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# WNP-2

# CYCLE 13

# Core Operating Limits Report

July 1997

Washington Public Power Supply System

WNP-2
Cycle 13
Core Operating Limits Report

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WNP-2
Cycle 13
Core Operating Limits Report

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## 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 **Power to Flow Map** for WNP-2, Cycle 13 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 6.6 describe the LOCA analysis for rated power. The analysis was performed with a methodology that results in Single Loop Operation being adequately covered by Two Loop Operation. The thermal limits for all fuel types for Single Loop Operation are the same as Two Loop Operation. The thermal limits for fuel given in this report are documented in the "WNP-2 Cycle 13 Reload Report" (Reference 6.3), the "WNP-2 Cycle 13 Transient Analysis Report" (Reference 6.4), and Reference 6.5. The basis for power to flow map which addresses the instability operating region limits is documented in Reference 6.3.

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 throughout the WNP-2 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 WNP-2 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%.

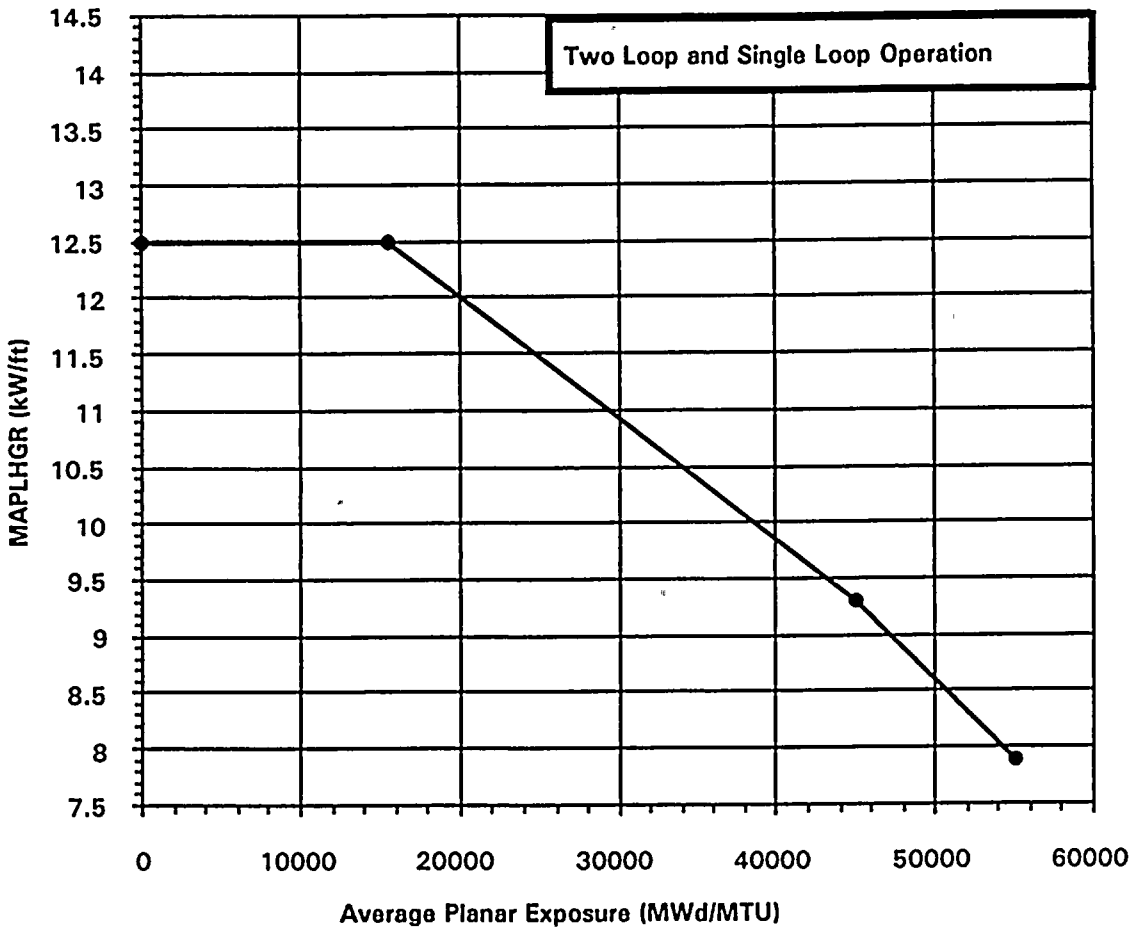
Preparation, review, and approval of this report were performed in accordance with applicable Supply System procedures. The specific topical report revisions and supplements which describe the methodology utilized in this cycle specific analysis are referenced in Technical Specification 5.6.5.

## 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 when in two loop or single loop operation:

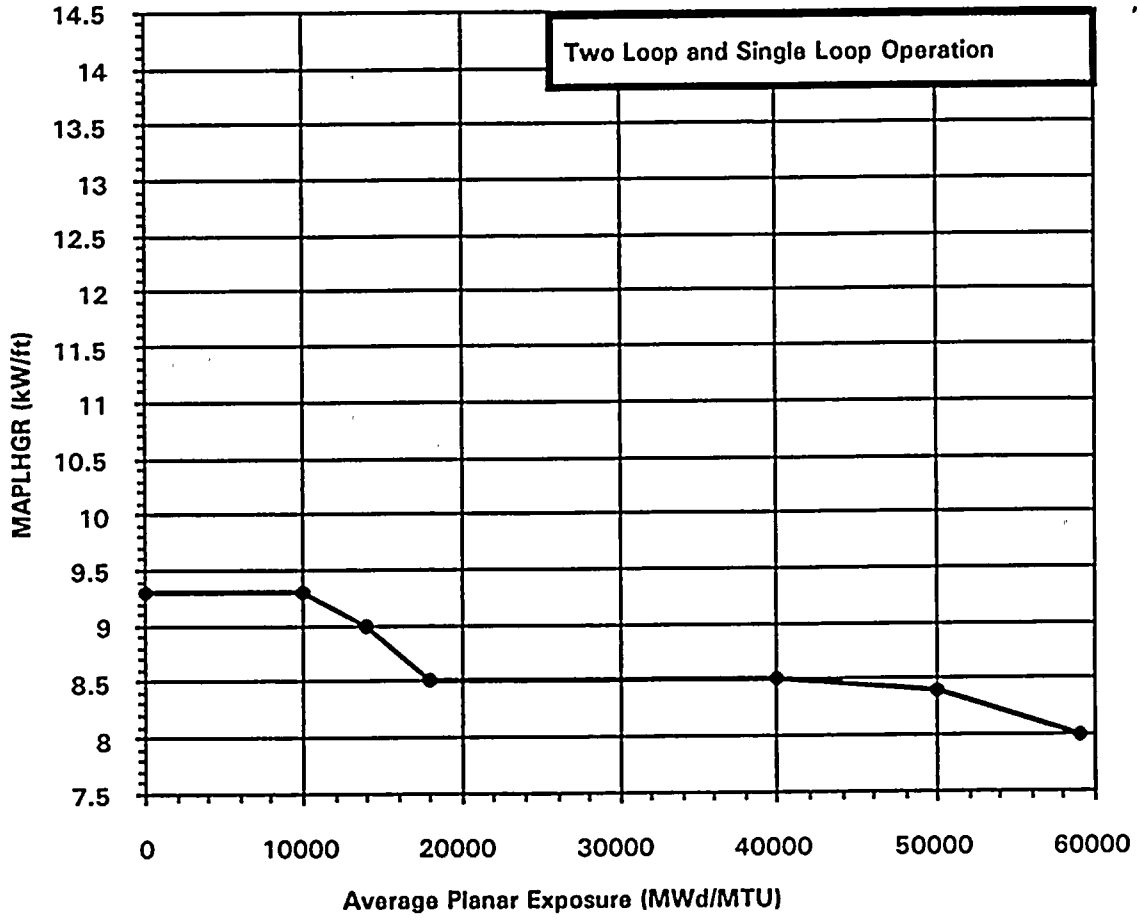
a. Figure 2.1 - SPC 9x9-9X reload fuel

b. Figure 2.2 - ABB SVEA-96 reload fuel




| Average Planar Exposure (MWd/MTU) | MAPLHGR (kW/ft) |
|---|---|
| 0 | 12.5 |
| 15500 | 12.5 |
| 45000 | 9.3 |
| 55000 | 7.9 |

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)
Versus Average Planar Exposure
SPC 9x9-9X
Figure 2.1




| Average Planar Exposure (MWd/MTU) | MAPLHGR (kW/ft) |
|---|---|
| 0 | 9.3 |
| 10000 | 9.3 |
| 14000 | 9.0 |
| 18000 | 8.5 |
| 40000 | 8.5 |
| 50000 | 8.4 |
| 59000 | 8.0 |

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR)
Versus Average Planar Exposure
ABB SVEA-96
Figure 2.2

## 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 3.31 through 3.34. For the purposes of cycle extension, the feedwater temperature entering the reactor vessel should not be reduced to less than 355°F. The MCPR limits given apply to both two loop and single loop operation.

The MCPR safety limit for SPC 9x9-9X is 1.13 for two loop operation and 1.14 for single loop operation. Note: ATRIUM-9X and SPC 9x9-9X are equivalent terms for the same fuel type and may be used interchangeably.

The MCPR safety limit for SVEA-96 is 1.07 for two loop operation and 1.08 for single loop operation.

The MCPR safety limits are applicable to Cycle 13 only.

## Table 3.1a

## WNP-2 Cycle 13 MCPR Operating Limits
## Two Loop and Single Loop Operation
## Turbine Bypass System Operable

## Cycle Exposure $\leq$ 5000 MWd/MTU

| Condition | Limit | SLMCPR = 1.13 (2) SPC 9x9-9X | SLMCPR = 1.07 (2) ABB SVEA-96 |
|---|---|---|---|
| NSS (1) | Full Power | 1.40 (3) | 1.30 (3) |
| | Flow Dependent (4) | Fig. 3.1 | Fig. 3.2 |
| | Power Dependent (5) | Fig. 3.3 | Fig. 3.7 |
| TSSS (1) | Full Power | 1.40 (3) | 1.31 |
| | Flow Dependent (4) | Fig. 3.1 | Fig. 3.2 |
| | Power Dependent (5) | Fig. 3.11 | Fig. 3.15 |
| NSS (1) RPT Inop. | Full Power | 1.40 (3) | 1.30 (3) |
| | Flow Dependent (4) | Fig. 3.1 | Fig. 3.2 |
| | Power Dependent (5) | Fig. 3.27 | Fig. 3.31 |

## Table 3.1b

## WNP-2 Cycle 13 MCPR Operating Limits
## Two Loop and Single Loop Operation
## Turbine Bypass System Operable

## Cycle Exposure > 5000 MWd/MTU

| Condition | Limit | SLMCPR | | FFTR SLMCPR | |
|---|---|---|---|---|---|
| | | 1.13 (2) | 1.07 (2) | 1.13 (2) | 1.07 (2) |
| | | SPC 9x9-9X | ABB SVEA-96 | SPC 9x9-9X | ABB SVEA-96 |
| NSS (1) | Full Power | 1.40 (3) | 1.33 | 1.40 (3) | 1.33 |
| | Flow Dependent (4) | Fig. 3.1 | Fig. 3.2 | Fig. 3.1 | Fig. 3.2 |
| | Power Dependent (5) | Fig. 3.4 | Fig. 3.8 | Fig. 3.19 | Fig. 3.21 |
| TSSS (1) | Full Power | 1.42 | 1.38 | 1.42 | 1.38 |
| | Flow Dependent (4) | Fig. 3.1 | Fig. 3.2 | Fig. 3.1 | Fig. 3.2 |
| | Power Dependent (5) | Fig. 3.12 | Fig. 3.16 | Fig. 3.23 | Fig. 3.25 |
| NSS (1) RPT Inop. | Full Power | 1.44 | 1.38 | Not Analyzed | |
| | Flow Dependent (4) | Fig. 3.1 | Fig. 3.2 | | |
| | Power Dependent (5) | Fig. 3.28 | Fig. 3.32 | | |

## Table 3.2a

## WNP-2 Cycle 13 MCPR Operating Limits
## Two Loop and Single Loop Operation
## Turbine Bypass System Inoperable

## Cycle Exposure $\leq$ 5000 MWd/MTU

| Condition | Limit | SLMCPR = 1.13 (2) | SLMCPR = 1.07 (2) |
|---|---|---|---|
| | | SPC 9x9-9X | ABB SVEA-96 |
| NSS (1) | Full Power | 1.40 (3) | 1.30 (3) |
| | Flow Dependent (4) | Fig. 3.1 | Fig. 3.2 |
| | Power Dependent (5) | Fig. 3.5 | Fig. 3.9 |
| TSSS (1) | Full Power | 1.40 (3) | 1.34 |
| | Flow Dependent (4) | Fig. 3.1 | Fig. 3.2 |
| | Power Dependent (5) | Fig. 3.13 | Fig. 3.17 |
| NSS (1) RPT Inop. | Full Power | 1.40 (3) | 1.31 |
| | Flow Dependent (4) | Fig. 3.1 | Fig. 3.2 |
| | Power Dependent (5) | Fig. 3.29 | Fig. 3.33 |

## Table 3.2b

## WNP-2 Cycle 13 MCPR Operating Limits
## Two Loop and Single Loop Operation
## Turbine Bypass System Inoperable

## Cycle Exposure > 5000 MWd/MTU

| Condition | Limit | SLMCPR | | FFTR SLMCPR | |
|---|---|---|---|---|---|
| | | 1.13 (2) | 1.07 (2) | 1.13 (2) | 1.07 (2) |
| | | SPC 9x9-9X | ABB SVEA-96 | SPC 9x9-9X | ABB SVEA-96 |
| NSS (1) | Full Power | 1.41 | 1.36 | 1.42 | 1.38 |
| | Flow Dependent (4) | Fig. 3.1 | Fig. 3.2 | Fig. 3.1 | Fig. 3.2 |
| | Power Dependent (5) | Fig. 3.6 | Fig. 3.10 | Fig. 3.20 | Fig. 3.22 |
| TSSS (1) | Full Power | 1.45 | 1.41 | 1.46 | 1.41 |
| | Flow Dependent (4) | Fig. 3.1 | Fig. 3.2 | Fig. 3.1 | Fig. 3.2 |
| | Power Dependent (5) | Fig. 3.14 | Fig. 3.18 | Fig. 3.24 | Fig. 3.26 |
| NSS (1) RPT Inop. | Full Power | 1.46 | 1.41 | Not Analyzed | |
| | Flow Dependent (4) | Fig. 3.1 | Fig. 3.2 | | |
| | Power Dependent (5) | Fig. 3.30 | Fig. 3.34 | | |

## Notes for Tables 3. la, 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 the ABB transient analysis performed using the control rod insertion times shown below (defined as normal scram speed: NSS). In the event that SRs 3.1.4.1, 3.1.4.2, and 3.1.4.4 show these scram insertion times have been exceeded, the MCPR limit shall be determined from the applicable Technical Specification Scram Speed (TSSS) MCPR limits in Tables 3.1a, 3.1b, 3.2a, and 3.2b.

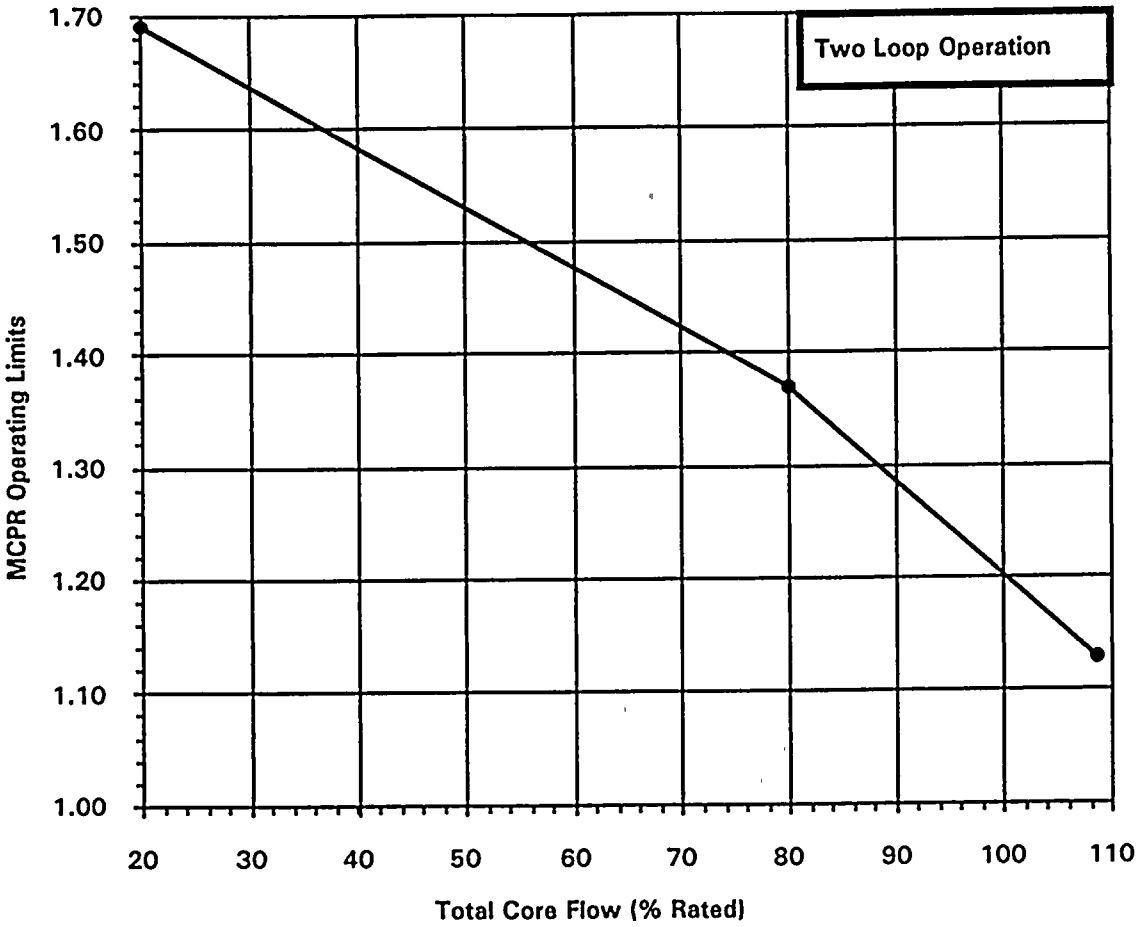
| Position Inserted From Fully Withdrawn | Slowest measured average control rod insertion times to specified notches for all operable control rods for each group of four control rods arranged in a two-by-two array (seconds) |
|---|---|
| Notch 45 | 0.430 |
| Notch 39 | 0.720 |
| Notch 25 | 1.600 |
| Notch 5 | 2.950 |

Note 2: For Single Loop Operation (SLO), the SLMCPR increases by 0.01. The increase is included in the MCPR operating limits.

Note 3: For the noted full power MCPR limits, the Rod Withdrawal Error (RWE) event is limiting. When turbine bypass is operable, the Generator Load Rejection No Bypass (GLRNB) event is limiting for the full power limits. When turbine bypass is inoperable, the Feedwater Controller Failure No Bypass (FWCFNB) event is limiting for the full power limits. The RWE analysis was performed with a nominal Rod Block Monitor (RBM) setpoint of 1.06.

Note 4: Flow dependent MCPRs are not applicable for SLO.

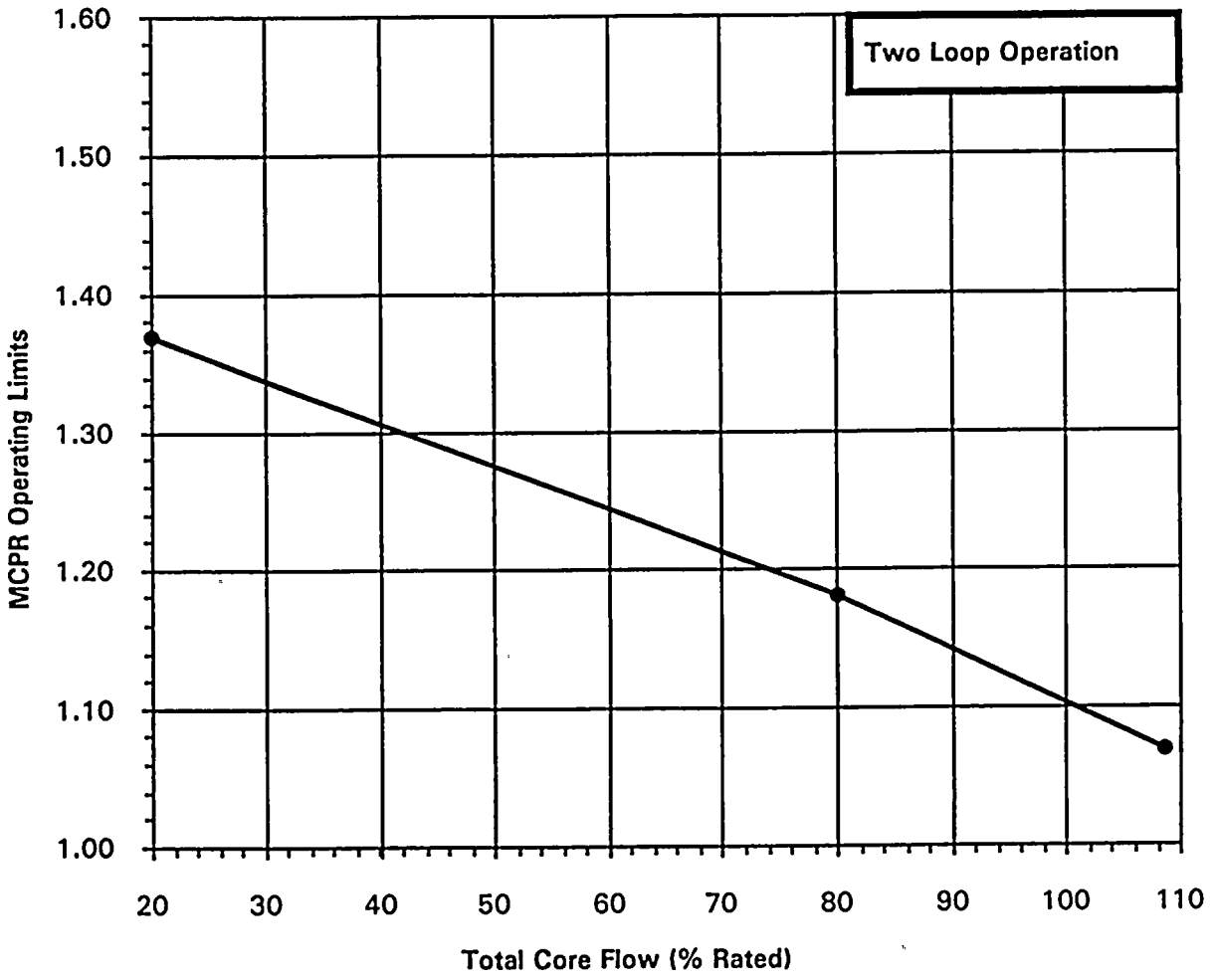
Note 5: Power dependent MCPR limits are provided for core thermal powers greater than or equal to 25 % of rated power at all core flows. The power dependent MCPR limits for core thermal powers less than or equal to 30% of rated power are subdivided by core flow. Limits are provided for core flows greater than 50% of rated flow and less than or equal to 50% of rated flow, respectively. 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.




| Total Core Flow Rate | Operating Limit MCPR |
|---|---|
| 108.5% | 1.13 |
| 80% | 1.37 |
| 20% | 1.69 |

Reduced Flow MCPR Operating Limit Versus Total Core Flow
SPC 9x9-9X

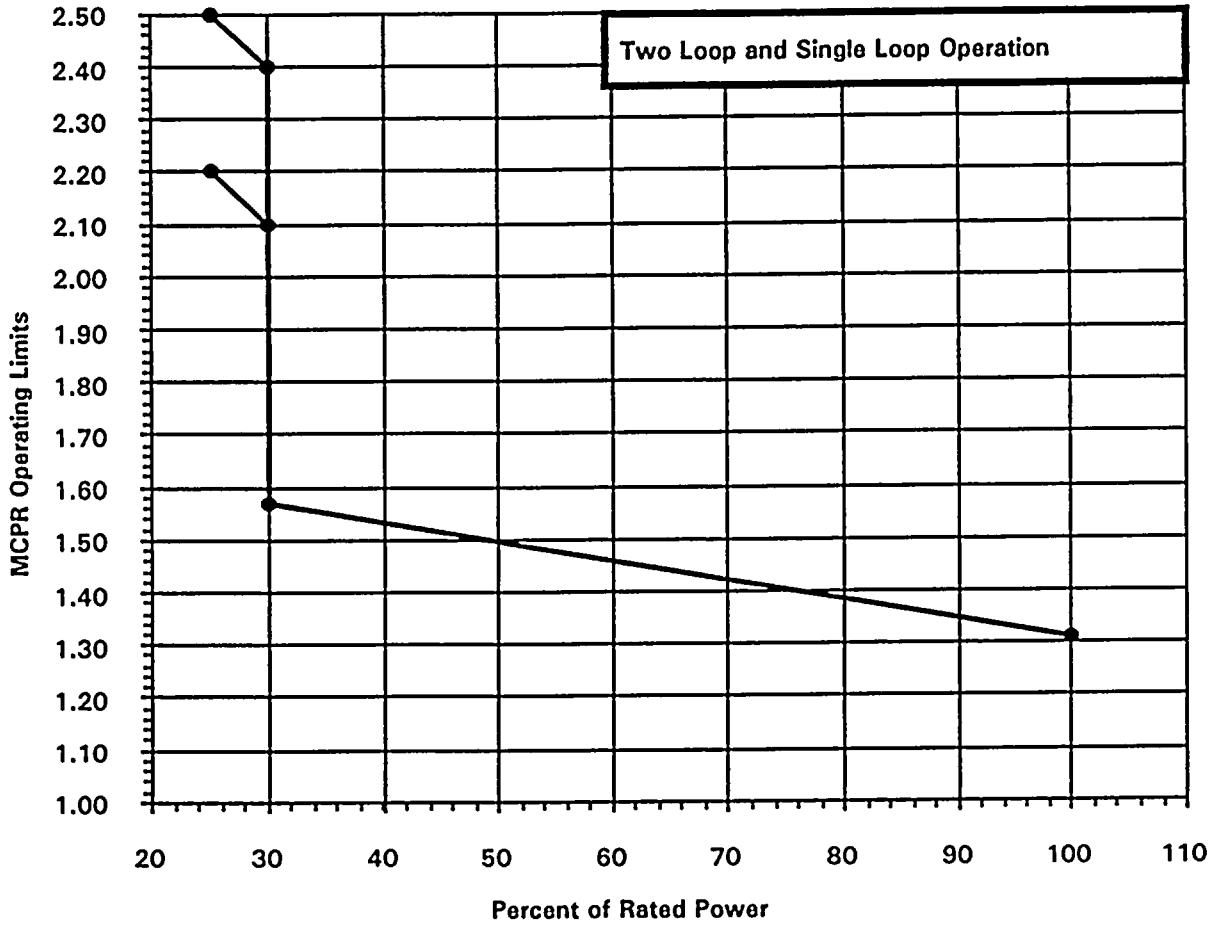
Figure 3.1




| Total Core Flow Rate | Operating Limit MCPR |
|---|---|
| 108.5% | 1.07 |
| 80% | 1.18 |
| 20% | 1.37 |

Reduced Flow MCPR Operating Limit Versus Total Core Flow
ABB SVEA-96

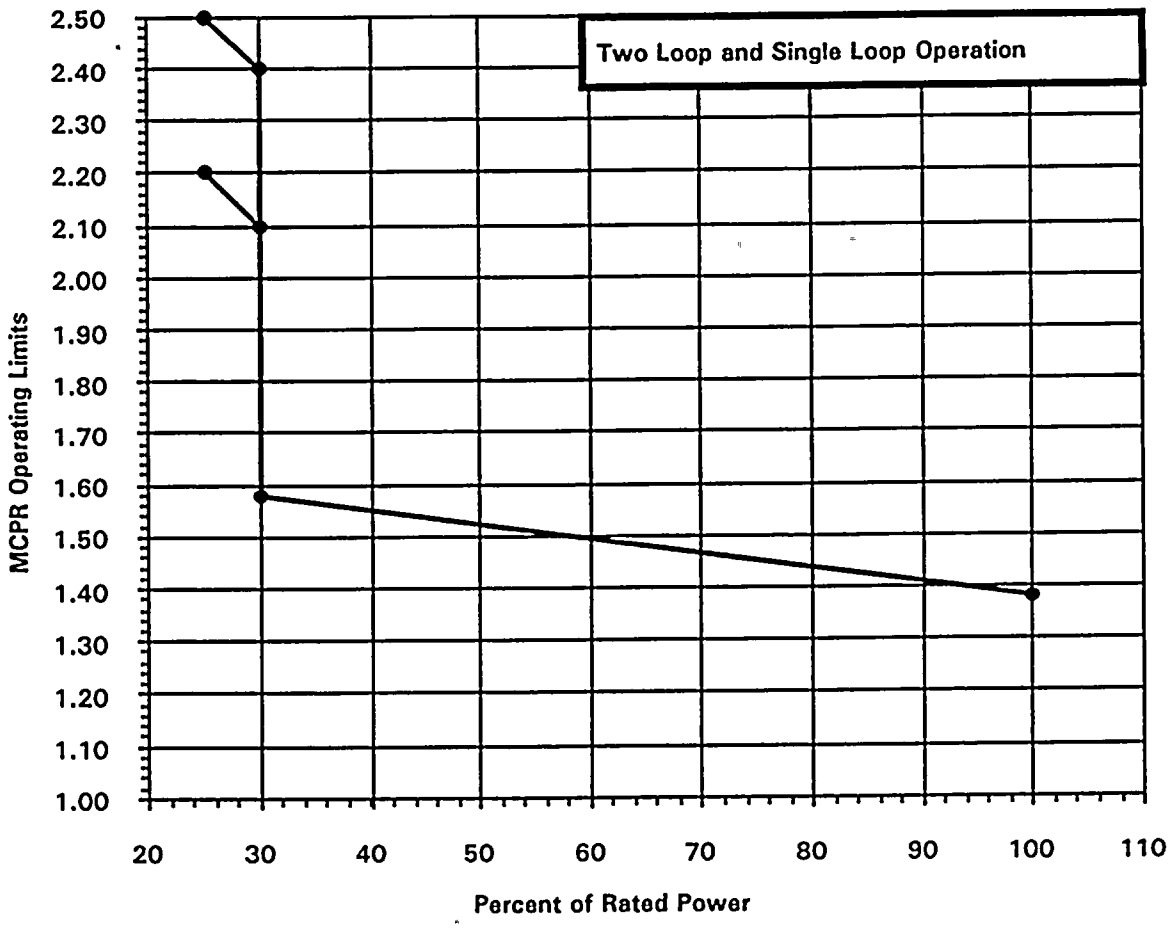
Figure 3.2




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.31 |
| | 30% | 1.57 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Operable, Turbine Bypass Operable, SPC 9x9-9X
Cycle Exposures ≤5000 MWd/MTU

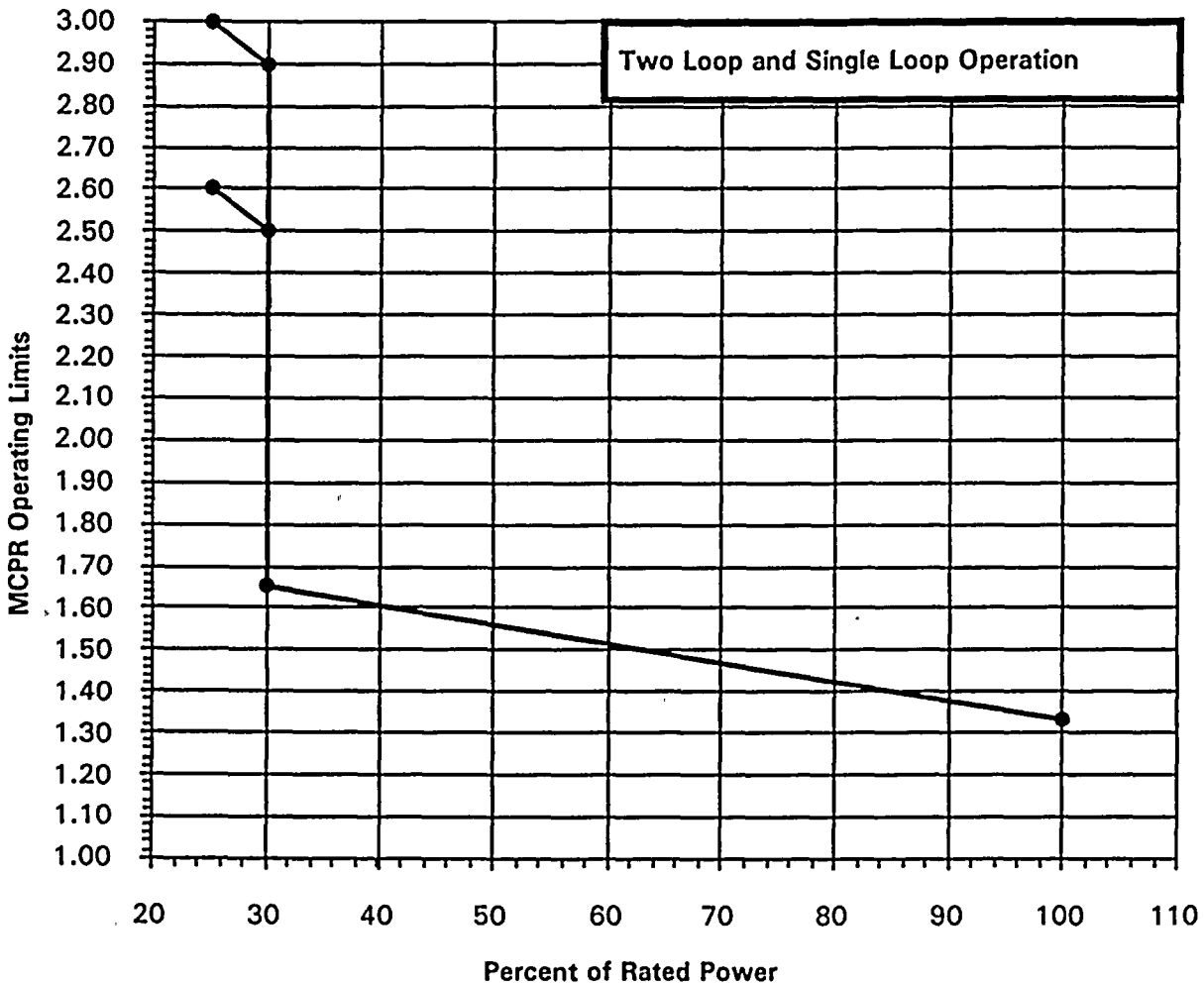
Figure 3.3




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.38 |
| | 30% | 1.58 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Operable, Turbine Bypass Operable, SPC 9x9-9X
Cycle Exposures >5000 MWd/MTU

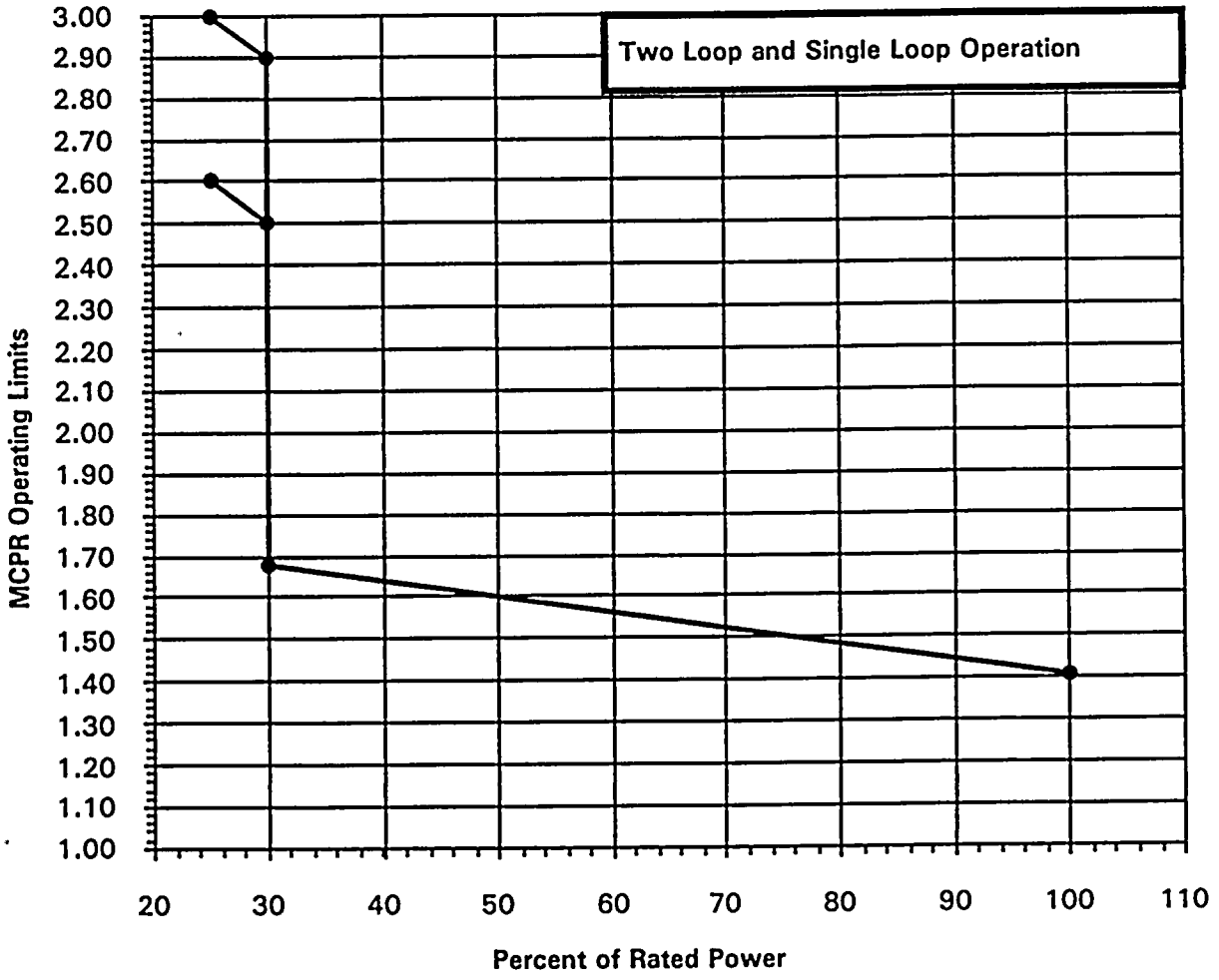
Figure 3.4




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.33 |
| | 30% | 1.65 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Operable, Turbine Bypass Inoperable, SPC 9x9-9X
Cycle Exposures ≤5000 MWd/MTU

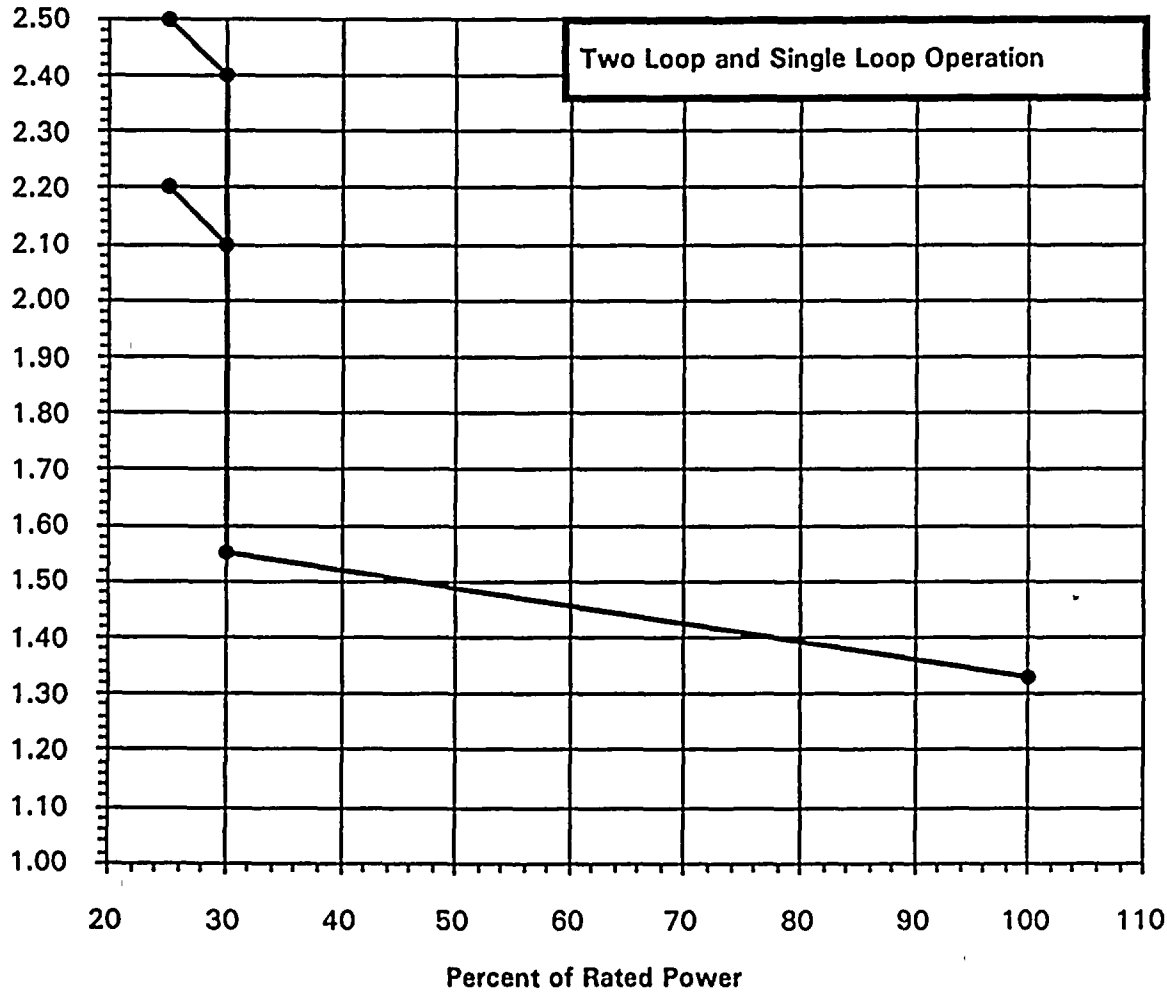
Figure 3.5




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.41 |
| | 30% | 1.68 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Operable, Turbine Bypass Inoperable, SPC 9x9-9X
Cycle Exposures >5000 MWd/MTU

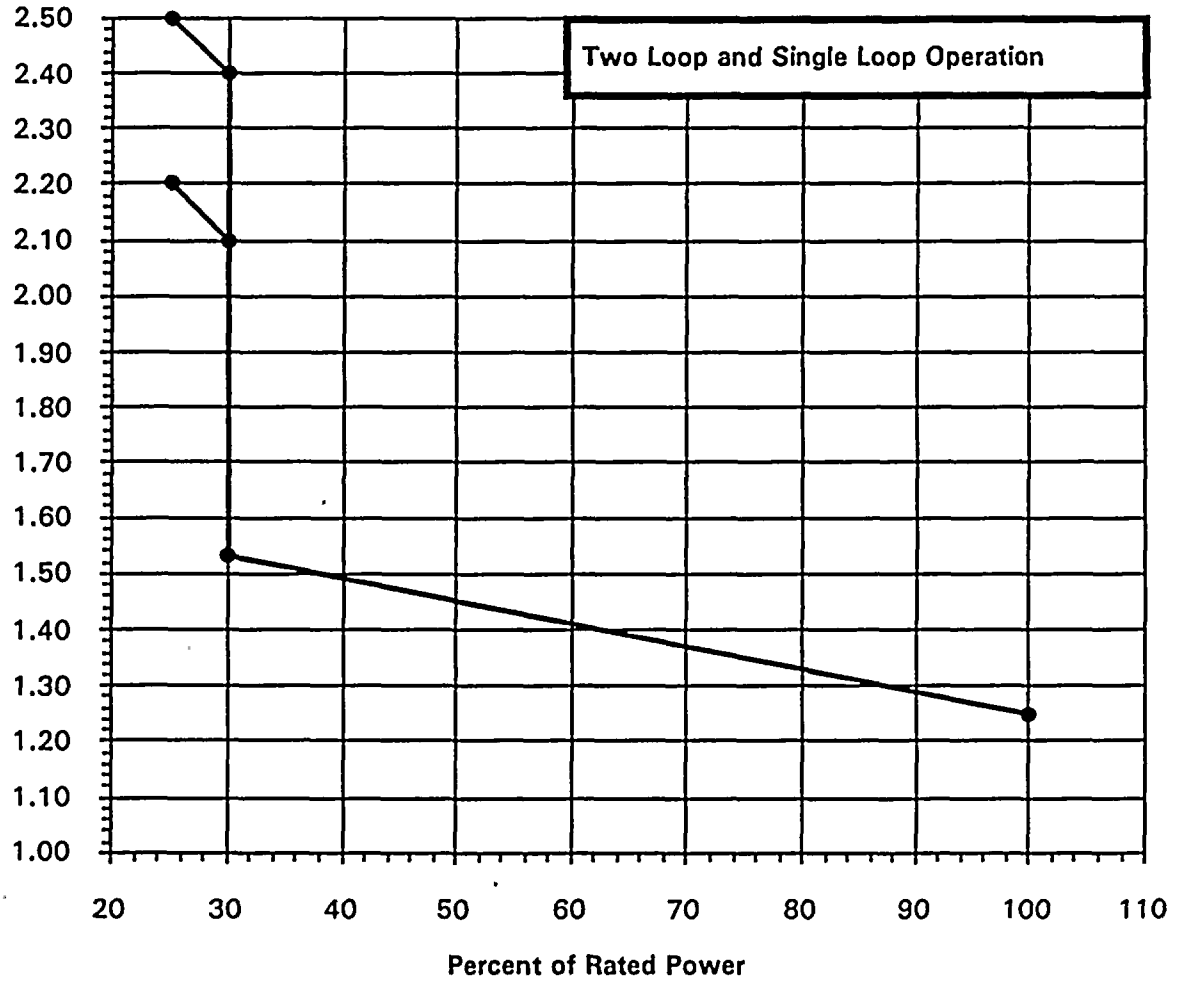
Figure 3.6




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.33 |
| | 30% | 1.55 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Operable, Turbine Bypass Operable, ABB SVEA-96
Cycle Exposures >5000 MWd/MTU

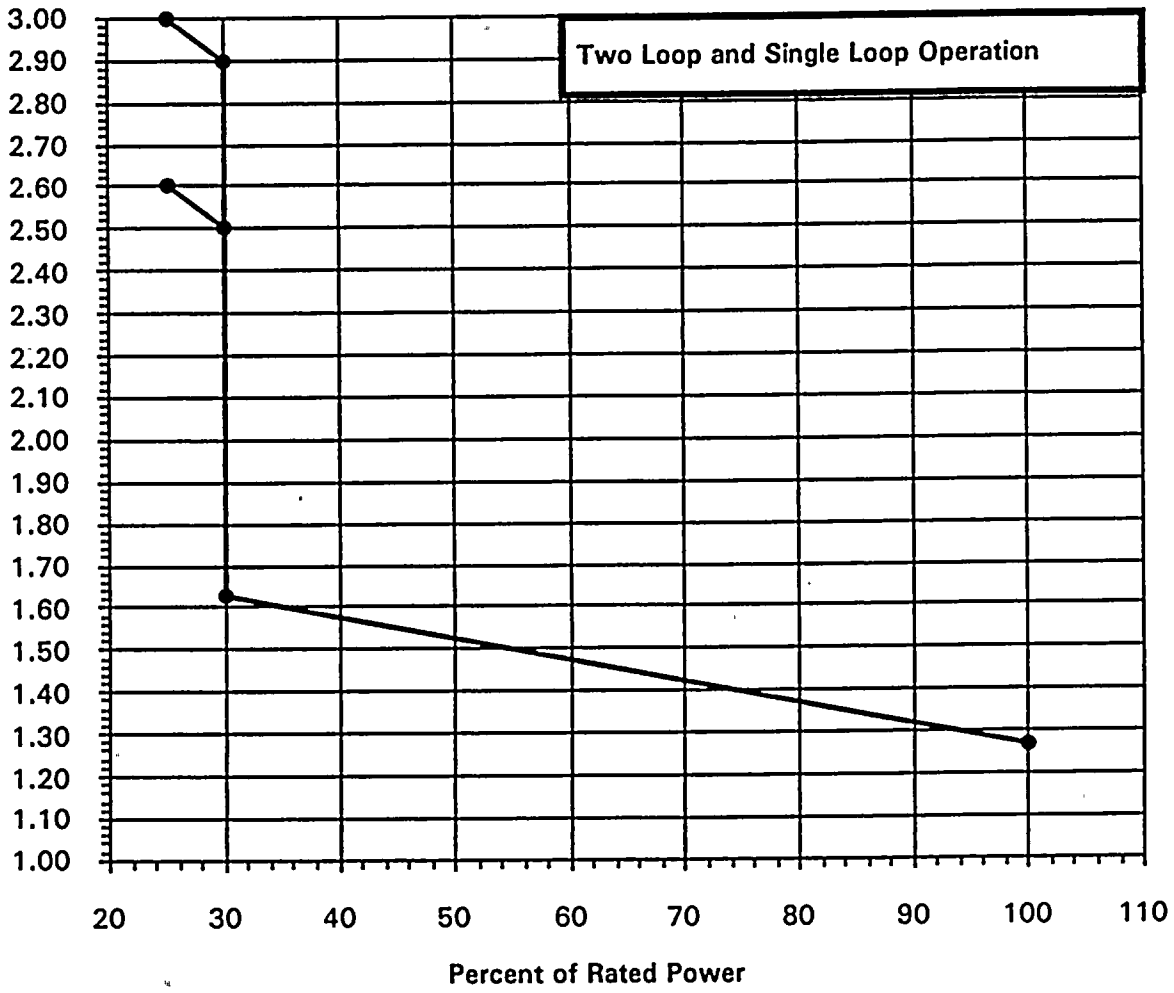
Figure 3.8




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.25 |
| | 30% | 1.53 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Operable, Turbine Bypass Operable, ABB SVEA-96
Cycle Exposures ≤5000 MWd/MTU

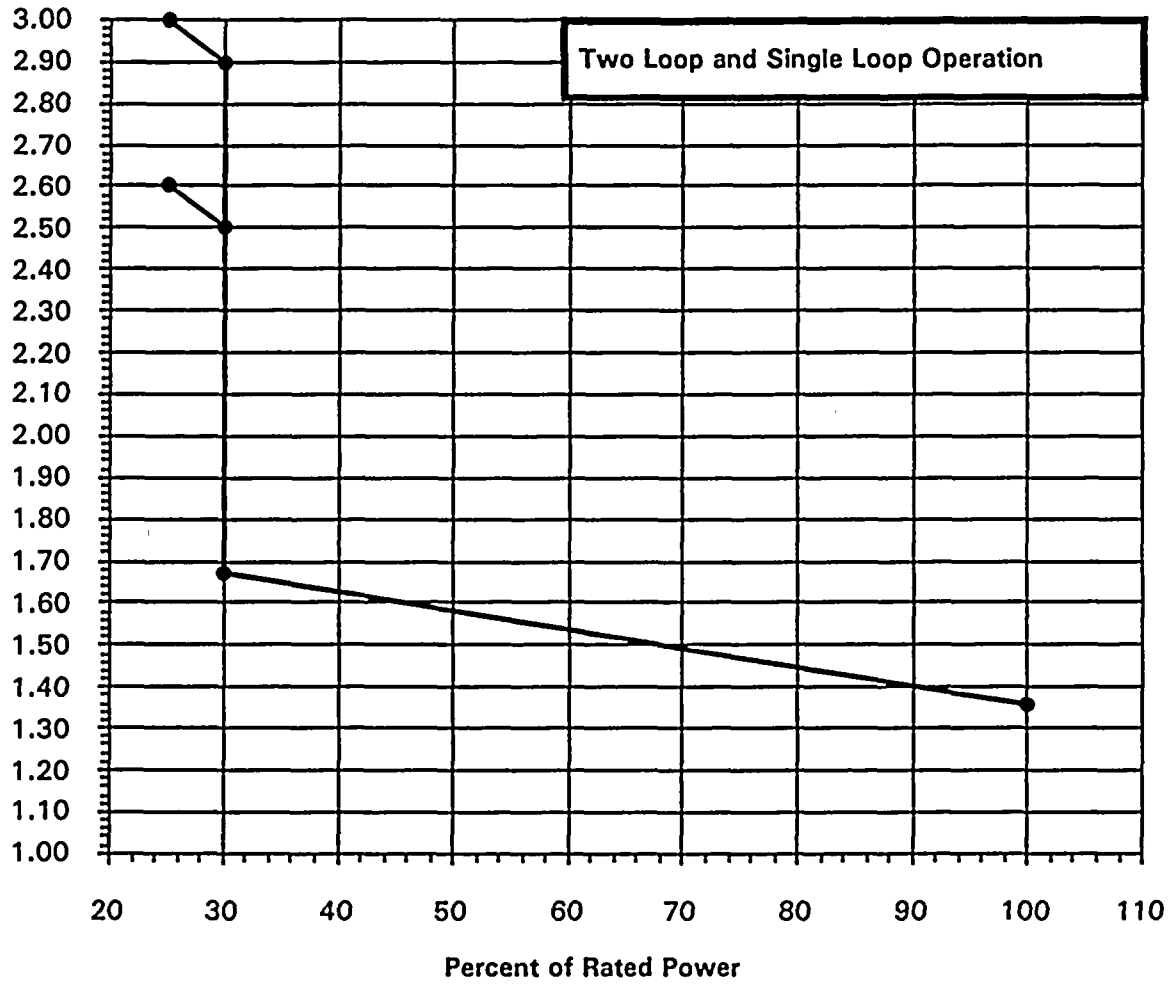
Figure 3.7




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.27 |
| | 30% | 1.63 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Operable, Turbine Bypass Inoperable, ABB SVEA-96
Cycle Exposures ≤5000 MWd/MTU

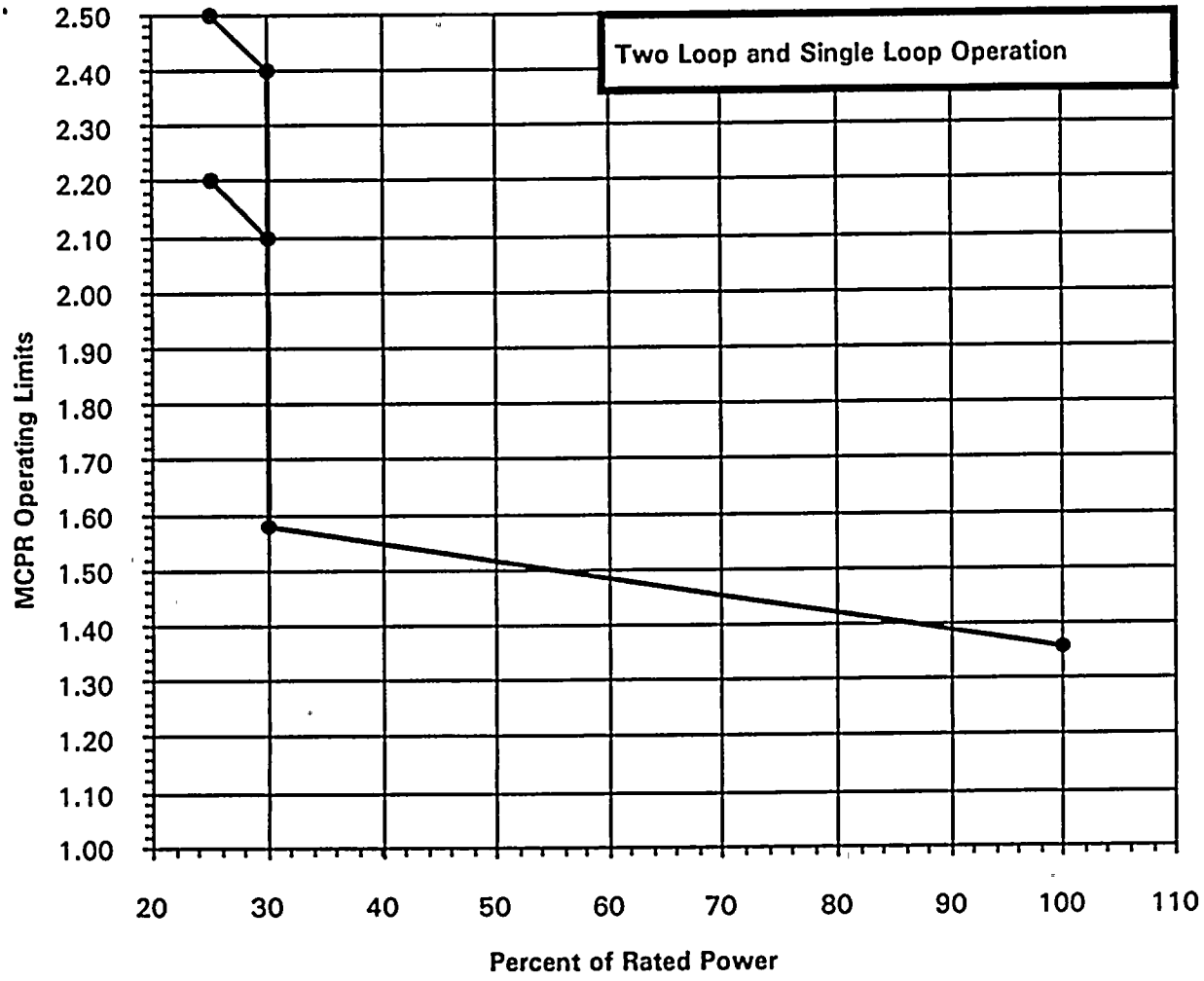
Figure 3.9




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.36 |
| | 30% | 1.67 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Operable, Turbine Bypass Inoperable, ABB SVEA-96
Cycle Exposures >5000 MWd/MTU

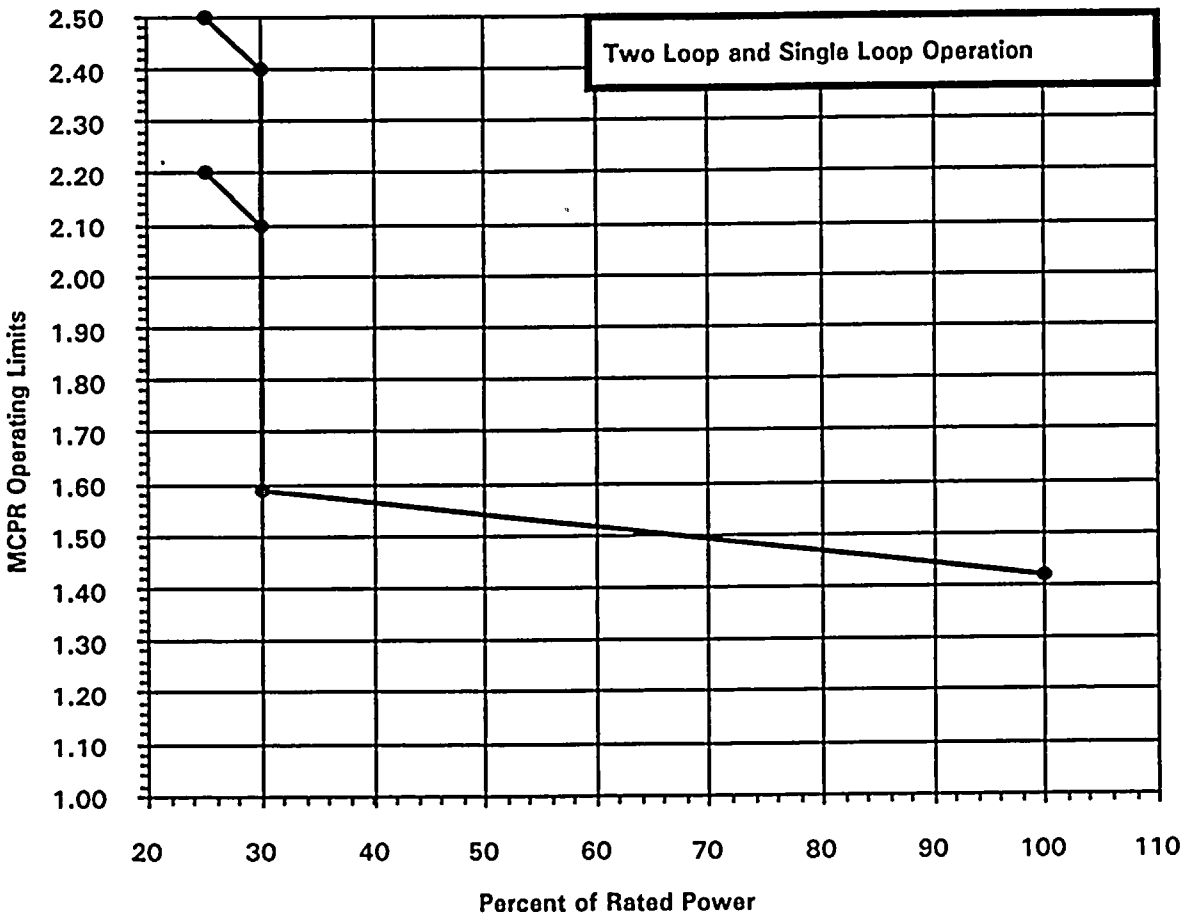
Figure 3.10




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.36 |
| | 30% | 1.58 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
TSSS, RPT Operable, Turbine Bypass Operable, SPC 9x9-9X
Cycle Exposures ≤5000 MWd/MTU

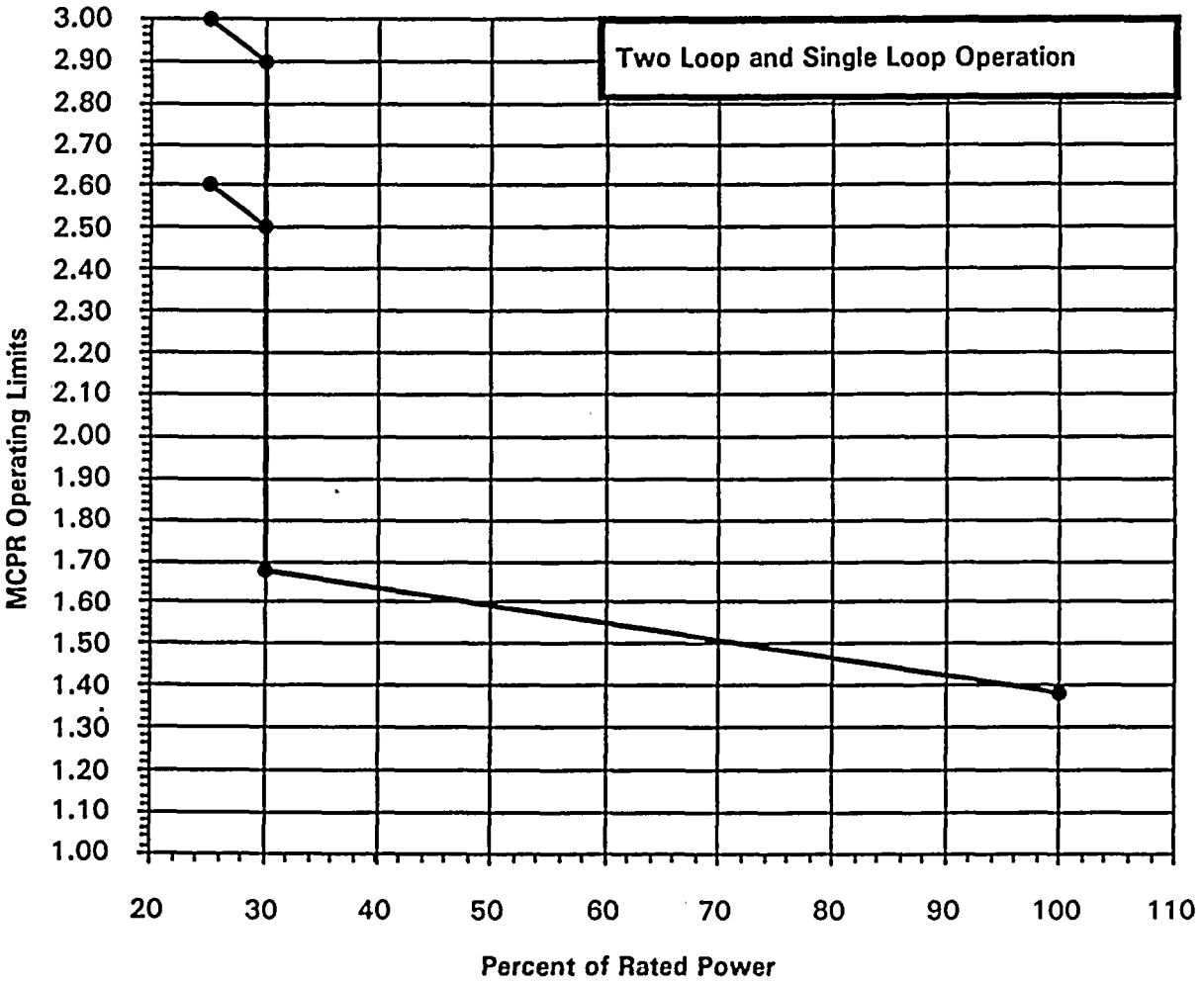
Figure 3.11




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.42 |
| | 30% | 1.59 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
TSSS, RPT Operable, Turbine Bypass Operable, SPC 9x9-9X
Cycle Exposures >5000 MWd/MTU

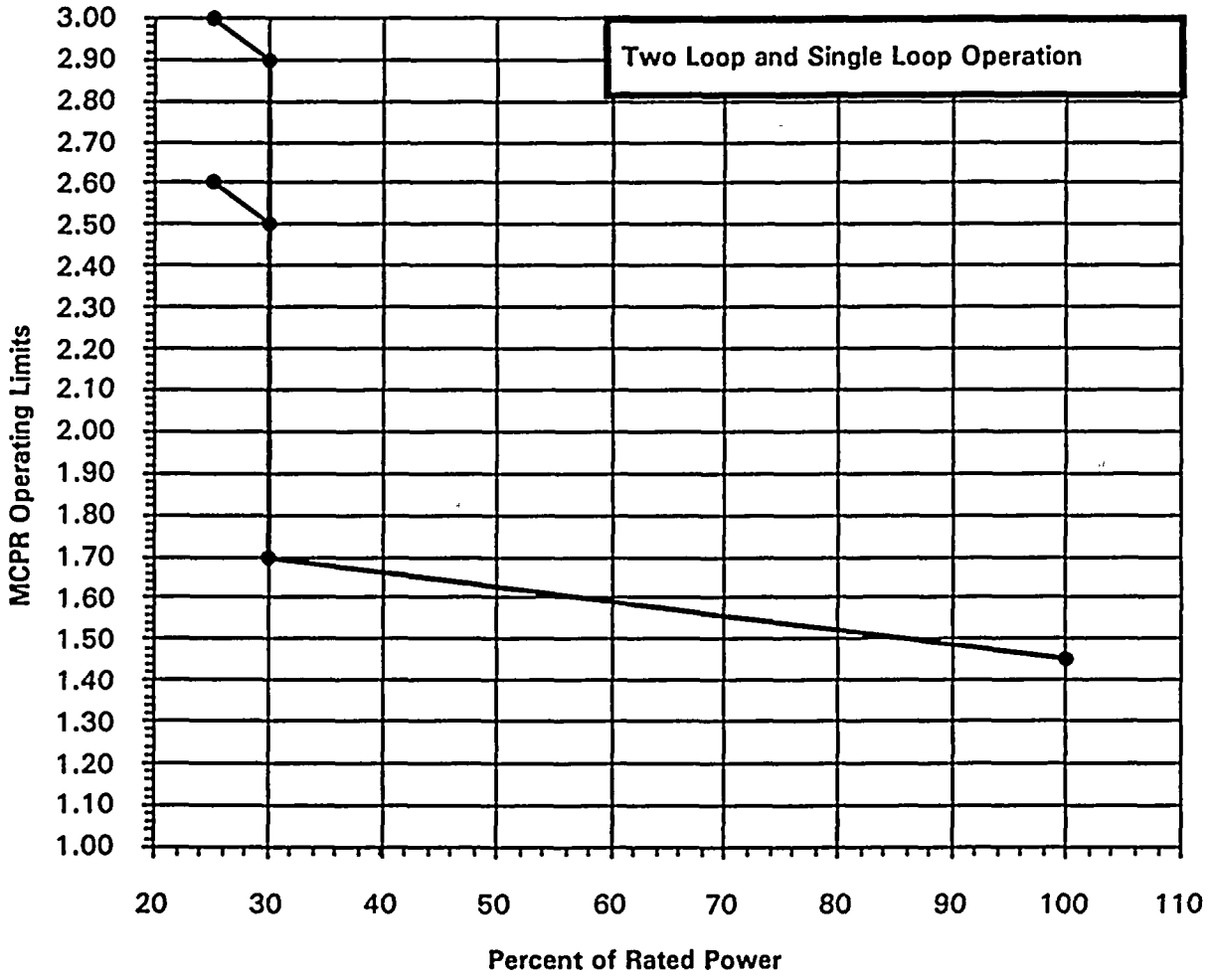
Figure 3.12




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.38 |
| | 30% | 1.68 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
TSSS, RPT Operable, Turbine Bypass Inoperable, SPC 9x9-9X
Cycle Exposures ≤5000 MWd/MTU

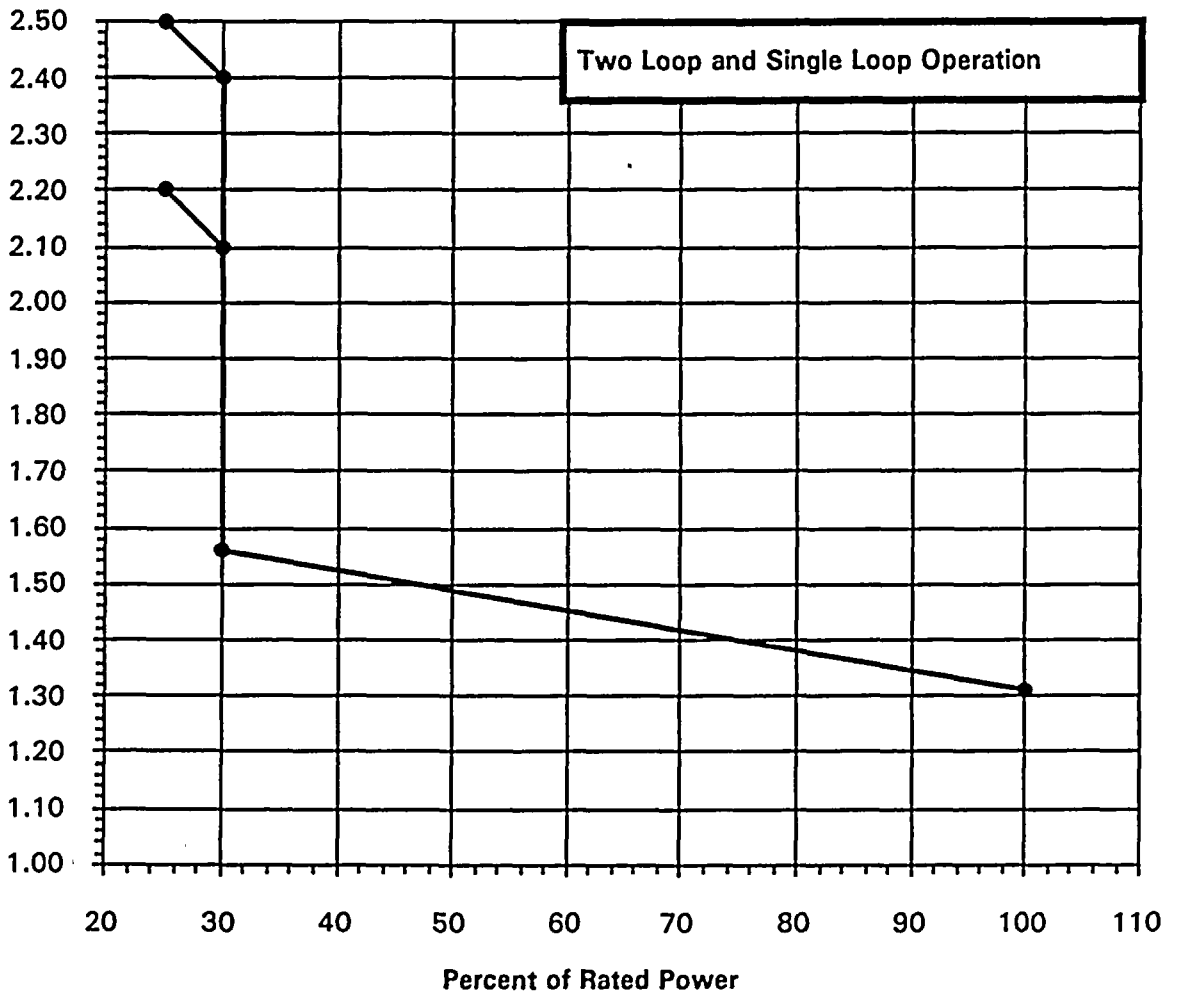
Figure 3.13




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.45 |
| | 30% | 1.70 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
TSSS, RPT Operable, Turbine Bypass Inoperable, SPC 9x9-9X
Cycle Exposures >5000 MWd/MTU

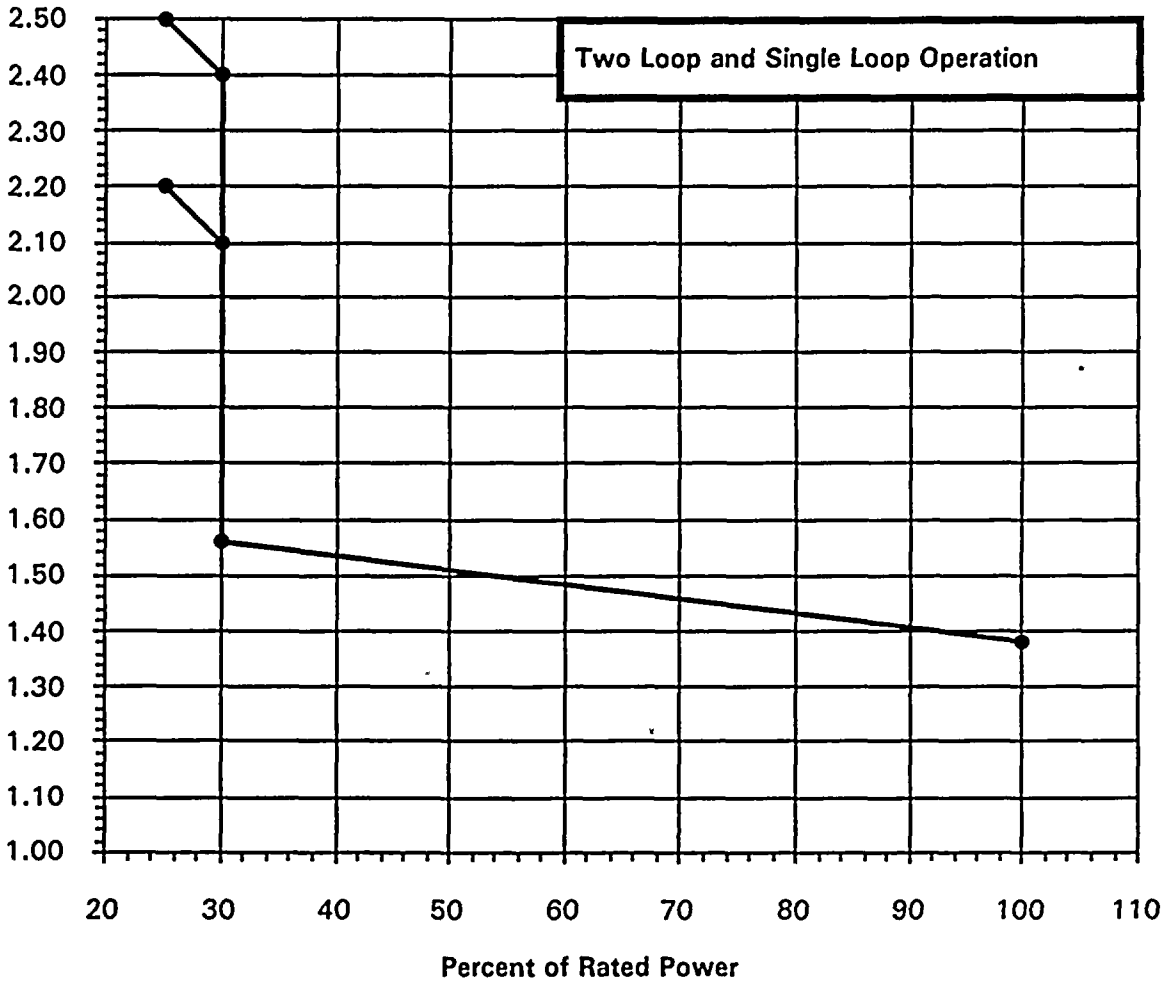
Figure 3.14




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.31 |
| | 30% | 1.56 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
TSSS, RPT Operable, Turbine Bypass Operable, ABB SVEA-96
Cycle Exposures ≤5000 MWd/MTU

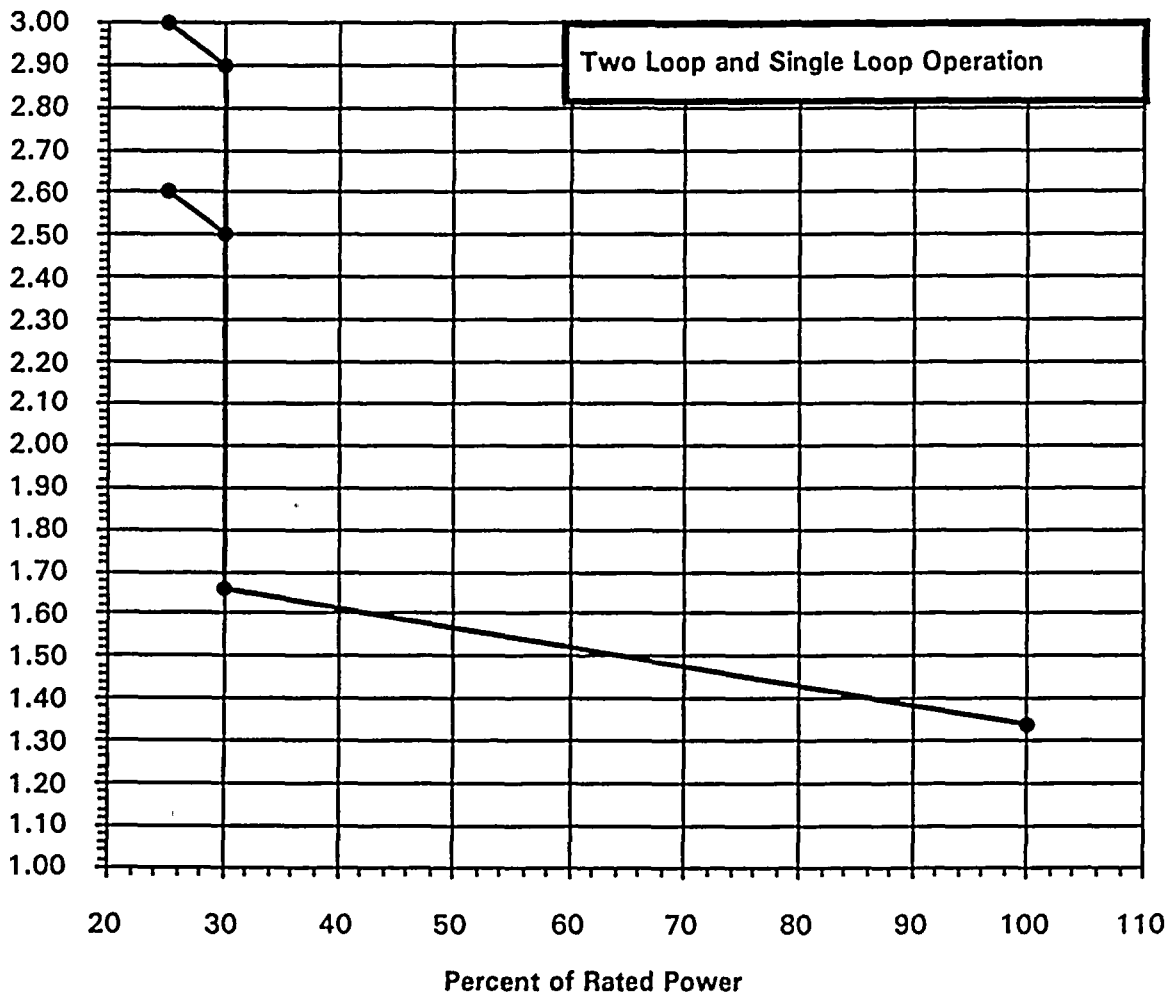
Figure 3.15




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.38 |
| | 30% | 1.56 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
TSSS, RPT Operable, Turbine Bypass Operable, ABB SVEA-96
Cycle Exposures >5000 MWd/MTU

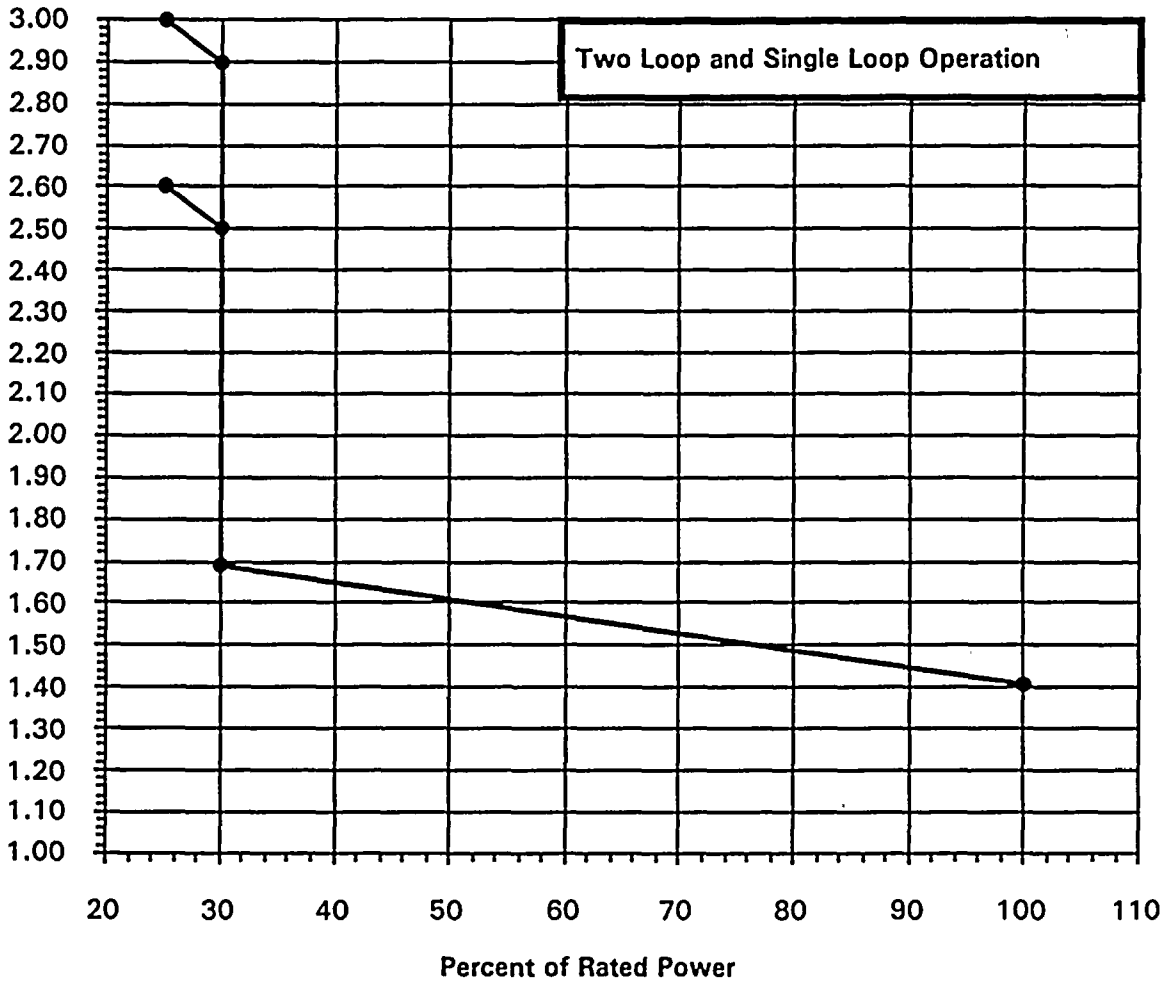
Figure 3.16




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.34 |
| | 30% | 1.66 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
TSSS, RPT Operable, Turbine Bypass Inoperable, ABB SVEA-96
Cycle Exposures ≤5000 MWd/MTU

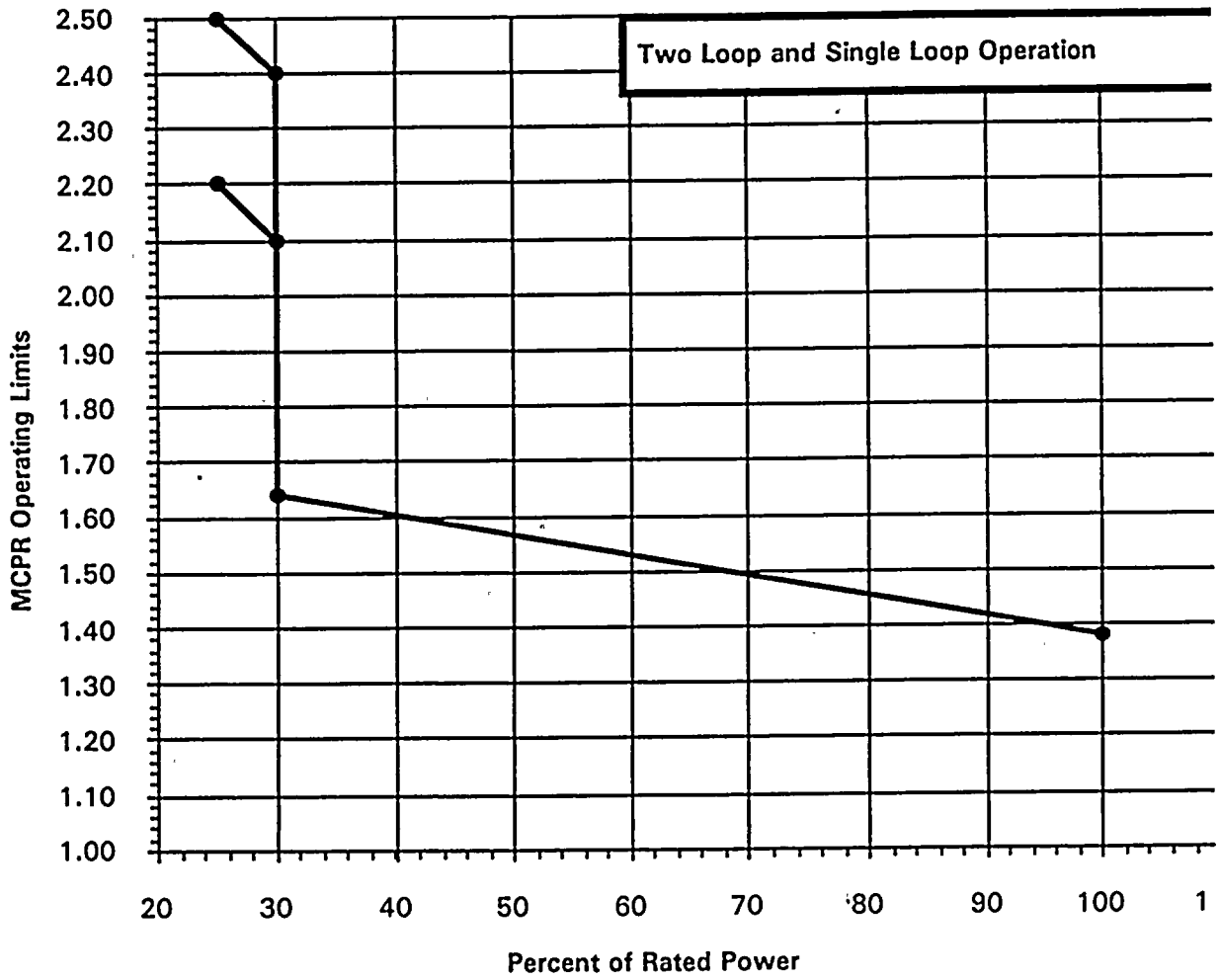
Figure 3.17




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.41 |
| | 30% | 1.69 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
TSSS, RPT Operable, Turbine Bypass Inoperable, ABB SVEA-96
Cycle Exposures >5000 MWd/MTU

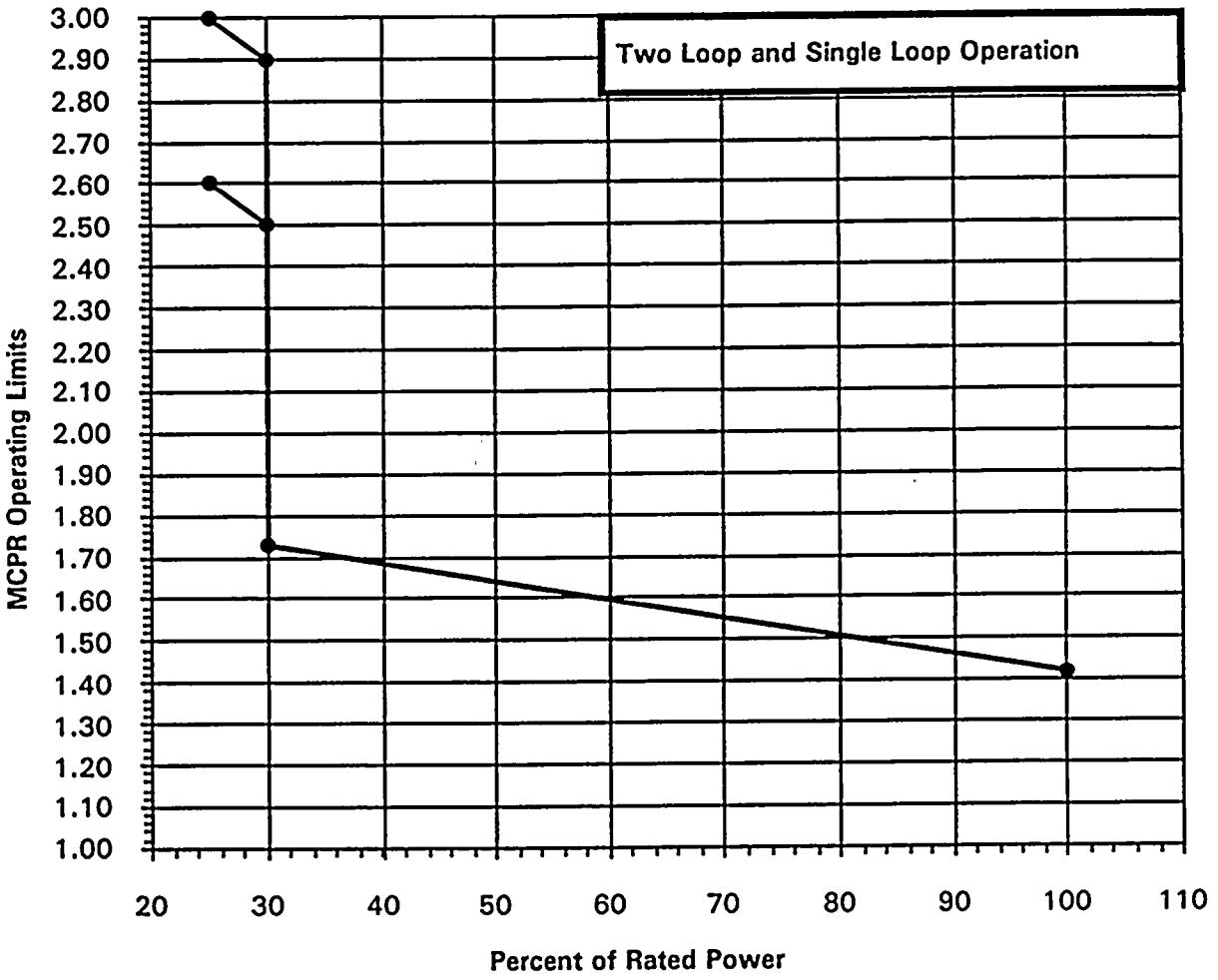
Figure 3.18




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.38 |
| | 30% | 1.64 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Operable, Turbine Bypass Operable, SPC 9x9-9X
FFTR Operation

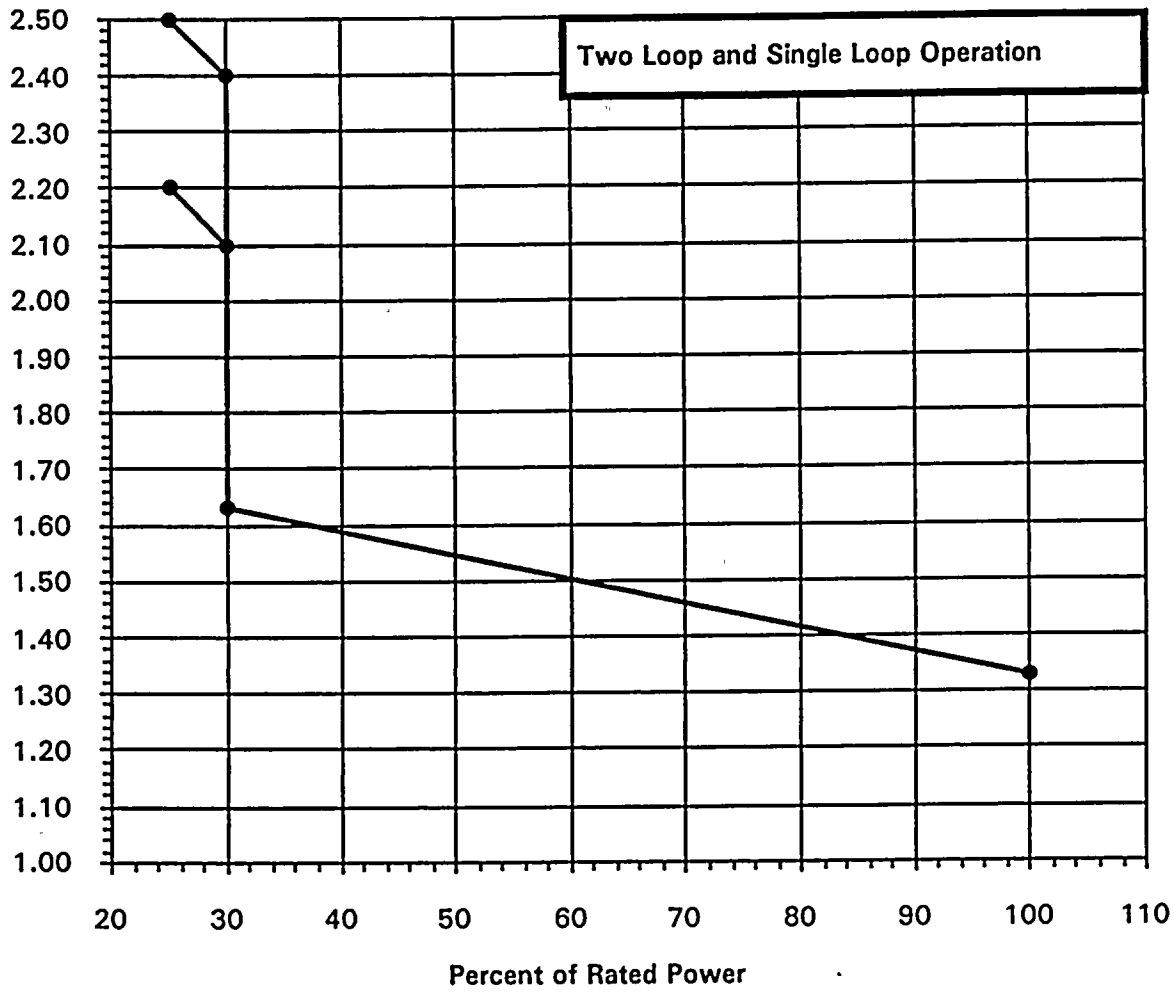
Figure 3.19




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.42 |
| | 30% | 1.73 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Operable, Turbine Bypass Inoperable, SPC 9x9-9X
FFTR Operation

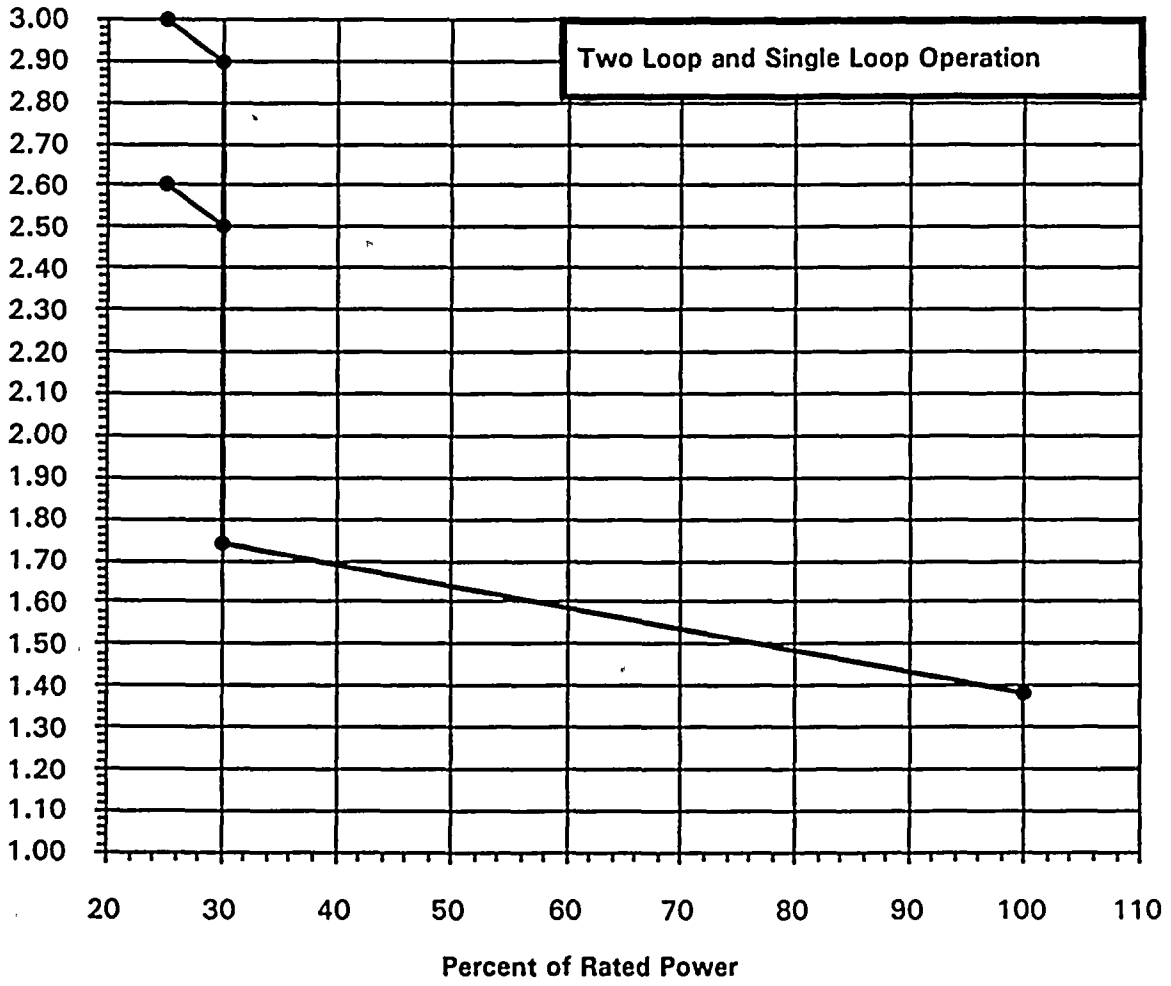
Figure 3.20




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.33 |
| | 30% | 1.63 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Operable, Turbine Bypass Operable, ABB SVEA-96
FFTR Operation

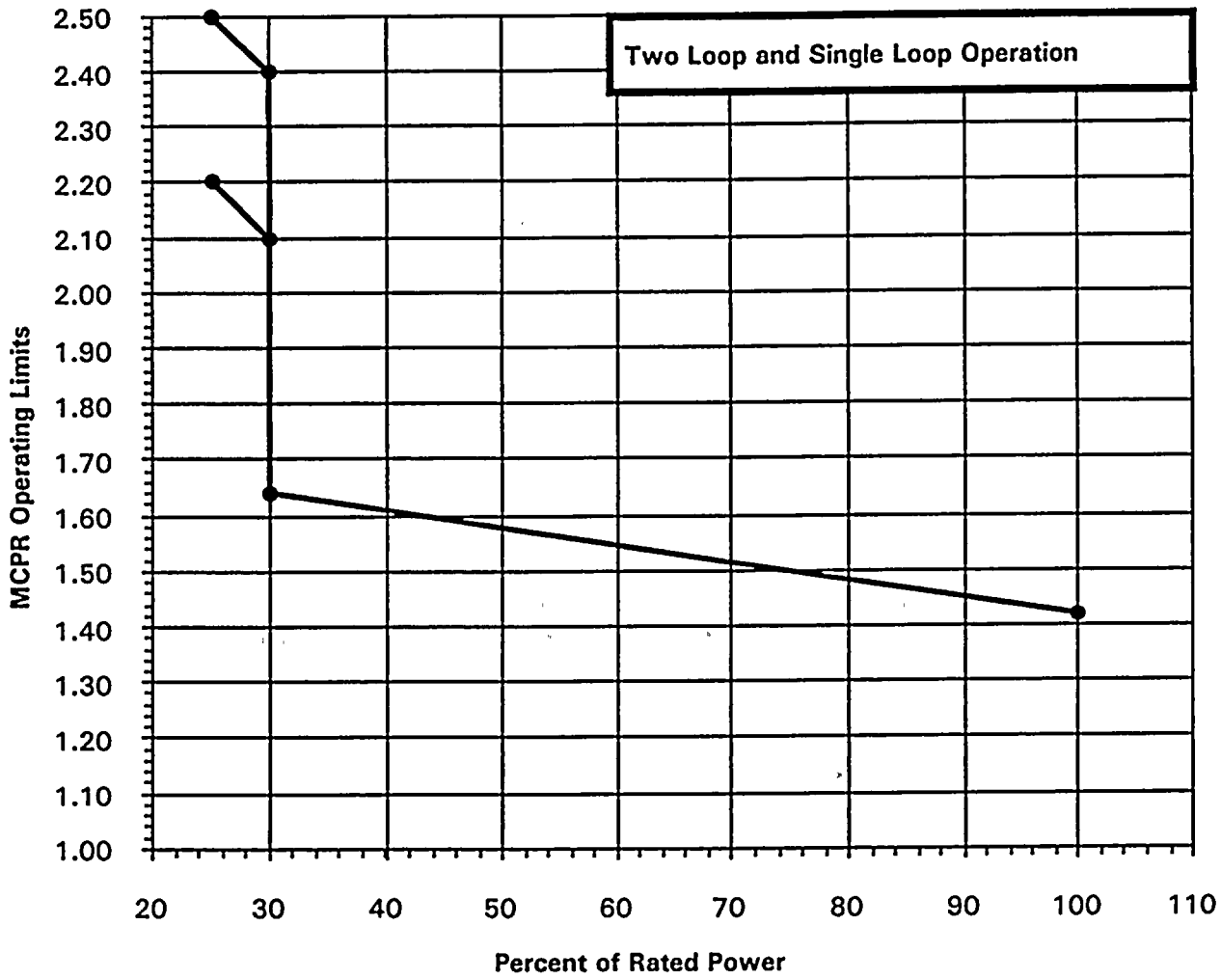
Figure 3.21




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.38 |
| | 30% | 1.74 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Operable, Turbine Bypass Inoperable, ABB SVEA-96
FFTR Operation

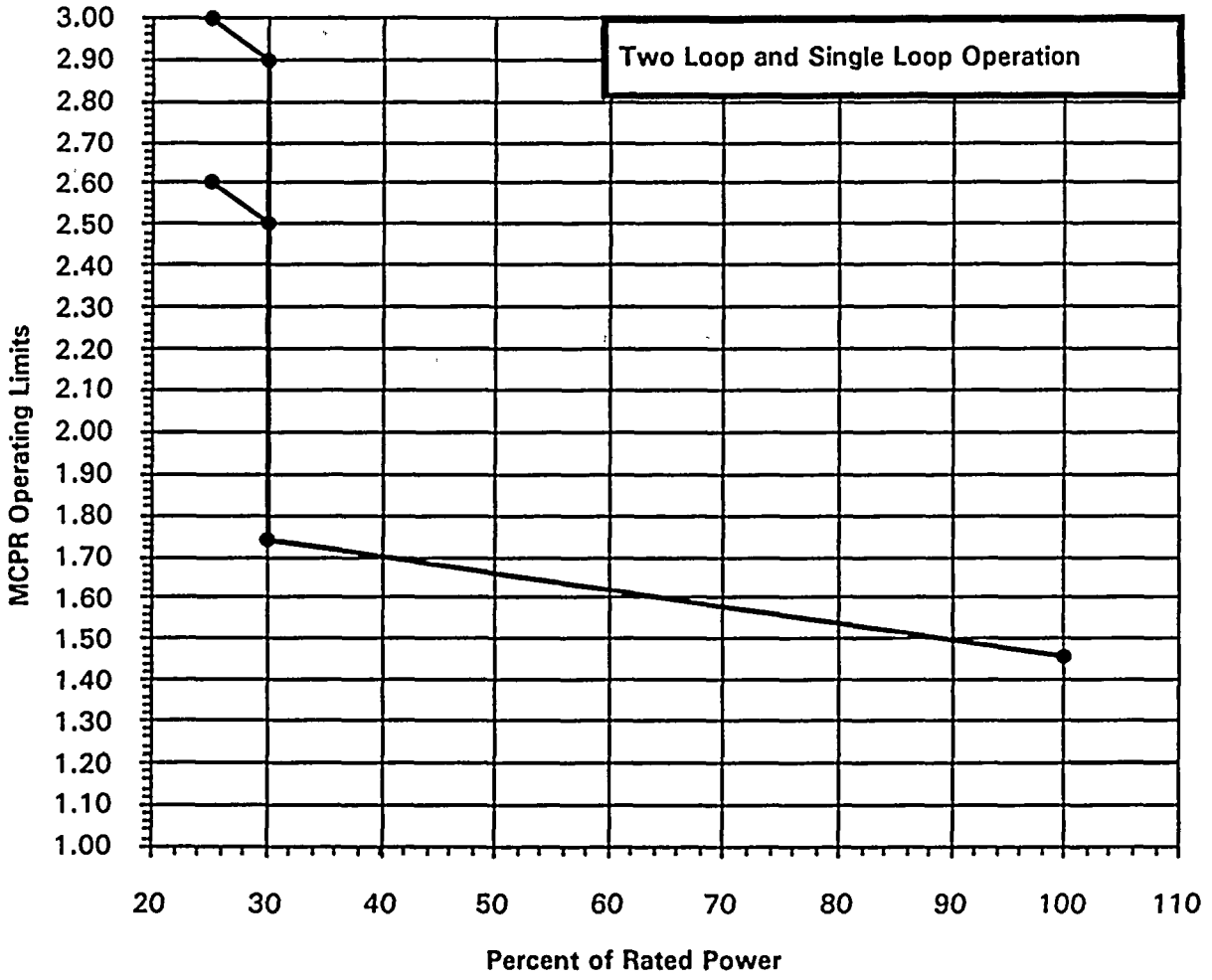
Figure 3.22




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.42 |
| | 30% | 1.64 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
TSSS, RPT Operable, Turbine Bypass Operable, SPC 9x9-9X
FFTR Operation

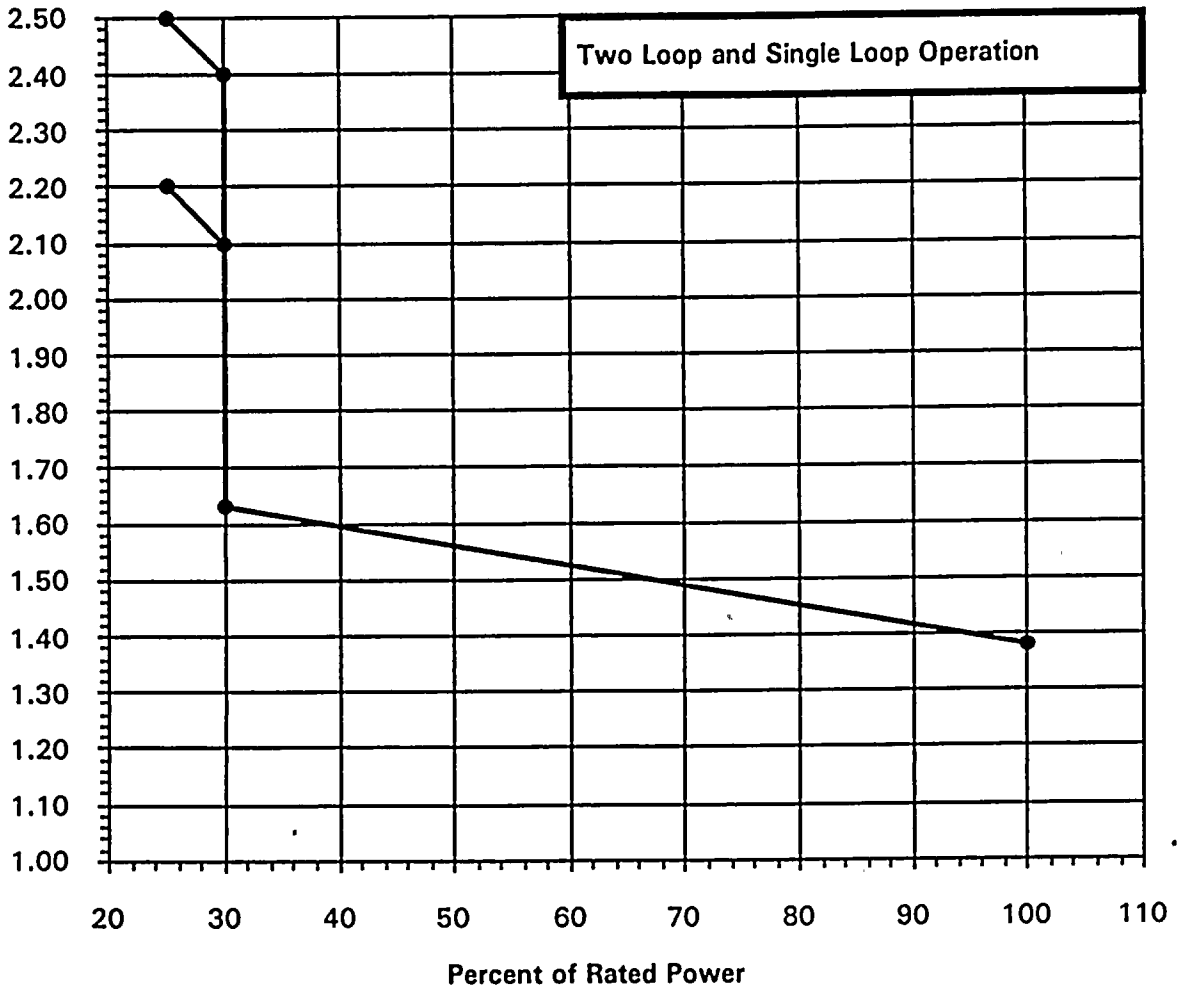
Figure 3.23




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.46 |
| | 30% | 1.74 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
TSSS, RPT Operable, Turbine Bypass Inoperable, SPC 9x9-9X
FFTR Operation

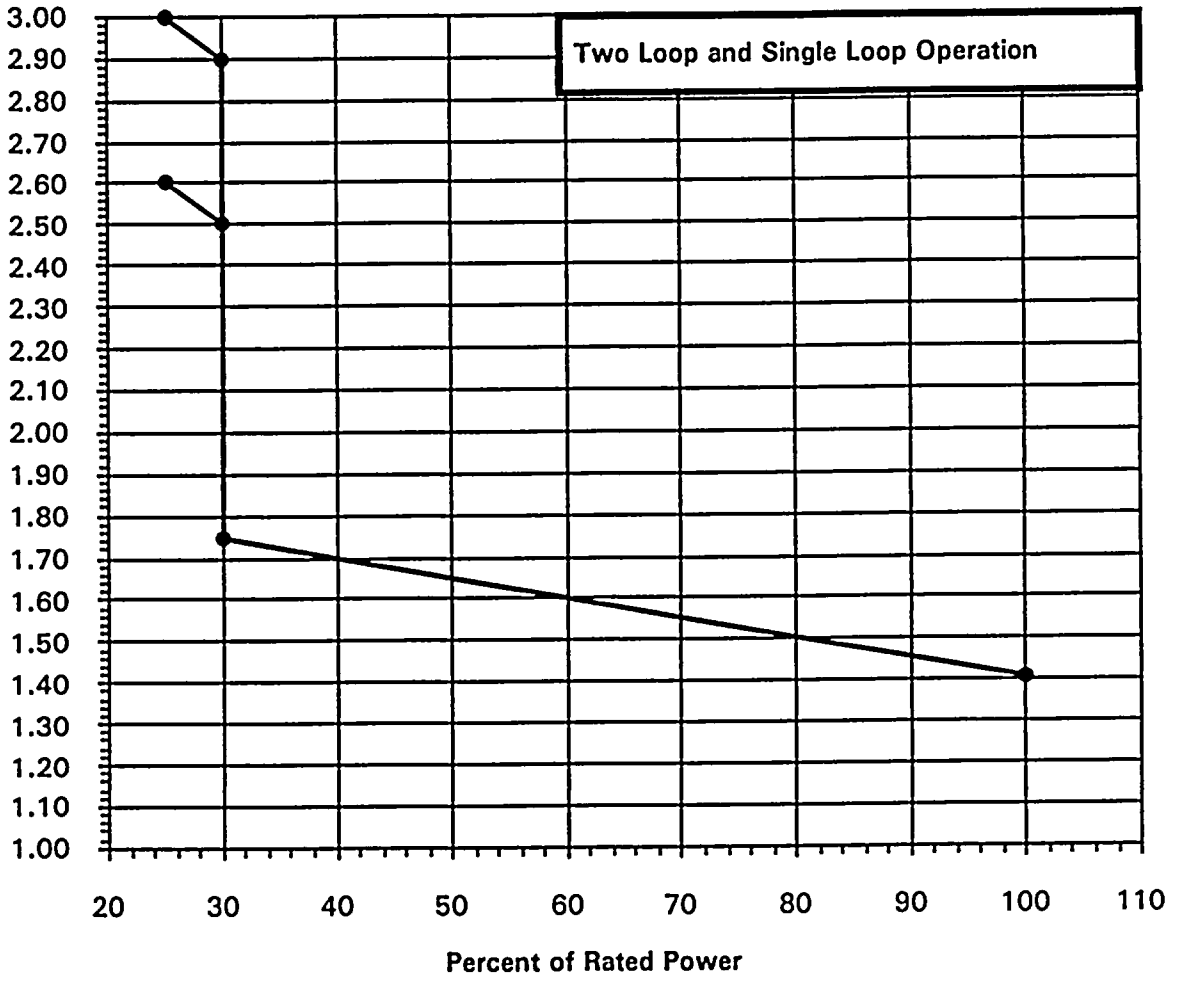
Figure 3.24




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.38 |
| | 30% | 1.63 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
TSSS, RPT Operable, Turbine Bypass Operable, ABB SVEA-96
FFTR Operation

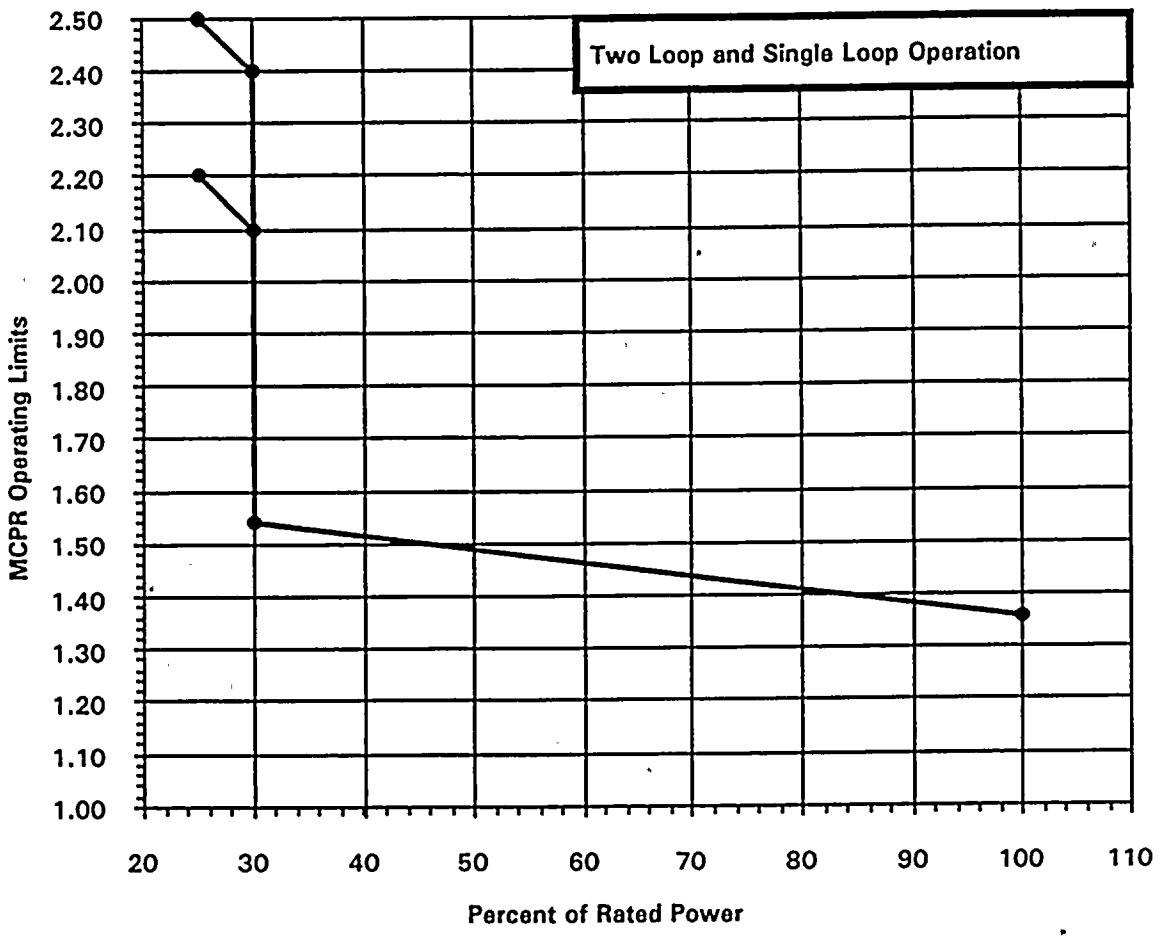
Figure 3.25




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.41 |
| | 30% | 1.75 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
TSSS, RPT Operable, Turbine Bypass Inoperable, ABB SVEA-96
FFTR Operation

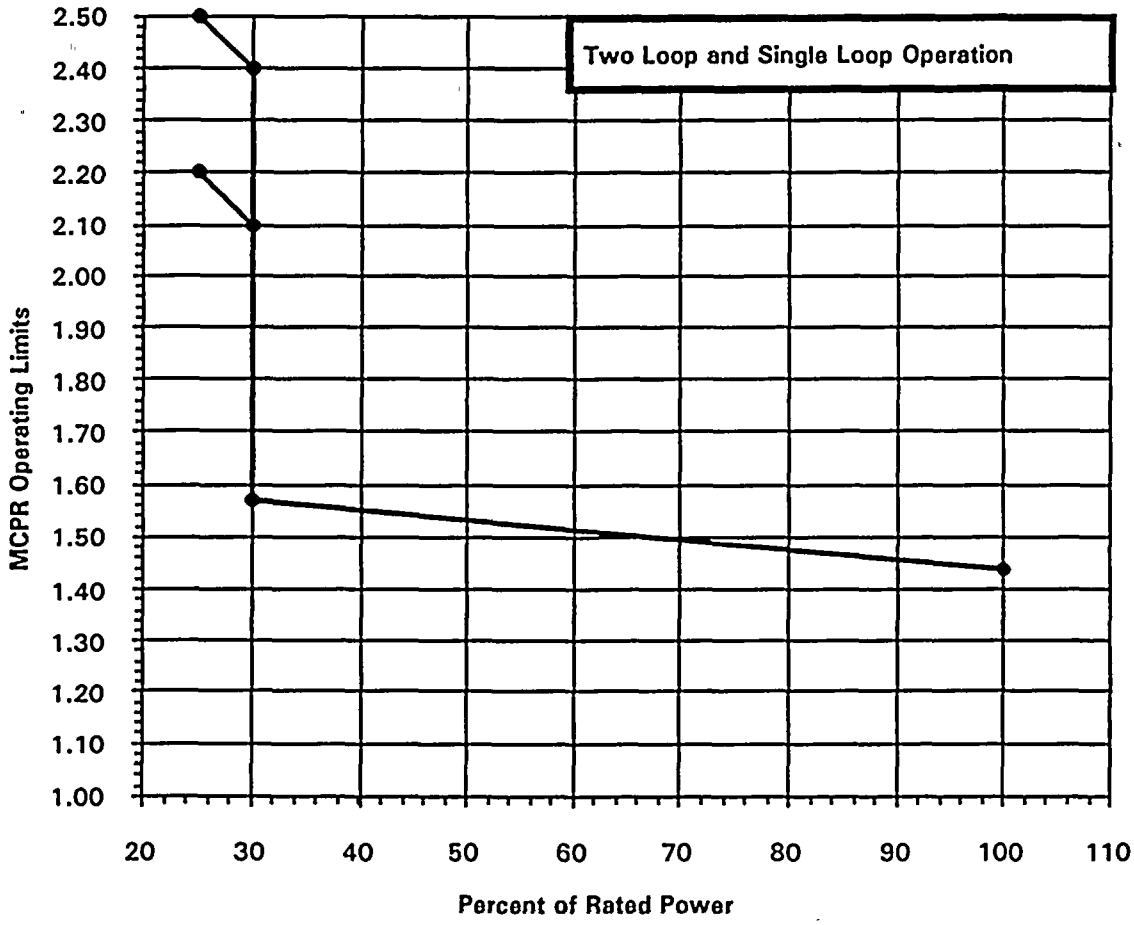
Figure 3.26




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.36 |
| | 30% | 1.54 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Operable, SPC 9x9-9X
Cycle Exposures ≤5000 MWd/MTU

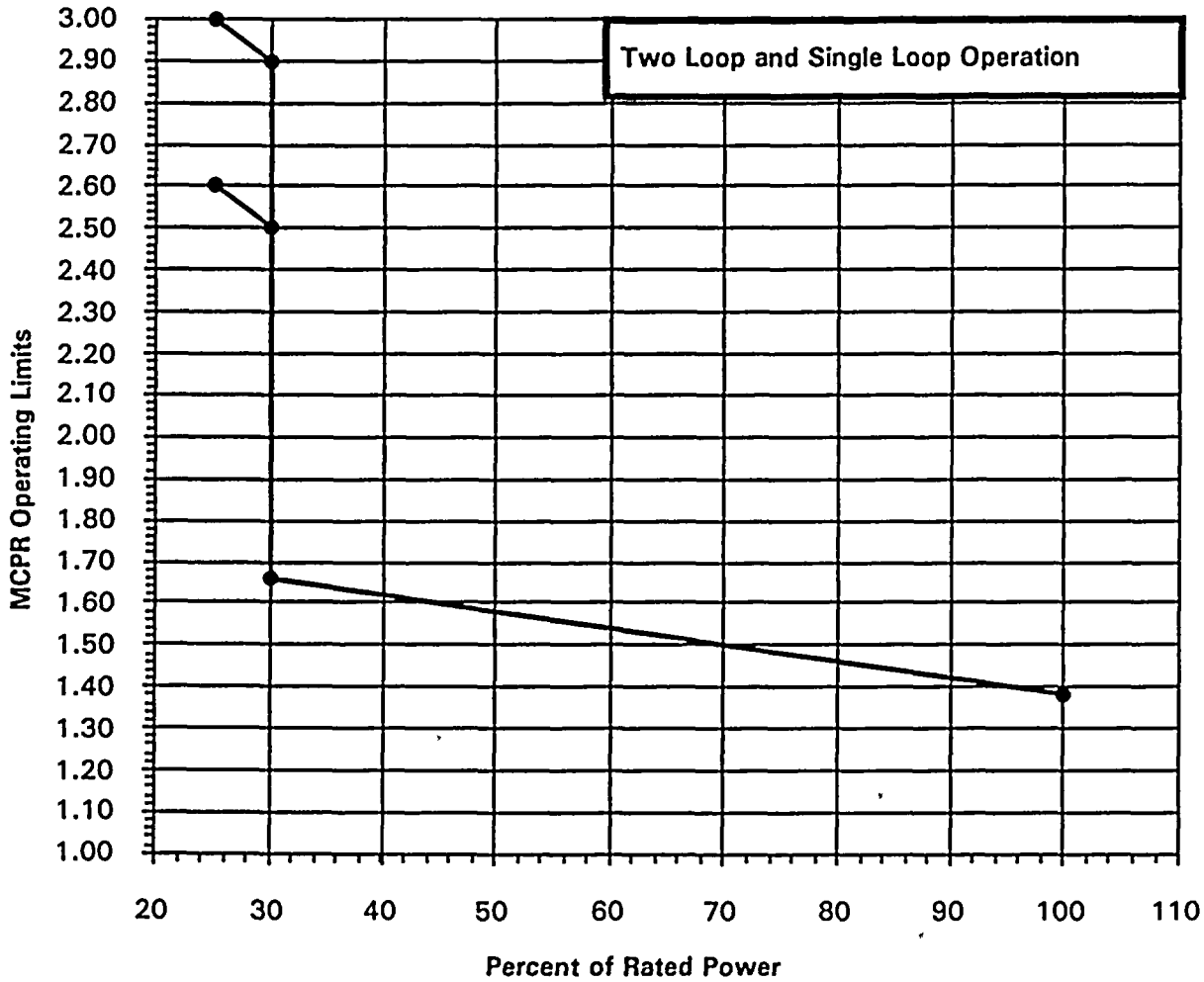
Figure 3.27




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.44 |
| | 30% | 1.57 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Operable, SPC 9x9-9X
Cycle Exposures >5000 MWd/MTU

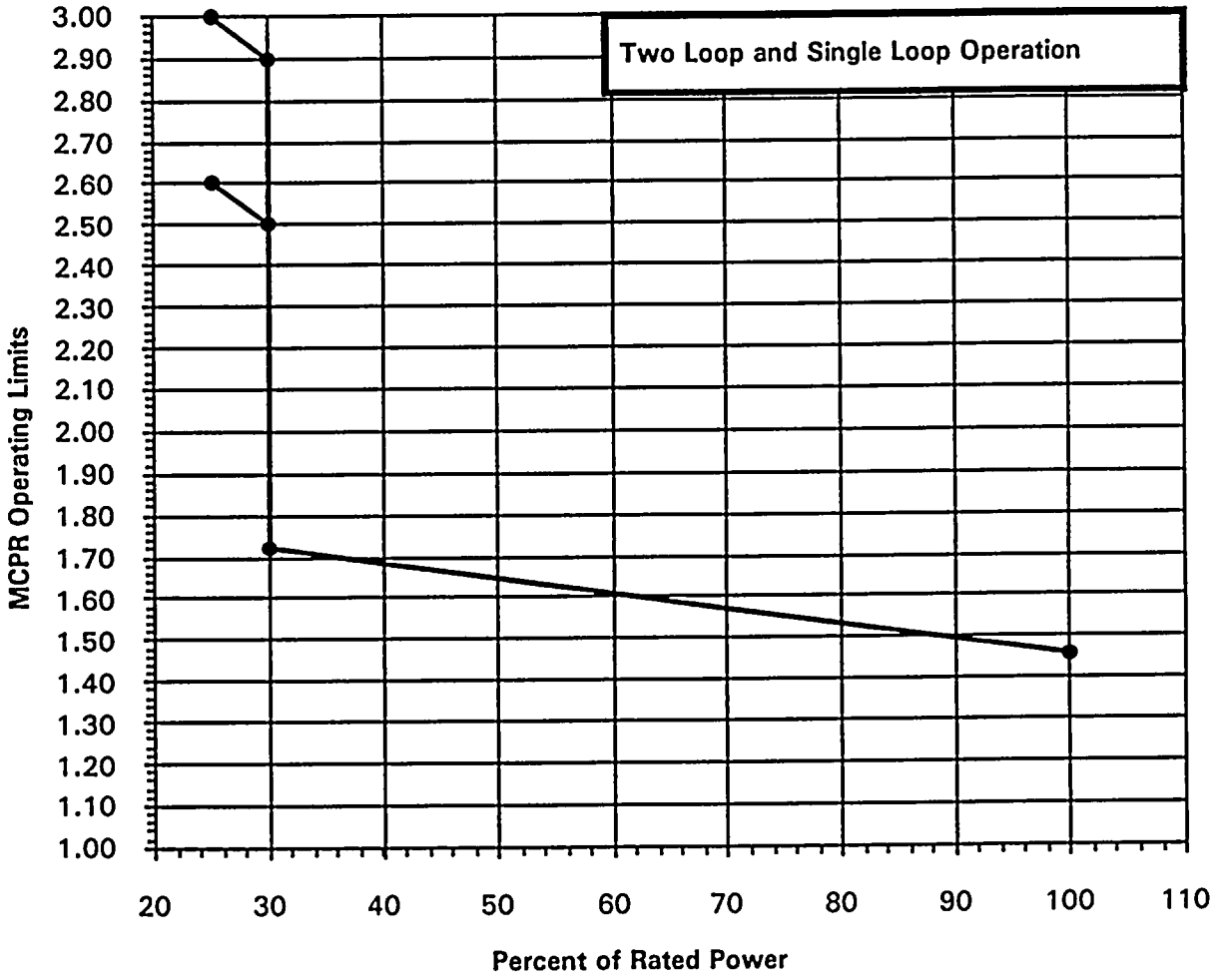
Figure 3.28




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.38 |
| | 30% | 1.66 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Inoperable, SPC 9x9-9X
Cycle Exposures ≤5000 MWd/MTU

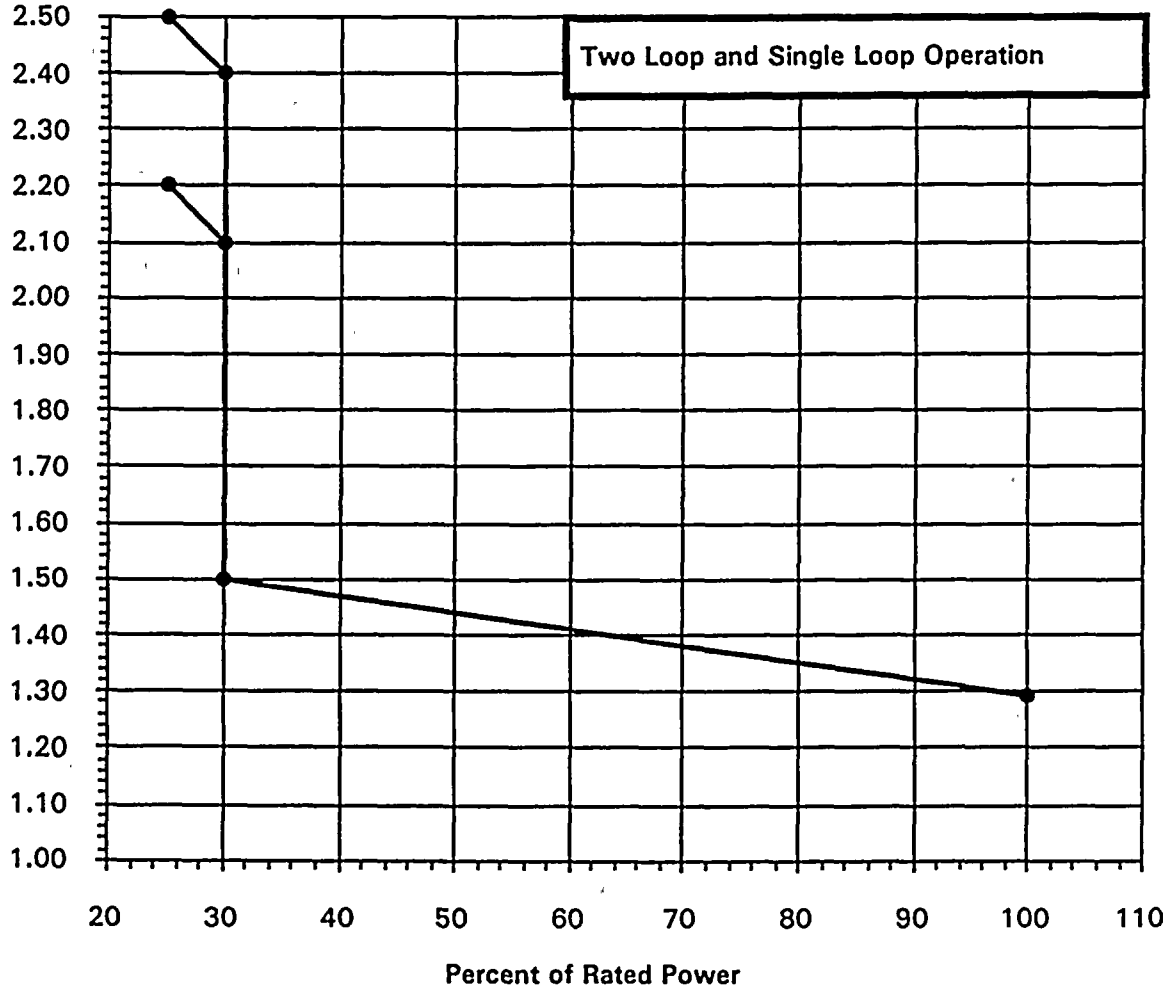
Figure 3.29




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.46 |
| | 30% | 1.72 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Inoperable, SPC 9x9-9X
Cycle Exposures >5000 MWd/MTU

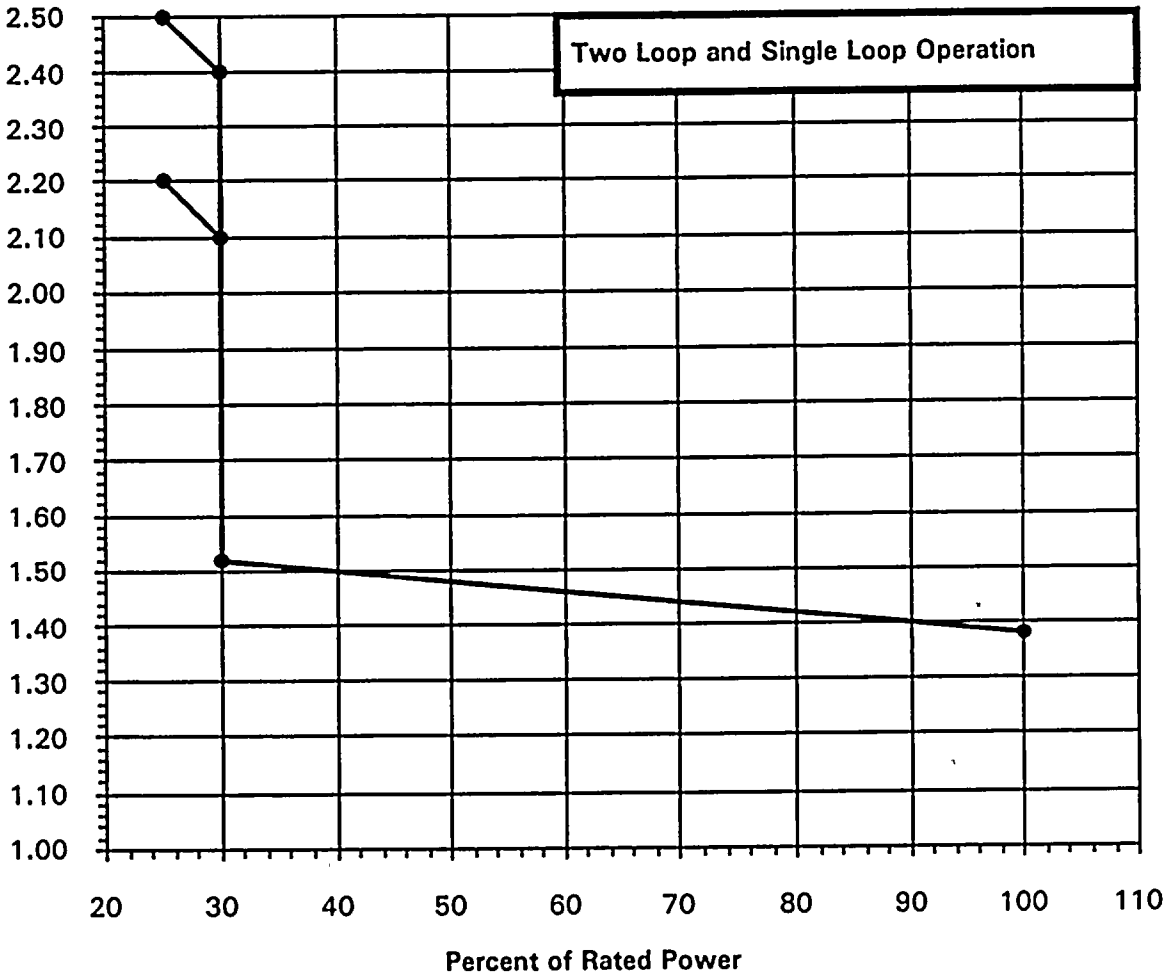
Figure 3.30




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.29 |
| | 30% | 1.50 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Operable, ABB SVEA-96
Cycle Exposures ≤5000 MWd/MTU

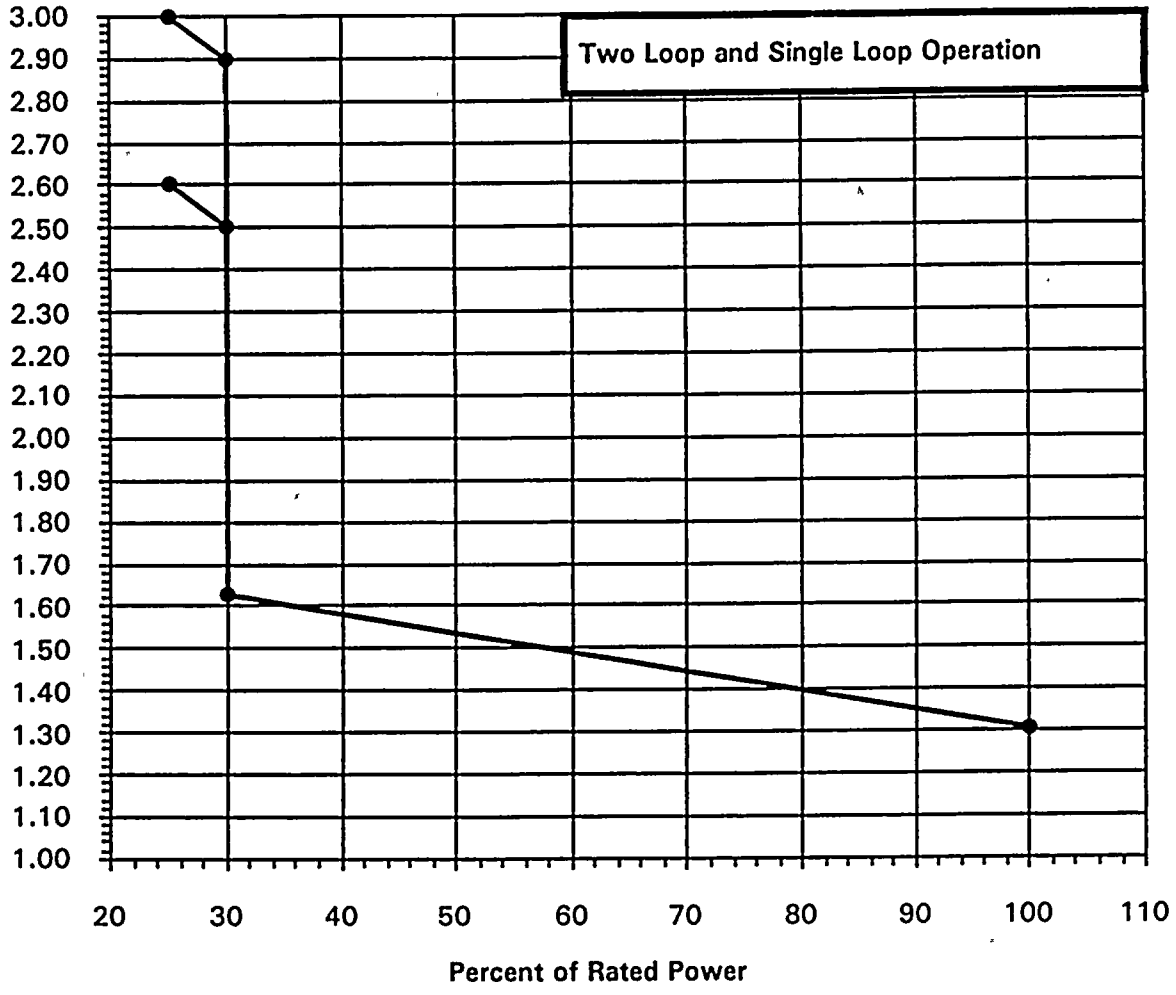
Figure 3.31




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.38 |
| | 30% | 1.52 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.10 |
| | 25% | 2.20 |
| Core Flow >50%, Power ≤30% | 30% | 2.40 |
| | 25% | 2.50 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Operable, ABB SVEA-96
Cycle Exposures >5000 MWd/MTU

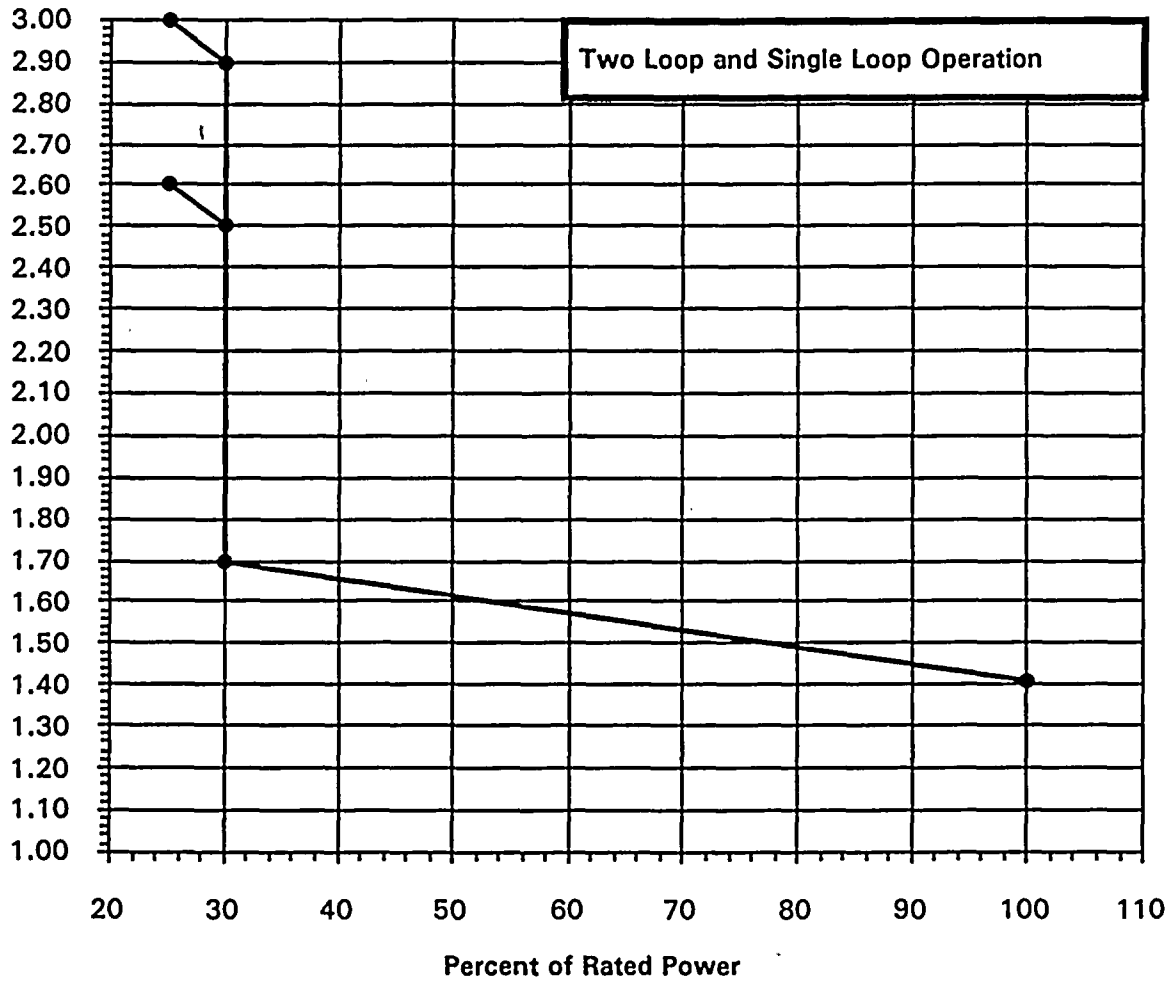
Figure 3.32




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.31 |
| | 30% | 1.63 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Inoperable, ABB SVEA-96
Cycle Exposures ≤5000 MWd/MTU

Figure 3.33




| Range | Power | Operating Limit MCPR |
|---|---|---|
| All Core Flows, Power >30% | 100% | 1.41 |
| | 30% | 1.70 |
| Core Flow ≤50%, Power ≤30% | 30% | 2.50 |
| | 25% | 2.60 |
| Core Flow >50%, Power ≤30% | 30% | 2.90 |
| | 25% | 3.00 |

Reduced Power MCPR Operating Limit Versus Percent of Rated Power
NSS, RPT Inoperable, Turbine Bypass Inoperable, ABB SVEA-96
Cycle Exposures >5000 MWd/MTU

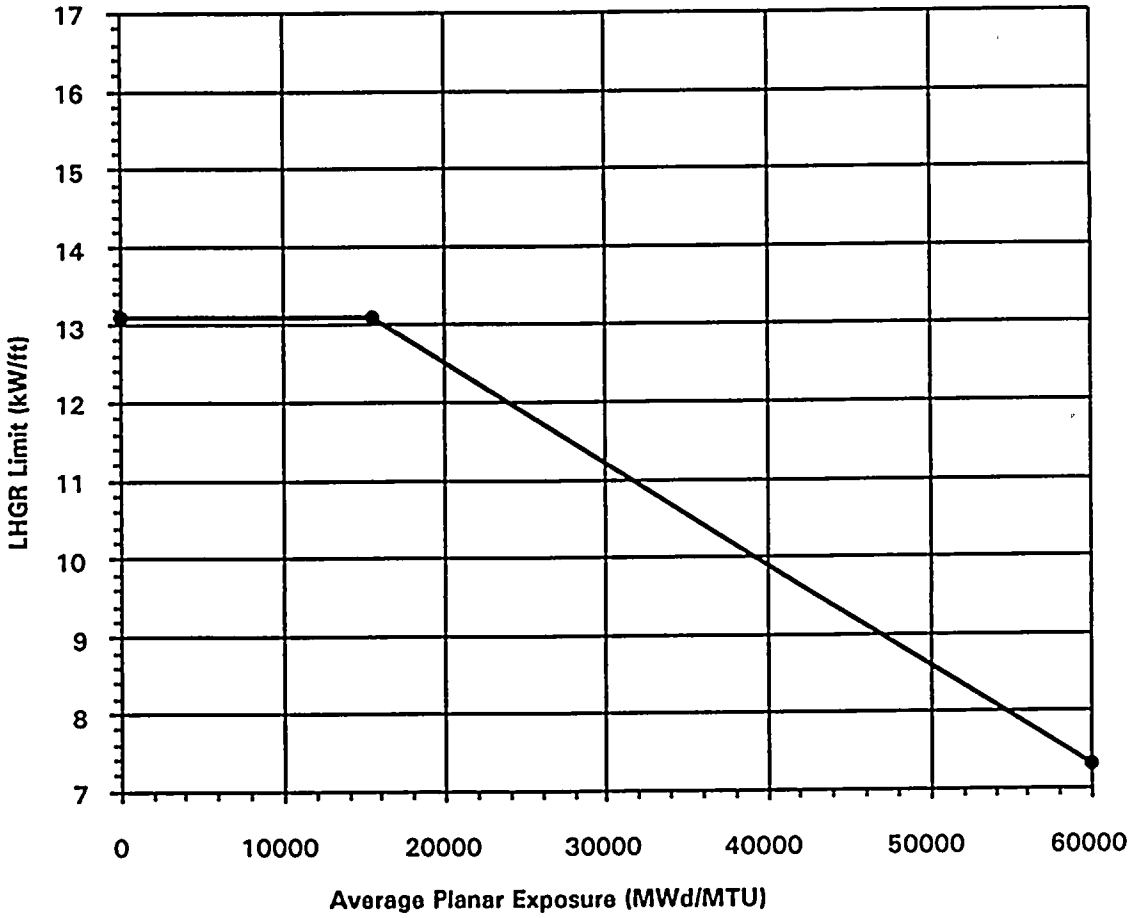
Figure 3.34

## 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, as a function of Average Planar Exposure, shall not exceed the limits shown in the following figures:

a. Figure 4.1 - SPC 9x9-9X reload fuel

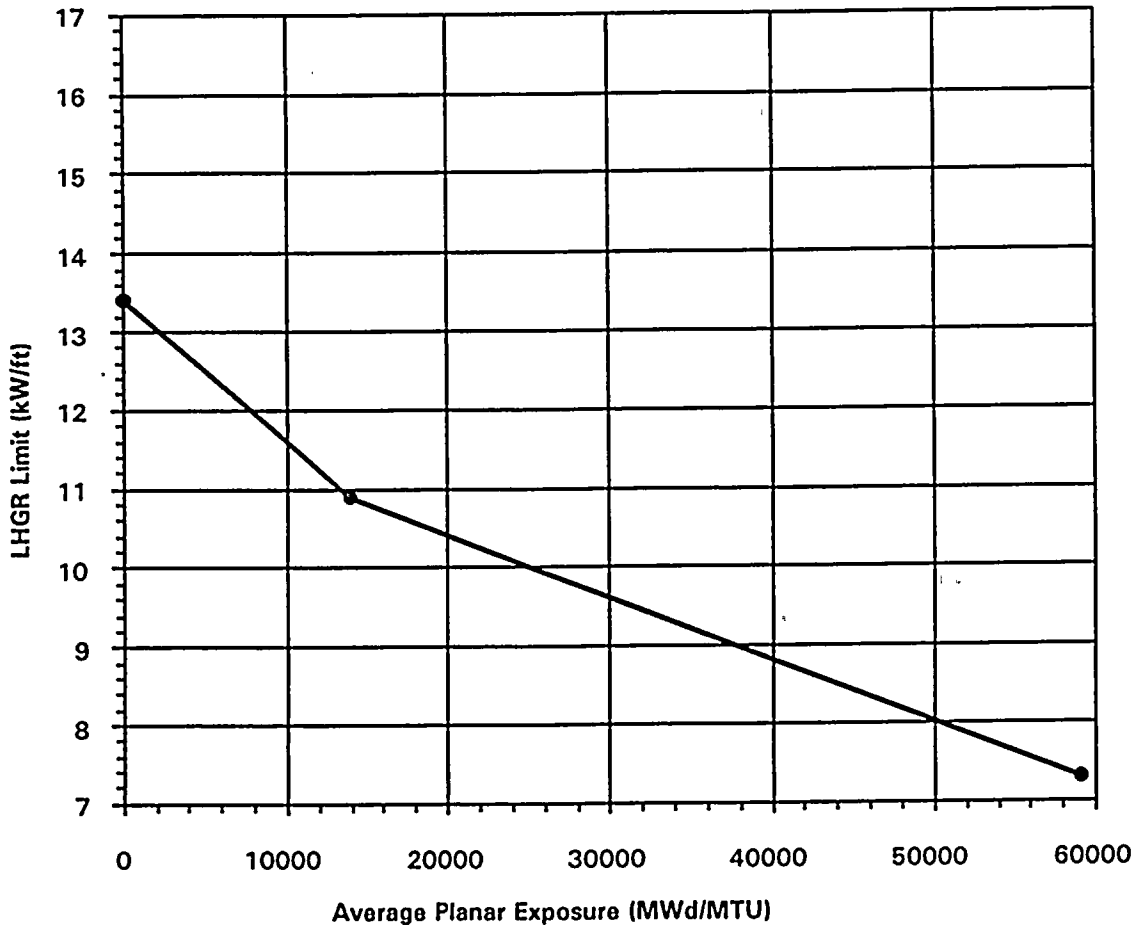
b. Figure 4.2 - ABB SVEA-96 reload fuel




| Average Planar Exposure (MWd/MTU) | LHGR (kW/ft) |
|---|---|
| 0 | 13.1 |
| 15500 | 13.1 |
| 60000 | 7.3 |

Linear Heat Generation Rate (LHGR) Versus Average Planar Exposure
SPC 9x9-9X

Figure 4.1



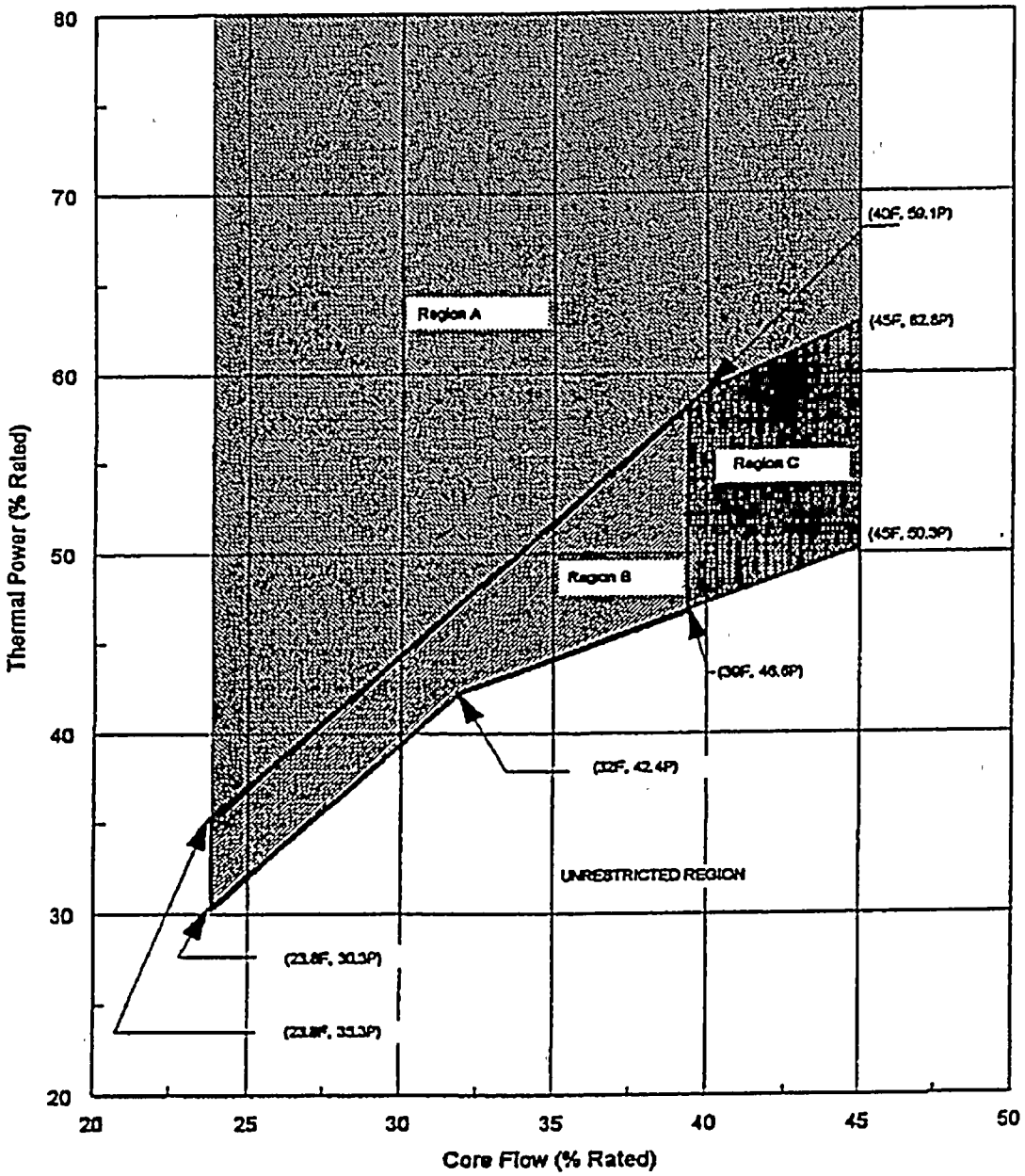

| Average Planar Exposure (MWd/MTU) | LHGR (kW/ft) |
|---|---|
| 0 | 13.4 |
| 13950 | 10.9 |
| 59000 | 7.3 |

Linear Heat Generation Rate (LHGR) Versus Average Planar Exposure
ABB SVEA-96

Figure 4.2

## 5.0 POWER/FLOW INSTABILITY

The power/flow conditions for use in Technical Specification 3.4.1 shall conform to the limits shown in Figure 5.1.




Operating Region Limits of Specification 3.4.1

Figure 5.1

Note: Applicable up to and including 3000 MWD/MTU

## 6.0 REFERENCES


6.1 NEDO-32269, "Washington Public Power Supply System Nuclear Project 2, Supplement to SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis," GE Nuclear Energy, September 1993.

6.2 Letter, Kaveh Taghavi (GE) to J. D. Fisher (WPPSS), "Extended MAPLHGR Curve for SNP 9x9-9X," October 4, 1995.

6.3 CE NPSD-821-P, Rev. 3, "WNP-2 Cycle 13 Reload Report," ABB Combustion Engineering Nuclear Operations, July 1997.

6.4 CE NPSD-820-P, "WNP-2 Cycle 13 Transient Analysis Report," ABB Combustion Engineering Nuclear Operations, April 1997.

6.5 Letter KVW-95:050, K. V. Walters (Siemens Power Corporation) to R. A. Vopalensky (WPPSS), "WNP-2 Fuel Misorientation Error Analysis," October 16, 1995.

6.6 CE NPSD-801-P, "WNP-2 LOCA Analysis Report," ABB Combustion Engineering Nuclear Operations, May 1996.