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Monticello Nuclear Generating Plant
2807 West County Road 75
Monticello, MN 55362-9637

Operated by Nuclear Management Company LLC

December 17, 2001

Technical Specification
6.7.A.7

US Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

MONTICELLO NUCLEAR GENERATING PLANT
Docket No. 50-263 License No. DPR-22

Submittal of the Core Operating Limits Report for Cycle 21

Reference 1: NMC Letter to US Nuclear Regulatory Commission, "License Amendment Request for Monticello Cycle 21 Safety Limit Minimum Critical Power Ratio," dated August 30, 2001

Reference 2: NMC Letter to NRC, "Response to NRC Request For Additional Information Regarding Request to Withhold Information from Public Disclosure," dated October, 10, 2001

Reference 3: NMC Letter to NRC, "Response to NRC Request For Additional Information Regarding License Amendment Request for Monticello Cycle 21 Safety Limit Minimum Critical Power Ratio (TAC No. MB2855)," dated November 16, 2001

The Monticello Core Operating Limits Report (COLR) for Cycle 21, Revision 0, is enclosed. This report provides the values of the limits for Cycle 21 as required by Technical Specification Section 6.7.A.7. These values have been established using NRC approved methodology such that all applicable limits of the plant safety analysis are met.

The COLR reflects a Safety Limit Minimum Critical Power Ratio (SLMCPR) of 1.10 for two-loop operation, and 1.12 for single-loop operation for all fuel in Cycle 21. This is consistent with the License Amendment Request and supplements concerning the Cycle 21 SLMCPR (References 1, 2 and 3), approved as License Amendment 125.

The appropriate Operating Limit Minimum Critical Power Ratio in the core monitoring system has been updated, prior to startup for Cycle 21.

Please contact Doug Neve at 763-295-1353 if you have any questions related to this submittal.

Jeffrey S. Forbes
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Monticello Nuclear Generating Plant

c: Regional Administrator – III, NRC
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Enclosure: Core Operating Limits Report for Cycle 21 (Rev 0)

MONTICELLO NUCLEAR GENERATING PLANT

Core Operating Limit Report

Record of Revision

Cycle	Revision Number	Approval Date	Remarks
14	0	09/28/89	
15	0	05/23/91	
16	0	03/25/93	
16	1	05/17/94	
16	2	06/27/94	
17	0	09/22/94	
18	0	05/14/96	
18	1	05/18/96	
18	2	07/12/96	
18	3	11/12/96	
19	0	04/13/98	
19	1	09/08/98	
19	2	09/21/98	
19	3	01/03/00	
20	0	01/31/00	
20	1	07/23/01	
20	2	10/04/01	
21	0	11/14/01	

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MONTICELLO NUCLEAR GENERATING PLANT

Core Operating Limits Report

Cycle 21

Revision 0

NAD-MN-003

Prepared By:	Douglas W. Shilts Principal Engineer Associate, Nuclear Analysis and Design	11/14/01 Date
Reviewed By:	Arne L. Myrabo Superintendent, Nuclear Engineering - Monticello	11-21-01 Date
Approved By:	Richard J. Rohrer Project Manager, Nuclear Analysis and Design	11/14/01 Date

Introduction

This report provides the values of the limits for Cycle 21 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.

A SLCPR of 1.10 was used for two-loop operation for all fuel types in Cycle 21 (GE11, GE12, and GE14). The SLCPR for single-loop operation is 1.12. These values are consistent with the values specified by G NF in Reference 2.

This report 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 4.

Reference 1: TD.NMC.NAD-MN-001.00, "Monticello Cycle 21 Final Reload Design Report (Reload Safety Evaluation)", Revision 0, October 2001.

Reference 2: Letter from L. R. Conner (GNF) to R. Rohrer (NMC), "Additional Information Regarding the Cycle Specific SLMCPR for MN Cycle 21", LRC:01.023, July 10, 2001.

Reference 3: Letter from M. F. Hammer (NSP) to USNRC dated July 30, 1998, "Supplementary Information Regarding the Monticello Power Rerate (TAC No. 96238)," including attachments.

Reference 4: 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.

Reference 5: Letter from M. F. Hammer (NSP) to USNRC dated December 4, 1997, "Revision 1 to License Amendment Request Dated July 26, 1996 Supporting the Monticello Nuclear Generating Plant Power Rerate Program," including attached exhibits.

Reference 6: Letter from Tae Kim (USNRC) to Roger O. Anderson (NSP), "Monticello Nuclear Generating Plant - Issuance of Amendment Re: Power Uprate Program (Tac No. M96238)", including enclosures, September 16, 1998.

Rod Block Monitor Operability Requirements

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

MCPR < 1.76

Whenever the monitored core MCPR is less than 1.76, 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)	≤	120/125 of full scale
Intermediate Trip Setpoint (ITSP)	≤	115/125 of full scale
High Trip Setpoint (HTSP)	≤	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 all fuel types is the greater of:

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

If thermal power ≤ 45%, then the MCPR limit for all fuel types is obtained in Figure 3.

For single recirculation loop operation the MCPR limit as defined previously by two recirculation loop operation is increased by the following adders:

0.02 ΔMCPR adder to account for core flow measuring and TIP reading uncertainties.
0.03 ΔMCPR adder to prevent transition boiling for the Recirculation Pump Seizure event.

Reference Technical Specification Section: 3.11.C.

Power-Flow Operating Map

The Power-Flow Operating Map based on analysis to support Cycle 21 is shown in Figures 5 & 6. This Power-Flow Operating Map is consistent with the rated power of 1775 as described in References 3, 5, and 6.

Approved Analytical Methods

NEDE-24011-P-A	Rev 14	"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"
NEDO-31960-A		"BWR Owners Group Long-Term Stability Solutions Licensing Methodology," Licensing Topical Report, June 1991.
NEDO-31960-A	Sup 1	"BWR Owners Group Long-Term Stability Solutions Licensing Methodology," Licensing Topical Report, 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 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.

Reference Technical Specification Section 3.11.A.

TABLE 1
MAPLHGR Limit[1] for each fuel type [kW/ft]

Exposure [MWD/STU]	GE11-P9DUB 348-10GZ [2124] [2]	GE11-P9DUB 347-10GZ [2123] [2]	GE12-P10DSB 330-12GZ [2173] [2]	GE11-P9DUB 366-16GZ [2271] [2]	GE11-P9DUB 366-17GZ [2272] [2]	GE11-P9DUB 380-16GZ [2368] [2]	GE11-P9DUB 380-17GZ [2367] [2]
200	9.06	8.75	8.54	8.73	8.28	8.35	8.21
1000	9.22	8.83	8.57	8.93	8.47	8.49	8.37
5000	9.87	9.71	9.31	10.01	9.41	9.25	9.13
10000	10.77	10.85	10.25	10.75	10.61	10.26	10.33
15000	11.16	11.10	10.13	11.20	11.00	10.84	10.83
20000	11.24	11.22	9.78	11.29	10.88	10.90	10.96
25000	10.71	10.73	9.45	10.90	10.75	10.39	10.39
30000	10.03	10.15	9.08	10.20	10.00	9.82	9.83
35000	9.37	9.56	8.66	9.54	9.28	9.24	9.25
40000	8.71	8.91	8.19	8.88	8.54	8.57	8.57
45000	8.05	8.27	7.46	8.22	7.85	7.88	7.87
50000	7.38	7.59	6.70	7.56	7.19	7.22	7.21
55000	6.70	6.62	5.99	6.90	6.55	6.58	6.57
55920	-	-	-	-	-	6.46	-
55982	-	-	-	-	-	-	6.44
57684	6.28	-	-	-	-	-	-
57694	-	-	-	6.53	-	-	-
58047	-	6.06	-	-	-	-	-
58225	-	-	-	-	6.13	-	-
60060	-	-	5.31	-	-	-	-

Exposure [MWD/STU]	GE14-P10DNAB 391-14GZ [2427] [2]	GE14-P10DNAB 391-14GZ [2428] [2]
200	8.36	8.30
1000	8.49	8.45
5000	8.99	8.95
10000	9.59	9.51
15000	10.01	9.84
20000	10.20	9.83
25000	10.22	9.82
30000	10.06	9.79
35000	9.49	9.20
40000	8.93	8.64
45000	8.39	8.12
50000	7.89	7.63
55000	6.26	6.25
58320	-	4.59
58390	4.55	-

Notes: [1] Table 1 is for two recirculation loop operation. For single loop operation, multiply the GE11 and GE12 values by 0.80 and the GE14 values by 0.90.

[2] Engineering Databank (EDB) Number

Linear Heat Generation Rate

TABLE 2 LHGR Limit[1] for Each Fuel Type (kW/ft)								
GE11- P9DUB 348-10GZ [2124] [2]	GE11- P9DUB 347-10GZ [2123] [2]	GE12- P10DSB 330-12GZ [2173] [2]	GE11- P9DUB 366-16GZ [2271] [2]	GE11- P9DUB 366-17GZ [2272] [2]	GE11- P9DUB 380-16GZ [2368] [2]	GE11- P9DUB 380-17GZ [2367] [2]	GE14- P10DNAB 391-14GZ [2427] [2]	GE14- P10DNAB 391-14GZ [2428] [2]
14.4	14.4	11.8	14.4	14.4	14.4	14.4	13.4	13.4

Notes

[1] Reference Technical Specification Section: 3.11.B.
[2] Engineering Databank (EDB) Number.

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.

Scram Time Dependence

Technical Specification 3.3.C provides the scram insertion time versus position requirements for continued operations. Technical Specification 4.3.C provides the surveillance requirements for the CRDs. Data from testing of the CRDs, or from an unplanned scram, is summarized in Surveillance Test 0081. Using this cycle specific information, values of τ_{20} can be calculated in accordance with the equation at the 20% insertion position, which is:

$$\tau_{20} = \frac{\sum_{i=1}^{n} N_i t_i}{\sum_{i=1}^{n} N_i} + 0.0875 \left[\frac{N_1}{\sum_{i=1}^{n} N_i} \right]^{\frac{1}{2}}$$

where: τ_{20} = the weighted cycle average scram time at a 95% confidence level at the 20% insertion position.

n = the number of surveillance tests performed following core alterations.

N_i = the number of control rods measured in the i^{th} test.

N_1 = the total number of active rods measured in the first test following core alterations.

t_i = average scram time at the 20% insertion position of all rods measured in the i^{th} test.

τ_{20} = 0.927 seconds shall be assumed until cycle specific scram data following a core alteration becomes available. When scram insertion time data is available, credit may be taken for faster insertion times, if desired. It should also be noted that when data does become available, the average scram time values must be calculated with either CRD insertion time data at reactor pressures above 965 psia, or with data that is corrected for low reactor pressures in accordance with Surveillance Test 0081 Appendix A.

After obtaining the cycle specific values of τ_{20} for the 20% insertion positions, a comparison can be made to Table 3 in order to get the scram time adjusted OLCPR. The value of the scram time adjusted OLCPR is obtained from Table 3 by linearly interpolating the value of τ at the 20% insertion position. Note that extrapolation is not permitted in Table 3.

The adjustment to the OLCPR limit can only be performed if the plant is operating with both recirculation loops. Credit for scram insertion times may not be taken if the plant is operating with a single recirculation loop.

TABLE 3

Full Power/Flow OLCPR as a Function of Scram Time

τ_{20}	**0.860 (sec)**	**0.900 (sec)**	**0.927 (sec)** [3]
OLCPR [1,2]	1.42	1.46	1.47

NOTES

1. Credit for scram insertion times may not be taken if the plant is operating with a single recirculation loop.
2. Extrapolation of this data is not permitted.
3. Technical Specification Scram Insertion Time plus measurement uncertainty

Sample Interpolation

After a Surveillance Test 0081 has been completed for Cycle 21, the results can be used to calculate a new average scram insertion time at the 20% insertion position. This time can then be linearly interpolated to change the OLCPR values found in Table 3. If the scram insertion time changed from 0.927 seconds to 0.880 seconds then the OLCPR value would change as shown in the example that follows:

TABLE 4

Sample Interpolation for Full Power/Flow OLCPR as a Function of Scram Time

τ_{20}	**0.860**	***0.880***	**0.900**	**0.927**
OLCPR GE10	1.42	*1.44*	1.46	1.47

For example, from Table 4 the OLCPR for all fuel types would be 1.44 instead of 1.47 at the Technical Specification scram insertion time plus measurement uncertainty base condition thus increasing operating margin.

Figure 1

Monticello Cycle 21
Power Dependent MAPLHGR Limits

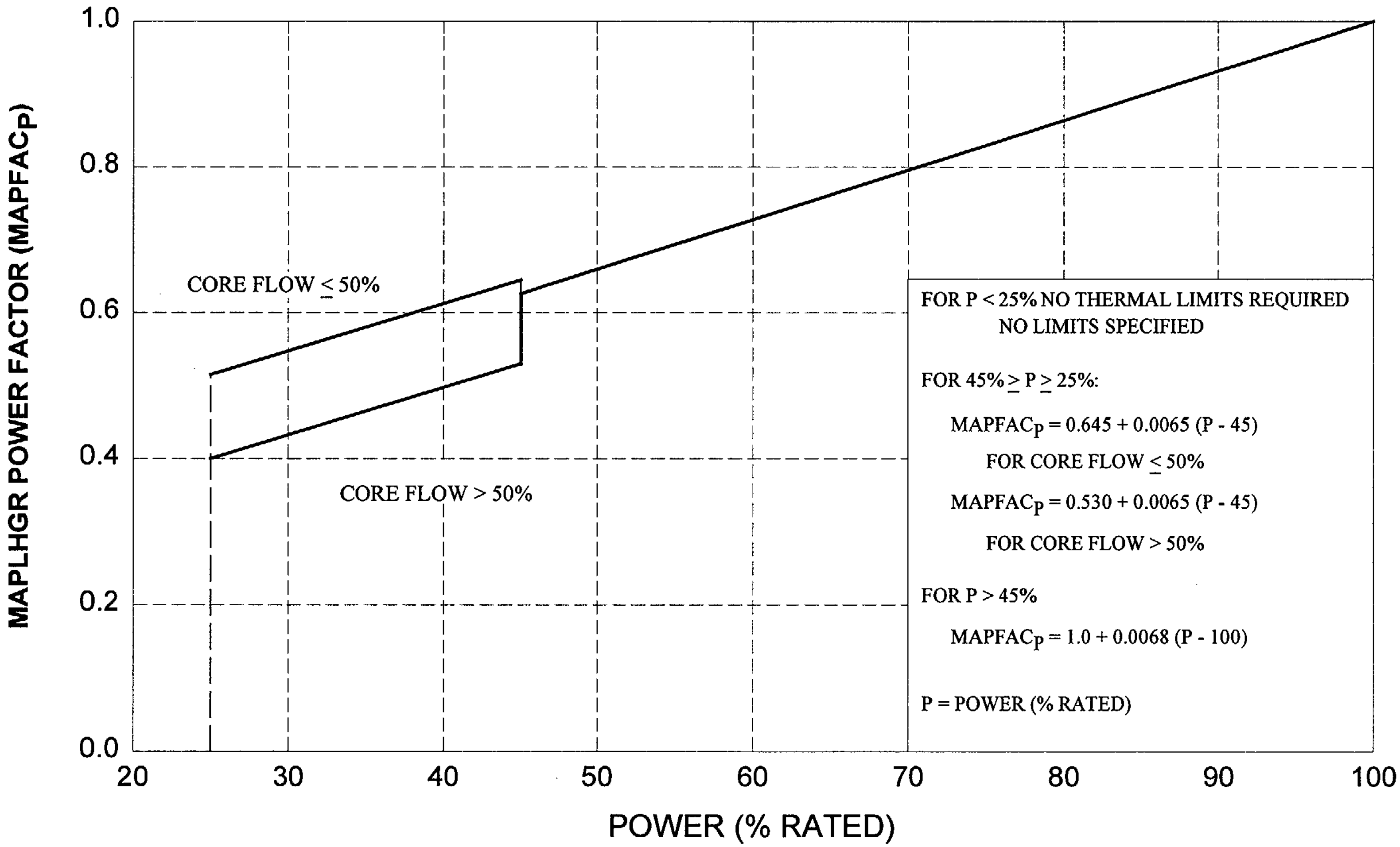


FIGURE 1

Figure 2

Monticello Cycle 21
Flow Dependent MAPLHGR Limits

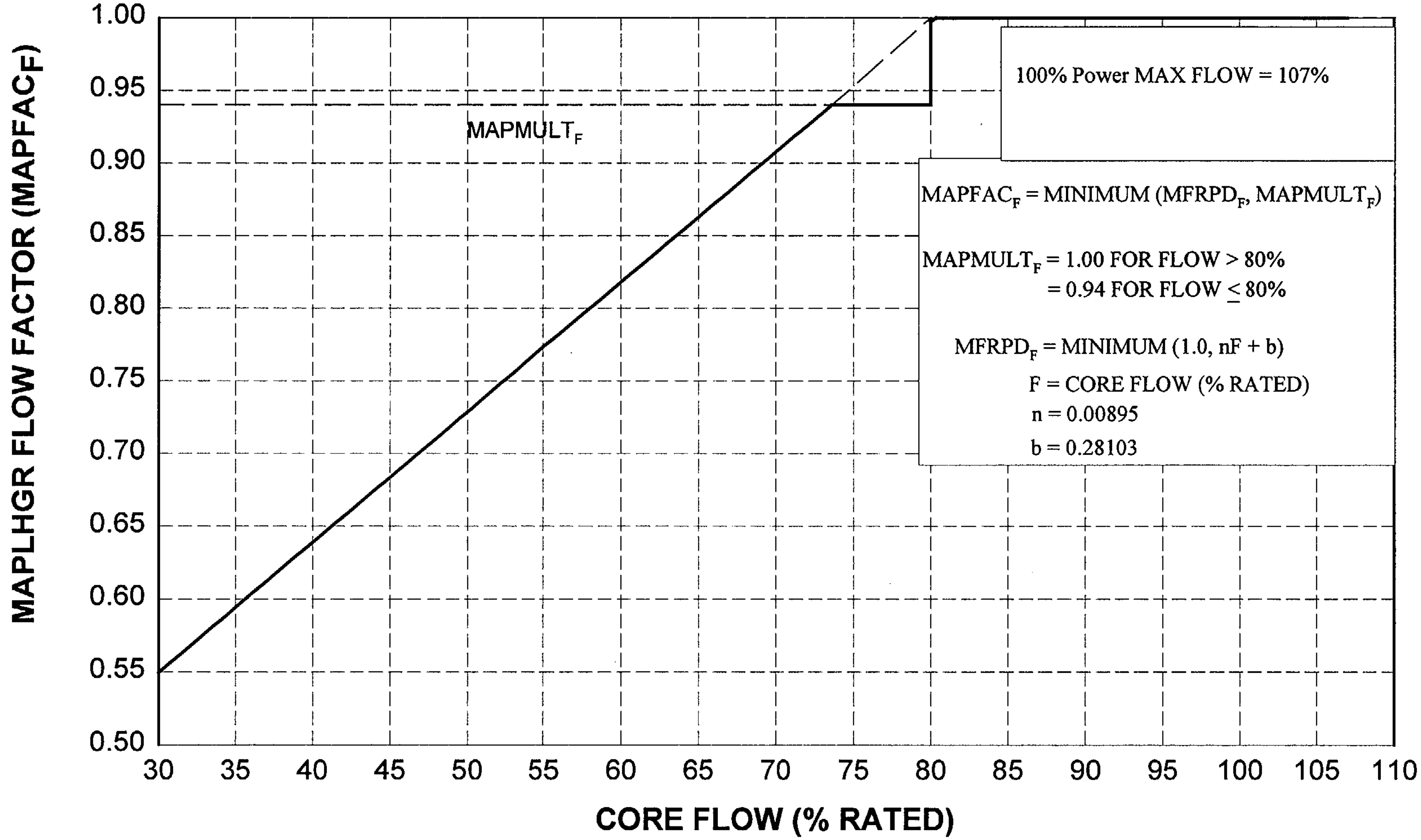


FIGURE 2

Figure 3

Monticello Cycle 21
Power Dependent CPR Limits

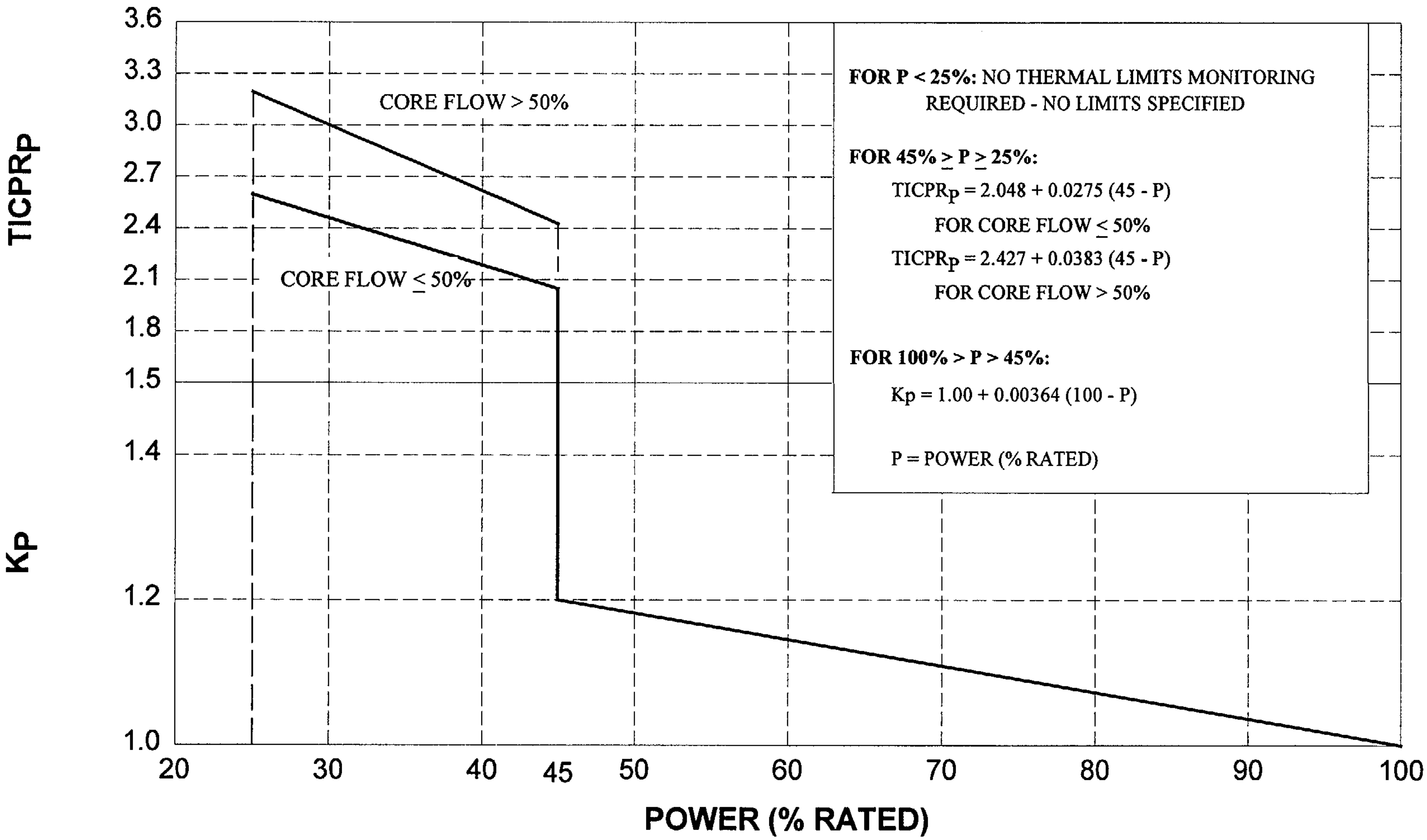
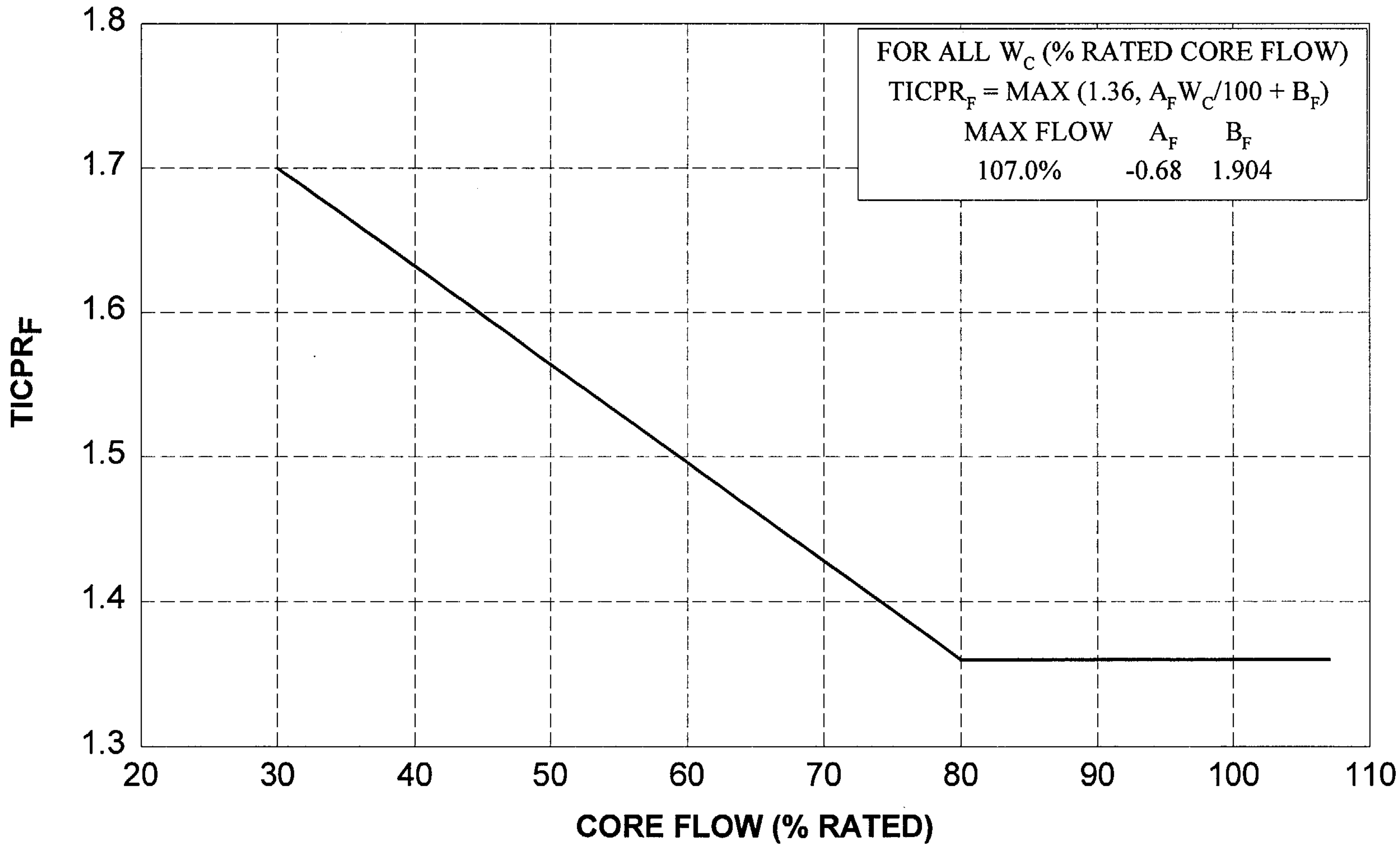


FIGURE 3

Figure 4

Monticello Cycle 21
Flow Dependent CPR Limits



Monticello Nuclear Generating Plant
Power-Flow Operating Map

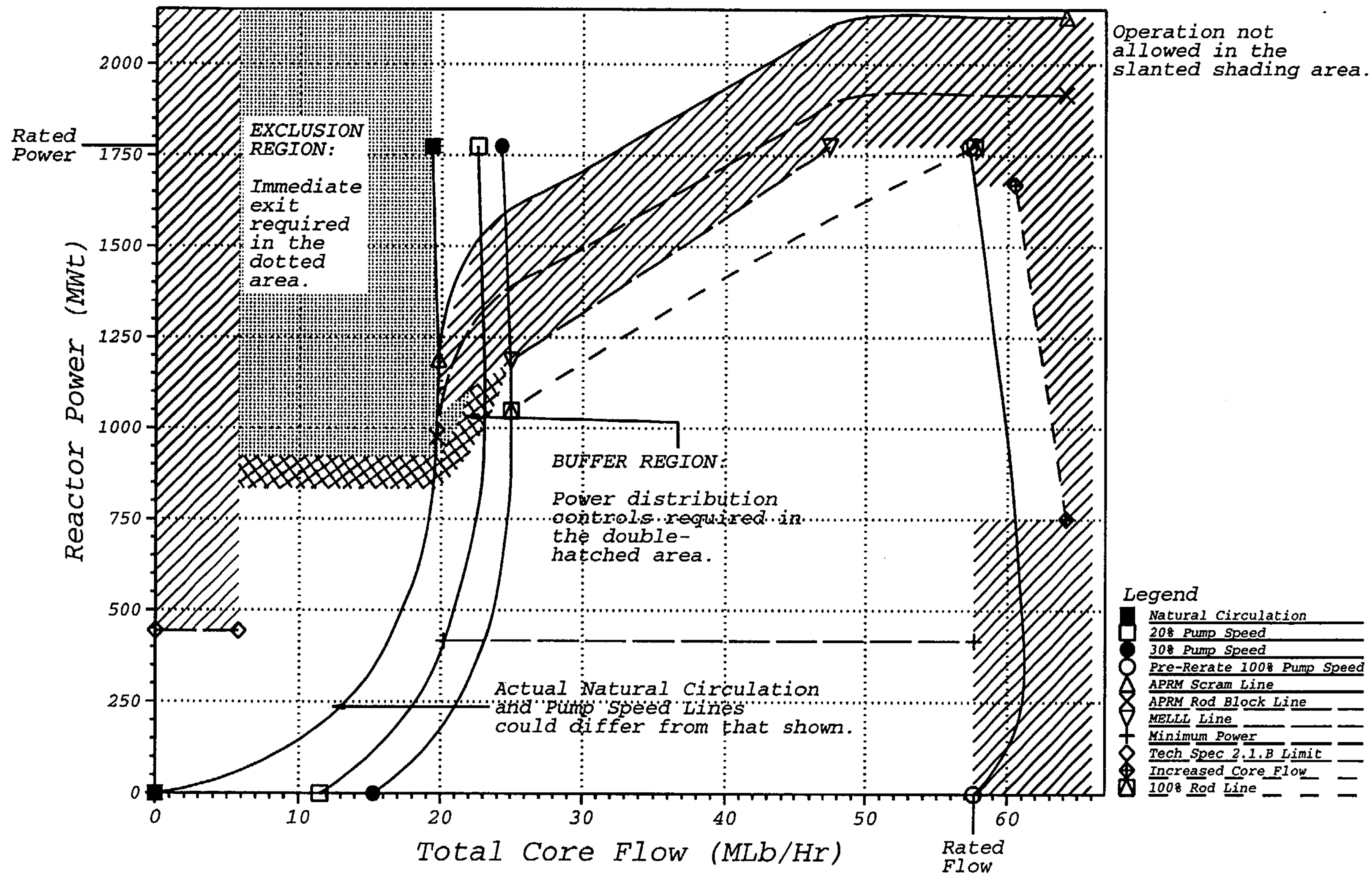


FIGURE 5

Monticello Nuclear Generating Plant Power-Flow Operating Map

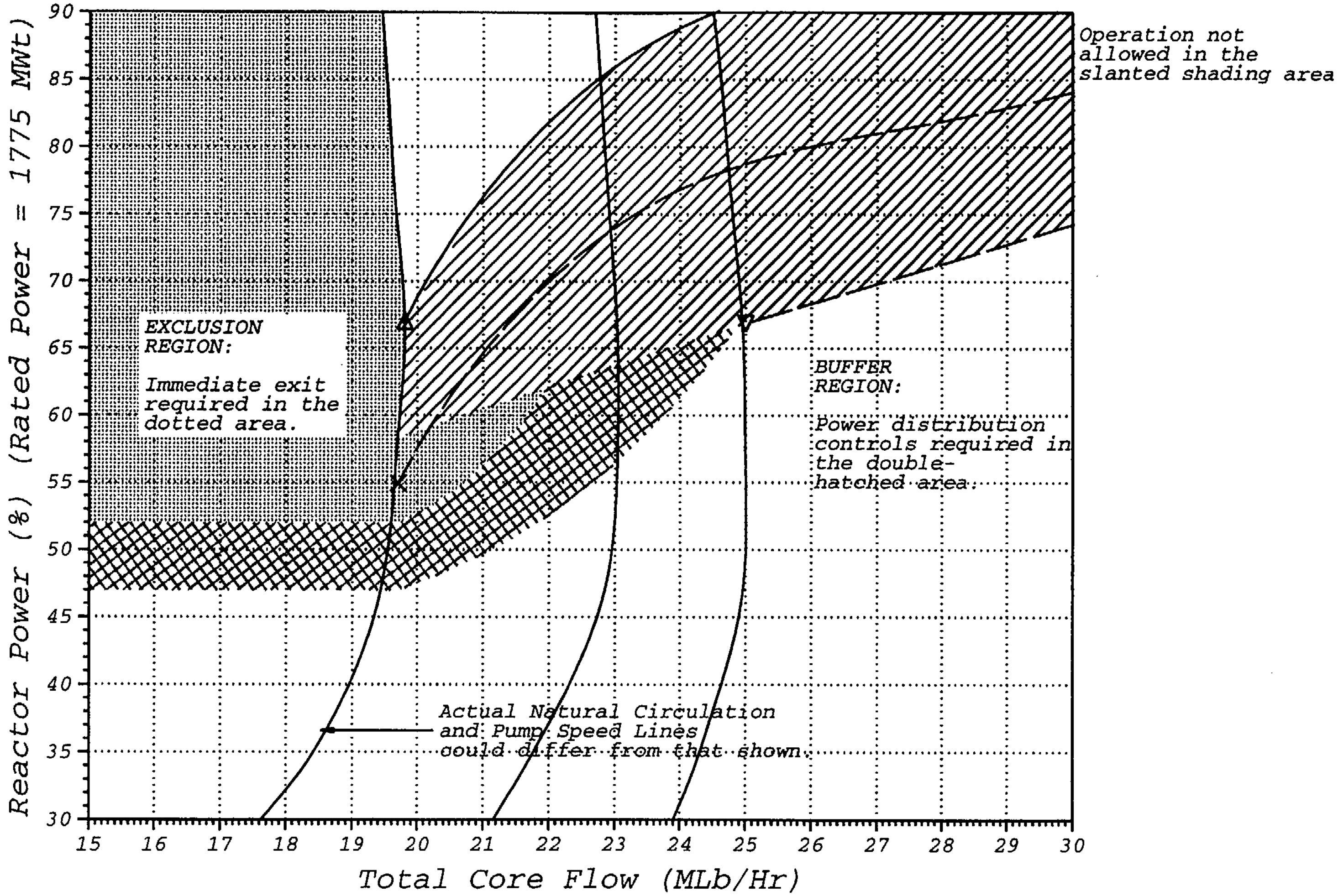


FIGURE 6

FIGURE 7

Stability Criterion Map