ENERGY NORTHWEST
People·Vision·Solutions

P.O. Box 968 • Richland, WA • 99352-0968

May 17, 2005
GO2-05-094

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

Subject: **COLUMBIA GENERATING STATION, DOCKET NO. 50-397; CYCLE 17, CORE OPERATING LIMITS REPORT (COLR), REVISIONS 0 AND 1**

Dear Sir or Madam:

Energy Northwest herewith submits the Cycle 17 COLR, Revisions 0 and 1, as required by the Columbia Generating Station Technical Specification (TS) 5.6.3.d (previously 5.6.5.d). The operating limits in the COLR were developed in accordance with the requirements of TS 5.6.3.a, b., and c. The changes to the COLR have been reviewed and approved by the Columbia Generating Station Plant Operations Committee.

The Cycle 17 COLRs apply to the recently completed operating cycle. Revision 0 was issued in June 2003 and Revision 1 was issued in October 2003. The failure to submit the Cycle 17 COLRs upon their issuance, as required by the TS, was recently identified and this deficiency was entered into Energy Northwest's corrective action program. These two Cycle 17 COLRs are submitted at this time to bring the Columbia docket up to date. The failure to submit past COLRs is isolated to cycle 17.

Should you have any questions or desire additional information regarding this matter, please contact me at (509) 377-4342.

Respectfully,

Gregory V. Cullen for

DW Coleman
Manager, Regulatory Programs
Mail Drop PE20

A001

Attachments: COLR Rev. 0
COLR Rev. 1

cc: BS Mallett - NRC RIV
BJ Benney - NRC NRR
NRC Senior Resident Inspector – 988C
JO Luce - EFSEC
WA Horin - Winston & Strawn
RN Sherman - BPA/1399

CYCLE 17, CORE OPERATING LIMITS REPORT (COLR), REVISION 0

Columbia Generating Station

Cycle 17

Core Operating Limits Report

June 2003

Columbia Generating Station
Cycle 17
Core Operating Limits Report

List of Effective Pages

27 0
28 0
29 0
30 0
31 0
32 0
33 0
34 0
35 0
36 0
37 0
38 0
39 0
40 0
41 0
42 0
43 0
44 0
45 0
46 0
47 0
48 0
49 0
50 0
51 0
52 0
53 0
54 0
55 0

Columbia Generating Station
Cycle 17
Core Operating Limits Report

Table of Contents

1.0 Introduction and Summary

This report provides the **Average Planar Linear Heat Generation Rate (APLHGR)** limits, the **Minimum Critical Power Ratio (MCPR)** limits, the **Linear Heat Generation Rate (LHGR)** limits and the **Oscillation Power Range Monitor (OPRM) Instrumentation** limits for Columbia Generating Station Cycle 17 as required by Technical Specification 5.6.5. As required by Technical Specification 5.6.5, these limits were determined using NRC-approved methodology and are established so that all applicable limits of the plant safety analysis are met. References 6.1, 6.2, 6.3, and 6.4 describe the LOCA analyses for rated power. These analyses were performed with methodologies that result in Single Loop Operation (SLO) APLHGR limits as well as Two Loop Operation (TLO) APLHGR limits. The thermal limits for ATRIUM-10 fuel given in this report are documented in Reference 6.3. The MCPR limits for the SVEA-96 fuel are also documented in Reference 6.3. The APLHGR and LHGR limits for SVEA-96 fuel are documented in References 6.1 and 6.6. The basis for the OPRM Instrumentation limits is documented in References 6.3 and 6.5.

The MCPR limit is the maximum of (a) the applicable exposure dependent, full power and full flow MCPR limit, (b) the applicable exposure and power dependent MCPR limit, and (c) the applicable flow dependent MCPR limit specified in this report. This stipulation assures that the safety limit MCPR will not be violated during steady-state operation and anticipated operational occurrences throughout the Columbia Generating Station operating regime. Full power MCPR limits are specified to define operating limits at rated power and flow. Power dependent MCPR limits are specified to define operating limits at other than rated power conditions. A flow dependent MCPR is specified to define operating limits at other than rated flow conditions. The reduced flow MCPR limit, set by the limiting Recirculation Flow Increase event, provides bounding protection for all events at reduced flow.

The reload licensing analyses for this cycle provide operating limits for Extended Load Line Limit Analysis (ELLLA) operation which extends the power and flow operating regime for Columbia Generating Station up to the 108% rod line which at full power corresponds to 88% of rated flow. The MCPR limits defined in this report are applicable up to 100% of rated thermal power along and below the 108% rod line. The minimum flow for operation at rated power is 88% of rated flow; the maximum is 106%.

Per Technical Specification 4.2.1, the 12 fresh SVEA-96 fuel assemblies shall be loaded and operated so they will be nonlimiting MCPR assemblies.

The specific topical report revisions and supplements which describe the methodology utilized in this cycle specific analysis are shown in Table 1.1.

Table 1.1

Columbia Generating Station
Reference Topical Reports

1. XN-NF-81-58(P)(A) Revision 2 and Supplements 1 and 2, *RODEX2 Fuel Rod Thermal-Mechanical Response Evaluation Model*, Exxon Nuclear Company, March 1984.

2. XN-NF-85-67(P)(A) Revision 1, *Generic Mechanical Design for Exxon Nuclear Jet Pump BWR Reload Fuel*, Exxon Nuclear Company, September 1986.

3. EMF-85-74(P) Revision 0 Supplement 1(P)(A) and Supplement 2(P)(A), *RODEX2A (BWR) Fuel Rod Thermal-Mechanical Evaluation Model*, Siemens Power Corporation, February 1998.

4. ANF-89-98(P)(A) Revision 1 and Supplement 1, *Generic Mechanical Design Criteria for BWR Fuel Designs*, Advanced Nuclear Fuels Corporation, May 1995.

5. XN-NF-80-19(P)(A) Volume 1 and Supplements 1 and 2, *Exxon Nuclear Methodology for Boiling Water Reactors - Neutronic Methods for Design and Analysis*, Exxon Nuclear Company, March 1983.

6. XN-NF-80-19(P)(A) Volume 4 Revision 1, *Exxon Nuclear Methodology for Boiling Water Reactors: Application of the ENC Methodology to BWR Reloads*, Exxon Nuclear Company, June 1986.

7. EMF-2158(P)(A) Revision 0, *Siemens Power Corporation Methodology for Boiling Water Reactors: Evaluation and Validation of CASMO-4/MICROBURN-B2*, Siemens Power Corporation, October 1999.

8. XN-NF-80-19(P)(A) Volume 3 Revision 2, *Exxon Nuclear Methodology for Boiling Water Reactors, THERMEX: Thermal Limits Methodology Summary Description*, Exxon Nuclear Company, January 1987.

9. XN-NF-84-105(P)(A) Volume 1 and Volume 1 Supplements 1 and 2, *XCOBRA-T: A Computer Code for BWR Transient Thermal-Hydraulic Core Analysis*, Exxon Nuclear Company, February 1987.

10. ANF-524(P)(A) Revision 2 and Supplements 1 and 2, *ANF Critical Power Methodology for Boiling Water Reactors*, Advanced Nuclear Fuels Corporation, November 1990.

11. ANF-913(P)(A) Volume 1 Revision 1 and Volume 1 Supplements 2, 3 and 4, *COTRANSA2: A Computer Program for Boiling Water Reactor Transient* Analysis, Advanced Nuclear Fuels Corporation, August 1990.

12. ANF-1358(P)(A) Revision 1, *The Loss of Feedwater Heating Transient in Boiling Water Reactors*, Advanced Nuclear Fuels Corporation, September 1992.

13. EMF-2209(P)(A) Revision 1, *SPCB Critical Power Correlation*, Siemens Power Corporation, July 2000.

14. EMF-2245(P)(A) Revision 0, *Application of Siemens Power Corporation's Critical Power Correlations to Co-Resident Fuel*, Siemens Power Corporation, August 2000.

15. EMF-2361(P)(A) Revision 0, *EXEM BWR-2000 ECCS Evaluation Model*, Framatome ANP, May 2001.

16. EMF-2292(P)(A) Revision 0, *ATRIUM™–10: Appendix K Spray Heat Transfer Coefficients*, Siemens Power Corporation, September 2000.

17. EMF-CC-074(P)(A) Volume 4 Revision 0, *BWR Stability Analysis - Assessment of STAIF with Input from MICROBURN-B2*, Siemens Power Corporation, August 2000.

18. CENPD-300-P-A, *Reference Safety Report for Boiling Water Reactor Reload Fuel*, ABB Combustion Engineering Nuclear Operations, July 1996.

19. NEDO-32465-A, *BWR Owners' Group Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology and Reload Applications*, August 1996.

2.0 Average Planar Linear Heat Generation Rate (APLHGR) Limits for Use in Technical Specification 3.2.1

The APLHGRs for use in Technical Specification 3.2.1, as a function of Average Planar Exposure, shall not exceed the limits shown in the following figures. Note that the APLHGR limits for single loop operation for ATRIUM-10 fuel are obtained by applying a 0.9 multiplier to the two loop operation APLHGR limits.

a. Figure 2.1 – SA- and SB-Type SVEA-96 reload fuel – Two Loop Operation

b. Figure 2.2 – SA- and SB-Type SVEA-96 reload fuel – Single Loop Operation

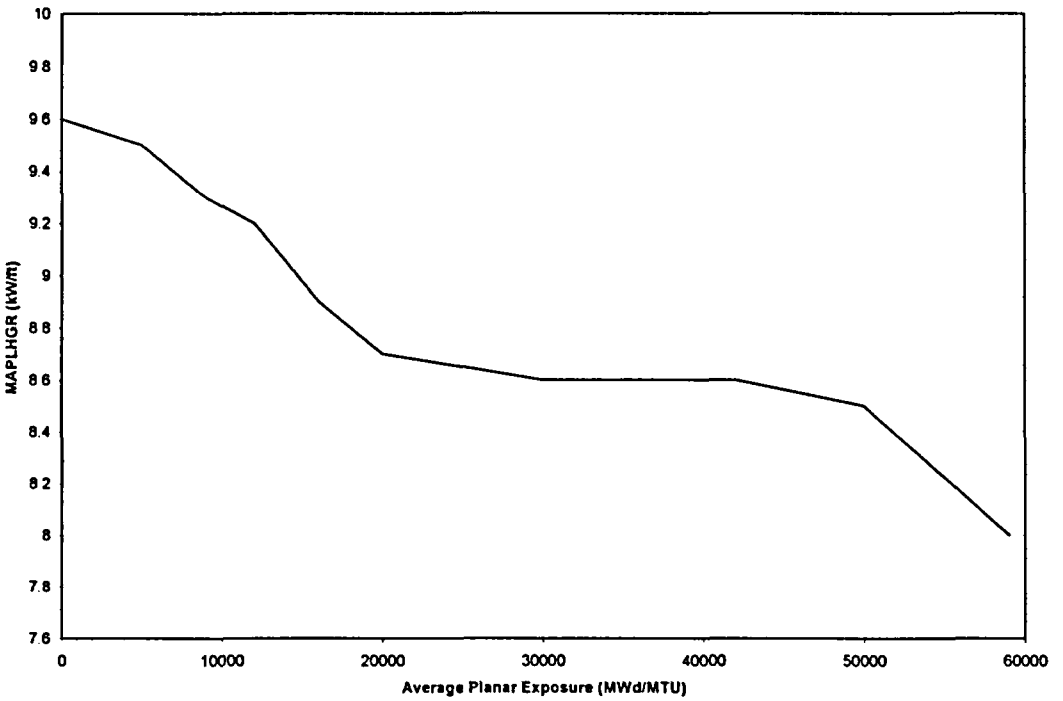
c. Figure 2.3 – SC- and SD-Type SVEA-96 reload fuel – Two Loop Operation

d. Figure 2.4 – SC- and SD-Type SVEA-96 reload fuel – Single Loop Operation

e. Figure 2.5 – SE- and SF-Type SVEA-96 reload fuel – Two Loop Operation

f. Figure 2.6 – SE- and SF-Type SVEA-96 reload fuel – Single Loop Operation

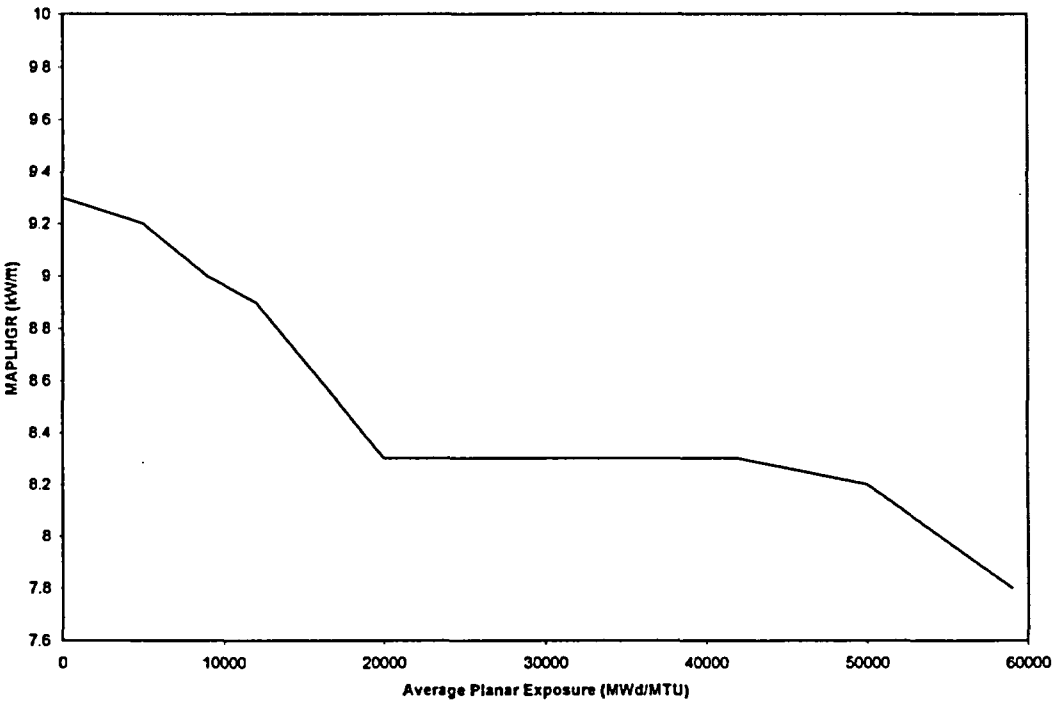
g. Figure 2.7 – ATRIUM-10 reload fuel



Average Planar Exposure (MWd/MTU)	MAPLHGR (kW/ft)
0	9.6
5000	9.5
9000	9.3
12000	9.2
16000	8.9
20000	8.7
30000	8.6
42000	8.6
50000	8.5
59000	8.0

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)
Versus Average Planar Exposure – Two Loop Operation
SA- and SB-Type SVEA-96

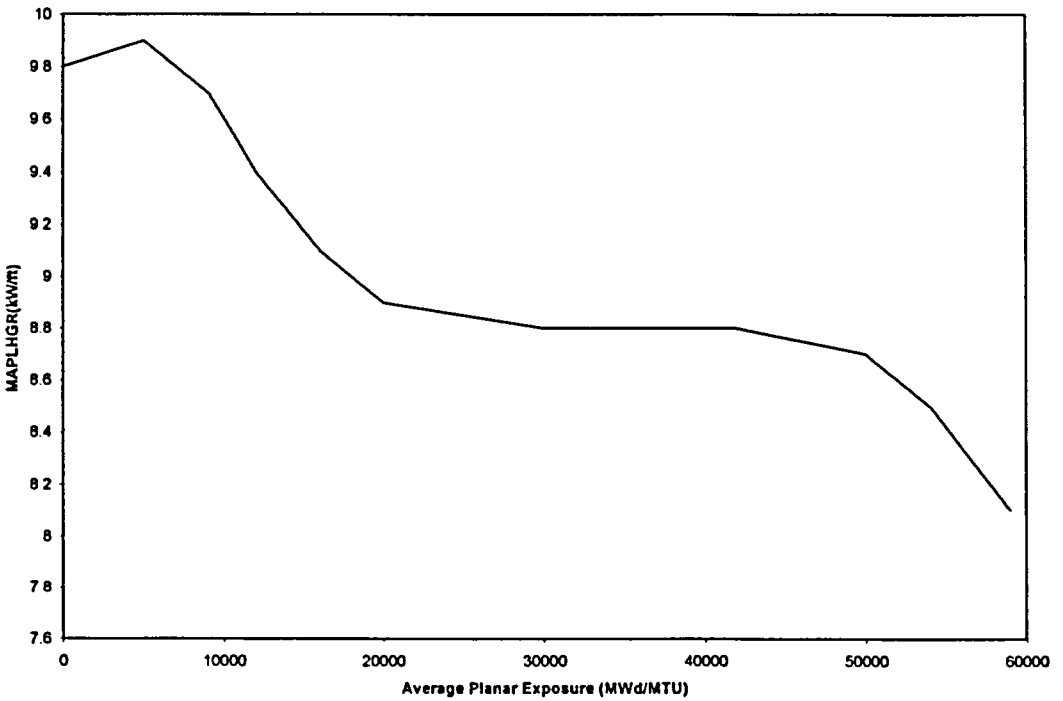
Figure 2.1



Average Planar Exposure (MWd/MTU)	MAPLHGR (kW/ft)
0	9.3
5000	9.2
9000	9.0
12000	8.9
16000	8.6
20000	8.3
30000	8.3
42000	8.3
50000	8.2
59000	7.8

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) Versus Average Planar Exposure – Single Loop Operation SA- and SB-Type SVEA-96

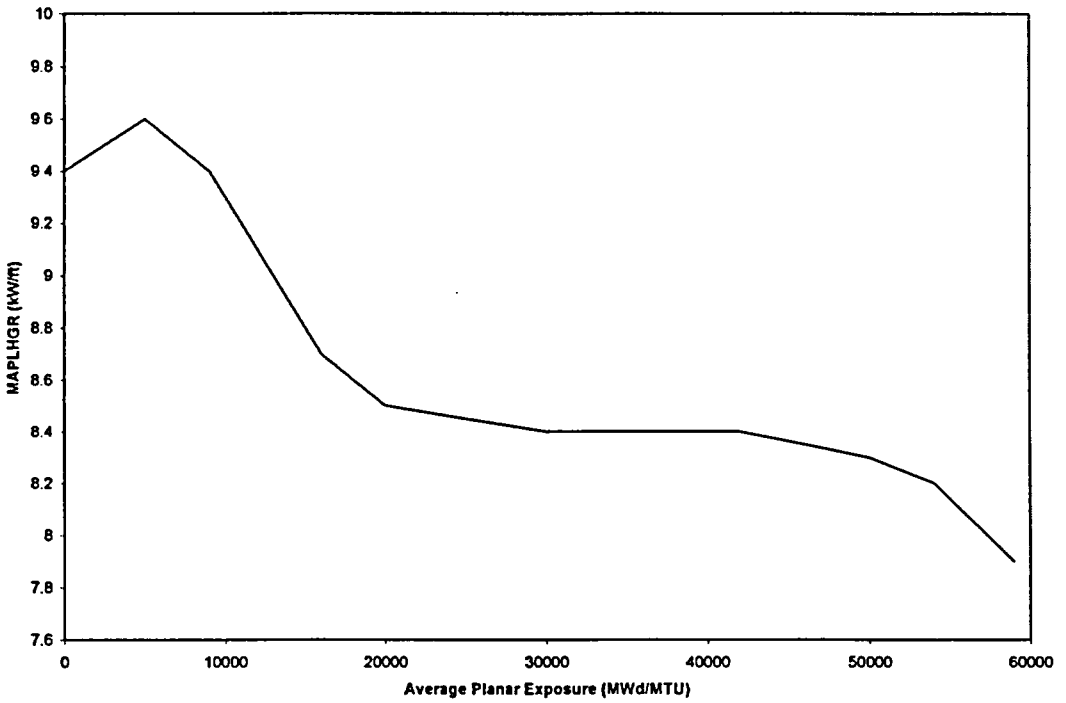
Figure 2.2



Average Planar Exposure (MWd/MTU)	MAPLHGR (kW/ft)
0	9.8
5000	9.9
9000	9.7
10000	9.6
12000	9.4
16000	9.1
20000	8.9
30000	8.8
42000	8.8
50000	8.7
54000	8.5
59000	8.1

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)
Versus Average Planar Exposure – Two Loop Operation
SC- and SD-Type SVEA-96

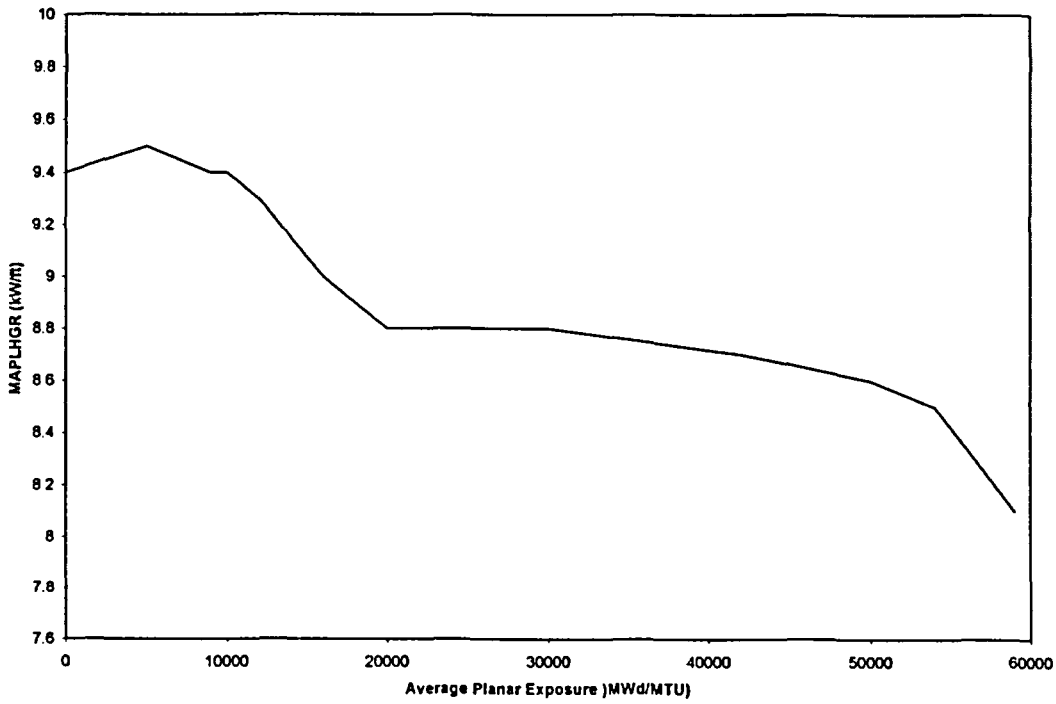
Figure 2.3



Average Planar Exposure (MWd/MTU)	MAPLHGR (kW/ft)
0	9.4
5000	9.6
9000	9.4
10000	9.3
12000	9.1
16000	8.7
20000	8.5
30000	8.4
42000	8.4
50000	8.3
54000	8.2
59000	7.9

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)
Versus Average Planar Exposure – Single Loop Operation
SC- and SD-Type SVEA-96

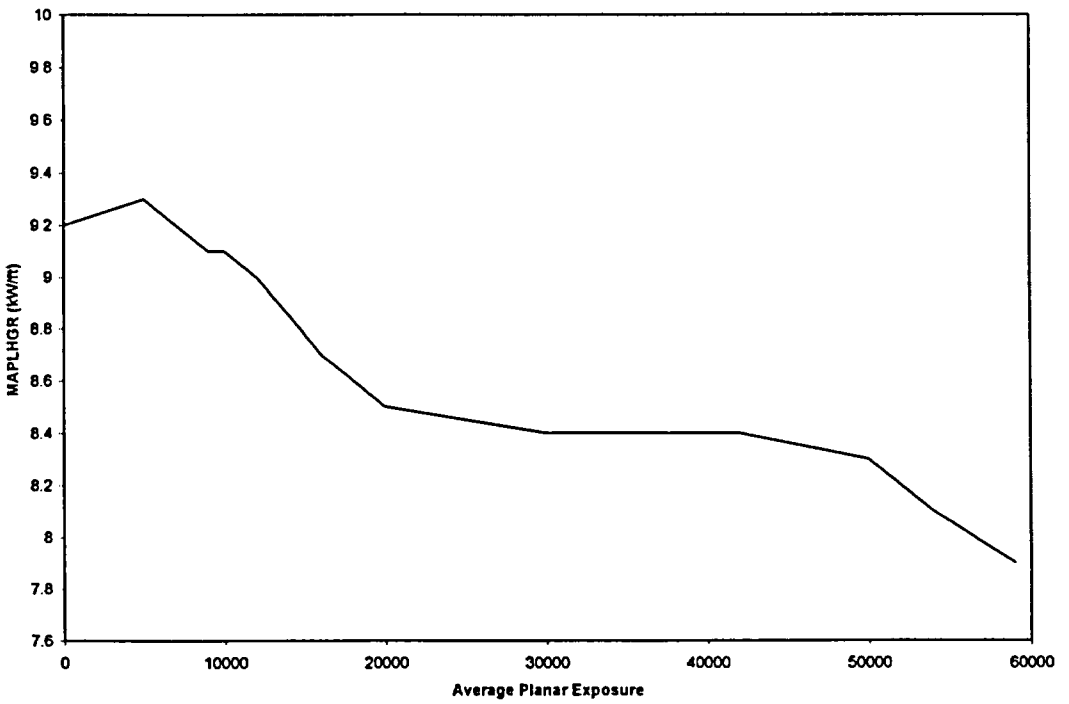
Figure 2.4



Average Planar Exposure (MWd/MTU)	MAPLHGR (kW/ft)
0	9.4
5000	9.5
9000	9.4
10000	9.4
12000	9.3
16000	9.0
20000	8.8
30000	8.8
42000	8.7
50000	8.6
54000	8.5
59000	8.1

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)
Versus Average Planar Exposure – Two Loop Operation
SE- and SF-Type SVEA-96

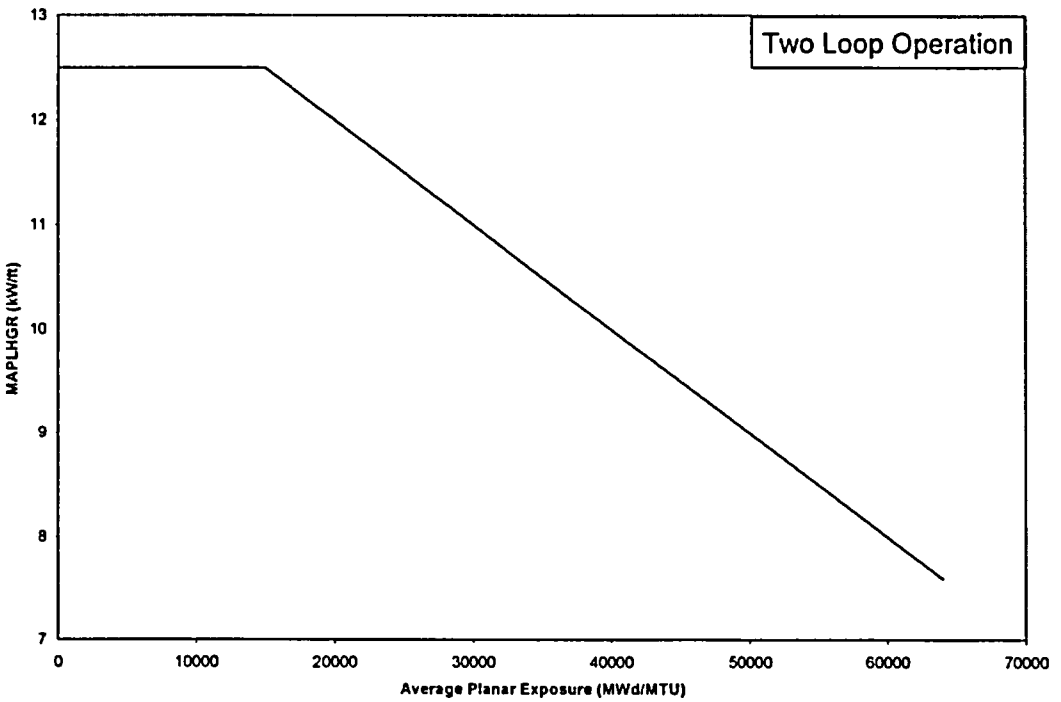
Figure 2.5



Average Planar Exposure (MWd/MTU)	MAPLHGR (kW/ft)
0	9.2
5000	9.3
9000	9.1
10000	9.1
12000	9.0
16000	8.7
20000	8.5
30000	8.4
42000	8.4
50000	8.3
54000	8.1
59000	7.9

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) Versus Average Planar Exposure – Single Loop Operation SE- and SF-Type SVEA-96

Figure 2.6



Average Planar Exposure (MWd/MTU)	TLO MAPLHGR (kW/ft)	SLO MAPLHGR (kW/ft)
0	12.5	11.2
15000	12.5	11.2
64000	7.6	6.8

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)
Versus Average Planar Exposure
ATRIUM-10

Figure 2.7

3.0 Minimum Critical Power Ratio (MCPR) Limit for Use in Technical Specification 3.2.2

The MCPR limit for use in Technical Specification 3.2.2 shall be greater than or equal to the bounding limits determined from Table 3.1a, Table 3.1b, Table 3.2a, Table 3.2b, and Figures 3.1 through 3.33. For the purposes of cycle extension, the feedwater temperature entering the reactor vessel shall not be reduced to less than 355 °F.

The MCPR safety limit for Cycle 17 is 1.09 for two loop operation and 1.10 for single loop operation. The power dependent MCPR limits ($MCPR_p$) for single loop operation (SLO) include a 0.01 adder to the two loop operation (TLO) MCPR limits due to the difference in the MCPR safety limit.

Table 3.1a

Columbia Generating Station MCPR Operating Limits
Two-Loop Operation
Core Average Exposures < 28307 MWd/MTU

EOOS Condition	Limit	SLMCPR = 1.09[2]	
		ATRIUM-10 Fuel	SVEA-96 Fuel
NSS[1]	Full power	1.31[3]	1.28[3]
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.2	Figure 3.3
TSSS[1]	Full power	1.31[3]	1.30
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.10	Figure 3.11
NSS[1] RPT Inoperable	Full power	1.31[3]	1.28[3]
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.26	Figure 3.27

Table 3.1b

Columbia Generating Station MCPR Operating Limits
Two-Loop Operation
Core Average Exposures ≥ 28307 MWd/MTU

EOOS Condition	Limit	SLMCPR = 1.09[2] Core Average Exposures ≤ 32203 MWd/MTU		SLMCPR = 1.09[2] FFTR/Coastdown Extended Core Average Exposures ≤ 35226 MWd/MTU	
		ATRIUM-10 Fuel	SVEA-96 Fuel	ATRIUM-10 Fuel	SVEA-96 Fuel
NSS[1]	Full power	1.38	1.38	1.40	1.38
	Flow dependent[5]	Figure 3.1	Figure 3.1	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.4	Figure 3.5	Figure 3.18	Figure 3.19
TSSS[1]	Full power	1.41	1.41	1.43	1.41
	Flow dependent[5]	Figure 3.1	Figure 3.1	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.12	Figure 3.13	Figure 3.22	Figure 3.23
NSS[1] RPT Inoperable	Full power	1.44	1.44	Not analyzed	
	Flow dependent[5]	Figure 3.1	Figure 3.1		
	Power dependent[4]	Figure 3.28	Figure 3.29		

Table 3.2a

Columbia Generating Station MCPR Operating Limits
Two-Loop Operation
Turbine Bypass System Inoperable
Core Average Exposures < 28307 MWd/MTU

EOOS Condition	Limit	SLMCPR = 1.09[2]	
		ATRIUM-10 Fuel	SVEA-96 Fuel
NSS[1]	Full power	1.31[3]	1.30
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.6	Figure 3.7
TSSS[1]	Full power	1.36	1.35
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.14	Figure 3.15
NSS[1] RPT Inoperable	Full power	1.33	1.33
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.30	Figure 3.31

Table 3.2b

Columbia Generating Station MCPR Operating Limits
Two-Loop Operation
Turbine Bypass System Inoperable
Core Average Exposures ≥ 28307 MWd/MTU

EOOS Condition	Limit	SLMCPR = 1.09[2] Core Average Exposures ≤ 32203 MWd/MTU		SLMCPR = 1.09[2] FFTR/Coastdown Extended Core Average Exposures ≤ 35226 MWd/MTU	
		ATRIUM-10 Fuel	SVEA-96 Fuel	ATRIUM-10 Fuel	SVEA-96 Fuel
NSS[1]	Full power	1.42	1.41	1.44	1.41
	Flow dependent[5]	Figure 3.1	Figure 3.1	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.8	Figure 3.9	Figure 3.20	Figure 3.21
TSSS[1]	Full power	1.45	1.44	1.46	1.44
	Flow dependent[5]	Figure 3.1	Figure 3.1	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.16	Figure 3.17	Figure 3.24	Figure 3.25
NSS[1] RPT Inoperable	Full power	1.48	1.48	Not analyzed	
	Flow dependent[5]	Figure 3.1	Figure 3.1		
	Power dependent[4]	Figure 3.32	Figure 3.33		

Notes for Tables 3.1a, 3.1b, 3.2a, and 3.2b

Note 1: The scram insertion times must meet the requirements of Technical Specification 3.1.4. The NSS MCPR values are based on Framatome ANP (FANP) transient analyses performed using control rod insertion times consistent with the following table. If Technical Specification 3.1.4 is met with the NSS insertion times shown below, the NSS MCPR limits in Tables 3.1a, 3.1b, 3.2a, and 3.2b are applicable. If the NSS insertion times are exceeded, then the MCPR limits shall be determined using the appropriate TSSS limits. The NSS and TSSS MCPR limits are based on analyses that account for up to 8 declared "slow" rods, 1 stuck rod, and 1 rod assumed to fail to scram.

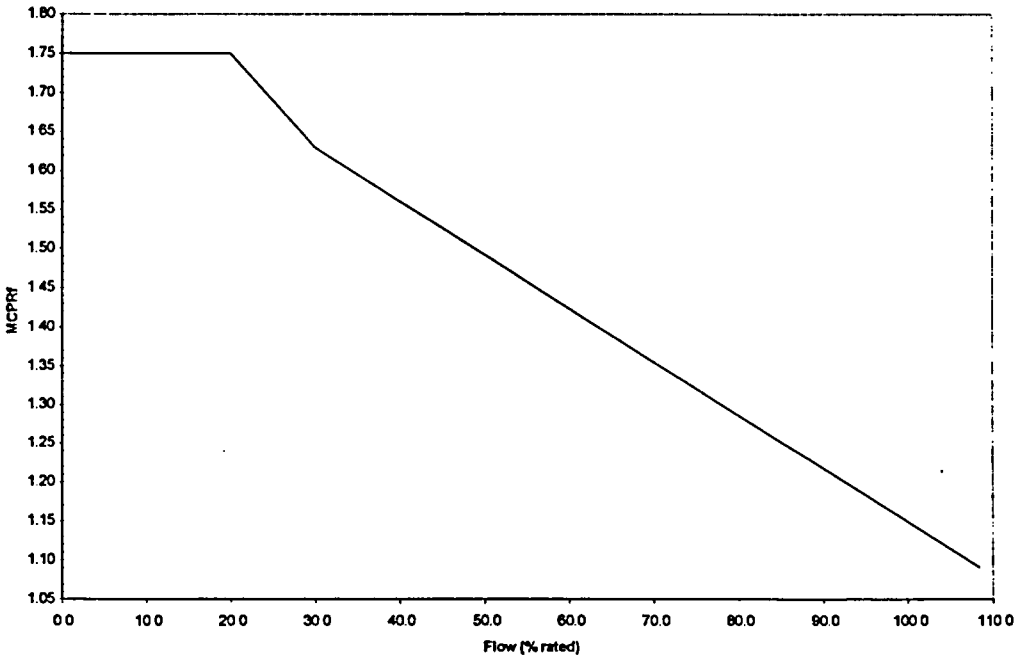
Control Rod Position (notch)	NSS Time (sec)
45	0.43
39	0.72
25	1.60
5	2.95

Note 2: For Single Loop Operation (SLO), the SLMCPR increases by 0.01. This 0.01 increase must also be applied to the Two Loop Operation $MCPR_p$ Operating Limit to obtain the SLO operating limit.

Note 3: For the noted full power MCPR limits, the Rod Withdrawal Error (RWE) event is limiting. The RWE analysis was performed with a nominal Rod Block Monitor (RBM) setpoint of 1.06.

Note 4: Power dependent MCPR limits are provided for core thermal powers greater than or equal to 25% of rated power at all core flows. The power dependent MCPR limits for core thermal powers less than or equal to 30% of rated power are subdivided by core flow. Limits are provided for core flows greater than 50% of rated flow and less than or equal to 50% of rated flow. A step change in the power dependent MCPR limits occurs at 30% of rated power because direct scram on turbine throttle valve closure is automatically bypassed below 30% of rated power and not applicable per Technical Specification 3.3.1.1.

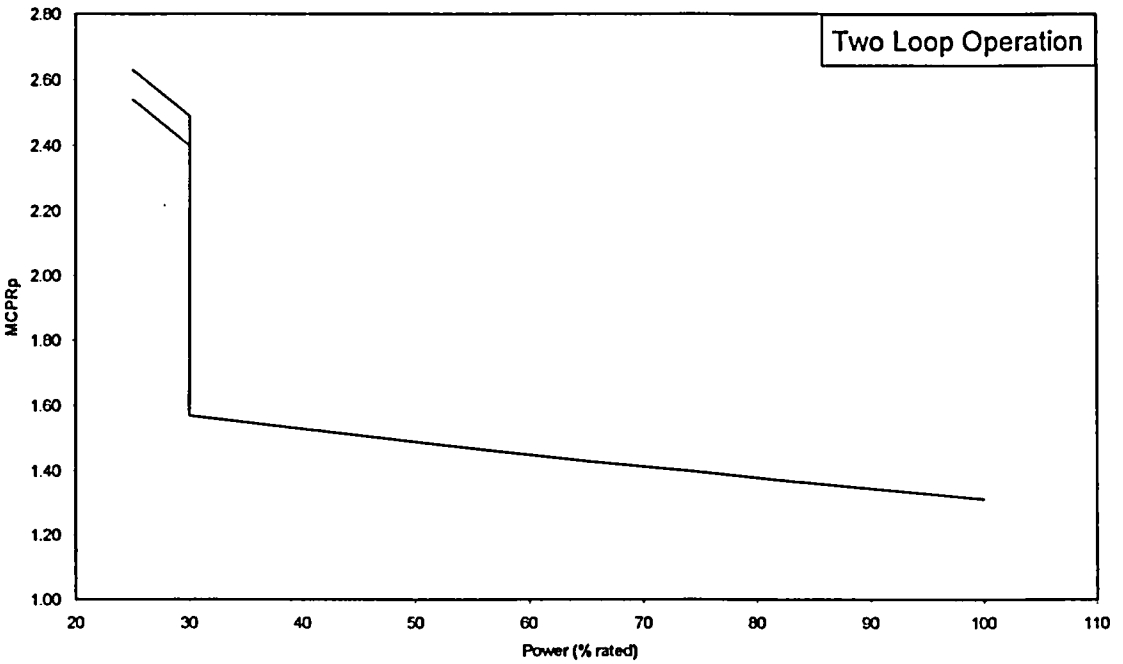
Note 5: Flow dependent MCPR limits are applicable to both TLO and SLO.



Flow (% of rated)	$MCPR_f$ ATRIUM-10	$MCPR_f$ SVEA-96
0	1.75	1.75
20	1.75	1.75
30	1.63	1.63
108.5	1.09	1.09

Reduced Flow MCPR Operating Limit Versus Total Core Flow
ATRIUM-10 and SVEA-96

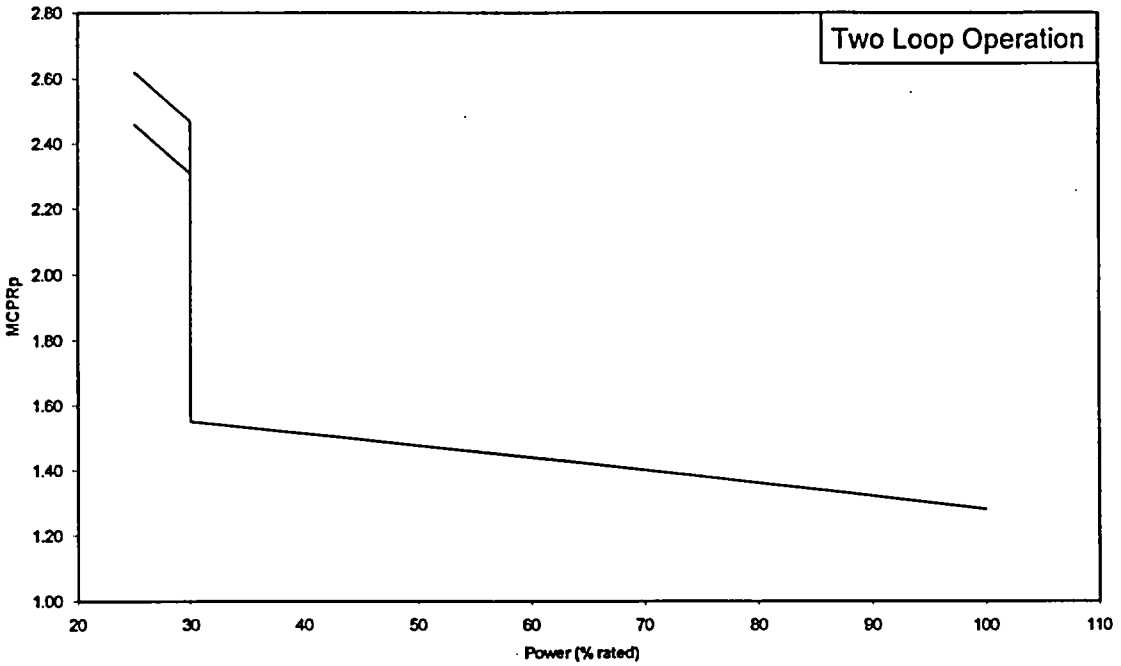
Figure 3.1



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.31	1.32
65	1.43	1.44
30	1.57	1.58
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, ATRIUM-10
Core Average Exposures < 28307 MWd/MTU

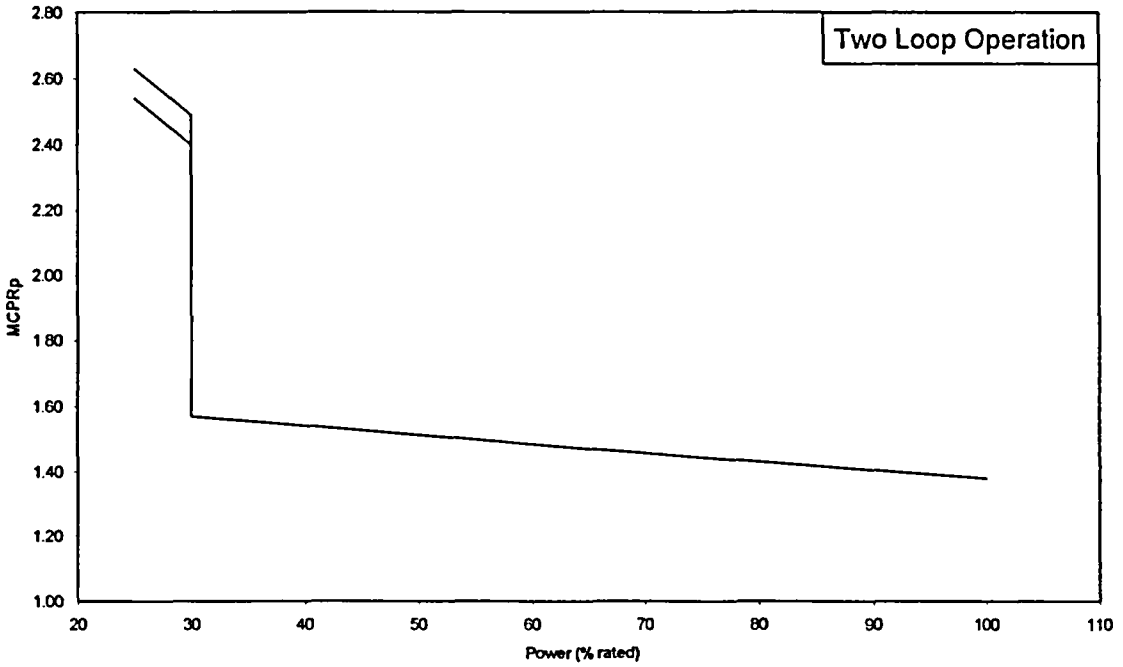
Figure 3.2



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.28	1.29
65	1.42	1.43
30	1.55	1.56
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, SVEA-96
Core Average Exposures < 28307 MWd/MTU

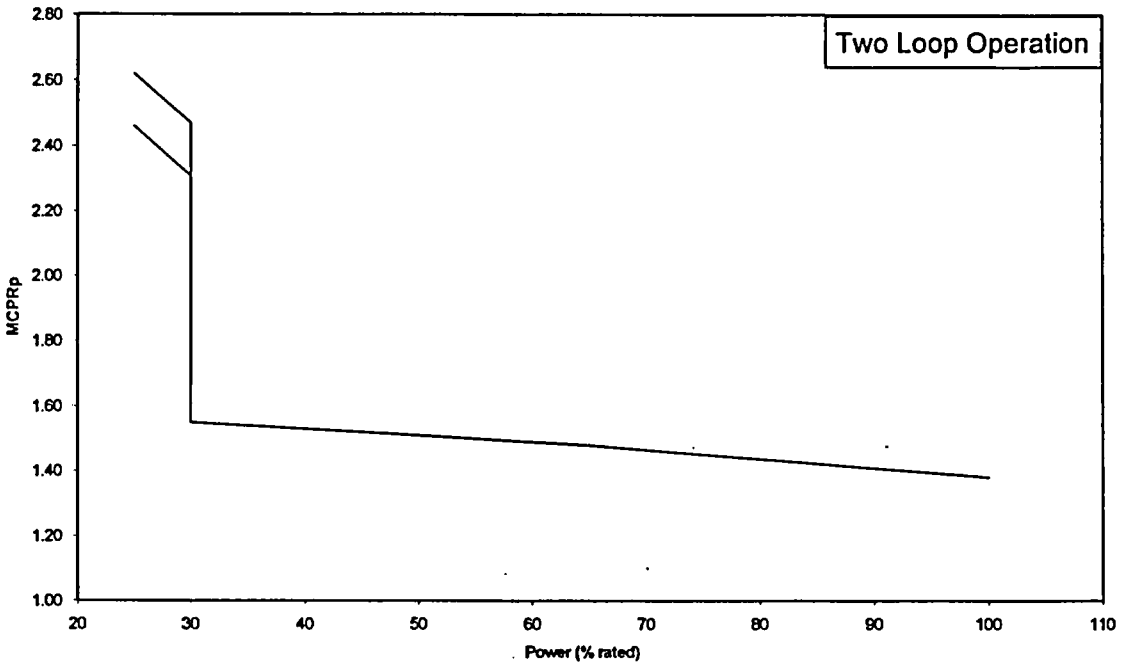
Figure 3.3



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.38	1.39
65	1.47	1.48
30	1.57	1.58
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, ATRIUM-10
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

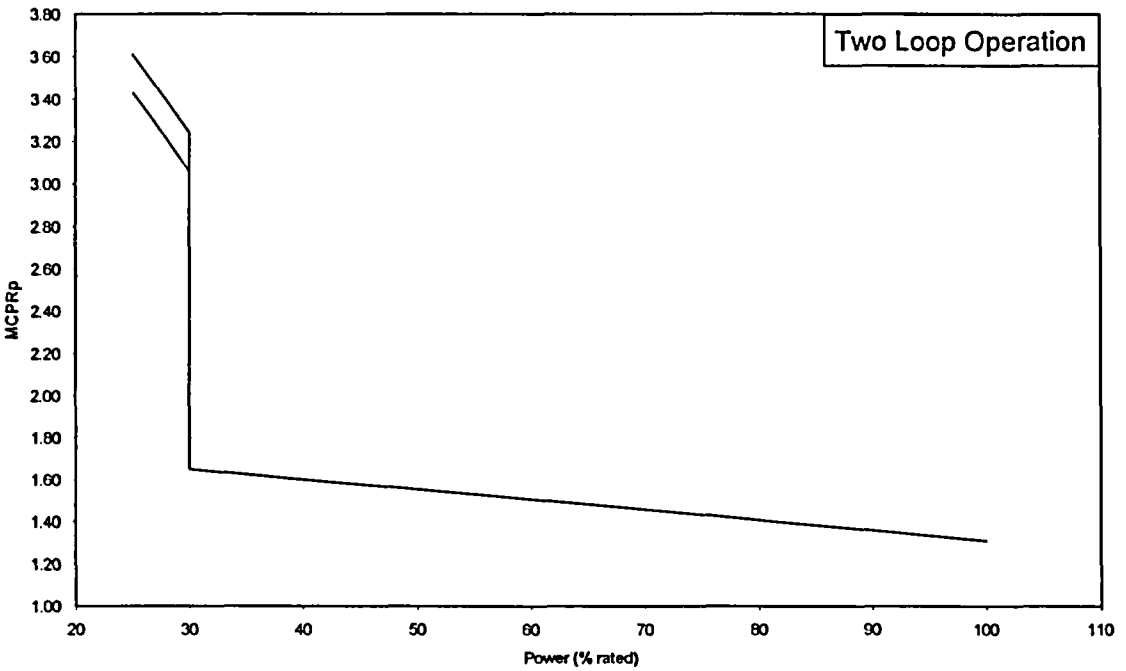
Figure 3.4



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.38	1.39
65	1.48	1.49
30	1.55	1.56
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, SVEA-96
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

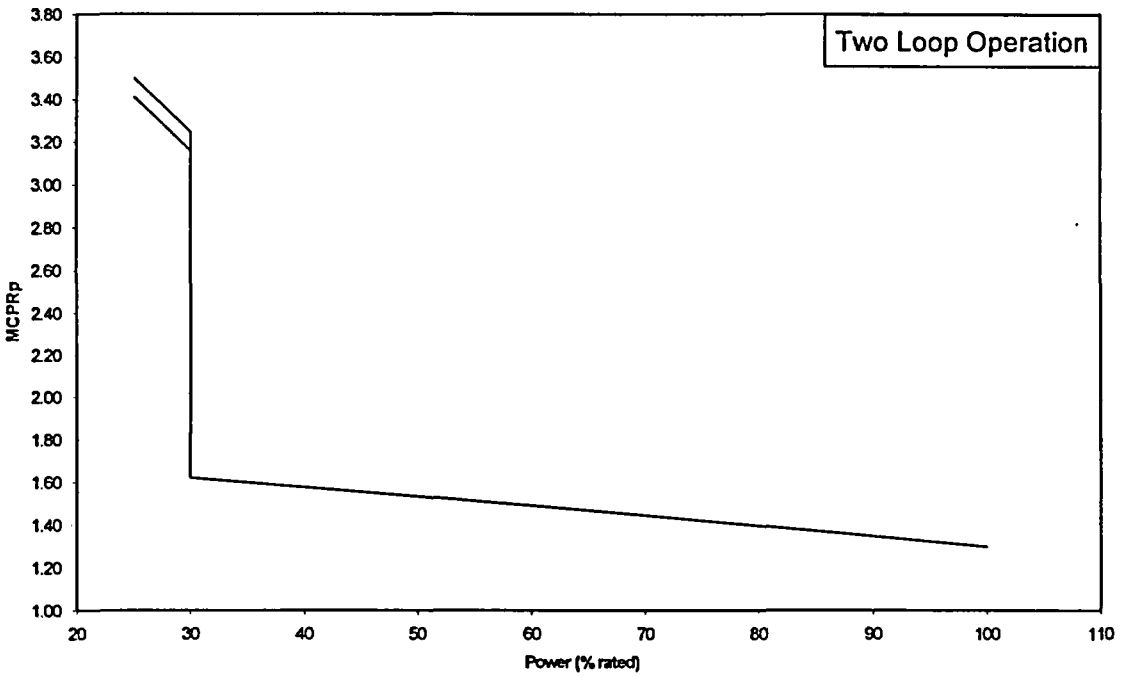
Figure 3.5



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.31	1.32
65	1.48	1.49
30	1.65	1.66
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, ATRIUM-10
Core Average Exposures < 28307 MWd/MTU

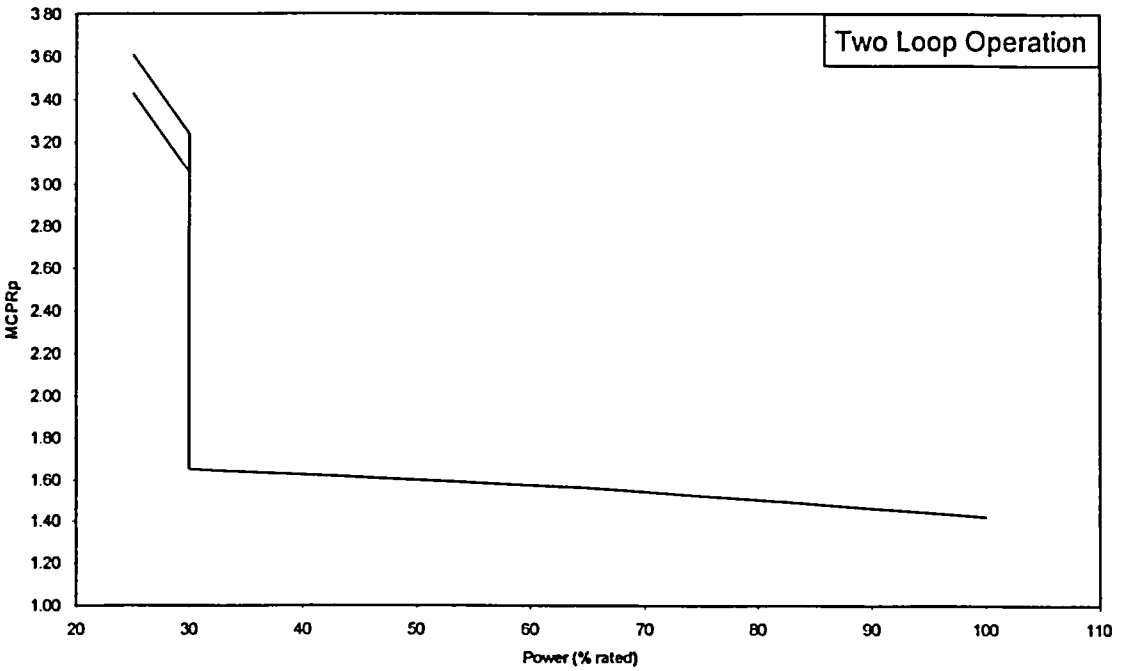
Figure 3.6



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.30	1.31
65	1.47	1.48
30	1.62	1.63
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, SVEA-96
Core Average Exposures < 28307 MWd/MTU

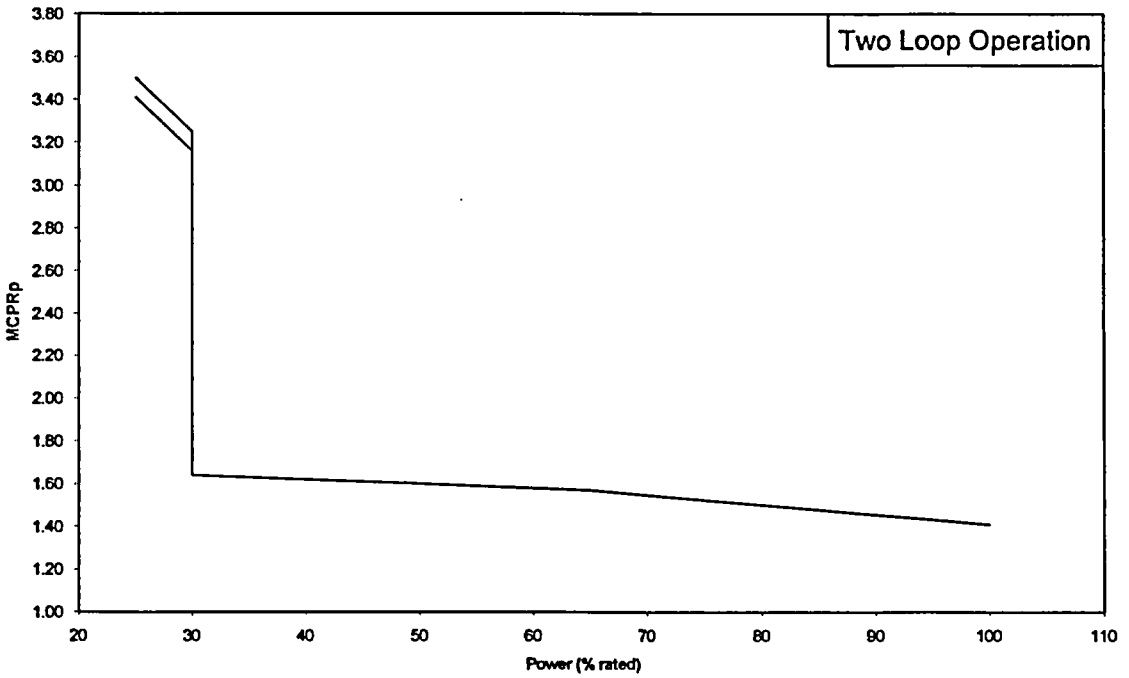
Figure 3.7



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.42	1.43
65	1.56	1.57
30	1.65	1.66
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, ATRIUM-10
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

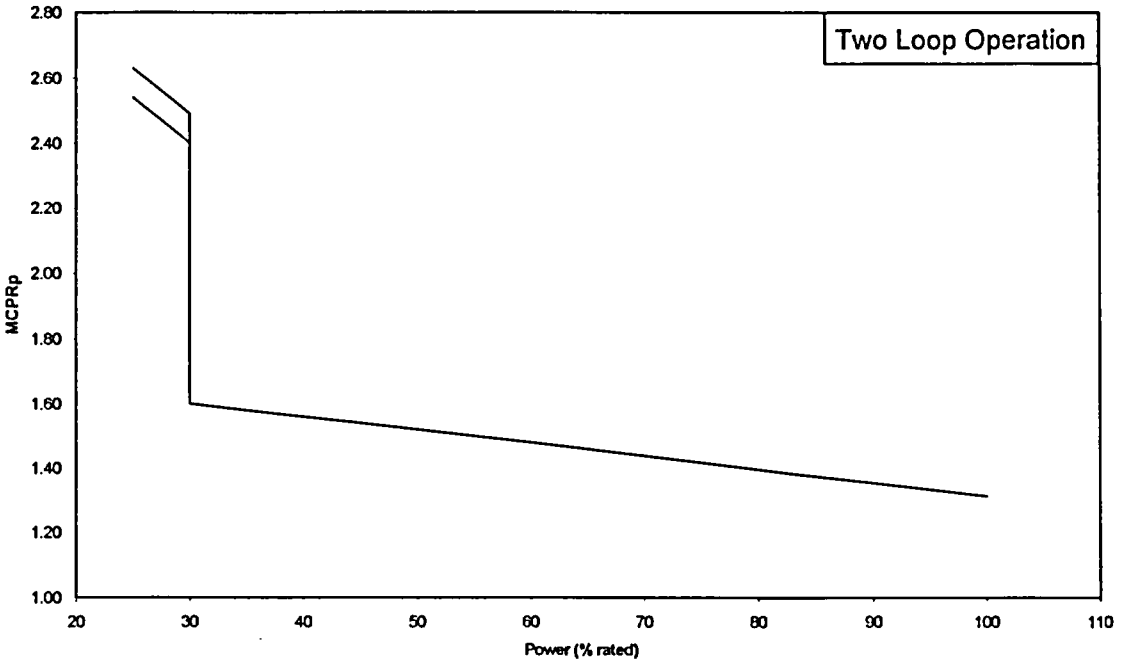
Figure 3.8



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.41	1.42
65	1.57	1.58
30	1.64	1.65
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, SVEA-96
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

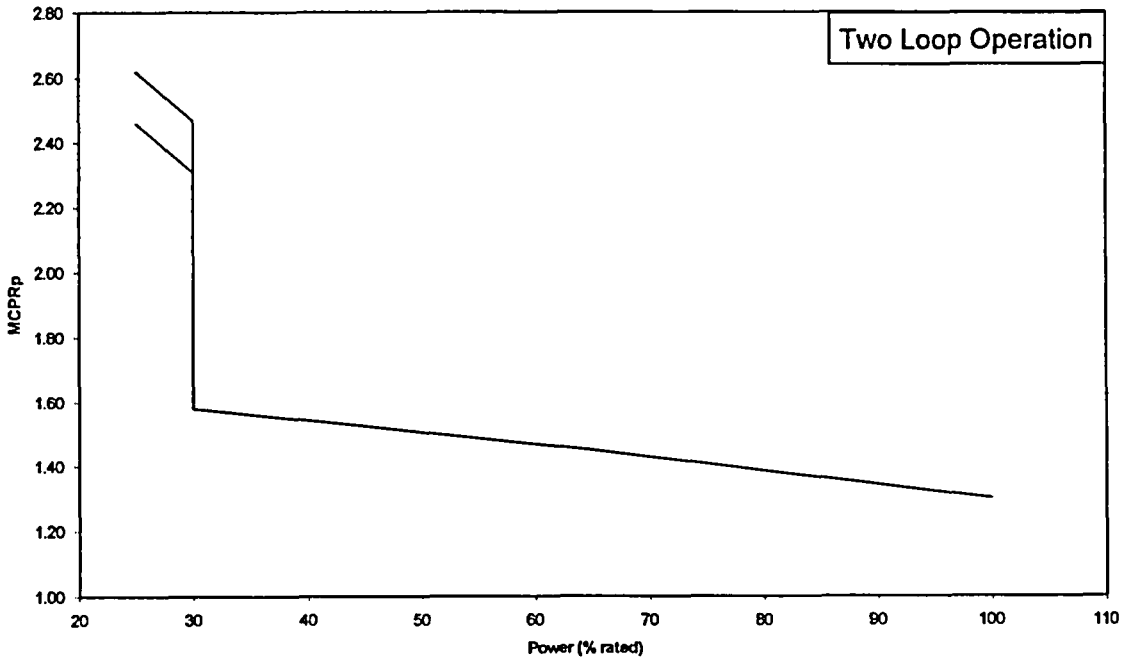
Figure 3.9



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.31	1.32
65	1.46	1.47
30	1.60	1.61
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, ATRIUM-10
Core Average Exposures < 28307 MWd/MTU

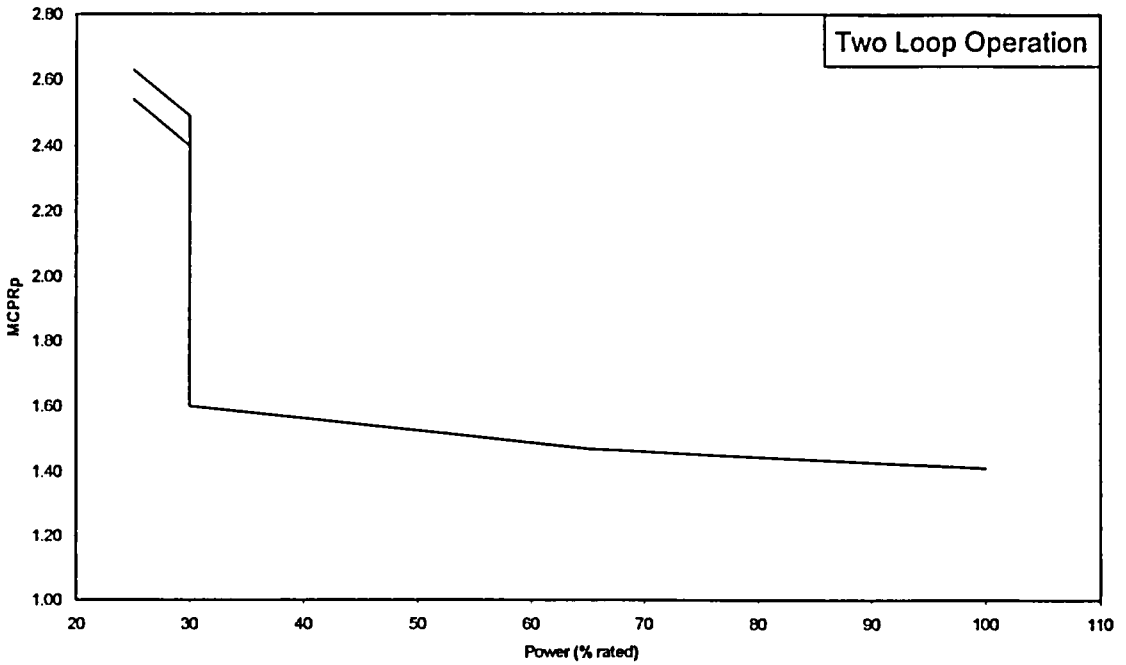
Figure 3.10



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.30	1.31
65	1.45	1.46
30	1.58	1.59
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, SVEA-96
Core Average Exposures < 28307 MWd/MTU

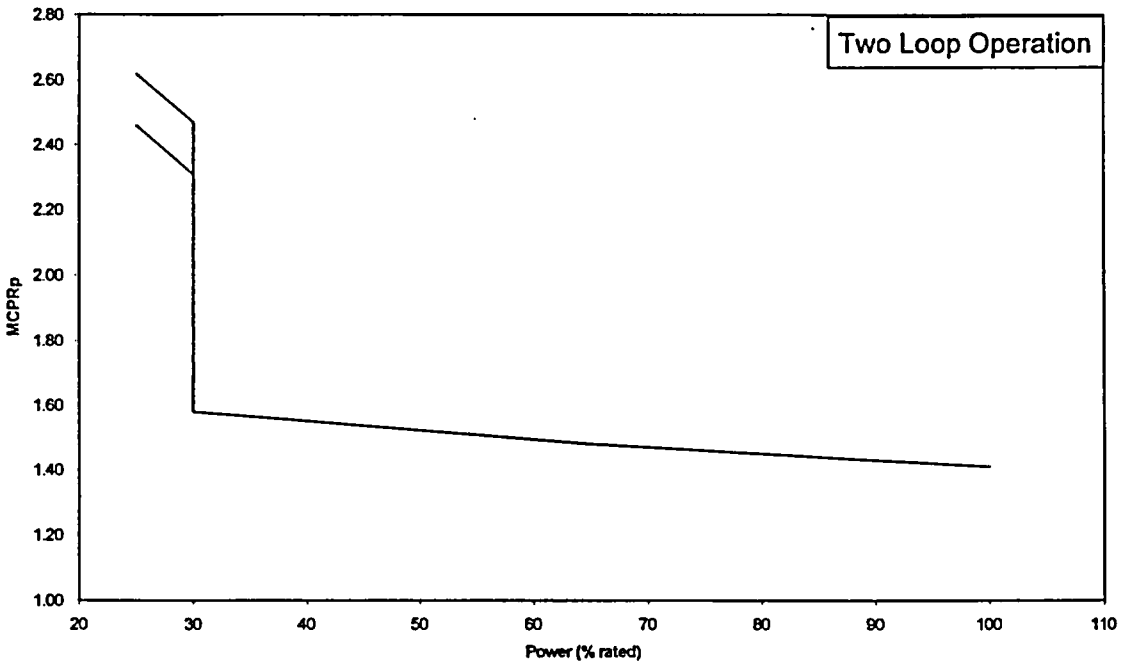
Figure 3.11



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.41	1.42
65	1.47	1.48
30	1.60	1.61
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, ATRIUM-10
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

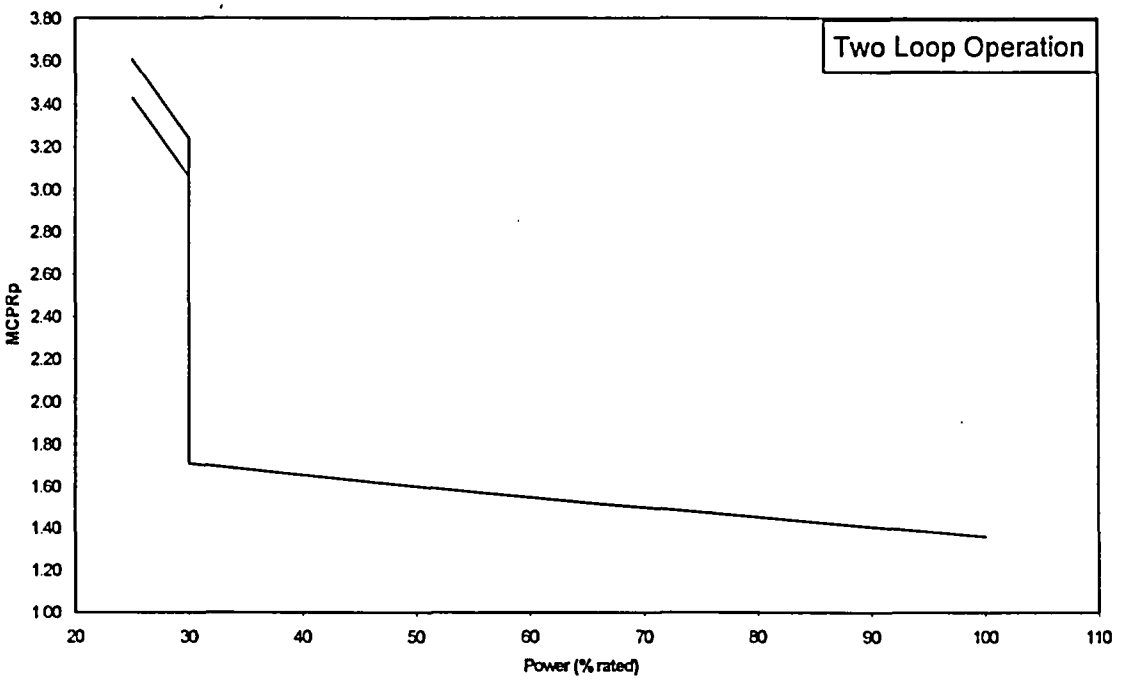
Figure 3.12



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.41	1.42
65	1.48	1.49
30	1.58	1.59
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, SVEA-96
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

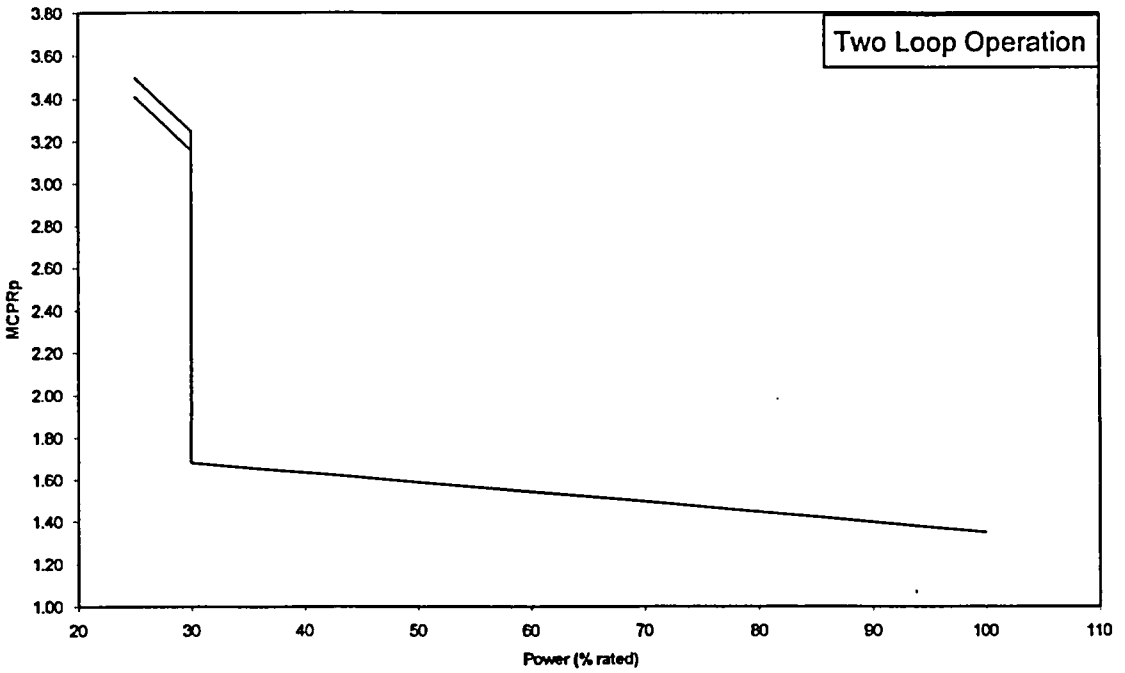
Figure 3.13



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.36	1.37
65	1.52	1.53
30	1.71	1.72
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, Turbine Bypass Inoperable, ATRIUM-10
Core Average Exposures < 28307 MWd/MTU

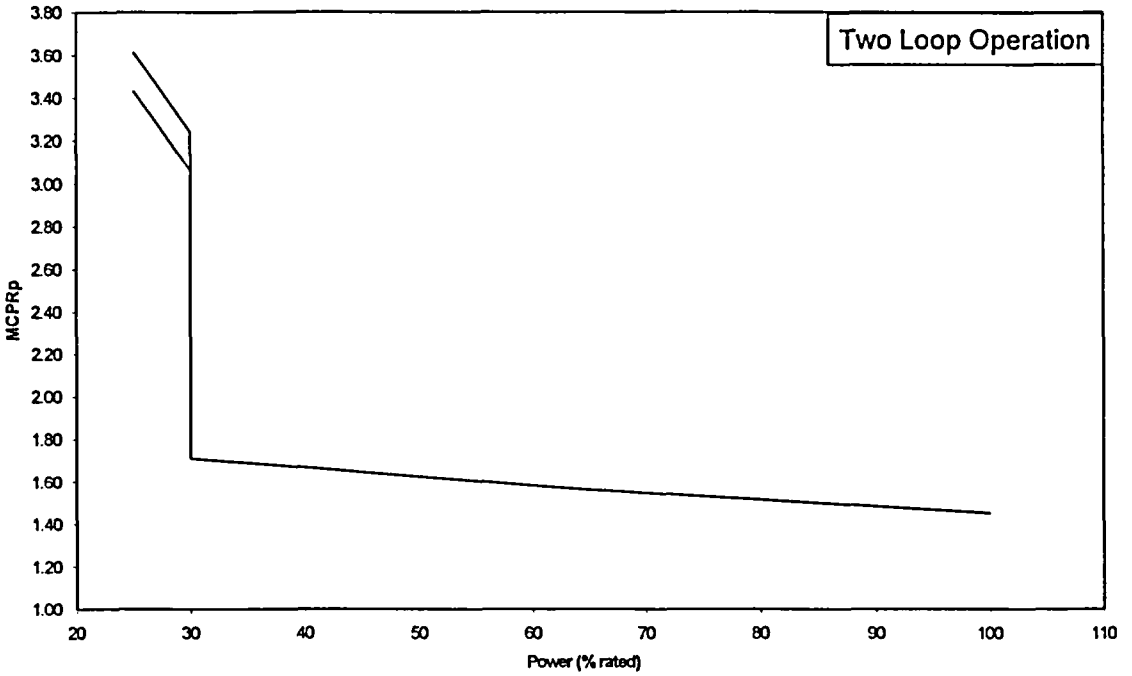
Figure 3.14



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.35	1.36
65	1.52	1.53
30	1.68	1.69
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, Turbine Bypass Inoperable, SVEA-96
Core Average Exposures < 28307 MWd/MTU

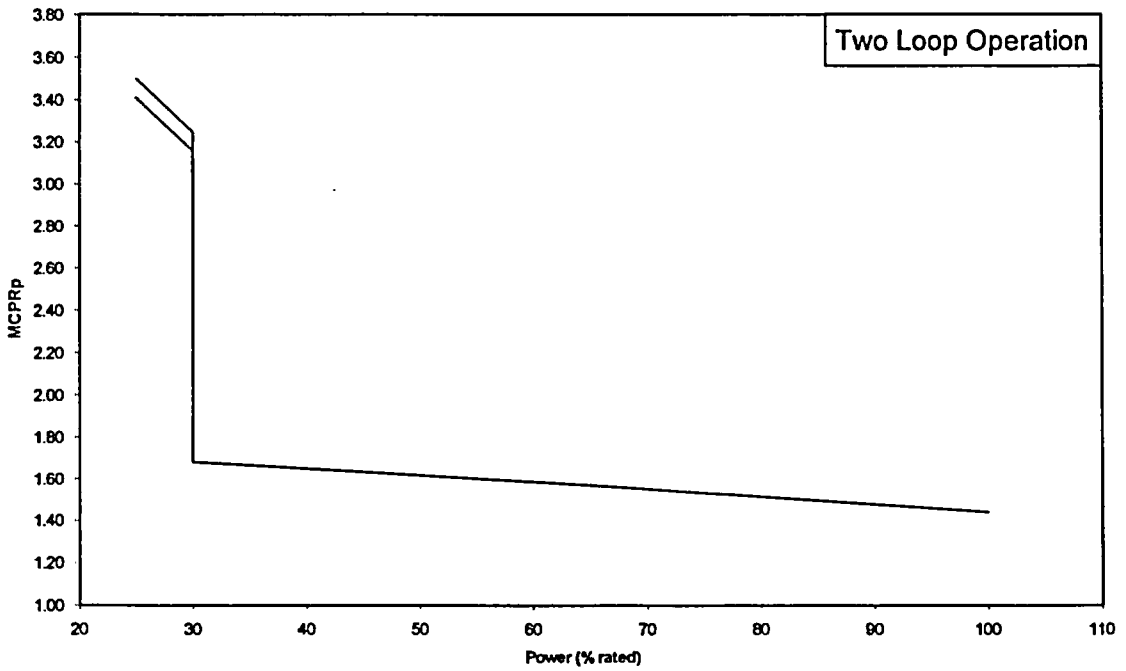
Figure 3.15



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.45	1.46
65	1.56	1.57
30	1.71	1.72
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, Turbine Bypass Inoperable, ATRIUM-10
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

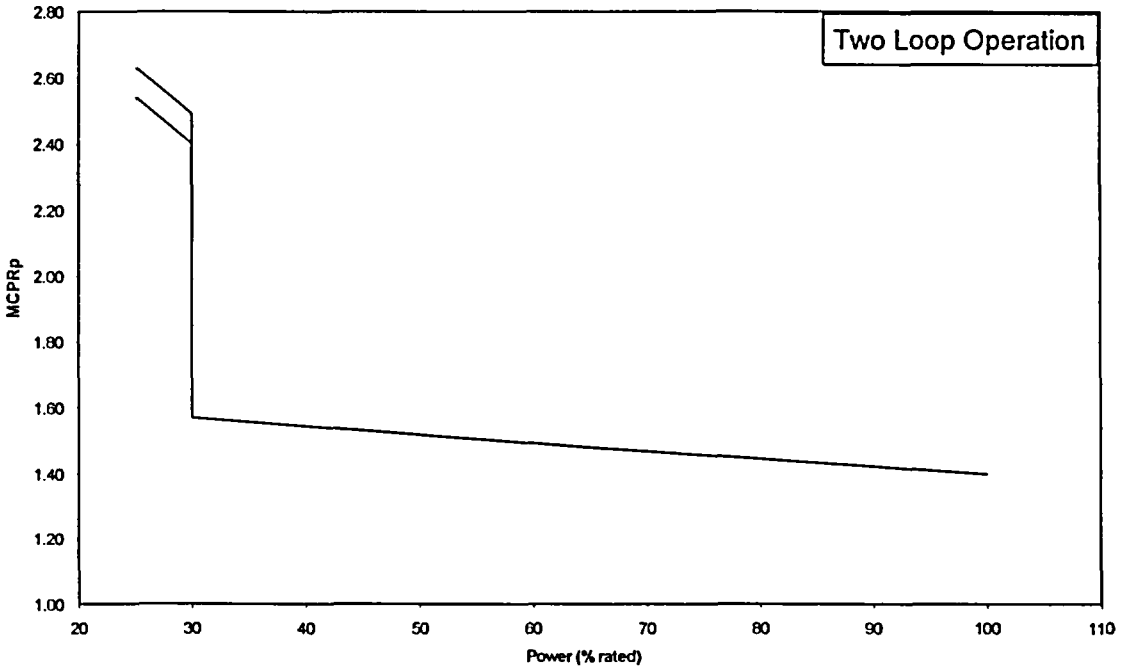
Figure 3.16



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.44	1.45
65	1.57	1.58
30	1.68	1.69
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, Turbine Bypass Inoperable, SVEA-96
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

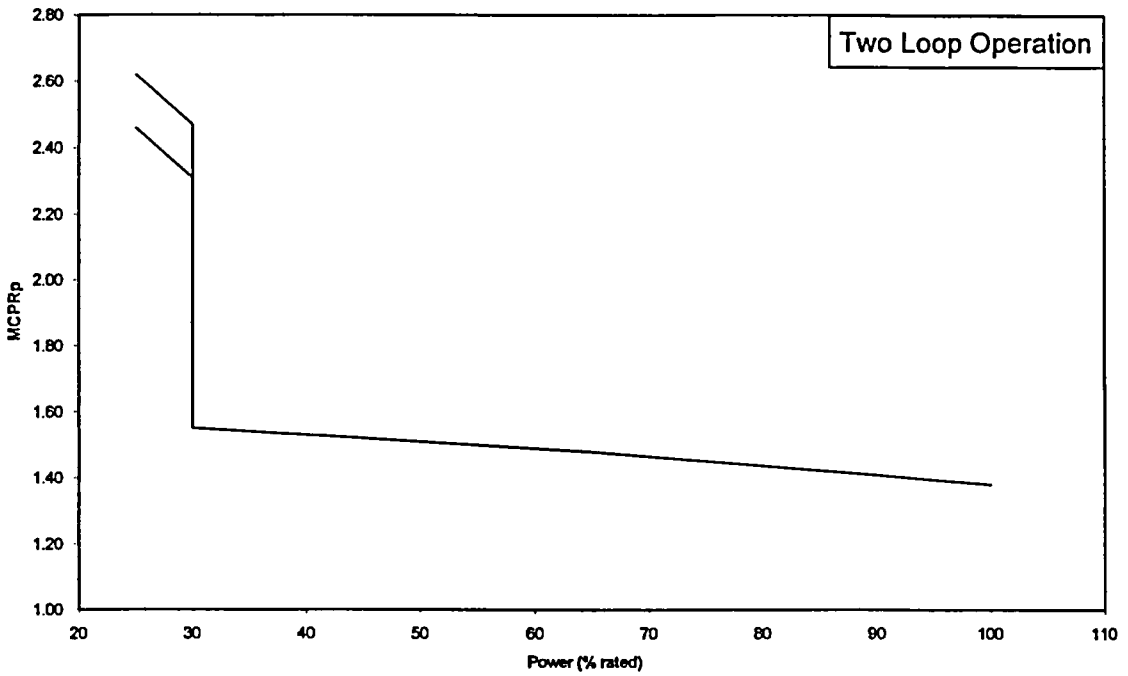
Figure 3.17



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.40	1.41
65	1.48	1.49
30	1.57	1.58
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, ATRIUM-10
FFTR/Coastdown Operation

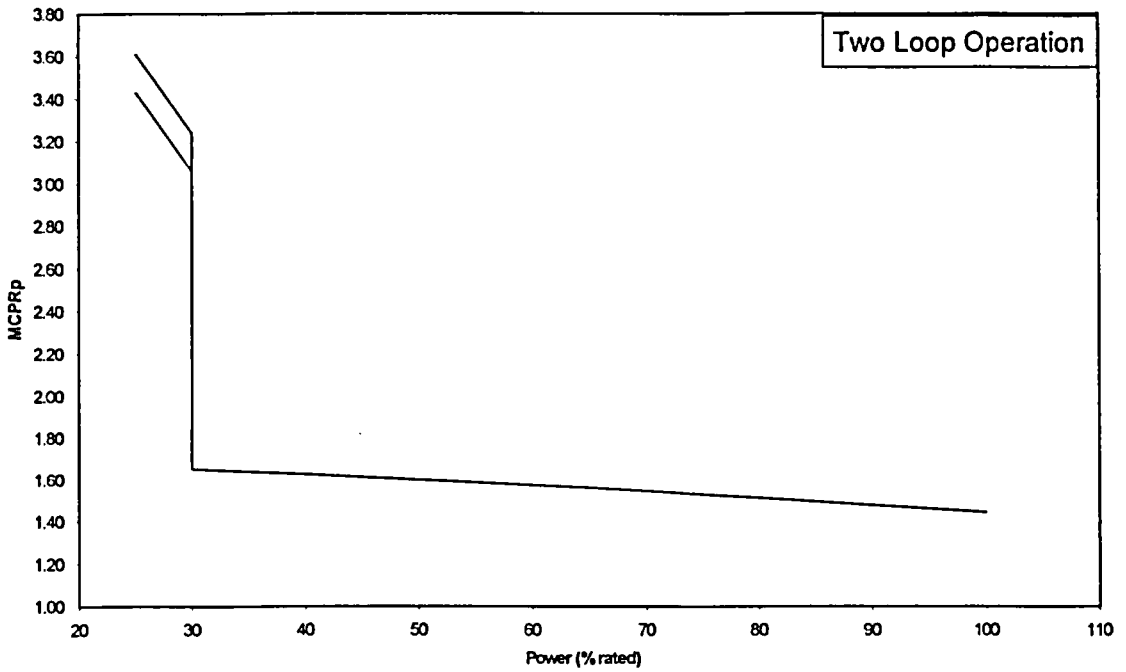
Figure 3.18



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.38	1.39
65	1.48	1.49
30	1.55	1.56
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, SVEA-96
FFTR/Coastdown Operation

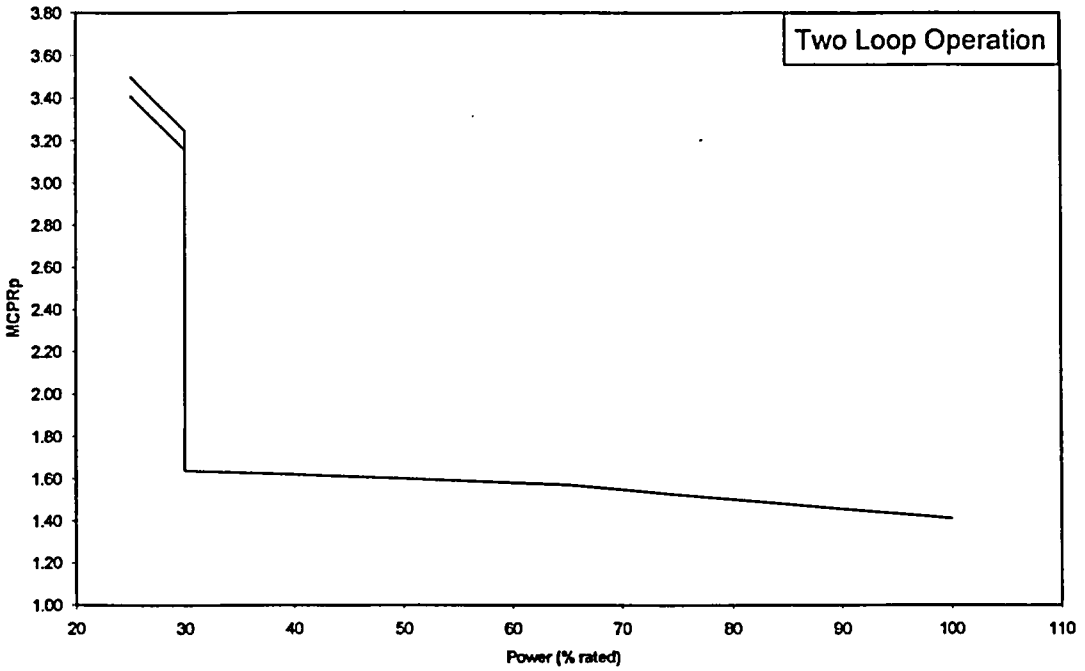
Figure 3.19



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.44	1.45
65	1.56	1.57
30	1.65	1.66
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, ATRIUM-10
FFTR/Coastdown Operation

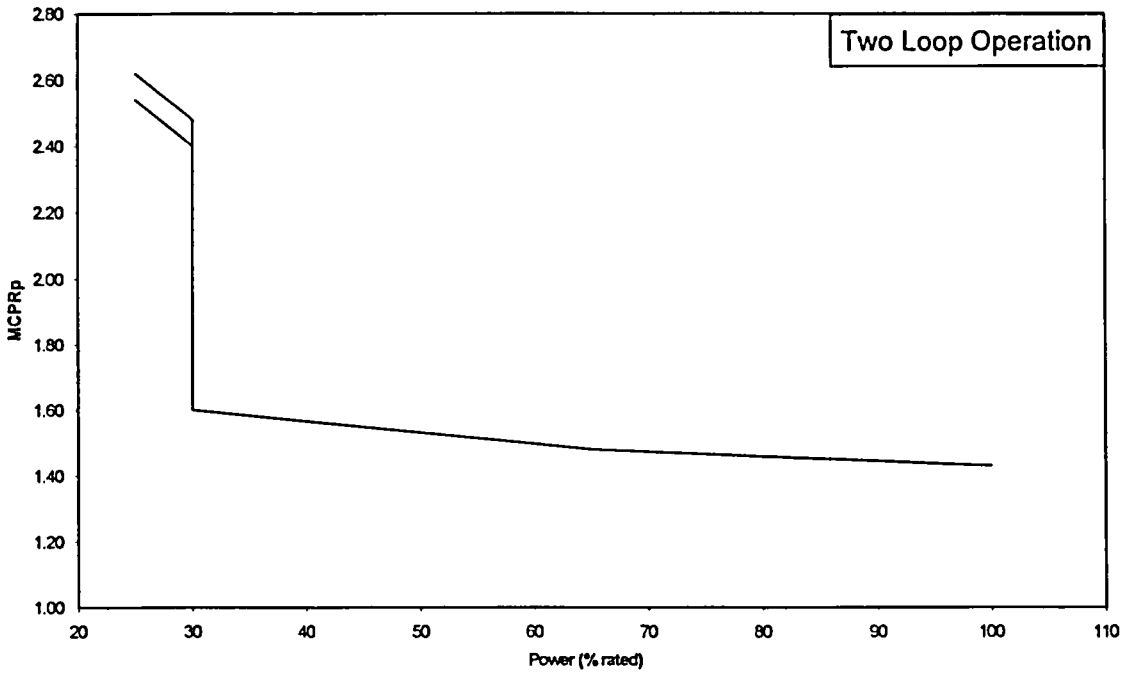
Figure 3.20



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.41	1.42
65	1.57	1.58
30	1.64	1.65
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, SVEA-96
FFTR/Coastdown Operation

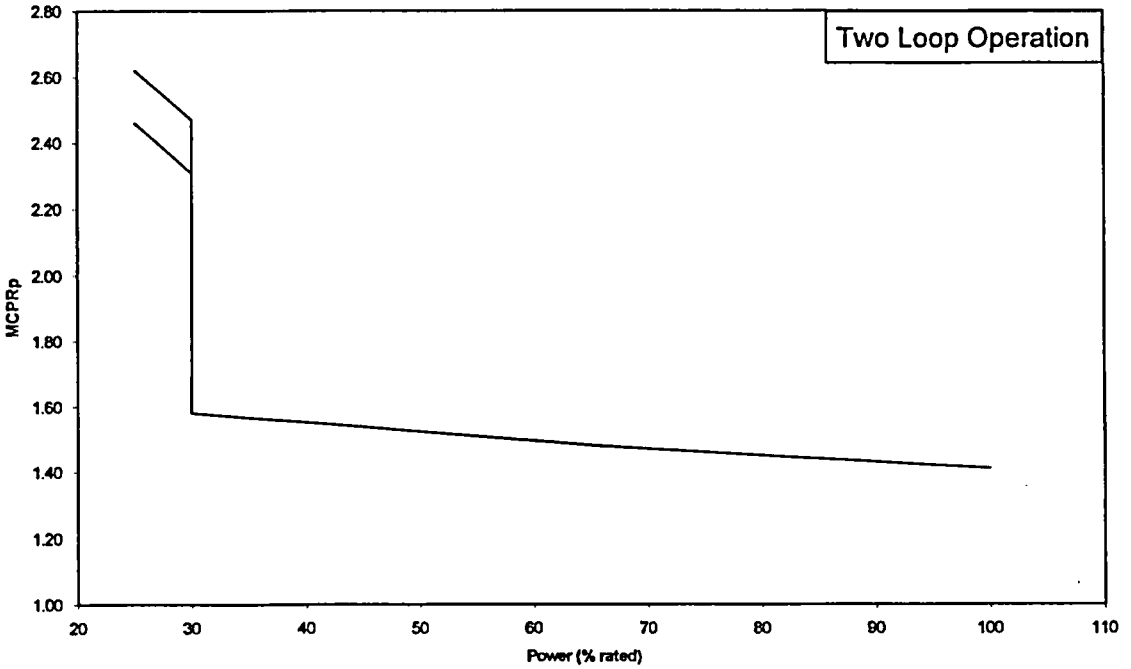
Figure 3.21



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.43	1.44
65	1.48	1.49
30	1.60	1.61
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, ATRIUM-10
FFTR/Coastdown Operation

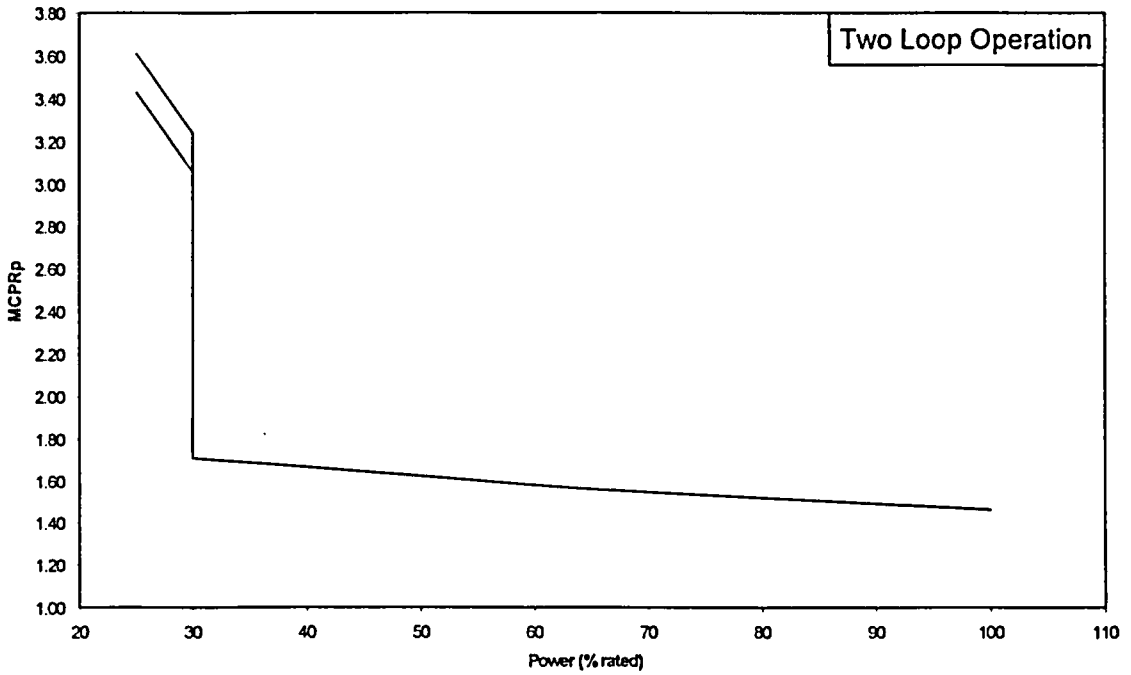
Figure 3.22



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.41	1.42
65	1.48	1.49
30	1.58	1.59
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, SVEA-96
FFTR/Coastdown Operation

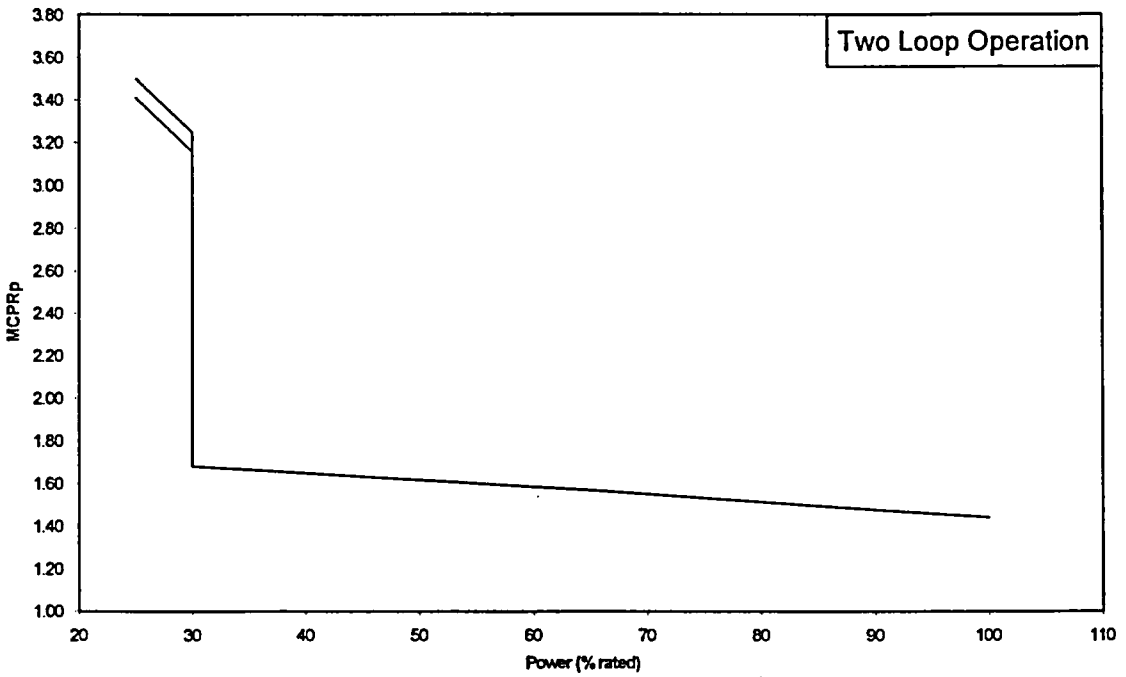
Figure 3.23



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.46	1.47
65	1.56	1.57
30	1.71	1.72
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power TSSS, Turbine Bypass Inoperable, ATRIUM-10 FFTR/Coastdown Operation

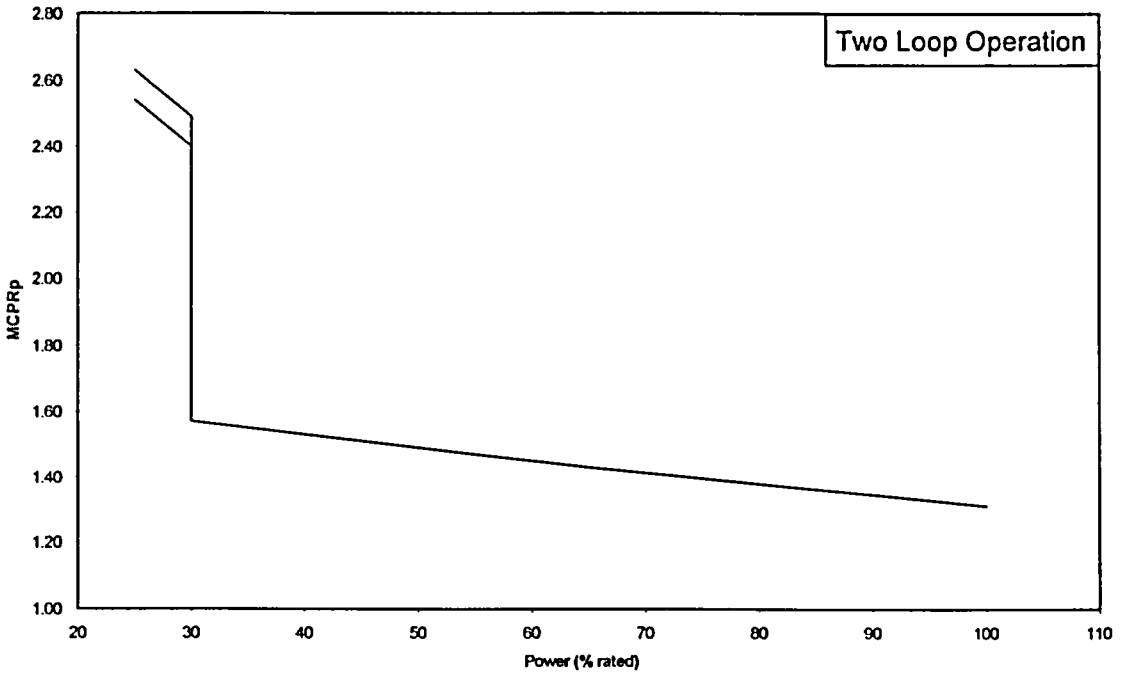
Figure 3.24



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.44	1.45
65	1.57	1.58
30	1.68	1.69
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, Turbine Bypass Inoperable, SVEA-96
FFTR/Coastdown Operation

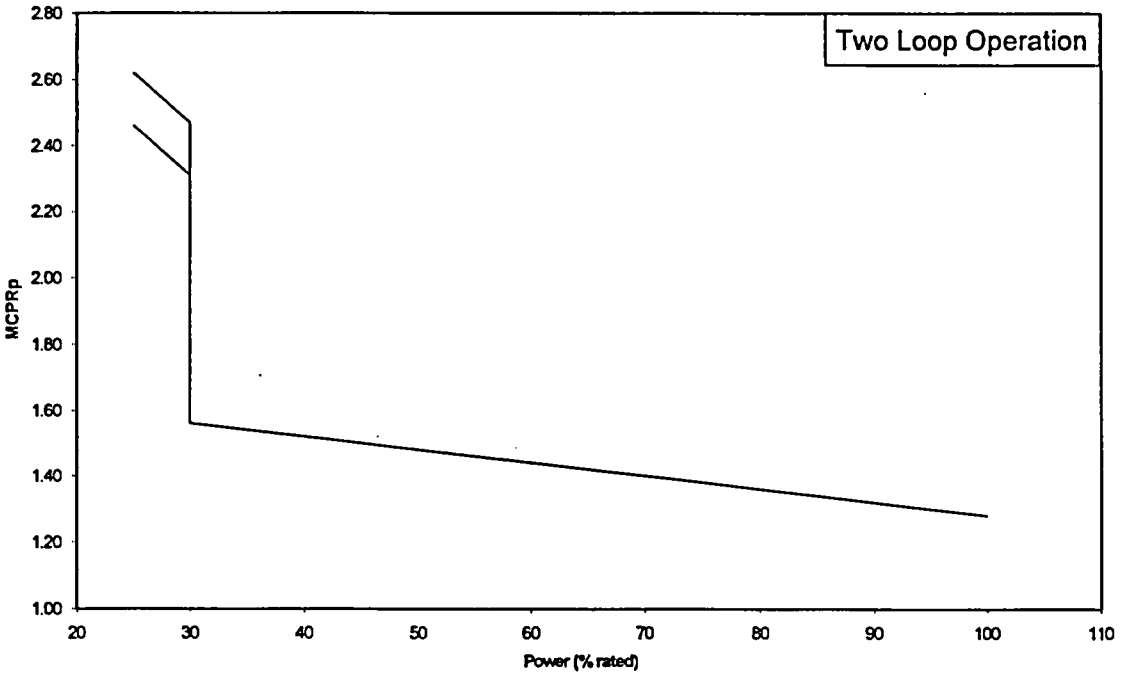
Figure 3.25



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.31	1.32
65	1.43	1.44
30	1.57	1.58
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, ATRIUM-10
Core Average Exposures < 28307 MWd/MTU

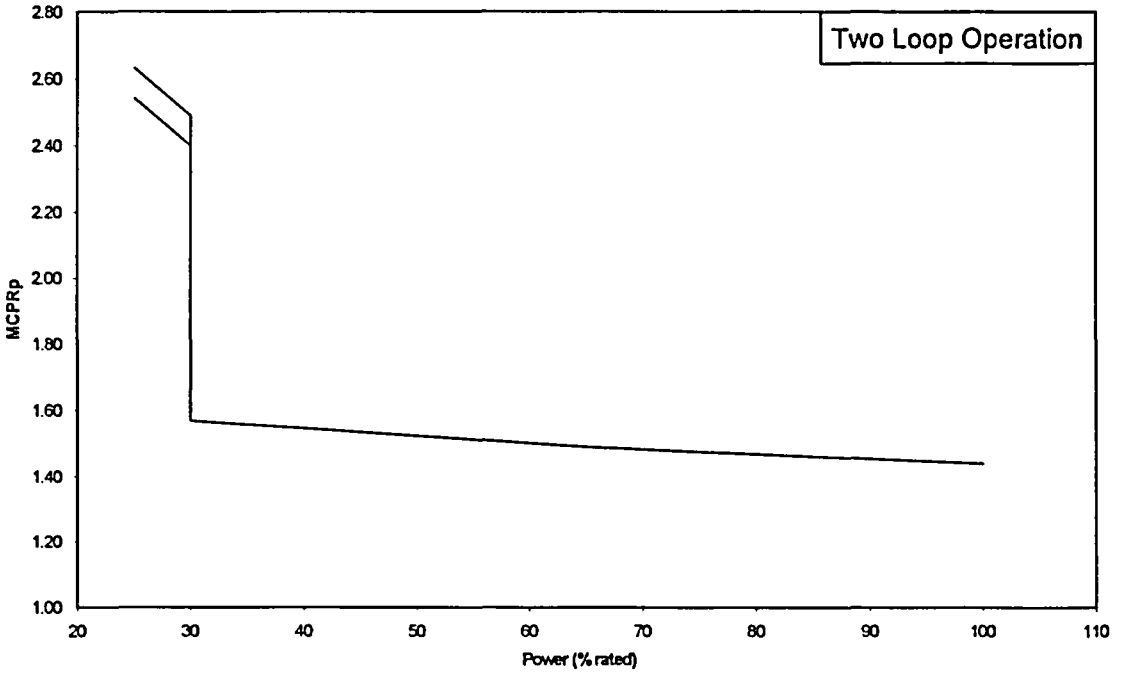
Figure 3.26



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.28	1.29
65	1.42	1.43
30	1.56	1.57
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, SVEA-96
Core Average Exposures < 28307 MWd/MTU

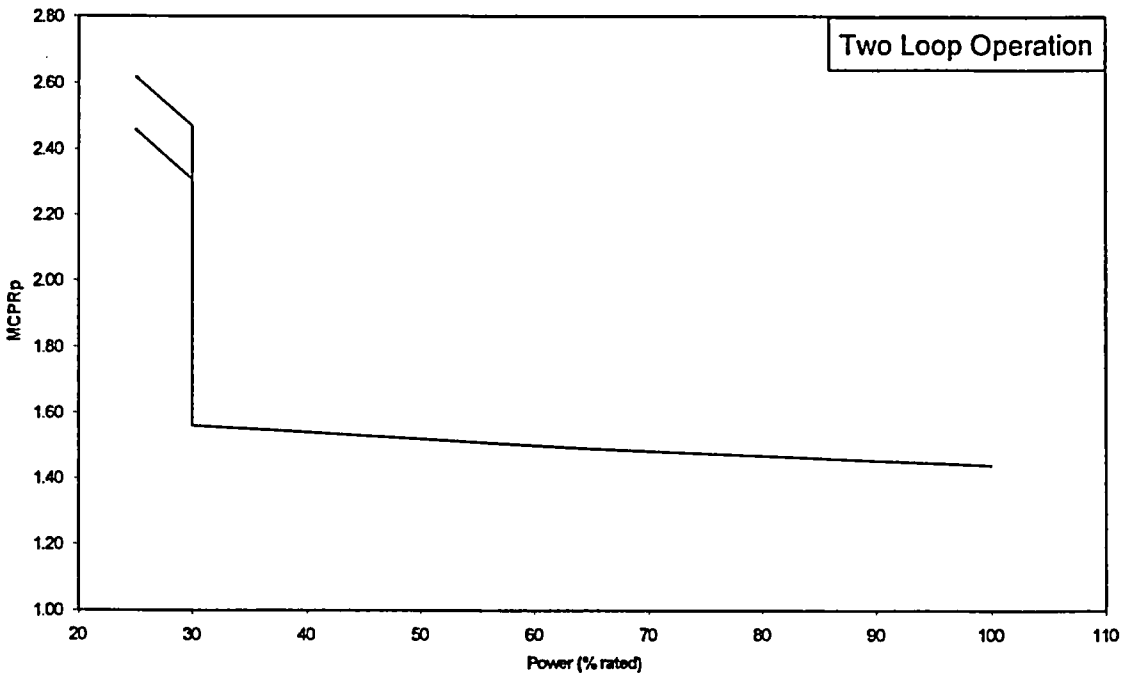
Figure 3.27



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.44	1.45
65	1.49	1.50
30	1.57	1.58
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, ATRIUM-10
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

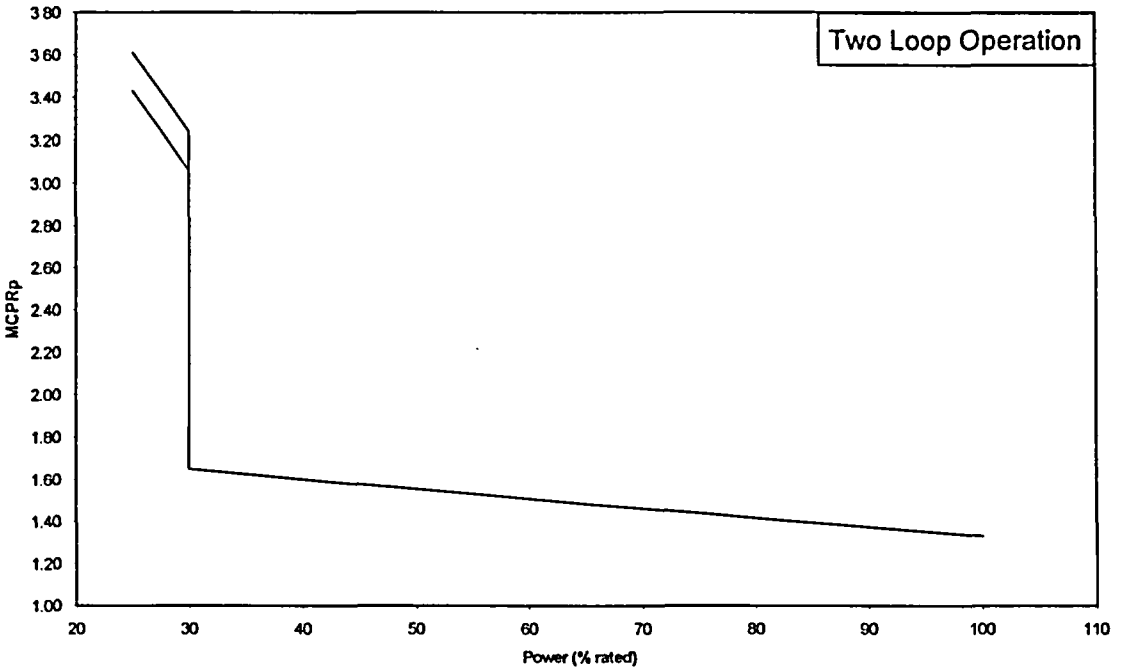
Figure 3.28



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.44	1.45
65	1.49	1.50
30	1.56	1.57
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, SVEA-96
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

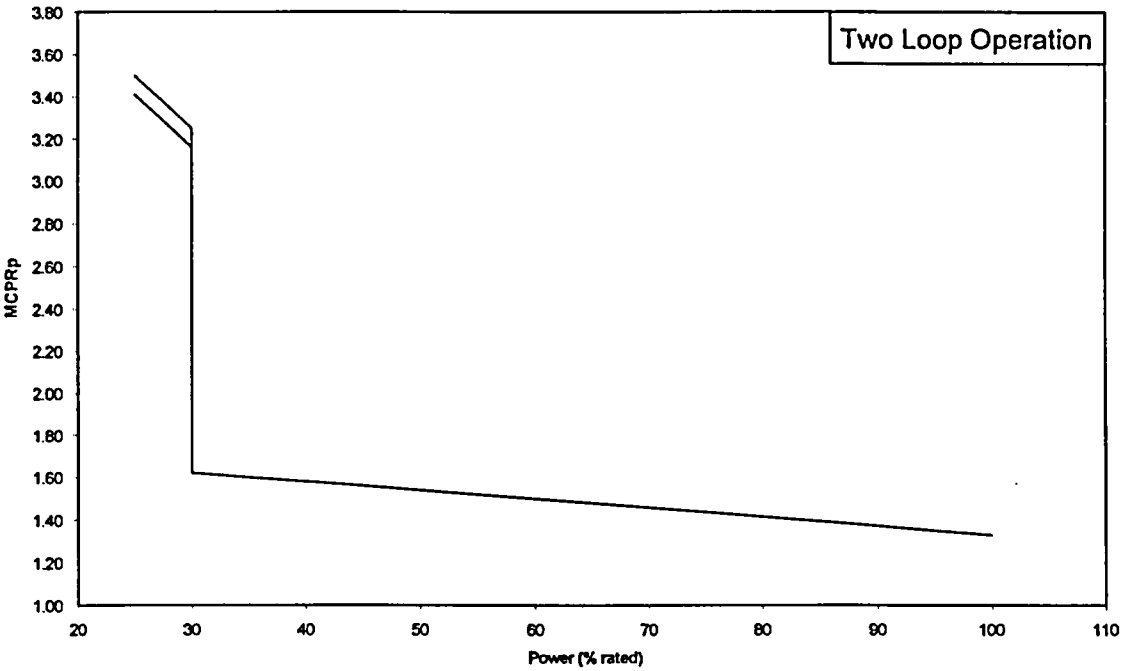
Figure 3.29



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.33	1.34
65	1.48	1.49
30	1.65	1.66
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Inoperable, ATRIUM-10
Core Average Exposures < 28307 MWd/MTU

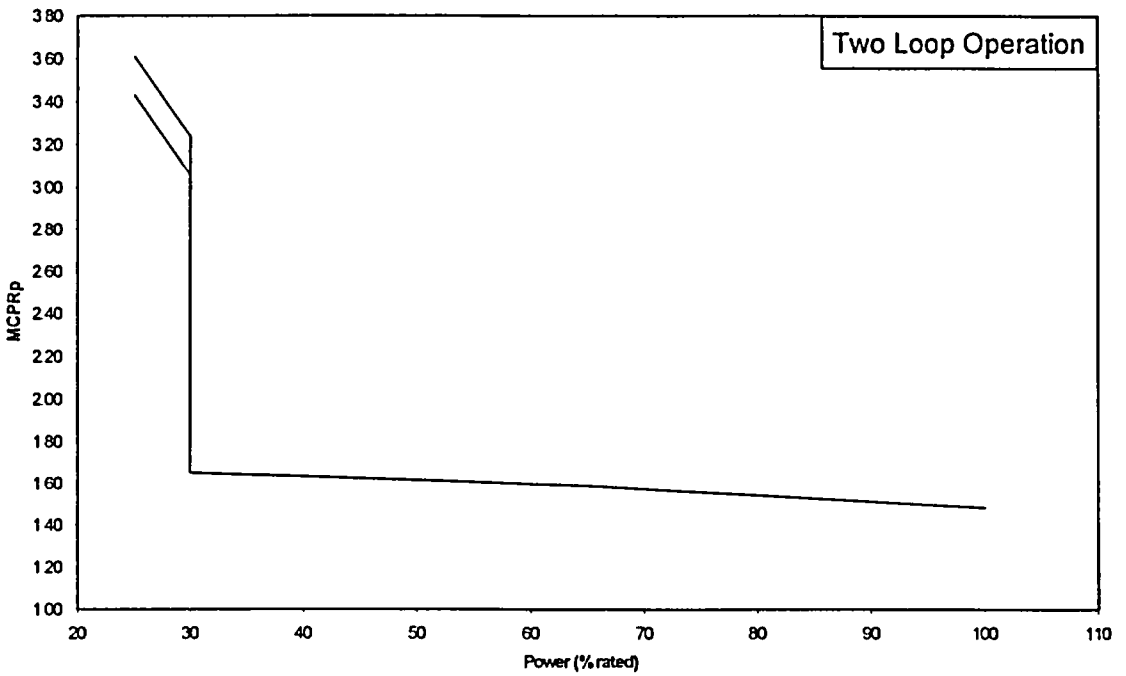
Figure 3.30



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.33	1.34
65	1.48	1.49
30	1.62	1.63
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Inoperable, SVEA-96
Core Average Exposures < 28307 MWd/MTU

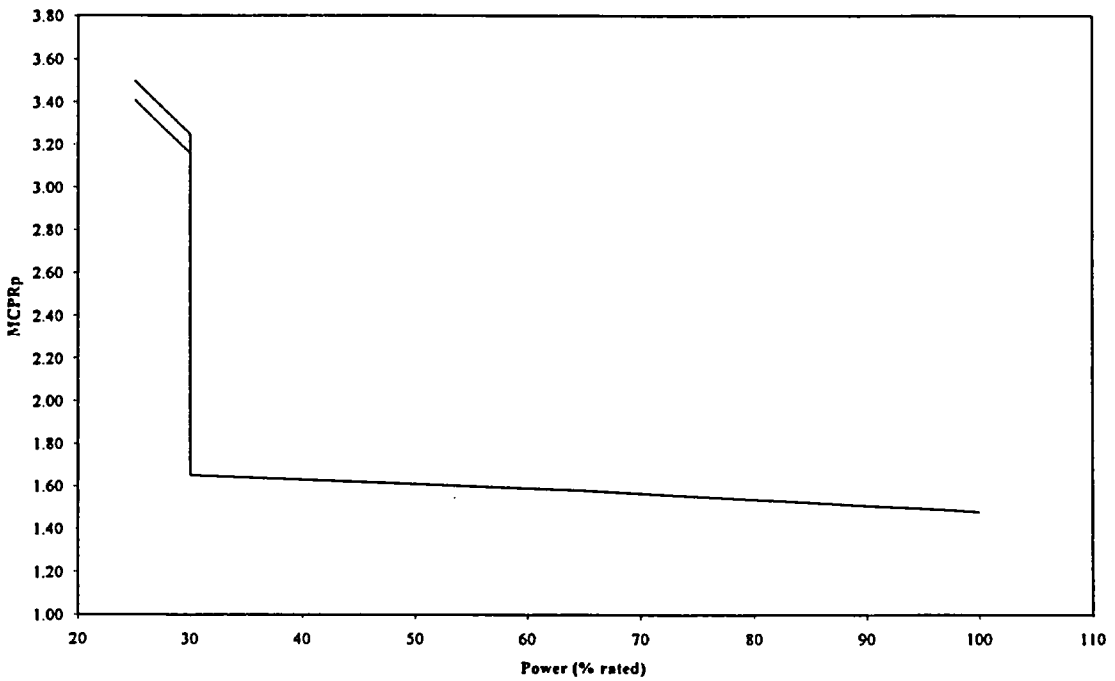
Figure 3.31



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.48	1.49
65	1.59	1.60
30	1.65	1.66
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Inoperable, ATRIUM-10
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

Figure 3.32



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.48	1.49
65	1.58	1.59
30	1.65	1.66
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Inoperable, SVEA-96
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

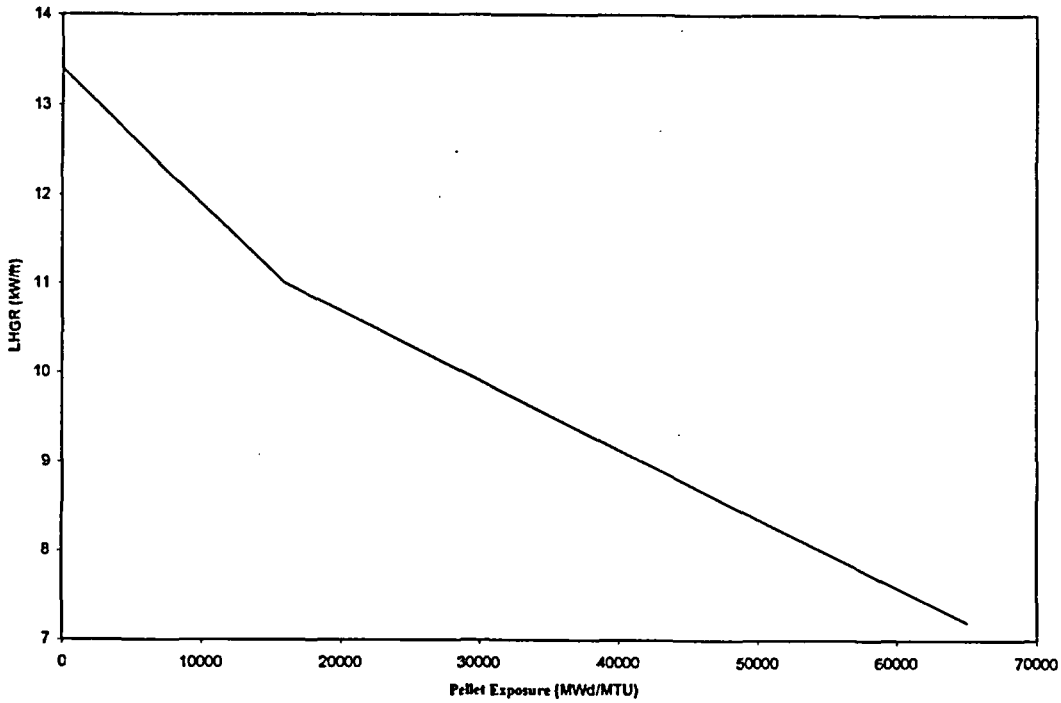
Figure 3.33

4.0 Linear Heat Generation Rate (LHGR) Limits for Use in Technical Specification 3.2.3

The LHGRs for use in Technical Specification 3.2.3 are given as a function of Average Planar Exposure for ATRIUM-10 and as a function of nodal pellet exposure for SVEA-96. The LHGRs shall not exceed the limits shown in the following figures:

a. Figure 4.1 – SVEA-96 reload fuel

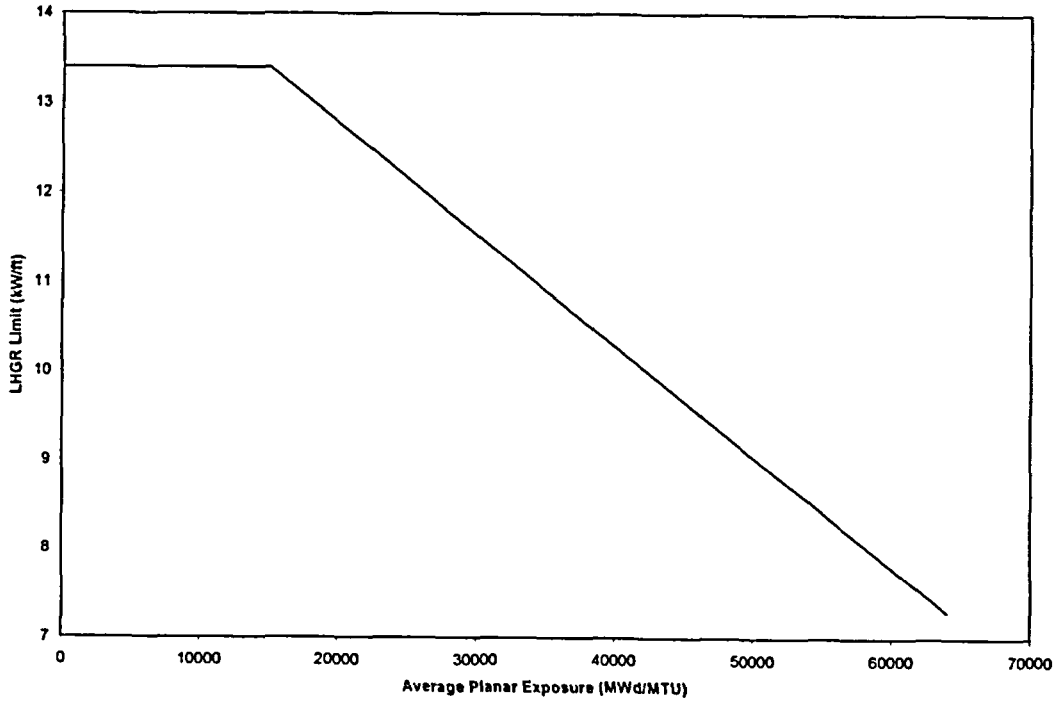
b. Figure 4.2 – ATRIUM-10 reload fuel



Pellet Exposure (MWd/MTU)	LHGR (kW/ft)
0	13.4
16000	11.0
65000	7.2

Linear Heat Generation Rate (LHGR)
Versus Pellet Exposure
SVEA-96

Figure 4.1



Average Planar Exposure (MWd/MTU)	LHGR (kW/ft)
0	13.4
15000	13.4
64000	7.3

Linear Heat Generation Rate (LHGR)
Versus Average Planar Exposure
ATRIUM-10

Figure 4.2

5.0 Oscillation Power Range Monitor (OPRM) Instrumentation Limits for Use in LCO 3.3.1.3

The OPRM instrumentation limits for use in LCO 3.3.1.3 shall not exceed the following:

Function	Trip Setpoint
Period Based Detection Algorithm (PBDA)	
Amplitude Setpoint: Sp	1.09 Peak/Average
Confirmation Count Setpoint: N2	12

6.0 References

6.1 CE NPSD-883-P, Revision 0, "COLUMBIA Cycle 16 Reload Licensing Report," Westinghouse CE Nuclear Power LLC, March 2001.

6.2 CE NPSD-801-P, Revision 5, "WNP-2 LOCA Analysis Report," Westinghouse CE Nuclear Power LLC, February 2001.

6.3 EMF-2863 Revision 0, "Columbia Generating Station Cycle 17 Reload Analysis," Framatome ANP, March 2003.

6.4 EMF-2841(P) Revision 1, "Columbia Generating Station LOCA-ECCS Analysis MAPLHGR Limit for ATRIUM™-10 Fuel," Framatome ANP, March 2003.

6.5 NE-02-00-03, Revision 0, "Oscillation Power Range Monitor (OPRM) Trip Setpoints," Energy Northwest, June 7, 2000.

6.6 CE NPSD-792-P, "Fuel Assembly Mechanical Design Report for WNP2," ABB Combustion Engineering Nuclear Operations, May 1996.

CYCLE 17, CORE OPERATING LIMITS REPORT (COLR), REVISION 1

Columbia Generating Station

Cycle 17

Core Operating Limits Report

October 2003

Columbia Generating Station
Cycle 17
Core Operating Limits Report

List of Effective Pages

27 0
28 0
29 0
30 0
31 0
32 0
33 0
34 0
35 0
36 0
37 0
38 0
39 0
40 0
41 0
42 0
43 0
44 0
45 0
46 0
47 0
48 0
49 0
50 0
51 0
52 0
53 0
54 0
55 1

Columbia Generating Station
Cycle 17
Core Operating Limits Report

Table of Contents

1.0 Introduction and Summary

This report provides the **Average Planar Linear Heat Generation Rate (APLHGR)** limits, the **Minimum Critical Power Ratio (MCPR)** limits, the **Linear Heat Generation Rate (LHGR)** limits and the **Oscillation Power Range Monitor (OPRM) Instrumentation** limits for Columbia Generating Station Cycle 17 as required by Technical Specification 5.6.5. As required by Technical Specification 5.6.5, these limits were determined using NRC-approved methodology and are established so that all applicable limits of the plant safety analysis are met. References 6.1, 6.2, 6.3, and 6.4 describe the LOCA analyses for rated power. These analyses were performed with methodologies that result in Single Loop Operation (SLO) APLHGR limits as well as Two Loop Operation (TLO) APLHGR limits. The thermal limits for ATRIUM-10 fuel given in this report are documented in Reference 6.3. The MCPR limits for the SVEA-96 fuel are also documented in Reference 6.3. The APLHGR and LHGR limits for SVEA-96 fuel are documented in References 6.1 and 6.6. The basis for the OPRM Instrumentation limits is documented in References 6.3 and 6.5.

The MCPR limit is the maximum of (a) the applicable exposure dependent, full power and full flow MCPR limit, (b) the applicable exposure and power dependent MCPR limit, and (c) the applicable flow dependent MCPR limit specified in this report. This stipulation assures that the safety limit MCPR will not be violated during steady-state operation and anticipated operational occurrences throughout the Columbia Generating Station operating regime. Full power MCPR limits are specified to define operating limits at rated power and flow. Power dependent MCPR limits are specified to define operating limits at other than rated power conditions. A flow dependent MCPR is specified to define operating limits at other than rated flow conditions. The reduced flow MCPR limit, set by the limiting Recirculation Flow Increase event, provides bounding protection for all events at reduced flow.

The reload licensing analyses for this cycle provide operating limits for Extended Load Line Limit Analysis (ELLLA) operation which extends the power and flow operating regime for Columbia Generating Station up to the 108% rod line which at full power corresponds to 88% of rated flow. The MCPR limits defined in this report are applicable up to 100% of rated thermal power along and below the 108% rod line. The minimum flow for operation at rated power is 88% of rated flow; the maximum is 106%.

Per Technical Specification 4.2.1, the 12 fresh SVEA-96 fuel assemblies shall be loaded and operated so they will be nonlimiting MCPR assemblies.

The specific topical report revisions and supplements which describe the methodology utilized in this cycle specific analysis are shown in Table 1.1.

Table 1.1

Columbia Generating Station
Reference Topical Reports

1. XN-NF-81-58(P)(A) Revision 2 and Supplements 1 and 2, *RODEX2 Fuel Rod Thermal-Mechanical Response Evaluation Model*, Exxon Nuclear Company, March 1984.

2. XN-NF-85-67(P)(A) Revision 1, *Generic Mechanical Design for Exxon Nuclear Jet Pump BWR Reload Fuel*, Exxon Nuclear Company, September 1986.

3. EMF-85-74(P) Revision 0 Supplement 1(P)(A) and Supplement 2(P)(A), *RODEX2A (BWR) Fuel Rod Thermal-Mechanical Evaluation Model*, Siemens Power Corporation, February 1998.

4. ANF-89-98(P)(A) Revision 1 and Supplement 1, *Generic Mechanical Design Criteria for BWR Fuel Designs*, Advanced Nuclear Fuels Corporation, May 1995.

5. XN-NF-80-19(P)(A) Volume 1 and Supplements 1 and 2, *Exxon Nuclear Methodology for Boiling Water Reactors - Neutronic Methods for Design and Analysis*, Exxon Nuclear Company, March 1983.

6. XN-NF-80-19(P)(A) Volume 4 Revision 1, *Exxon Nuclear Methodology for Boiling Water Reactors: Application of the ENC Methodology to BWR Reloads*, Exxon Nuclear Company, June 1986.

7. EMF-2158(P)(A) Revision 0, *Siemens Power Corporation Methodology for Boiling Water Reactors: Evaluation and Validation of CASMO-4/MICROBURN-B2*, Siemens Power Corporation, October 1999.

8. XN-NF-80-19(P)(A) Volume 3 Revision 2, *Exxon Nuclear Methodology for Boiling Water Reactors, THERMEX: Thermal Limits Methodology Summary Description*, Exxon Nuclear Company, January 1987.

9. XN-NF-84-105(P)(A) Volume 1 and Volume 1 Supplements 1 and 2, *XCOBRA-T: A Computer Code for BWR Transient Thermal-Hydraulic Core Analysis*, Exxon Nuclear Company, February 1987.

10. ANF-524(P)(A) Revision 2 and Supplements 1 and 2, *ANF Critical Power Methodology for Boiling Water Reactors*, Advanced Nuclear Fuels Corporation, November 1990.

11. ANF-913(P)(A) Volume 1 Revision 1 and Volume 1 Supplements 2, 3 and 4, *COTRANSA2: A Computer Program for Boiling Water Reactor Transient* Analysis, Advanced Nuclear Fuels Corporation, August 1990.

12. ANF-1358(P)(A) Revision 1, *The Loss of Feedwater Heating Transient in Boiling Water Reactors*, Advanced Nuclear Fuels Corporation, September 1992.

13. EMF-2209(P)(A) Revision 1, *SPCB Critical Power Correlation*, Siemens Power Corporation, July 2000.

14. EMF-2245(P)(A) Revision 0, *Application of Siemens Power Corporation's Critical Power Correlations to Co-Resident Fuel*, Siemens Power Corporation, August 2000.

15. EMF-2361(P)(A) Revision 0, *EXEM BWR-2000 ECCS Evaluation Model*, Framatome ANP, May 2001.

16. EMF-2292(P)(A) Revision 0, *ATRIUM™–10: Appendix K Spray Heat Transfer Coefficients*, Siemens Power Corporation, September 2000.

17. EMF-CC-074(P)(A) Volume 4 Revision 0, *BWR Stability Analysis - Assessment of STAIF with Input from MICROBURN-B2*, Siemens Power Corporation, August 2000.

18. CENPD-300-P-A, *Reference Safety Report for Boiling Water Reactor Reload Fuel*, ABB Combustion Engineering Nuclear Operations, July 1996.

19. NEDO-32465-A, *BWR Owners' Group Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology and Reload Applications*, August 1996.

2.0 Average Planar Linear Heat Generation Rate (APLHGR) Limits for Use in Technical Specification 3.2.1

The APLHGRs for use in Technical Specification 3.2.1, as a function of Average Planar Exposure, shall not exceed the limits shown in the following figures. Note that the APLHGR limits for single loop operation for ATRIUM-10 fuel are obtained by applying a 0.9 multiplier to the two loop operation APLHGR limits.

a. Figure 2.1 – SA- and SB-Type SVEA-96 reload fuel – Two Loop Operation

b. Figure 2.2 – SA- and SB-Type SVEA-96 reload fuel – Single Loop Operation

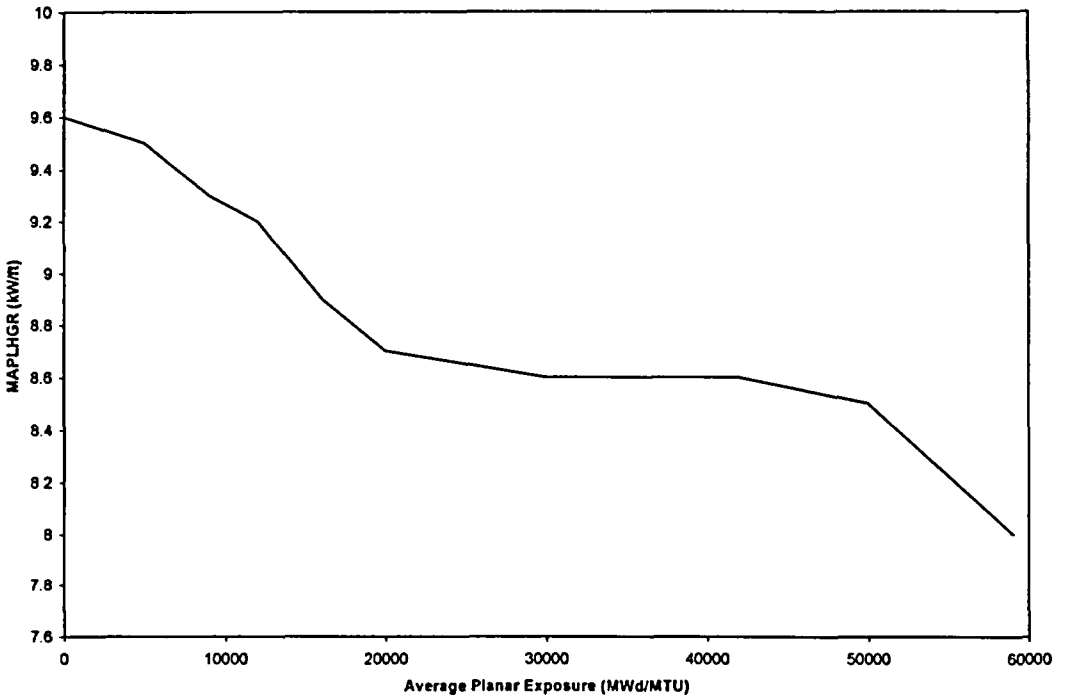
c. Figure 2.3 – SC- and SD-Type SVEA-96 reload fuel – Two Loop Operation

d. Figure 2.4 – SC- and SD-Type SVEA-96 reload fuel – Single Loop Operation

e. Figure 2.5 – SE- and SF-Type SVEA-96 reload fuel – Two Loop Operation

f. Figure 2.6 – SE- and SF-Type SVEA-96 reload fuel – Single Loop Operation

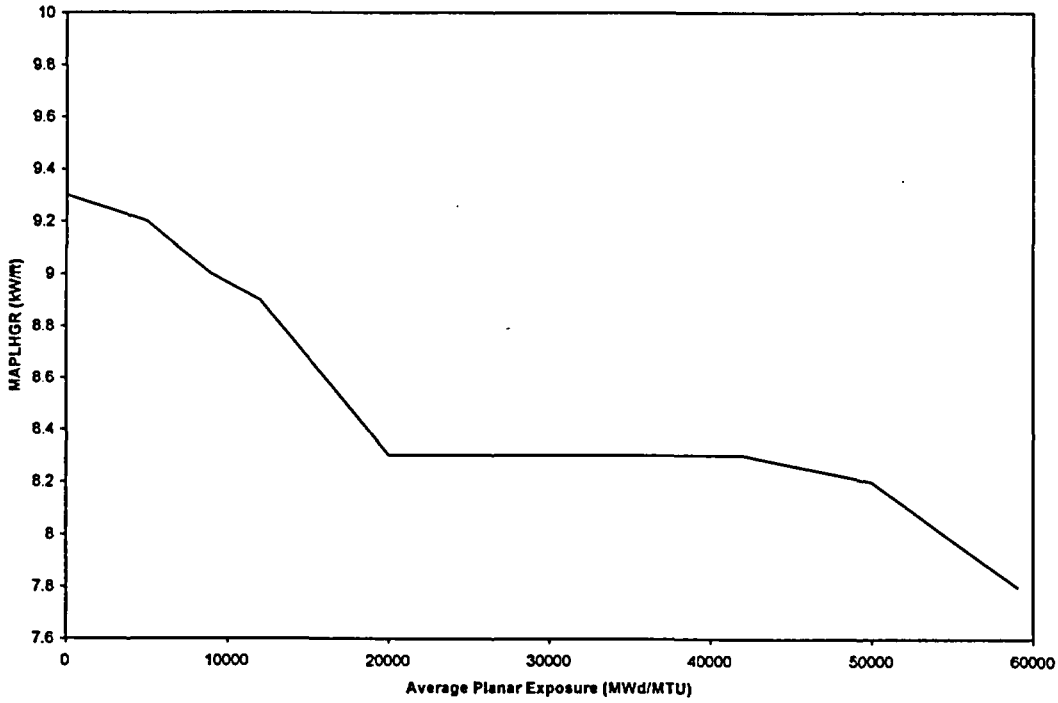
g. Figure 2.7 – ATRIUM-10 reload fuel



Average Planar Exposure (MWd/MTU)	MAPLHGR (kW/ft)
0	9.6
5000	9.5
9000	9.3
12000	9.2
16000	8.9
20000	8.7
30000	8.6
42000	8.6
50000	8.5
59000	8.0

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)
Versus Average Planar Exposure – Two Loop Operation
SA- and SB-Type SVEA-96

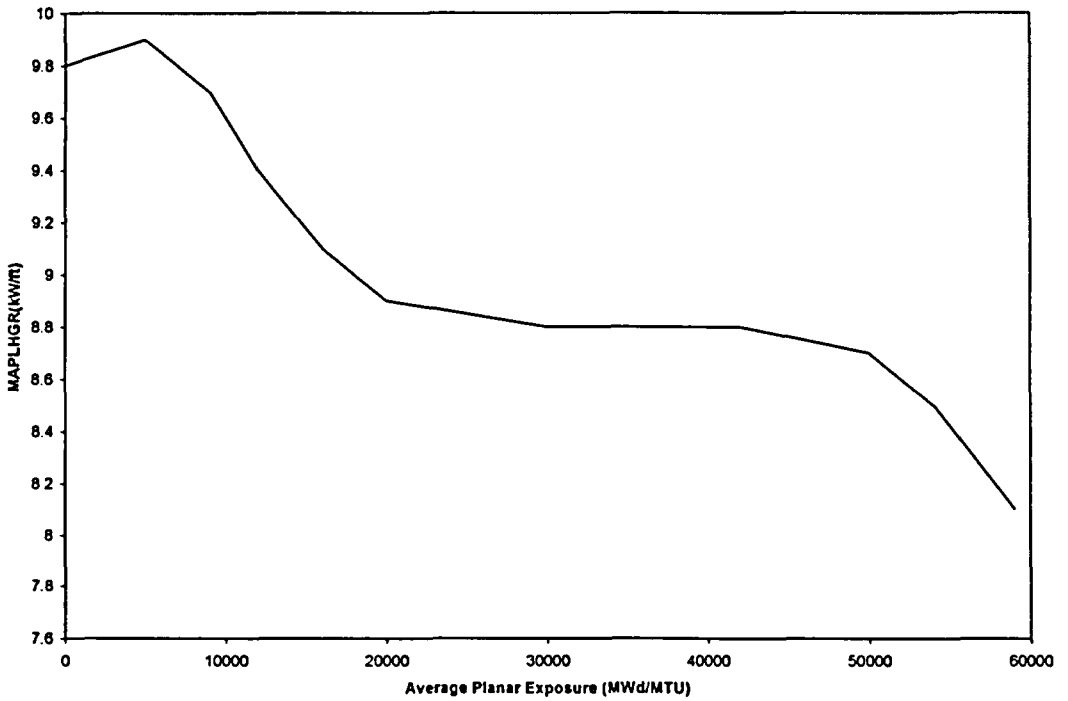
Figure 2.1



Average Planar Exposure (MWd/MTU)	MAPLHGR (kW/ft)
0	9.3
5000	9.2
9000	9.0
12000	8.9
16000	8.6
20000	8.3
30000	8.3
42000	8.3
50000	8.2
59000	7.8

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)
Versus Average Planar Exposure – Single Loop Operation
SA- and SB-Type SVEA-96

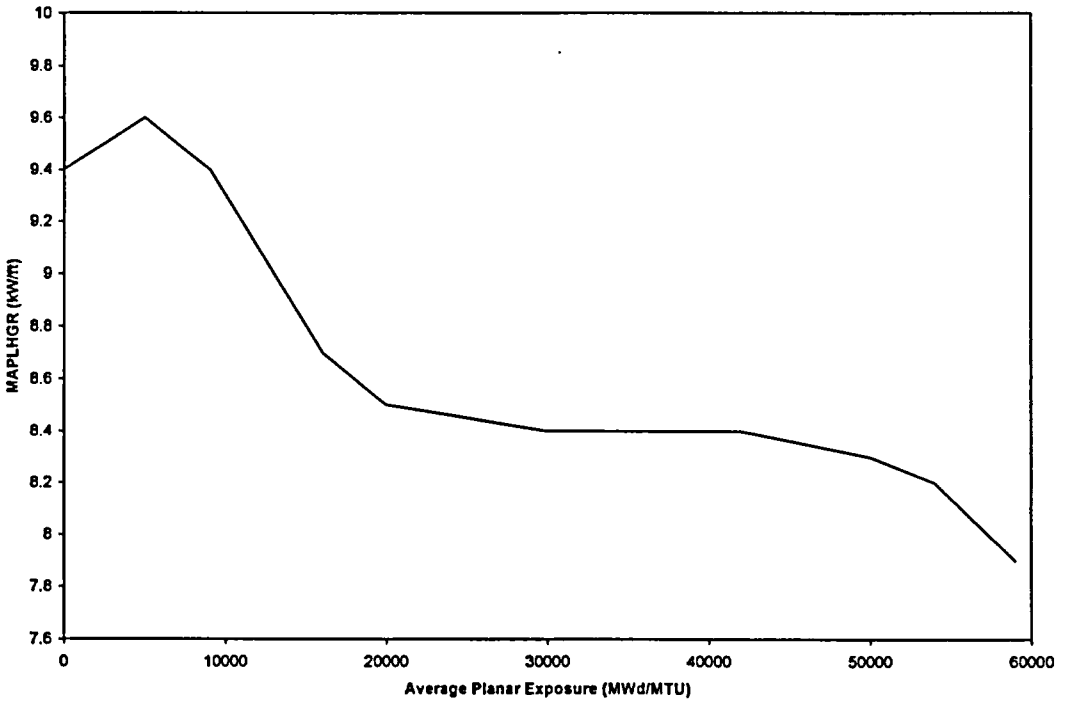
Figure 2.2



Average Planar Exposure (MWd/MTU)	MAPLHGR (kW/ft)
0	9.8
5000	9.9
9000	9.7
10000	9.6
12000	9.4
16000	9.1
20000	8.9
30000	8.8
42000	8.8
50000	8.7
54000	8.5
59000	8.1

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)
Versus Average Planar Exposure – Two Loop Operation
SC- and SD-Type SVEA-96

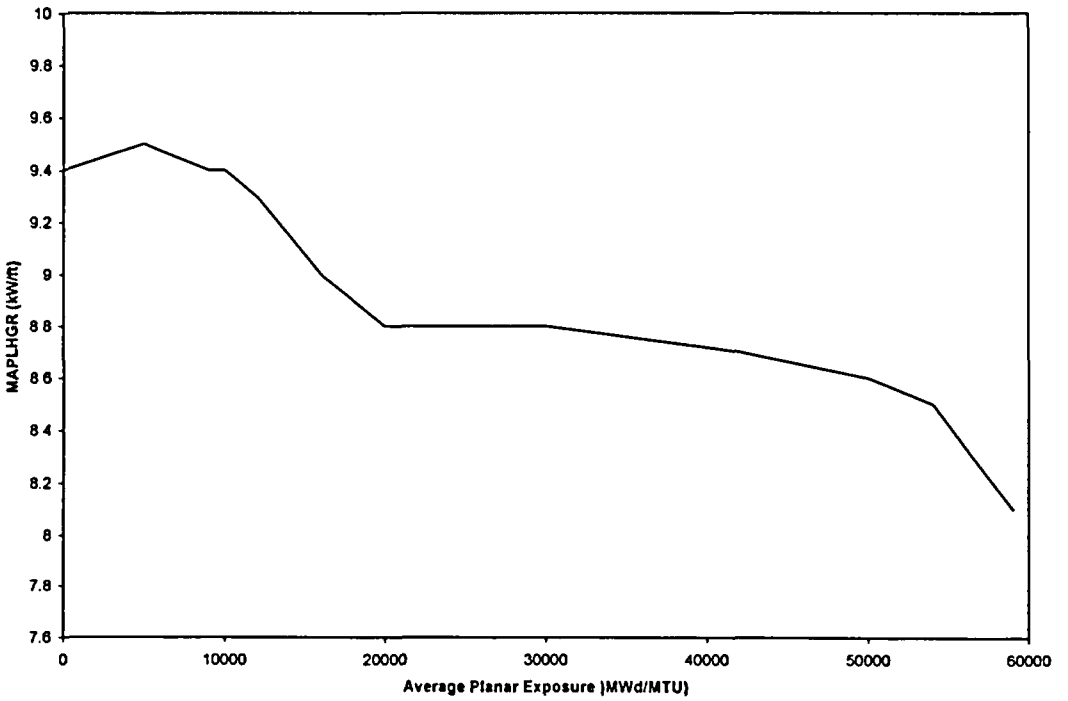
Figure 2.3



Average Planar Exposure (MWd/MTU)	MAPLHGR (kW/ft)
0	9.4
5000	9.6
9000	9.4
10000	9.3
12000	9.1
16000	8.7
20000	8.5
30000	8.4
42000	8.4
50000	8.3
54000	8.2
59000	7.9

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) Versus Average Planar Exposure – Single Loop Operation SC- and SD-Type SVEA-96

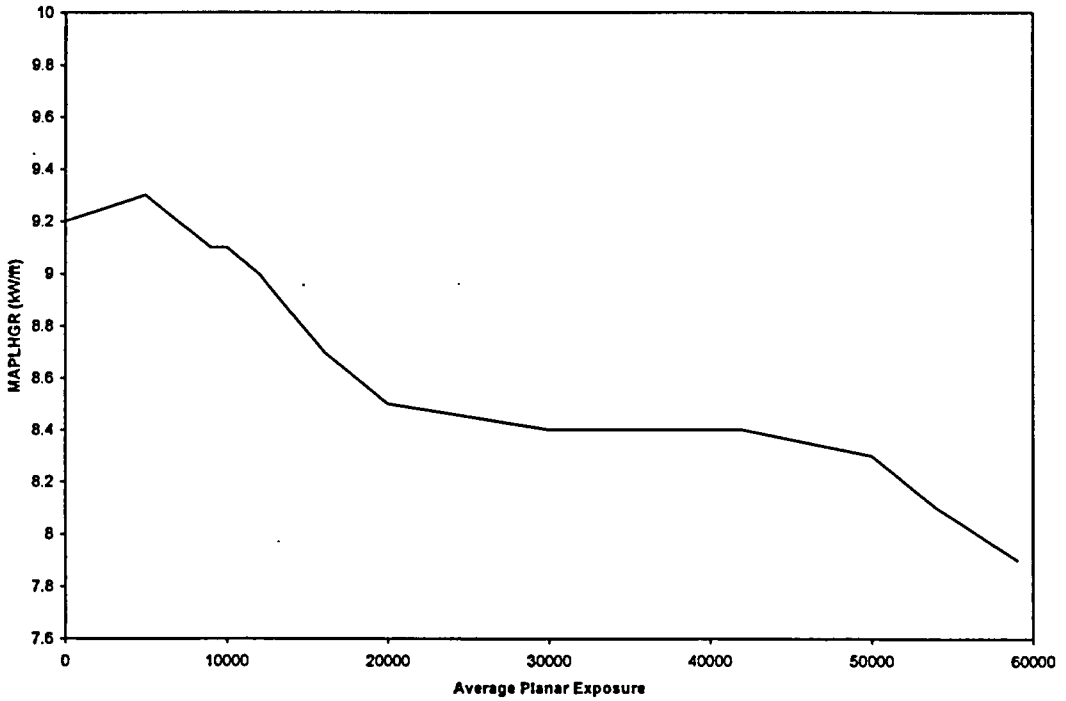
Figure 2.4



Average Planar Exposure (MWd/MTU)	MAPLHGR (kW/ft)
0	9.4
5000	9.5
9000	9.4
10000	9.4
12000	9.3
16000	9.0
20000	8.8
30000	8.8
42000	8.7
50000	8.6
54000	8.5
59000	8.1

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)
Versus Average Planar Exposure – Two Loop Operation
SE- and SF-Type SVEA-96

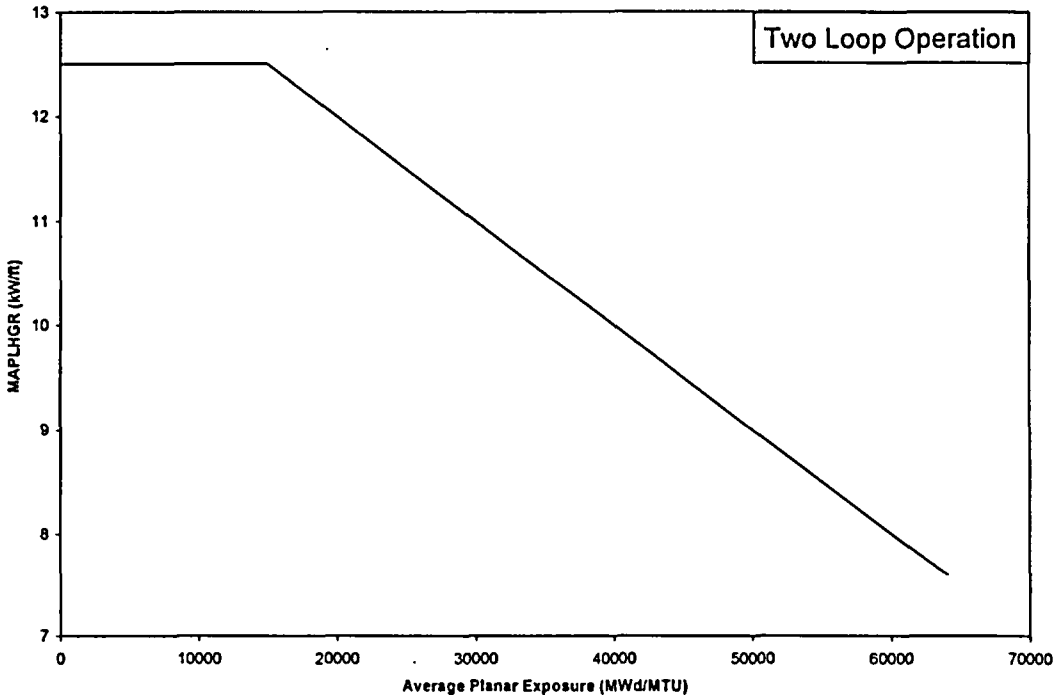
Figure 2.5



Average Planar Exposure (MWd/MTU)	MAPLHGR (kW/ft)
0	9.2
5000	9.3
9000	9.1
10000	9.1
12000	9.0
16000	8.7
20000	8.5
30000	8.4
42000	8.4
50000	8.3
54000	8.1
59000	7.9

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) Versus Average Planar Exposure – Single Loop Operation SE- and SF-Type SVEA-96

Figure 2.6



Average Planar Exposure (MWd/MTU)	TLO MAPLHGR (kW/ft)	SLO MAPLHGR (kW/ft)
0	12.5	11.2
15000	12.5	11.2
64000	7.6	6.8

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)
Versus Average Planar Exposure
ATRIUM-10

Figure 2.7

3.0 Minimum Critical Power Ratio (MCPR) Limit for Use in Technical Specification 3.2.2

The MCPR limit for use in Technical Specification 3.2.2 shall be greater than or equal to the bounding limits determined from Table 3.1a, Table 3.1b, Table 3.2a, Table 3.2b, and Figures 3.1 through 3.33. For the purposes of cycle extension, the feedwater temperature entering the reactor vessel shall not be reduced to less than 355 °F.

The MCPR safety limit for Cycle 17 is 1.09 for two loop operation and 1.10 for single loop operation. The power dependent MCPR limits ($MCPR_p$) for single loop operation (SLO) include a 0.01 adder to the two loop operation (TLO) MCPR limits due to the difference in the MCPR safety limit.

Table 3.1a

Columbia Generating Station MCPR Operating Limits
Two-Loop Operation
Core Average Exposures < 28307 MWd/MTU

EOOS Condition	Limit	SLMCPR = 1.09[2]	
		ATRIUM-10 Fuel	SVEA-96 Fuel
NSS[1]	Full power	1.31[3]	1.28[3]
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.2	Figure 3.3
TSSS[1]	Full power	1.31[3]	1.30
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.10	Figure 3.11
NSS[1] RPT Inoperable	Full power	1.31[3]	1.28[3]
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.26	Figure 3.27

Table 3.1b

Columbia Generating Station MCPR Operating Limits
Two-Loop Operation
Core Average Exposures ≥ 28307 MWd/MTU

EOOS Condition	Limit	SLMCPR = 1.09[2] Core Average Exposures ≤ 32203 MWd/MTU		SLMCPR = 1.09[2] FFTR/Coastdown Extended Core Average Exposures ≤ 35226 MWd/MTU	
		ATRIUM-10 Fuel	SVEA-96 Fuel	ATRIUM-10 Fuel	SVEA-96 Fuel
NSS[1]	Full power	1.38	1.38	1.40	1.38
	Flow dependent[5]	Figure 3.1	Figure 3.1	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.4	Figure 3.5	Figure 3.18	Figure 3.19
TSSS[1]	Full power	1.41	1.41	1.43	1.41
	Flow dependent[5]	Figure 3.1	Figure 3.1	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.12	Figure 3.13	Figure 3.22	Figure 3.23
NSS[1] RPT Inoperable	Full power	1.44	1.44	Not analyzed	
	Flow dependent[5]	Figure 3.1	Figure 3.1		
	Power dependent[4]	Figure 3.28	Figure 3.29		

Table 3.2a

Columbia Generating Station MCPR Operating Limits
Two-Loop Operation
Turbine Bypass System Inoperable
Core Average Exposures < 28307 MWd/MTU

EOOS Condition	Limit	SLMCPR = 1.09[2]	
		ATRIUM-10 Fuel	SVEA-96 Fuel
NSS[1]	Full power	1.31[3]	1.30
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.6	Figure 3.7
TSSS[1]	Full power	1.36	1.35
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.14	Figure 3.15
NSS[1] RPT Inoperable	Full power	1.33	1.33
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.30	Figure 3.31

Table 3.2b

Columbia Generating Station MCPR Operating Limits
Two-Loop Operation
Turbine Bypass System Inoperable
Core Average Exposures ≥ 28307 MWd/MTU

EOOS Condition	Limit	SLMCPR = 1.09[2] Core Average Exposures ≤ 32203 MWd/MTU		SLMCPR = 1.09[2] FFTR/Coastdown Extended Core Average Exposures ≤ 35226 MWd/MTU	
		ATRIUM-10 Fuel	SVEA-96 Fuel	ATRIUM-10 Fuel	SVEA-96 Fuel
NSS[1]	Full power	1.42	1.41	1.44	1.41
	Flow dependent[5]	Figure 3.1	Figure 3.1	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.8	Figure 3.9	Figure 3.20	Figure 3.21
TSSS[1]	Full power	1.45	1.44	1.46	1.44
	Flow dependent[5]	Figure 3.1	Figure 3.1	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.16	Figure 3.17	Figure 3.24	Figure 3.25
NSS[1] RPT Inoperable	Full power	1.48	1.48	Not analyzed	
	Flow dependent[5]	Figure 3.1	Figure 3.1		
	Power dependent[4]	Figure 3.32	Figure 3.33		

Notes for Tables 3.1a, 3.1b, 3.2a, and 3.2b

Note 1: The scram insertion times must meet the requirements of Technical Specification 3.1.4. The NSS MCPR values are based on Framatome ANP (FANP) transient analyses performed using control rod insertion times consistent with the following table. If Technical Specification 3.1.4 is met with the NSS insertion times shown below, the NSS MCPR limits in Tables 3.1a, 3.1b, 3.2a, and 3.2b are applicable. If the NSS insertion times are exceeded, then the MCPR limits shall be determined using the appropriate TSSS limits. The NSS and TSSS MCPR limits are based on analyses that account for up to 8 declared "slow" rods, 1 stuck rod, and 1 rod assumed to fail to scram.

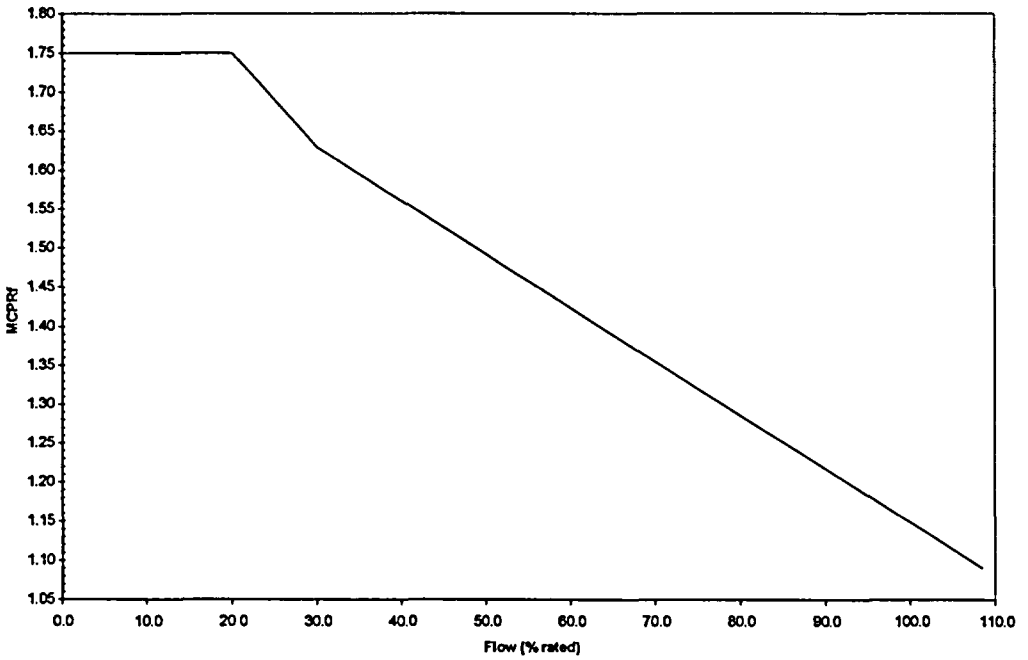
Control Rod Position (notch)	NSS Time (sec)
45	0.43
39	0.72
25	1.60
5	2.95

Note 2: For Single Loop Operation (SLO), the SLMCPR increases by 0.01. This 0.01 increase must also be applied to the Two Loop Operation $MCPR_p$ Operating Limit to obtain the SLO operating limit.

Note 3: For the noted full power MCPR limits, the Rod Withdrawal Error (RWE) event is limiting. The RWE analysis was performed with a nominal Rod Block Monitor (RBM) setpoint of 1.06.

Note 4: Power dependent MCPR limits are provided for core thermal powers greater than or equal to 25% of rated power at all core flows. The power dependent MCPR limits for core thermal powers less than or equal to 30% of rated power are subdivided by core flow. Limits are provided for core flows greater than 50% of rated flow and less than or equal to 50% of rated flow. A step change in the power dependent MCPR limits occurs at 30% of rated power because direct scram on turbine throttle valve closure is automatically bypassed below 30% of rated power and not applicable per Technical Specification 3.3.1.1.

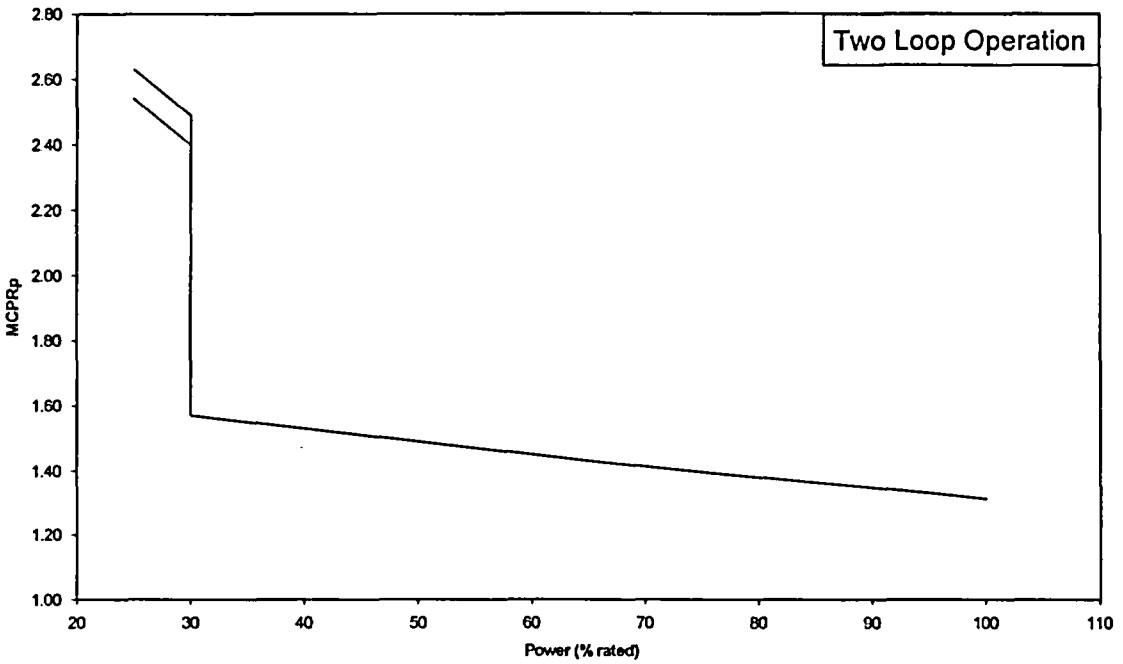
Note 5: Flow dependent MCPR limits are applicable to both TLO and SLO.



Flow (% of rated)	$MCPR_f$ ATRIUM-10	$MCPR_f$ SVEA-96
0	1.75	1.75
20	1.75	1.75
30	1.63	1.63
108.5	1.09	1.09

Reduced Flow MCPR Operating Limit Versus Total Core Flow
ATRIUM-10 and SVEA-96

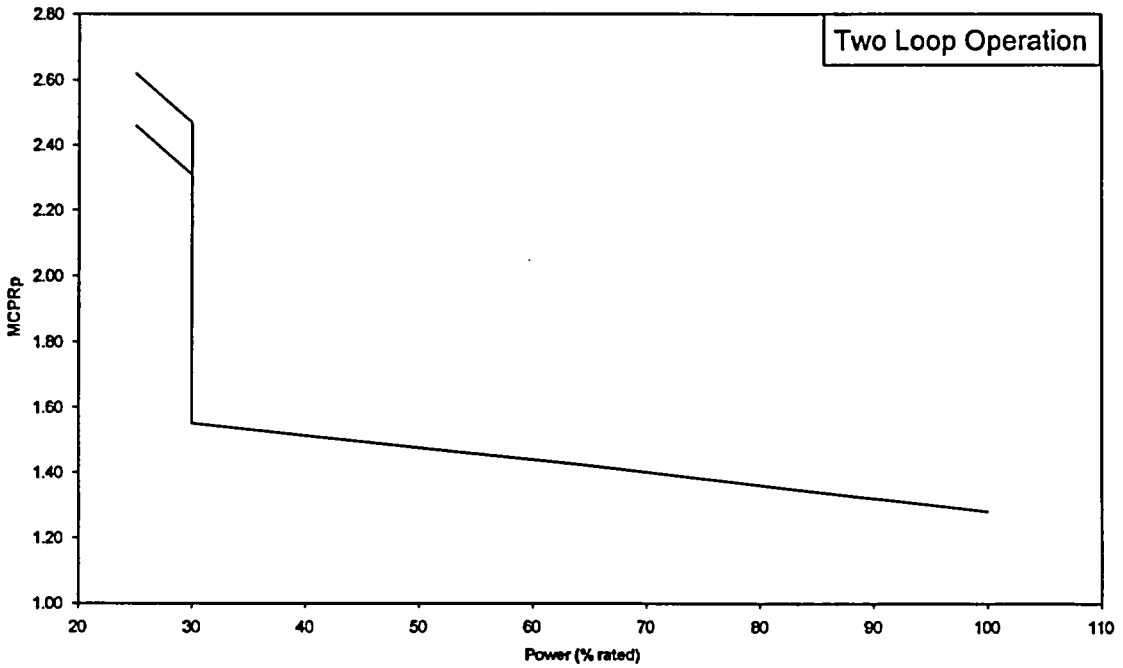
Figure 3.1



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.31	1.32
65	1.43	1.44
30	1.57	1.58
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, ATRIUM-10
Core Average Exposures < 28307 MWd/MTU

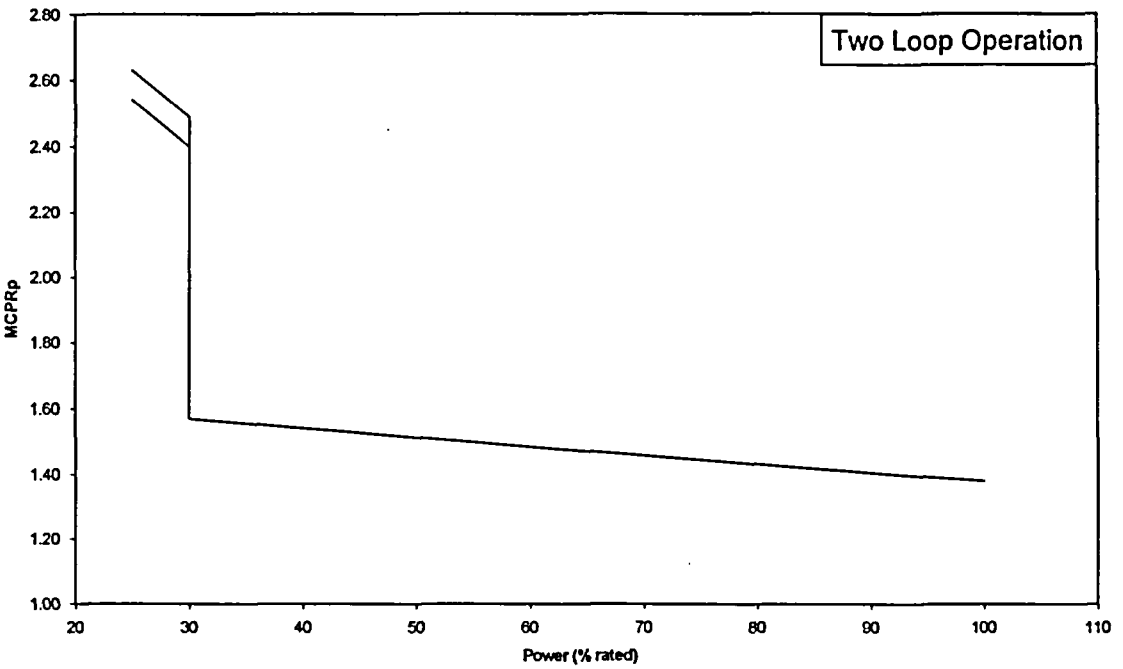
Figure 3.2



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.28	1.29
65	1.42	1.43
30	1.55	1.56
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, SVEA-96
Core Average Exposures < 28307 MWd/MTU

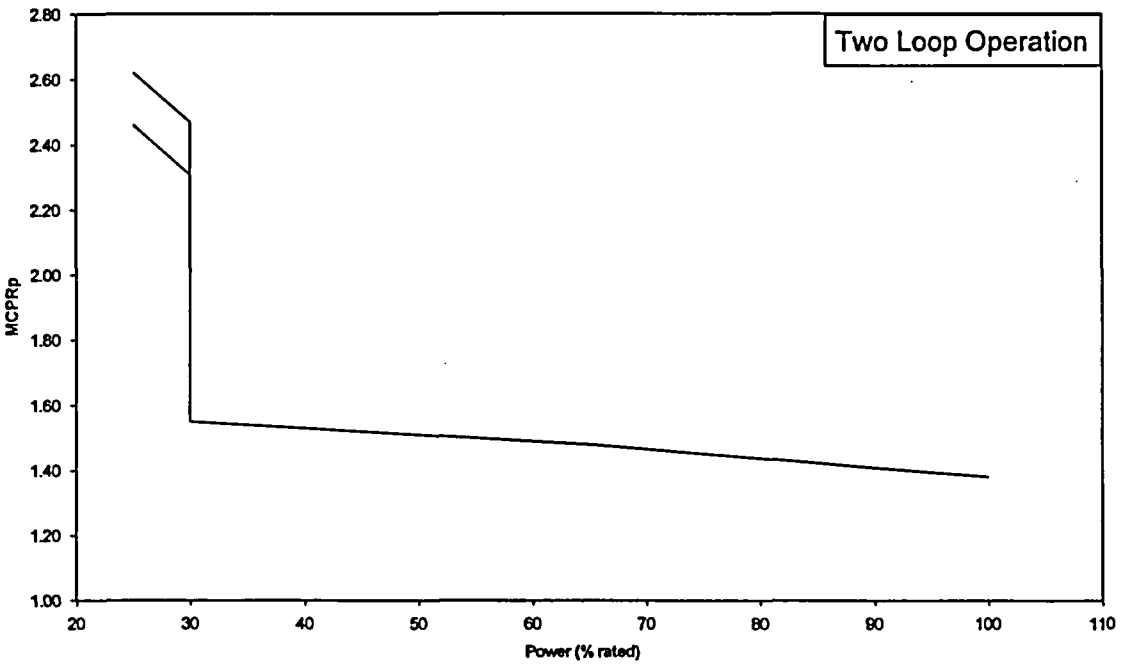
Figure 3.3



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.38	1.39
65	1.47	1.48
30	1.57	1.58
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, ATRIUM-10
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

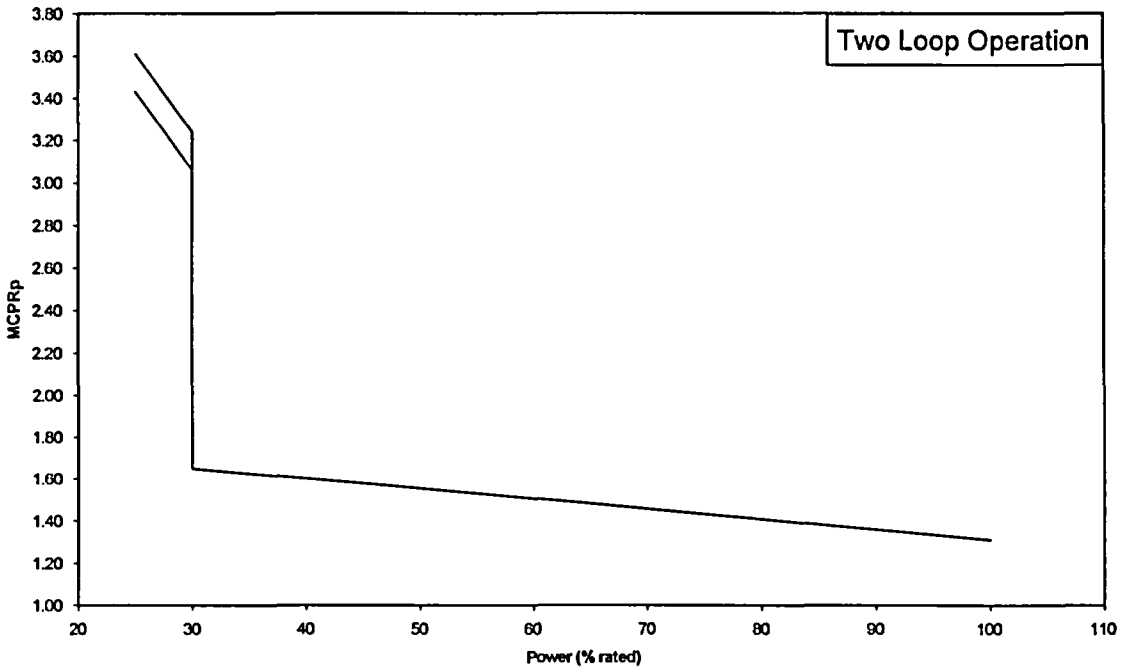
Figure 3.4



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.38	1.39
65	1.48	1.49
30	1.55	1.56
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, SVEA-96
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

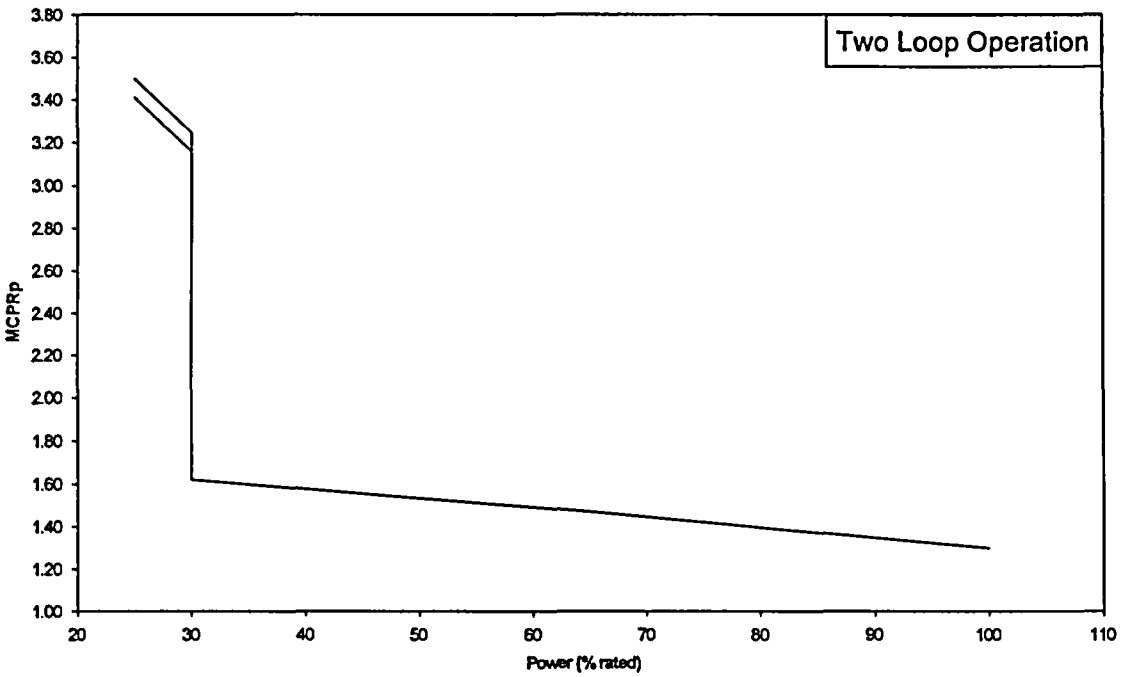
Figure 3.5



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.31	1.32
65	1.48	1.49
30	1.65	1.66
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, ATRIUM-10
Core Average Exposures < 28307 MWd/MTU

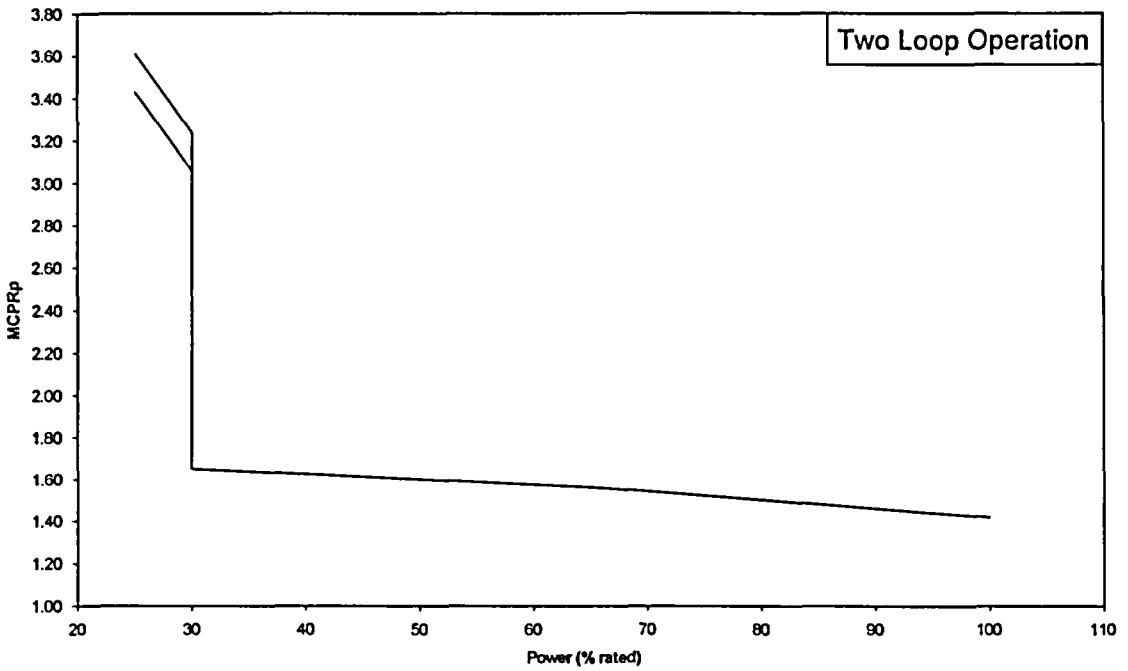
Figure 3.6



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.30	1.31
65	1.47	1.48
30	1.62	1.63
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, SVEA-96
Core Average Exposures < 28307 MWd/MTU

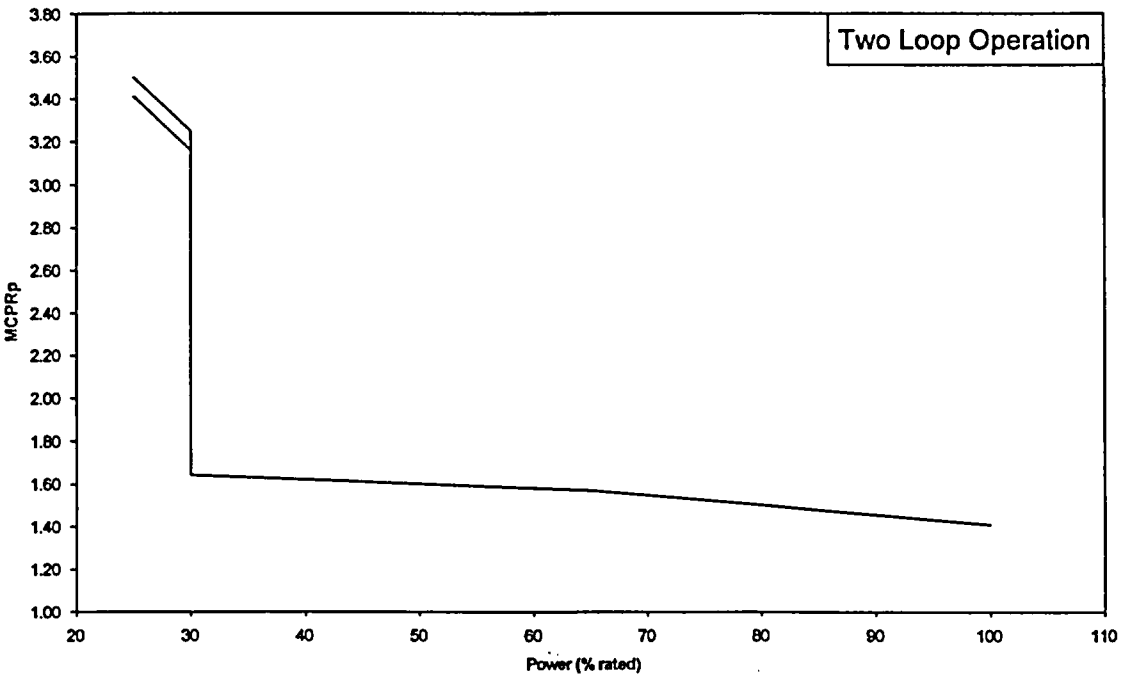
Figure 3.7



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.42	1.43
65	1.56	1.57
30	1.65	1.66
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, ATRIUM-10
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

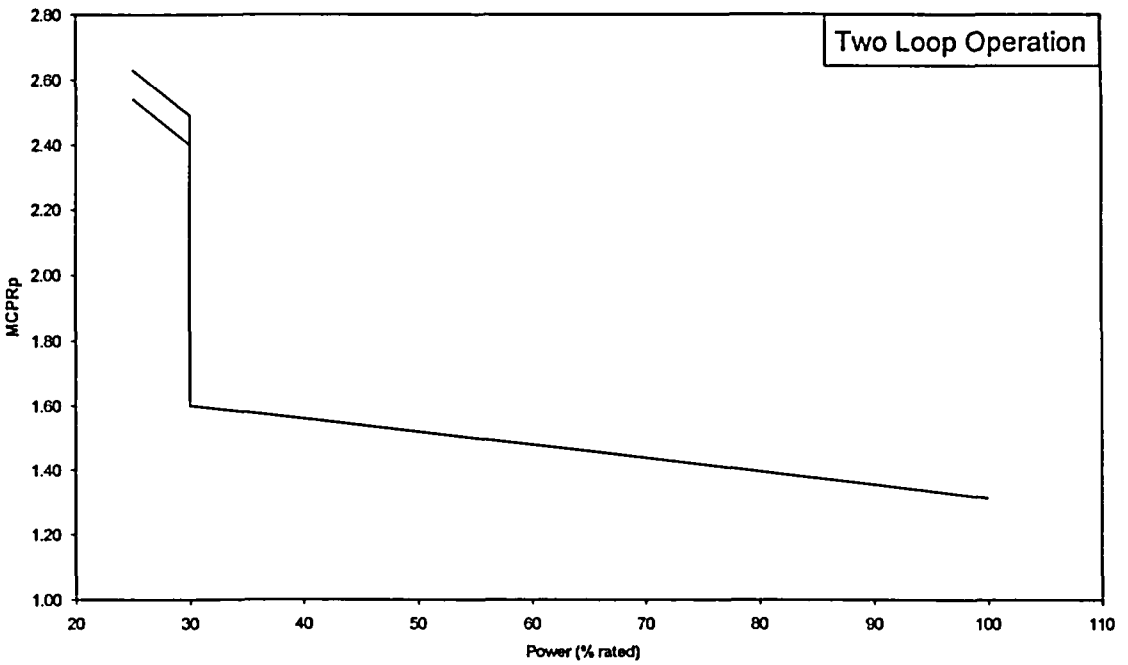
Figure 3.8



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.41	1.42
65	1.57	1.58
30	1.64	1.65
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, SVEA-96
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

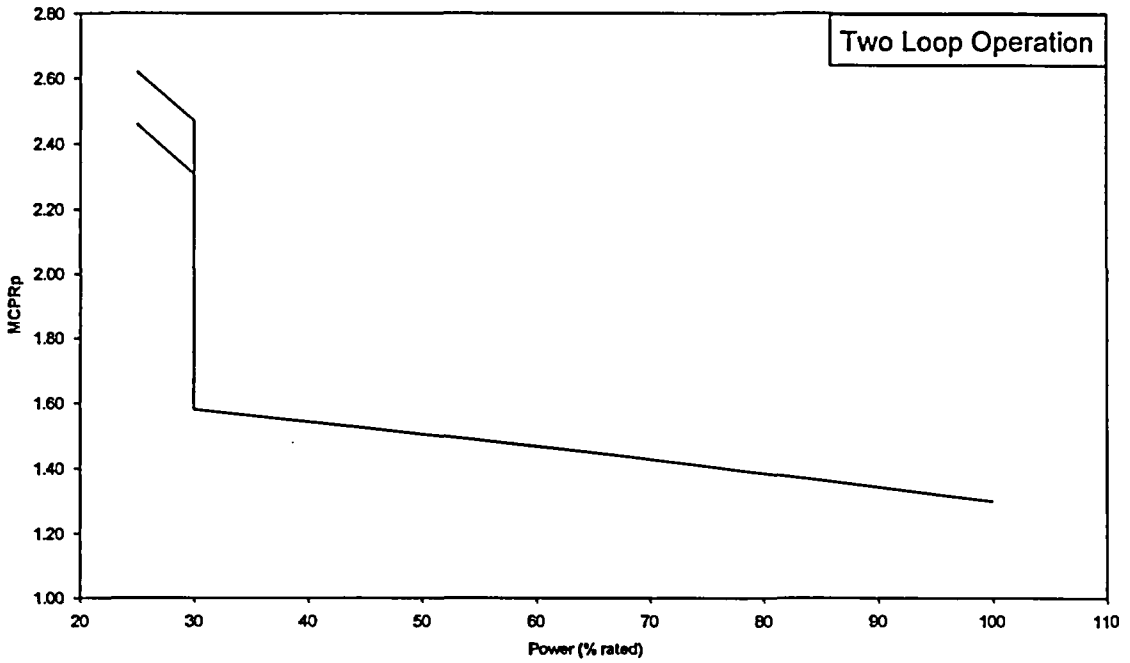
Figure 3.9



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.31	1.32
65	1.46	1.47
30	1.60	1.61
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, ATRIUM-10
Core Average Exposures < 28307 MWd/MTU

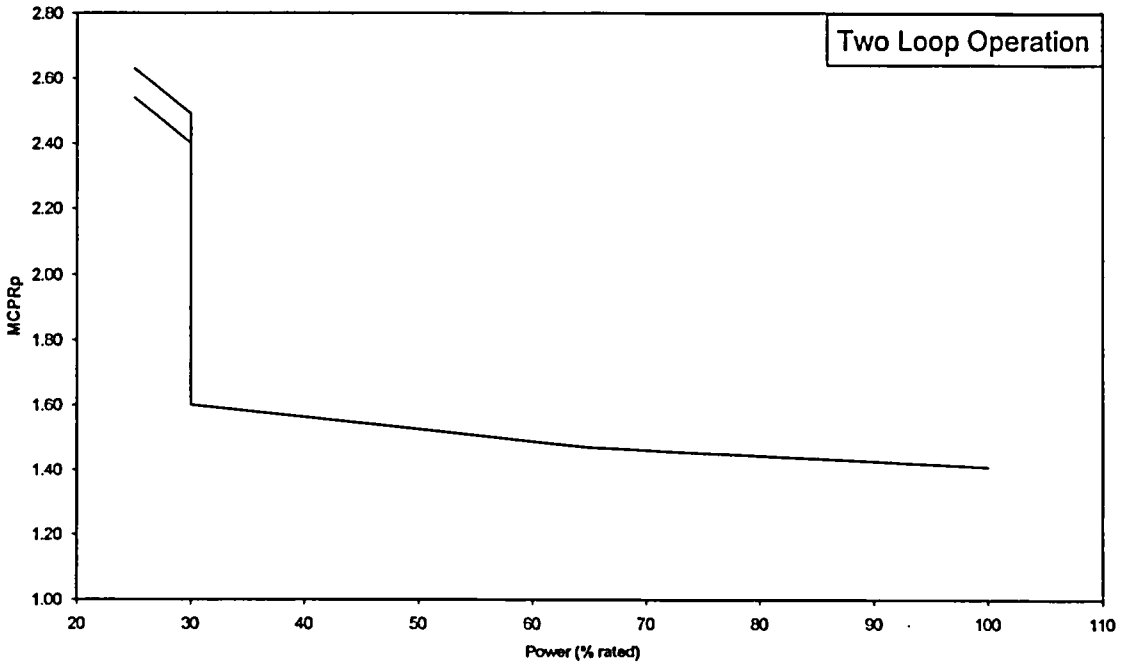
Figure 3.10



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.30	1.31
65	1.45	1.46
30	1.58	1.59
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, SVEA-96
Core Average Exposures < 28307 MWd/MTU

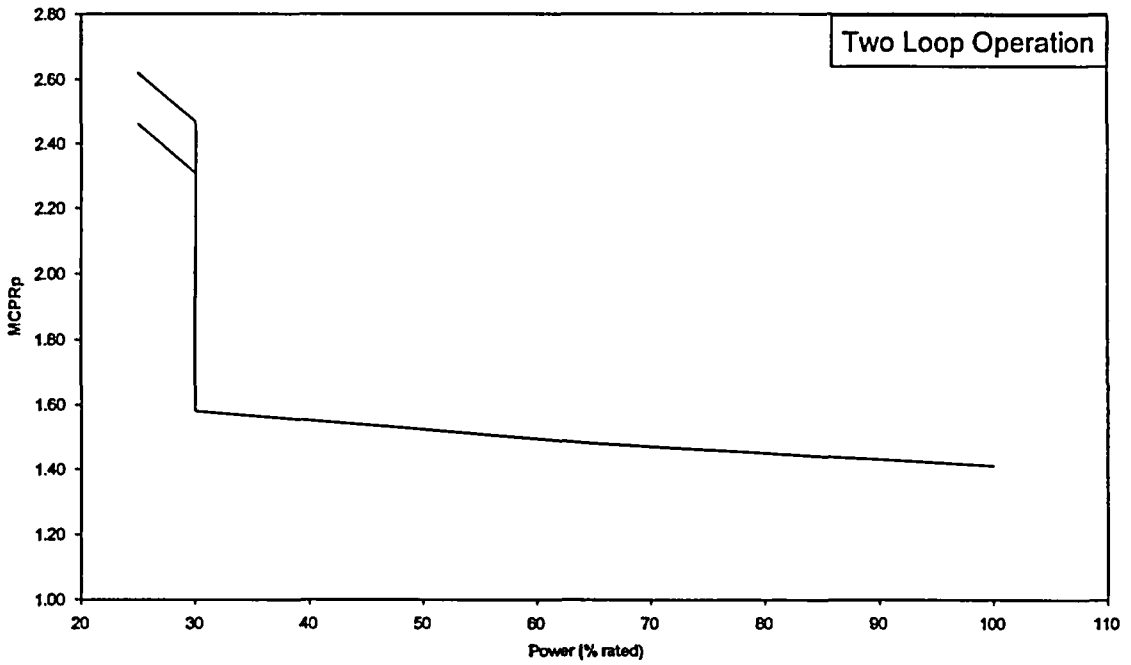
Figure 3.11



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.41	1.42
65	1.47	1.48
30	1.60	1.61
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, ATRIUM-10
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

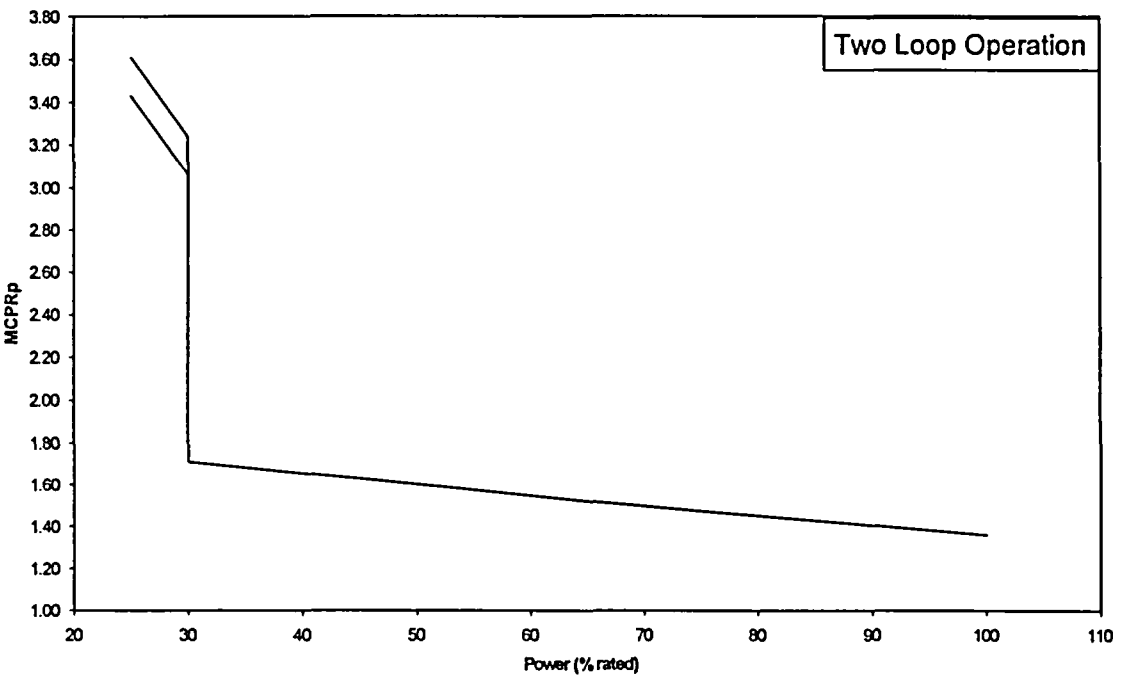
Figure 3.12



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.41	1.42
65	1.48	1.49
30	1.58	1.59
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, SVEA-96
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

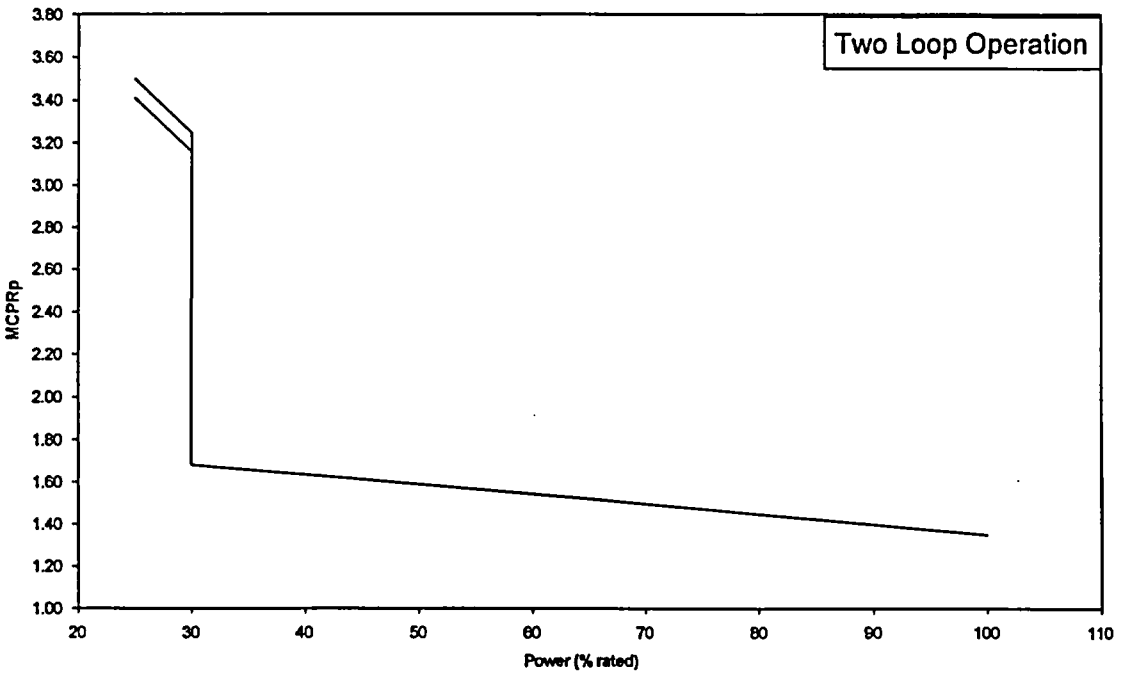
Figure 3.13



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.36	1.37
65	1.52	1.53
30	1.71	1.72
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, Turbine Bypass Inoperable, ATRIUM-10
Core Average Exposures < 28307 MWd/MTU

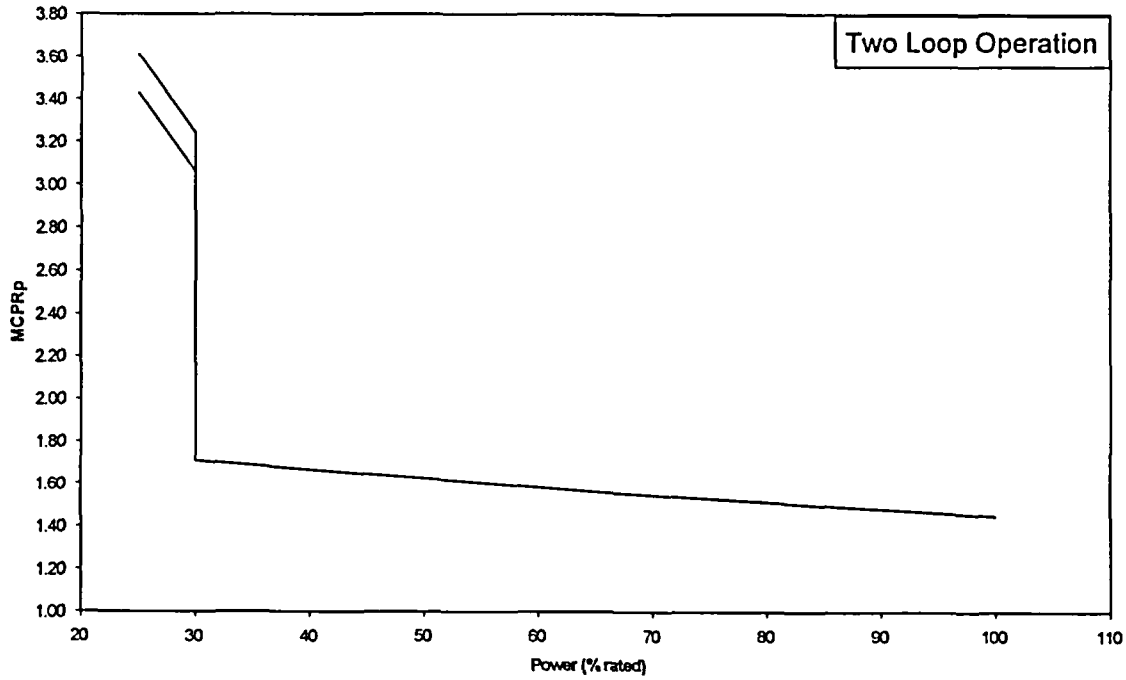
Figure 3.14



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.35	1.36
65	1.52	1.53
30	1.68	1.69
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, Turbine Bypass Inoperable, SVEA-96
Core Average Exposures < 28307 MWd/MTU

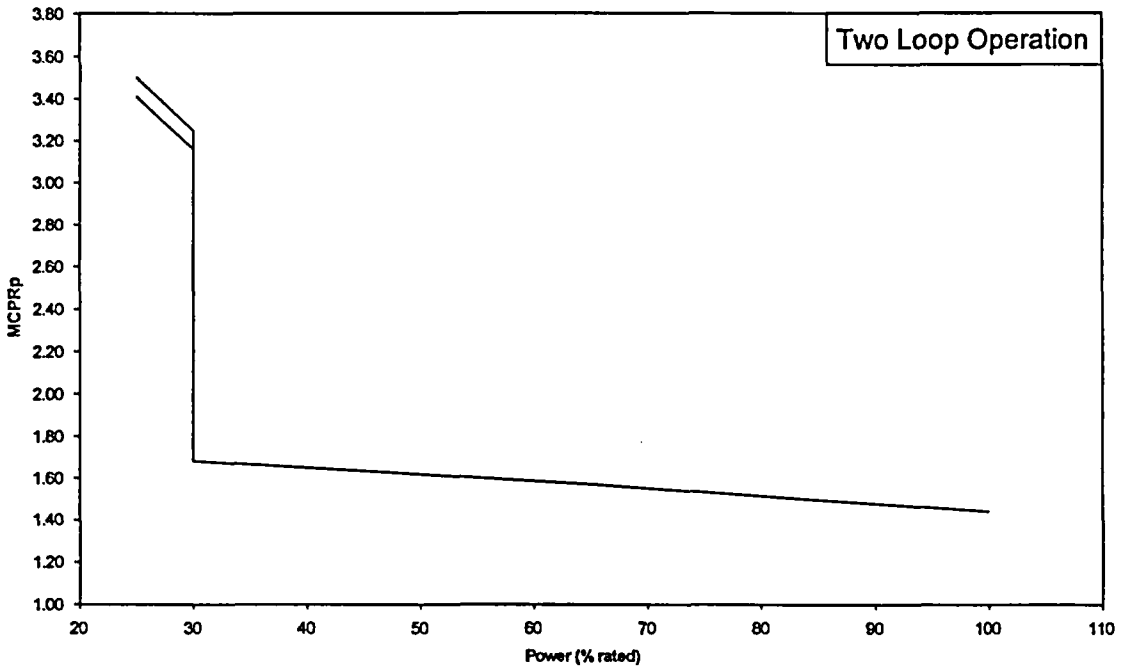
Figure 3.15



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.45	1.46
65	1.56	1.57
30	1.71	1.72
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, Turbine Bypass Inoperable, ATRIUM-10
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

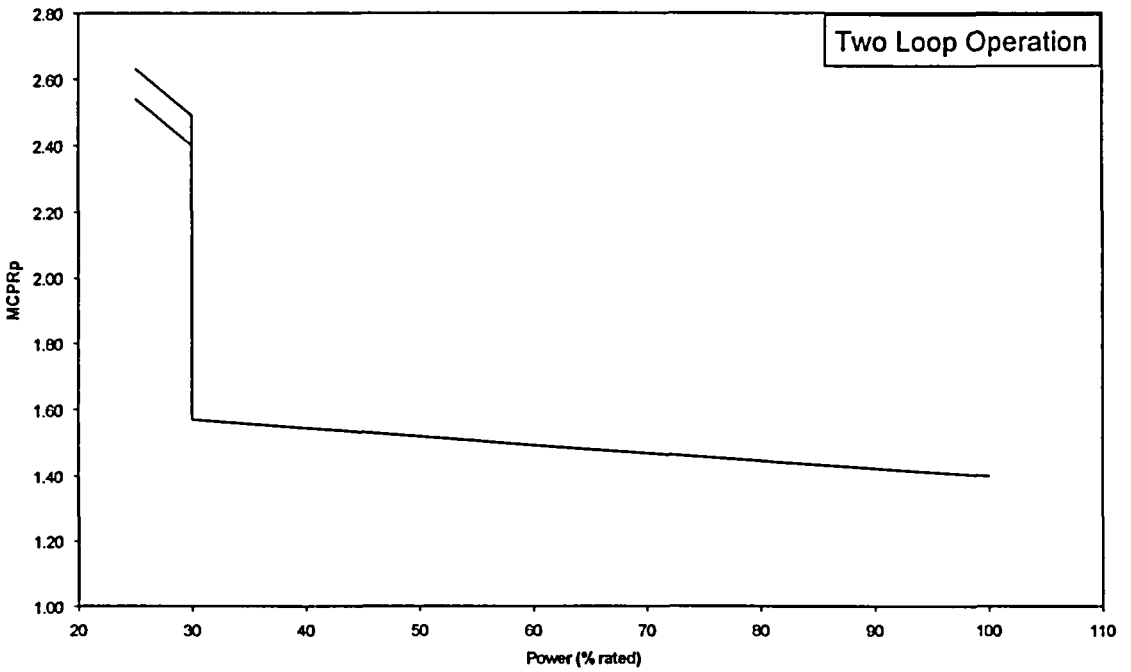
Figure 3.16



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.44	1.45
65	1.57	1.58
30	1.68	1.69
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, Turbine Bypass Inoperable, SVEA-96
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

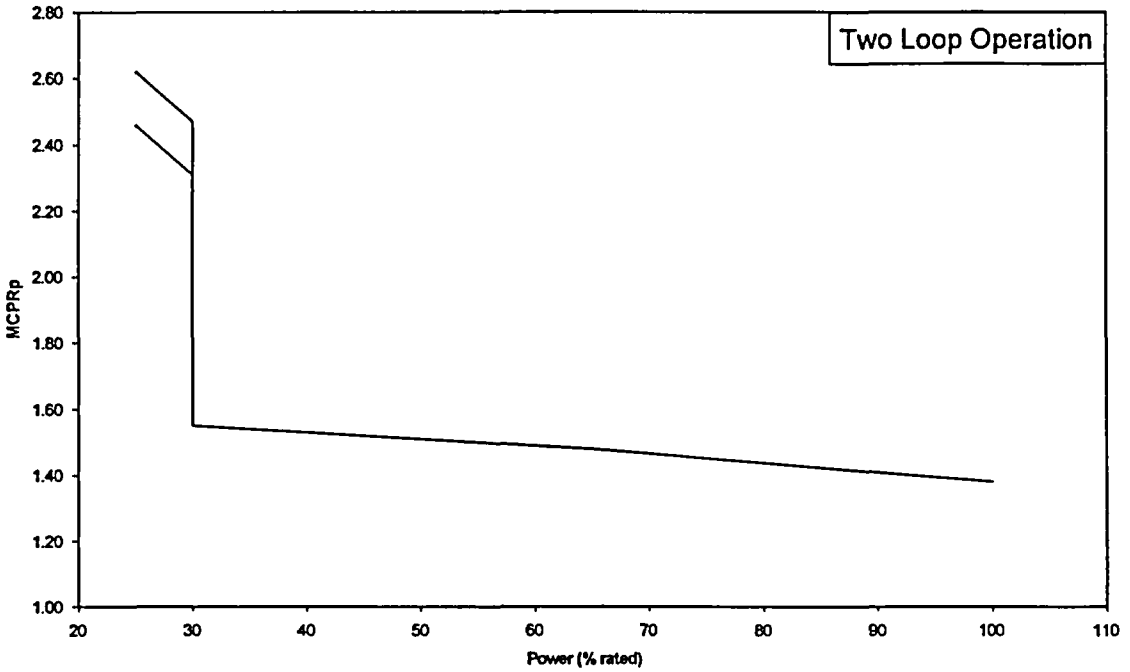
Figure 3.17



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.40	1.41
65	1.48	1.49
30	1.57	1.58
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, ATRIUM-10
FFTR/Coastdown Operation

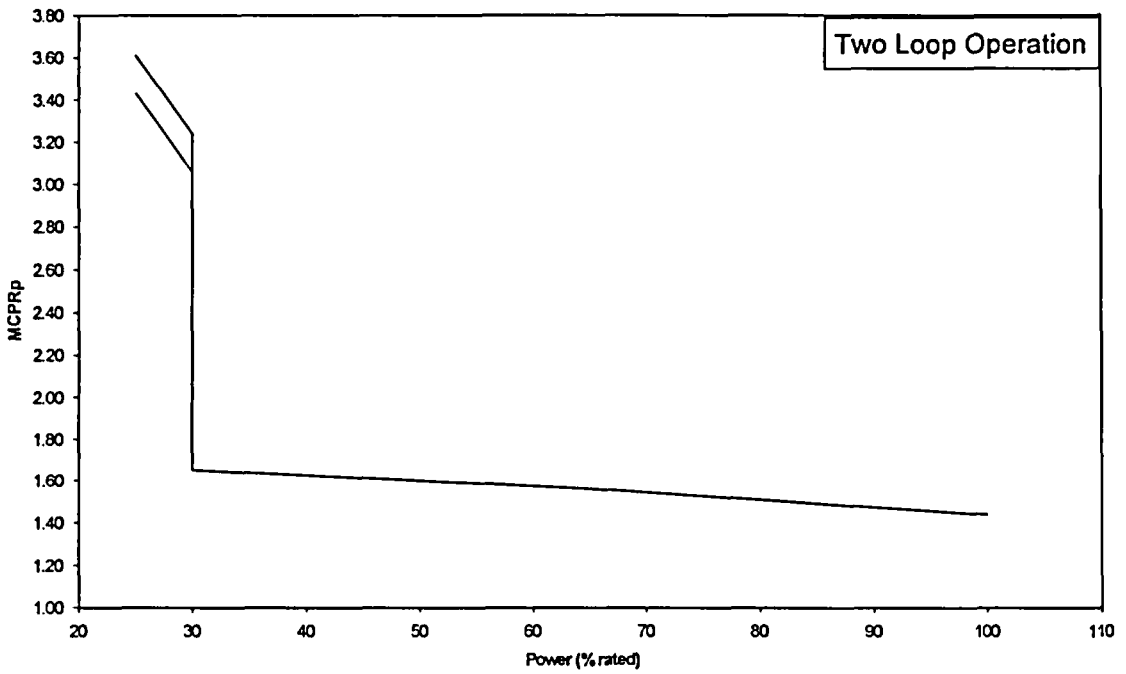
Figure 3.18



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.38	1.39
65	1.48	1.49
30	1.55	1.56
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, SVEA-96
FFTR/Coastdown Operation

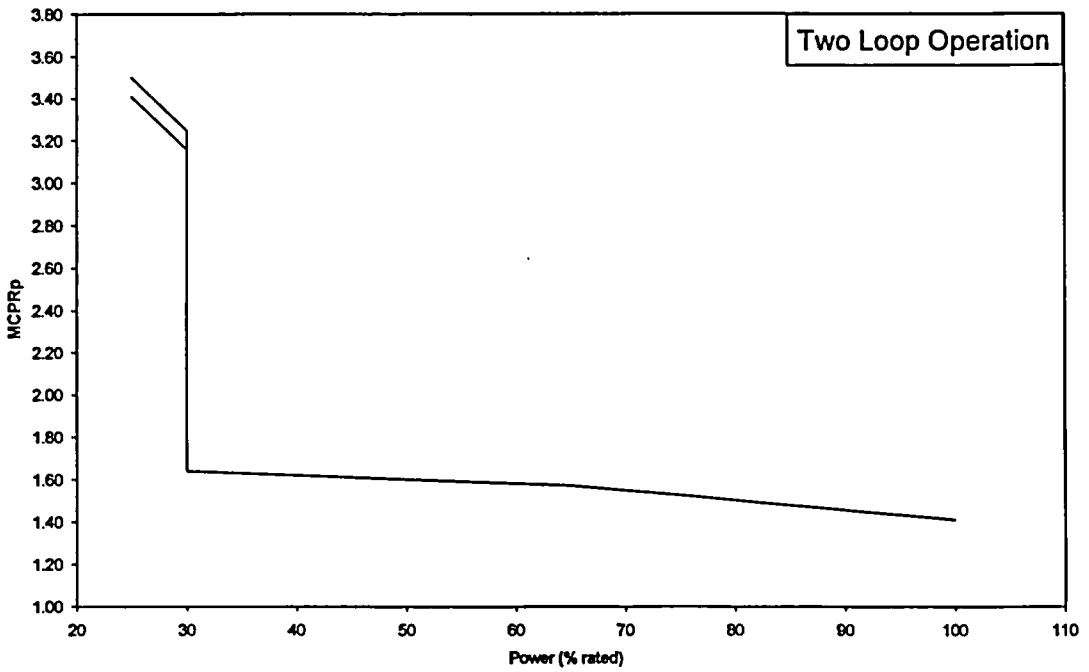
Figure 3.19



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.44	1.45
65	1.56	1.57
30	1.65	1.66
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, ATRIUM-10
FFTR/Coastdown Operation

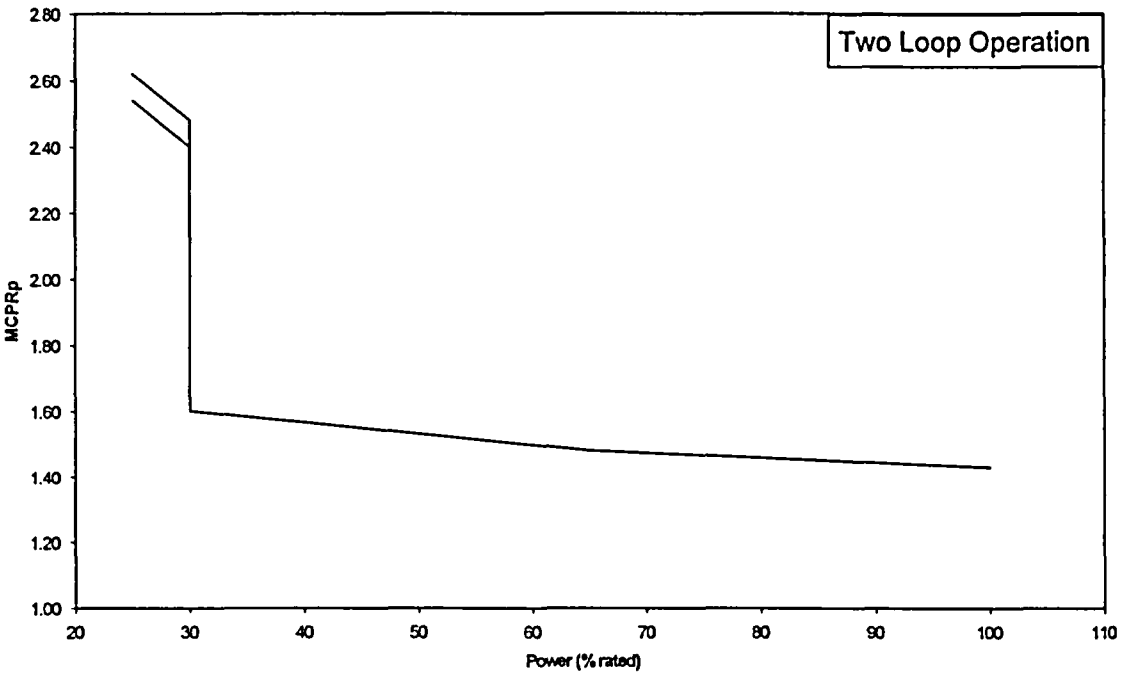
Figure 3.20



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.41	1.42
65	1.57	1.58
30	1.64	1.65
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, SVEA-96
FFTR/Coastdown Operation

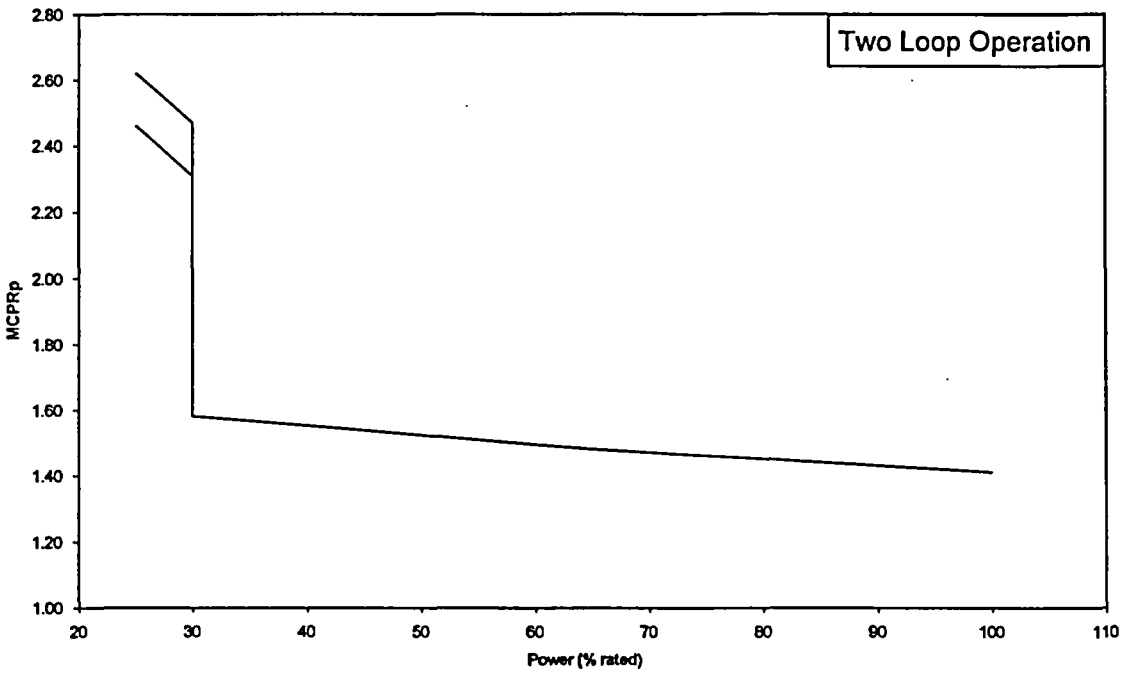
Figure 3.21



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.43	1.44
65	1.48	1.49
30	1.60	1.61
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, ATRIUM-10
FFTR/Coastdown Operation

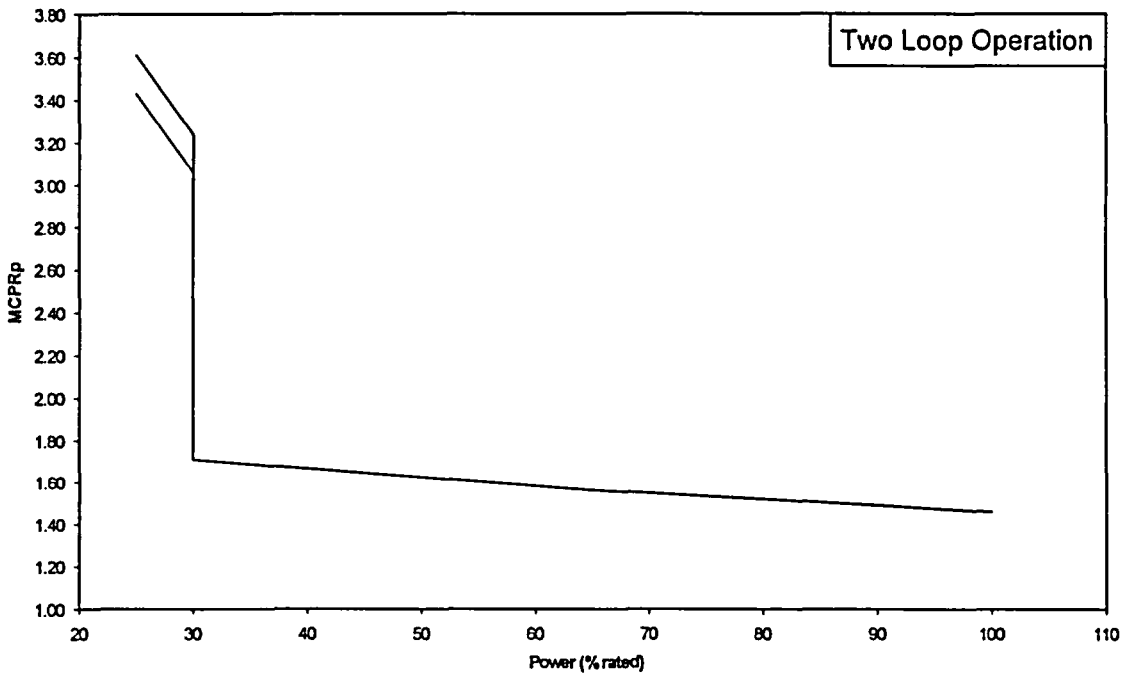
Figure 3.22



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.41	1.42
65	1.48	1.49
30	1.58	1.59
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, SVEA-96
FFTR/Coastdown Operation

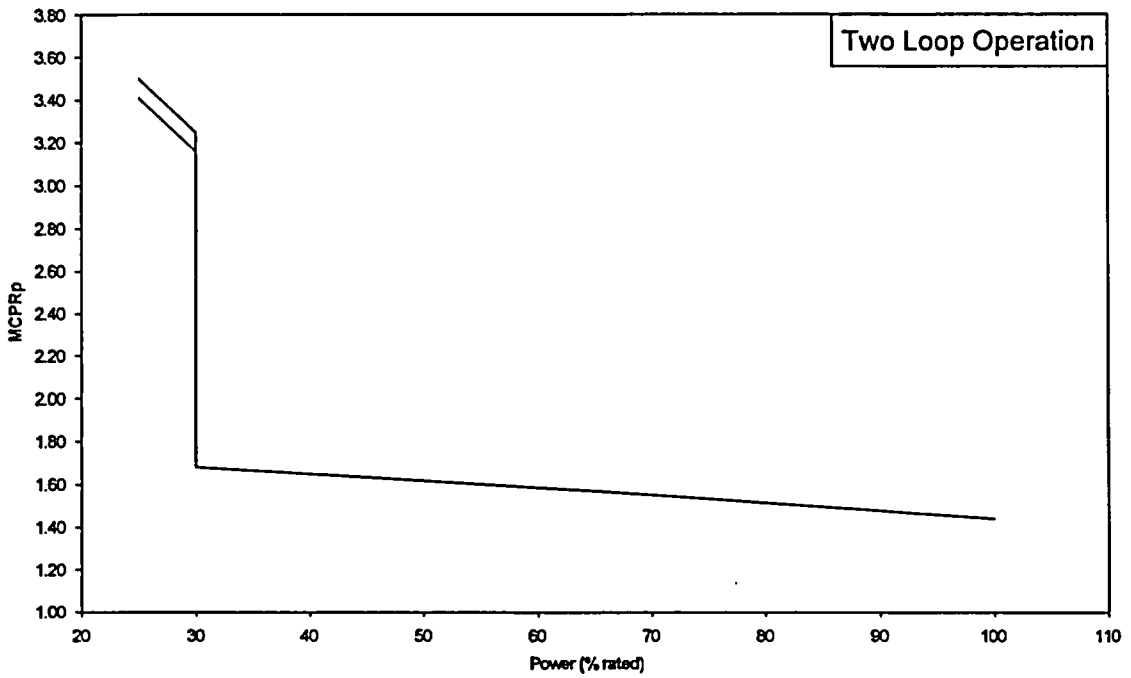
Figure 3.23



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.46	1.47
65	1.56	1.57
30	1.71	1.72
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, Turbine Bypass Inoperable, ATRIUM-10
FFTR/Coastdown Operation

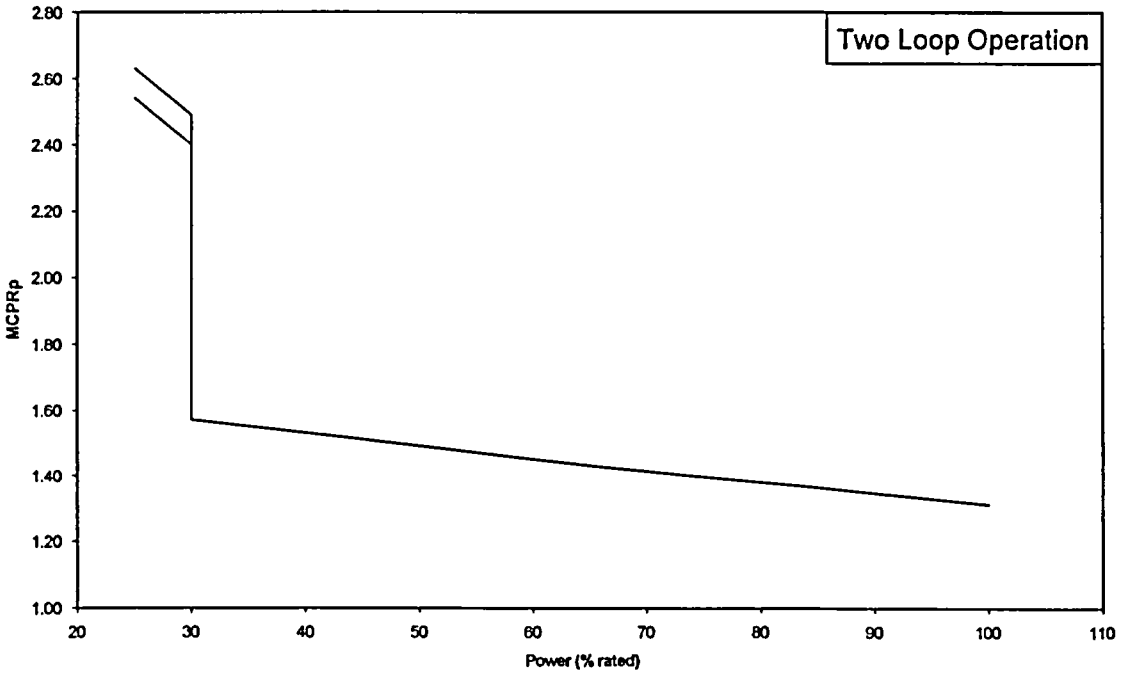
Figure 3.24



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.44	1.45
65	1.57	1.58
30	1.68	1.69
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, Turbine Bypass Inoperable, SVEA-96
FFTR/Coastdown Operation

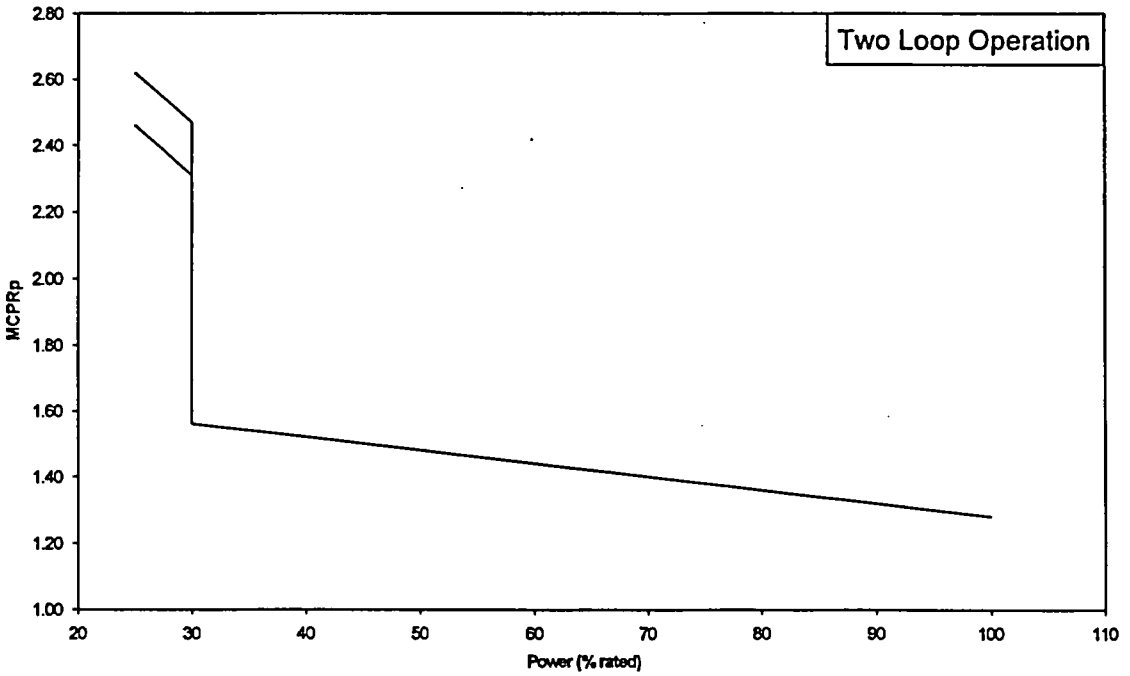
Figure 3.25



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.31	1.32
65	1.43	1.44
30	1.57	1.58
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, ATRIUM-10
Core Average Exposures < 28307 MWd/MTU

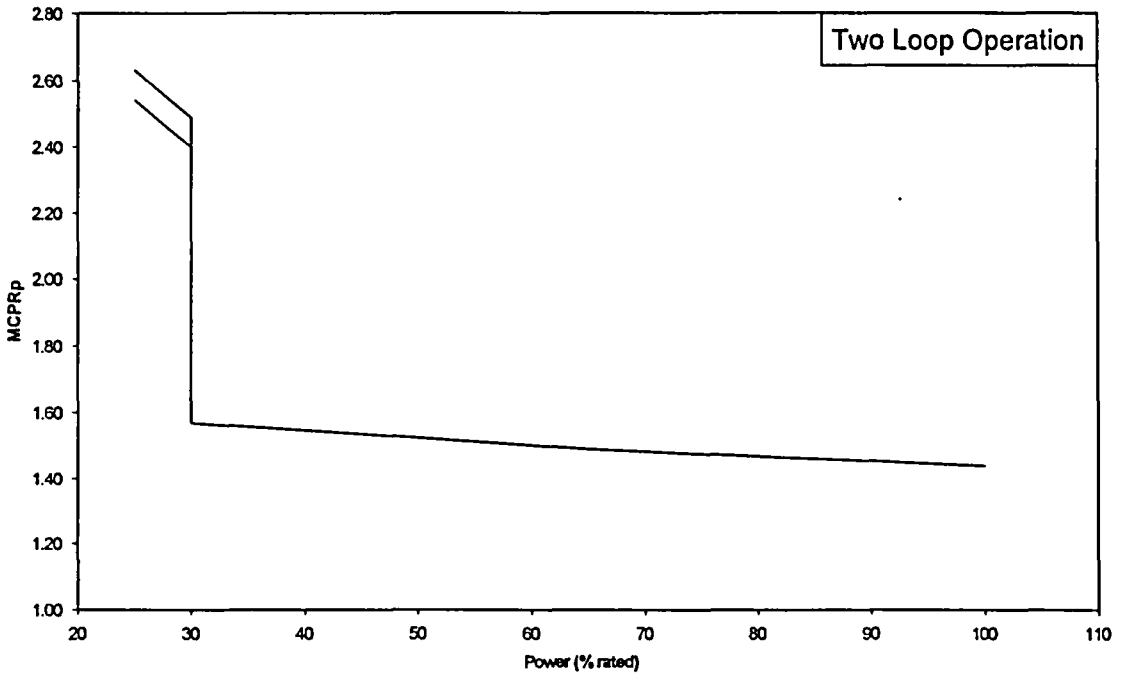
Figure 3.26



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.28	1.29
65	1.42	1.43
30	1.56	1.57
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, SVEA-96
Core Average Exposures < 28307 MWd/MTU

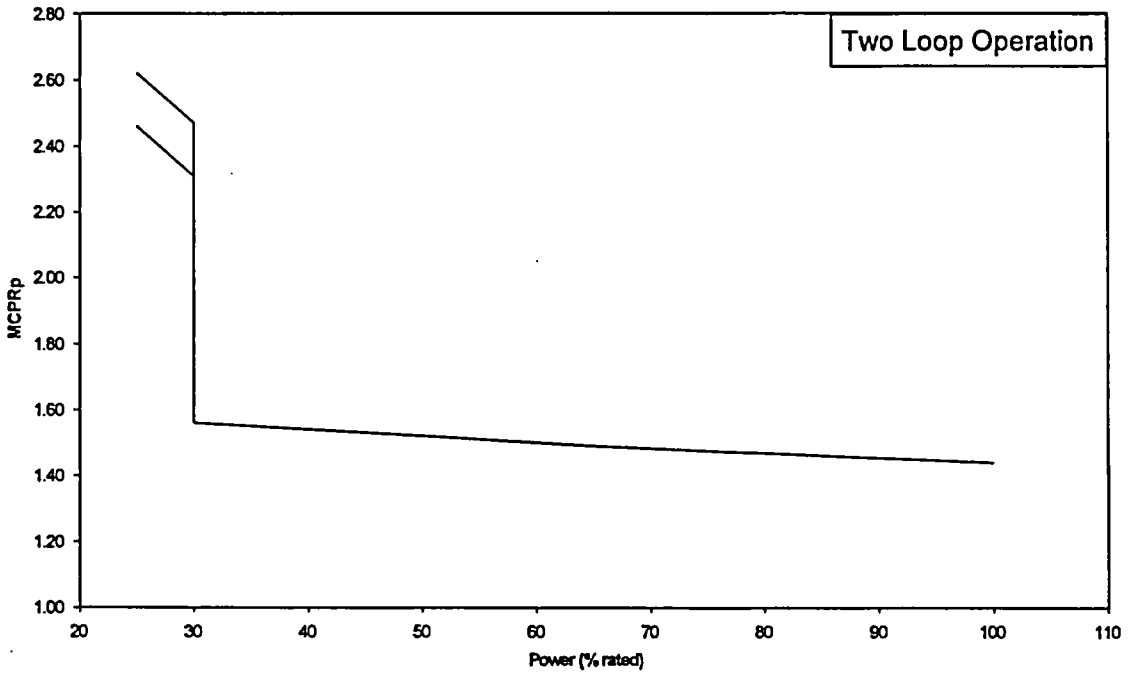
Figure 3.27



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.44	1.45
65	1.49	1.50
30	1.57	1.58
30 at ≤ 50% flow	2.40	2.41
25 at ≤ 50% flow	2.54	2.55
30 at > 50% flow	2.49	2.50
25 at > 50% flow	2.63	2.64

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, ATRIUM-10
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

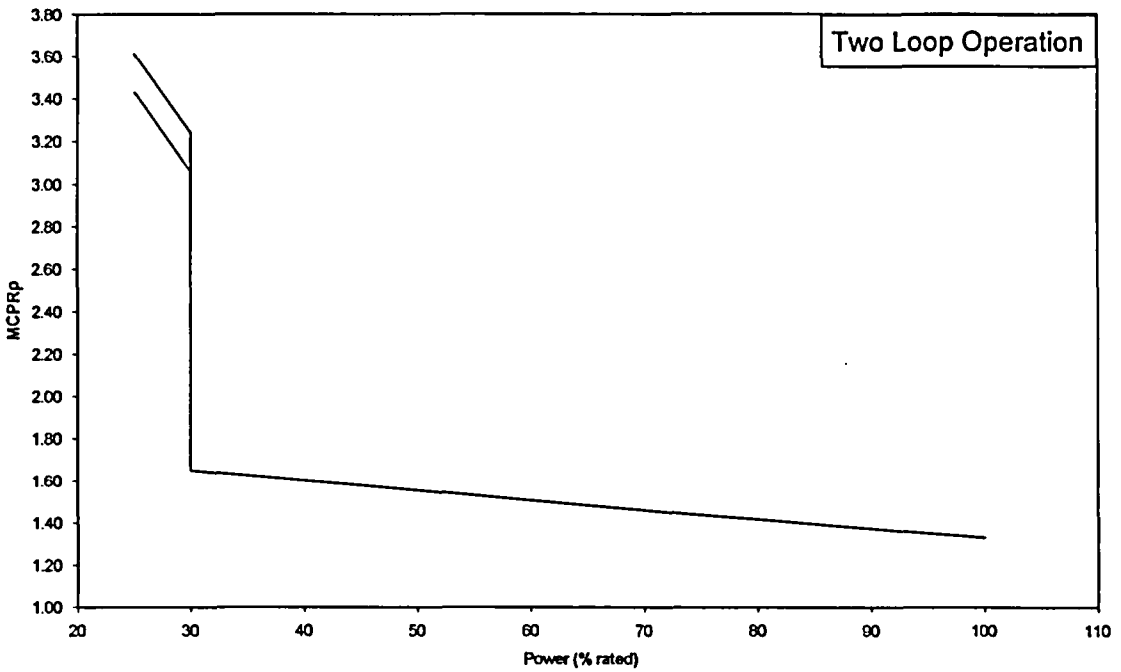
Figure 3.28



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.44	1.45
65	1.49	1.50
30	1.56	1.57
30 at ≤ 50% flow	2.31	2.32
25 at ≤ 50% flow	2.46	2.47
30 at > 50% flow	2.47	2.48
25 at > 50% flow	2.62	2.63

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, SVEA-96
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

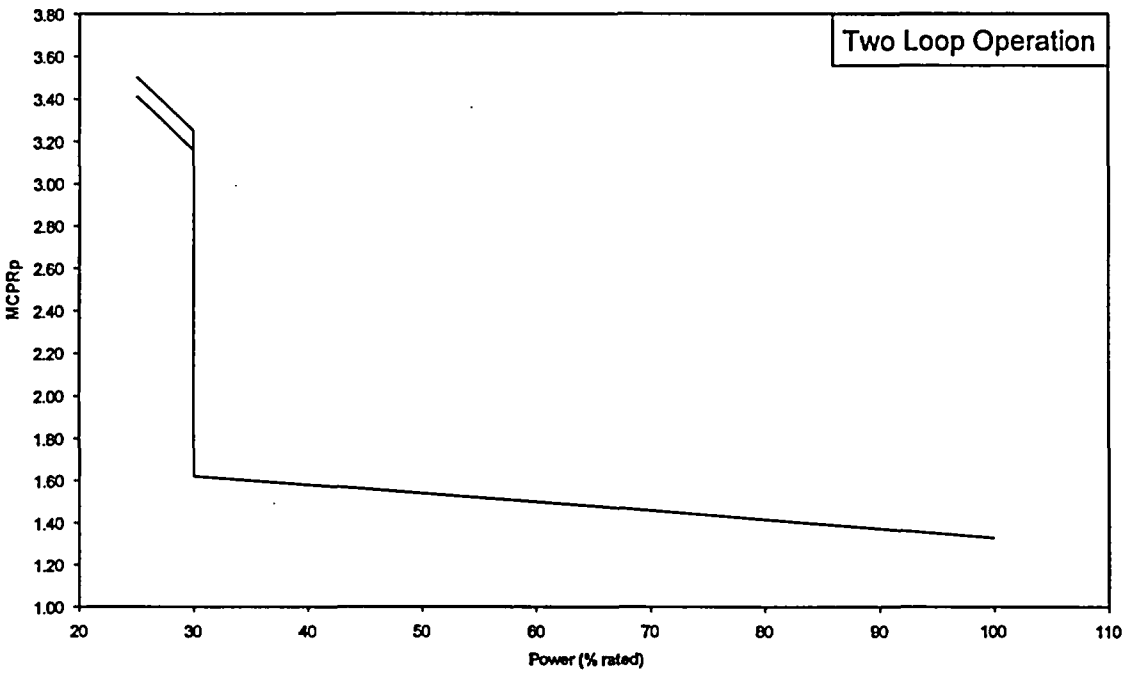
Figure 3.29



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.33	1.34
65	1.48	1.49
30	1.65	1.66
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Inoperable, ATRIUM-10
Core Average Exposures < 28307 MWd/MTU

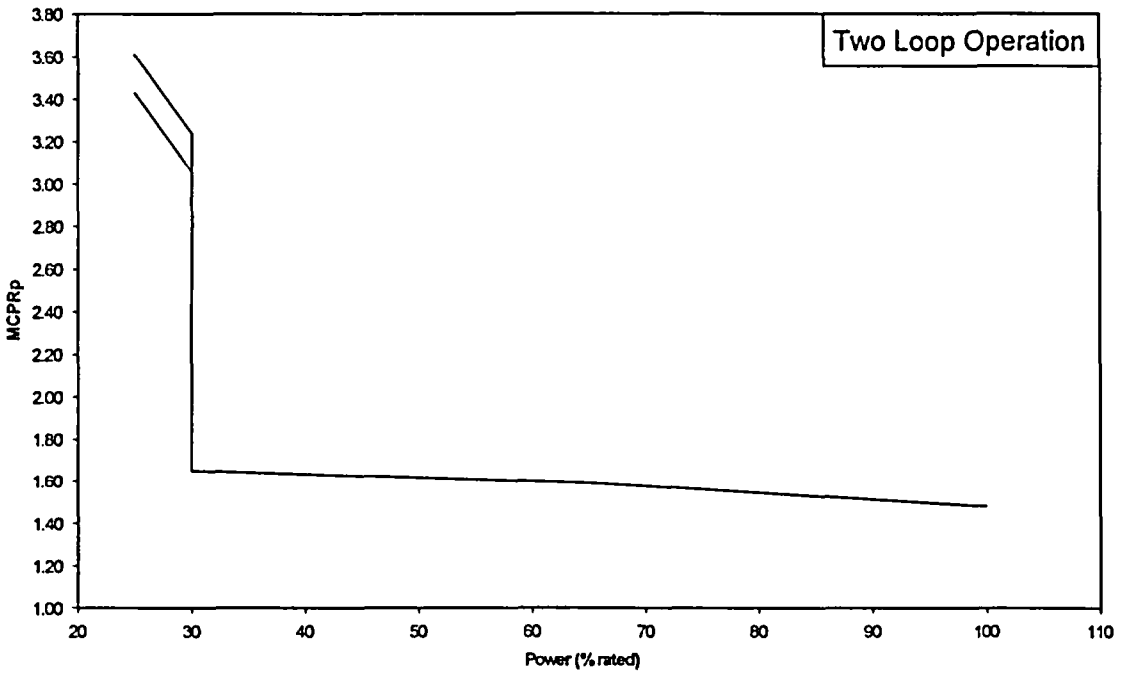
Figure 3.30



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.33	1.34
65	1.48	1.49
30	1.62	1.63
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Inoperable, SVEA-96
Core Average Exposures < 28307 MWd/MTU

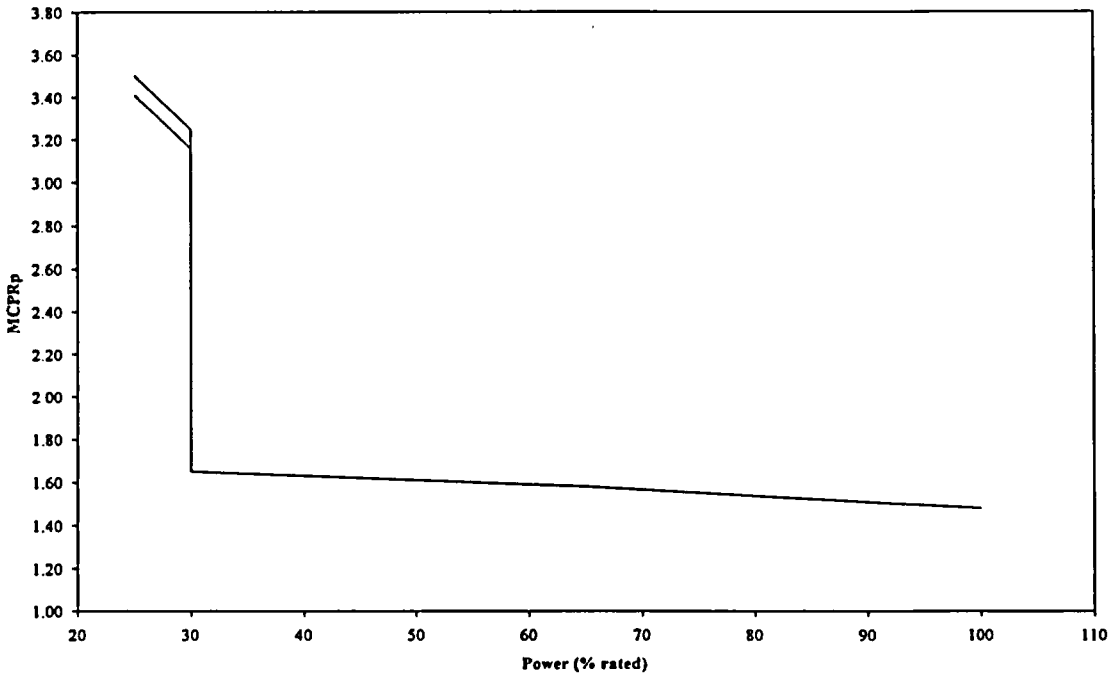
Figure 3.31



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.48	1.49
65	1.59	1.60
30	1.65	1.66
30 at ≤ 50% flow	3.06	3.07
25 at ≤ 50% flow	3.43	3.44
30 at > 50% flow	3.24	3.25
25 at > 50% flow	3.61	3.62

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Inoperable, ATRIUM-10
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

Figure 3.32



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.48	1.49
65	1.58	1.59
30	1.65	1.66
30 at ≤ 50% flow	3.16	3.17
25 at ≤ 50% flow	3.41	3.42
30 at > 50% flow	3.25	3.26
25 at > 50% flow	3.50	3.51

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Inoperable, SVEA-96
28307 MWd/MTU ≤ Core Average Exposures ≤ 32203 MWd/MTU

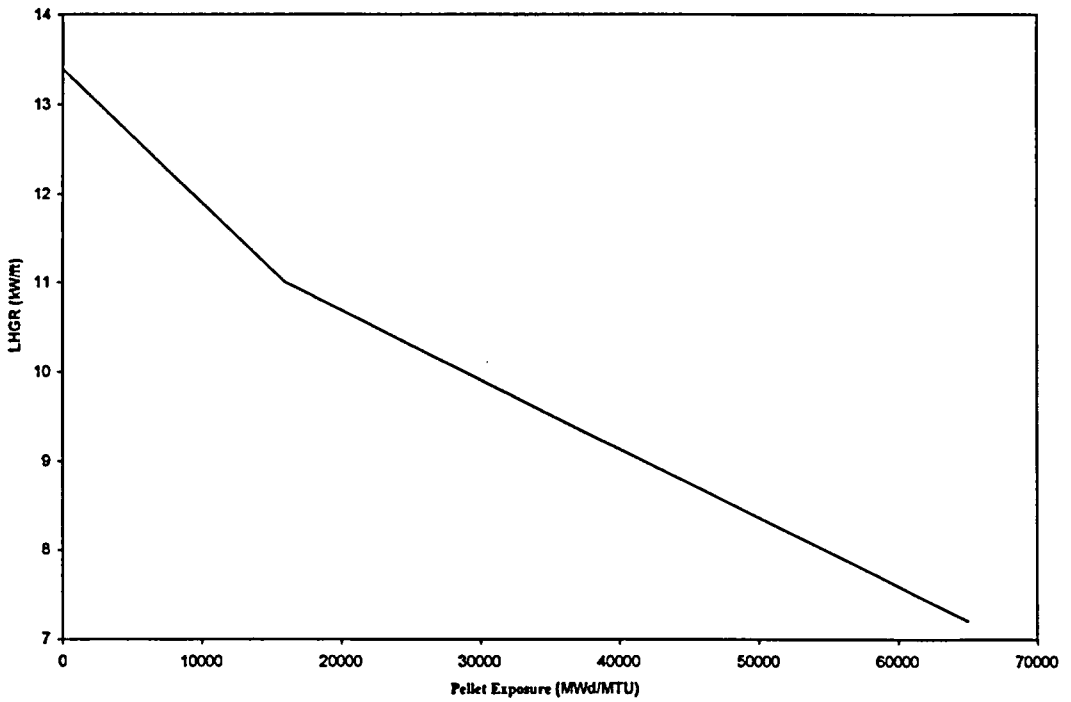
Figure 3.33

4.0 Linear Heat Generation Rate (LHGR) Limits for Use in Technical Specification 3.2.3

The LHGRs for use in Technical Specification 3.2.3 are given as a function of Average Planar Exposure for ATRIUM-10 and as a function of nodal pellet exposure for SVEA-96. The LHGRs shall not exceed the limits shown in the following figures:

a. Figure 4.1 – SVEA-96 reload fuel

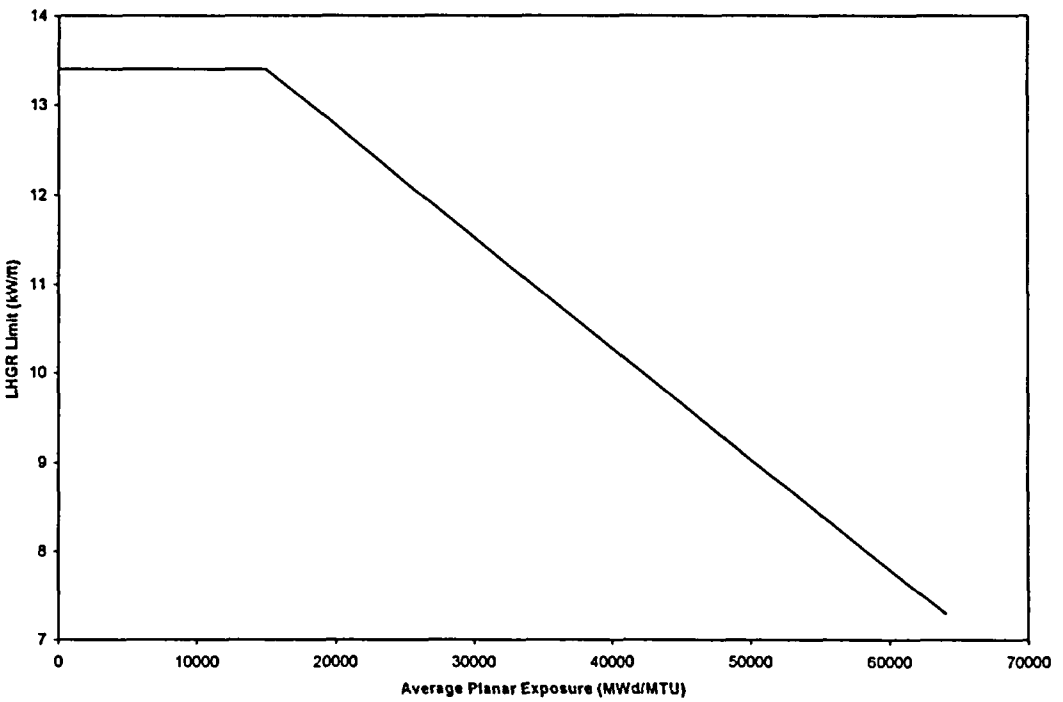
b. Figure 4.2 – ATRIUM-10 reload fuel



Pellet Exposure (MWd/MTU)	LHGR (kW/ft)
0	13.4
16000	11.0
65000	7.2

Linear Heat Generation Rate (LHGR)
Versus Pellet Exposure
SVEA-96

Figure 4.1



Average Planar Exposure (MWd/MTU)	LHGR (kW/ft)
0	13.4
15000	13.4
64000	7.3

Linear Heat Generation Rate (LHGR)
Versus Average Planar Exposure
ATRIUM-10

Figure 4.2

5.0 Oscillation Power Range Monitor (OPRM) Instrumentation Limits for Use in LCO 3.3.1.3

The OPRM instrumentation limits for use in LCO 3.3.1.3 shall not exceed the following:

Function	Trip Setpoint
Period Based Detection Algorithm (PBDA)	
Amplitude Setpoint: Sp	1.09 Peak/Average
Confirmation Count Setpoint: N2	12

6.0 References

6.1 CE NPSD-883-P, Revision 0, "COLUMBIA Cycle 16 Reload Licensing Report," Westinghouse CE Nuclear Power LLC, March 2001.

6.2 CE NPSD-801-P, Revision 5, "WNP-2 LOCA Analysis Report," Westinghouse CE Nuclear Power LLC, February 2001.

6.3 EMF-2863 Revision 1, "Columbia Generating Station Cycle 17 Reload Analysis," Framatome ANP, September 2003.

6.4 EMF-2841(P) Revision 1, "Columbia Generating Station LOCA-ECCS Analysis MAPLHGR Limit for ATRIUM™-10 Fuel," Framatome ANP, March 2003.

6.5 NE-02-00-03, Revision 0, "Oscillation Power Range Monitor (OPRM) Trip Setpoints," Energy Northwest, June 7, 2000.

6.6 CE NPSD-792-P, "Fuel Assembly Mechanical Design Report for WNP2," ABB Combustion Engineering Nuclear Operations, May 1996.