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GO2-07-089

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: **COLUMBIA GENERATING STATION, DOCKET NO. 50-397**
CYCLE 19 CORE OPERATING LIMITS REPORT (COLR), REVISION 0

Dear Sir or Madam:

In accordance with the Columbia Generating Station Technical Specifications (TS) 5.6.3.d, Energy Northwest herewith submits the Cycle 19 COLR, Revision 0. 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 by the Columbia Generating Station Plant Operations Committee.

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

Respectfully,

D. W. Coleman

DW Coleman
Manager, Regulatory Programs

Attachment: COLR 07-19, Revision 0

cc: BS Mallett – NRC RIV
CF Lyon – NRC NRR
NRC Sr. Resident Inspector – 988C (2)
WA Horin – Winston & Strawn
RN Sherman – BPA/1399

A001
NRR

Columbia Generating Station

Cycle 19

Core Operating Limits Report

May 2007

Columbia Generating Station
Cycle 19
Core Operating Limits Report

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Columbia Generating Station
Cycle 19
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 19 as required by Technical Specification 5.6.3. As required by Technical Specification 5.6.3, 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 APLHGR and LHGR limits for ATRIUM-10 fuel given in this report are documented in Reference 6.3. The MCPR limits for all Cycle 19 fuel types (SVEA-96 as well as ATRIUM-10 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%.

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 3, *The Loss of Feedwater Heating Transient in Boiling Water Reactors*, Framatome ANP, September 2005.

13. EMF-2209(P)(A) Revision 2, *SPCB Critical Power Correlation*, Siemens Power Corporation, September 2003.

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.

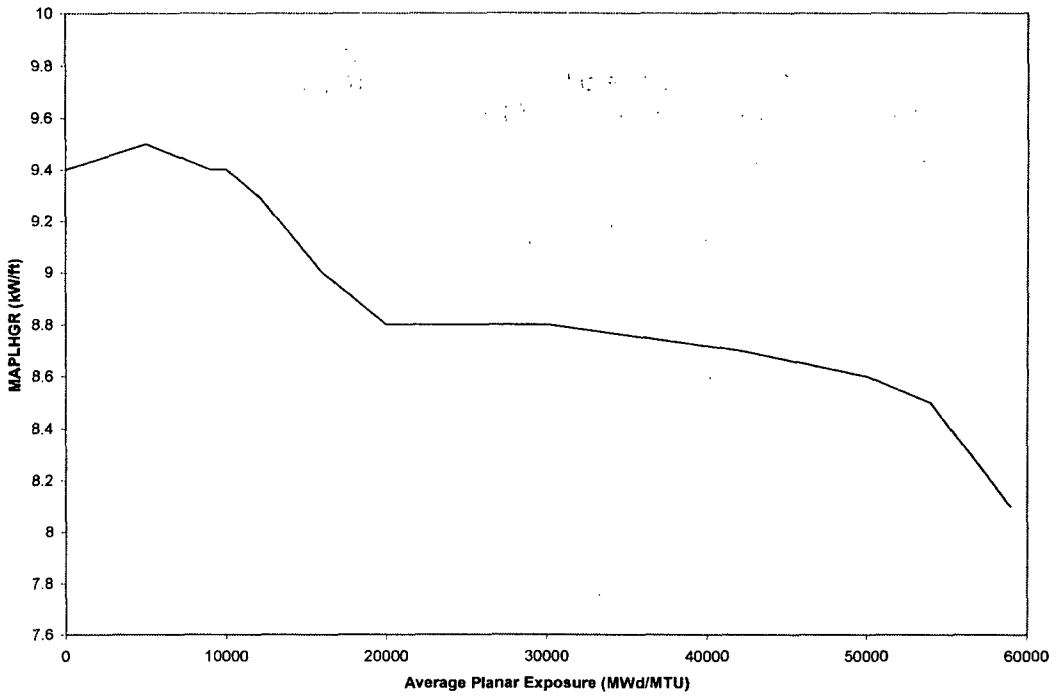
2.0 Average Planar Linear Heat Generation Rate (APLHGR) Limits for Use in Technical Specification 3.2.1

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 – SE- and SF-Type SVEA-96 reload fuel – Two Loop Operation

b. Figure 2.2 – SE- and SF-Type SVEA-96 reload fuel – Single Loop Operation

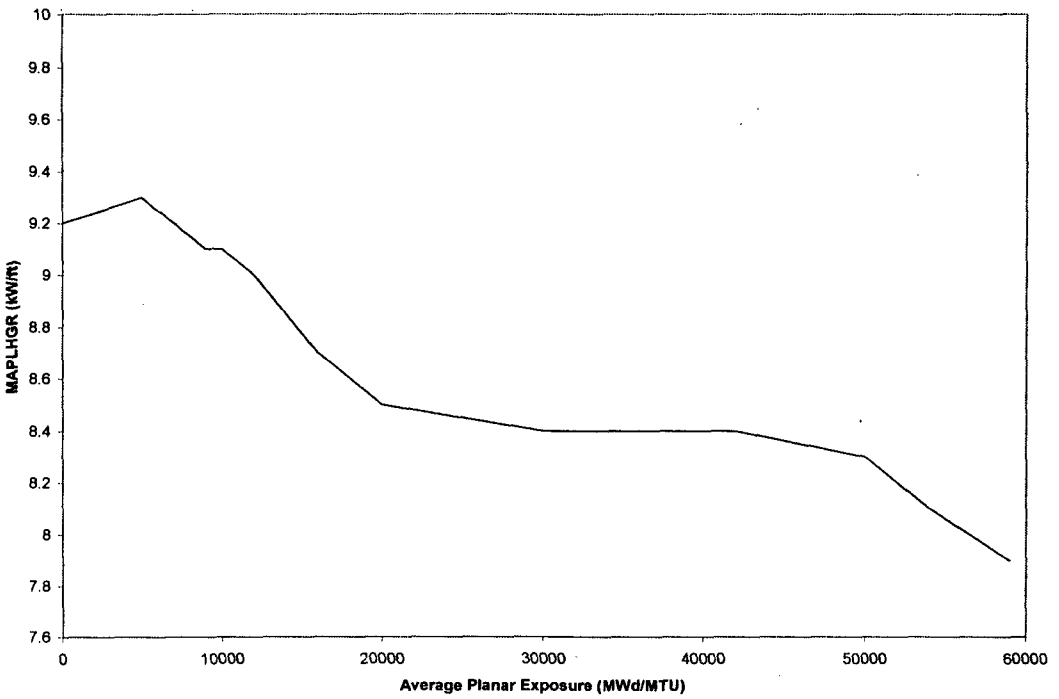
c. Figure 2.3– ATRIUM-10 reload fuel



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

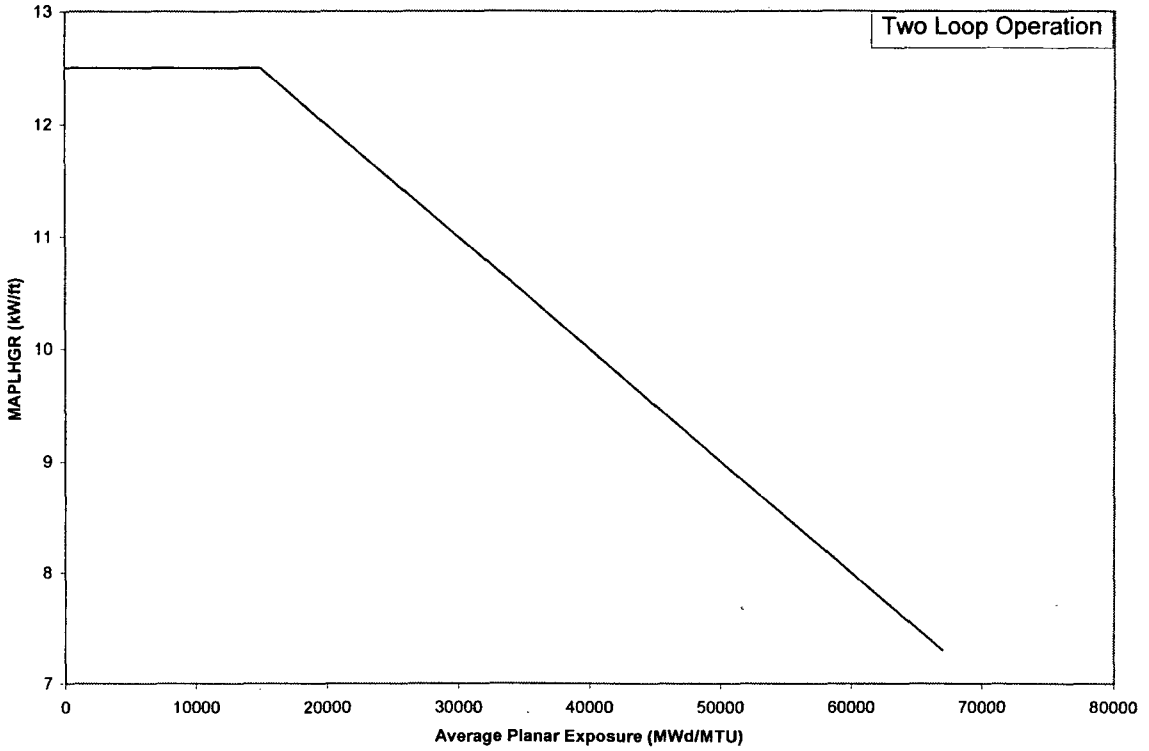
Figure 2.1



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 2.2



Average Planar Exposure (MWd/MTU)	TLO MAPLHGR (kW/ft)	SLO MAPLHGR (kW/ft)
0	12.5	11.2
15000	12.5	11.2
67000	7.3	6.5

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

Figure 2.3

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 3.17. 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 19 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 < 31891 MWd/MTU

EOOS Condition	Limit	SLMCPR = 1.09[2]
		All Cycle 19 Fuel Types
NSS[1]	Full power	1.31[3]
	Flow dependent[5]	Figure 3.1
	Power dependent[4]	Figure 3.2
TSSS[1]	Full power	1.34
	Flow dependent[5]	Figure 3.1
	Power dependent[4]	Figure 3.6
NSS[1] RPT Inoperable	Full power	1.33
	Flow dependent[5]	Figure 3.1
	Power dependent[4]	Figure 3.14

Table 3.1b

Columbia Generating Station MCPR Operating Limits
Two-Loop Operation
Core Average Exposures ≥ 31891 MWd/MTU

EOOS Condition	Limit	SLMCPR = 1.09[2]	SLMCPR = 1.09[2]
		Core Average Exposures ≤ 34433 MWd/MTU	FFTR/Coastdown[6] Extended Core Average Exposures ≤ 37561 MWd/MTU
		All Cycle 19 Fuel Types	All Cycle 19 Fuel Types
NSS[1]	Full power	1.35	1.36
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.3	Figure 3.10
TSSS[1]	Full power	1.38	1.39
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.7	Figure 3.12
NSS[1] RPT Inoperable	Full power	1.38	Not analyzed
	Flow dependent[5]	Figure 3.1	
	Power dependent[4]	Figure 3.15	

Table 3.2a

Columbia Generating Station MCPR Operating Limits
Two-Loop Operation
Turbine Bypass System Inoperable
Core Average Exposures < 31891 MWd/MTU

EOOS Condition	Limit	SLMCPR = 1.09[2]
		All Cycle 19 Fuel Types
NSS[1]	Full power	1.35
	Flow dependent[5]	Figure 3.1
	Power dependent[4]	Figure 3.4
TSSS[1]	Full power	1.39
	Flow dependent[5]	Figure 3.1
	Power dependent[4]	Figure 3.8
NSS[1] RPT Inoperable	Full power	1.38
	Flow dependent[5]	Figure 3.1
	Power dependent[4]	Figure 3.16

Table 3.2b

Columbia Generating Station MCPR Operating Limits
Two-Loop Operation
Turbine Bypass System Inoperable
Core Average Exposures ≥ 31891 MWd/MTU

EOOS Condition	Limit	SLMCPR = 1.09[2]	SLMCPR = 1.09[2]
		Core Average Exposures ≤ 34433 MWd/MTU	FFTR/Coastdown[6] Extended Core Average Exposures ≤ 37561 MWd/MTU
		All Cycle 19 Fuel Types	All Cycle 19 Fuel Types
NSS[1]	Full power	1.39	1.41
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.5	Figure 3.11
TSSS[1]	Full power	1.42	1.43
	Flow dependent[5]	Figure 3.1	Figure 3.1
	Power dependent[4]	Figure 3.9	Figure 3.13
NSS[1] RPT Inoperable	Full power	1.42	Not analyzed
	Flow dependent[5]	Figure 3.1	
	Power dependent[4]	Figure 3.17	

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 AREVA NP 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

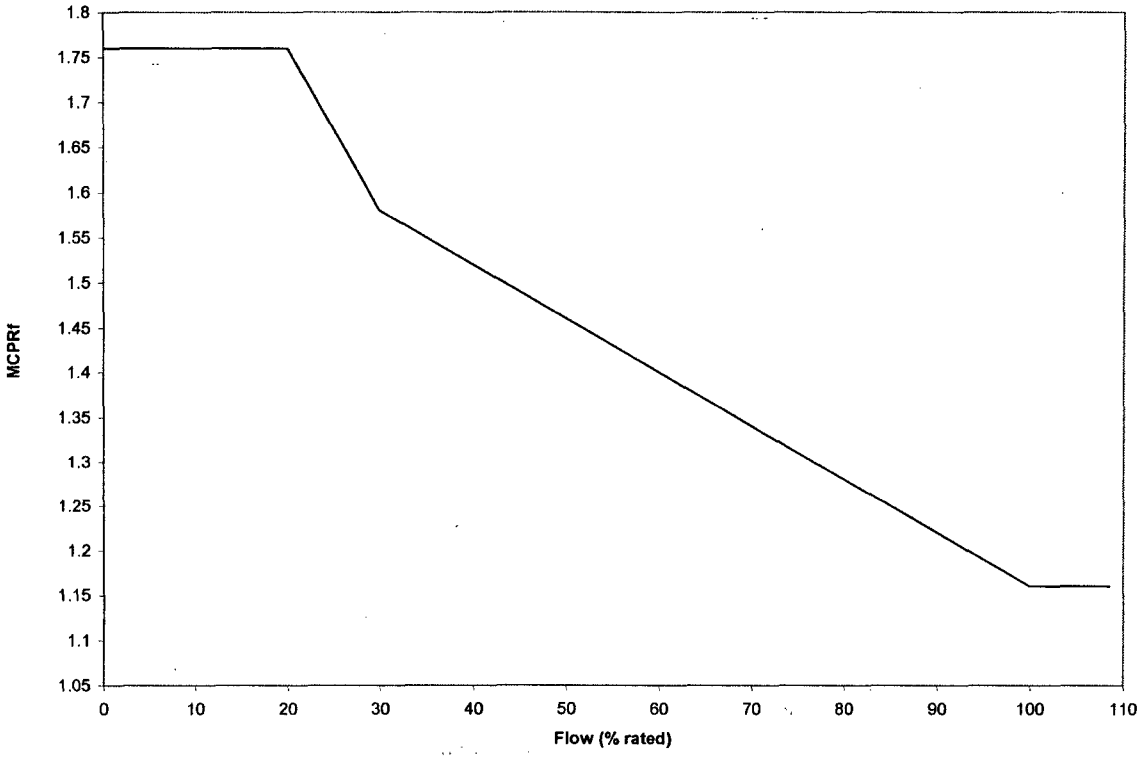
Note 2: For Single Loop Operation (SLO), the SLMCPR increases by 0.01. This 0.01 increase must also be applied to the Two Loop Operation $MCPR_p$ Operating Limit to obtain the SLO operating limit.

Note 3: The Cycle 19 MCPR limits were established assuming a Rod Block Monitor (RBM) setpoint of 1.06. With a 1.06 RBM setpoint, the Rod Withdrawal Error (RWE) event is not limiting. The RWE event remains nonlimiting as long as the RBM setpoint is ≤ 1.07.

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 scrams on turbine throttle valve closure and turbine governor valve fast closure are 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.

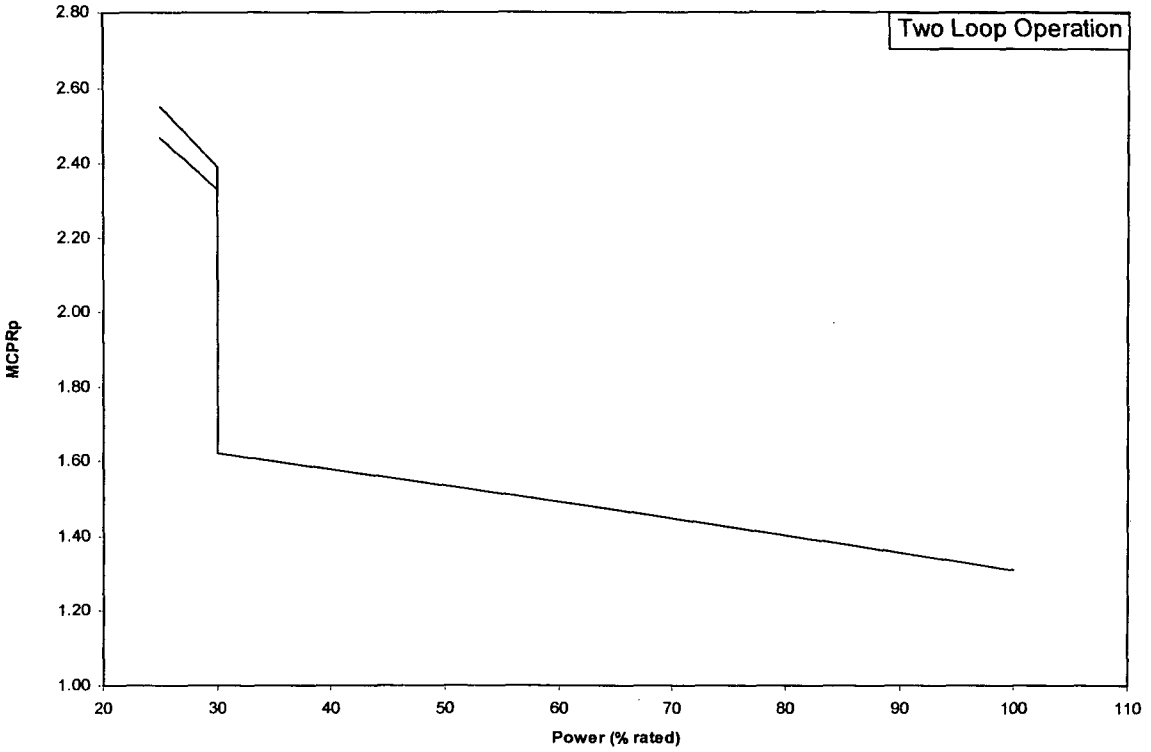
Note 6: The NSS FFTR/Coastdown limits support a feedwater temperature reduction down to 355°F or 35°F below nominal, whichever is lower. The NSS with turbine bypass inoperable and all TSSS FFTR/Coastdown limits support a feedwater temperature reduction down to 355°F or 20°F below nominal, whichever is lower.



Flow (% of rated)	$MCPR_f$ All Cycle 19 Fuel Types
0	1.76
20	1.76
30	1.58
100	1.16
108.5	1.16

Reduced Flow MCPR Operating Limit Versus Total Core Flow
All Cycle 19 Fuel Types

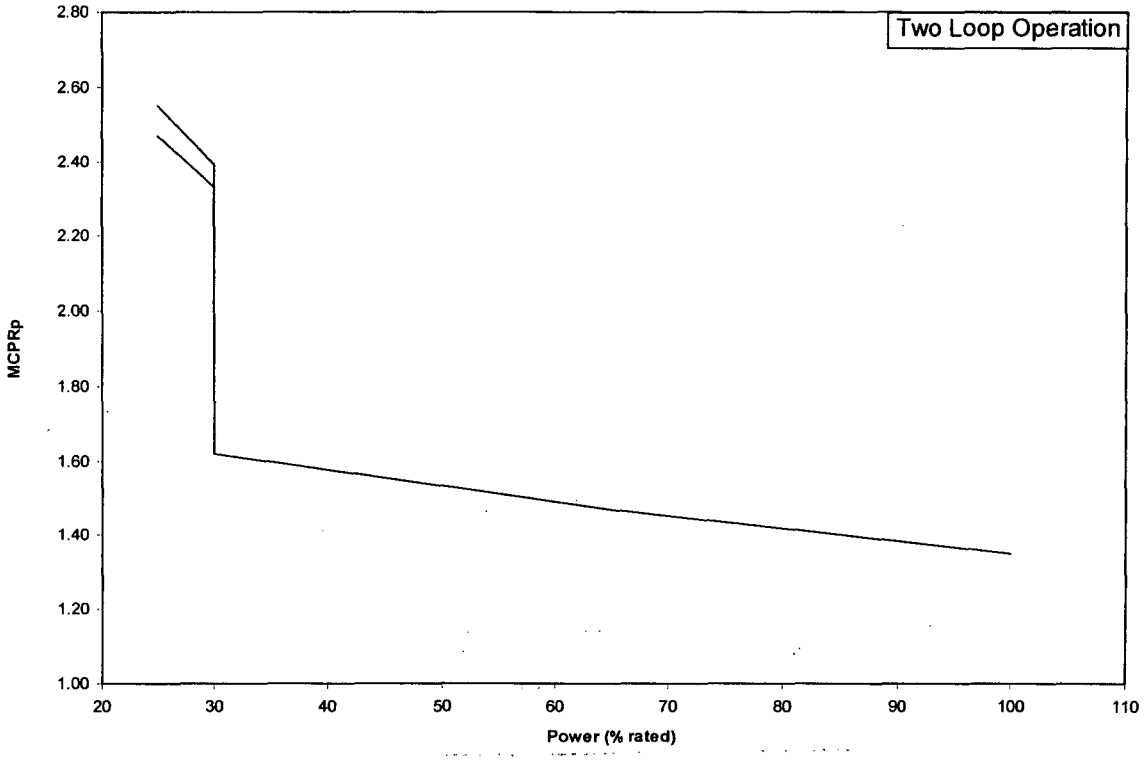
Figure 3.1



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.31	1.32
65	1.47	1.48
30	1.62	1.63
30 at ≤ 50% flow	2.33	2.34
25 at ≤ 50% flow	2.47	2.48
30 at > 50% flow	2.39	2.40
25 at > 50% flow	2.55	2.56

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, All Cycle 19 Fuel Types
Core Average Exposures < 31891 MWd/MTU

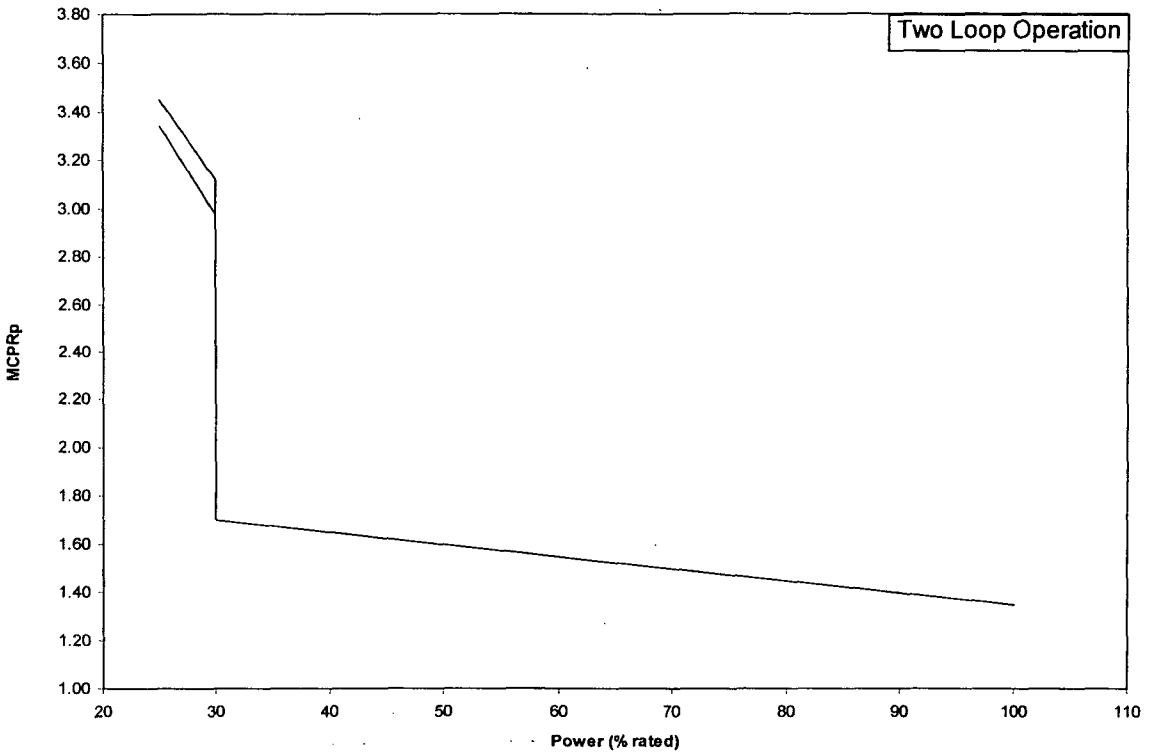
Figure 3.2



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.35	1.36
65	1.47	1.48
30	1.62	1.63
30 at ≤ 50% flow	2.33	2.34
25 at ≤ 50% flow	2.47	2.48
30 at > 50% flow	2.39	2.40
25 at > 50% flow	2.55	2.56

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, All Cycle 19 Fuel Types
31891 MWd/MTU ≤ Core Average Exposures ≤ 34433 MWd/MTU

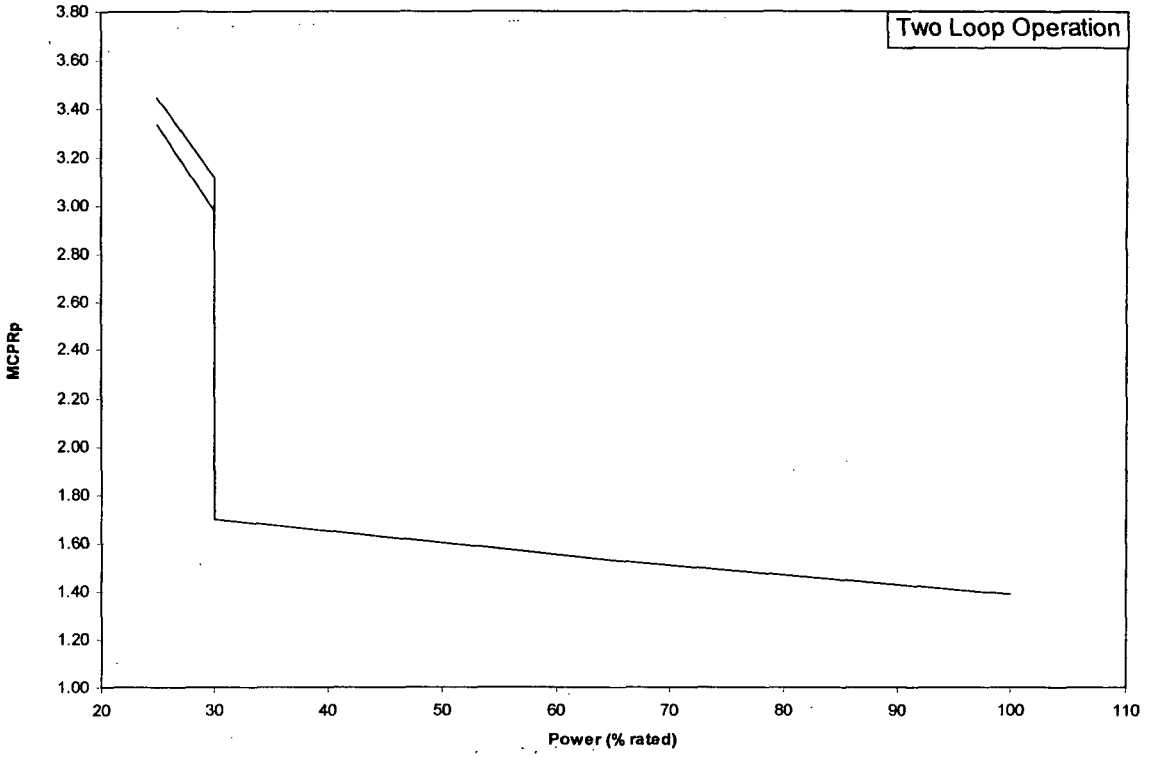
Figure 3.3



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.35	1.36
65	1.52	1.53
30	1.70	1.71
30 at ≤ 50% flow	2.98	2.99
25 at ≤ 50% flow	3.34	3.35
30 at > 50% flow	3.12	3.13
25 at > 50% flow	3.45	3.46

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, All Cycle 19 Fuel Types
Core Average Exposures < 31891 MWd/MTU

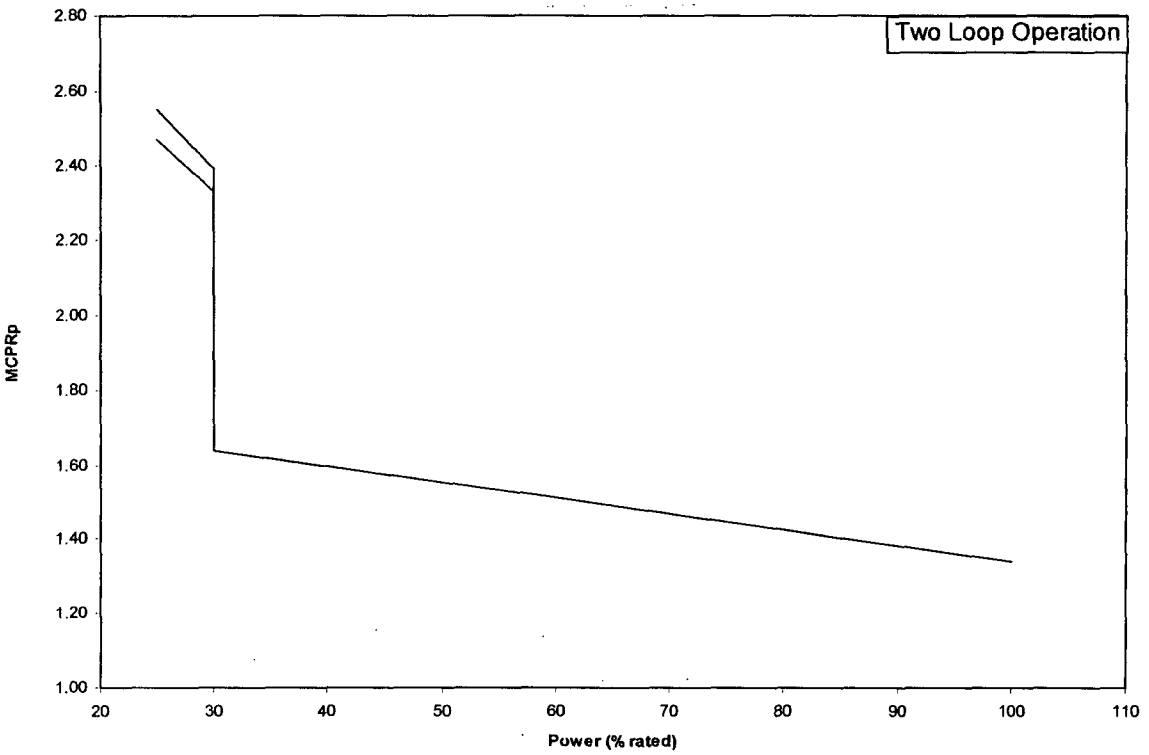
Figure 3.4



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.39	1.40
65	1.53	1.54
30	1.70	1.71
30 at ≤ 50% flow	2.98	2.99
25 at ≤ 50% flow	3.34	3.35
30 at > 50% flow	3.12	3.13
25 at > 50% flow	3.45	3.46

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, All Cycle 19 Fuel Types
31891 MWd/MTU ≤ Core Average Exposures ≤ 34433 MWd/MTU

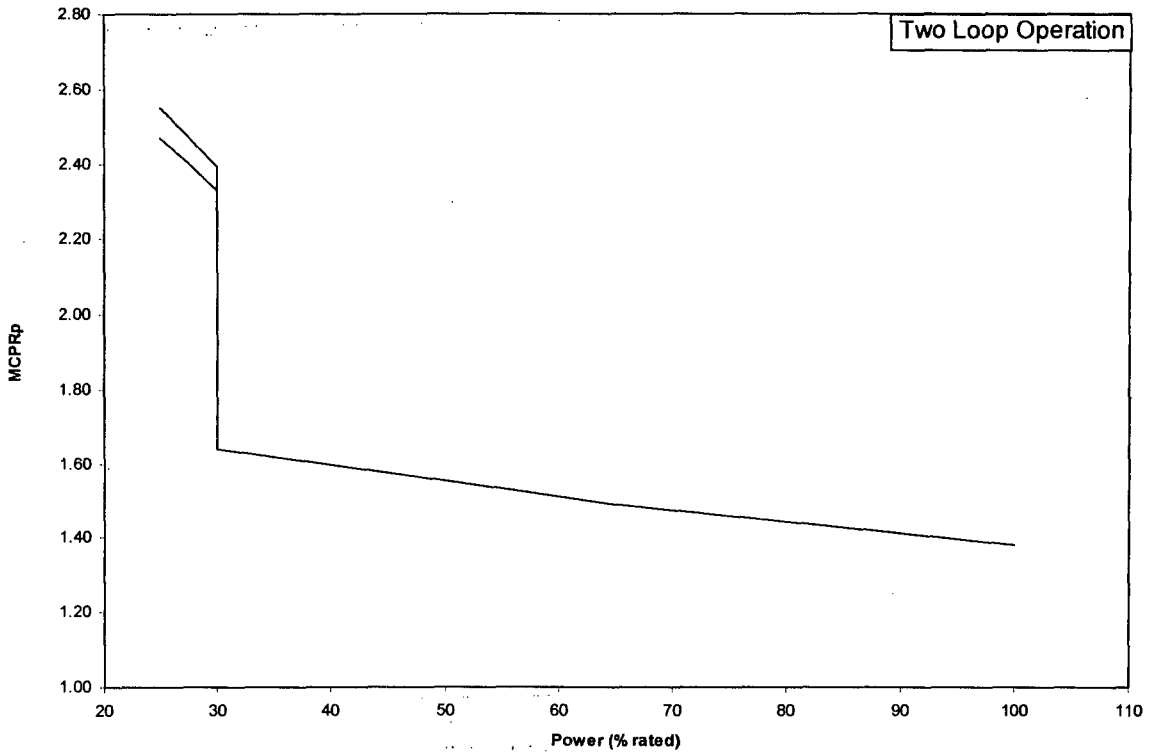
Figure 3.5



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.34	1.35
65	1.49	1.50
30	1.64	1.65
30 at ≤ 50% flow	2.33	2.34
25 at ≤ 50% flow	2.47	2.48
30 at > 50% flow	2.39	2.40
25 at > 50% flow	2.55	2.56

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, All Cycle 19 Fuel Types
Core Average Exposures < 31891 MWd/MTU

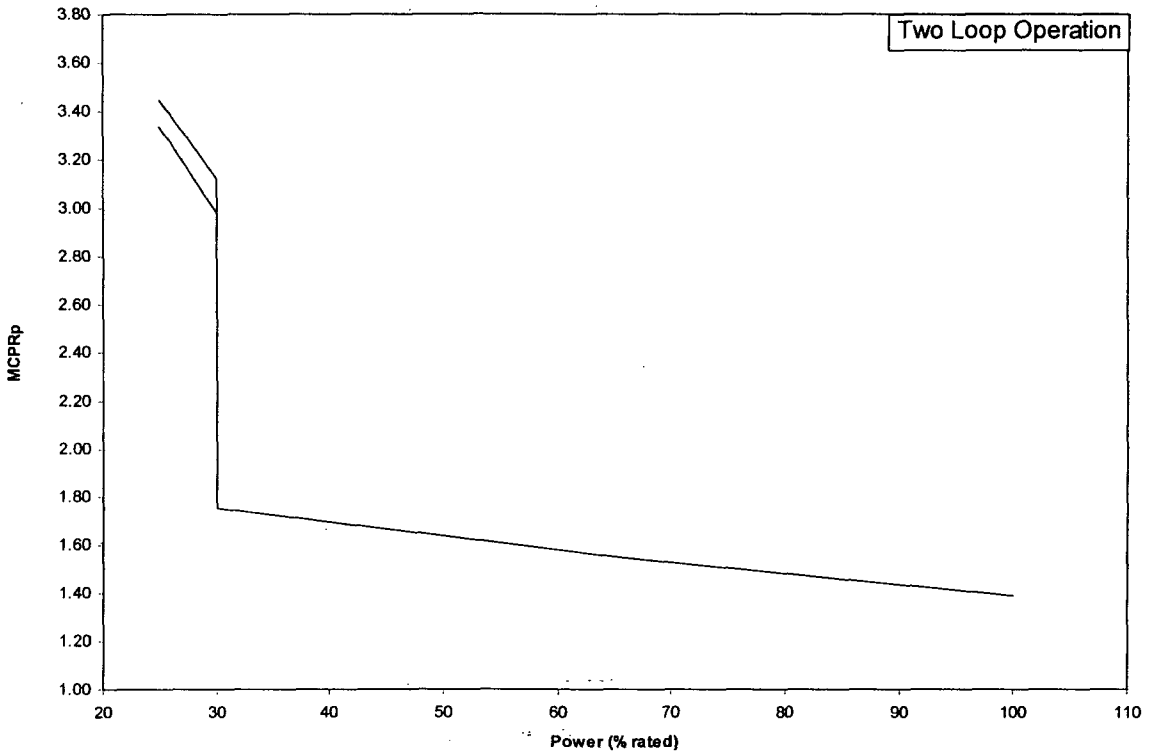
Figure 3.6



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.38	1.39
65	1.49	1.50
30	1.64	1.65
30 at ≤ 50% flow	2.33	2.34
25 at ≤ 50% flow	2.47	2.48
30 at > 50% flow	2.39	2.40
25 at > 50% flow	2.55	2.56

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, All Cycle 19 Fuel Types
31891 MWd/MTU ≤ Core Average Exposures ≤ 34433 MWd/MTU

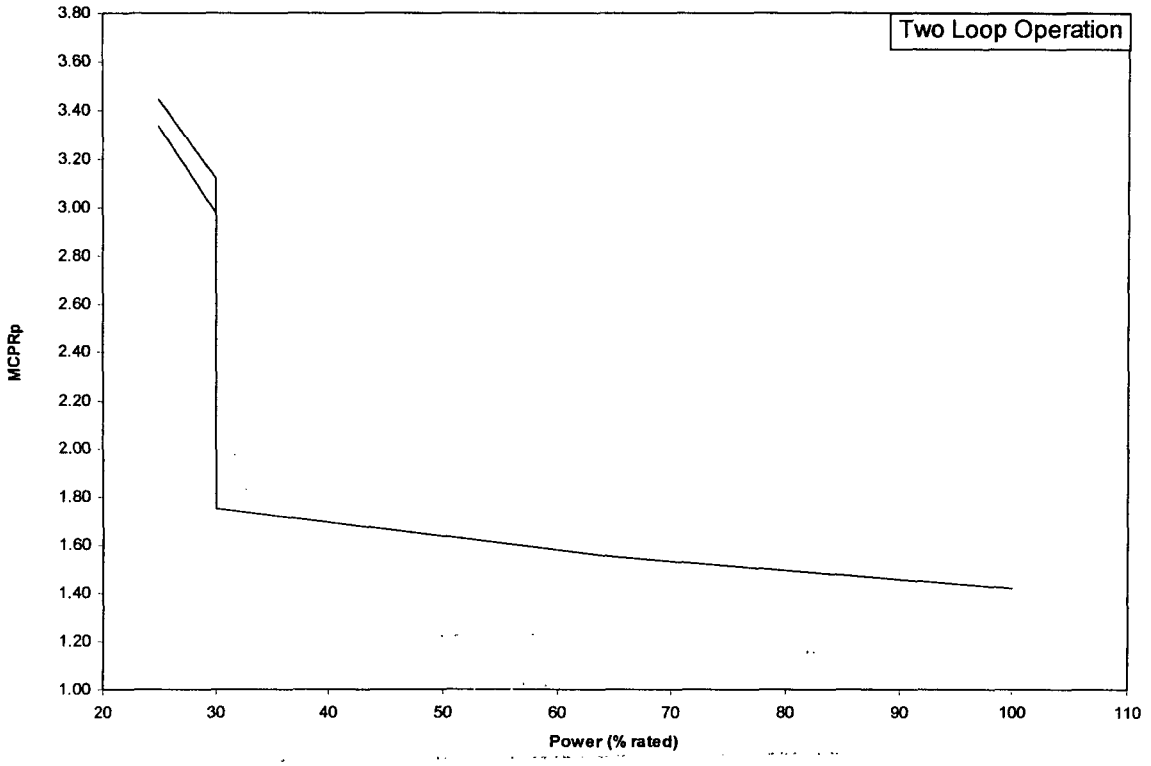
Figure 3.7



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.39	1.40
65	1.55	1.56
30	1.75	1.76
30 at ≤ 50% flow	2.98	2.99
25 at ≤ 50% flow	3.34	3.35
30 at > 50% flow	3.12	3.13
25 at > 50% flow	3.45	3.46

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, Turbine Bypass Inoperable, All Cycle 19 Fuel Types
Core Average Exposures < 31891 MWd/MTU

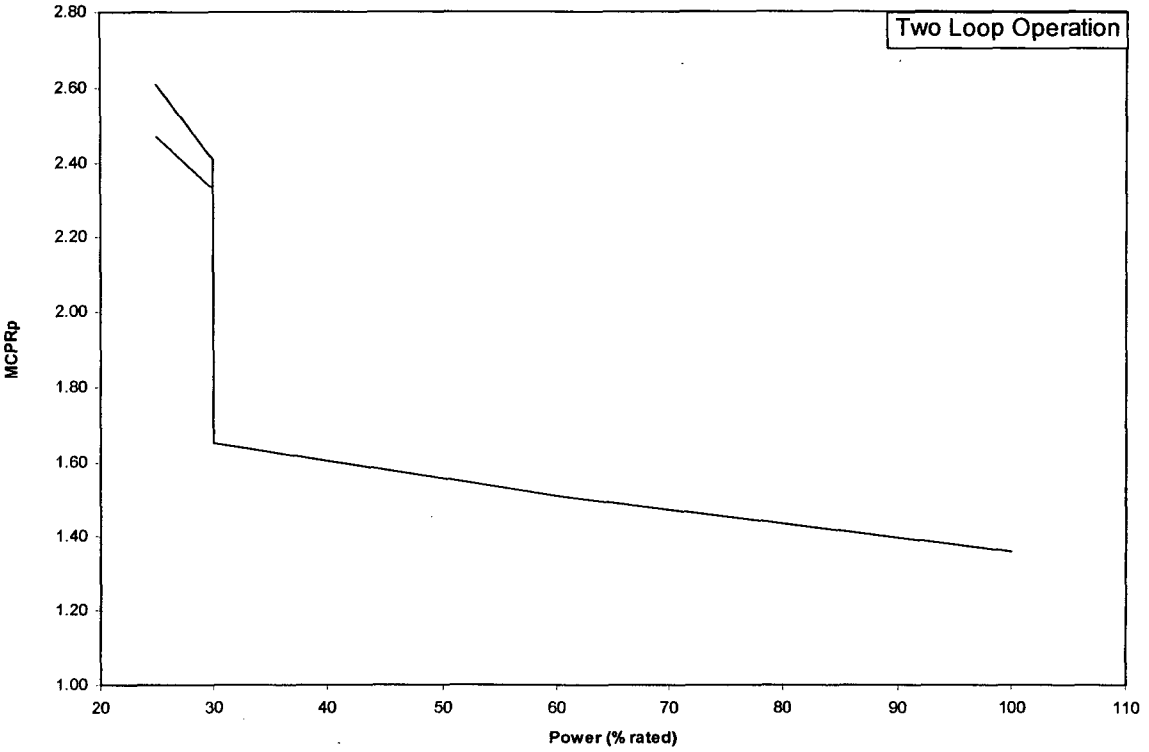
Figure 3.8



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.42	1.43
65	1.55	1.56
30	1.75	1.76
30 at ≤ 50% flow	2.98	2.99
25 at ≤ 50% flow	3.34	3.35
30 at > 50% flow	3.12	3.13
25 at > 50% flow	3.45	3.46

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, Turbine Bypass Inoperable, All Cycle 19 Fuel Types
31891 MWd/MTU ≤ Core Average Exposures ≤ 34433 MWd/MTU

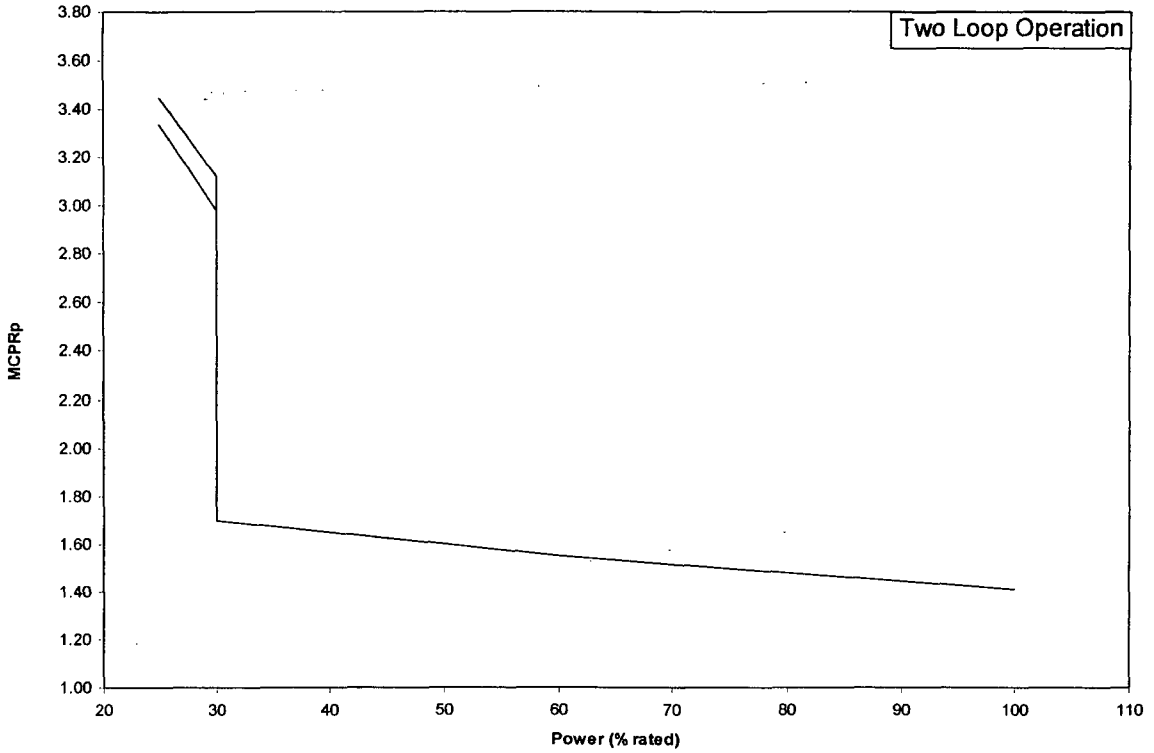
Figure 3.9



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.36	1.37
60	1.51	1.52
30	1.65	1.66
30 at ≤ 50% flow	2.33	2.34
25 at ≤ 50% flow	2.47	2.48
30 at > 50% flow	2.41	2.42
25 at > 50% flow	2.61	2.62

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, All Cycle 19 Fuel Types
FFTR/Coastdown Operation
Core Average Exposures ≤ 37561 MWd/MTU

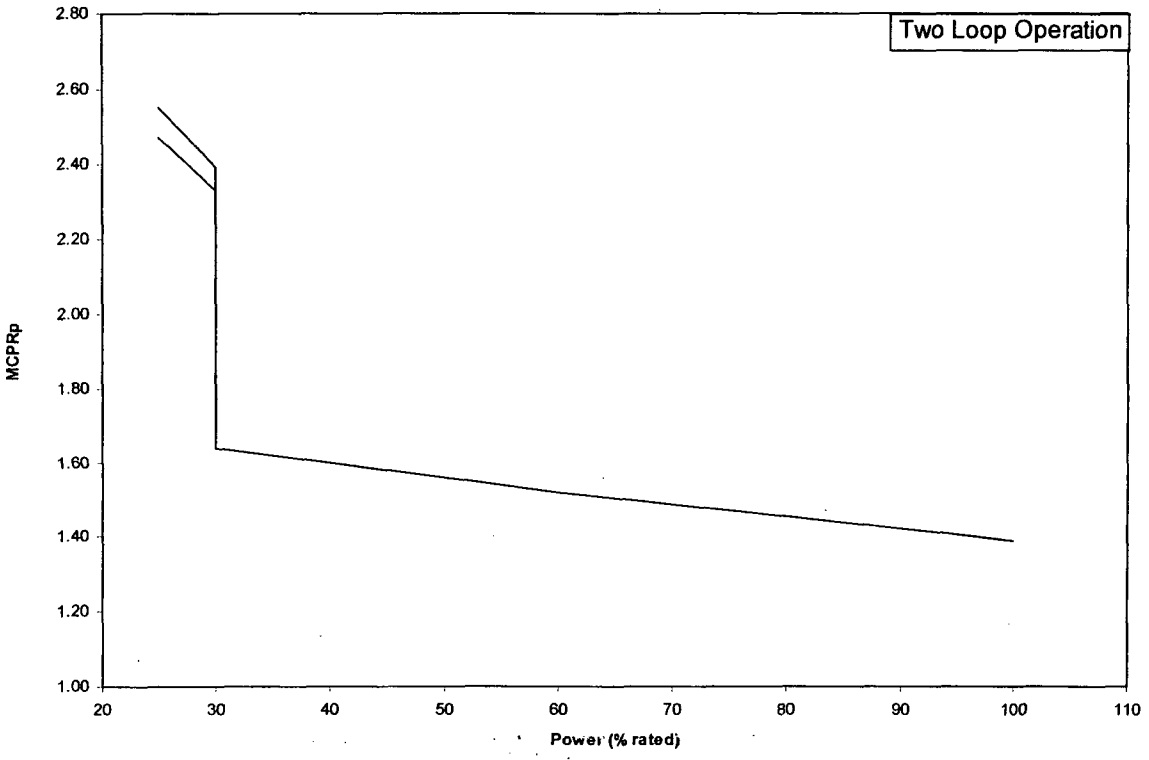
Figure 3.10



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.41	1.42
60	1.55	1.56
30	1.70	1.71
30 at ≤ 50% flow	2.98	2.99
25 at ≤ 50% flow	3.34	3.35
30 at > 50% flow	3.12	3.13
25 at > 50% flow	3.45	3.46

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, Turbine Bypass Inoperable, All Cycle 19 Fuel Types
FFTR/Coastdown Operation
Core Average Exposures ≤ 37561 MWd/MTU

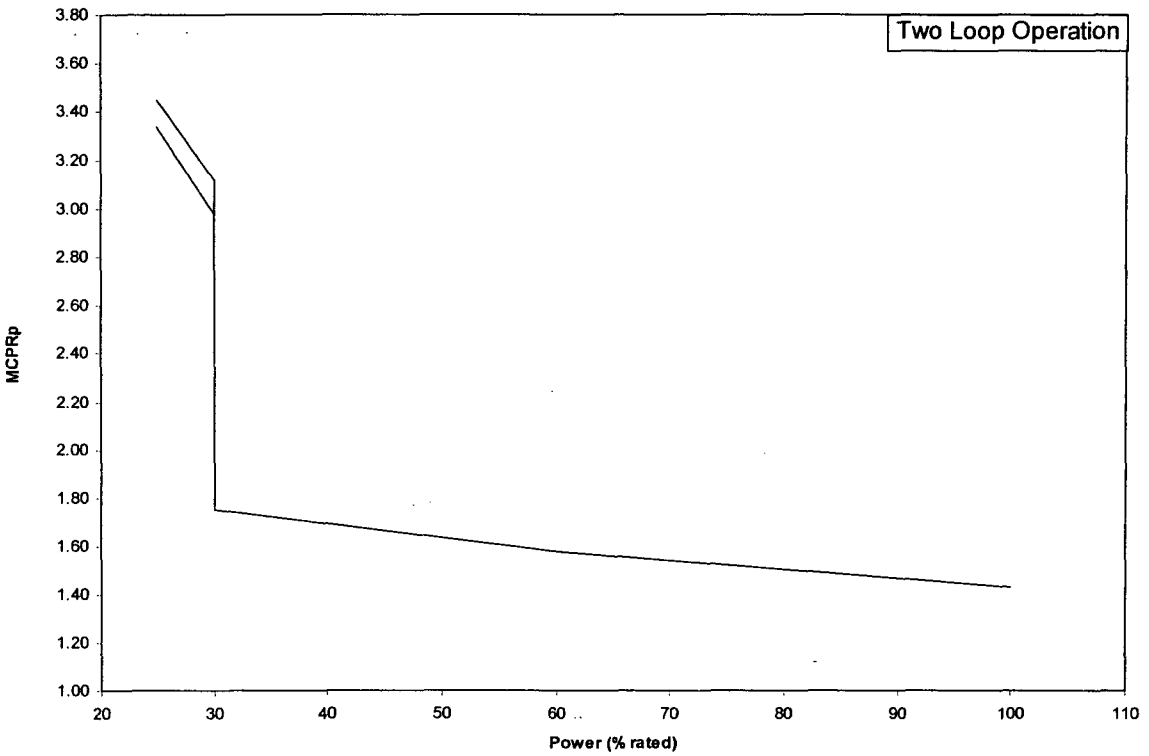
Figure 3.11



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.39	1.40
60	1.52	1.53
30	1.64	1.65
30 at ≤ 50% flow	2.33	2.34
25 at ≤ 50% flow	2.47	2.48
30 at > 50% flow	2.39	2.40
25 at > 50% flow	2.55	2.56

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, All Cycle 19 Fuel Types
FFTR/Coastdown Operation
Core Average Exposures ≤ 37561 MWd/MTU

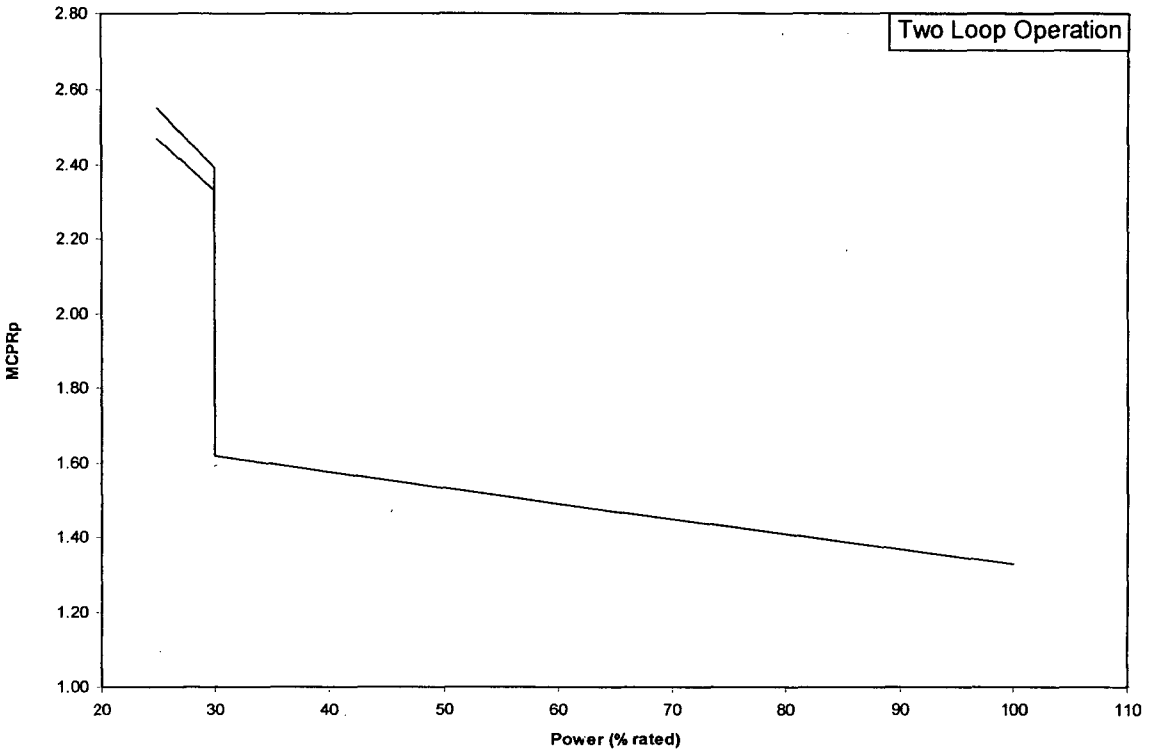
Figure 3.12



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.43	1.44
60	1.58	1.59
30	1.75	1.76
30 at ≤ 50% flow	2.98	2.99
25 at ≤ 50% flow	3.34	3.35
30 at > 50% flow	3.12	3.13
25 at > 50% flow	3.45	3.46

$MCPR_p$ Limits Versus Percent of Rated Power
TSSS, Turbine Bypass Inoperable, All Cycle 19 Fuel Types
FFTR/Coastdown Operation
Core Average Exposures ≤ 37561 MWd/MTU

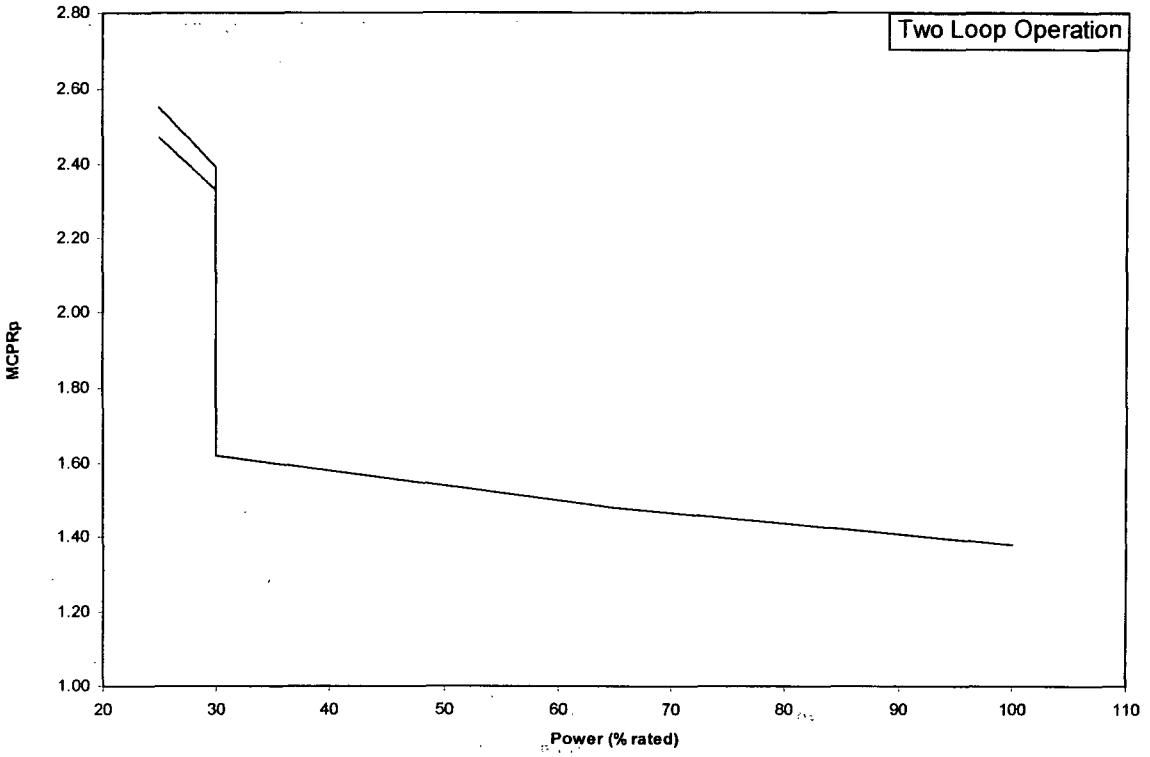
Figure 3.13



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.33	1.34
65	1.47	1.48
30	1.62	1.63
30 at ≤ 50% flow	2.33	2.34
25 at ≤ 50% flow	2.47	2.48
30 at > 50% flow	2.39	2.40
25 at > 50% flow	2.55	2.56

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, All Cycle 19 Fuel Types
Core Average Exposures < 31891 MWd/MTU

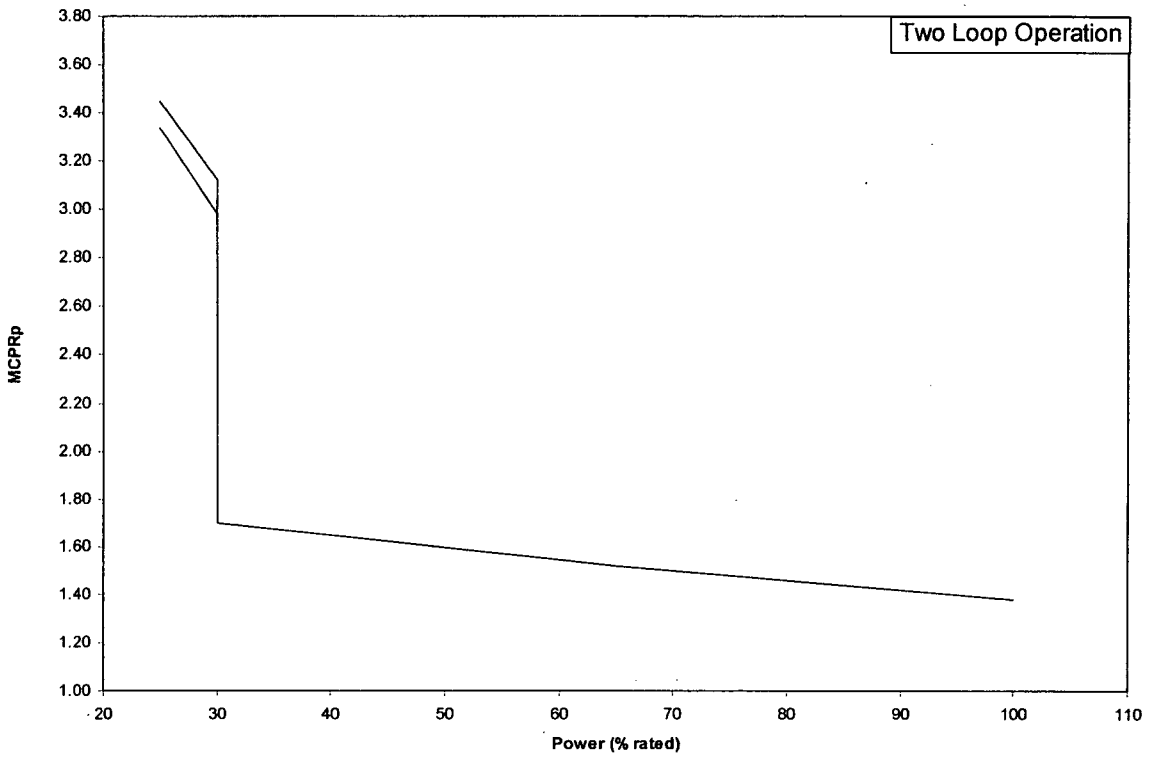
Figure 3.14



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.38	1.39
65	1.48	1.49
30	1.62	1.63
30 at ≤ 50% flow	2.33	2.34
25 at ≤ 50% flow	2.47	2.48
30 at > 50% flow	2.39	2.40
25 at > 50% flow	2.55	2.56

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, All Cycle 19 Fuel Types
31891 MWd/MTU ≤ Core Average Exposures ≤ 34433 MWd/MTU

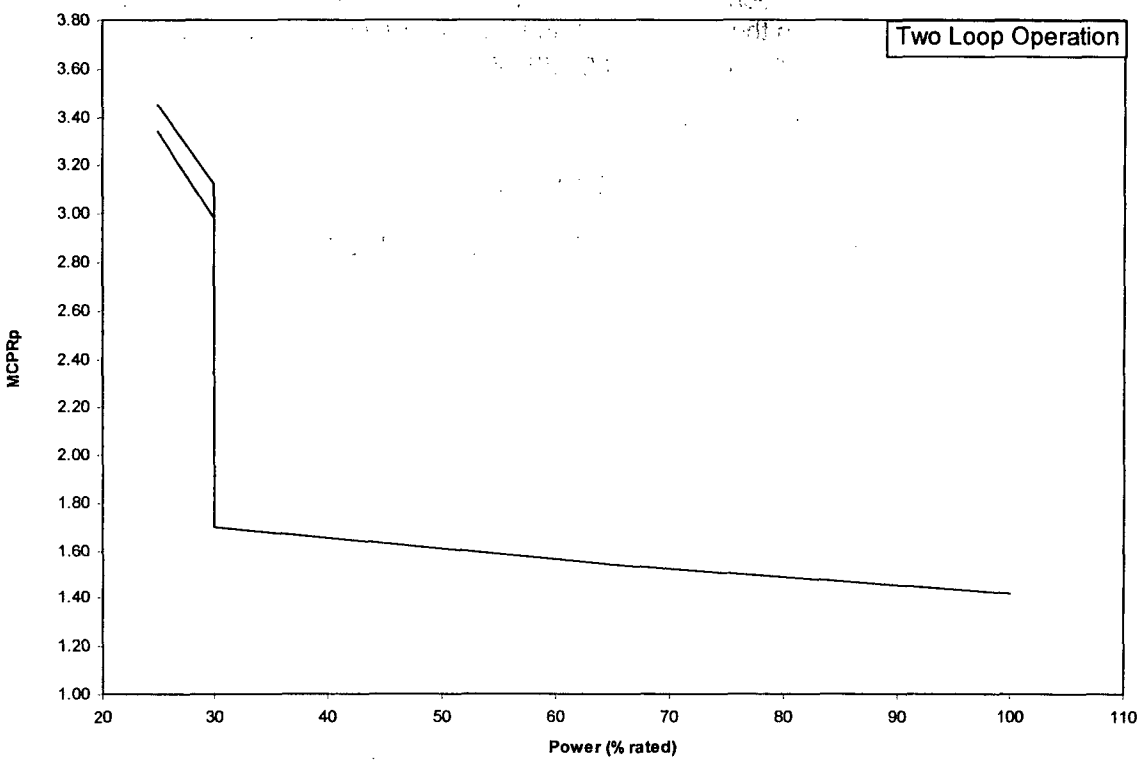
Figure 3.15



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.38	1.39
65	1.52	1.53
30	1.70	1.71
30 at ≤ 50% flow	2.98	2.99
25 at ≤ 50% flow	3.34	3.35
30 at > 50% flow	3.12	3.13
25 at > 50% flow	3.45	3.46

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Inoperable, All Cycle 19 Fuel Types
Core Average Exposures < 31891 MWd/MTU

Figure 3.16



Power (%)	TLO $MCPR_p$ Limit	SLO $MCPR_p$ Limit
100	1.42	1.43
65	1.54	1.55
30	1.70	1.71
30 at ≤ 50% flow	2.98	2.99
25 at ≤ 50% flow	3.34	3.35
30 at > 50% flow	3.12	3.13
25 at > 50% flow	3.45	3.46

$MCPR_p$ Limits Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Inoperable, All Cycle 19 Fuel Types
31891 MWd/MTU ≤ Core Average Exposures ≤ 34433 MWd/MTU

Figure 3.17

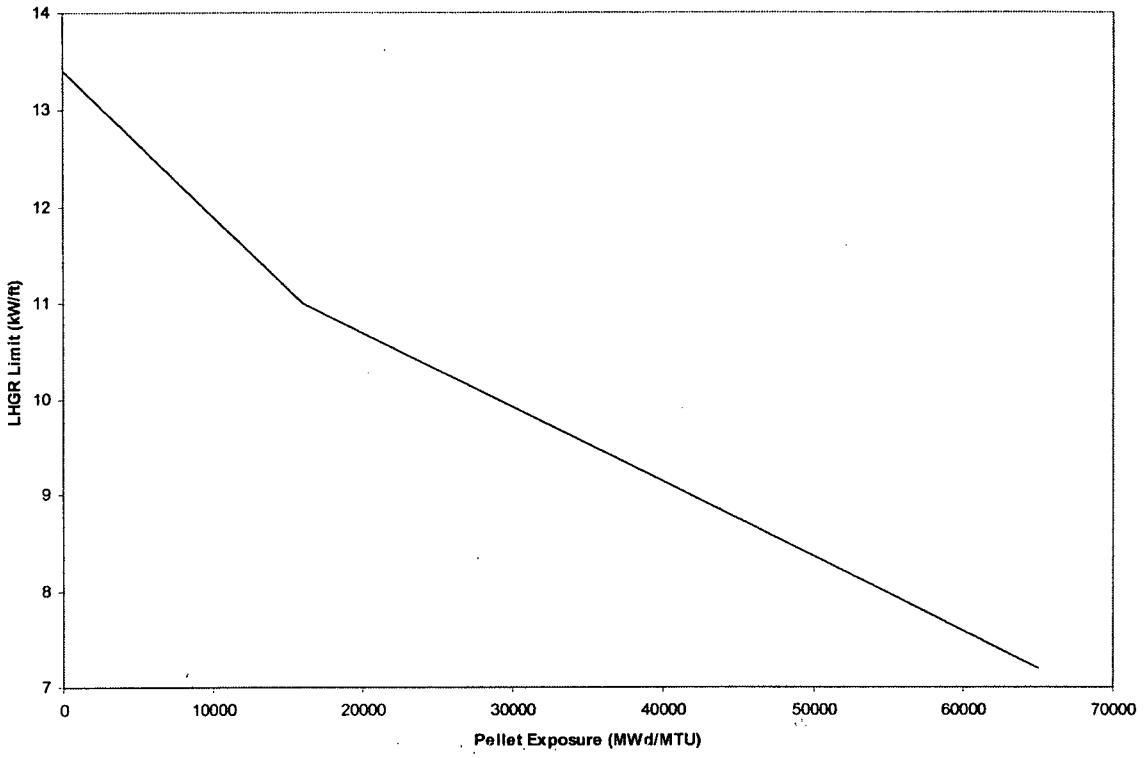
4.0 Linear Heat Generation Rate (LHGR) Limits for Use in Technical Specification 3.2.3

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

a. Figure 4.1 – SVEA-96 reload fuel

b. Figure 4.2 – Cycle 17 ATRIUM-10 reload fuel

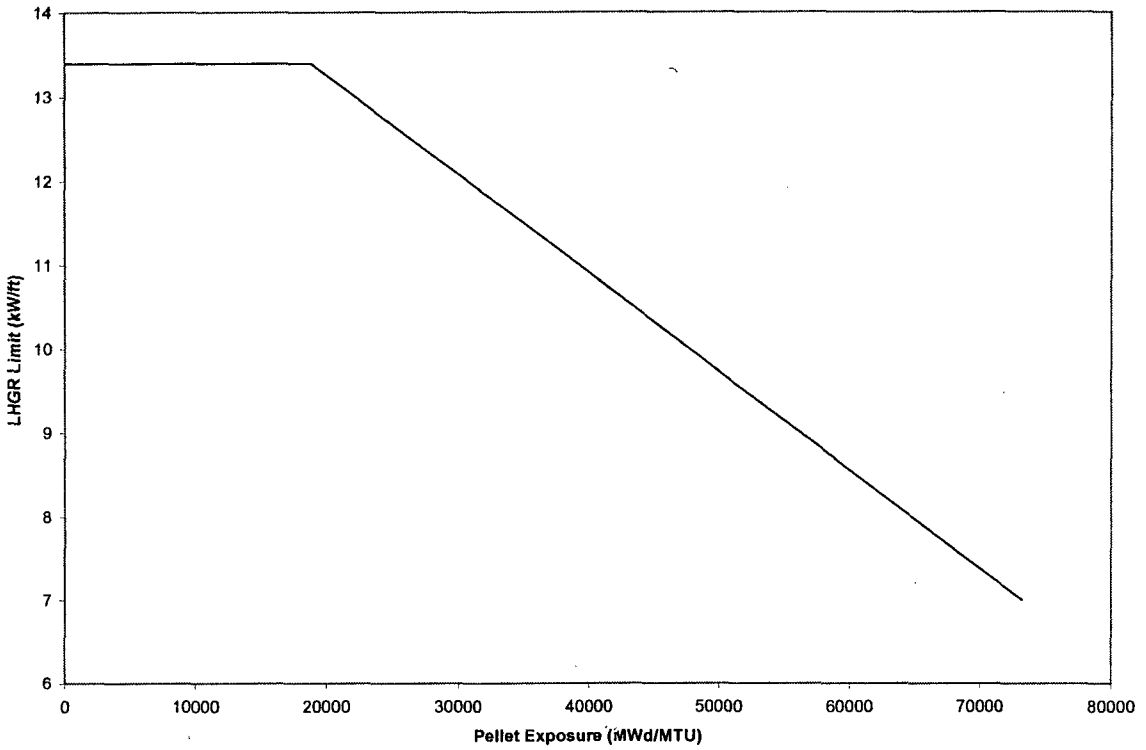
c. Figure 4.3 – Cycle 18 and 19 ATRIUM-10 reload fuel



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

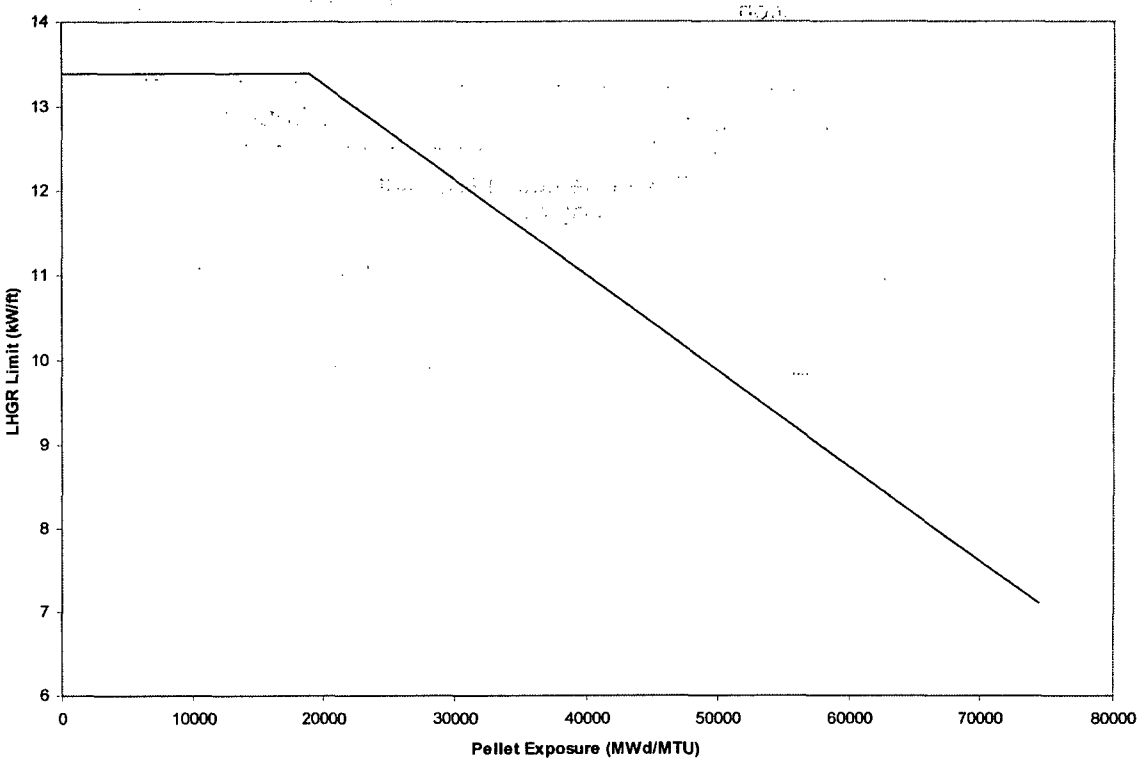
Figure 4.1



Pellet Exposure (MWd/MTU)	LHGR (kW/ft)
0	13.4
18900	13.4
73200	7.0

Linear Heat Generation Rate (LHGR)
Versus Pellet Exposure
Cycle 17 ATRIUM-10 Reload Fuel

Figure 4.2



Pellet Exposure (MWd/MTU)	LHGR (kW/ft)
0	13.4
18900	13.4
74400	7.1

Linear Heat Generation Rate (LHGR)
Versus Pellet Exposure
Cycle 18 and 19 ATRIUM-10 Reload Fuel

Figure 4.3

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	1.11 Peak/Average
Confirmation Count Setpoint: N2	14

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, "Columbia LOCA Analysis Report," Westinghouse CE Nuclear Power LLC, February 2001.

6.3 ANP-2602 Revision 0, "Columbia Generating Station Cycle 19 Reload Analysis," AREVA NP, March 2007.

6.4 EMF-3172(P) Revision 1, "Columbia Generating Station LOCA-ECCS Analysis MAPLHGR Limit for ATRIUM™-10 Fuel," Framatome ANP, June 2005.

6.5 NE-02-00-03, Revision 0, "Oscillation Power Range Monitor (OPRM) Trip Setpoints," Energy Northwest, June 17, 2000.

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