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L-MT-09-008
Technical Specification 5.6.3

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Monticello Nuclear Generating Plant
Docket 50-263
Renewed Facility Operating License No. DPR-22

Revision 1 to the MNGP Core Operating Limits Report for Cycle 24

References: 1) Letter NMC to NRC, "Submittal of the Core Operating Limits Report for Cycle 24," (L-MT-07-033) dated May 3, 2007.

Pursuant to Monticello Nuclear Generating Plant (MNGP) Technical Specification (TS) 5.6.3, "Core Operating Limits Report (COLR)", the Northern States Power Company – a Minnesota corporation (NSPM), is providing Revision 1 to the MNGP COLR for Cycle 24. This revision to the MNGP Cycle 24 COLR provides thermal limits to permit operation when a backup pressure regulator is not operational.

The COLR provides the cycle-specific values of limits established applying U.S. Nuclear Regulatory Commission (NRC) approved methodologies such that the applicable limits of the plant safety analysis are met. TS 5.6.3 requires the COLR, including any mid-cycle revisions or supplements, be provided to the NRC upon issuance. The enclosed revision supersedes the report previously submitted (Reference 1).

Summary of Commitments

No new commitments or changes to any existing commitments are proposed by this letter.

I declare under penalty of perjury that the foregoing is true and correct. Executed on January 14, 2009.

Bradley J. Sawatzke
Plant Manager, Monticello Nuclear Generating Plant
Northern States Power Company – Minnesota

Enclosure

cc: Administrator, Region III, USNRC
Project Manager, Monticello, USNRC
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ENCLOSURE 1

MONTICELLO NUCLEAR GENERATING PLANT

REVISION 1 TO CYCLE 24 CORE OPERATING LIMITS REPORT

NAD-MN-015, Revision 1

NMC
Committed to Nuclear Excellence

Monticello Nuclear Generating Plant

Cycle 24

Core Operating Limits Report

NAD-MN-015

Revision 1

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1.0 Core Operating Limits Report (COLR)

This Core Operating Limits Report for Monticello Nuclear Generating Plant Cycle 24 is prepared in accordance with the requirements of Technical Specification 5.6.3. The core operating limits are developed using NRC approved methodology (References 1 and 3), and are established such that all applicable thermal limits of the plant safety analysis are met.

The SLMCPR of 1.10 was used for two-loop operation for all fuel types in Cycle 24. The SLMCPR for single loop operation is 1.12. These values are consistent with the values specified in Reference 2.

This report includes stability exclusion region definition, buffer region definition, and power distribution limits as required by Amendment 97 of Monticello's operating license approved by the NRC in Reference 10.

Revision 1 of this report includes thermal limits to permit operation with a Pressure Regulator Out of Service (PROOS), also called operation without a backup pressure regulator. See Section 5.3 for more details.

2.0 References

1.0 General Electric Standard Application for Reactor Fuel (GESTAR-II), NEDE-24011-P-A-15, September 2005.

2.0 Supplemental Reload Licensing Report for Monticello Reload 23, Cycle 24, 0000-0052-4339-SRLR, Revision 2, September 2007.

3.0 General Electric Licensing Topical Report ODYSY Application for Stability Licensing Calculations, NEDC-32992-P-A, DRF AI3-00426-00, July 2001.

4.0 Fuel Bundle Information Report for Monticello Nuclear Generating Plant, Reload 22, Cycle 23, 0000-0029-6441-FBIR, Revision 0, (Proprietary), January 2005.

5.0 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 Rerate Program, including attached exhibits.

6.0 Document GE14 Fuel Design Cycle-Independent Analysis for Monticello Nuclear Generating Plant, GE-NE-0000-0013-9576P, GE Nuclear Energy (Proprietary), March 2003.

7.0 Letter from Les Conner (GNF) to R. J. Rohrer (NMC), dated March 24, 2003, Monticello Option B Licensing Basis, IC.MN.2003.010, Global Nuclear Fuel.

8.0 GE14 Fuel Design, Cycle Independent Transient Analysis for Monticello Nuclear Generating Plant, GE-NE-0000-0014-7048-01P, Rev. 0, March 2003 (GNF Proprietary).

9.0 BWR Owners Group Long Term Stability Solution Licensing Methodology, (Supplement 1), NEDO-31960-A, Licensing Topical Report, Supplement 1, March 1992.

10.0 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 1-D Core Stability Solution (TAC No. M92947)," including enclosures, September 17, 1996.

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

12.0 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.

13.0 Fuel Bundle Information Report for Monticello Reload 23 Cycle 24, 0000-0052-4339-FBIR, Revision 0, January 2007.

14.0 Supplemental Reload Licensing Report for Monticello Nuclear Generating Plant, Reload 22, Cycle 23, 0000-0029-6441-SRLR, Revision 0, January 2005.

15.0 Supplemental Reload Licensing Report (SRLR) for Monticello Reload 21, Cycle 22, 0000-0007-8709SRLR-0, Revision 0, March 2003.

16.0 Monticello Nuclear Generating Plant, Cycle 21 Core Operating Limits Report NAD-MN-003, Revision 0, November 2001.

17.0 Monticello Nuclear Generating Plant, Cycle 23 Core Operating Limits Report, NAD-MN-010, Revision 2, September 2006.

18.0 Monticello Operations Manual, Section B.05.01.02-06, Revision 4, Figure 9 "RBM ROD BLOCK Trip Levels", page 11 of 13.

19.0 GE BWR Licensing Report, Average Power Range Monitor, Rod Block Monitor, and Technical Specification Improvement (ARTS) Program for Monticello Nuclear Generation Plant, NEDC-30492-P, Section 4, April 1984.

20.0 GE Services Information Letter, Backup Pressure Regulator, GE SIL No. 614 Revision 1, March 15, 1999.

21.0 Nuclear Management Company Monticello Nuclear Generating Plant Pressure Regulator Downscale Failure Analysis, GE-NE-0000-0051-2643-R0, September 2007.

3.0 Rod Block Monitor Operability Requirements

The ARTS Rod Withdrawal Error (RWE) analysis (Reference 2) validated that the following MCPR values provide the required margin for full withdrawal of any control rod during Monticello Cycle 24:

For Power < 90%: MCPR ≥ 1.70

For Power ≥ 90%: MCPR ≥ 1.40

When the core power is less than 90% of rated and the MCPR is less than 1.70, then a limiting control rod pattern exists and the Rod Block Monitor is required to be operable. If the core power is greater than or equal to 90% and the MCPR is less than 1.40, then a limiting control rod pattern exists and the Rod Block Monitor is required to be operable.

Reference: Technical Specification Table 3.3.2.1-1 Function 1.

4.0 Rod Block Monitor Upscale Trip Setpoint

4.1 Technical Specification Trip Setpoints and Allowable Values

Function		Trip Setpoint	Allowable Values
Low Power Range – Upscale	(a)	≤ 120/125 of full scale	≤ 120.4/125 of full scale
Intermediate Power Range – Upscale	(b)	≤ 115/125 of full scale	≤ 115.4/125 of full scale
High Power Range – Upscale	(c), (d)	≤ 110/125 of full scale	≤ 110.4/125 of full scale

Applicable Thermal Power

(a) Thermal Power ≥ 30% and < 65% RTP and MCPR is below the limit specified in Section 3.
(b) Thermal Power ≥ 65% and < 85% RTP and MCPR is below the limit specified in Section 3.
(c) Thermal Power ≥ 85% and < 90% RTP and MCPR is below the limit specified in Section 3.
(d) Thermal Power ≥ 90% RTP and MCPR is below the limit specified in Section 3.

Reference: Technical Specification Table 3.3.2.1-1 Functions 1.a, 1.b, and 1.c.
The Reference for the **"Trip Setpoints"** is Reference 18.
The Reference for the **"Allowable Values"** is Reference 19.

5.0 Minimum Critical Power Ratio (MCPR)

5.1 Option A

The Operating Limit Minimum Critical Power Ratio (OLMCPR) for Option A does not account for scram speeds that are faster than those required by Technical Specifications.

5.1.1 Option A OLMCPR for Two Recirculation Loop Operation

The Option A OLMCPR shall be determined for two recirculation loop operation as follows:

If core thermal power (P) is ≥ 45% of rated core thermal power, then the Option A OLMCPR for all fuel types is the greater of {1.70 * K(P) from Figure 3} or {MCPR(F) from Figure 4}, where 1.70 is the Option A OLMCPR at rated (100%) core thermal power reported in Table 16.

i.e. if P ≥ 45% rated core thermal power,
then Option A OLMCPR limit
= Maximum of 1.70 * {K(P) from Figure 3} or {MCPR(F) from Figure 4}.

If core thermal power (P) is < 45% of rated core thermal power, the Option A OLMCPR for all fuel types is obtained from Figure 3.

Reference: Technical Specification Section 3.2.2.

5.1.2 Option A OLMCPR for Single Recirculation Loop Operation

The Option A OLMCPR as defined above for two recirculation loop operation in Section 5.1.1 is increased by the following adder for single recirculation loop operation:

0.02 ΔMCPR adder to account for core flow measurement and TIP reading uncertainties.

Reference: Technical Specification Section 3.2.2.

5.2 Option B

Option B does take into account the measured scram speeds that are faster than the Technical Specification requirements, thus reducing the potential consequences of a limiting transient. Calculation of the Option B OLMCPR value as a function of measured scram speeds is described in Section 10.

5.2.1 Option B OLMCPR for Two Recirculation Loop Operation

The Option B OLMCPR shall be determined for two recirculation loop operation as follows:

The rated (100%) core thermal power Option B OLMCPR ($OLMCPR_{OptionB}^{100\%}$) is 1.57, and is reported in Table 16. This $OLMCPR_{OptionB}^{100\%}$ of 1.57 is modified as described in Section 10 to be a function of the measured scram speeds to yield $OLMCPR_{OptionB}^{New}$.

Then, if core thermal power (P) is ≥ 45% of rated core thermal power, the Option B OLMCPR for all fuel types is the greater of:

$OLMCPR_{OptionB}^{New}$ * {K(P) from Figure 3} or {MCPR(F) from Figure 4},

i.e. if P ≥ 45% rated core thermal power, then Option B OLMCPR limit

= Maximum of { $OLMCPR_{OptionB}^{New}$ * K(P) from Figure 3} or {MCPR(F) from Figure 4}.

If core thermal power (P) is < 45% of rated core thermal power, the Option B OLMCPR for all fuel types is obtained from Figure 3.

Reference: Technical Specification 3.2.2.

5.2.2 Option B OLMCPR for Single Recirculation Loop Operation

The Option B OLMCPR as defined above for two recirculation loop operation in Section 5.2.1 is increased by the following adder for single recirculation loop operation:

0.02 ΔMCPR adder to account for core flow measurement and TIP reading uncertainties.

Reference: Technical Specification 3.2.2.

5.3 Pressure Regulator Out of Service (PROOS) Operation

Reference 20 GE SIL 614, Revision 1 describes the impact of operation without a backup pressure regulator (also called PROOS). This section provides power dependent MCPR limits when a backup pressure regulator is not operational.

The existing power dependent MAPLHGR and LHGR limits described in Sections 8.1 and 8.2 have been found to be valid (bounding) for operation without a backup pressure regulator (Reference 21).

A Pressure Regulator Fails Down-Scale (PRFDS) event without backup pressure regulator was evaluated for Monticello Cycle 24 (Reference 21). This event resulted in a

more restrictive Power Dependent MCPR limit than required for normal reduced power operation with both pressure regulators operational. Figure 8 provides the required more restrictive power dependent MCPR ARTS limits for powers below 85% and greater than or equal to 45%. For powers greater than or equal to 85% or below 45%, the power dependent MCPR and K(P) ARTS limits provided in Figure 3 are still valid.

Figure 8 combines the unchanged limits from Figure 3 along with the more restrictive limits determined in Reference 21 for PROOS operation. Figure 8 should only be used for operation without a backup pressure regulator. Figure 8 is valid for both Option A and Option B OLMCPR limits.

An interim MFLCPR Limit is provided in Figure 9. This limit should only be used if the Gardel thermal limit input has not been modified as described in Sections 5.3.1 or 5.3.2 to account for pressure regulator out of service operation. i.e. Only Figure 8 or Figure 9 should be used to provide the appropriate PROOS limit. These figures should not be utilized in combination.

5.3.1 OLMCPR for Two Recirculation Loop Operation, WITHOUT A BACKUP PRESSURE REGULATOR.

The Option A or B OLMCPR shall be determined for two recirculation loop operation as follows:

The Option A OLMCPR is calculated as shown below for the Option B example with the following exception:

- The the $OLMCPR_{OptionB}^{New}$ is replaced with the Option A OLMCPR of 1.70.

The Option B OLMCPR is calculated as follows:

The rated (100%) core thermal power Option B OLMCPR ($OLMCPR_{OptionB}^{100\%}$) is 1.57, and is reported in Table 16. This $OLMCPR_{OptionB}^{100\%}$ of 1.57 is modified as described in Section 10 to be a function of the measured scram speeds to yield $OLMCPR_{OptionB}^{New}$.

Then, if core thermal power (P) is ≥ 85% of rated core thermal power, the Option B OLMCPR for all fuel types is the greater of:

$OLMCPR_{OptionB}^{New}$ * {K(P) from Figure 8} or {MCPR(F) from Figure 4},

i.e. if P ≥ 85% rated core thermal power, then Option B OLMCPR limit

= Maximum of { $OLMCPR_{OptionB}^{New}$ * K(P) from Figure 8} or {MCPR(F) from Figure 4}.

If core thermal power (P) is < 85% of rated core thermal power, the OLMCPR for all fuel types is obtained from Figure 8.

5.3.2 OLMCPR for Single Recirculation Loop Operation, WITHOUT A BACKUP PRESSURE REGULATOR

The Option A or B OLMCPR as defined previously for two recirculation loop operation in Section 5.3.1 is increased by the following adder for single recirculation loop operation:

0.02 ΔMCPR adder to account for core flow measurement and TIP reading uncertainties.

6.0 Power-Flow Map

The Power-Flow Operating Map based on analysis to support Cycle 24 is shown in Figures 5, and 6. The Power-Flow Operating Map is consistent with a rated power of 1775 MWth as described in References 5, 11, and 12.

Reference: Technical Specification 3.4.1.

7.0 Approved Analytical Methods

NEDE-24011-P-A	Rev. 15	"General Electric Standard Application for Reactor Fuel (GESTAR)"
NEDE-24011-P-A-US	Rev. 15	"General Electric Standard Application for Reactor Fuel (GESTAR) – Supplement for the United States."
NEDO-31960-A		"BWR Owners Group Long-Term Stability Solution Licensing Methodology," Licensing Topical Report, June 1991.
NEDO-31960-A	Sup. 1	"BWR Owners Group Long-Term Stability Solution Licensing Methodology, (Supplement 1)," Licensing Topical Report, Supplement 1, March 1992.
NEDC-32992P-A		General Electric Licensing Topical Report, "ODYSY Application for Stability Licensing Calculations," July 2001.
NSPNAD-8608-A	Rev. 4	"Reload Safety Evaluation Methods for Application to the Monticello Generating Plant." October 1995.
NSPNAD-8609-A	Rev. 3	"Qualification of Reactor Physics Methods for Application to Monticello," October 1995.

8.0 Fuel Rod Heat Generation Rate

8.1 Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) as a Function of Exposure

The MAPLHGR limits in Tables 1 through 7 are conservative values bounding all fuel lattice types (all natural uranium lattices are excluded) in a given fuel bundle design, and are intended only for use in hand calculations as described in Technical Specification 3.2.1. No channel bow effects are included in the bounding MAPLHGR values in Tables 1 through 7 as there are no reused channels. MAPLHGR limits for each individual fuel lattice for a given bundle design as a function of axial location and average planar exposure are determined based on the approved methodology referenced in Monticello Technical Specification 5.6.3.b and are loaded into the process computer for use in core monitoring calculations.

When and if hand calculations are required:

8.1.1 Two-Recirculation Loop Operation (MAPLHGR)

At rated core thermal power and core flow conditions, the MAPLHGR limit for each fuel bundle design as a function of average planar exposure shall not exceed the bounding limits provided in Tables 1 through 7.

The MAPLHGR limit is adjusted for off-rated core thermal power and core flow conditions by determining the following:

MAPLHGR(P) = MAPFAC(P) * MAPLHGR limit from Tables 1 through 7.
MAPLHGR(F) = MAPFAC(F) * MAPLHGR limit from Tables 1 through 7.

where MAPFAC(P) and MAPFAC(F) are determined from Figures 1 and 2, respectively, and where P is the core thermal power in percent of rated, and F is the core flow in percent of rated.

The Technical Specification (TS) MAPLHGR limit is determined as follows:

MAPLHGR (TS) Limit = Minimum{MAPLHGR(P), MAPLHGR(F)}

Note that all natural uranium lattices are excluded in Tables 1 through 7. Straight line interpolation between nearest data points is permitted only within each individual Tables 1 through 7.

8.1.2 Single Recirculation Loop Operation (MAPLHGR)

When in single recirculation loop operation, perform the following:

8.1.2.1 Perform the action specified in Section 8.1.1 above.

8.1.2.2 Separately, apply the single loop operation multiplier to the limiting values of MAPLHGR from Tables 1 through 7 as follows:

for GE14C: multiplier is 0.90.

8.1.2.3 Select the more limiting (i.e. smaller) value from Sections 8.1.2.1 or 8.1.2.2.

Reference: Technical Specification 3.2.1.

8.2 Linear Heat Generation Rate (LHGR)

The uranium dioxide (UO_2) and gadolinia LHGR limits as a function of fuel rod peak pellet exposure for each bundle type in Cycle 24 is provided in Tables 8 through 14. The gadolinia LHGR limits in Tables 8 through 14 are bounding gadolinia LHGR limits for all the gadolinia concentrations occurring in each of the bundle types used in Cycle 24. The LHGR limits are fuel rod nodal limits, and are to be applied at every node of the fuel rod including the natural uranium lattices.

The individual LHGR limits for the uranium dioxide and gadolinia fuel rods in each fuel bundle type used in Cycle 24, as a function of axial location and pellet exposure are determined based on the approved methodology referenced in Monticello Technical Specification 5.6.3.b and are loaded into the process computer for use in core monitoring calculations.

The LHGR limits are presented in this report for use when and if hand calculations are performed to demonstrate compliance with Technical Specification 3.2.3.

When and if hand calculations are performed:

8.2.1 Two-Recirculation Loop Operation (LHGR)

At rated core thermal power and core flow conditions, the LHGR limit for each fuel bundle design as a function of peak pellet exposure and fuel pin type shall not exceed the bounding limits provided in Tables 8 through 14.

The LHGR limit is adjusted for off-rated core thermal power and core flow conditions by determining the following:

LHGR(P) = MAPFAC(P) * LHGR limit from Tables 8 through 14.
LHGR(F) = MAPFAC(F) * LHGR limit from Tables 8 through 14.

where the multipliers MAPFAC(P) and MAPFAC(F) are determined from Figures 1 and 2, respectively, and where P is the core thermal power in percent of rated, and F is the core flow in percent of rated.

The Technical Specification (TS) LHGR limit is determined as follows:

LHGR TS Limit = Minimum{LHGR(P), LHGR(F)}

Note that the LHGR limits are fuel rod nodal limits, and are to be applied at every node of the fuel rod, including the natural uranium lattices. Straight line interpolation between nearest data points is permitted only within each individual Tables 8 through 14.

8.2.2 Single Recirculation Loop Operation (LHGR)

When in single recirculation loop operation, perform the following:

8.2.2.1 Perform the same action specified in Section 8.2.1 above. There are no separate single loop operation specific multipliers applicable to LHGR, i.e. the multipliers from Section 8.2.1 also apply to single recirculation loop operation.

Reference: Technical Specification Section 3.2.3.

Table 1:
MAPLHGR Limits[1]
GE14C EDB-2598[2]: GE14-P10DNAB393-17GZ-100T-145-T6-2598

(formerly EDB-2587)

Average Planar Exposure GWD/MTU(GWD/STU)	MAPLHGR Limit (kW/ft)[3]
0.00 (0.00)	8.14
0.22 (0.20)	8.20
1.10 (1.00)	8.34
2.20 (2.00)	8.47
3.31 (3.00)	8.59
4.41 (4.00)	8.71
5.51 (5.00)	8.84
6.61 (6.00)	8.97
7.72 (7.00)	9.11
8.82 (8.00)	9.23
9.92 (9.00)	9.35
11.02 (10.00)	9.47
12.13 (11.00)	9.59
13.23 (12.00)	9.70
14.33 (13.00)	9.80
15.43 (14.00)	9.90
16.53 (15.00)	9.98
18.74 (17.00)	9.98
22.05 (20.00)	9.97
27.56 (25.00)	9.95
33.07 (30.00)	9.83
38.58 (35.00)	9.23
41.33 (37.49)	8.95
44.09 (40.00)	8.66
49.60 (45.00)	8.13
55.12 (50.00)	7.61
60.63 (55.00)	6.26
63.50 (57.61)	4.94
63.59 (57.68)	4.90
63.72 (57.81)	4.89
64.44 (58.46)	4.90
64.47 (58.49)	4.89

Note:

(1) Values in Table 1 are for two recirculation loop operation; see Section 8.1.1. For single recirculation loop operation, see Section 8.1.2.

(2) Engineering Data Bank (EDB) number, Reference 14.

(3) MAPLHGR limits from Reference 14.

Table 2:

MAPLHGR Limits[1]

GE14C EDB-2599[2]: GE14-P10DNAB393-17GZ-100T-145-T6-2599

(formerly EDB-2588)

Average Planar Exposure GWD/MTU (GWD/STU)	MAPLHGR Limit (kW/ft) [3]
0.00 (0.00)	8.21
0.22 (0.20)	8.26
1.10 (1.00)	8.35
2.20 (2.00)	8.47
3.31 (3.00)	8.59
4.41 (4.00)	8.71
5.51 (5.00)	8.84
6.61 (6.00)	8.97
7.72 (7.00)	9.11
8.82 (8.00)	9.23
9.92 (9.00)	9.35
11.02 (10.00)	9.47
12.13 (11.00)	9.59
13.23 (12.00)	9.70
14.33 (13.00)	9.80
15.43 (14.00)	9.90
16.53 (15.00)	9.98
18.74 (17.00)	9.97
22.05 (20.00)	9.96
27.56 (25.00)	9.94
33.07 (30.00)	9.84
38.58 (35.00)	9.24
41.33 (37.49)	8.95
44.09 (40.00)	8.67
49.60 (45.00)	8.13
55.12 (50.00)	7.62
60.63 (55.00)	6.26
63.50 (57.61)	4.94
63.59 (57.68)	4.90
63.72 (57.81)	4.89
64.46 (58.48)	4.90
64.49 (58.50)	4.89

Note:

(1) Values in Table 2 are for two recirculation loop operation; see Section 8.1.1. For single recirculation loop operation, see Section 8.1.2.

(2) Engineering Data Bank (EDB) number, Reference 14.

(3) MAPLHGR limits from Reference 14.

Table 3:

MAPLHGR Limits[1]

GE14C EDB-2824[2]: GE14-P10DNAB392-16GZ-100T-145-T6-2824

Average Planar Exposure GWD/MTU (GWD/STU)	MAPLHGR Limit (kW/ft)[3]
0.00 (0.00)	8.33
0.22 (0.20)	8.37
1.10 (1.00)	8.44
2.20 (2.00)	8.54
3.31 (3.00)	8.63
4.41 (4.00)	8.73
5.51 (5.00)	8.84
6.61 (6.00)	8.93
7.72 (7.00)	9.02
8.82 (8.00)	9.11
9.92 (9.00)	9.21
11.02 (10.00)	9.32
12.13 (11.00)	9.44
13.23 (12.00)	9.56
14.33 (13.00)	9.50
15.43 (14.00)	9.50
16.53 (15.00)	9.52
18.74 (17.00)	9.54
22.05 (20.00)	9.56
27.56 (25.00)	9.60
33.07 (30.00)	9.41
38.58 (35.00)	8.91
41.33 (37.49)	8.67
44.09 (40.00)	8.43
49.60 (45.00)	7.90
55.12 (50.00)	7.39
60.63 (55.00)	5.79
63.16 (57.30)	4.68
63.50 (57.61)	4.84
63.59 (57.68)	4.91
63.72 (57.81)	4.90
63.76 (57.85)	4.73

Note:

(1) Values in Table 3 are for two recirculation loop operation; see Section 8.1.1. For single recirculation loop operation, see Section 8.1.2.

(2) Engineering Data Bank (EDB) number, Reference 14.

(3) MAPLHGR Data Reference 14.

Table 4

MAPLHGR Limits[1]

GE14C EDB-2480[2]: GE14-P10DNAB391-14GZ-100T-145-T6-2480

(formerly EDB-2427)

Average Planar Exposure GWD/MTU (GWD/STU)	MAPLHGR Limit (kW/ft) [3]
0.00 (0.00)	8.37
0.22 (0.20)	8.43
1.10 (1.00)	8.54
2.20 (2.00)	8.65
3.31 (3.00)	8.77
4.41 (4.00)	8.90
5.51 (5.00)	9.03
6.61 (6.00)	9.16
7.72 (7.00)	9.27
8.82 (8.00)	9.39
9.92 (9.00)	9.51
11.02 (10.00)	9.63
12.13 (11.00)	9.75
13.23 (12.00)	9.84
14.33 (13.00)	9.92
15.43 (14.00)	9.98
16.53 (15.00)	10.03
18.74 (17.00)	10.10
22.05 (20.00)	10.20
27.56 (25.00)	10.19
33.07 (30.00)	10.04
38.58 (35.00)	9.44
41.33 (37.49)	9.15
44.09 (40.00)	8.87
49.60 (45.00)	8.33
55.12 (50.00)	7.81
60.63 (55.00)	6.26
63.50 (57.61)	4.95
63.72 (57.81)	4.85
63.79 (57.87)	4.85
64.37 (58.40)	4.90
64.39 (58.42)	4.89

Note:

(1) Values in Table 4 are for two recirculation loop operation; see Section 8.1.1. For single recirculation loop operation, see Section 8.1.2.

(2) Engineering Data Bank (EDB) number, Reference 14.

(3) MAPLHGR Data Reference 14.

Table 5:

MAPLHGR Limits[1]

GE14C EDB-2481[2]: GE14-P10DNAB391-14GZ-100T-145-T6-2481

(formerly EDB-2428)

Average Planar Exposure GWD/MTU (GWD/STU)	MAPLHGR Limit (kW/ft) [3]
0.00 (0.00)	8.32
0.22 (0.20)	8.37
1.10 (1.00)	8.48
2.20 (2.00)	8.63
3.31 (3.00)	8.75
4.41 (4.00)	8.87
5.51 (5.00)	8.99
6.61 (6.00)	9.11
7.72 (7.00)	9.22
8.82 (8.00)	9.33
9.92 (9.00)	9.44
11.02 (10.00)	9.56
12.13 (11.00)	9.68
13.23 (12.00)	9.79
14.33 (13.00)	9.88
15.43 (14.00)	9.95
16.53 (15.00)	9.84
18.74 (17.00)	9.80
22.05 (20.00)	9.79
27.56 (25.00)	9.79
33.07 (30.00)	9.74
38.58 (35.00)	9.14
41.33 (37.49)	8.87
44.09 (40.00)	8.59
49.60 (45.00)	8.06
55.12 (50.00)	7.56
60.63 (55.00)	6.25
63.50 (57.61)	4.94
63.68 (57.77)	4.86
63.79 (57.87)	4.85
64.30 (58.33)	4.90
64.32 (58.35)	4.89

Note:

(1) Values in Table 5 are for two recirculation loop operation; see Section 8.1.1. For single recirculation loop operation, see Section 8.1.2.

(2) Engineering Data Bank (EDB) number, Reference 14.

(3) MAPLHGR Data Reference 14.

Table 6:

MAPLHGR Limits[1]

GE14C EDB-2932[2]: GE14-P10DNAB392-17GZ-100T-145-T6-2932

Average Planar Exposure GWD/MTU (GWD/STU)	MAPLHGR Limit (kW/ft) [3]
0.00 (0.00)	8.20
0.22 (0.20)	8.24
1.10 (1.00)	8.34
2.20 (2.00)	8.45
3.31 (3.00)	8.58
4.41 (4.00)	8.70
5.51 (5.00)	8.83
6.61 (6.00)	8.96
7.72 (7.00)	9.10
8.82 (8.00)	9.21
9.92 (9.00)	9.33
11.02 (10.00)	9.46
12.13 (11.00)	9.58
13.23 (12.00)	9.69
14.33 (13.00)	9.80
15.43 (14.00)	9.89
16.53 (15.00)	9.97
18.74 (17.00)	9.96
22.05 (20.00)	9.95
27.56 (25.00)	9.93
33.07 (30.00)	9.82
38.58 (35.00)	9.22
41.33 (37.49)	8.94
44.09 (40.00)	8.65
49.60 (45.00)	8.12
55.12 (50.00)	7.59
60.63 (55.00)	6.25
63.50 (57.61)	4.93
63.57 (57.67)	4.90
63.70 (57.79)	4.89
64.44 (58.46)	4.90
64.48 (58.50)	4.89

Note:

(1) Values in Table 6 are for two recirculation loop operation; see Section 8.1.1. For single recirculation loop operation, see Section 8.1.2.

(2) Engineering Data Bank (EDB) number, Reference 2.

(3) MAPLHGR Data Reference 2.

Table 7:

MAPLHGR Limits[1]

GE14C EDB-2931[2]: GE14-P10DNAB392-16GZ-100T-145-T6-2931

Average Planar Exposure GWD/MTU (GWD/STU)	MAPLHGR Limit (kW/ft) [3]
0.00 (0.00)	8.32
0.22 (0.20)	8.36
1.10 (1.00)	8.43
2.20 (2.00)	8.52
3.31 (3.00)	8.62
4.41 (4.00)	8.72
5.51 (5.00)	8.82
6.61 (6.00)	8.92
7.72 (7.00)	9.00
8.82 (8.00)	9.09
9.92 (9.00)	9.19
11.02 (10.00)	9.31
12.13 (11.00)	9.43
13.23 (12.00)	9.55
14.33 (13.00)	9.50
15.43 (14.00)	9.49
16.53 (15.00)	9.51
18.74 (17.00)	9.53
22.05 (20.00)	9.55
27.56 (25.00)	9.60
33.07 (30.00)	9.41
38.58 (35.00)	8.90
41.33 (37.49)	8.67
44.09 (40.00)	8.43
49.60 (45.00)	7.90
55.12 (50.00)	7.38
60.63 (55.00)	5.78
63.13 (57.27)	4.68
63.50 (57.61)	4.83
63.54 (57.65)	4.91
63.68 (57.77)	4.91
63.73 (57.82)	4.73

Note:

(1) Values in Table 7 are for two recirculation loop operation; see Section 8.1.1. For single recirculation loop operation, see Section 8.1.2.

(2) Engineering Data Bank (EDB) number, Reference 2.

(3) MAPLHGR Data Reference 2.

Table 8 [2]
UO2/Gd Thermal Mechanical LHGR Limits
(Reference 17)

Bundle Type: GE14-P10DNAB393-17GZ-100T-145-T6-2598 (GE14C)
Engineering Data Bank (EDB) Bundle Number [1]: 2598 (formerly EDB-2587)

Peak Pellet Exposure GWd/MT (GWD/ST)	UO_2 LHGR Limit (kW/ft)	Peak Pellet Exposure GWd/MT (GWD/ST)	Most Limiting Gadolinia LHGR Limit (kW/ft)
0.00 (0.00)	13.40	0.00 (0.00)	12.26
16.00 (14.51)	13.40	13.53 (12.28)	12.26
63.50 (57.61)	8.00	60.63 (55.00)	7.32
70.00 (63.50)	5.00	67.07 (60.84)	4.57

Notes:
1. Reference 17.
2. Applicable multipliers per Section 8.2 will be applied to the data in this table for two recirculation loop and single recirculation loop operations.

Table 9 [2]
UO2/Gd Thermal Mechanical LHGR Limits
(Reference 17)

Bundle Type: GE14-P10DNAB393-17GZ-100T-145-T6-2599 (GE14C)
Engineering Data Bank (EDB) Bundle Number [1]: 2599 (formerly EDB-2588)

Peak Pellet Exposure GWd/MT (GWD/ST)	UO2 LHGR Limit (kW/ft)	Peak Pellet Exposure GWd/MT (GWD/ST)	Most Limiting Gadolinia LHGR Limit (kW/ft)
0.00 (0.00)	13.40	0.00 (0.00)	12.26
16.00 (14.51)	13.40	13.53 (12.28)	12.26
63.50 (57.61)	8.00	60.63 (55.00)	7.32
70.00 (63.50)	5.00	67.07 (60.84)	4.57

Notes:
1. Reference 17.
2. Applicable multipliers per Section 8.2 will be applied to the data in this table for two recirculation loop and single recirculation loop operations.

Table 10 [2]
UO2/Gd Thermal Mechanical LHGR Limits
(Reference 17)

Bundle Type: GE14-P10DNAB392-16GZ-100T-145-T6-2824 (GE14C)
Engineering Data Bank (EDB) Bundle Number [1]: 2824 (no former EDB designation)

Peak Pellet Exposure GWd/MT (GWD/ST)	UO2 LHGR Limit (kW/ft)	Peak Pellet Exposure GWd/MT (GWD/ST)	Most Limiting Gadolinia LHGR Limit (kW/ft)
0.00 (0.00)	13.40	0.00 (0.00)	12.00
16.00 (14.51)	13.40	13.42 (12.17)	12.00
63.50 (57.61)	8.00	60.17 (54.59)	7.16
70.00 (63.50)	5.00	66.57 (60.39)	4.48

Notes:
1. Reference 17.
2. Applicable multipliers per Section 8.2 will be applied to the data in this table for two recirculation loop and single recirculation loop operations.

Table 11 [2]
UO2/Gd Thermal Mechanical LHGR Limits
(Reference 17)

Bundle Type: GE14-P10DNAB391-14GZ-100T-145-T6-2480 (GE14C)
Engineering Data Bank (EDB) Bundle Number [1]: 2480 (formerly EDB-2427)

Peak Pellet Exposure GWd/MT (GWD/ST)	UO2 LHGR Limit (kW/ft)	Peak Pellet Exposure GWd/MT (GWD/ST)	Most Limiting Gadolinia LHGR Limit (kW/ft)
0.00 (0.00)	13.40	0.00 (0.00)	12.52
16.00 (14.51)	13.40	13.66 (12.39)	12.52
63.50 (57.61)	8.00	61.12 (55.44)	7.47
70.00 (63.50)	5.00	67.61 (61.33)	4.67

Notes:
1. Reference 17.
2. Applicable multipliers per Section 8.2 will be applied to the data in this table for two recirculation loop and single recirculation loop operations.

Table 12 [2]
UO2/Gd Thermal Mechanical LHGR Limits
(Reference 17)

Bundle Type: GE14-P10DNAB391-14GZ-100T-145-T6-2481 (GE14C)
Engineering Data Bank (EDB) Bundle Number [1]: 2481 (formerly EDB-2428)

Peak Pellet Exposure GWd/MT (GWD/ST)	UO2 LHGR Limit (kW/ft)	Peak Pellet Exposure GWd/MT (GWD/ST)	Most Limiting Gadolinia LHGR Limit (kW/ft)
0.00 (0.00)	13.40	0.00 (0.00)	12.26
16.00 (14.51)	13.40	13.53 (12.28)	12.26
63.50 (57.61)	8.00	60.63 (55.00)	7.32
70.00 (63.50)	5.00	67.07 (60.84)	4.57

Notes:
1. Reference 17.
2. Applicable multipliers per Section 8.2 will be applied to the data in this table for two recirculation loop and single recirculation loop operations.

Table 13 [2]
UO2/Gd Thermal Mechanical LHGR Limits
(Reference 13)

Bundle Type: GE14-P10DNAB392-16GZ-100T-145-T6-2931 (GE14C)
Engineering Data Bank (EDB) Bundle Number [1]: 2931 (no former EDB designation)

Peak Pellet Exposure GWd/MT (GWD/ST)	UO2 LHGR Limit (kW/ft)	Peak Pellet Exposure GWd/MT (GWD/ST)	Most Limiting Gadolinia LHGR Limit (kW/ft)
0.00 (0.00)	13.40	0.00 (0.00)	12.00
16.00 (14.51)	13.40	13.42 (12.17)	12.00
63.50 (57.61)	8.00	60.17 (54.59)	7.16
70.00 (63.50)	5.00	66.57 (60.39)	4.48

Notes:
1. Reference 13.
2. Applicable multipliers per Section 8.2 will be applied to the data in this table for two recirculation loop and single recirculation loop operations.

Table 14 [2]
UO2/Gd Thermal Mechanical LHGR Limits
(Reference 13)

Bundle Type: GE14-P10DNAB392-17GZ-100T-145-T6-2932 (GE14C)
Engineering Data Bank (EDB) Bundle Number [1]: 2932 (no former EDB designation)

Peak Pellet Exposure GWd/MT (GWD/ST)	UO2 LHGR Limit (kW/ft)	Peak Pellet Exposure GWd/MT (GWD/ST)	Most Limiting Gadolinia LHGR Limit (kW/ft)
0.00 (0.00)	13.40	0.00 (0.00)	12.26
16.00 (14.51)	13.40	13.53 (12.28)	12.26
63.50 (57.61)	8.00	60.63 (55.00)	7.32
70.00 (63.50)	5.00	67.07 (60.84)	4.57

Notes:
1. Reference 13.0
2. Applicable multipliers per Section 8.2 will be applied to the data in this table for two recirculation loop and single recirculation loop operations.

9.0 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 shall 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 shall be maintained within the stable portion of Figure 7.

Normal Region
The normal region is shown in Figures 5 and 6.

Reference: Technical Specification 3.4.1.

10.0 Scram Time Dependence

The Technical Specification Option A (no scram times dependence) OLMCPR can be found in Section 5 of this report. If the Option B scram time dependence option is preferred, then the procedure listed in sections 10.1 may be used.

10.1 Technical Specification Scram Time Dependence

Technical Specification 3.1.4 and Table 3.1.4-1 provide the scram insertion time versus position requirements for continued operations. Technical Specification Surveillance Requirements SR 3.1.4.1 – SR 3.1.4.4 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_{ave} can be calculated in accordance with the equation below for the notch 36 position.

The Equation (1) used to calculate the average of all the scram data generated to date in the cycle is:

$$\tau_{ave} = \frac{\sum_{i=1}^{n} N_i \tau_i}{\sum_{i=1}^{n} N_i} \qquad (1)$$

where: n = the number of surveillance tests performed to date in the cycle;

$\sum_{i=1}^{n} N_i$ = total number of active control rods measured to date in the cycle, and

$\sum_{i=1}^{n} N_i \tau_i$ = sum of the scram times to the 36th notch position of all active rods measured to date in the cycle to comply with the Technical Specification surveillance requirements SR 3.1.4.1, SR 3.1.4.2, SR 3.1.4.3, SR 3.1.4.4.

The average scram time, τ_{ave} is tested against the analysis mean using the following equation:

$$\tau_{ave} \leq \tau_B \qquad (2)$$

where:

$$\tau_B = \mu + 1.65 \sqrt{\left(\frac{N_1}{\sum_{i=1}^{n} N_i} \right)} \sigma \qquad (3)$$

The parameters μ and σ are the mean and standard deviation of the distribution of the average scram insertion time to notch 36 position in the ODYN Option B analysis (Table 15), and N_1 = number of active control rods tested at BOC.

Table 15
GEMINI Methods, CRD Notch Position for τ_B Determination

Notch Position	μ	σ
36	0.830	0.019

If the cycle average scram time satisfies the Equation 2 criteria, continued plant operation under the ODYN Option B operating limit minimum critical power ratio (OLMCPR) for pressurization events is permitted. If not, the OLMCPR for pressurization events must be re-established, based on linear interpolation between the Option B and Option A OLMCPRs.

Note that Option B has an OLMCPR applicable to two recirculation loop operation, and an OLMCPR applicable to single recirculation loop operation. The Option B OLMCPR value for single recirculation loop operation is 0.02 greater than the Option B OLMCPR value for two recirculation loop operation.

The equation to establish the new operating limit for pressurization events is given below:

$$\mathrm{OLMCPR}_{\mathrm{NEW}} = MAX\left(\mathrm{OLMCPR}^{100\%}_{\mathrm{OptionB}} + \frac{\tau_{\mathrm{ave}} - \tau_B}{\tau_A - \tau_B} \Delta\mathrm{OLMCPR}, \mathrm{OLMCPR}_{\mathrm{TTWBP}} \right) \quad (4)$$

where:

τ_{ave} and τ_B are defined in Equations 1 and 3, respectively; and

τ_A = The Technical Specification limit on scram time to notch position 36 . (Technical Specification Table 3.1.4-1 at notch position 36)

ΔOLMCPR = the difference between the Option A OLMCPR and the Option B OLMCPR reported in Table 16.

Table 16
Cycle OLMCPR Values

Transient	Option A	Option B
Inadvertent HPCI / L8 Turbine Trip	**1.70**	**1.53**
Turbine Trip with Bypass[1]	**1.57**	

1. The Turbine Trip with Bypass transient will be used as the Minimum OLMCPR transient for Option B Analysis.
2. All the OLMCPR values reported in Table 16 are for two recirculation loop operation.
3. For Options A and B, the OLMCPR value for single recirculation loop operation is 0.02 greater than the OLMCPR value for two recirculation loop operation.

Sample Calculation:

Assume two recirculation loop operation.

If τ_{ave} is 0.820 seconds (scram time test) and τ_B (as calculated with equation 3) is 0.850 seconds then the criteria from Equation 2 is met and the Option B OLMCPR of 1.57 can be used.

If τ_{ave} is 0.940 seconds and τ_B is 0.850 seconds, then Equation 2 is not met and a new Option B OLMCPR must be calculated using Equation 4 above.

The example calculation is as follows:

$$\mathrm{OLMCPR}_{\mathrm{NEW}} = MAX\left(\mathrm{OLMCPR}^{100\%}_{\mathrm{OptionB}} + \frac{\tau_{\mathrm{ave}} - \tau_{\mathrm{B}}}{\tau_{\mathrm{A}} - \tau_{\mathrm{B}}} \Delta\mathrm{OLMCPR}, \mathrm{OLMCPR}_{\mathrm{TTWBP}} \right)$$

$\mathrm{OLMCPR}^{100\%}_{\mathrm{OptionB}}$ = 1.53 (from Table 16 above.)

τ_{ave} = 0.940

τ_B = 0.850

τ_A = 1.080 (Technical Specification Table 3.1.4-1 at notch position 36)

$\Delta\mathrm{OLMCPR}$ = 1.70 - 1.53 = 0.17 (from Table 16 above; assume two recirculation loop operation)

$$\mathrm{OLMCPR}_{\mathrm{NEW}} = MAX\left(1.53 + \left(\frac{0.940 - 0.850}{1.080 - 0.850} \right) * 0.17,\ 1.57 \right) = 1.60$$; two recirculation loop operation.

Note: If single recirculation loop operation Option B OLMCPR value is desired, add 0.02, i.e. 1.60 + 0.02 = 1.62.

11.0 Turbine Bypass System Response Time

The TURBINE BYPASS SYSTEM RESPONSE TIME shall be that time interval from when the main turbine trip solenoid is activated until 80% of the turbine bypass capacity is established. The TURBINE BYPASS SYSTEM RESPONSE TIME shall be $\leq$ 1.1 seconds.

Reference: Technical Specification 1.1, Surveillance Requirement 3.7.7.3.

12.0 Shutdown Margin (SDM) Confirmation

Technical Specification 3.1.1 requires that the SDM be confirmed for Monticello Cycle 24. Analytical SDM has been confirmed in the Supplemental Reload Licensing Report (Reference 2, Section 4).

For any mid-cycle core loading changes, the analytical SDM will be re-confirmed, formally documented, and reviewed prior to start-up.

Figure 1
Monticello Cycle 24
Power Dependent MAPLHGR and LHGR Multipliers

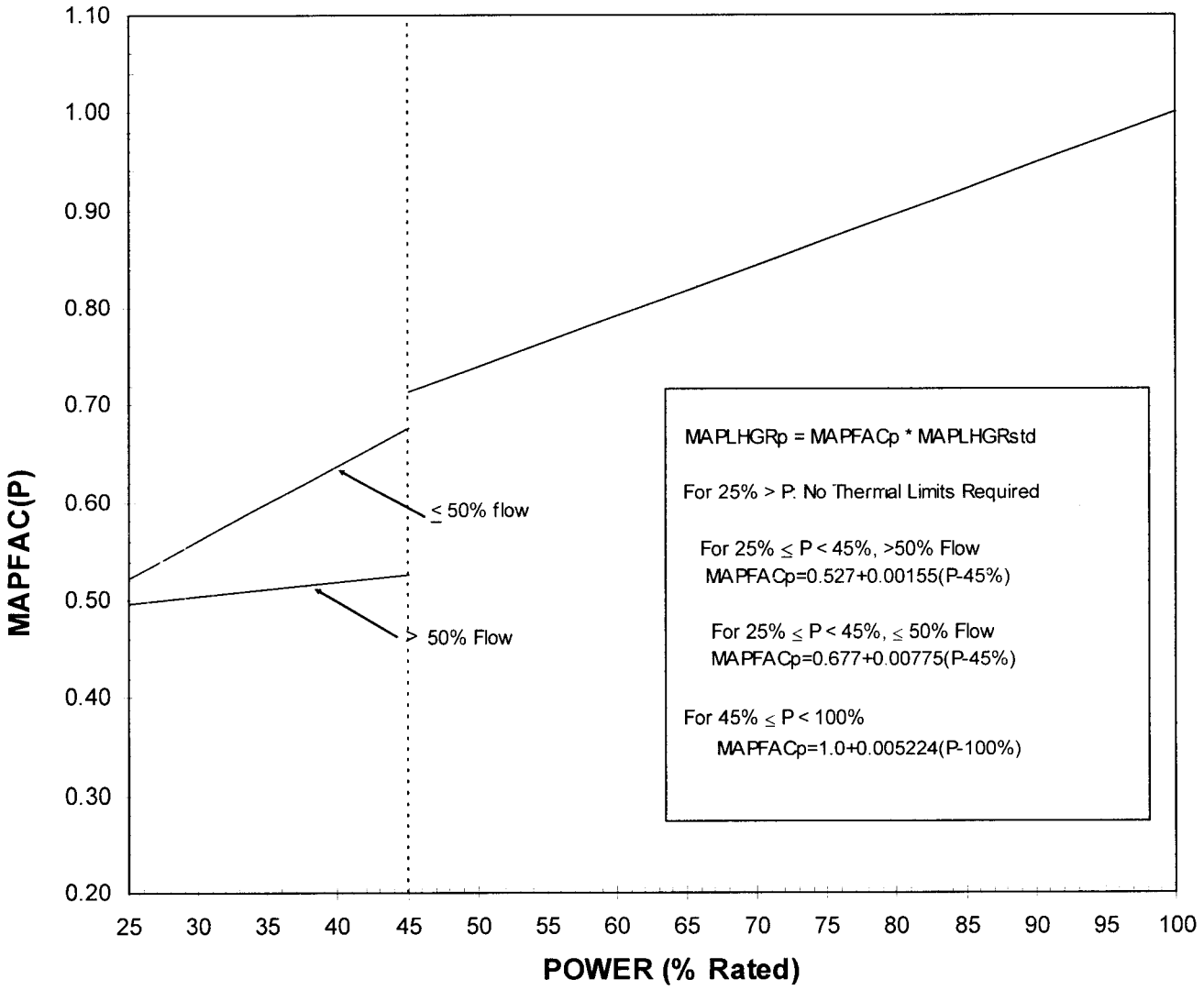


Figure 2
Monticello Cycle 24
Flow Dependent MAPLHGR and LHGR Multipliers

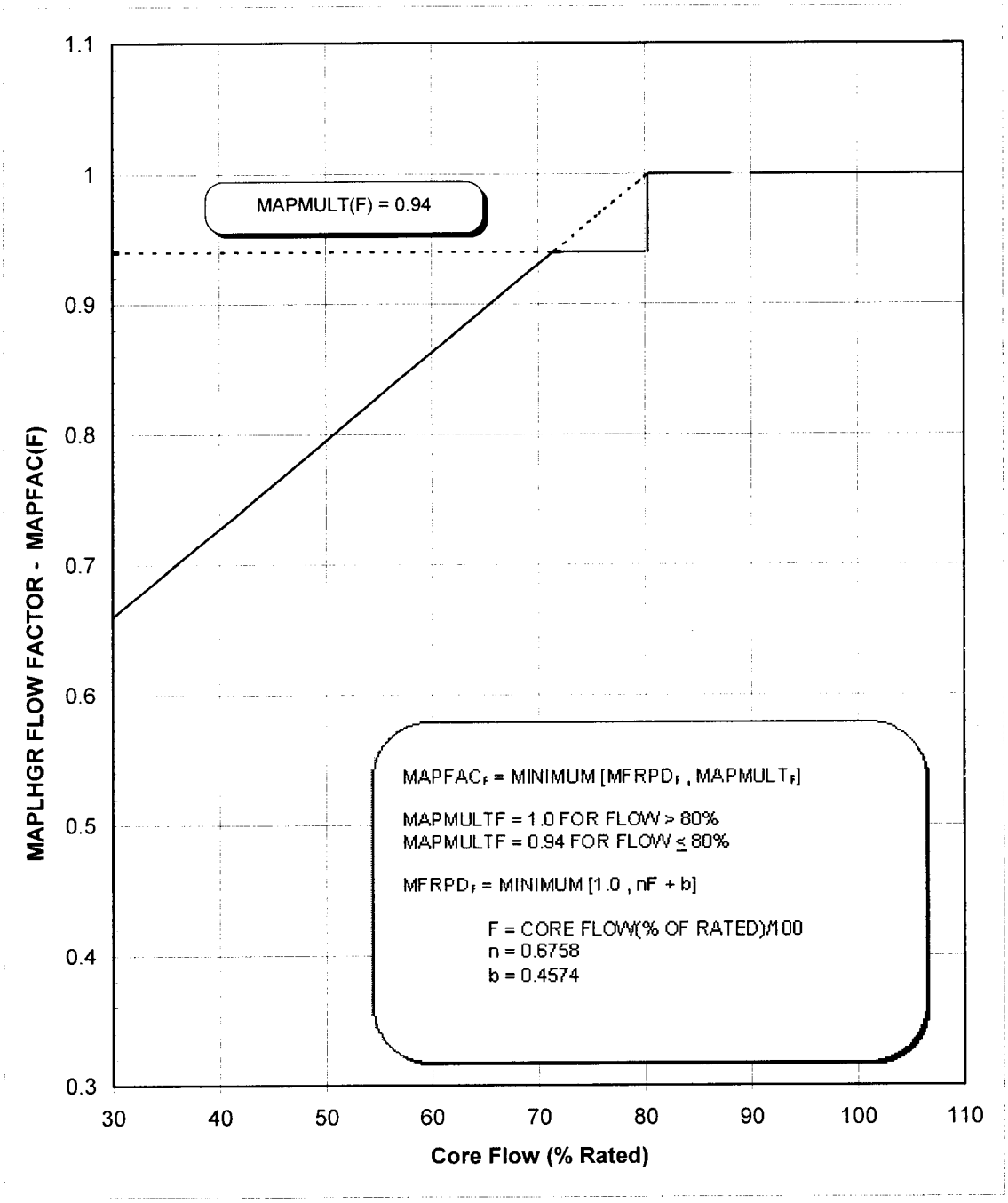


Figure 3
Monticello Cycle 24
Power Dependent K(P) / MCPR(P) Limits

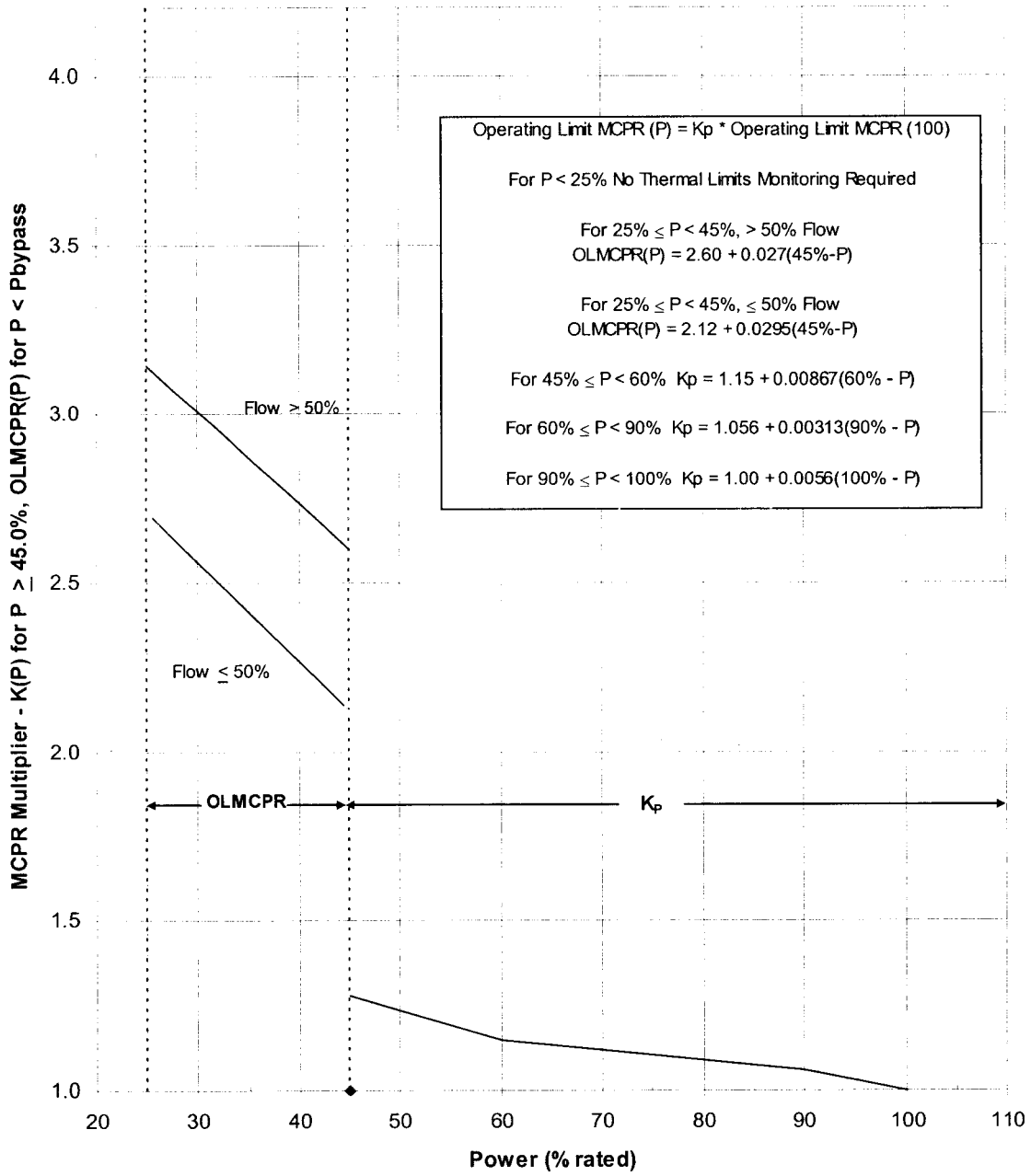


Figure 4
Monticello Cycle 24
Flow Dependent CPR Limits

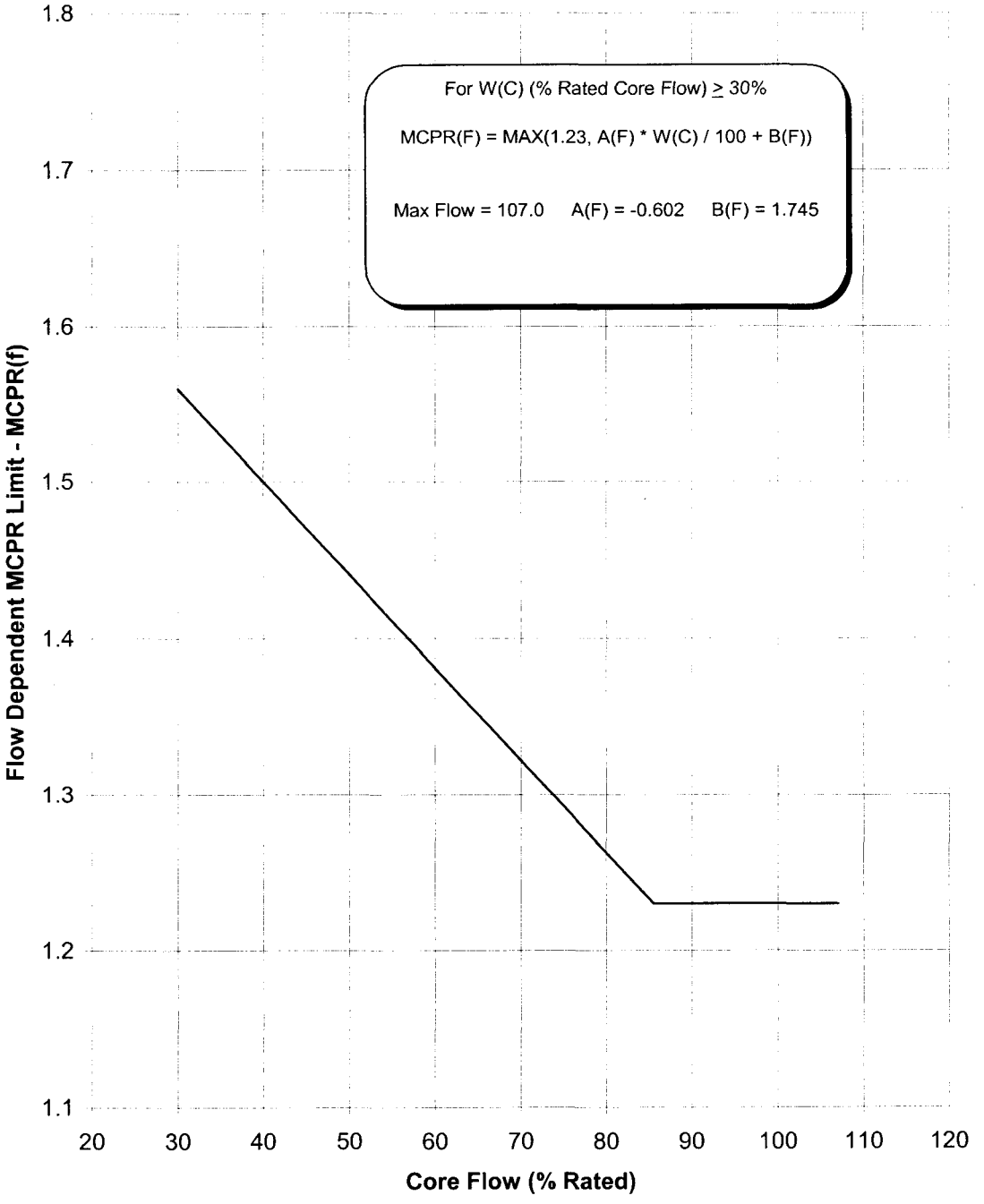


Figure 5

Monticello Nuclear Generating Plant Power-Flow Operating Map

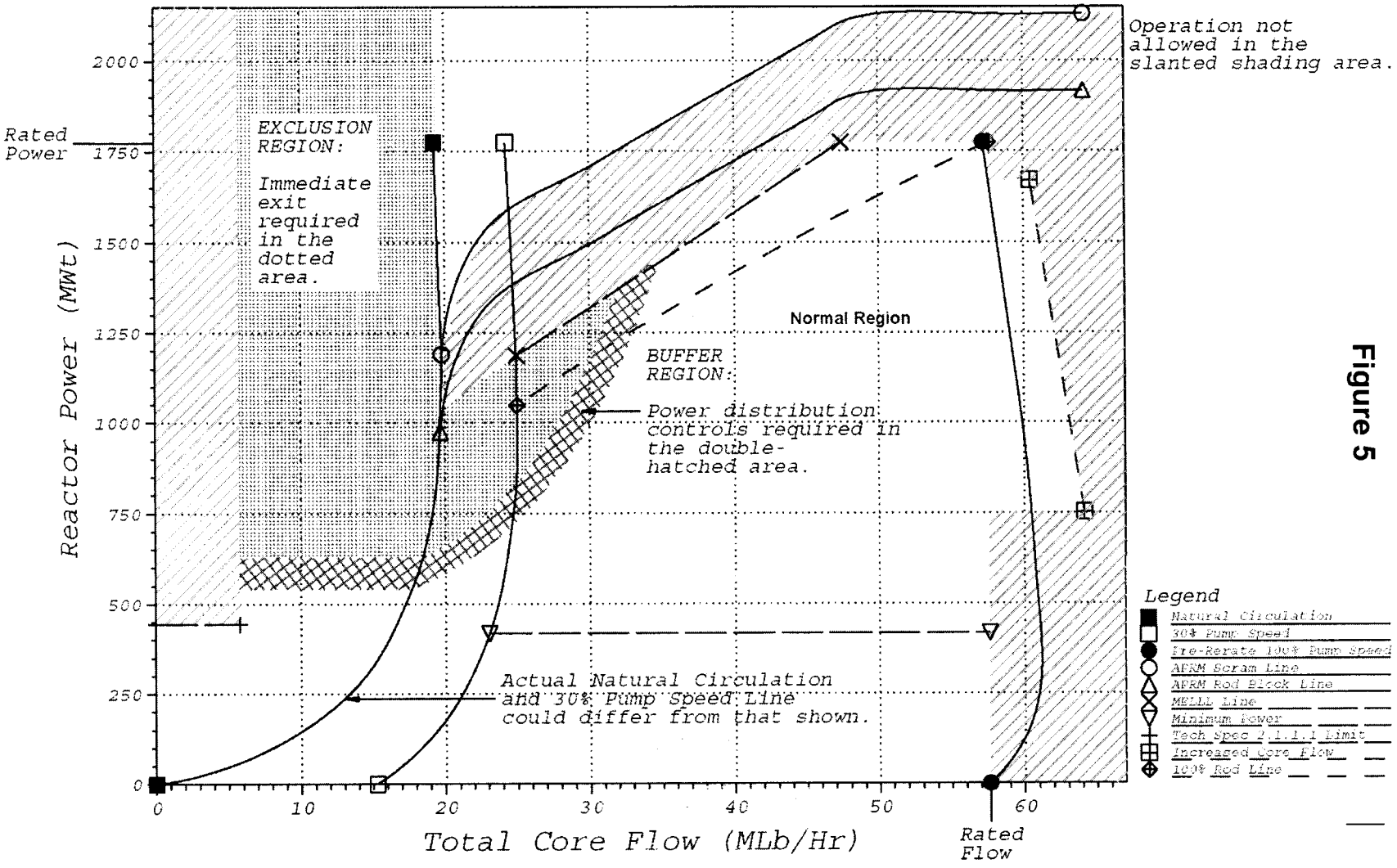


Figure 5

Figure 6

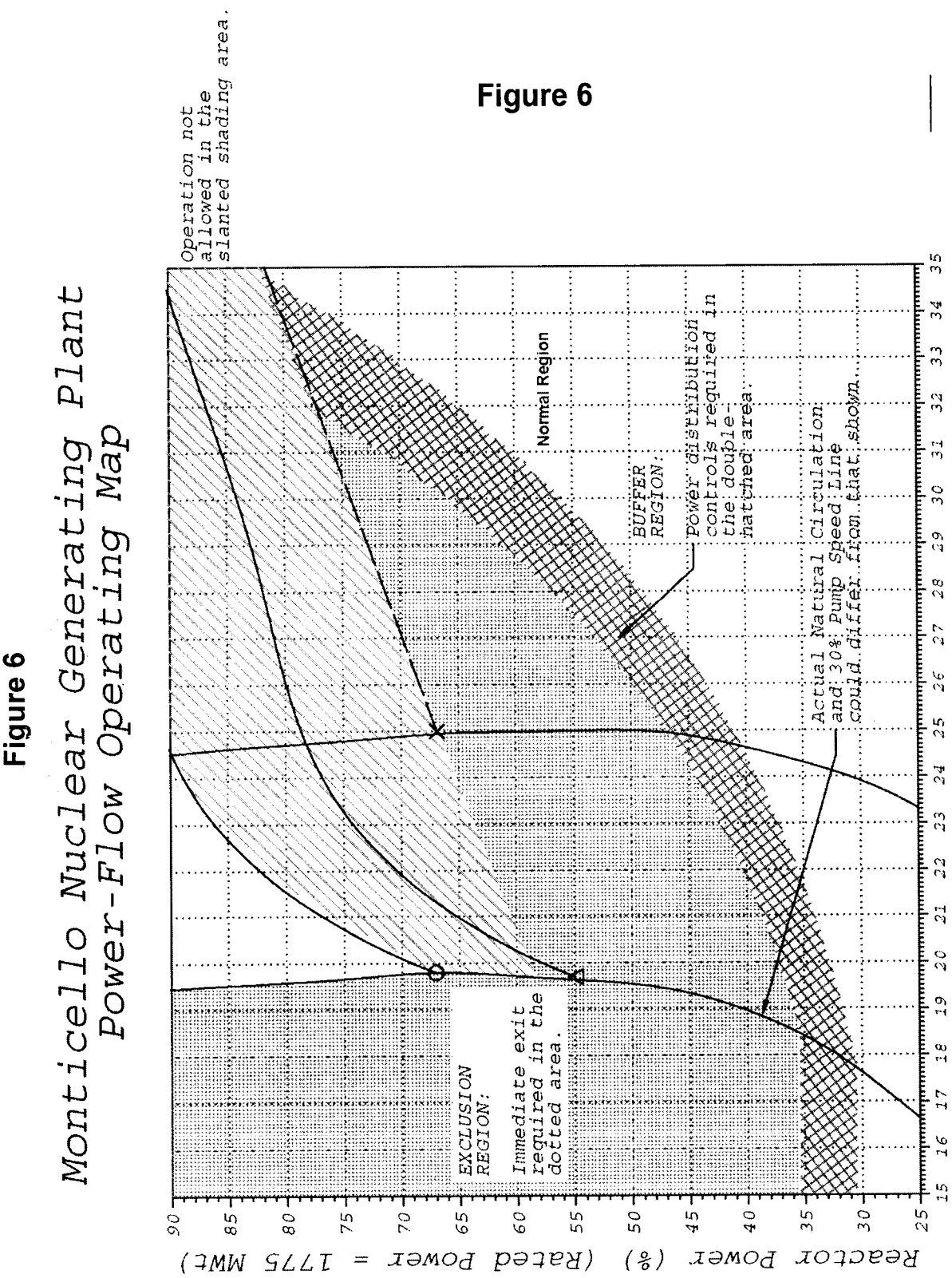

Monticello Nuclear Generating Plant
Power-Flow Operating Map
Operation not allowed in the slanted shading area.
Normal Region
BUFFER REGION:
Power distribution controls required in the double-hatched area.
Actual Natural Circulation and 30% Pump Speed Line could differ from that shown.
EXCLUSION REGION:
Immediate exit required in the dotted area.
Reactor Power (%) (Rated Power = 1775 MWt)
Total Core Flow (MLb/Hr)

Figure 7
Stability Criterion Map

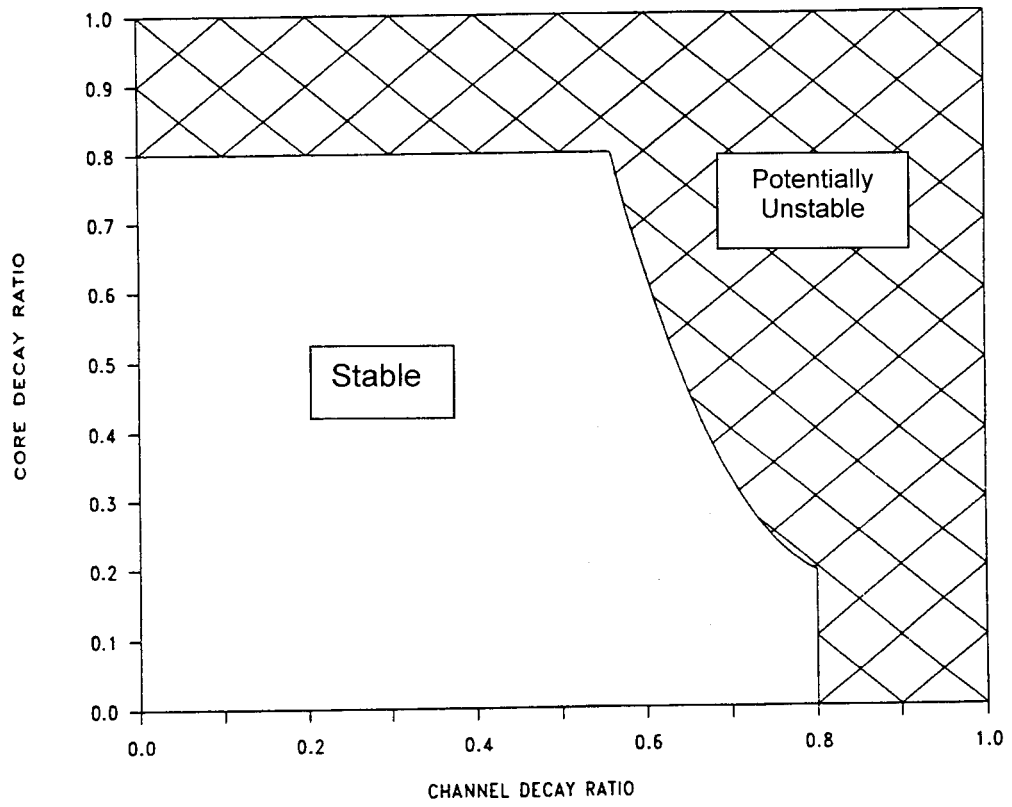


Figure 8
Monticello Cycle 24
Power Dependent K(P) and MCPR(P) Limits for Pressure Regulator Out of Service (PROOS)

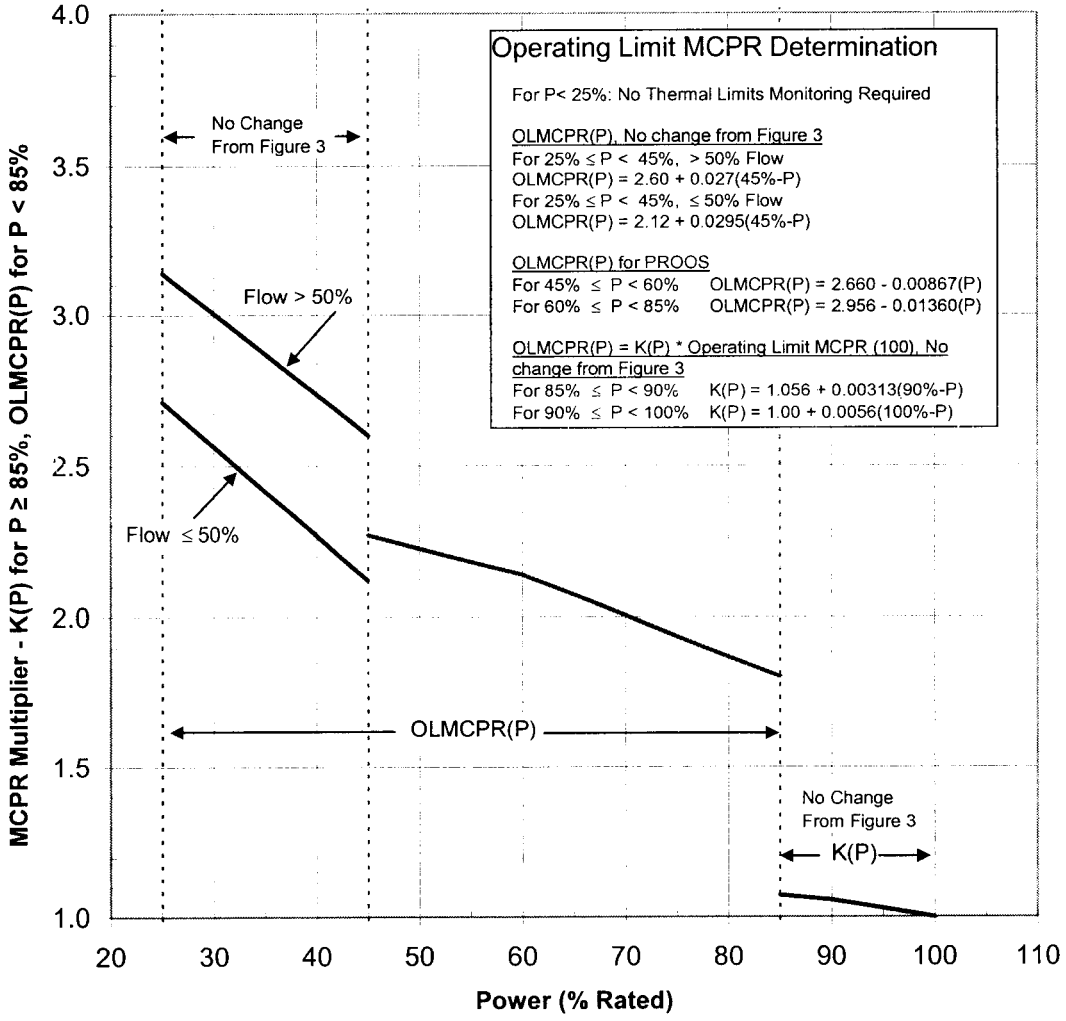
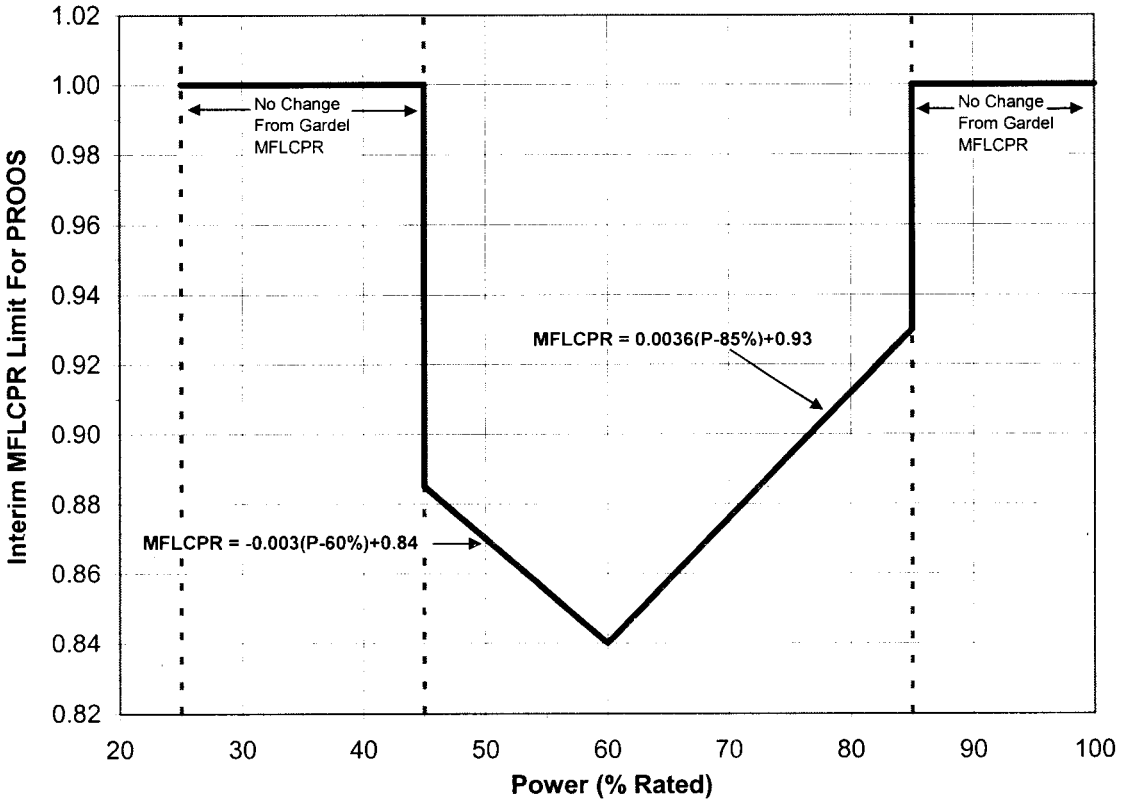


Figure 9
Pressure Regulator Out Of Service
Interim MFLCPR LIMIT



The plot is valid for Option A & B scram times.
The limit is not dependent on core flow.