



FirstEnergy Nuclear Operating Company

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Serial Number 2755

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United States Nuclear Regulatory Commission
Document Control Desk
Washington, D. C. 20555-0001

Subject: Revision to Core Operating Limits Report for Cycle 13

Ladies and Gentlemen:

Enclosed is a copy of Revision 1 of the Davis-Besse Nuclear Power Station, Unit 1 (DBNPS) Core Operating Limits Report (COLR) for the current Cycle 13 operation. This revision to the COLR is being submitted in accordance with DBNPS Technical Specification 6.9.1.7.

Revision 1 to the COLR reflects a core average temperature reduction of 8°F and a shortened operating cycle length. The temperature reduction and shortened operating cycle length are the result of actions taken in response to NRC Bulletin 2001-01, "Circumferential Cracking of Pressure Vessel Head Penetration Nozzles," dated August 3, 2001.

Should you have any questions or require additional information, please contact Mr. David H. Lockwood, Manager - Regulatory Affairs, at (419) 321-8450.

Very truly yours,

MKL/laj

cc: J. E. Dyer, Regional Administrator, NRC Region III
S. P. Sands, DB-1 NRC/NRR Project Manager
D. S. Simpkins, DB-1 NRC Resident Inspector
Utility Radiological Safety Board

Pool

Docket Number 50-346
License Number NPF-3
Serial Number 2755
Enclosure

COMMITMENT LIST

THE FOLLOWING LIST IDENTIFIES THOSE ACTIONS COMMITTED TO BY THE DAVIS-BESSE NUCLEAR POWER STATION (DBNPS) IN THIS DOCUMENT. ANY OTHER ACTIONS DISCUSSED IN THE SUBMITTAL REPRESENT INTENDED OR PLANNED ACTIONS BY THE DBNPS. THEY ARE DESCRIBED ONLY FOR INFORMATION AND ARE NOT REGULATORY COMMITMENTS. PLEASE NOTIFY THE MANAGER – REGULATORY AFFAIRS (419-321-8450) AT THE DBNPS OF ANY QUESTIONS REGARDING THIS DOCUMENT OR ANY ASSOCIATED REGULATORY COMMITMENTS.

COMMITMENTS

None

DUE DATE

Not Applicable

FIRSTENERGY NUCLEAR OPERATING COMPANY

DAVIS-BESSE UNIT 1

CYCLE 13

CORE OPERATING LIMITS REPORT

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FIRSTENERGY NUCLEAR OPERATING COMPANY

DAVIS-BESSE UNIT 1

CYCLE 13

CORE OPERATING LIMITS REPORT

1.0 Core Operating Limits

This CORE OPERATING LIMITS REPORT for DB-1 Cycle 13 has been prepared in accordance with the requirements of Technical Specification 6.9.1.7. The core Operating Limits have been developed using the methodology provided in reference 2.0 (1). The licensed length of Cycle 13 is 635 EFPDs.

The following cycle-specific core Operating Limits, Protective Limit and Flux - Δ Flux/Flow Reactor Protection System Allowable Values are included in this report:

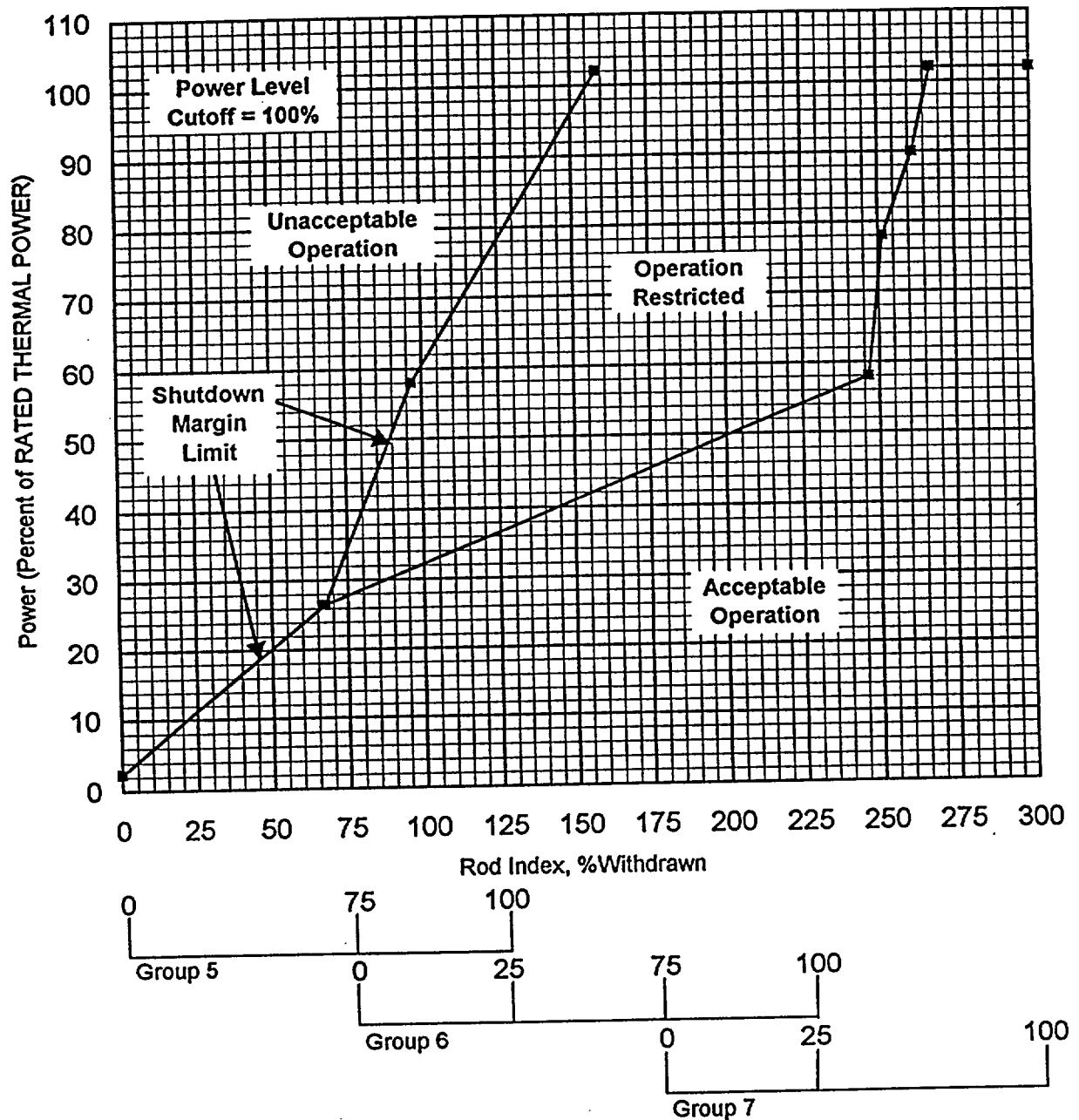
- 1) Regulating Group Position Alarm Setpoints (error adjusted Operating Limits) and Xenon reactivity "power level cutoff"
- 2) Rod program group positions (Control Rod Core locations and group assignments)
- 3) Axial Power Shaping Rod Alarm Setpoints (error adjusted Operating Limits)
- 4) AXIAL POWER IMBALANCE Alarm Setpoints (error adjusted Operating Limits)
- 5) AXIAL POWER IMBALANCE Protective Limits
- 6) Flux- Δ Flux/Flow (or Power/Imbalance/Flow) Allowable Values
- 7) QUADRANT POWER TILT limits
- 8) Negative Moderator Temperature Coefficient limit
- 9) Nuclear Heat Flux Hot Channel Factor, F_Q and
- 10) Nuclear Enthalpy Rise Hot Channel Factor, $F_{\Delta H}^N$

2.0 References

- (1) BAW-10179P-A, Revision 4, "Safety Criteria and Methodology For Acceptable Cycle Reload Analyses.", dated August 2001.
- (2) BAW-10227P-A, Revision 0, "Evaluation of Advanced Cladding and Structural Material (M5™) in PWR Reactor Fuel, dated February 2000.

Figure 1a Regulating Group Position Operating Limits
0 to 300 ± 10 EFPD, Four RC Pumps --
Davis-Besse 1, Cycle 13

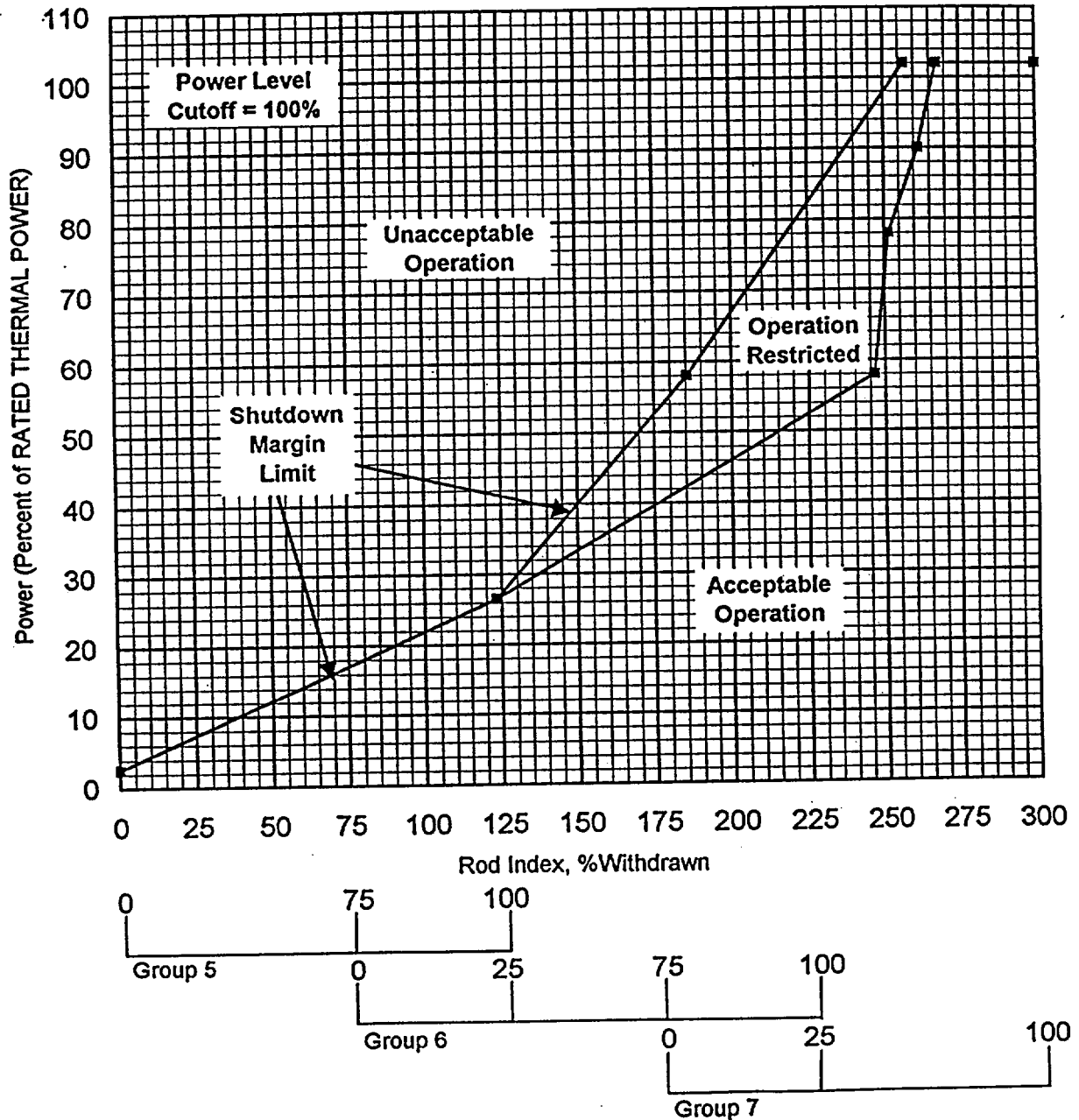
This Figure is referred to by Technical
Specifications 3.1.3.6 and 3.1.3.8



Note 1: A Rod Group overlap of 25 $\pm 5\%$ between sequential withdrawn groups 5 and 6, and 6 and 7, shall be maintained.
Note 2: Instrument error is accounted for in these Operating Limits.

Figure 1b Regulating Group Position Operating Limits
After 300 ± 10 EFPD, Four RC Pumps --
Davis-Besse 1, Cycle 13

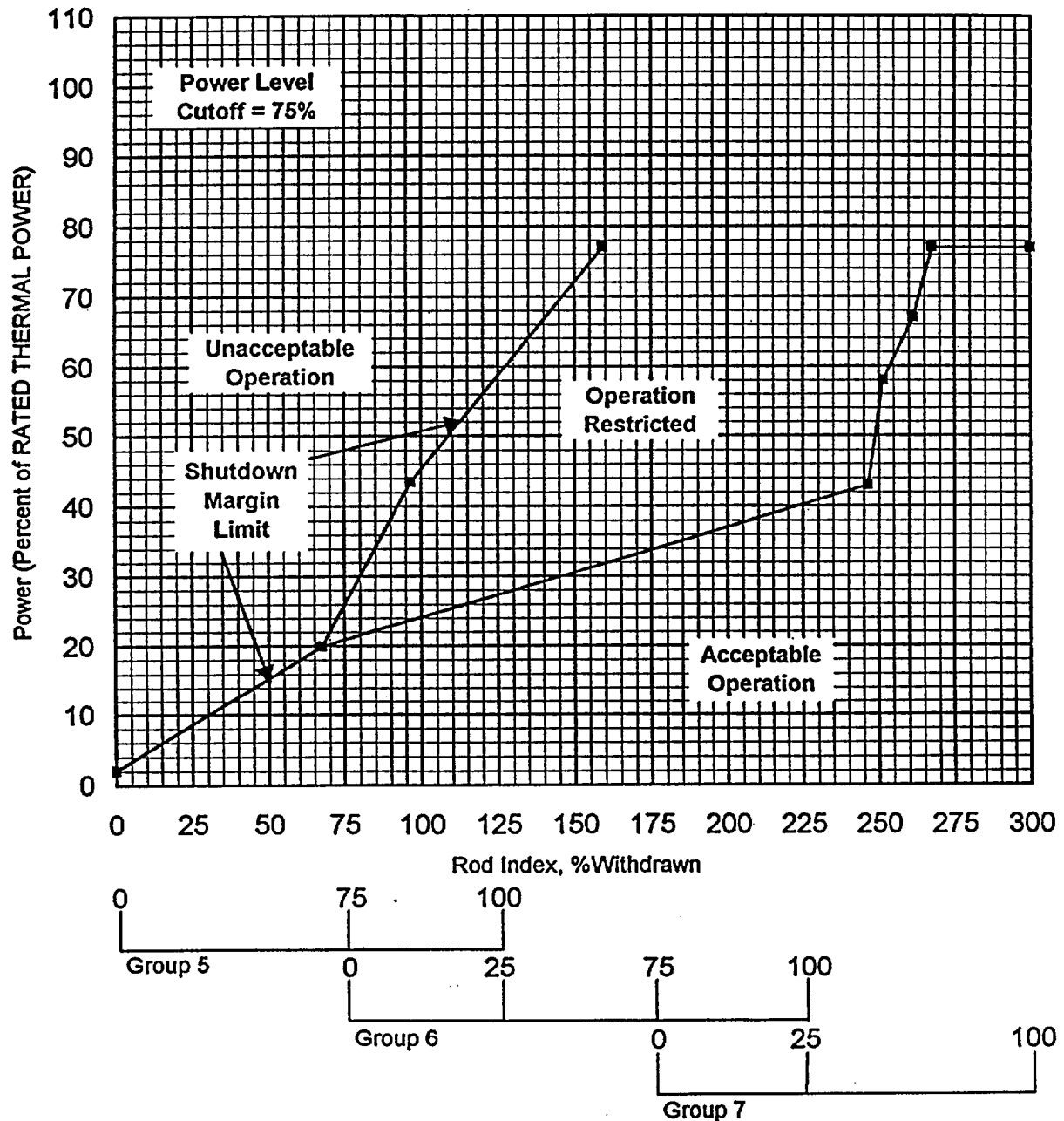
This Figure is referred to by Technical
Specifications 3.1.3.6 and 3.1.3.8



Note 1: A Rod Group overlap of $25 \pm 5\%$ between sequential withdrawn groups 5 and 6, and 6 and 7, shall be maintained.
Note 2: Instrument error is accounted for in these Operating Limits.

Figure 1c Regulating Group Position Operating Limits
0 to 300 ± 10 EFPD, Three RC Pumps --
Davis-Besse 1, Cycle 13

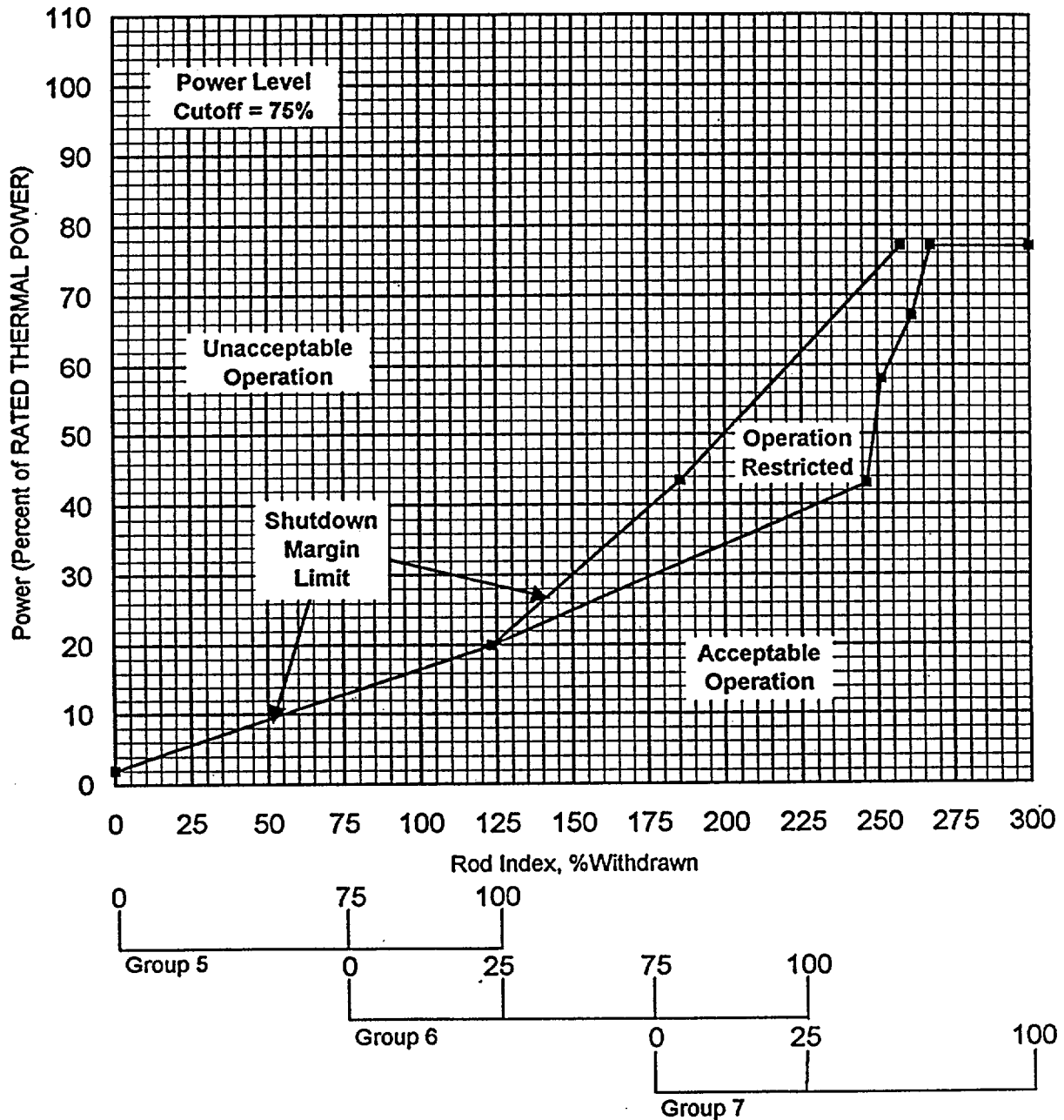
This Figure is referred to by Technical
Specifications 3.1.3.6 and 3.1.3.8



Note 1: A Rod Group overlap of 25 $\pm 5\%$ between sequential withdrawn groups 5 and 6, and 6 and 7, shall be maintained.
Note 2: Instrument error is accounted for in these Operating Limits.

Figure 1d Regulating Group Position Operating Limits
After 300 ± 10 EFPD, Three RC Pumps --
Davis-Besse 1, Cycle 13

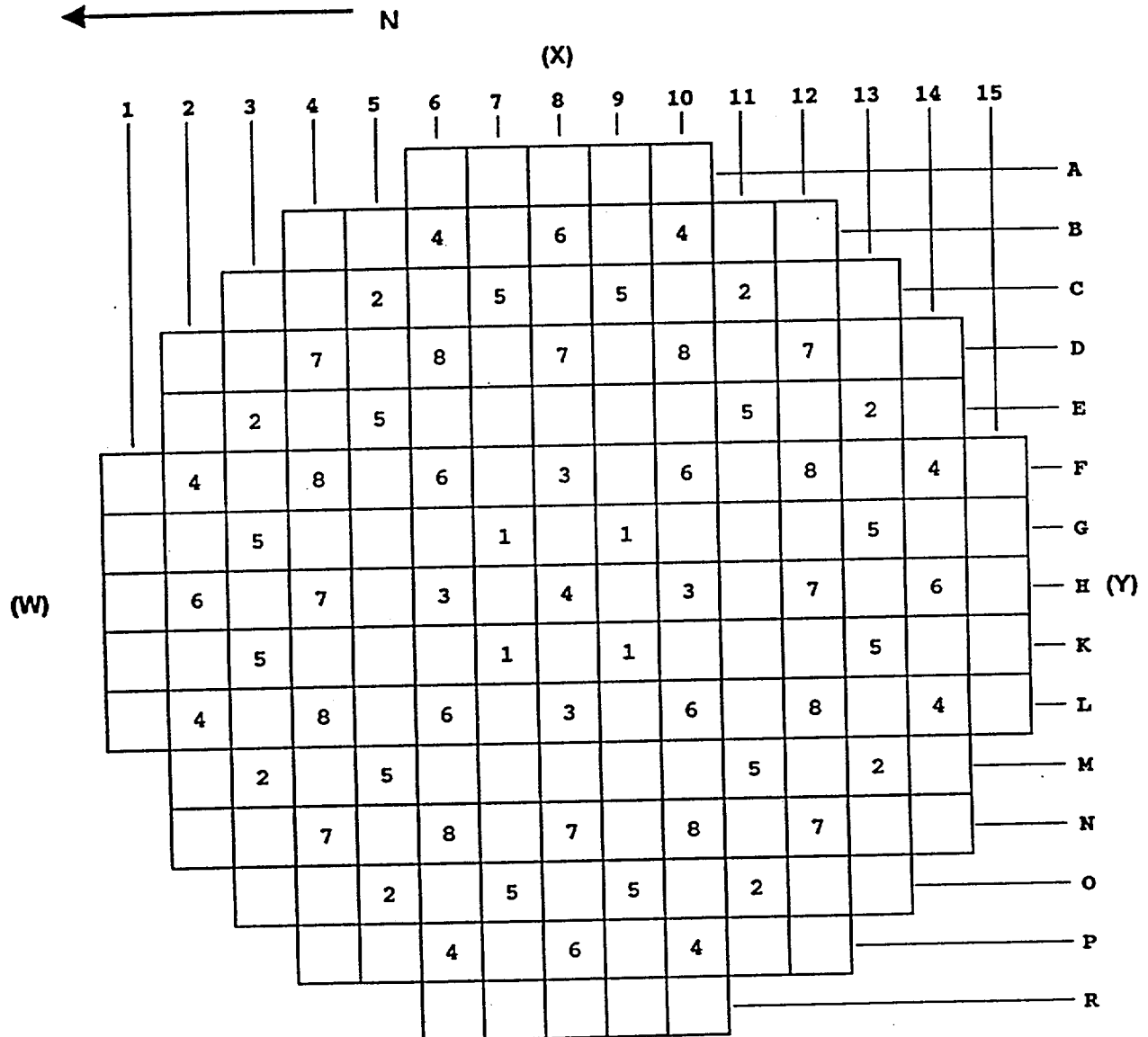
This Figure is referred to by Technical
Specifications 3.1.3.6 and 3.1.3.8



Note 1: A Rod Group overlap of $25 \pm 5\%$ between sequential withdrawn groups 5 and 6, and 6 and 7, shall be maintained.
Note 2: Instrument error is accounted for in these Operating Limits.

Figure 2 Control Rod Core Locations
and Group Assignments
Davis-Besse 1, Cycle 13

This Figure is referred to by
Technical Specification 3.1.3.7



X	Group Number		(Z)			
	Group	No. of Rods	Function	Group	No. of Rods	Function
	1	4	Safety	5	12	Control
	2	8	Safety	6	8	Control
	3	4	Safety	7	8	Control
	4	9	Safety	8	8	APSRs
				Total	61	

Figure 3 APSR Position Operating Limits

This Figure is referred to by
Technical Specification
3.1.3.9

0 EFPD to 635 EFPD
Three or Four RC pumps operation*

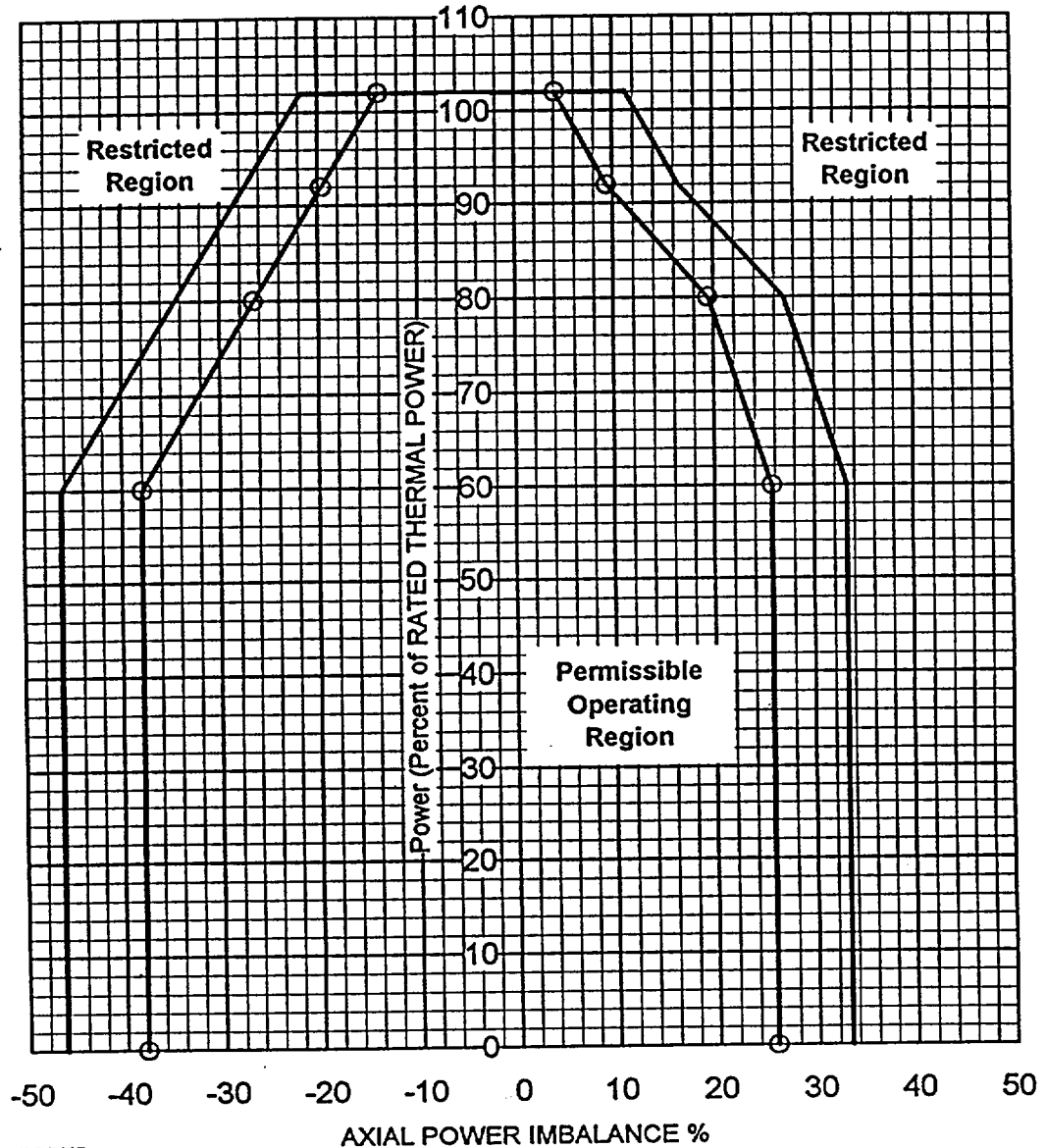
Lower Limit: 0 %WD

Upper Limit: 100 %WD

* Power restricted to 77% for three pump operation

Figure 4a AXIAL POWER IMBALANCE Operating Limits
0 to 300 \pm 10 EFPD, Four RC Pumps --
Davis-Besse 1, Cycle 13

This Figure is referred to by
Technical Specification 3.2.1



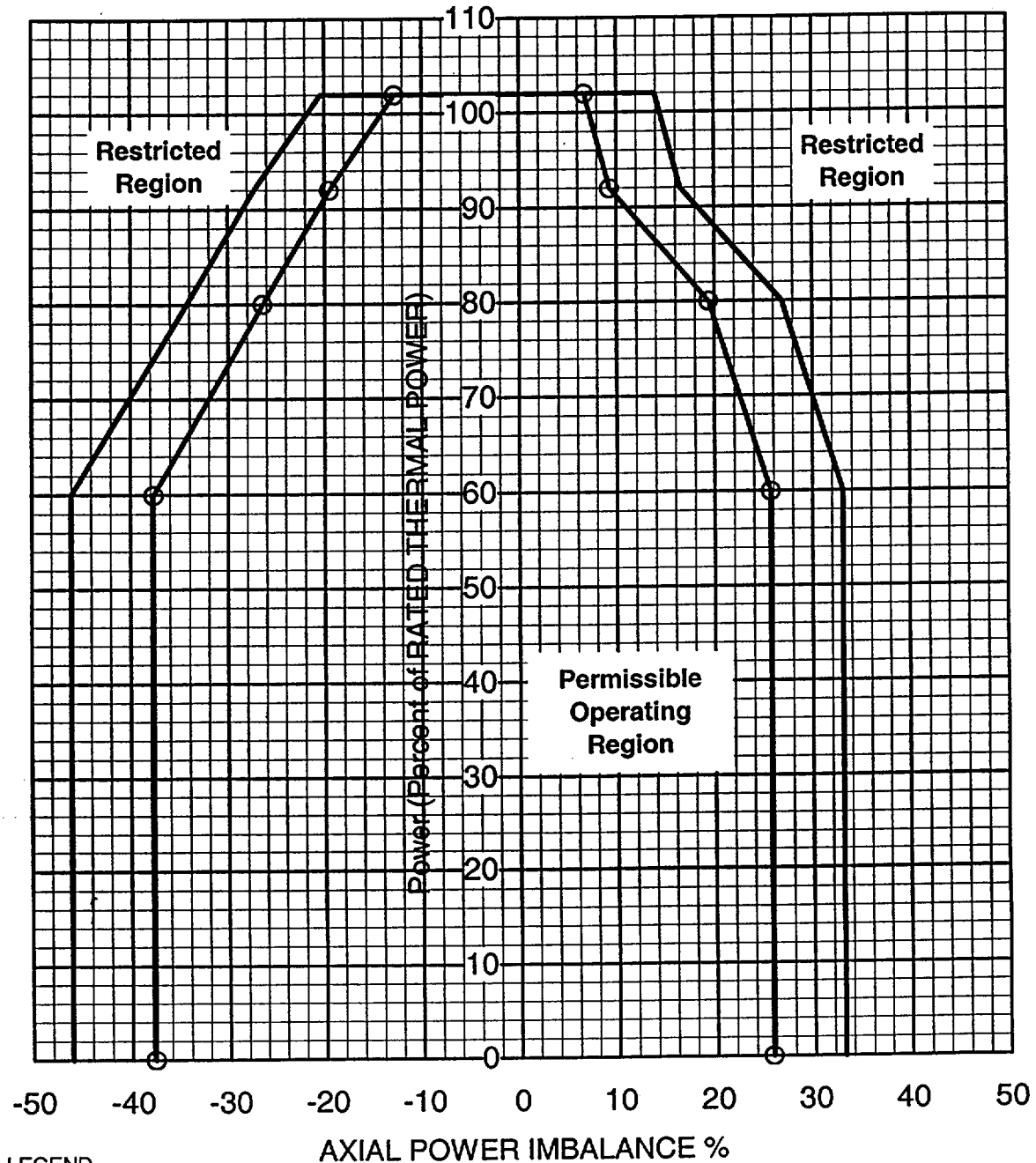
LEGEND
FULL INCORE
EXCORE

Note 1: Instrument error is accounted for in these Operating Limits.

Figure 4b AXIAL POWER IMBALANCE Operating Limits
After 300 ± 10 EFPD, Four RC Pumps --
Davis-Besse 1, Cycle 13

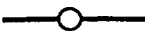
COLR
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This Figure is referred to by
Technical Specification 3.2.1



LEGEND
FULL INCORE

EXCORE



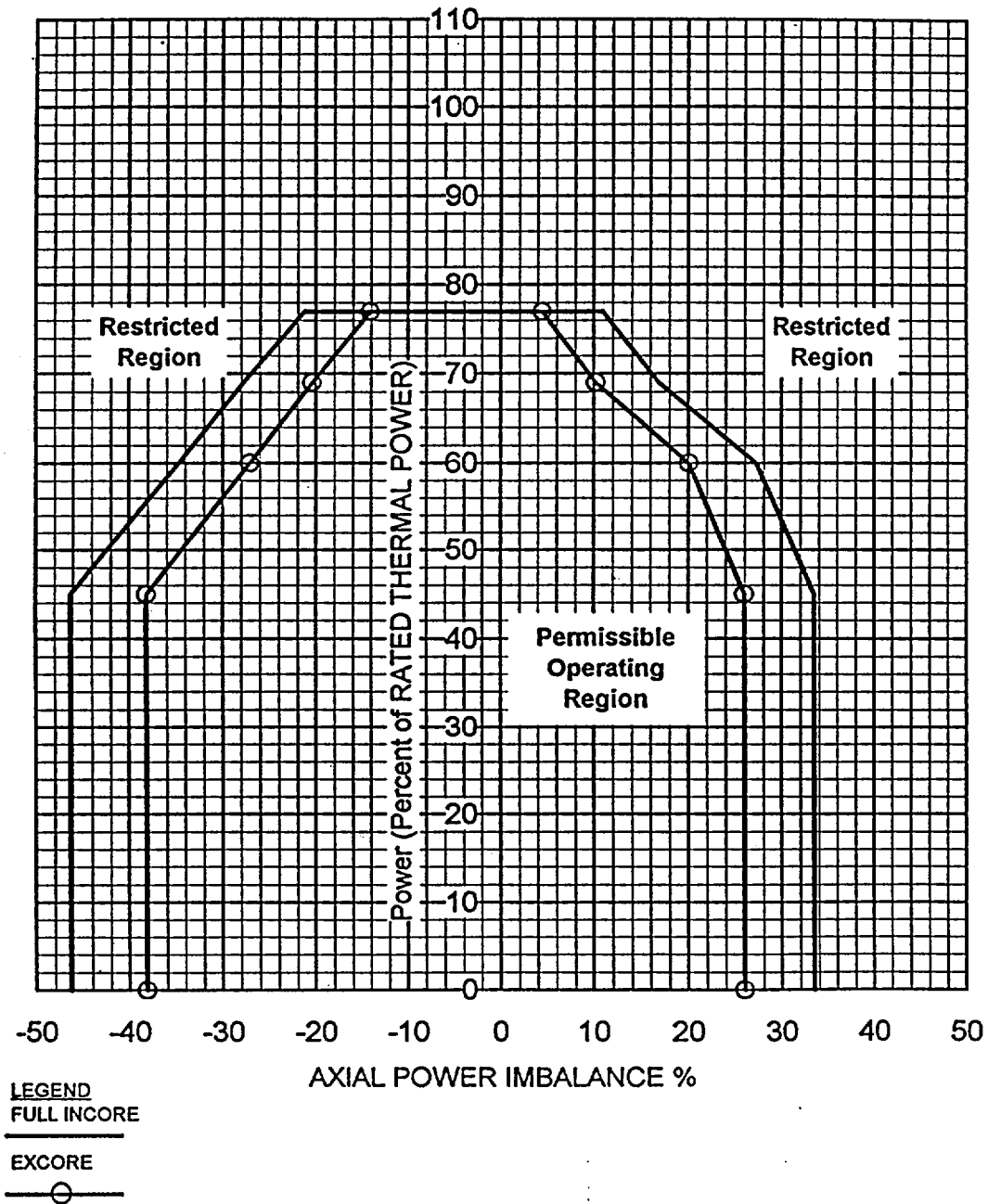
Note 1: Instrument error is accounted for in these Operating Limits.

Figure 4c

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Figure 4d AXIAL POWER IMBALANCE Operating Limits
0 to 300 ± 10 EFPD, Three RC Pumps --
Davis-Besse 1, Cycle 13

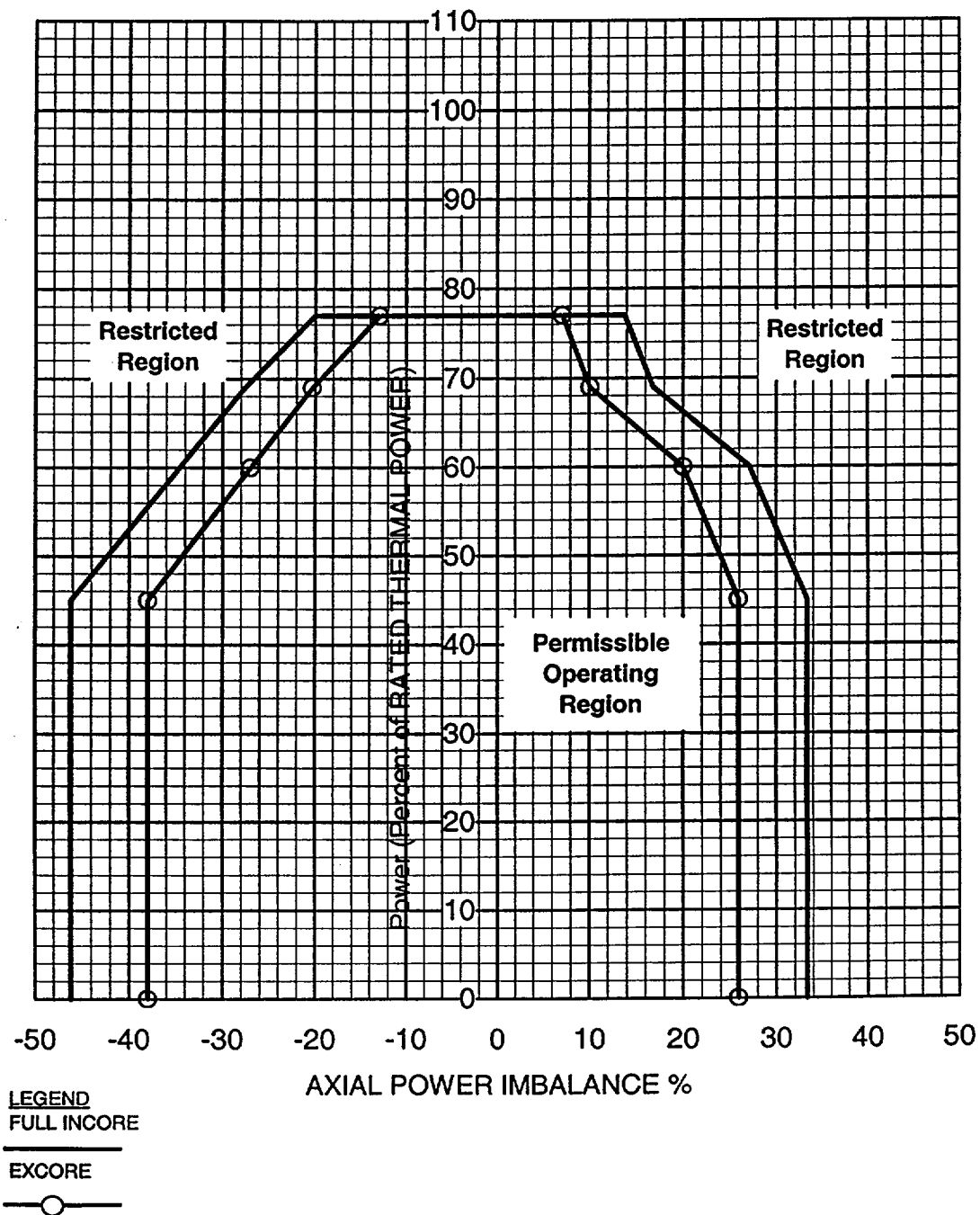
This Figure is referred to by
Technical Specification 3.2.1



Note 1: Instrument error is accounted for in these Operating Limits.

Figure 4e AXIAL POWER IMBALANCE Operating Limits
After 300 ± 10 EFPD, Three RC Pumps --
Davis-Besse 1, Cycle 13

This Figure is referred to by
Technical Specification 3.2.1

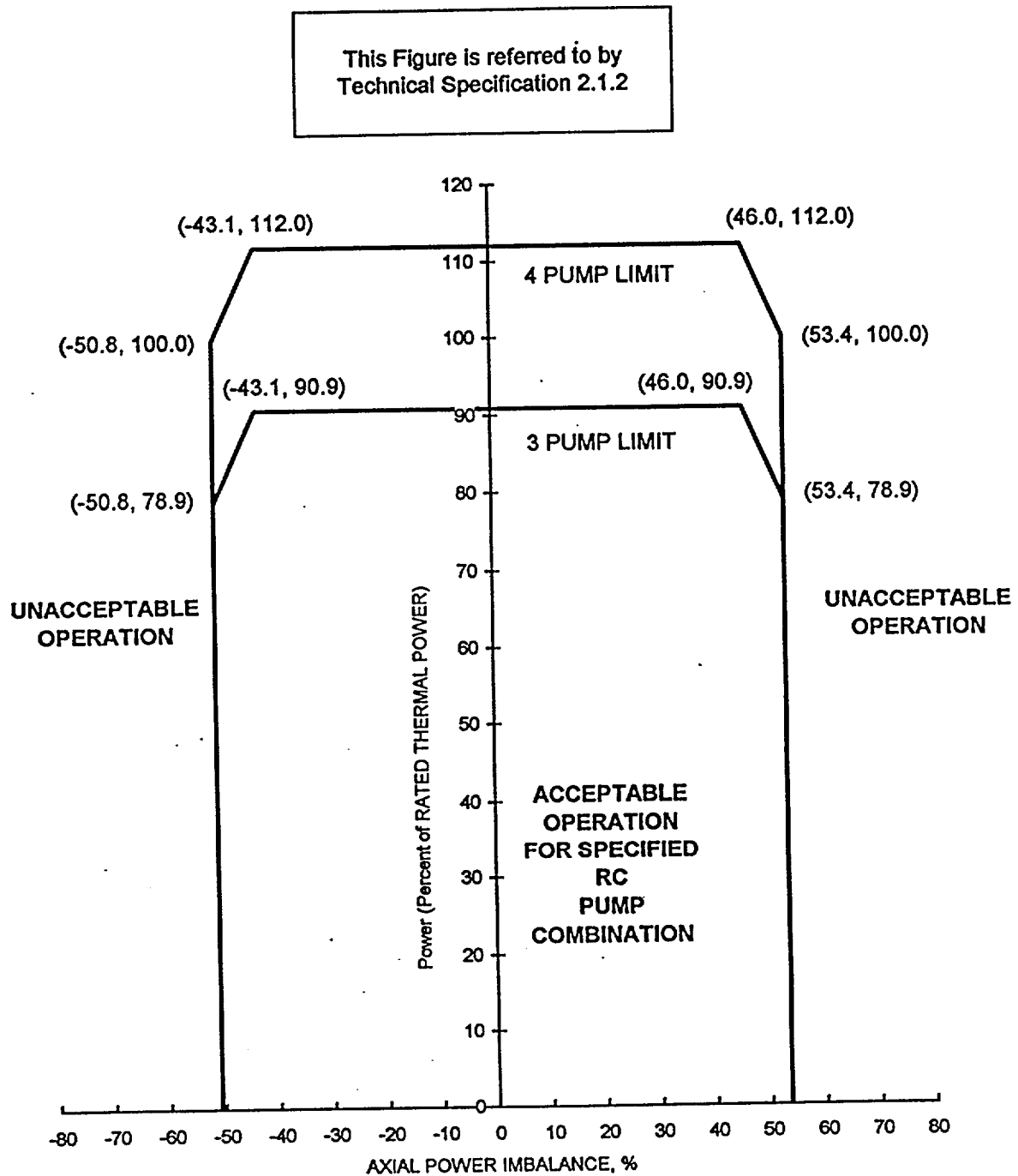


Note 1: Instrument error is accounted for in these Operating Limits.

Figure 4f

[Deleted]

Figure 5 AXIAL POWER IMBALANCE Protective Limits



<u>Pumps Operating</u>	<u>Reactor Coolant Flow, gpm</u>	<u>Required Measured Flow to Ensure Compliance, gpm</u>
4	380,000	389,500
3	283,860	290,957

Figure 6

Flux- Δ Flux/Flow
(or Power/Imbalance/Flow)
Allowable Values

This Figure is referred to by
Technical Specification 2.2.1

% RATED THERMAL POWER

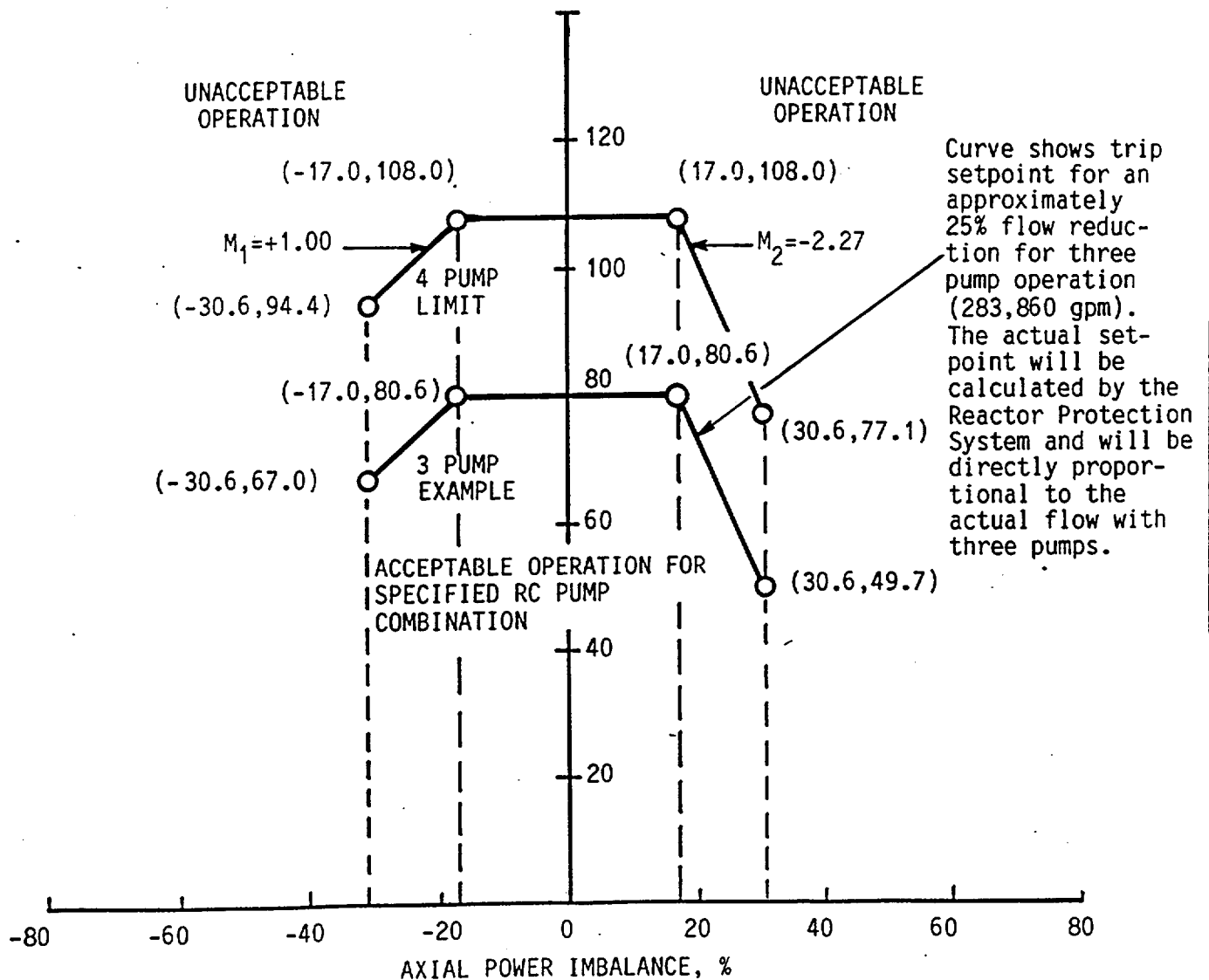


Table 1 QUADRANT POWER TILT Limits

This Table is referred to by
Technical Specification
3.2.4

QUADRANT POWER TILT as measured by:	From 0 EFPD to EOC-13			
	Steady-state Limit for THERMAL POWER $\leq 60\%$ (%)	Steady-state Limit for THERMAL POWER $> 60\%$ (%)	Transient Limit (%)	Maximum Limit (%)
Symmetrical Incore detector system	7.90	4.00	10.03	20.0

Table 2 Negative Moderator Temperature Coefficient Limit

This Table is referred
to by Technical Specification
3.1.1.3c

Negative Moderator Temperature
Coefficient Limit
(at RATED THERMAL POWER)

$-4.00 \times 10^{-4} \Delta k/k/^{\circ}F$

Table 3 Power to Melt Limits

This Table is referred to by
Technical Specification Bases
B2.1

	<u>Batch 9G</u>	<u>Batch 10A2</u>	<u>Batch 13</u>	<u>Batch 14</u>	<u>Batch 15</u>
Fuel Assembly Type	Mark-B8A	Mark-B8A	Mark-B10A	Mark-B10M	Mark-B10K
Minimum linear heat rate to melt, kW/ft	20.5	20.5	22.3	22.3 (20.8) (a) (20.8) (b)	22.1 (21.1) (c) (20.7) (d) (20.3) (e)

- (a) Limit for 3 wt% Gd rods - Batch 14
- (b) Limit for 6 wt% Gd rods - Batch 14
- (c) Limit for 2 wt% Gd rods - Batch 15
- (d) Limit for 3 wt% Gd rods - Batch 15
- (e) Limit for 8 wt% Gd rods - Batch 15

Table 4a Nuclear Heat Flux Hot Channel Factor - F_Q (NAS)

This Table is referred to by
Technical Specification
3.2.2

Nuclear Heat Flux Hot Channel Factor - F_Q

F_Q shall be limited by the following relationships:

$$F_Q \leq LHR^{ALLOW}(Bu) / [LHR^{AVG} * P] \quad (\text{for } P \leq 1.0)$$

$LHR^{ALLOW}(Bu)$: See Tables below

$LHR^{AVG} = 6.139$ kW/ft for Mark-B8A fuel

$LHR^{AVG} = 6.426$ kW/ft for Mark-B10A fuel

$LHR^{AVG} = 6.420$ kW/ft for Mark-B10M fuel

$LHR^{AVG} = 6.318$ kW/ft for Mark-B10K fuel

P = ratio of THERMAL POWER/RATED THERMAL POWER

Bu = Fuel Burnup (MWd/mtU)

Batch 9G (Mark-B8A) LHR^{ALLOW} kW/ft (a)

<u>Axial Segment</u>	<u>0 MWd/mtU</u>	<u>24,500 MWd/mtU</u>	<u>52,000 MWd/mtU</u>	<u>60,000 MWd/mtU</u>
1	15.6	15.6	11.8	10.3
2	15.3	15.3	11.8	10.3
3	14.5	14.5	11.8	10.3
4	14.5	14.5	11.8	10.3
5	14.9	14.9	11.8	10.3
6	14.9	14.9	11.8	10.3
7	14.2	14.2	11.4	9.9
8	13.9	13.9	11.2	9.7

Batch 10A2 (Mark-B8A) LHR^{ALLOW} kW/ft (a)

<u>Axial Segment</u>	<u>0 MWd/mtU</u>	<u>24,500 MWd/mtU</u>	<u>52,000 MWd/mtU</u>
1	15.6	15.6	11.8
2	15.3	15.3	11.8
3	14.5	14.5	11.8
4	14.5	14.5	11.8
5	14.9	14.9	11.8
6	14.9	14.9	11.8
7	14.2	14.2	11.4
8	13.9	13.9	11.2

TABLE 4a continued

Batch 13 (Mark-B10A) LHR^{ALLOW} kW/ft (a)

<u>Axial Segment</u>	<u>0</u> <u>MWd/mtU</u>	<u>35,000</u> <u>MWd/mtU</u>	<u>62,000</u> <u>MWd/mtU</u>
1	17.6	16.8	12.8
2	17.5	16.7	12.8
3	17.0	15.6	12.8
4	16.6	15.3	12.8
5	16.0	15.3	12.8
6	15.3	15.3	12.8
7	14.7	14.7	12.8
8	14.5	14.5	12.8

Batch 14 (Mark-B10M) LHR^{ALLOW} kW/ft (a)

<u>Axial Segment</u>	<u>0</u> <u>MWd/mtU</u>	<u>35,000</u> <u>MWd/mtU</u>	<u>62,000</u> <u>MWd/mtU</u>
1	17.6	16.8	12.8
2	17.5	16.7	12.8
3	17.0	15.6	12.8
4	16.6	15.3	12.8
5	16.0	15.3	12.8
6	15.3	15.3	12.8
7	14.7	14.7	12.8
8	14.5	14.5	12.8

Batch 15 (Mark-B10K) LHR^{ALLOW} kW/ft (a)

<u>Axial Segment</u>	<u>0</u> <u>MWd/mtU</u>	<u>35,000</u> <u>MWd/mtU</u>
1	17.6	16.8
2	17.5	16.7
3	17.0	15.6
4	16.6	15.3
5	16.0	15.3
6	15.3	15.3
7	14.7	14.7
8	14.5	14.5

(a) Linear interpolation for allowable linear heat rate between specified burnup points is valid for these tables.

Table 4b Nuclear Heat Flux Hot Channel Factor - F_Q (FIDMS)

This Table is referred to by
Technical Specification
3.2.2

Nuclear Heat Flux Hot Channel Factor - F_Q

F_Q shall be limited by the following relationships:

$$F_Q \leq \text{LHR}^{\text{ALLOW}}_{\text{(Bu)}} / [\text{LHR}^{\text{AVG}} * P] \quad (\text{for } P \leq 1.0)$$

$\text{LHR}^{\text{ALLOW}}_{\text{(Bu)}}$: See Tables below

$\text{LHR}^{\text{AVG}} = 6.377 \text{ kW/ft}$

P = ratio of THERMAL POWER/RATED THERMAL POWER

Bu = Fuel Burnup (MWd/mtU)

Batch 9G (Mark-B8A) $\text{LHR}^{\text{ALLOW}}$ kW/ft (a)

Core Elevation ft.	0 MWd/mtU	24,500 MWd/mtU	52,000 MWd/mtU	60,000 MWd/mtU
0.000	16.2	16.2	12.1	10.6
2.506	15.8	15.8	12.1	10.6
4.264	15.0	15.0	12.1	10.6
6.021	15.4	15.4	12.1	10.6
7.779	15.9	15.9	12.1	10.6
9.536	15.3	15.3	12.1	10.6
12.000	14.3	14.3	11.5	10.0

Batch 10A2 (Mark-B8A) $\text{LHR}^{\text{ALLOW}}$ kW/ft (a)

Core Elevation ft.	0 MWd/mtU	24,500 MWd/mtU	52,000 MWd/mtU
0.000	16.2	16.2	12.1
2.506	15.8	15.8	12.1
4.264	15.0	15.0	12.1
6.021	15.4	15.4	12.1
7.779	15.9	15.9	12.1
9.536	15.3	15.3	12.1
12.000	14.3	14.3	11.5

TABLE 4b continued

Batch 13 (Mark-B10A) LHR^{ALLOW} kW/ft (a)

Core Elevation ft.	0 MWd/mtU	35,000 MWd/mtU	62,000 MWd/mtU
0.000	17.6	16.8	12.8
2.506	17.6	16.8	12.8
4.264	17.1	15.7	12.8
6.021	16.6	15.3	12.8
7.779	16.0	15.8	12.8
9.536	15.3	15.3	12.8
12.000	14.5	14.5	12.8

Batch 14 (Mark-B10M) LHR^{ALLOW} kW/ft (a)

Core Elevation ft.	0 MWd/mtU	35,000 MWd/mtU	62,000 MWd/mtU
0.000	17.6	16.8	12.8
2.506	17.6	16.8	12.8
4.264	17.1	15.7	12.8
6.021	16.6	15.3	12.8
7.779	16.0	15.8	12.8
9.536	15.3	15.3	12.8
12.000	14.5	14.5	12.8

Batch 15 (Mark-B10K) LHR^{ALLOW} kW/ft (a)

Core Elevation ft.	0 MWd/mtU	35,000 MWd/mtU
0.000	17.6	16.8
2.506	17.6	16.8
4.264	17.1	15.7
6.021	16.6	15.3
7.779	16.0	15.8
9.536	15.3	15.3
12.000	14.5	14.5

- (a) Linear interpolation for allowable linear heat rate between specified burnup points is valid for these tables.

Table 5 Nuclear Enthalpy Rise Hot Channel Factor - F_{AH}^N

This Table is referred
to by Technical Specification
3.2.3

Enthalpy Rise Hot Channel Factor F_{AH}^N

$$F_{AH}^N \leq ARP [1 + 0.3(1 - P/P_m)]$$

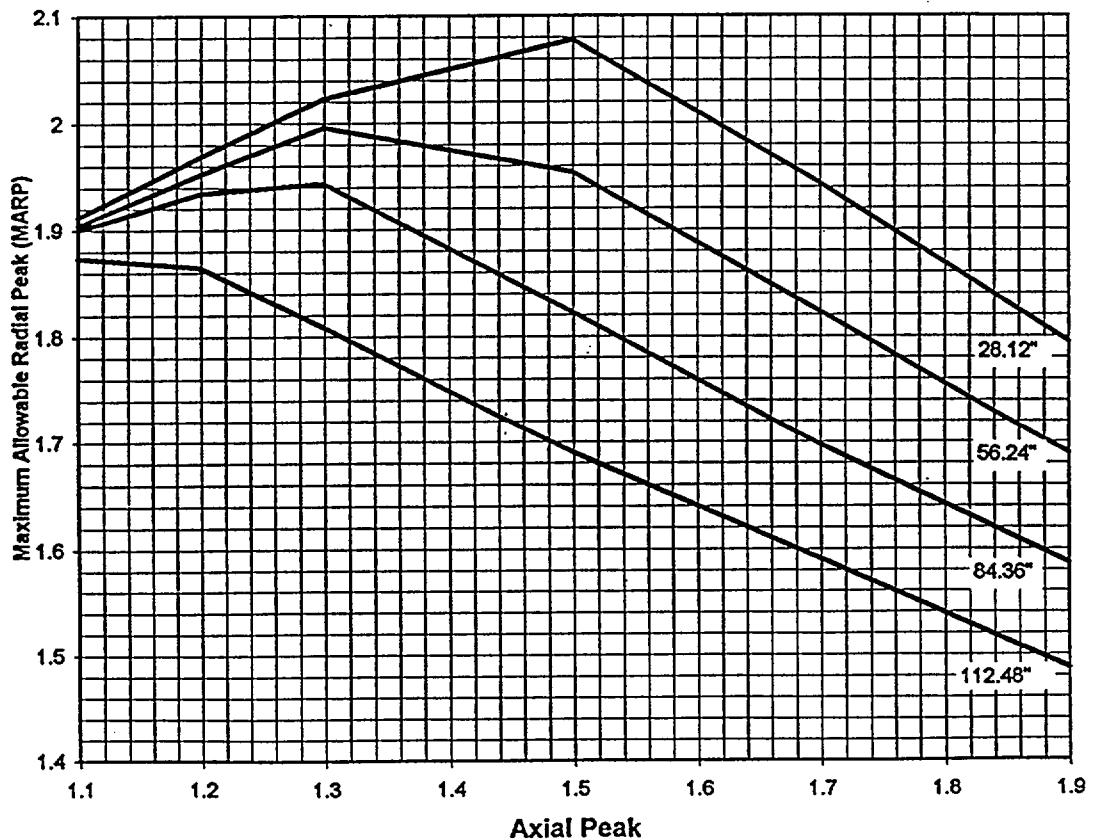
ARP = Allowable Radial Peak, see Figure

P = THERMAL POWER/RATED THERMAL POWER and $P \leq 1.0$

$P_m = 1.0$ for 4-RCP operation

$P_m = 0.75$ for 3-RCP operation

Figure 7 * Allowable Radial Peak for F_{AH}^N



* This figure is applicable to all fuel in the core. Linear interpolation and extrapolation above 112.48 inches are acceptable. For axial heights <28.12 inches, the value at 28.12 inches will be used.