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U. S. Nuclear Regulatory Commission  
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Dear Sirs:

**Subject: Palo Verde Nuclear Generating Station (PVNGS)  
Unit 2, Docket No. STN 50-529  
Core Operating Limits Report (COLR), Unit 2, Revision 3**

Pursuant to PVNGS Technical Specifications, Section 5.6.5.d, enclosed is Revision 3 to the COLR for Unit 2, which was made effective on December 14, 2000. This revision revises Figures 3.1.7-1 and 3.1.7-2 with additional tabular information as an aide to users, Figure 3.2.3-1 for Azimuthal Power Tilt limit above 20% power, and miscellaneous editorial changes. This revision replaces the previous Unit 2 COLR, Revision 2.

By copy of this letter and the enclosure, this COLR revision is being provided to the NRC Region IV Administrator and the PVNGS Senior Resident Inspector.

This letter does not make any commitments to the NRC. Please contact Scott A. Bauer at (623) 393-5978 if you have any questions or require additional information.

Sincerely,

AKK/SAB/JAP

Enclosure

cc: E. W. Merschoff  
J. N. Donohew  
J. M. Moorman

A001

**Enclosure**

**Core Operating Limits Report  
PVNGS Unit 2, Revision 3**

**PVNGS UNIT 2 CORE OPERATING LIMITS REPORT**

**CORE OPERATING LIMITS REPORT**

**PALO VERDE NUCLEAR GENERATING STATION (PVNGS)**

**UNIT 2**

**Revision 3**

## PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

## Table of Contents

<u>Description</u>	<u>Revision #</u>	<u>Page</u>
Cover Page	3	1
Table of Contents	3	2
List of Figures	3	3
List of Tables	3	4
Affected Technical Specifications	3	5
CORE Operating Limits		
3.1.1 Shutdown Margin (SDM) - Reactor Trip Breakers Open	3	5
3.1.2 Shutdown Margin (SDM) - Reactor Trip Breakers Closed	3	5
3.1.4 Moderator Temperature Coefficient (MTC)	3	5
3.1.5 Control Element Assembly (CEA) Alignment	3	6
3.1.7 Regulating CEA Insertion Limits	3	6
3.1.8 Part Length CEA Insertion Limits	3	6
3.2.1 Linear Heat Rate (LHR)	3	6
3.2.3 Azimuthal Power Tilt (Tq)	3	6
3.2.4 Departure From Nucleate Boiling Ratio (DNBR)	3	7
3.2.5 Axial Shape Index (ASI)	3	7
3.3.12 Boron Dilution Alarm System (BDAS)	3	7
3.9.1 Boron Concentration	3	7

# PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

## List of Figures

<u>Description</u>	<u>Revision #</u>	<u>Page</u>
Figure 3.1.1-1 Shutdown Margin Versus Cold Leg Temperature Reactor Trip Breakers Open	3	8
Figure 3.1.2-1 Shutdown Margin Versus Cold Leg Temperature Reactor Trip Breakers Closed	3	9
Figure 3.1.4-1 MTC Acceptable Operation, Modes 1 and 2	3	10
Figure 3.1.5-1 Core Power Limit After CEA Deviation	3	11
Figure 3.1.7-1 CEA Insertion Limits Versus Thermal Power (COLSS in Service)	3	12
Figure 3.1.7-2 CEA Insertion Limits Versus Thermal Power (COLSS Out of Service)	3	13
Figure 3.1.8-1 Part Length CEA Insertion Limits Versus Thermal Power	3	14
Figure 3.2.3-1 Azimuthal Power Tilt Versus Thermal Power (COLSS in Service)	3	15
Figure 3.2.4-1 COLSS DNBR Operating Limit Allowance for Both CEACs Inoperable	3	16
Figure 3.2.4-2 DNBR Margin Operating Limit Based on the Core Protection Calculators (COLSS Out of Service, CEACs Operable)	3	17
Figure 3.2.4-3 DNBR Margin Operating Limit Based on the Core Protection Calculators (COLSS Out of Service, CEACs Inoperable)	3	18

## PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

## List of Tables

<u>Description</u>	<u>Revision #</u>	<u>Page</u>
Table 3.3.12-1 Required Monitoring Frequencies for Backup Boron Dilution Detection as a Function of Operating Charging Pumps and Plant Operational Modes for $K_{eff} > 0.98$	3	19
Table 3.3.12-2 Required Monitoring Frequencies for Backup Boron Dilution Detection as a Function of Operating Charging Pumps and Plant Operational Modes for $0.98 \geq K_{eff} > 0.97$	3	20
Table 3.3.12-3 Required Monitoring Frequencies for Backup Boron Dilution Detection as a Function of Operating Charging Pumps and Plant Operational Modes for $0.97 \geq K_{eff} > 0.96$	3	21
Table 3.3.12-4 Required Monitoring Frequencies for Backup Boron Dilution Detection as a Function of Operating Charging Pumps and Plant Operational Modes for $0.96 \geq K_{eff} > 0.95$	3	22
Table 3.3.12-5 Required Monitoring Frequencies for Backup Boron Dilution Detection as a Function of Operating Charging Pumps and Plant Operational Modes for $K_{eff} \leq 0.95$	3	23

**PVNGS UNIT 2 CORE OPERATING LIMITS REPORT**

This Report has been prepared in accordance with the requirements of Technical Specification 5.6.5. The Core Operating Limits have been developed using the NRC approved methodologies specified in Section 5.6.5 b of the Palo Verde Unit 2 Technical Specifications.

**AFFECTED PVNGS TECHNICAL SPECIFICATIONS**

- 3.1.1 Shutdown Margin (SDM) - Reactor Trip Breakers Open
- 3.1.2 Shutdown Margin (SDM) - Reactor Trip Breakers Closed
- 3.1.4 Moderator Temperature Coefficient (MTC)
- 3.1.5 Control Element Assembly (CEA) Alignment
- 3.1.7 Regulating CEA Insertion Limits
- 3.1.8 Part Length CEA Insertion Limits
- 3.2.1 Linear Heat Rate (LHR)
- 3.2.3 Azimuthal Power Tilt ( $T_q$ )
- 3.2.4 Departure From Nucleate Boiling Ratio (DNBR)
- 3.2.5 Axial Shape Index (ASI)
- 3.3.12 Boron Dilution Alarm System (BDAS)
- 3.9.1 Boron Concentration

**CORE OPERATING LIMITS**

The cycle-specific operating limits for the specifications listed are presented below.

**3.1.1 - Shutdown Margin (SDM) - Reactor Trip Breakers Open**

The Shutdown Margin shall be greater than or equal to that shown in Figure 3.1.1-1.

**3.1.2 - Shutdown Margin (SDM) - Reactor Trip Breakers Closed**

The Shutdown Margin shall be greater than or equal to that shown in Figure 3.1.2-1.

**3.1.4 - Moderator Temperature Coefficient (MTC)**

The moderator temperature coefficient (MTC) shall be within the area of Acceptable Operation shown in Figure 3.1.4-1.

## PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

CORE OPERATING LIMITS - CONTINUED3.1.5 - Control Element Assembly (CEA) Alignment

With one or more full-length or part-length CEAs misaligned from any other CEAs in its group by more than 6.6 inches, the minimum required MODES 1 and 2 core power reduction is specified in Figure 3.1.5-1.

3.1.7 - Regulating CEA Insertion Limits

One or more CEACs OPERABLE: With COLSS IN SERVICE, regulating CEA groups shall be limited to the withdrawal sequence and to the insertion limits<sup>1</sup> shown in Figure 3.1.7-1; with COLSS OUT OF SERVICE, regulation CEA groups shall be limited to the withdrawal sequence and to the insertion limits<sup>1</sup> shown in Figure 3.1.7-2.

<sup>1</sup> A reactor power cutback will cause either (Case 1) Regulating Group 5 or Regulating Group 4 and 5 to be dropped with no sequential insertion of additional Regulating Groups (Groups 1, 2, 3, and 4) or (Case 2) Regulating Group 5 or Regulating Group 4 and 5 to be dropped with all or part of the remaining Regulating Groups (Groups 1, 2, 3, and 4) being sequentially inserted. In either case, the Transient Insertion Limit and withdrawal sequence specified in the CORE OPERATING LIMITS REPORT can be exceeded for up to 2 hours.

3.1.8 - Part Length CEA Insertion Limits

One or more CEACs OPERABLE: The part length CEA groups shall be limited to the insertion limits shown in Figure 3.1.8-1.

3.2.1 - Linear Heat Rate (LHR)

The linear heat rate limit of 13.1 kW/ft shall be maintained.

3.2.3 - Azimuthal Power Tilt ( $T_q$ )

The AZIMUTHAL POWER TILT ( $T_q$ ) shall be less than or equal to the limit in Figure 3.2.3-1 with COLSS IN SERVICE.

## PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

CORE OPERATING LIMITS - CONTINUED3.2.4 - Departure From Nucleate Boiling Ratio (DNBR)

COLSS IN SERVICE and Both CEACs INOPERABLE - Maintaining COLSS calculated core power less than or equal to COLSS calculated core power operation limit based on DNBR decreased by the allowance shown in Figure 3.2.4-1.

COLSS OUT OF SERVICE and Either One or Both CEACs are OPERABLE - Operating within the region of acceptable operation of Figure 3.2.4-2 using any operable CPC channel.

COLSS OUT OF SERVICE and CEACs INOPERABLE - Operating within the region of acceptable operation of Figure 3.2.4-3 using any operable CPC channel.

3.2.5 - Axial Shape Index (ASI)

The core average AXIAL SHAPE INDEX (ASI) shall be maintained within the following limits:

COLSS OPERABLE

$-0.18 \leq \text{ASI} \leq 0.16$  for power  $\geq 50\%$

$-0.28 \leq \text{ASI} \leq 0.16$  for power  $< 50\%$

COLSS OUT OF SERVICE (CPC)

$-0.10 \leq \text{ASI} \leq 0.10$

3.3.12 - Boron Dilution Alarm System (BDAS)

With one or both start-up channel high neutron flux alarms inoperable, the RCS boron concentration shall be determined at the applicable monitoring frequency specified in Tables 3.3.12-1 through 3.3.12-5.

3.9.1 - Boron Concentration

The boron concentration of all filled portions of the Reactor Coolant System and the refueling canal shall be maintained at a uniform concentration  $\geq 3000$  ppm.

FIGURE 3.1.1-1  
SHUTDOWN MARGIN VERSUS COLD LEG TEMPERATURE  
REACTOR TRIP BREAKERS OPEN

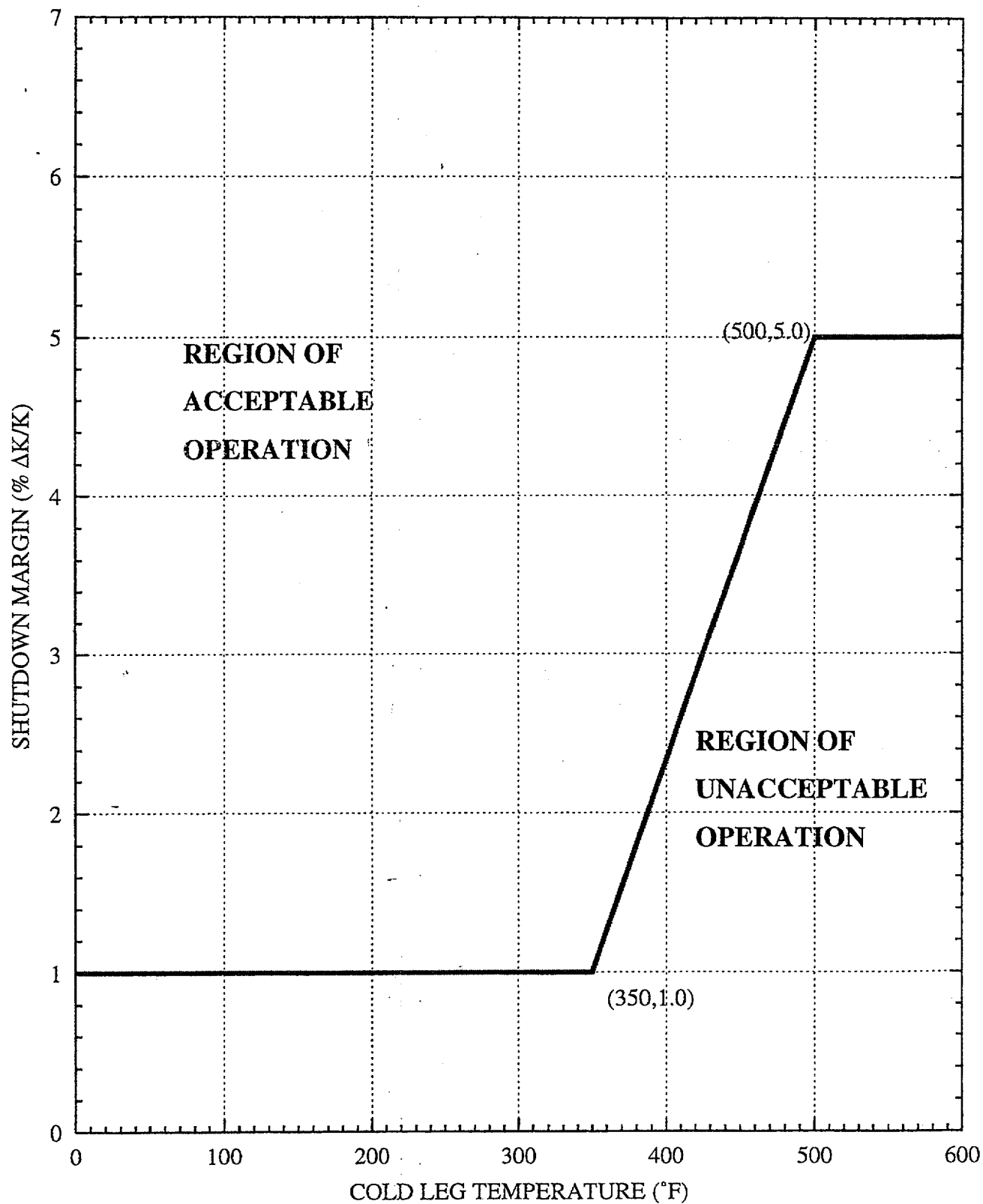


FIGURE 3.1.2-1

SHUTDOWN MARGIN VERSUS COLD LEG TEMPERATURE  
 REACTOR TRIP BREAKERS CLOSED

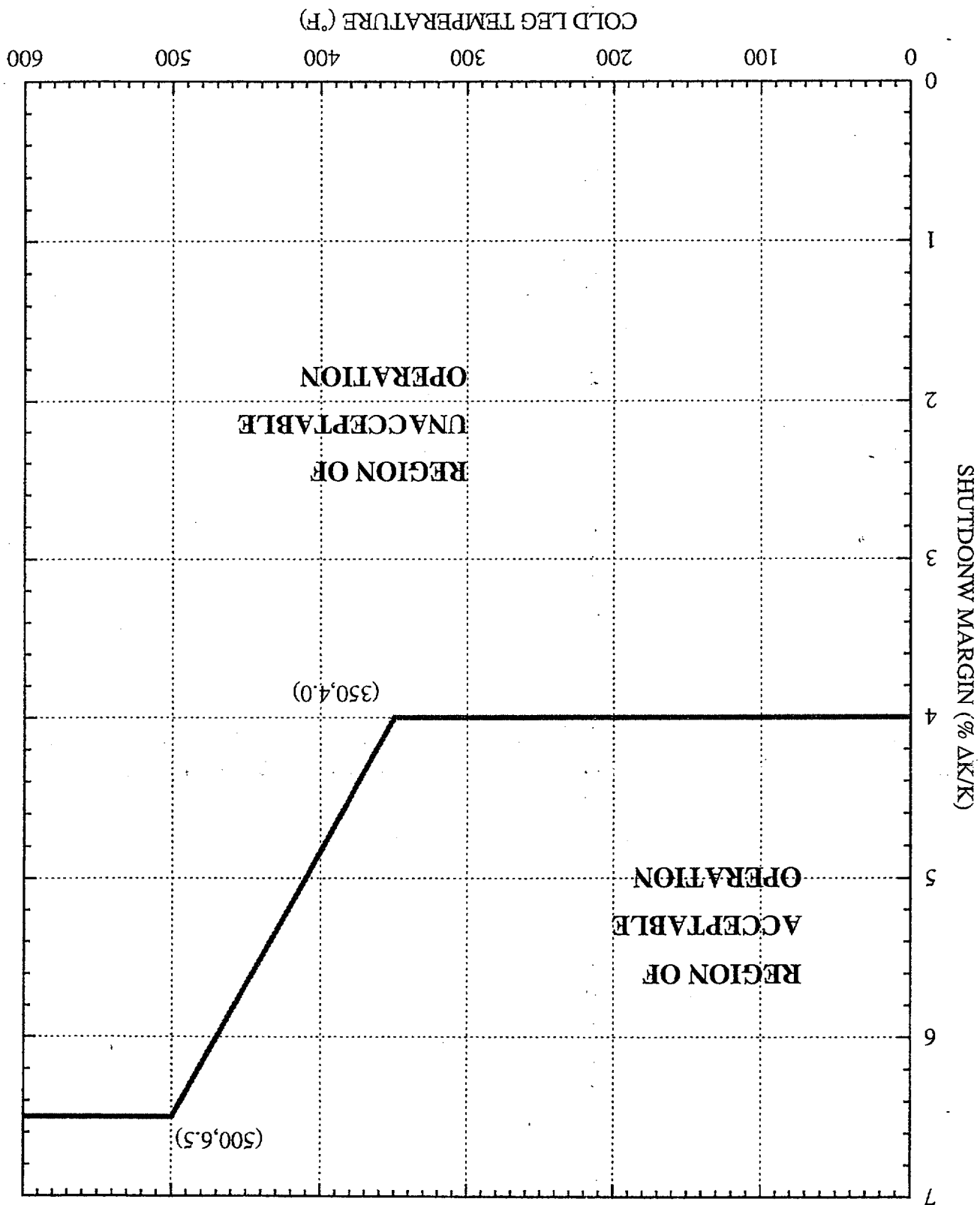
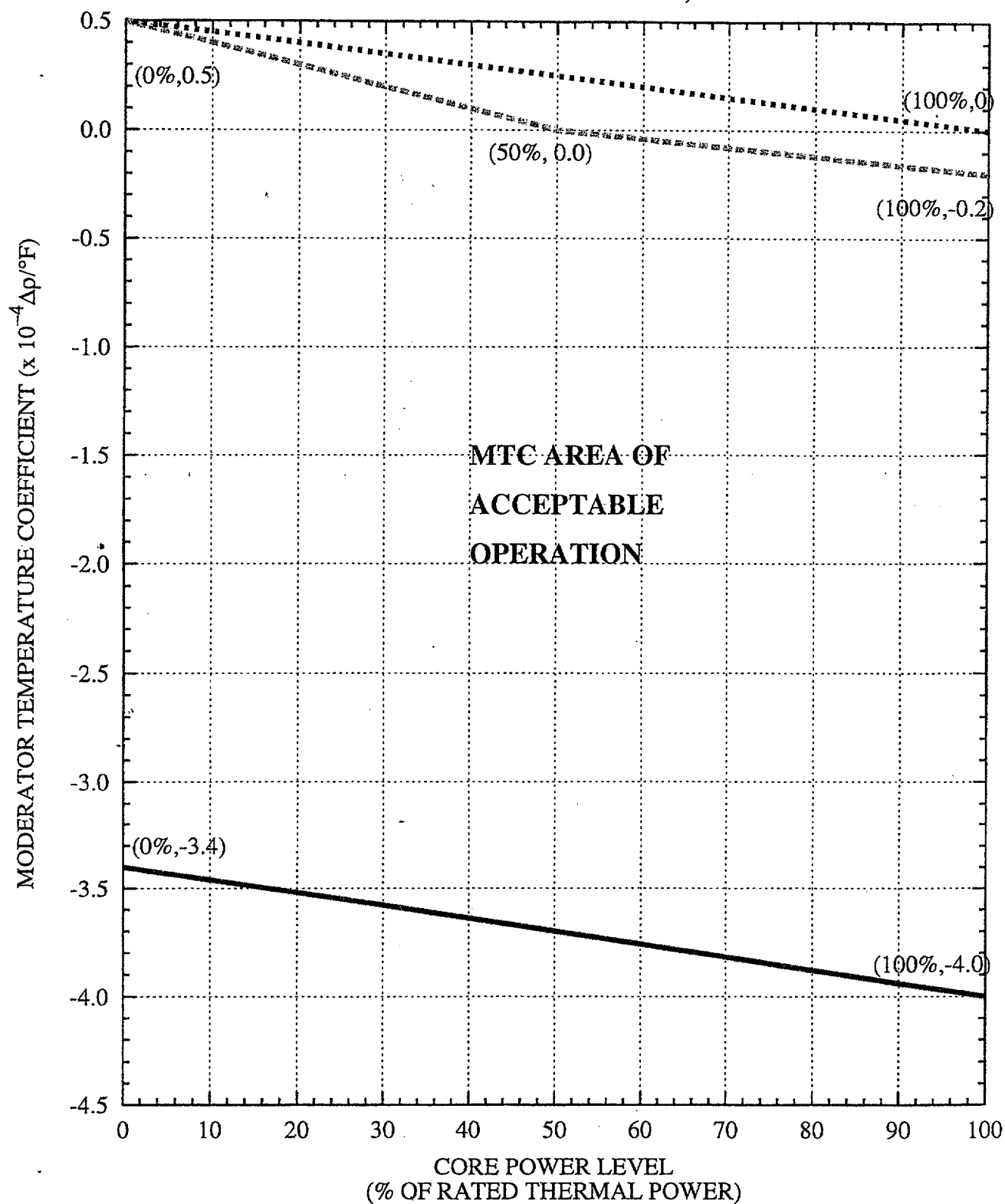
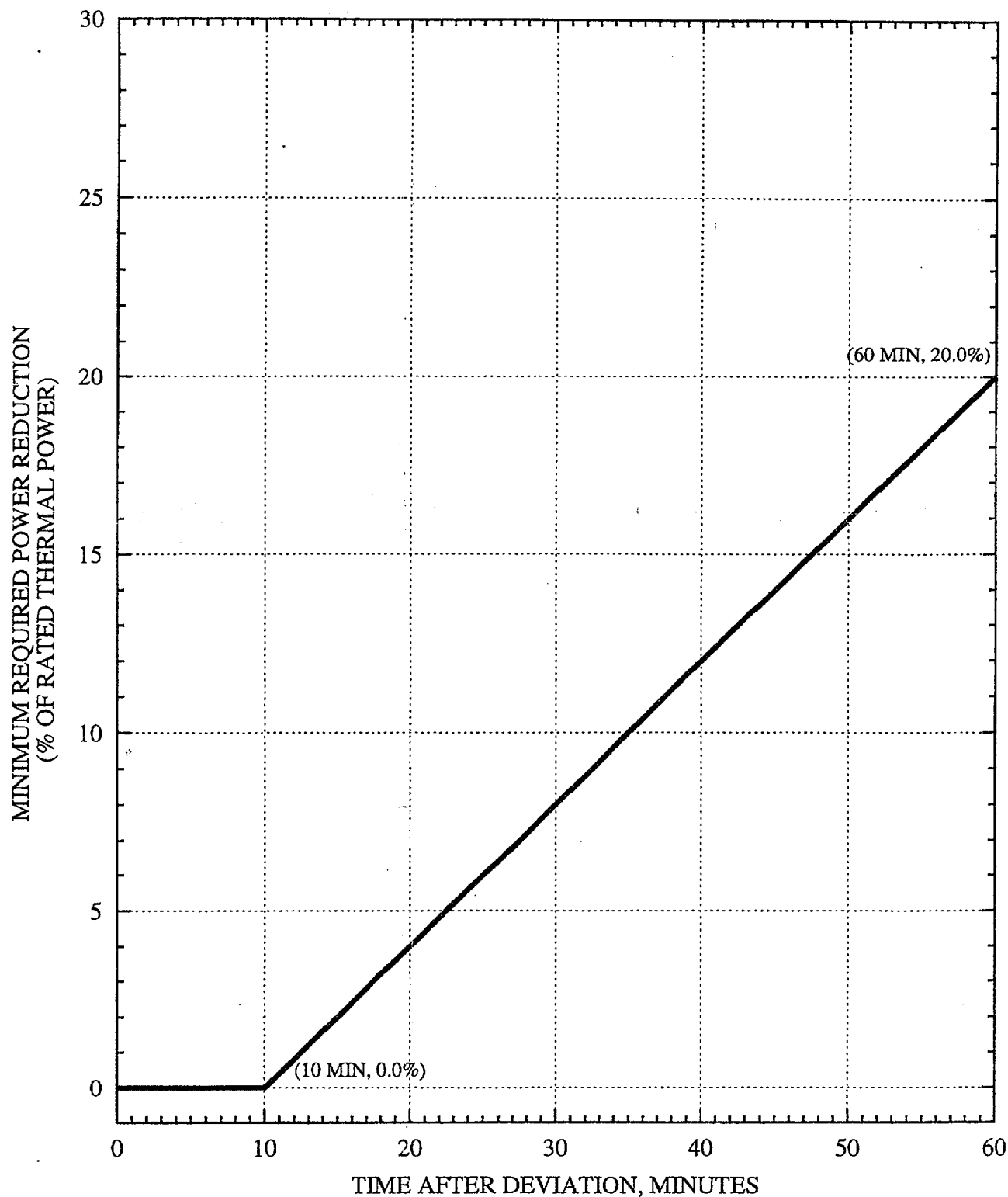


FIGURE 3.1.4-1  
MTC ACCEPTABLE OPERATION, MODES 1 AND 2



End of Cycle Limit —————  
Beginning of Cycle Limit - - - - -  
TECH SPEC 3.1.4 Maximum Upper Limit .....  
MTC AREA OF  
ACCEPTABLE  
OPERATION

FIGURE 3.1.5-1  
CORE POWER LIMIT AFTER CEA DEVIATION\*



\* WHEN CORE POWER IS REDUCED TO 55% OF RATED THERMAL POWER PER THIS LIMIT CURVE, FURTHER REDUCTION IS NOT REQUIRED.

FIGURE 3.1.7-1

# CEA INSERTION LIMITS VERSUS THERMAL POWER (COLSS IN SERVICE)

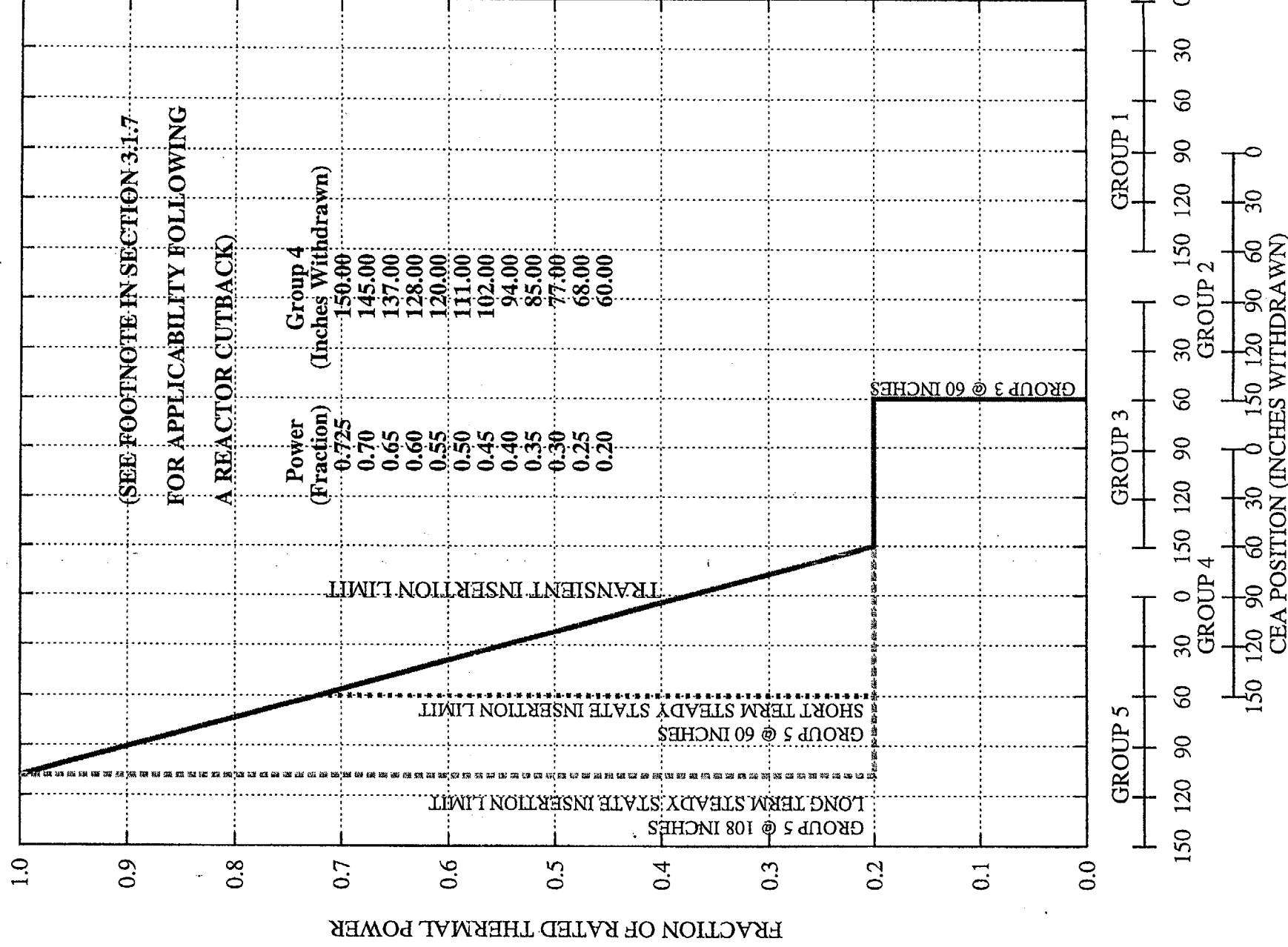


FIGURE 3.1.7-2

# CEA INSERTION LIMITS VERSUS THERMAL POWER (COLSS OUT OF SERVICE)

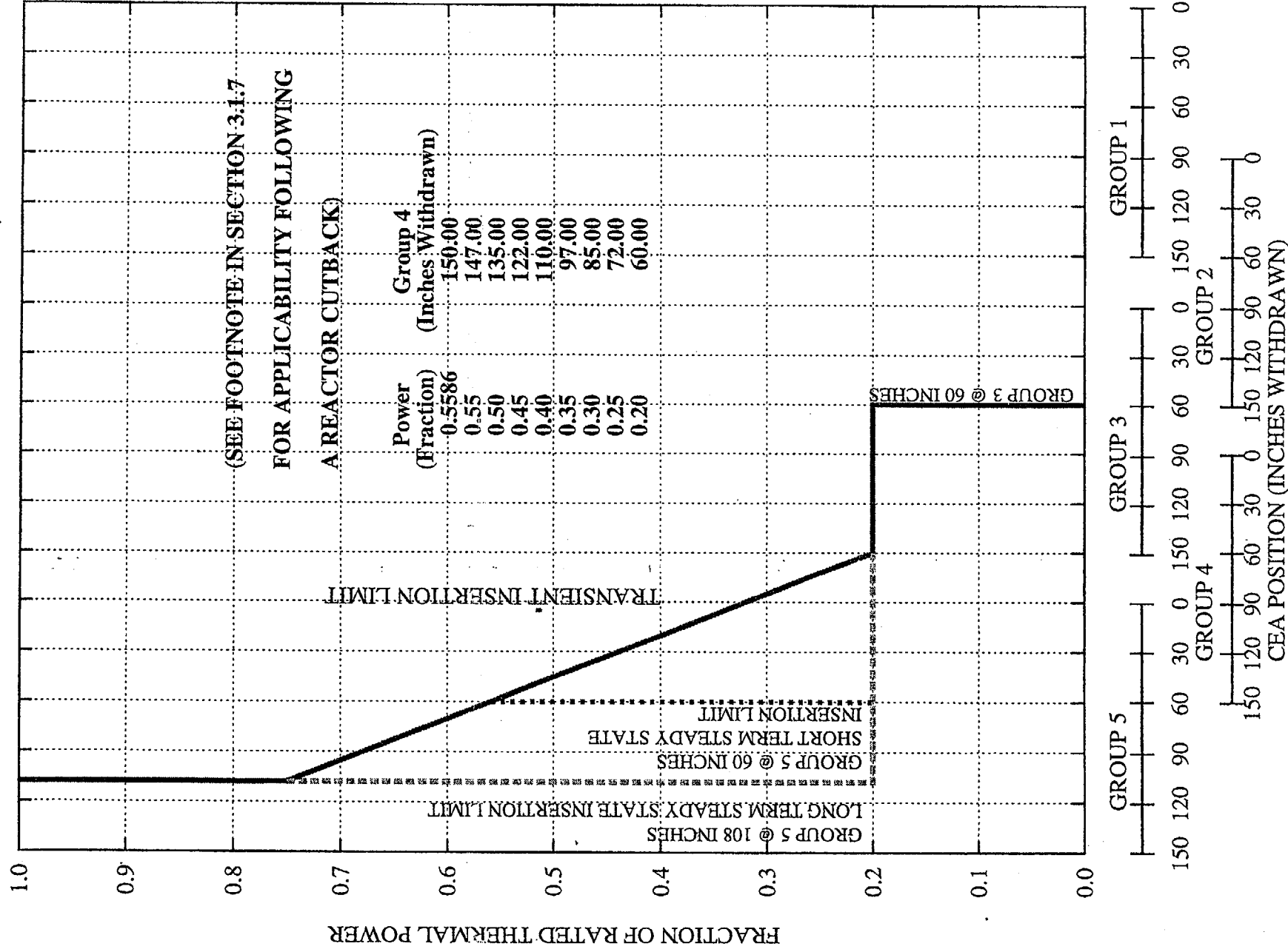


FIGURE 3.1.8-1  
PART LENGTH CEA INSERTION LIMITS  
VERSUS THERMAL POWER

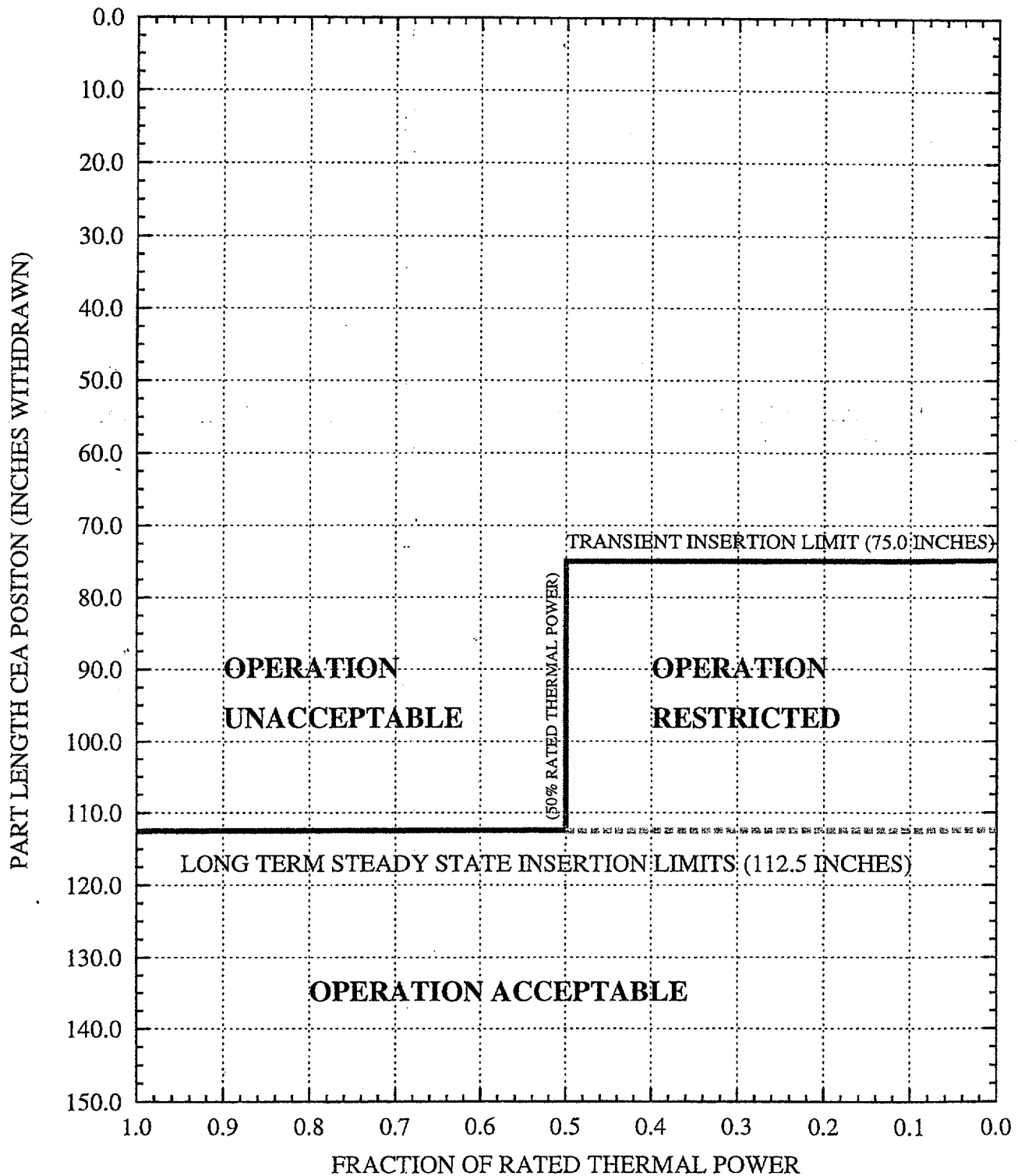


FIGURE 3.2.3-1  
AZIMUTHAL POWER TILT VERSUS THERMAL POWER  
(COLSS IN SERVICE)

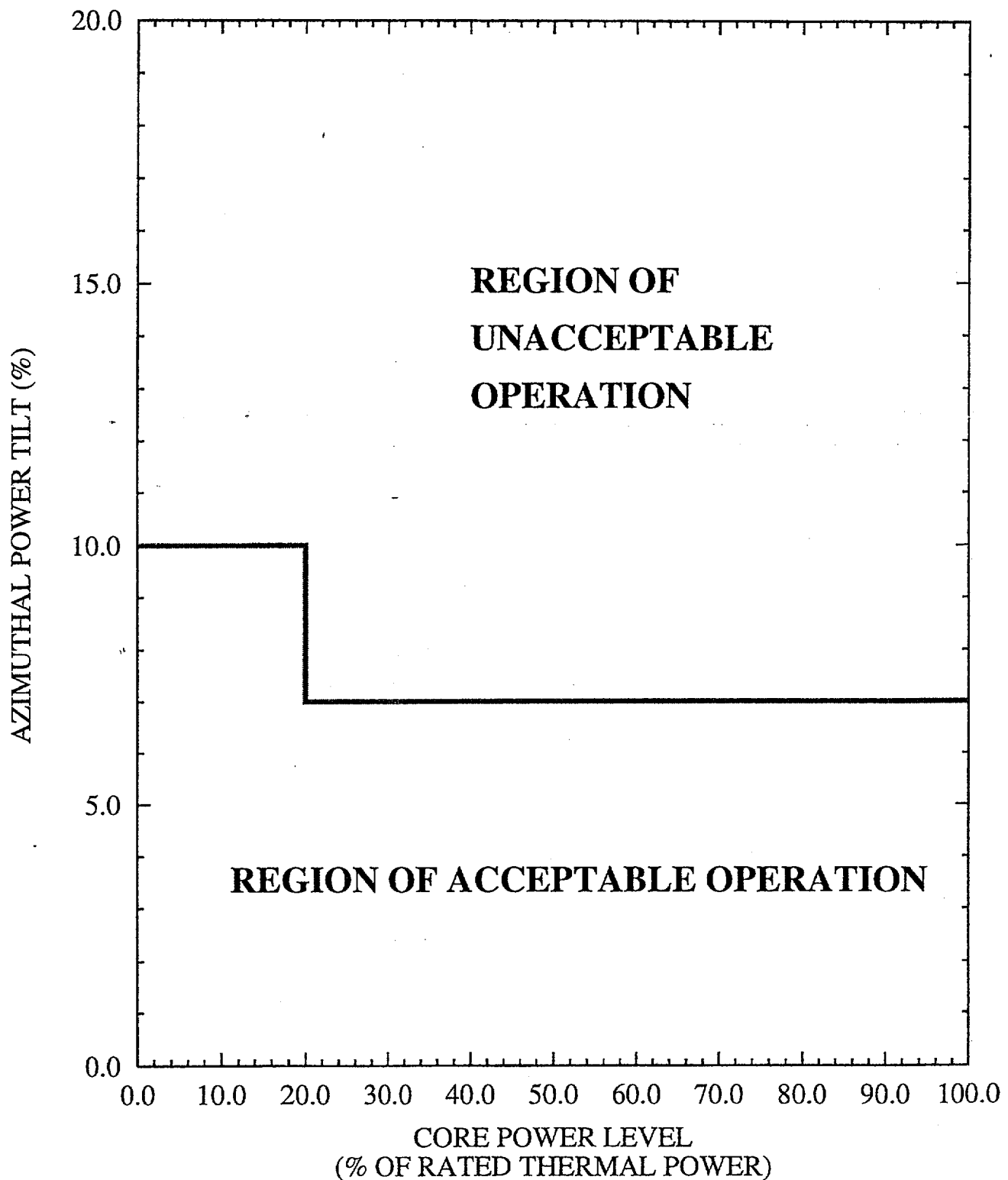


FIGURE 3.2.4-1  
COLSS DNBR OPERATING LIMIT  
ALLOWANCE FOR BOTH CEAC's INOPERABLE

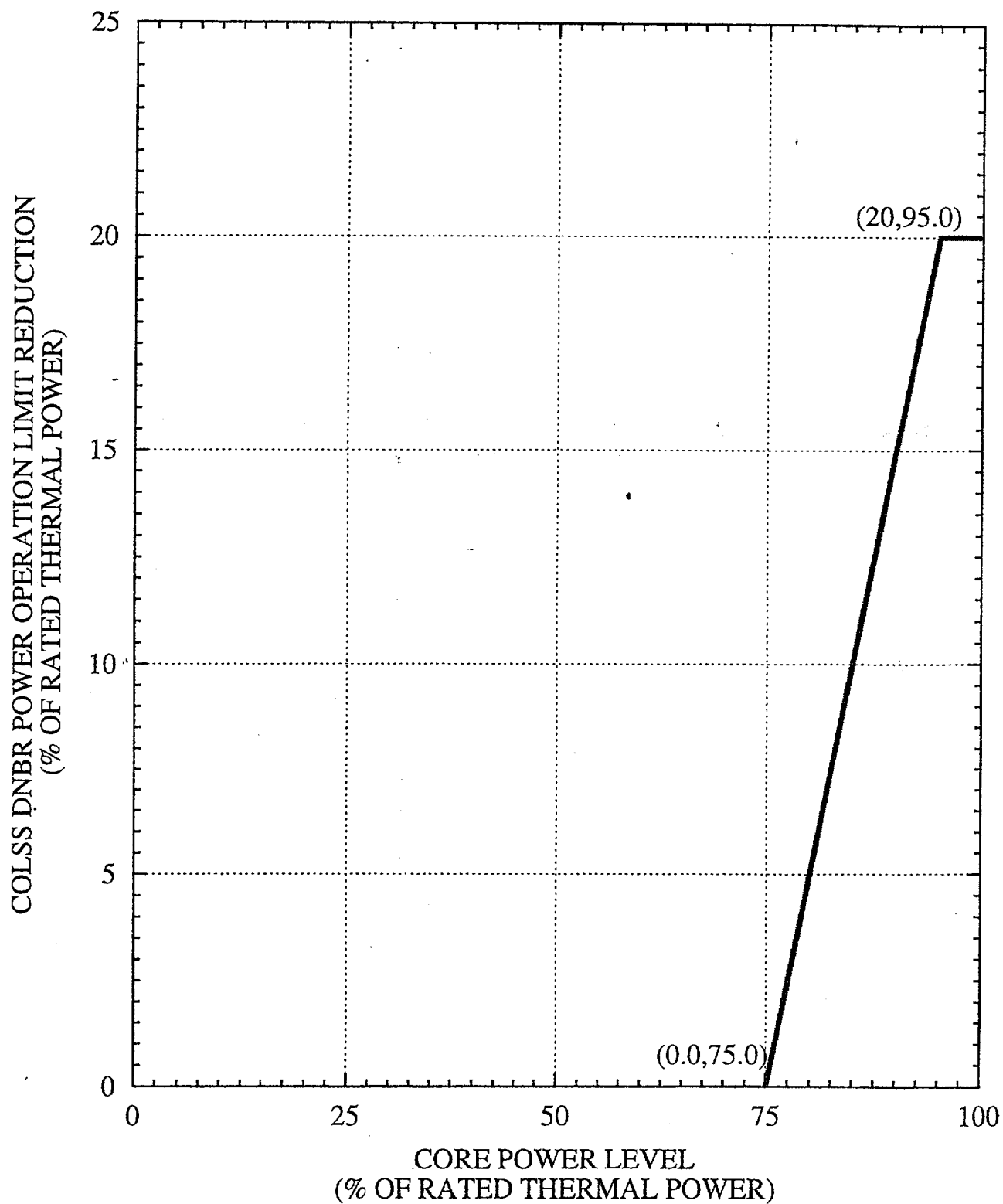


FIGURE 3.2.4-2

DNBR MARGIN OPERATING LIMIT BASED ON  
THE CORE PROTECTION CALCULATORS  
(COLSS OUT OF SERVICE, CEAC's OPERABLE)

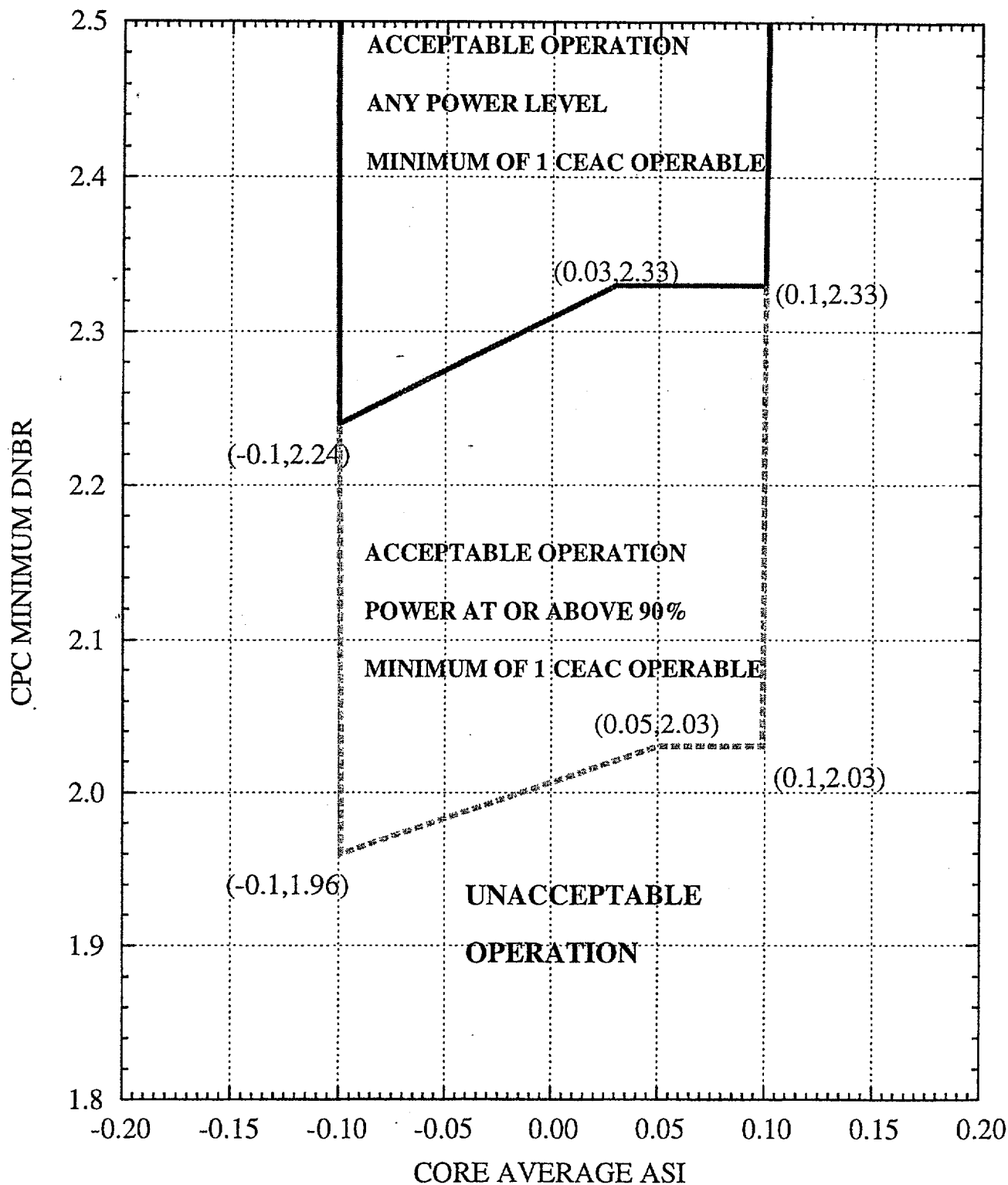
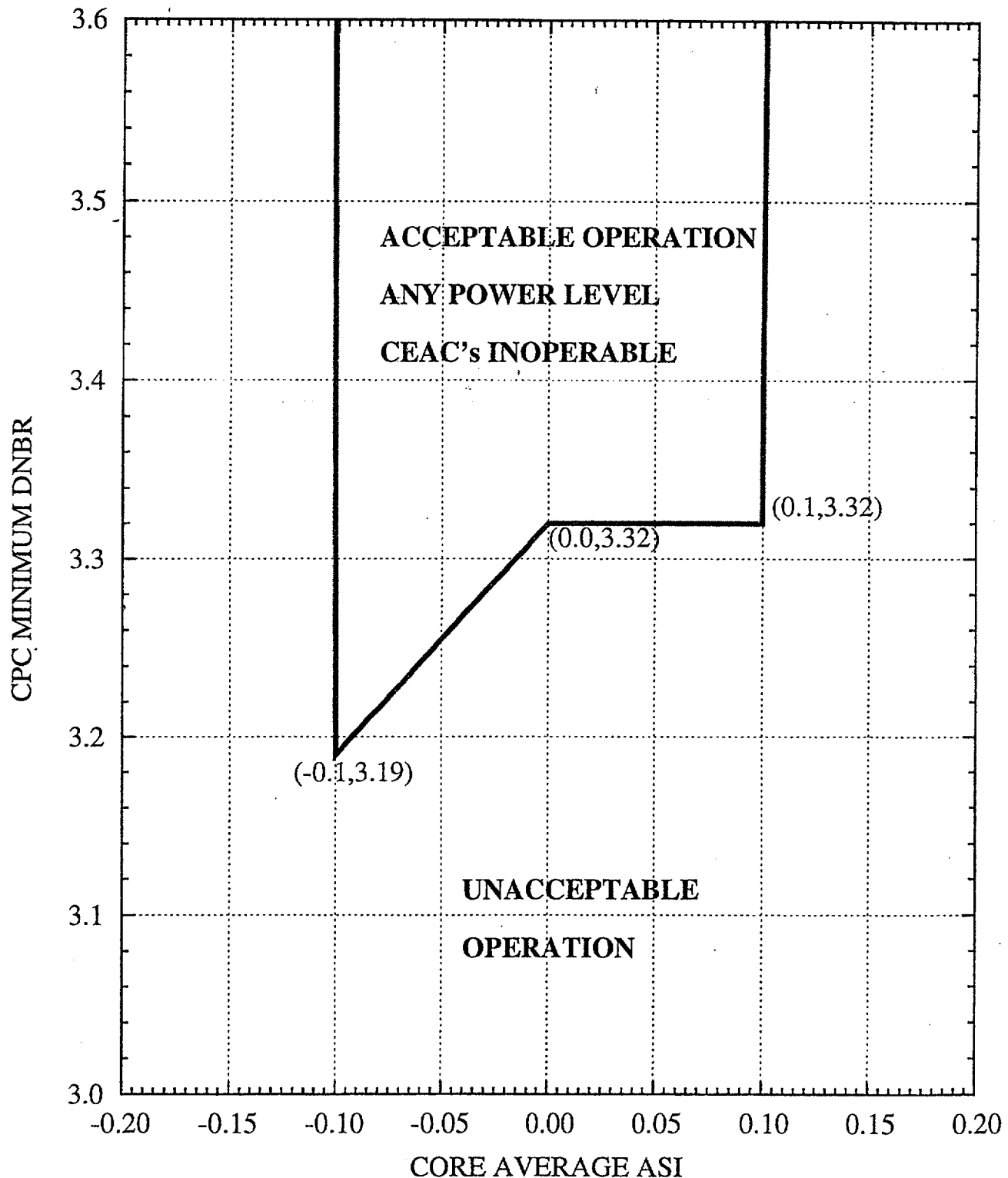


FIGURE 3.2.4-3

DNBR MARGIN OPERATING LIMIT BASED ON  
THE CORE PROTECTION CALCULATORS  
(COLSS OUT OF SERVICE, CEAC's INOPERABLE)



# PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

Table 3.3.12-1

REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON  
DILUTION DETECTION AS A FUNCTION OF OPERATING  
CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR  $K_{eff} > 0.98$

OPERATIONAL MODE	Number of Operating Charging Pumps			
	0	1	2	3
3	12 hours	0.5 hours	ONA	ONA
4 not on SCS	12 hours	0.5 hours	ONA	ONA
5 not on SCS	8 hours	0.5 hours	ONA	ONA
4 & 5 on SCS	ONA	ONA	ONA	ONA

Notes: SCS = Shutdown Cooling System  
ONA = Operation Not Allowed

## PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

Table 3.3.12-2

REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON  
DILUTION DETECTION AS A FUNCTION OF OPERATING  
CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR  $0.98 \geq K_{\text{eff}} > 0.97$

OPERATIONAL MODE	Number of Operating Charging Pumps			
	0	1	2	3
3	12 hours	1 hour	0.5 hours	ONA
4 not on SCS	12 hours	1.5 hours	0.5 hours	ONA
5 not on SCS	8 hours	1.5 hours	0.5 hours	ONA
4 & 5 on SCS	8 hours	0.5 hours	ONA	ONA

Notes: SCS = Shutdown Cooling System  
ONA = Operation Not Allowed

## PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

Table 3.3.12-3

REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON  
DILUTION DETECTION AS A FUNCTION OF OPERATING  
CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR  $0.97 \geq K_{\text{eff}} > 0.96$

OPERATIONAL MODE	Number of Operating Charging Pumps			
	0	1	2	3
3	12 hours	2.5 hours	1 hour	ONA
4 not on SCS	12 hours	2.5 hours	1 hour	0.5 hours
5 not on SCS	8 hours	2.5 hours	1 hour	0.5 hours
4 & 5 on SCS	8 hours	1 hour	ONA	ONA

Notes: SCS = Shutdown Cooling System  
ONA = Operation Not Allowed

## PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

Table 3.3.12-4

REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON  
DILUTION DETECTION AS A FUNCTION OF OPERATING  
CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR  $0.96 \geq K_{\text{eff}} > 0.95$

OPERATIONAL MODE	Number of Operating Charging Pumps			
	0	1	2	3
3	12 hours	3 hours	1 hour	0.5 hours
4 not on SCS	12 hours	3.5 hours	1.5 hours	0.75 hours
5 not on SCS	8 hours	3.5 hours	1.5 hours	0.75 hours
4 & 5 on SCS	8 hours	1.5 hours	0.5 hours	ONA

Notes: SCS = Shutdown Cooling System  
ONA = Operation Not Allowed

# PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

Table 3.3.12-5

REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON  
DILUTION DETECTION AS A FUNCTION OF OPERATING  
CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR  $K_{eff} \leq 0.95$

OPERATIONAL MODE	Number of Operating Charging Pumps			
	0	1	2	3
3	12 hours	4 hours	1.5 hours	1 hour
4 not on SCS	12 hours	4.5 hours	2 hours	1 hour
5 not on SCS	8 hours	4.5 hours	2 hours	1 hour
4 & 5 on SCS	8 hours	2 hours	0.75 hours	ONA
6	24 hours	1.5 hours	ONA	ONA

Notes: SCS = Shutdown Cooling System  
ONA = Operation Not Allowed