure MWD/STU	**GE10-HXB324-10GZ**	**GE10-HXB324-11GZ**	**GE10-HXB324-10GZ1**	**GE10-DXB333-10GZ**	**GE10-DXB324-11GZ**
200	10.92	10.36	11.19	11.64	10.71
1000	11.05	10.47	11.42	11.70	10.82
5000	12.01	11.55	12.20	12.30	11.78
10000	13.17	12.95	12.65	12.88	13.17
15000	12.95	12.97	12.47	12.65	12.88
20000	12.21	12.22	11.81	11.97	12.25
25000	11.52	11.52	11.21	11.31	11.60
30000	10.90	10.90	10.67	10.67	10.95
35000	10.29	10.28	10.14	10.02	10.30
40000	9.63	9.61	9.55	9.21	9.61
45000	8.98	8.94	8.97	8.40	8.92
50000	6.50	6.45	6.49	5.93	6.43

Exposure MWD/STU	**GE11-DUB348-10GZ**	**GE11-DUB347-10GZ**	**GE12-DSB330-12GZ**
200	10.32	9.96	8.54
1000	10.47	10.02	8.57
5000	11.21	11.04	9.31
10000	12.21	12.32	10.25
15000	12.06	11.93	10.13
20000	11.40	11.32	9.78
25000	10.71	10.73	9.45
30000	10.03	10.15	9.08
35000	9.37	9.56	8.66
40000	8.71	8.91	8.19
45000	8.05	8.27	7.46
50000	7.38	7.59	6.70
55000	6.70	6.62	5.99
57680	6.28		
58050		6.06	
60060			5.31

Note: Table 1 is for two recirculation loop operation. For single loop operation, multiply these values by 0.85.

Linear Heat Generation Rate

Table 2 LHGR for Each Fuel Type (kW/ft)							
GE10-HXB324-10GZ	**GE10-HXB324-11GZ**	**GE10-HXB324-10GZ1**	**GE10-DXB333-10GZ**	**GE10-DXB324-11GZ**	**GE11-DUB347-10GZ**	**GE11-DUB348-10GZ**	**GE12-DSB330-12GZ**
14.4	14.4	14.4	14.4	14.4	14.4	14.4	11.8

Reference Technical Specification Section: 3.11.B.

Monticello Cycle 18
Power Dependent MAPLHGR Limits

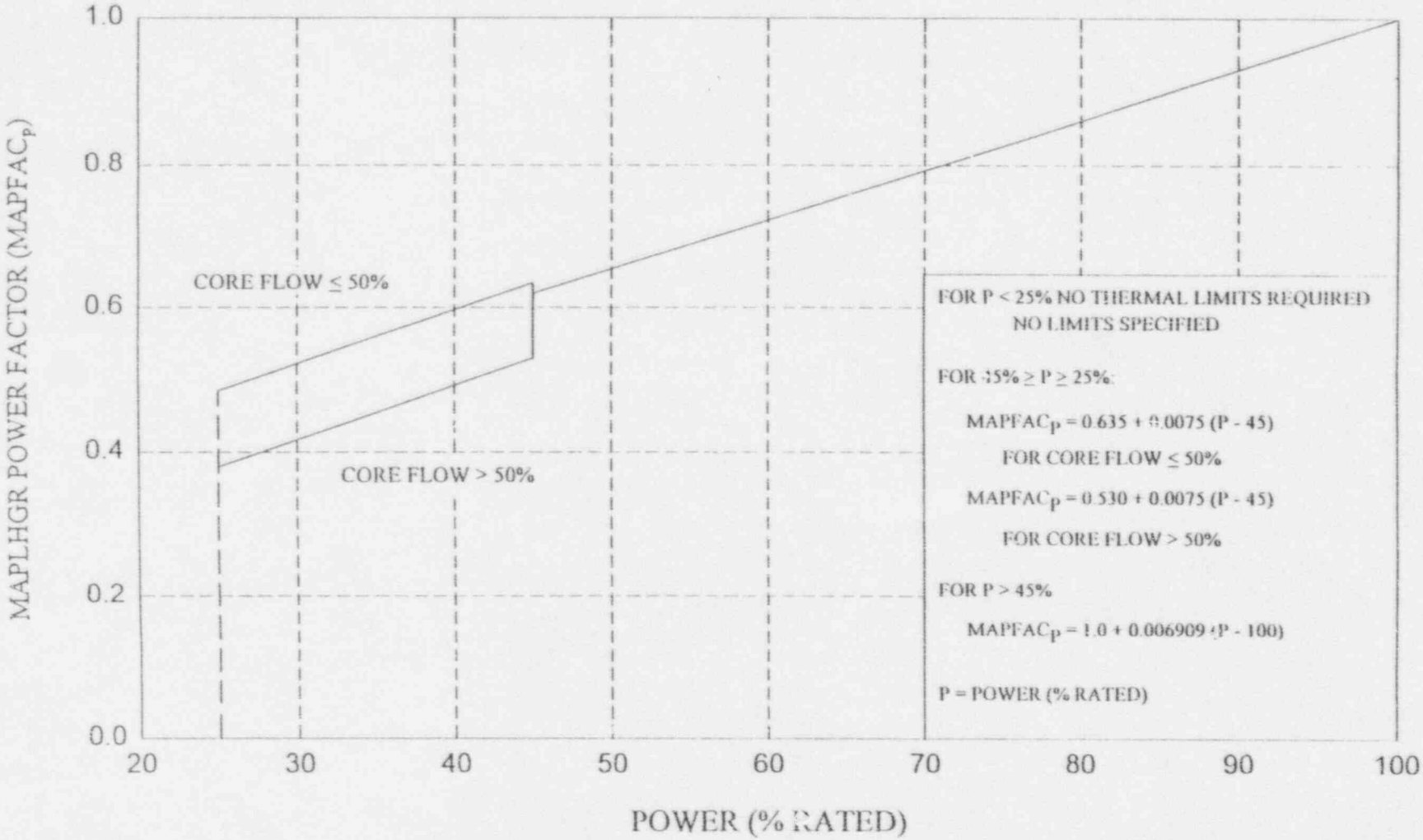

Figure 1

Monticello Cycle 18
Flow Dependent MAPLHGR Limits

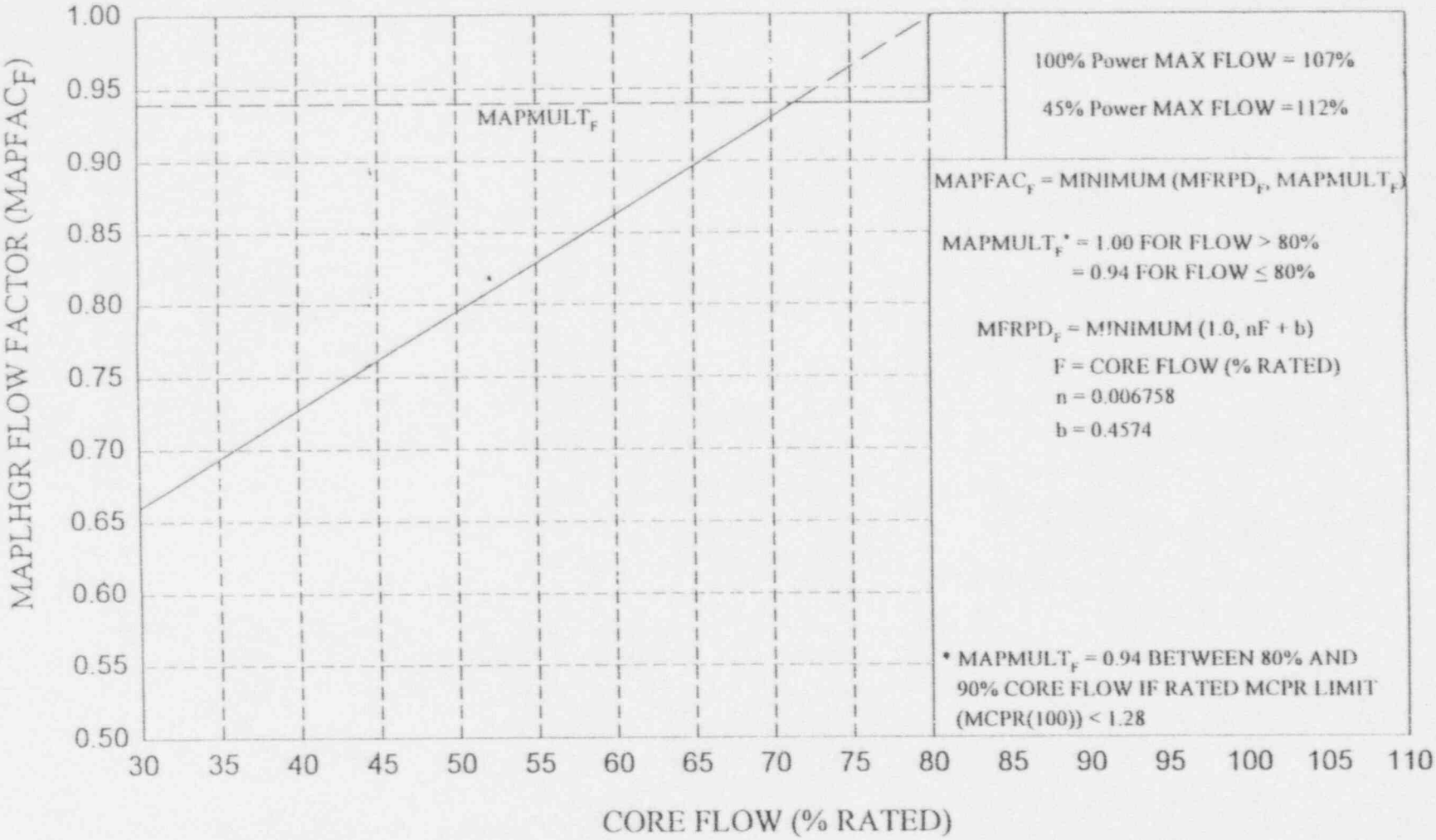

Figure 2

Monticello Cycle 18
Power Dependent CPR Limits

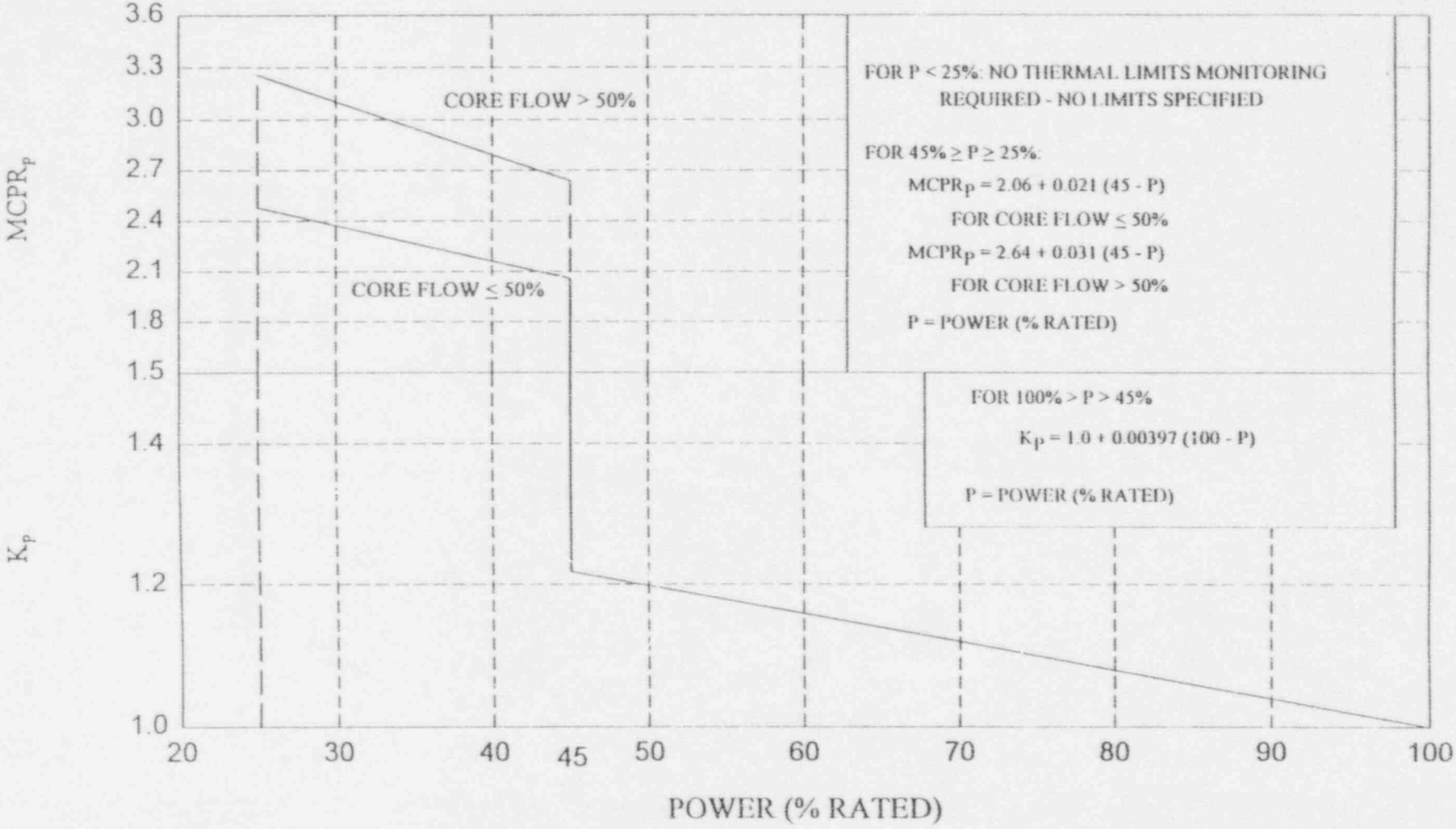

Figure 3

Monticello Cycle 18
Flow Dependent CPR Limits

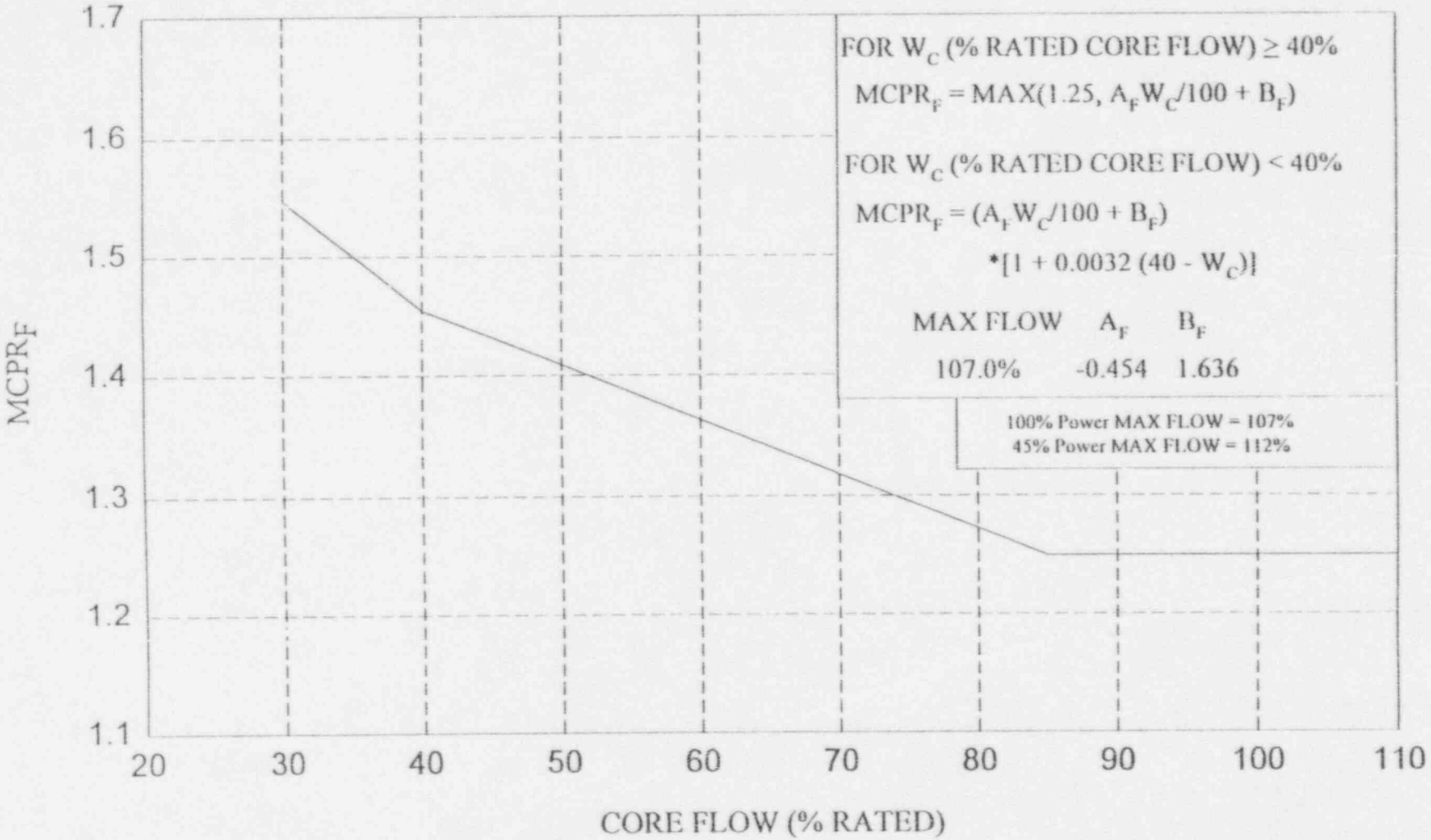

Figure 4

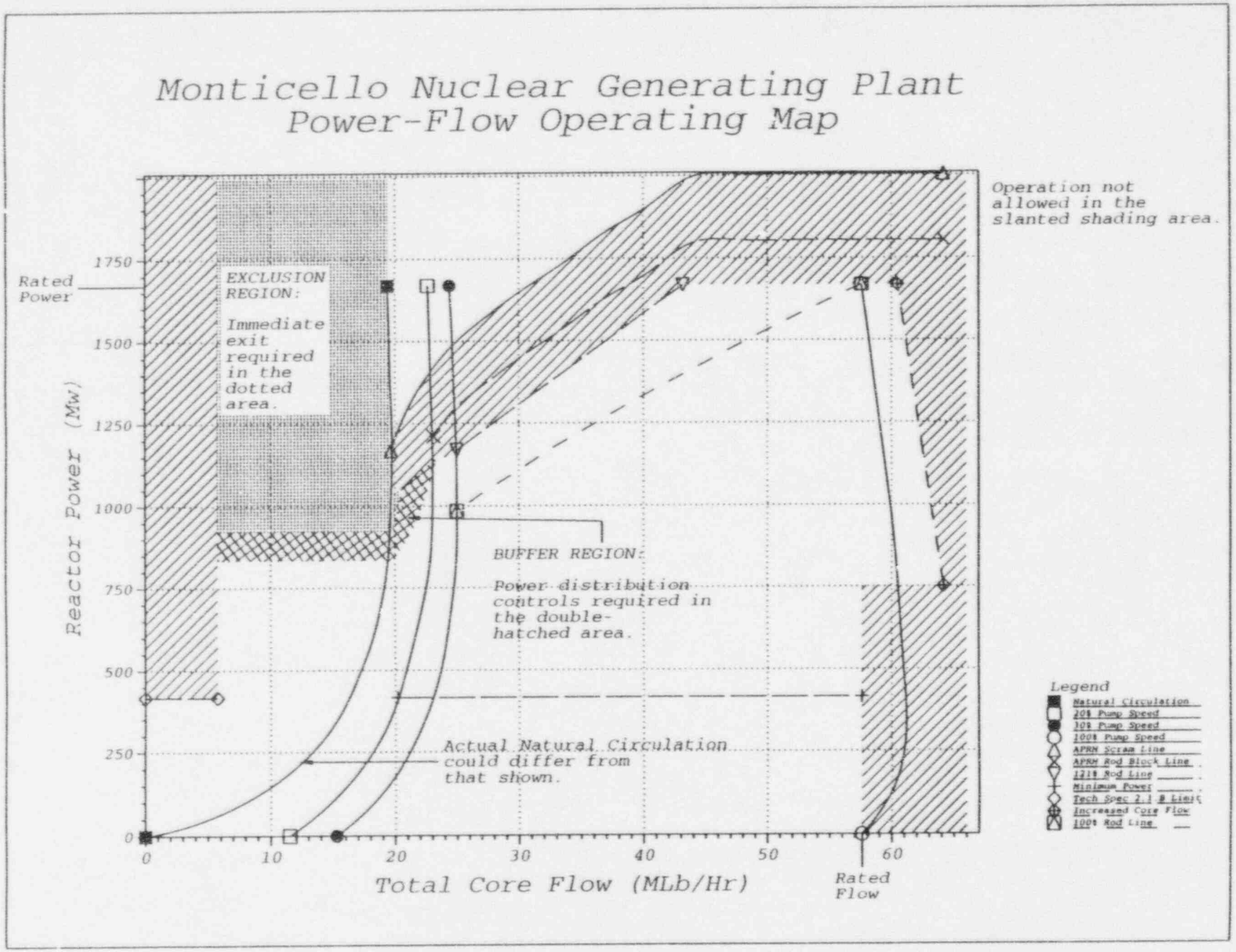
Monticello Nuclear Generating Plant
Power-Flow Operating Map
Operation not allowed in the slanted shading area.
Rated Power
EXCLUSION REGION:
Immediate exit required in the dotted area.
BUFFER REGION:
Power distribution controls required in the double-hatched area.
Actual Natural Circulation could differ from that shown.
Reactor Power (Mw)
Total Core Flow (MLb/Hr)
Rated Flow
0
250
500
750
1000
1250
1500
1750
0
10
20
30
40
50
60
Legend
Natural Circulation
20% Pump Speed
30% Pump Speed
100% Pump Speed
APRM Scram Line
APRM Rod Block Line
121% Rod Line
Minimum Power
Tech Spec 2.1.B Limit
Increased Core Flow
100% Rod Line

Figure 5

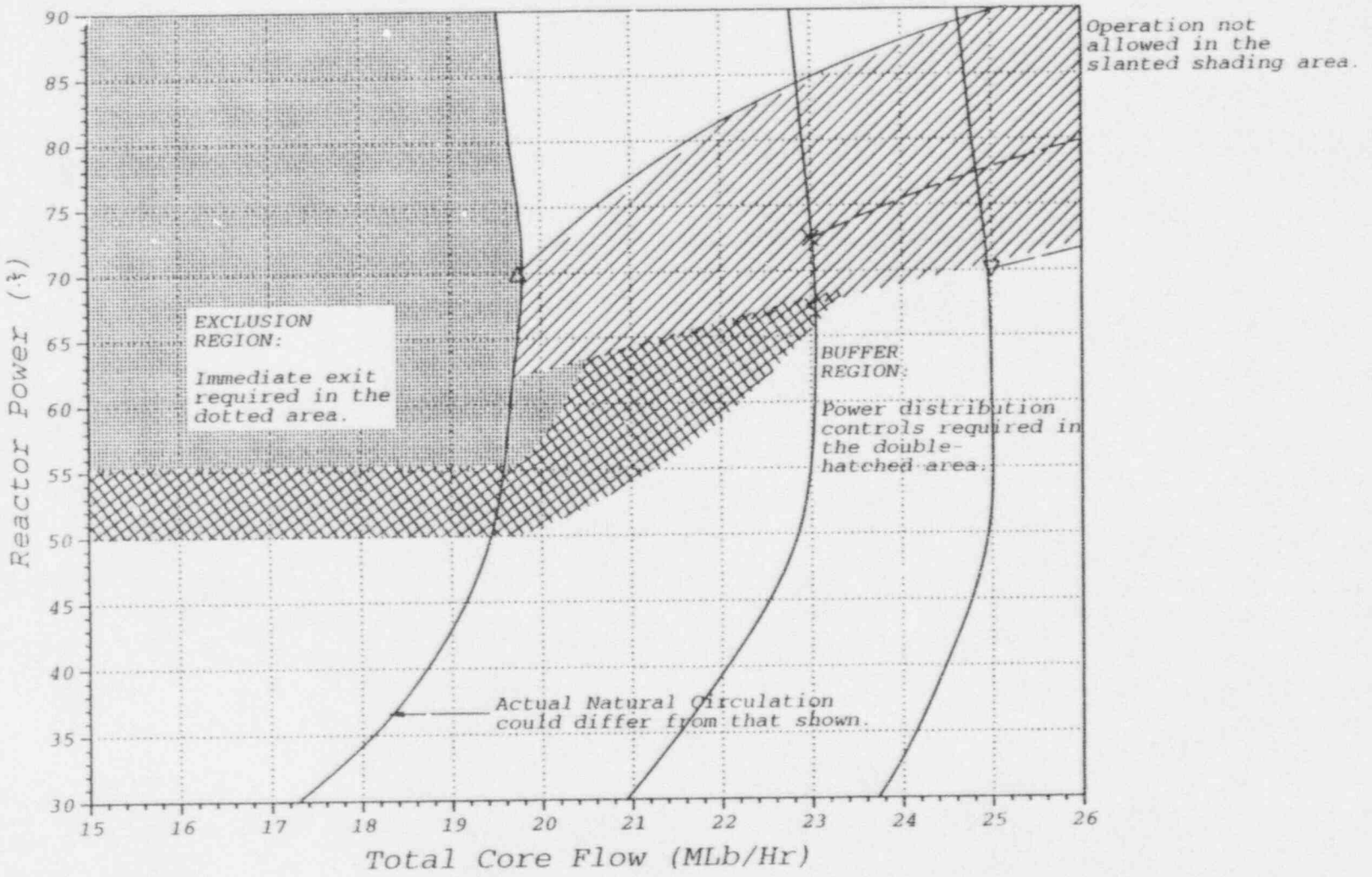
Monticello Nuclear Generating Plant
Power-Flow Operating Map
Reactor Power (%)
Total Core Flow (MLb/Hr)
90
85
80
75
70
65
60
55
50
45
40
35
30
15
16
17
18
19
20
21
22
23
24
25
26
EXCLUSION REGION:
Immediate exit required in the dotted area.
BUFFER REGION:
Power distribution controls required in the double-hatched area.
Operation not allowed in the slanted shading area.
Actual Natural Circulation could differ from that shown.

Figure 6

Figure 7

Stability Criterion Map