

ENTERGY OPERATIONS
ARKANSAS NUCLEAR ONE - UNIT ONE
CYCLE 14
CORE OPERATING LIMITS REPORT

1.0 CORE OPERATING LIMITS

This Core Operating Limits Report for ANO-1 Cycle 14 has been prepared in accordance with the requirements of Technical Specification 6.12.3. The core operating limits have been developed using the methodology provided in the references.

The following cycle - specific core operating limits are included in this report:

- 1) Regulating control rod position setpoints,
- 2) Reactor power imbalance setpoints,
- 3) LOCA limited maximum allowable linear heat rate limits,
- 4) Axial power imbalance protective limits,
- 5) Protection system maximum allowable setpoints for axial power imbalance,
- 6) Variable Low RCS Pressure-Temperature (P-T) Protective Limits,
- 7) RCS Pressure-Temperature (P-T) Protective Maximum Allowable Setpoints,
- 8) KW/ft limit for axial power imbalance protective limits,
- 9) Minimum shutdown margin,
- 10) Axial power shaping rod insertion limits and setpoints,
- 11) Quadrant power tilt limits,
- 12) Design Nuclear Power Peaking Factors.

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2.0 REFERENCES

1. "Safety Criteria and Methodology for Acceptable Cycle Reload Analysis," BAW-10179P-A, Rev.1, Framatome Cogema Fuels, Lynchburg, Virginia, February 1996.

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Figure is referred to by
Technical Specification 3.5.2.5

Figure 1-A Rod Position Setpoints for Four-Pump Operation
From 0 to 200 ± 10 EFPD – ANO-1 Cycle 14

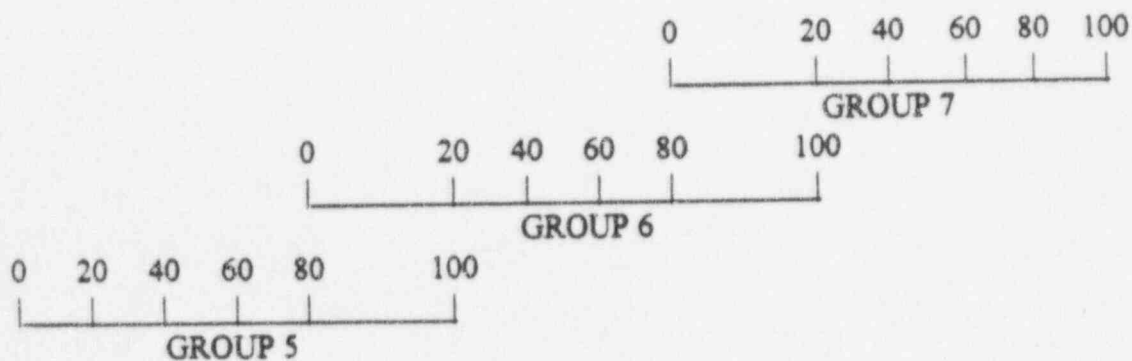
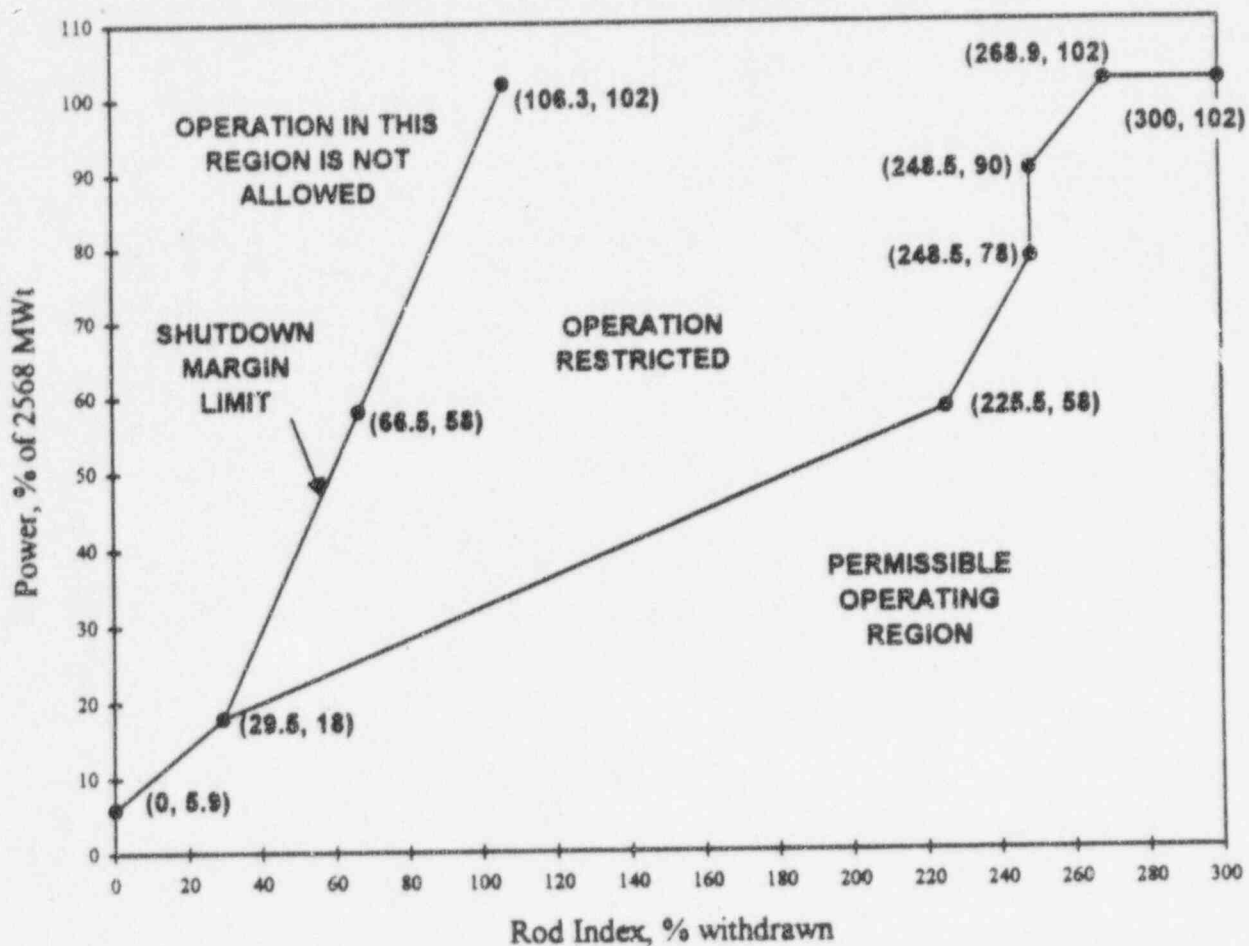


Figure is referred to by
Technical Specification 3.5.2.5

**Figure 1-B Rod Position Setpoints for Four-Pump Operation
From 200 ± 10 EFPD to EOC – ANO-1 Cycle 14**

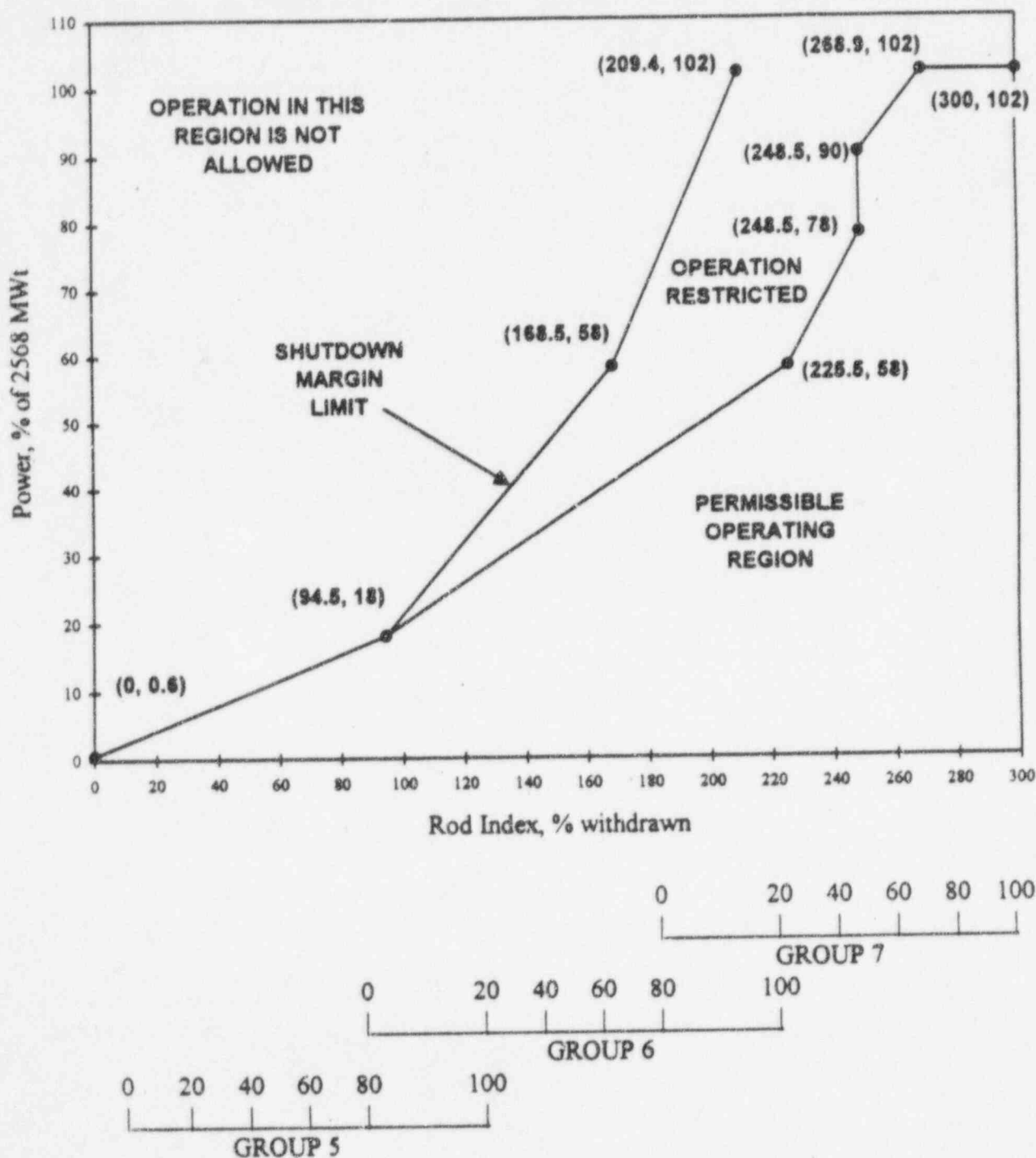


Figure is referred to by
Technical Specification 3.5.2.5

Figure 2-A Rod Position Setpoints for Three-Pump Operation
From 0 to 200 ± 10 EFPD – ANO-1 Cycle 14

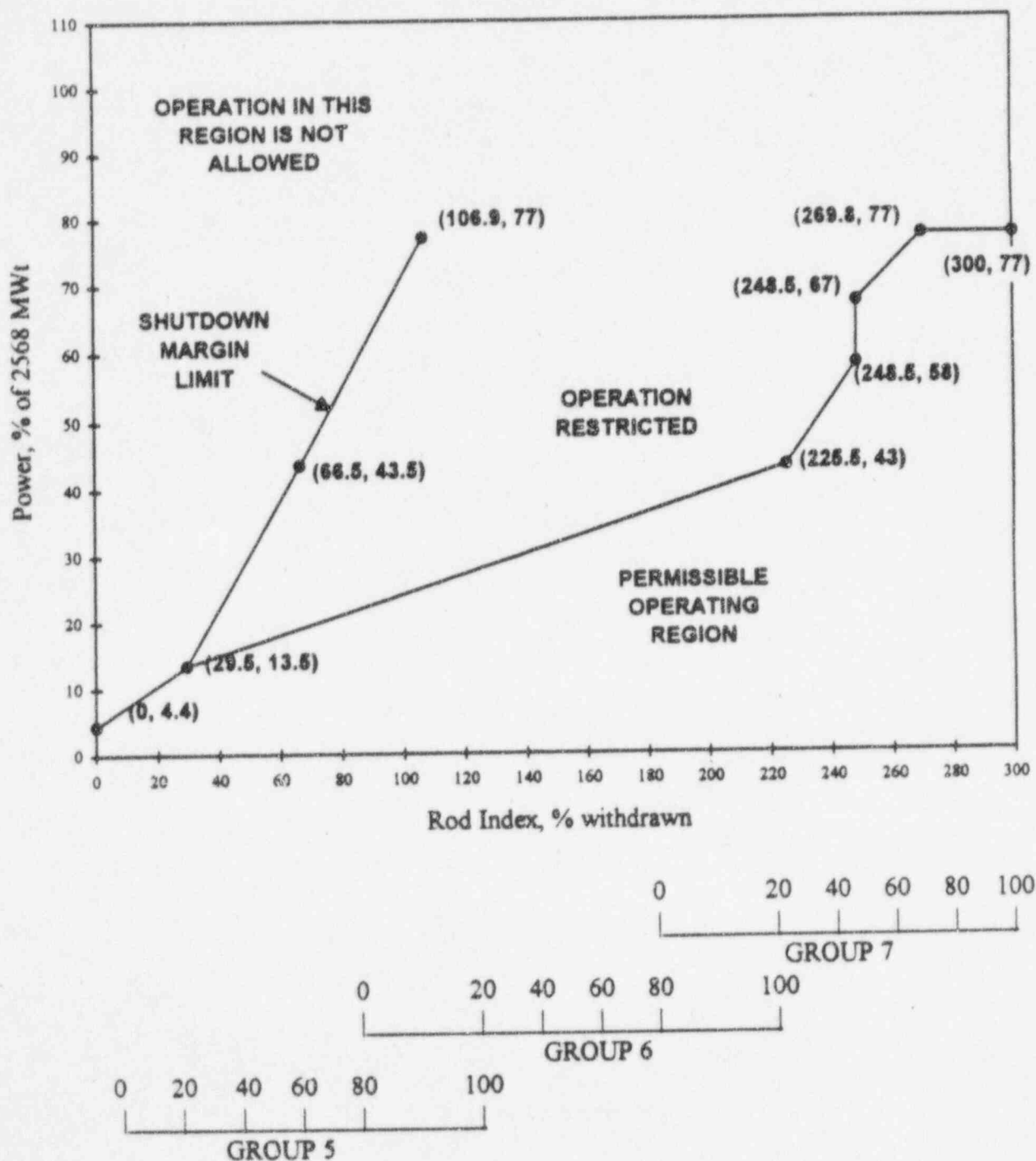


Figure is referred to by
Technical Specification 3.5.2.5

**Figure 2-B Rod Position Setpoints for Three-Pump Operation
From 200 ± 10 EFPD to EOC – ANO-1 Cycle 14**

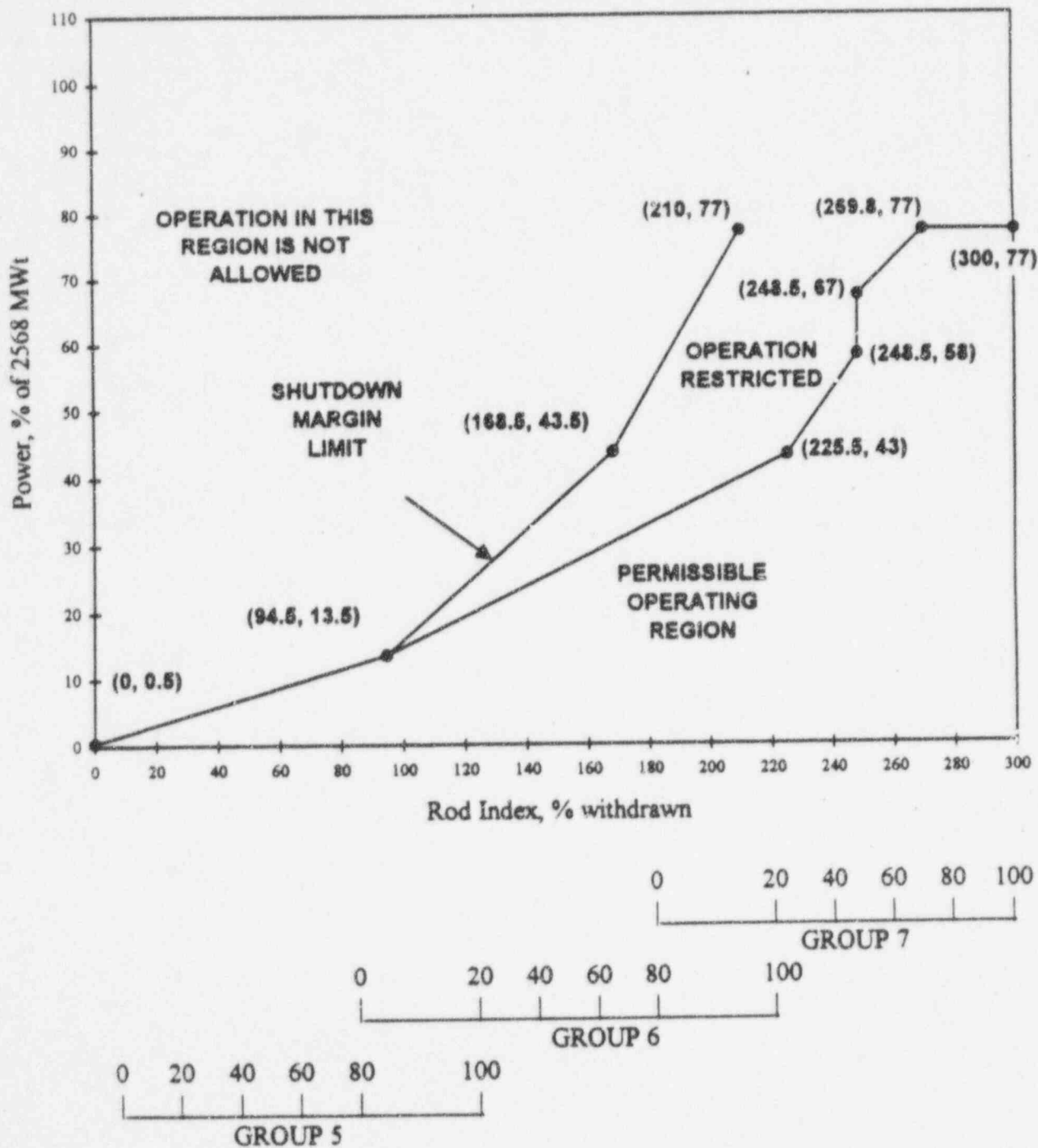


Figure is referred to by
Technical Specification 3.5.2.5

Figure 3-A **Rod Position Setpoints for Two-Pump Operation**
From 0 to 200 ± 10 EFPD – ANO-1 Cycle 14

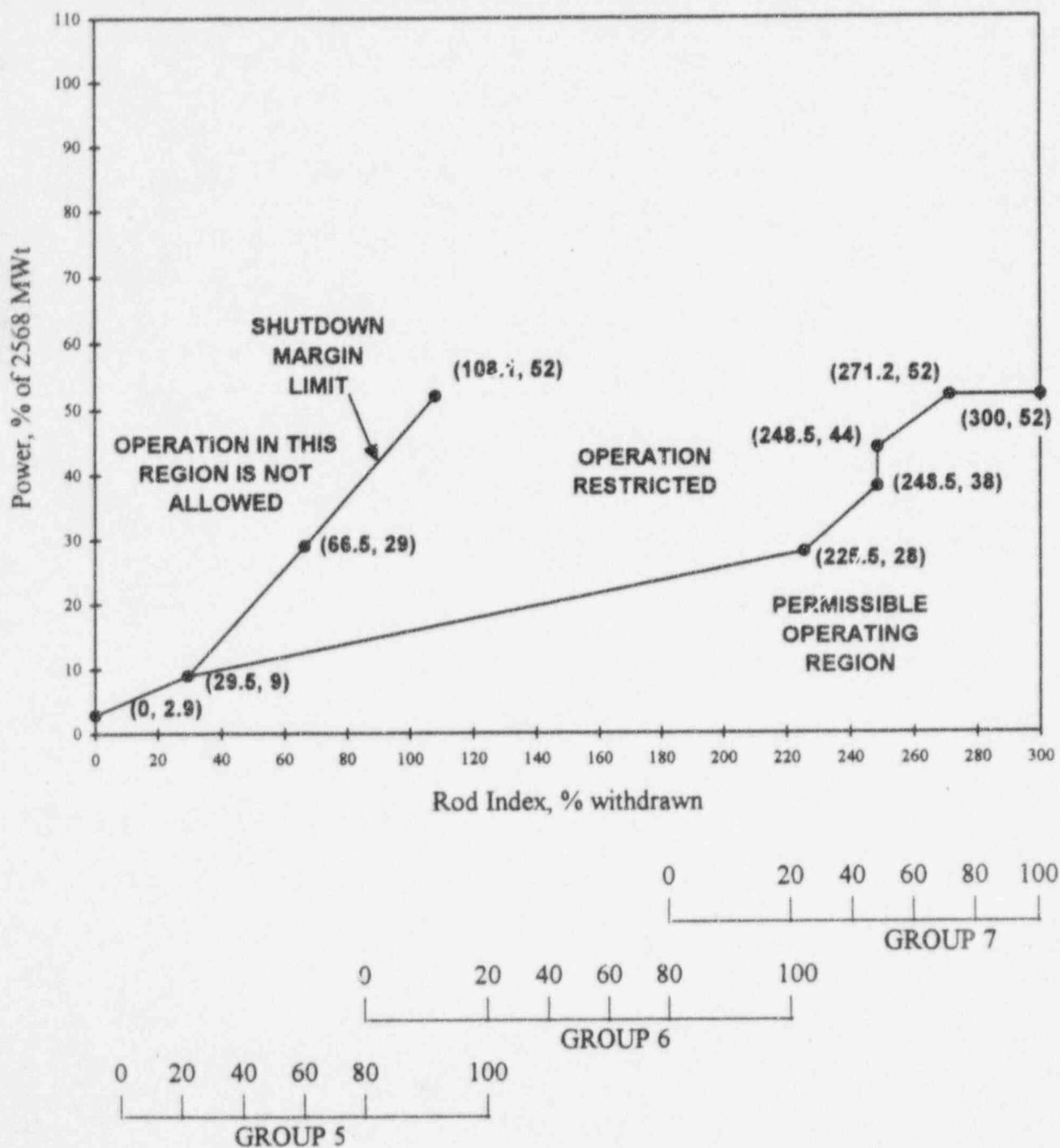


Figure is referred to by
Technical Specification 3.5.2.5

Figure 3-B Rod Position Setpoints for Two-Pump Operation
From 200 ± 10 EFPD to EOC – ANO-1 Cycle 14

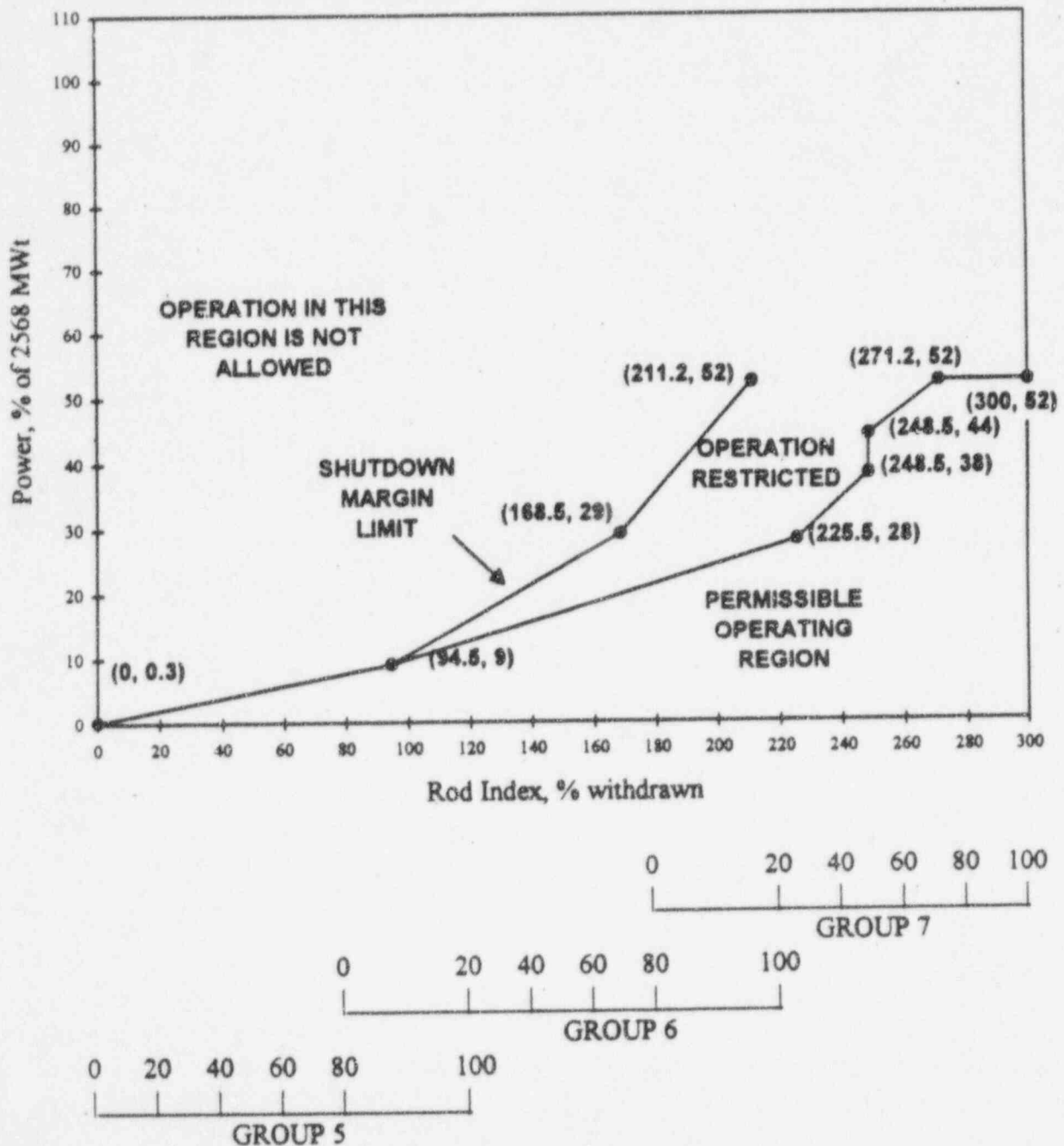


Figure is referred to by
Technical Specification 3.5.2.6

Figure 4 **Operational Power Imbalance Setpoints for Four-Pump
Operation From 0 EFPD to EOC – ANO-1 Cycle 14**

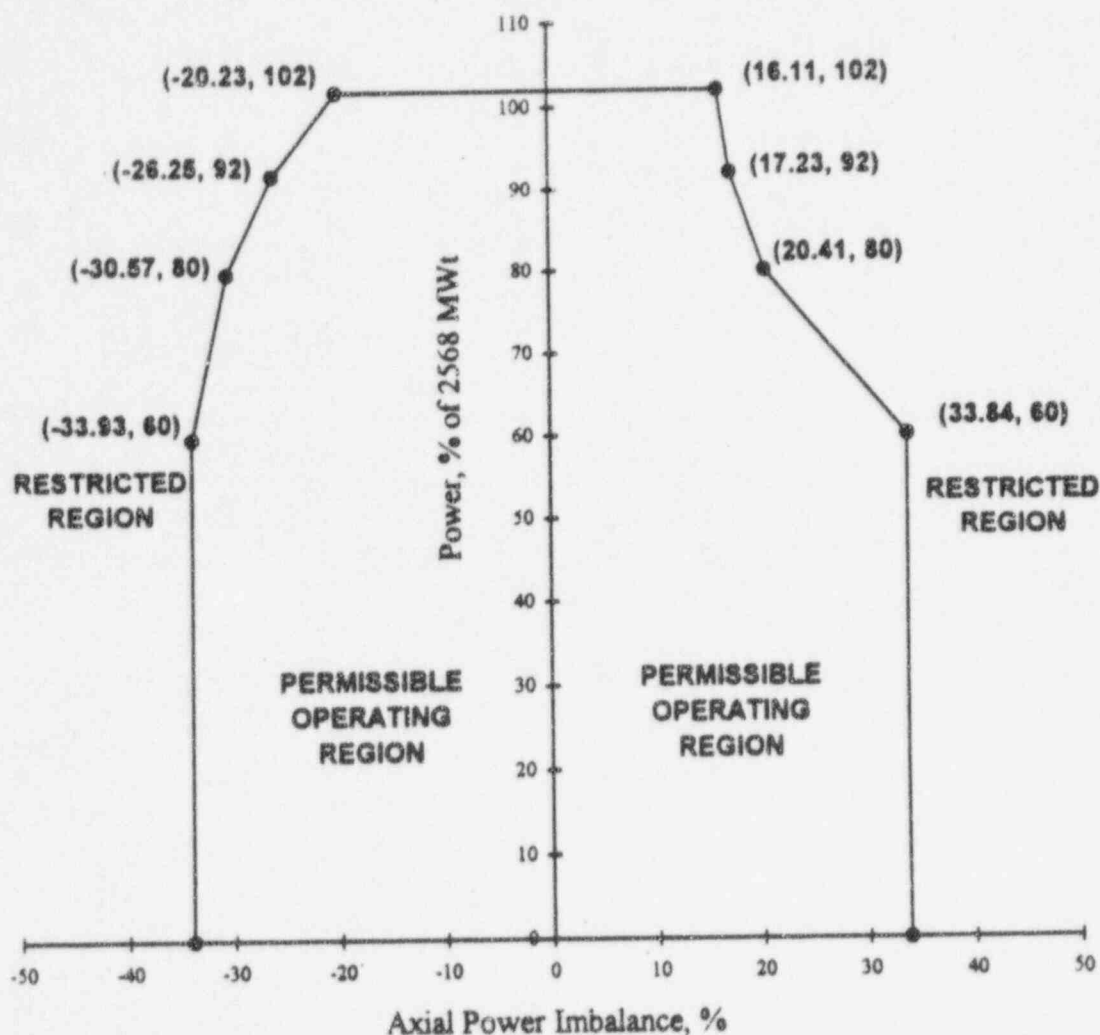


Figure is referred to by
Technical Specification 3.5.2.6

Figure 5

Operational Power Imbalance Setpoints for Three-Pump
Operation From 0 EFPD to EOC – ANO-1 Cycle 14

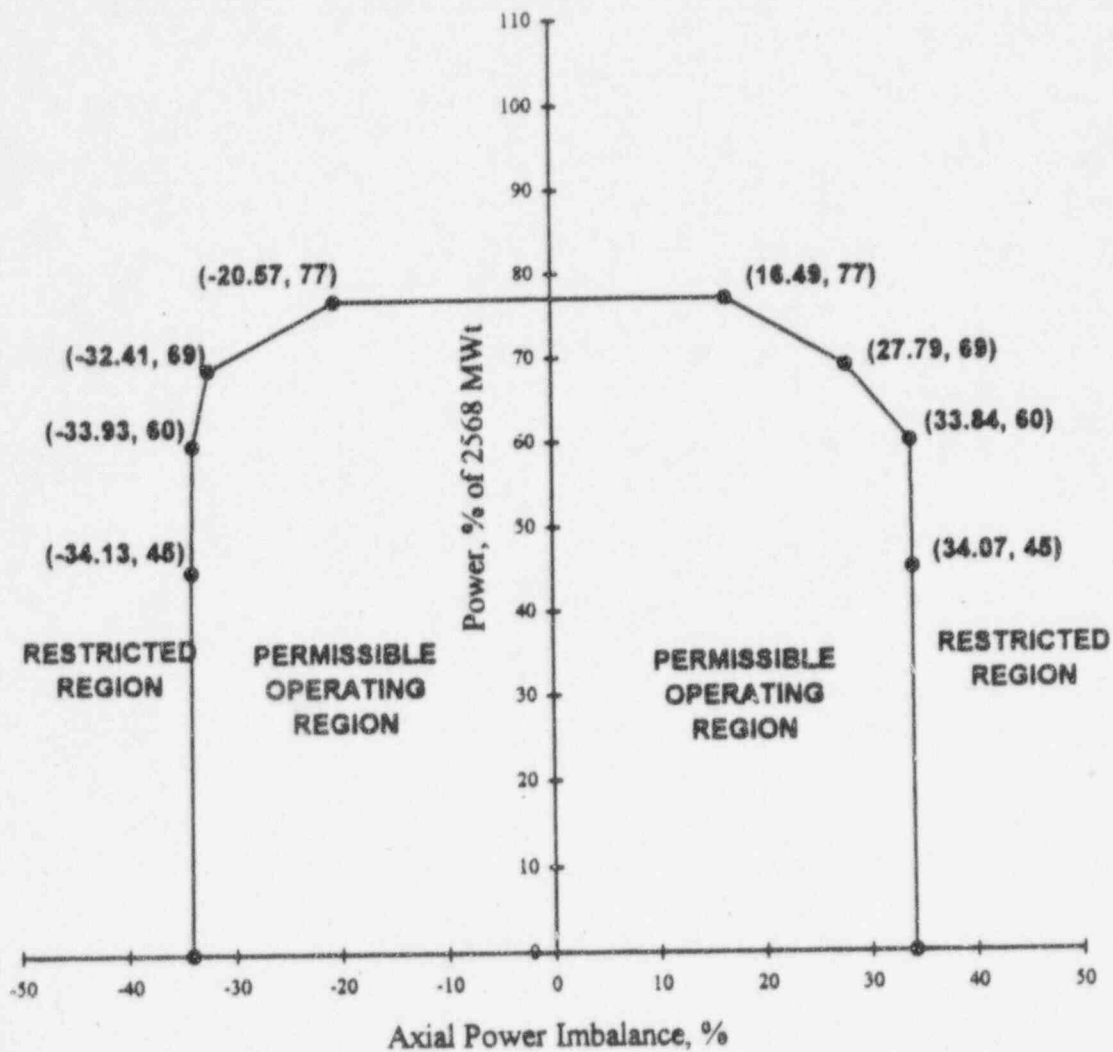


Figure is referred to by
Technical Specification 3.5.2.6

Figure 6 Operational Power Imbalance Setpoints for Two-Pump
Operation From 0 EFPD to EOC -- ANO-1 Cycle 14

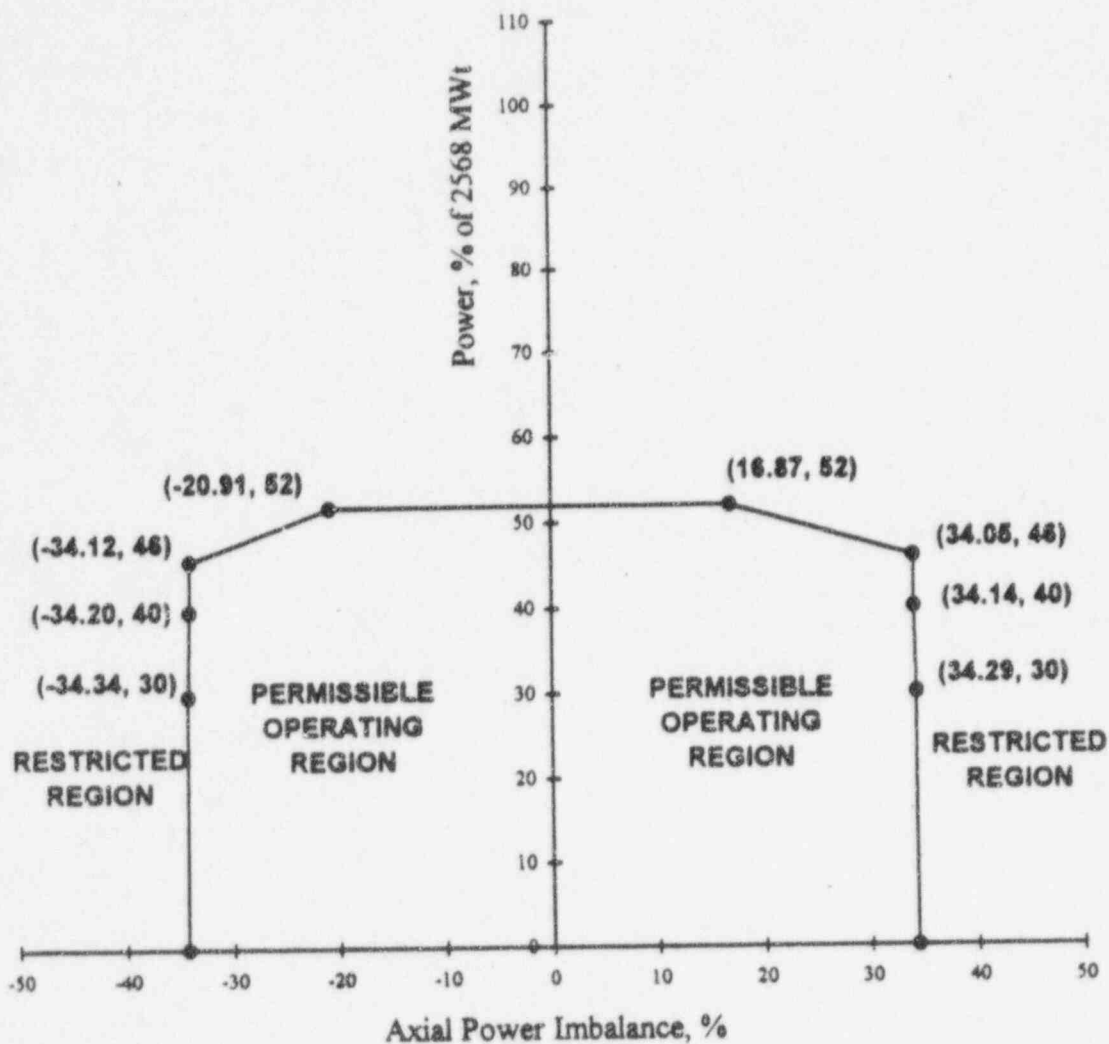


Figure is referred to by
Technical Specification 3.5.2 Bases

Figure 7 Mk-B8ZL and Mk-B9ZL LOCA Linear Heat Rate Limits

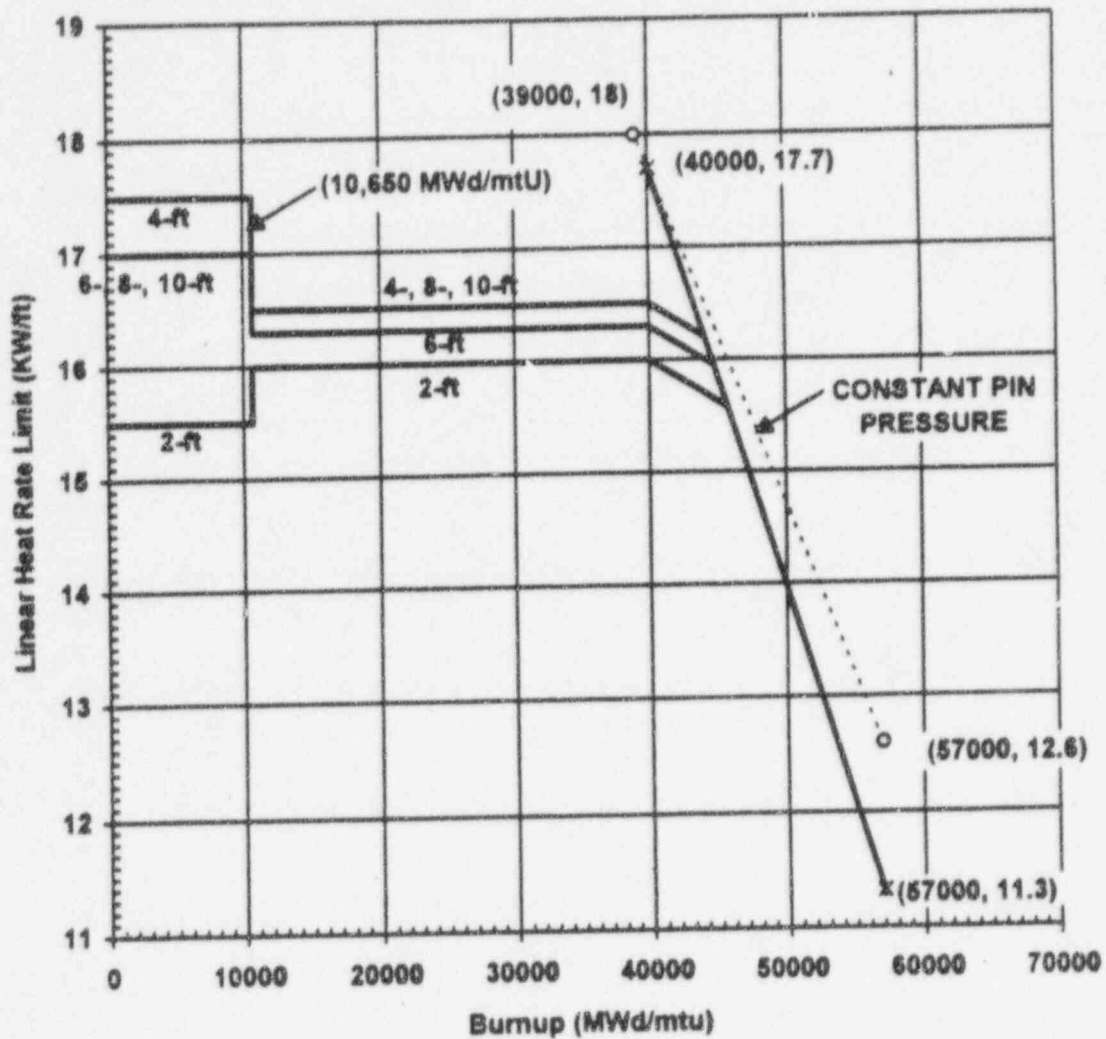


Figure is referred to by
Technical Specification 2.1.2

Figure 8 Axial Power Imbalance Protective Limits

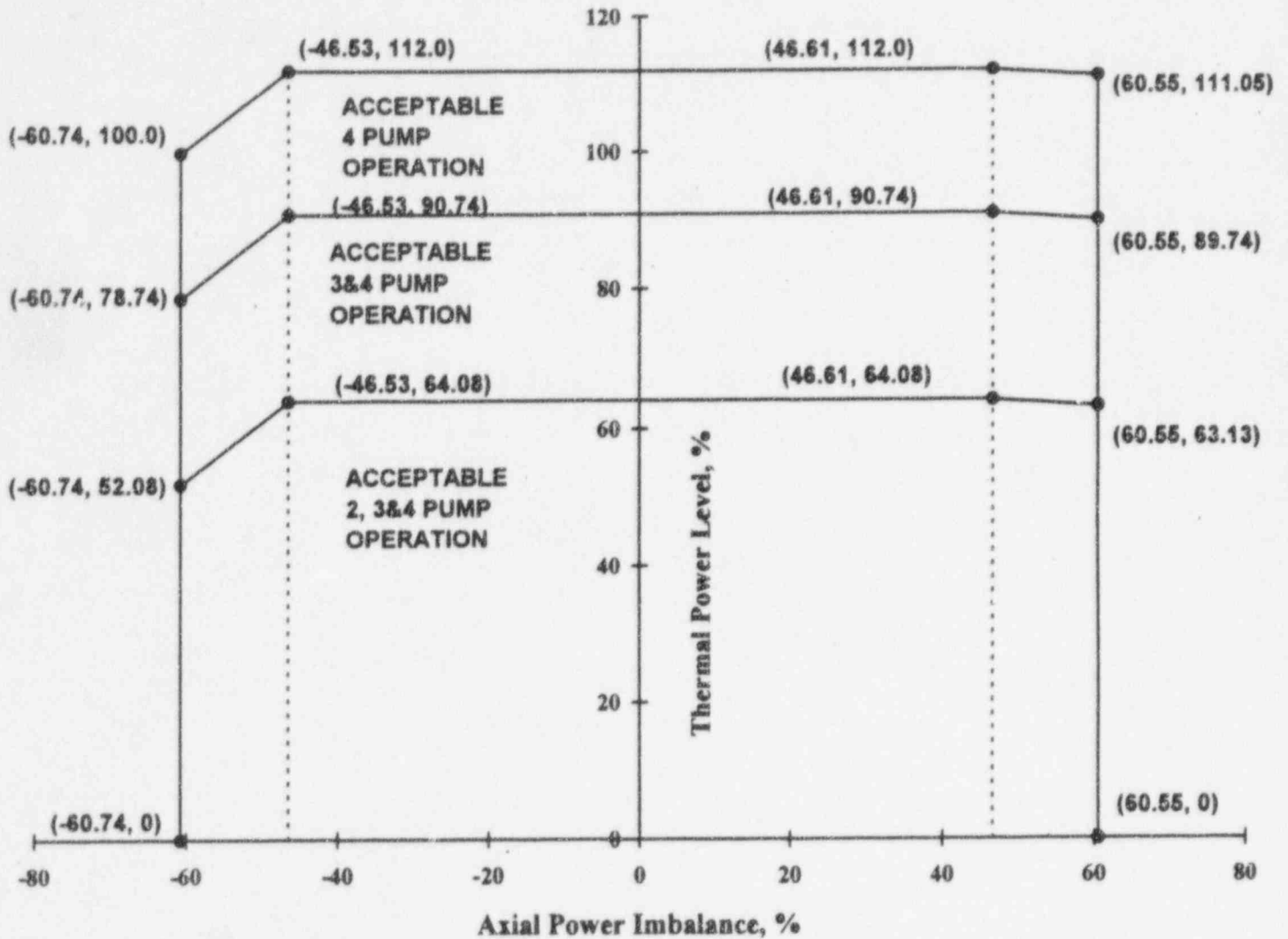


Figure is referred to by
Technical Specification 2.3.1

Figure 9 Protection System Maximum Allowable Setpoints for
Axial Power Imbalance

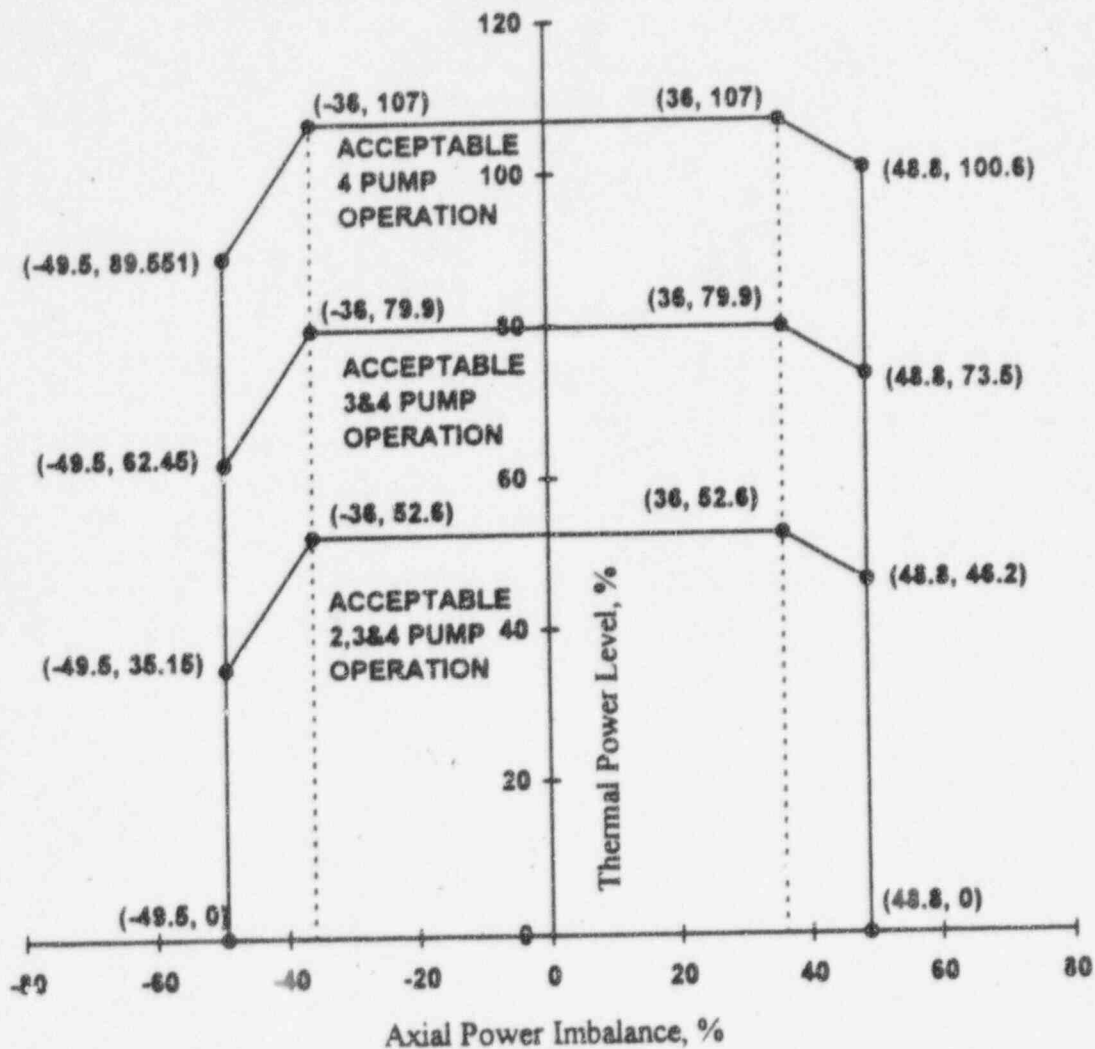
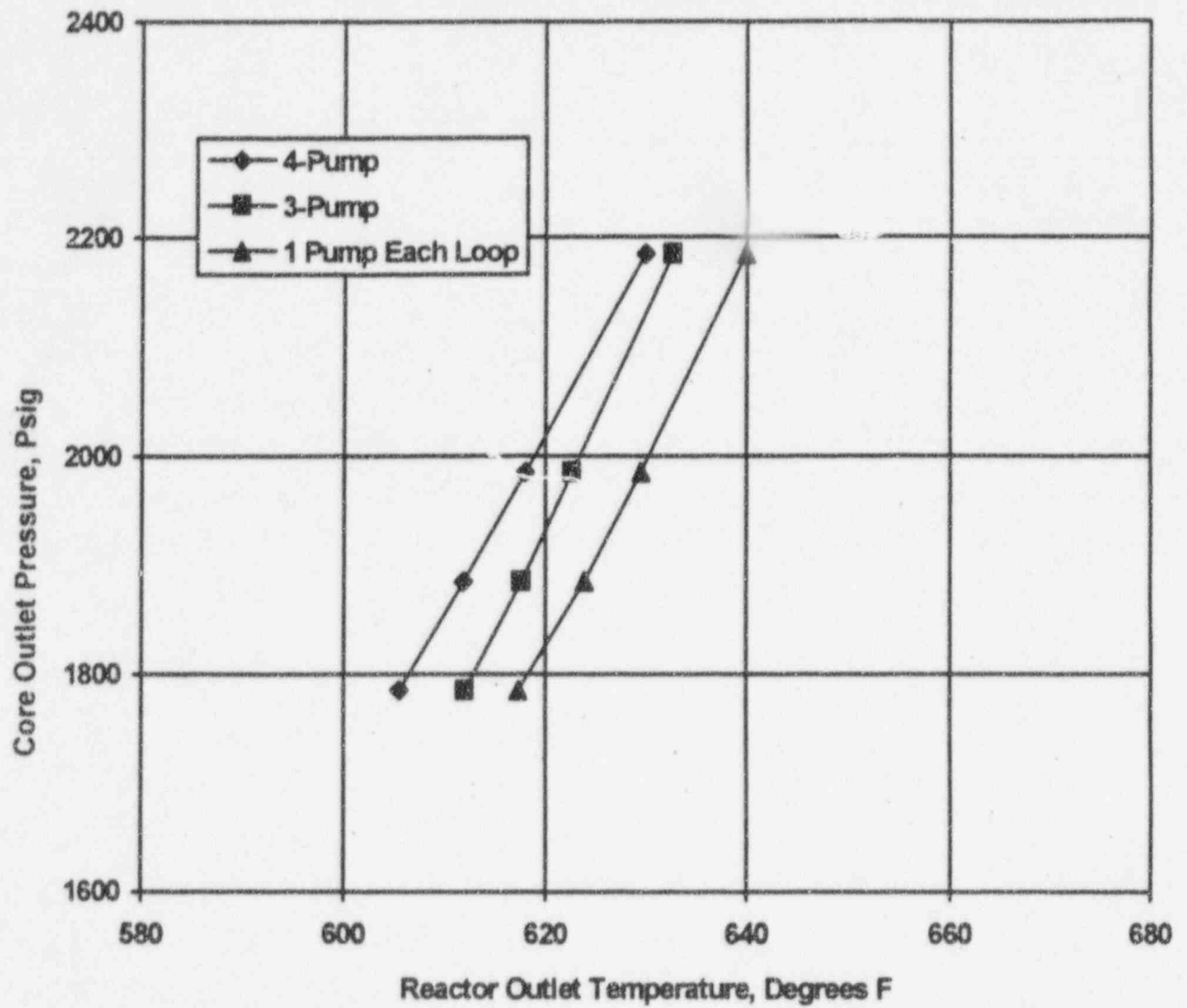


Figure is referred to by
Technical Specification 2.1.3

Figure 10 Variable Low RCS Pressure-Temperature Protective Limits



PUMPS OPERATING (TYPE OF LIMIT)

Four Pumps (DNBR Limit)

Three Pumps (DNBR Limit)

One Pump in Each Loop (DNBR Limit)

GPM

374,880 (100%) *

280,035 (74.7%)

184,441 (49.2%)

POWER

112%

91%

64%

* 106.5% of Design Flow

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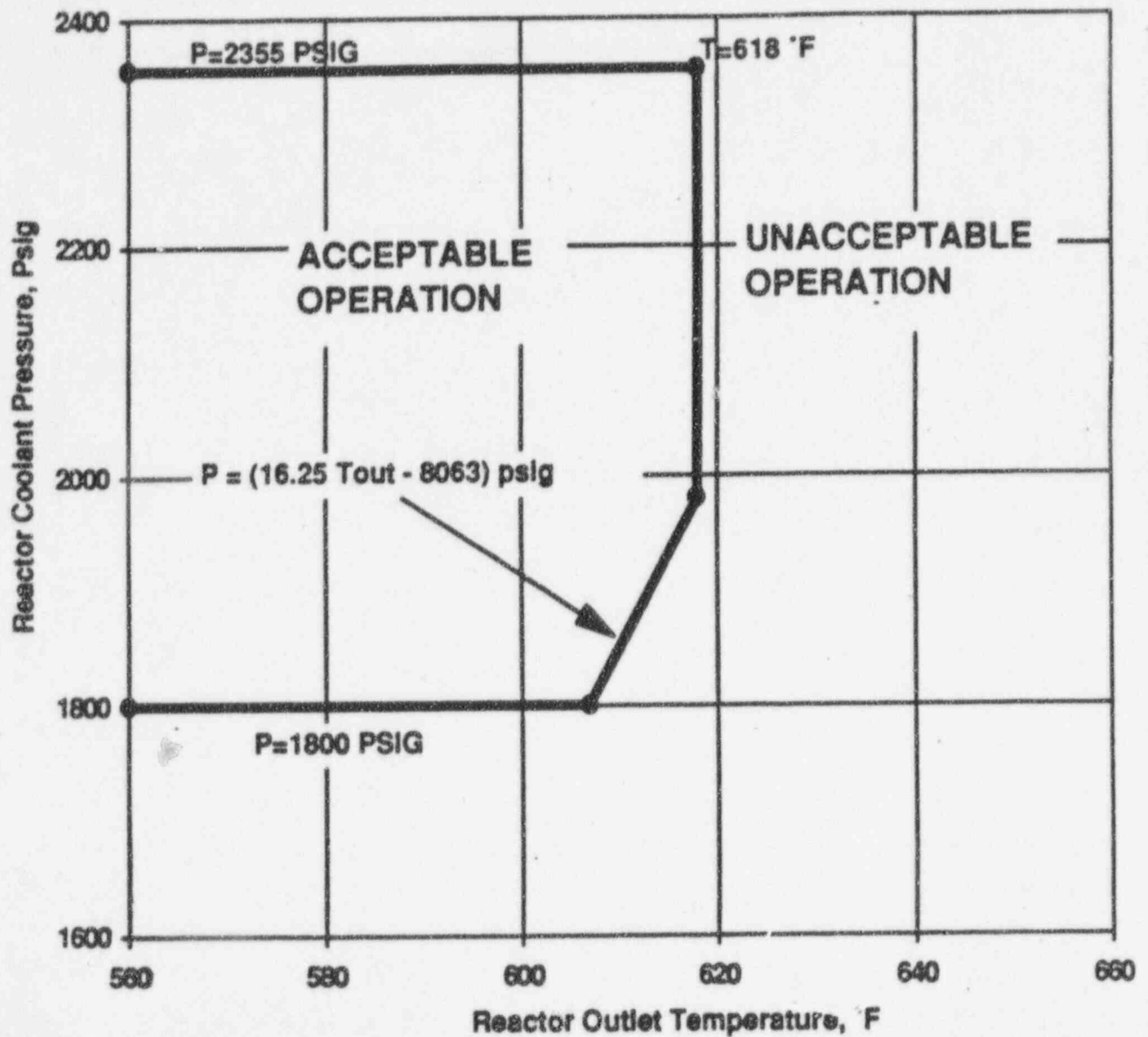
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Figure is referred to by
Technical Specification Table 2.3-1

Figure 11 RCS Pressure-Temperature Protective Maximum Allowable
Setpoints



**LIMIT IS REFERRED TO BY
TECHNICAL SPECIFICATION 2.1 BASES**

**KW/FT LIMIT FOR AXIAL POWER IMBALANCE PROTECTIVE
LIMITS**

The combination of radial and axial peak that prevents central fuel melting at the hot spot is:

$$\text{KW/FT Limit} = 21.9 \text{ kW/ft}$$

**LIMIT IS REFERRED TO BY
TECHNICAL SPECIFICATION 3.1.8.3 AND 3.5.2.1 AND 3.5.2.2.2
AND 3.5.2.2.3**

MINIMUM SHUTDOWN MARGIN

The minimum available shutdown margin shall be maintained $\geq 1\% \Delta k/k$.

**LIMITS ARE REFERRED TO BY
TECHNICAL SPECIFICATION 3.5.2.5.4**

**AXIAL POWER SHAPING ROD INSERTION LIMITS AND
SETPOINTS**

Up to $485 \pm 10/-10$ EFPD, the APSRs may be positioned as necessary for transient imbalance control, however, the APSRs shall be fully withdrawn by 495 EFPD. After the APSR withdrawal at $485 \pm 10/-10$ EFPD, the APSRs shall not be reinserted.

**VALUES ARE REFERRED TO BY
TECHNICAL SPECIFICATION 3.5.2.4**

ANO-1 CYCLE 14 TILT LIMITS AND SETPOINTS

<u>From 0 to 200 +/- 10 EFPD</u>		
<u>Measurement System</u>	<u>Steady State Value (%)</u>	<u>Maximum Value (%)</u>
Full In-core Detector System Setpoint	4.36	25.0
Minimum In-core Detector System Setpoint	1.90 ^(*)	25.0
Ex-core Power Range NI Channel Setpoint	1.96	25.0
Measurement System - Independent Limit	4.92	25.0

<u>From 200 +/- 10 EFPD to EOC</u>		
<u>Measurement System</u>	<u>Steady State Value (%)</u>	<u>Maximum Value (%)</u>
Full In-core Detector System Setpoint	4.24	25.0
Minimum In-core Detector System Setpoint	1.90 ^(*)	25.0
Ex-core Power Range NI Channel Setpoint	1.96	25.0
Measurement System - Independent Limit	4.92	25.0

^(*) Assumes that no individual detectors in the minimum in-core system exceed 60% sensitivity depletion.

**LIMIT IS REFERRED TO BY
TECHNICAL SPECIFICATION 2.1 BASES**

DESIGN NUCLEAR POWER PEAKING FACTORS

Maximum Radial	$(F^N_{\Delta H})$	1.71
Maximum Axial	(F^N_z)	1.65
Maximum Total	(F^N_q)	2.83