NMC
Committed to Nuclear Excellence

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

Operated by Nuclear Management Company LLC

August 10, 2001

Technical Specifications
6.7.A.7

U S 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 20, Revision 1

The Monticello Core Operating Limits Report (COLR) for Cycle 20 has been revised. Revision 1 of the COLR incorporates new Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) limits for the fuel at Monticello. The revised MAPLHGR limits will ensure that Monticello operates in such a way to keep the calculated Upper Bound Peak Cladding Temperature (UBPCT) less than 1600°F in the event of a Loss of Coolant Accident.

The revisions were needed to accommodate changes in the calculated UBPCT arising from the discovery of errors in the General Electric (GE) SAFER code. The error reports from Global Nuclear Fuels/GE that are covered by these changes are 2001-01 and 2001-02.

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

John D. Purkis
Plant Manager
Monticello Nuclear Generating Plant

c: Regional Administrator – III, NRC
NRR Project Manager, NRC
Sr Resident Inspector, NRC
Minnesota Dept. of Commerce
J. E. Silberg

A001

Enclosure: Core Operating Limits Report for Cycle 20 (Rev 1)

J:\LICENSE\Tech Specs\C.O.L.R\COLR C20-R1.doc

MONTICELLO NUCLEAR GENERATING PLANT

Core Operating Limit Report

Record of Revision

Cycle	Revision Number	Approval Date	Remarks
14	0	09/28/89	Core Operating Limit Report distributed with Technical Specification Revision 120
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	

MONTICELLO NUCLEAR GENERATING PLANT

Core Operating Limits Report

Cycle 20

Revision 1

Prepared By:	David J. Pribyl Lead Engineer, Nuclear Analysis and Design	7/19/01 Date
Reviewed By:	D. G. Wegener Superintendent, Nuclear Engineering - Monticello	7-23-1 Date
Reviewed By:	R. J. Rohrer Project Manager, Nuclear Analysis and Design	7/19/01 Date

Introduction

This report provides the values of the limits for Cycle 20 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.

Revision 1 of this report is published to incorporate revised MAPLHGR limits calculated in response to 10CFR50.46 Notification Letters 2001-01 and 2001-02. The revised MAPLHGR limits are documented in Reference 7.

A SLCPR of 1.11 was used for two-loop operation for all fuel types in Cycle 20 (GE10, GE11, and GE12). The SLCPR for single-loop operation is 1.12. These values are consistent with the values specified by GE 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: NSPNAD-99007 Revision 0, "Monticello Cycle 20 Final Reload Design Report (Reload Safety Evaluation)", November 1999.

Reference 2: Letter TGR:99-063 from T.G. Reason (GE Nuclear) to T.J. Asmus (NSP), "Additional Information Regarding the Cycle Specific SLMCPR for Monticello Cycle 20", September, 1999.

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.

Reference 7: Letter from L. R. Conner (GNF) to Richard J. Rohrer (NMC), "Transmittal of Monticello Cycle 20 Revised MAPLHGRs", July 16, 2001.

Rod Block Monitor Operability Requirements

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

MCPR < 1.68

Whenever the monitored core MCPR is less than 1.68, 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 GE10 is the greater of:

1.51 * K_P (K_P from Figure 3) or $TICPR_F$ from Figure 5.

If thermal power > 45%, then the MCPR for GE11 fuel is the greater of:

1.49 * K_P (K_P from Figure 4) or $TICPR_F$ from Figure 5.

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

1.51 * K_P (K_P from Figure 4) or $TICPR_F$ from Figure 5.

If thermal power ≤ 45%, then the MCPR limit for GE10 is obtained in Figure 3.
If thermal power ≤ 45%, then the MCPR limit for GE11 and GE12 fuel is obtained in Figure 4.

For single recirculation loop operation 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.

Reference Technical Specification Section: 3.11.C.

When both recirculation loops are in operation, the MCPRs calculated above may be replaced by values calculated in Table 3 if taking credit for scram speeds.

Power-Flow Operating Map

The Power-Flow Operating Map based on analysis to support Cycle 20 is shown in Figures 6 & 7. 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 13	"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, November 1995.
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 for each fuel type [kW/ft]

Exposure [MWD/STU]	GE10-DXB333-10GZ	GE10-DXB324-11GZ
200	10.21	9.40
1000	10.33	9.53
5000	10.77	10.37
10000	11.34	11.60
15000	11.44	11.76
20000	11.52	11.73
25000	11.31	11.60
30000	10.67	10.95
35000	10.02	10.30
40000	9.21	9.61
45000	8.40	8.92
50000	5.93	6.42

Exposure [MWD/STU]	GE11-DUB348-10GZ	GE11-DUB347-10GZ	GE12-DSB330-12GZ	GE11-DUB366-16GZ	GE11-DUB366-17GZ	GE11-DUB380-16GZ	GE11-DUB380-17GZ
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	-	-	-	-

Note: Table 1 is for two recirculation loop operation. For single loop operation, multiply the GE10 values by 0.78 and the GE11 and GE12 values by 0.80.

Linear Heat Generation Rate

TABLE 2
LHGR Limit for Each Fuel Type (kW/ft)

GE10-DXB333-10GZ	GE10-DXB324-11GZ	GE11-DUB347-10GZ	GE11-DUB348-10GZ	GE12-DSB330-12GZ	GE11-DUB366-16GZ	GE11-DUB366-17GZ	GE11-DUB380-16GZ	GE11-DUB380-17GZ
14.4	14.4	14.4	14.4	11.8	14.4	14.4	14.4	14.4

Reference Technical Specification Section: 3.11.B.

Core Stability Requirements

Stability Exclusion Region
The stability exclusion region is shown in Figure 6 and is given in greater detail in Figure 7.

Stability Buffer Region
The stability buffer region is shown in Figure 6 and is given in greater detail in Figure 7.

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 8. While operating in the stability buffer region, the hot channel and core wide decay ratios will be maintained within the stable portion of Figure 8.

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} = 0.900 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}	**0.773**	**0.900**
OLCPR GE10	1.45	1.51
OLCPR GE11	1.45	1.49
OLCPR GE12	1.45	1.51

NOTES
1. Credit for scram insertion times may not be taken if the plant is operating with a single recirculation loop.

Sample Interpolation

After a Surveillance Test 0081 has been completed for Cycle 20 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 0.900 seconds to 0.800 seconds then the OLCPR values would change as follows:

Table 4
Sample Interpolation for Full Power/Flow OLCPR as a Function of Scram Time

τ_{20}	**0.773**	**0.800**	**0.900**
OLCPR GE10	1.45	1.47	1.51
OLCPR GE11	1.45	1.46	1.49
OLCPR GE12	1.45	1.47	1.51

For example, from Table 4 the OLCPR for GE10 would be 1.47 instead of 1.51 at the technical specification scram insertion time thus increasing operating margin.

FIGURE 1

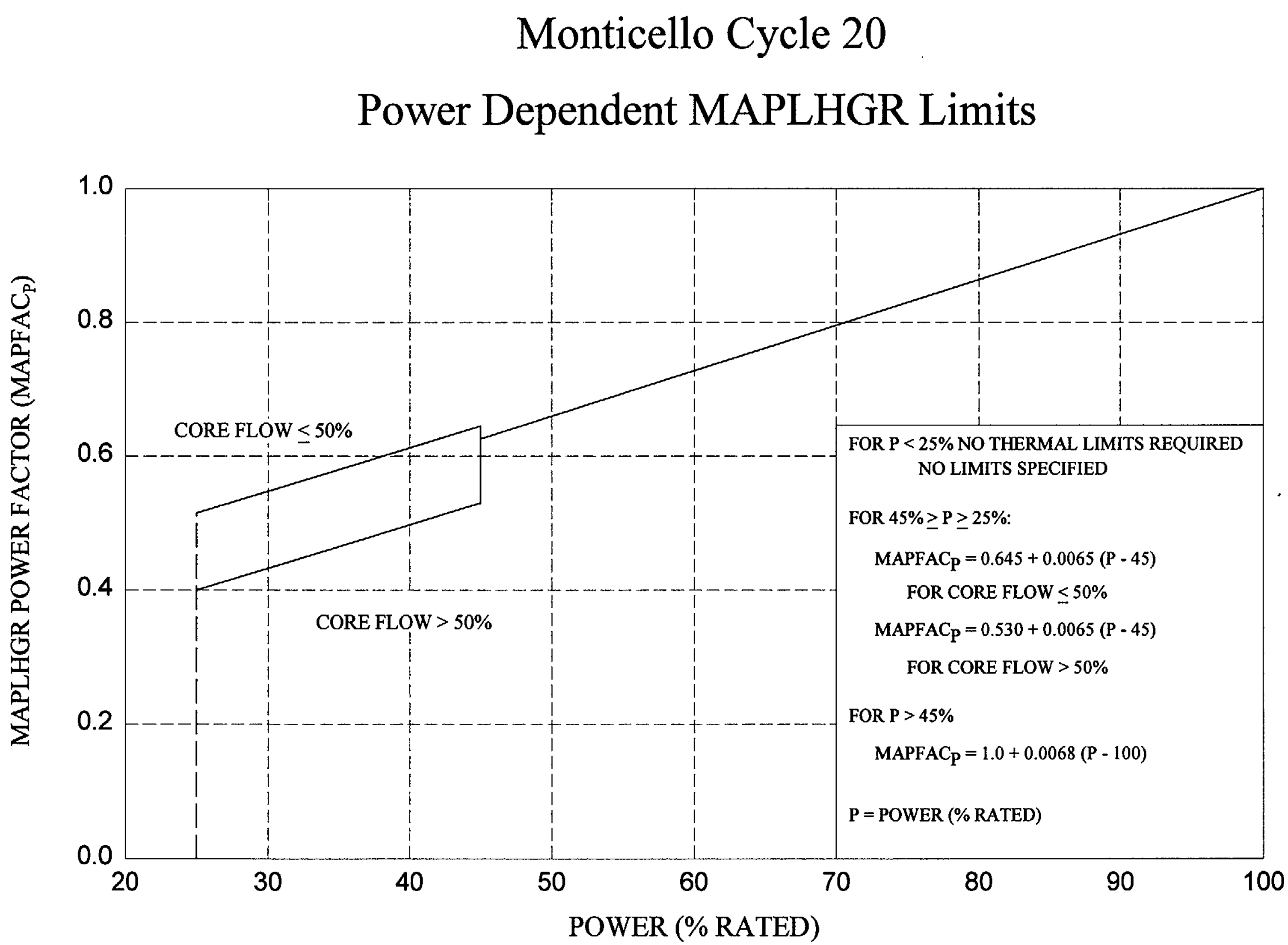

Monticello Cycle 20
Power Dependent MAPLHGR Limits
1.0
0.8
0.6
0.4
0.2
0.0
20
30
40
50
60
70
80
90
100
MAPLHGR POWER FACTOR (MAPFAC$_P$)
POWER (% RATED)
CORE FLOW ≤ 50%
CORE FLOW > 50%
FOR P < 25% NO THERMAL LIMITS REQUIRED
NO LIMITS SPECIFIED
FOR 45% ≥ P ≥ 25%:
$MAPFAC_P = 0.645 + 0.0065 (P - 45)$
FOR CORE FLOW ≤ 50%
$MAPFAC_P = 0.530 + 0.0065 (P - 45)$
FOR CORE FLOW > 50%
FOR P > 45%
$MAPFAC_P = 1.0 + 0.0068 (P - 100)$
P = POWER (% RATED)

FIGURE 2

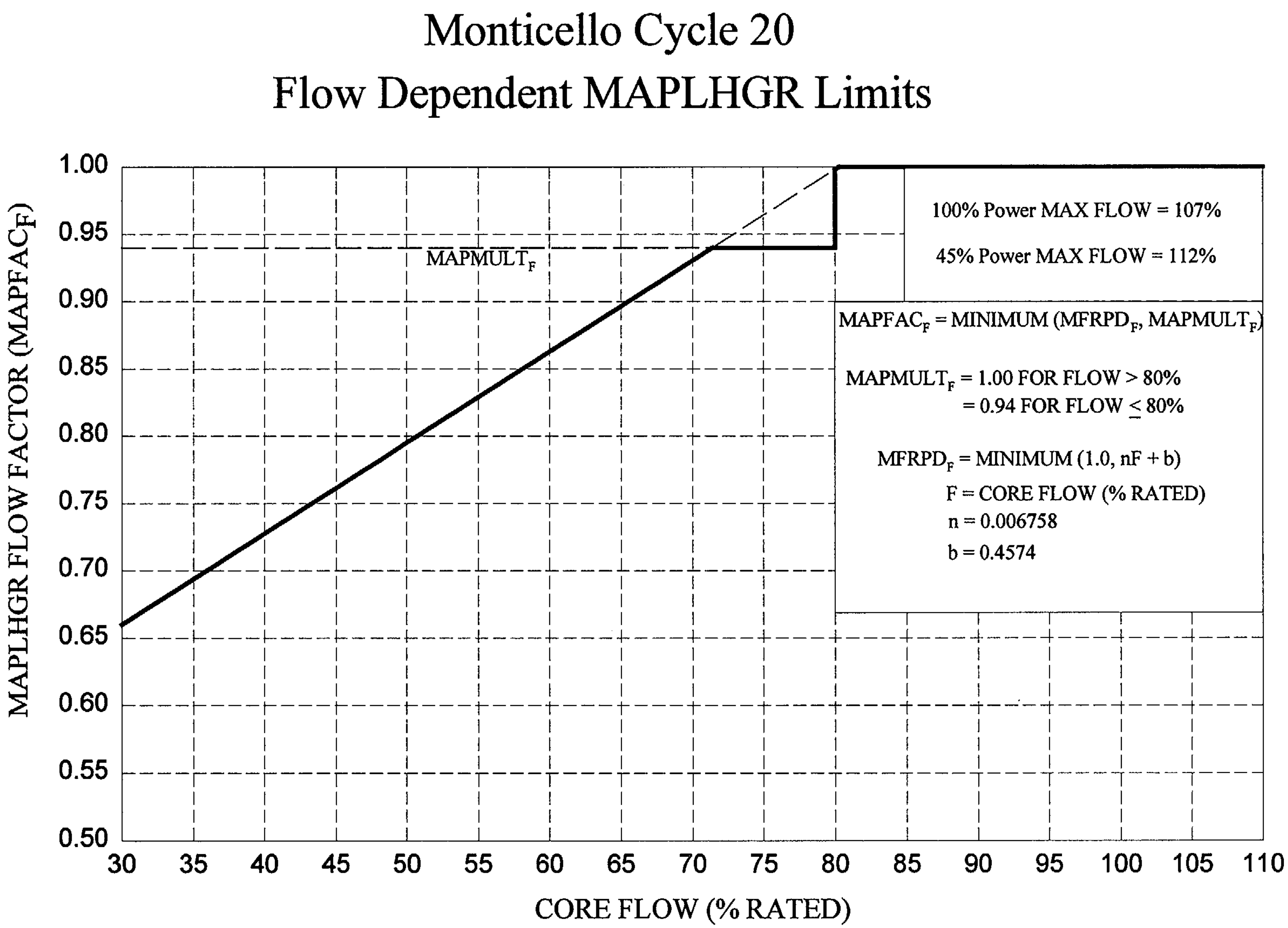
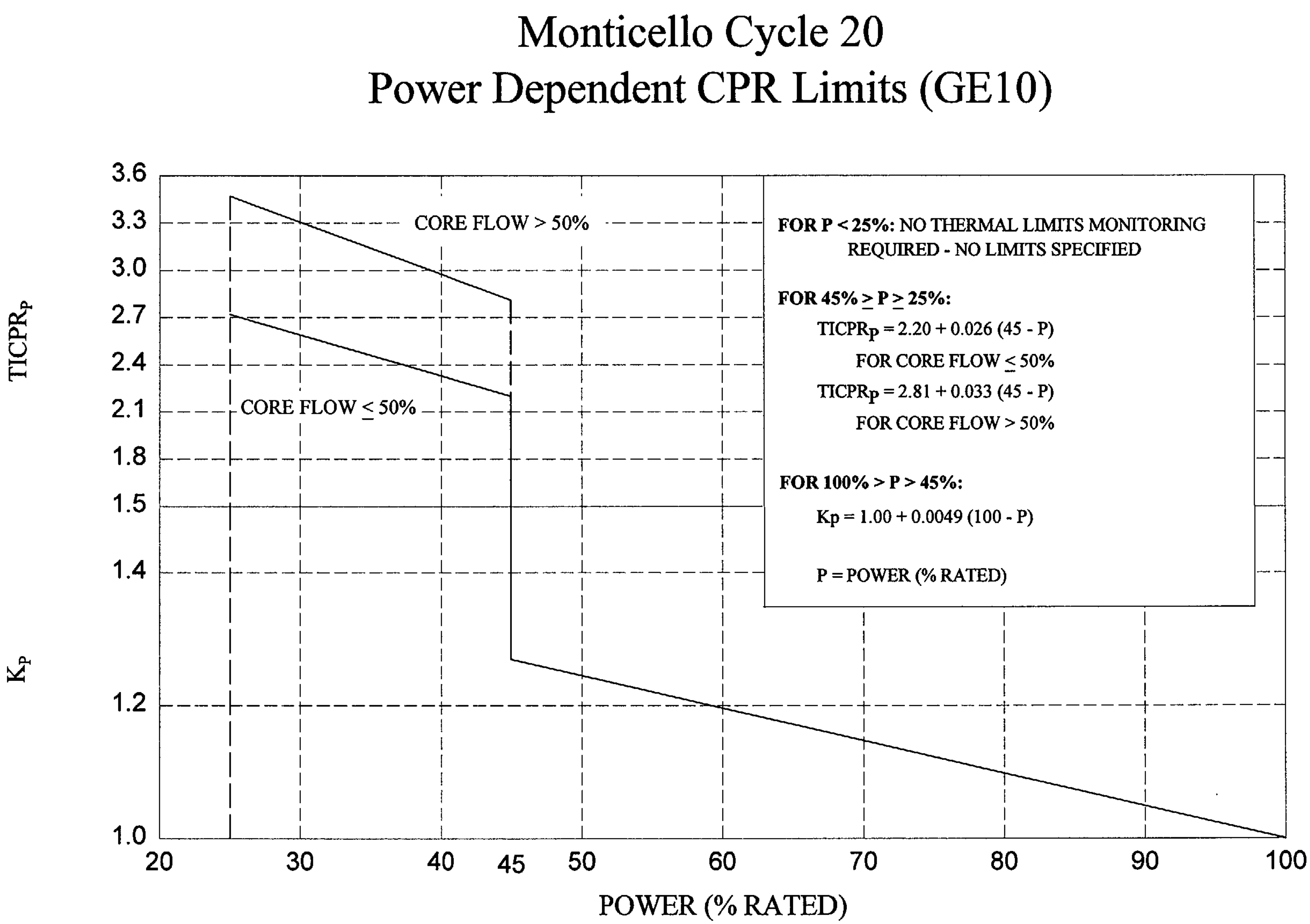
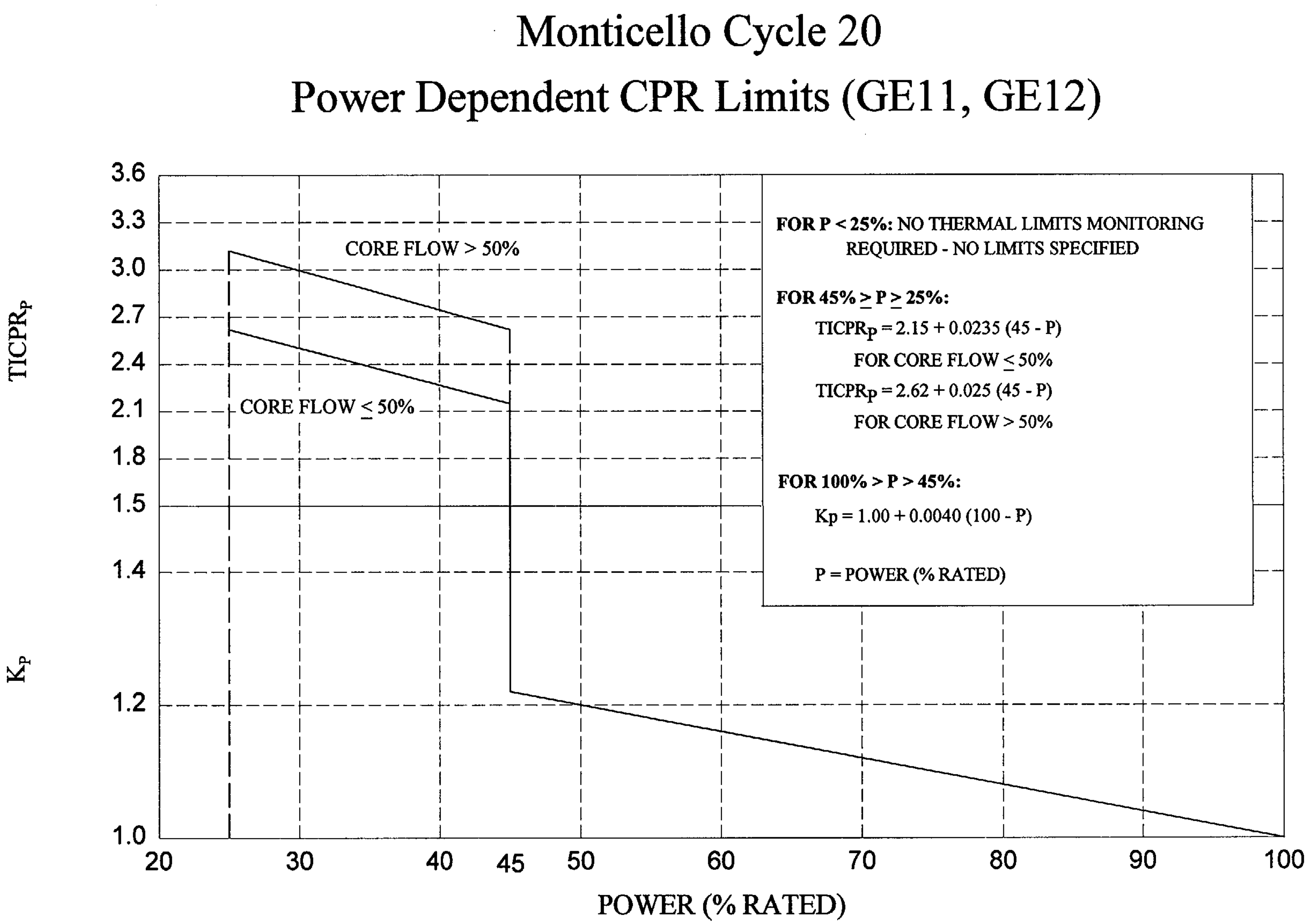

Monticello Cycle 20
Flow Dependent MAPLHGR Limits
MAPLHGR FLOW FACTOR (MAPFACF)
CORE FLOW (% RATED)
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
MAPMULTF
100% Power MAX FLOW = 107%
45% Power MAX FLOW = 112%
MAPFACF = MINIMUM (MFRPDF, MAPMULTF)
MAPMULTF = 1.00 FOR FLOW > 80%
= 0.94 FOR FLOW ≤ 80%
MFRPDF = MINIMUM (1.0, nF + b)
F = CORE FLOW (% RATED)
n = 0.006758
b = 0.4574

FIGURE 3



Monticello Cycle 20
Power Dependent CPR Limits (GE10)
CORE FLOW > 50%
CORE FLOW ≤ 50%
FOR P < 25%: NO THERMAL LIMITS MONITORING REQUIRED - NO LIMITS SPECIFIED
FOR 45% ≥ P ≥ 25%:
TICPRp = 2.20 + 0.026 (45 - P)
FOR CORE FLOW ≤ 50%
TICPRp = 2.81 + 0.033 (45 - P)
FOR CORE FLOW > 50%
FOR 100% > P > 45%:
Kp = 1.00 + 0.0049 (100 - P)
P = POWER (% RATED)
TICPRp
Kp
POWER (% RATED)

FIGURE 4



Monticello Cycle 20
Power Dependent CPR Limits (GE11, GE12)
TICPRP
KP
CORE FLOW > 50%
CORE FLOW ≤ 50%
FOR P < 25%: NO THERMAL LIMITS MONITORING REQUIRED - NO LIMITS SPECIFIED
FOR 45% ≥ P ≥ 25%:
TICPRp = 2.15 + 0.0235 (45 - P)
FOR CORE FLOW ≤ 50%
TICPRp = 2.62 + 0.025 (45 - P)
FOR CORE FLOW > 50%
FOR 100% > P > 45%:
Kp = 1.00 + 0.0040 (100 - P)
P = POWER (% RATED)
3.6
3.3
3.0
2.7
2.4
2.1
1.8
1.5
1.4
1.2
1.0
20
30
40
45
50
60
70
80
90
100
POWER (% RATED)

FIGURE 5

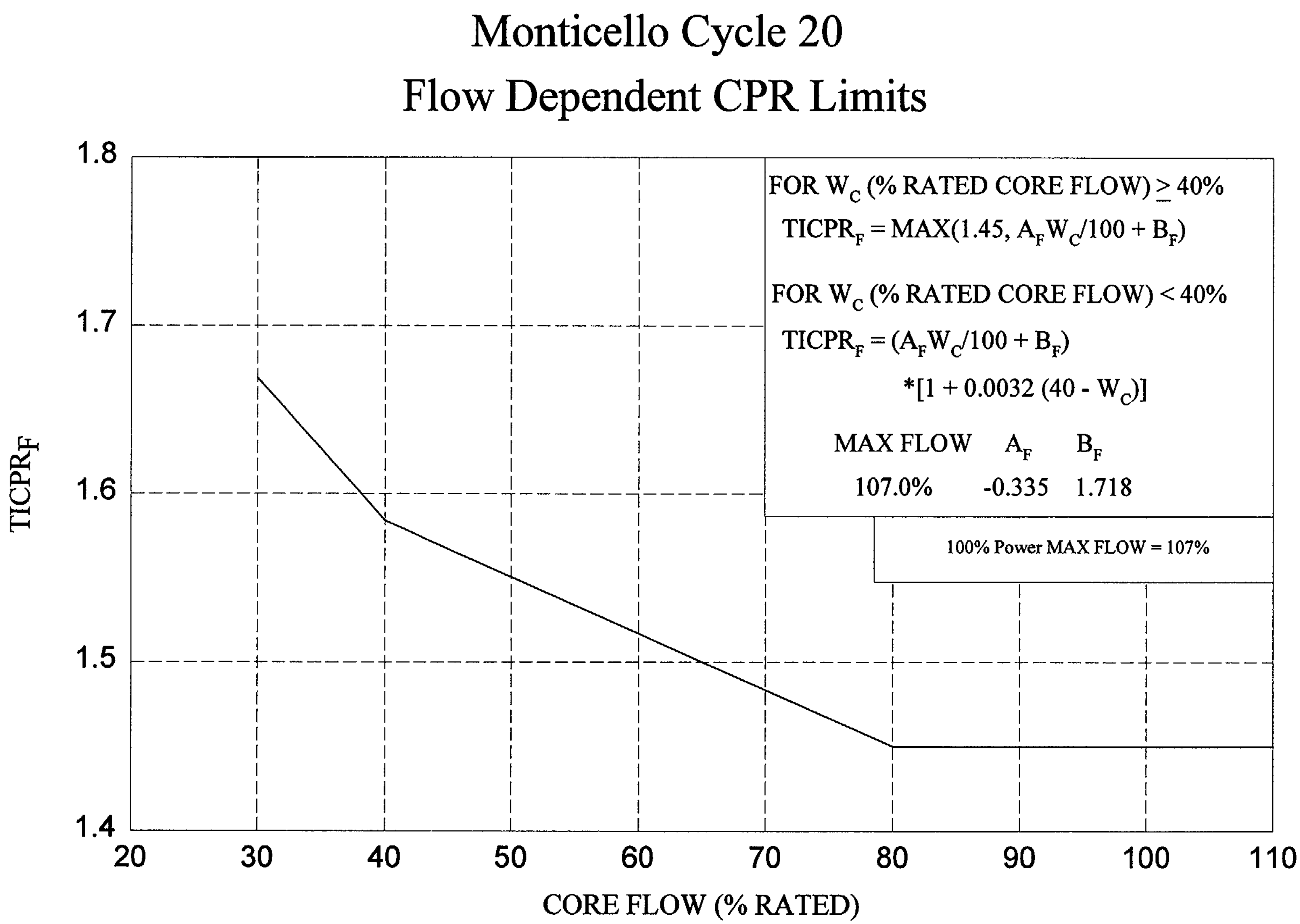

Monticello Cycle 20
Flow Dependent CPR Limits
FOR W_C (% RATED CORE FLOW) $\geq$ 40%
$TICPR_F = MAX(1.45, A_F W_C/100 + B_F)$
FOR W_C (% RATED CORE FLOW) < 40%
$TICPR_F = (A_F W_C/100 + B_F)$
$*[1 + 0.0032 (40 - W_C)]$
MAX FLOW A_F B_F
107.0% -0.335 1.718
100% Power MAX FLOW = 107%
$TICPR_F$
1.8
1.7
1.6
1.5
1.4
20
30
40
50
60
70
80
90
100
110
CORE FLOW (% RATED)

FIGURE 6

Power-Flow Operating Map

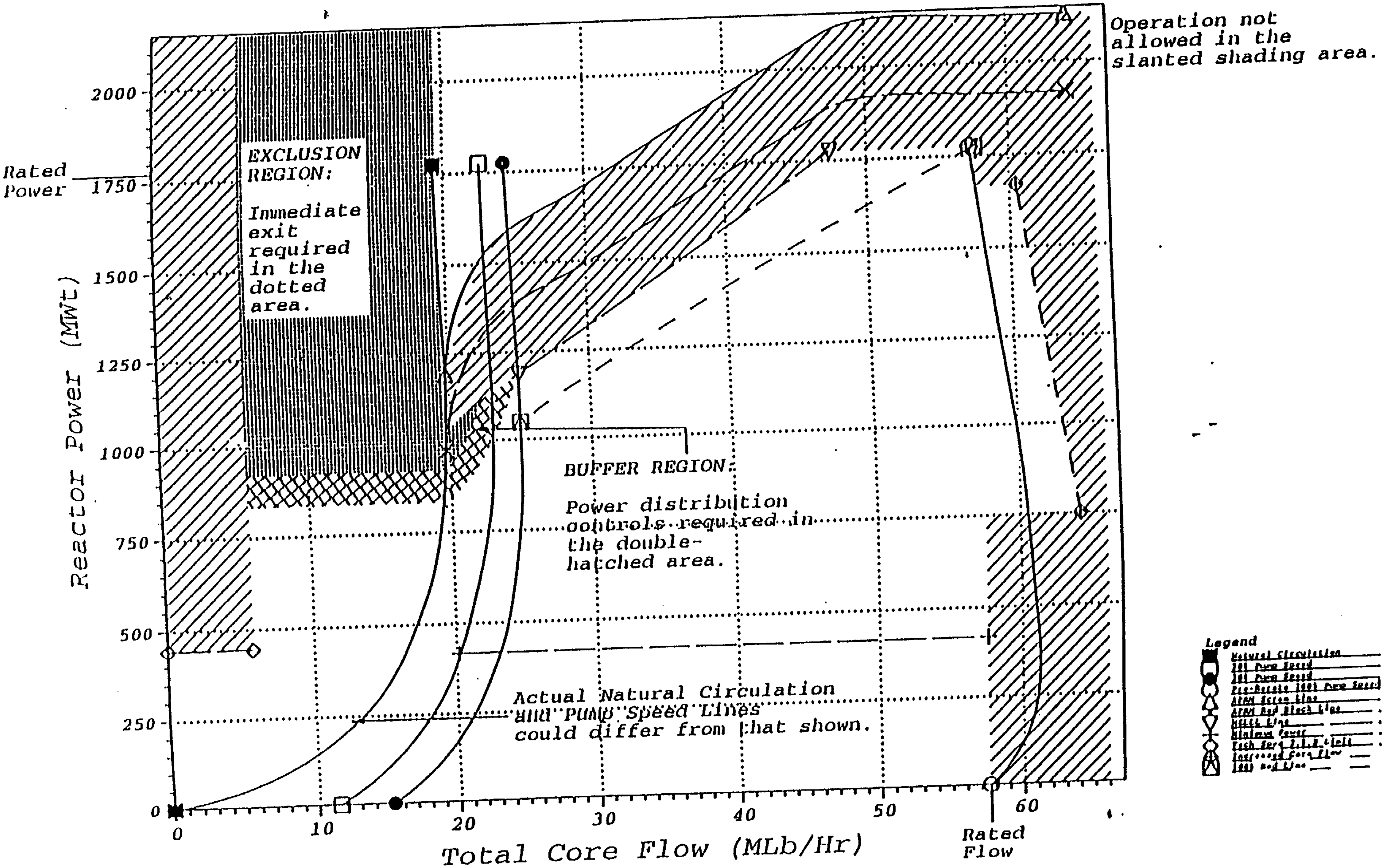


FIGURE 7

Power-Flow Operating Map

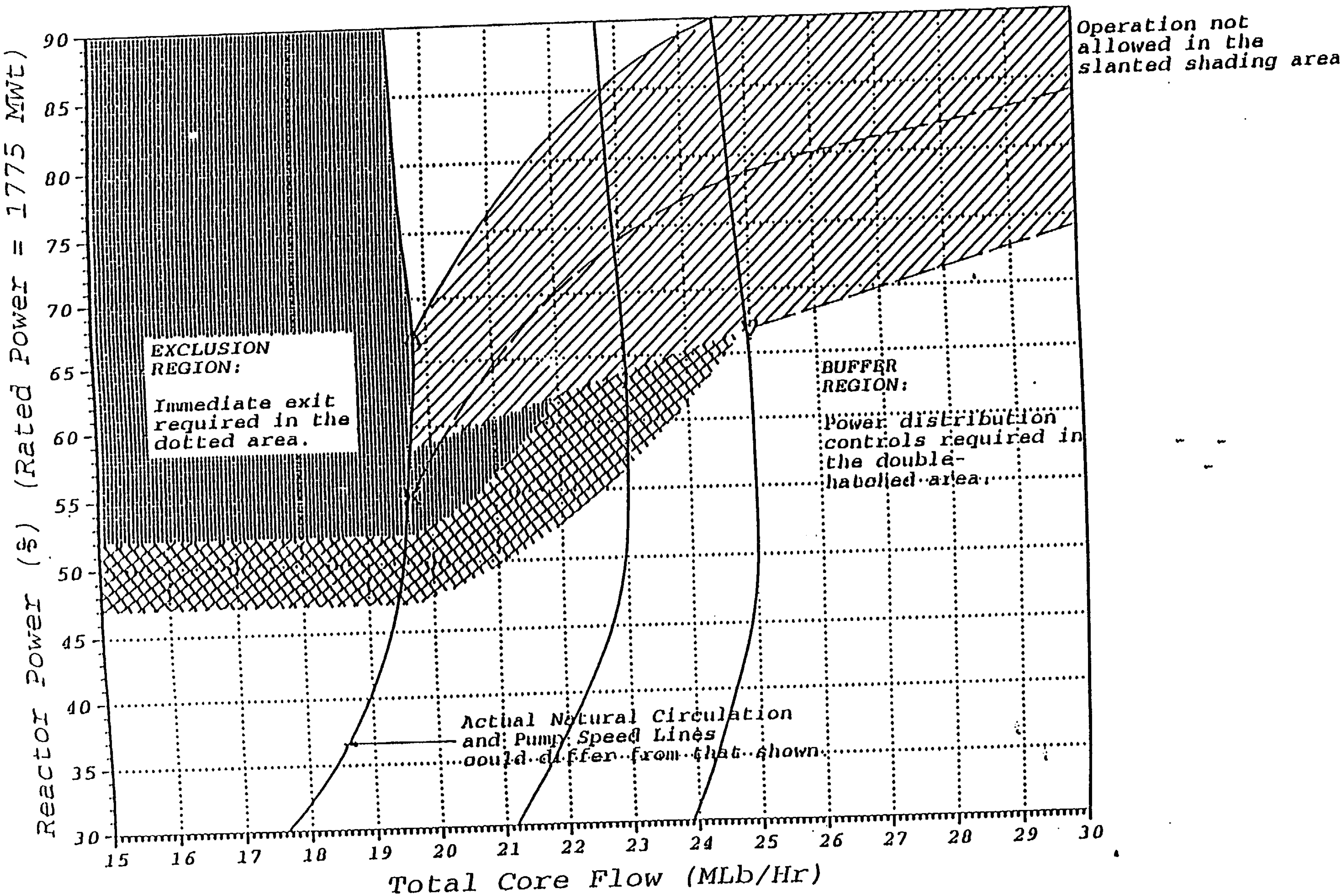


FIGURE 8

Stability Criterion Map