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Technical Specification 5.6.5.d

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December 23, 2003

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

Dear Sirs:

**Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 2
Docket No. STN 50-529
Core Operating Limits Report: Unit 2 - Revision 9**

Pursuant to Technical Specification 5.6.5.d, enclosed is Revision 9 of the PVNGS Unit 2 Core Operating Limits Report (COLR), issued November 21, 2003.

No commitments are being made to the NRC by this letter. Should you have any questions, please contact Thomas N. Weber at (623) 393-5764.

Sincerely,

SAB/TNW/JAP/kg

Enclosure

cc: B. S. Mallett NRC Region IV Regional Administrator
M. B. Fields NRC NRR Project Manager
N. L. Salgado NRC Senior Resident Inspector for PVNGS

ADD 1

Enclosure

**Core Operating Limits Report for
Palo Verde Nuclear Generating Station
Unit 2 - Revision 9**

PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

CORE OPERATING LIMITS REPORT

PALO VERDE NUCLEAR GENERATING STATION (PVNGS)

UNIT 2

Revision 9

Responsible Engineer Date	Digitally signed by: Wenzel, Richard R(Z99534) Date: 10/30/2003 07:23:27 Reason: I am the author of this document Location: PVNGS
Independent Reviewer Date	Digitally signed by: Webb, James R(V97187) Date: 10/30/2003 12:08:31 Reason: I have reviewed this document Location: PVNGS
Responsible Section Leader Date	Digitally signed by: Cannon, Thomas C(Z20485) Date: 10/30/2003 16:53:19 Reason: I am approving this document Location: PVNGS

PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

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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

PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

ANALYTICAL METHODS

The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

<u>Title</u>	<u>Report No.</u>	<u>Rev</u>	<u>Date</u>	<u>Supplement</u>
1) CE Method for Control Element Assembly Ejection Analysis (13-N001-1301-01204-1)	CENPD-0190-A	N.A.	January 1976	N.A.
2) The ROCS and DIT Computer Codes for Nuclear Design (13-N001-1900-01412-0)	CENPD-266-P-A	N.A.	April 1983	N.A.
3) Modified Statistical Combination of Uncertainties (13-N001-1303-01747-2)	CEN-356(V)-P-A	01-P-A (ARI)	May 1988 (April 1996)	N.A.
4) System 80 TM Inlet Flow Distribution (13-N001-1301-01228-0)	Enclosure 1-P to LD-82-054	N.A.	February 1993	1-P
5) Calculative Methods for the CE Large Break LOCA Evaluation Model for the Analysis of CE and W Designed NSSS (13-N001-1900-01391-0)	CENPD-132	N.A.	March 2001	4-P-A
6) Calculative Methods for the CE Small Break LOCA Evaluation Model (13-N001-1900-01392-0)	CENPD-137-P	N.A.	April 1998	2-P-A
7) Fuel Rod Maximum Allowable Pressure (13-N001-0201-00026-1)	CEN-372-P-A	N.A.	May 1990	N.A.
8) Arizona Public Service Company PWR Reactor Physics Methodology Using CASMO-4/SIMULATE-3 (NFM-002)	N.A.	N.A.	September 1999	N.A.

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<u>Title</u>	<u>Report No.</u>	<u>Rev</u>	<u>Date</u>	<u>Supplement</u>
9) Technical Manual for the CENTS Code (13-N001-1303-02349-1 for Vol. 1 13-N001-1303-02348-1 for Vol. 2 13-N001-1303-02376-1 for Vol. 3 13-N001-1303-02375-1 for Supplement 1-P)	CE-NPD 282-P-A Vols. 1-3	N.A.	June 1993	1-P
10) Implementation of ZIRLO™ Cladding Material in CE Nuclear Power Fuel Assembly Designs (13-N001-1900-01329-0)	CENPD- 404-P-A	0	November 2001	N.A.

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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.

3.1.5 - 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

With COLSS IN SERVICE, regulating CEA groups shall be limited to the withdrawal sequence and to the insertion limits¹ shown in Figure 3.1.7-1²; with COLSS OUT OF SERVICE, regulation CEA groups shall be limited to the withdrawal sequence and to the insertion limits¹ shown in Figure 3.1.7-2.²

¹ 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.

² The Separation between Regulating Groups 4 and 5 may be reduced from the 90 inch value specified in Figures 3.1.7-1 and 3.1.7-2 provided that each of the following conditions are satisfied:

PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

- a) Regulating Group 4 position is between 60 and 150 inches withdrawn.
- b) Regulating Group 5 position is maintained at least 10 inches lower than Regulating Group 4 position.
- c) Both Regulating Group 4 and Regulating Group 5 positions are maintained above the Transient Insertion Limit specified in Figure 3.1.7-1 (COLSS In Service) or Figure 3.1.7-2 (COLSS Out of Service).

3.1.8 - Part Length CEA Insertion Limits

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 5% with COLSS IN SERVICE when power is greater than 20%.

3.2.4 - Departure From Nucleate Boiling Ratio (DNBR)

COLSS IN SERVICE and Both CEACs INOPERABLE in Any OPERABLE CPC Channel - 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, CEAC(s) OPERABLE - Operating within the region of acceptable operation of Figure 3.2.4-2 using any operable CPC channel.

COLSS OUT OF SERVICE and Both CEACs INOPERABLE in Any OPERABLE CPC Channel - Operating within the region of acceptable operation of Figure 3.2.4-3 using any operable CPC channel with both CEACs INOPERABLE.

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3.2.5 - Axial Shape Index (ASI)

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

COLSS OPERABLE

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

$-0.28 \leq \text{ASI} \leq 0.18$ 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 ≥ 3000 ppm.

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

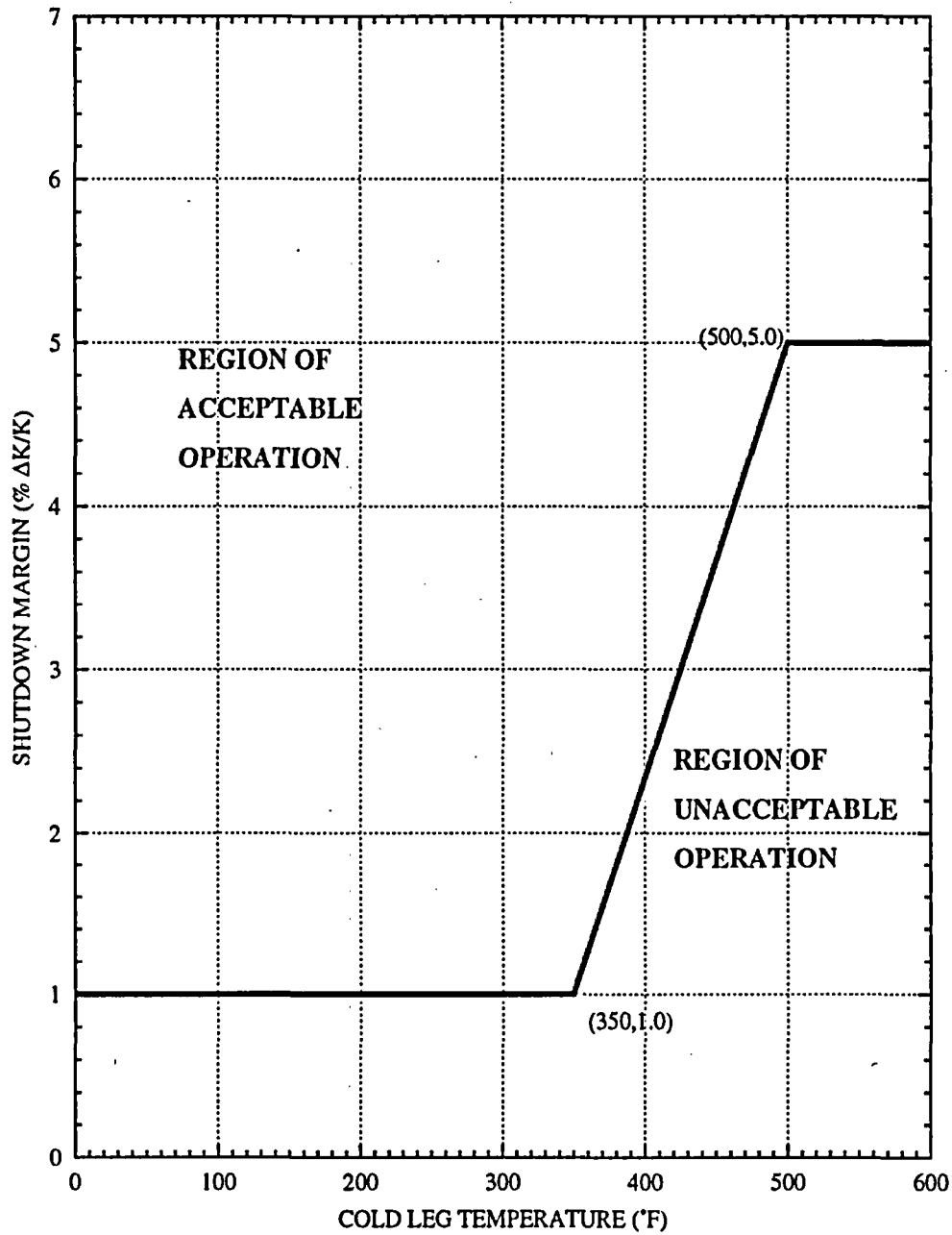


FIGURE 3.1.2-1
SHUTDOWN MARGIN VERSUS COLD LEG TEMPERATURE
REACTOR TRIP BREAKERS CLOSED

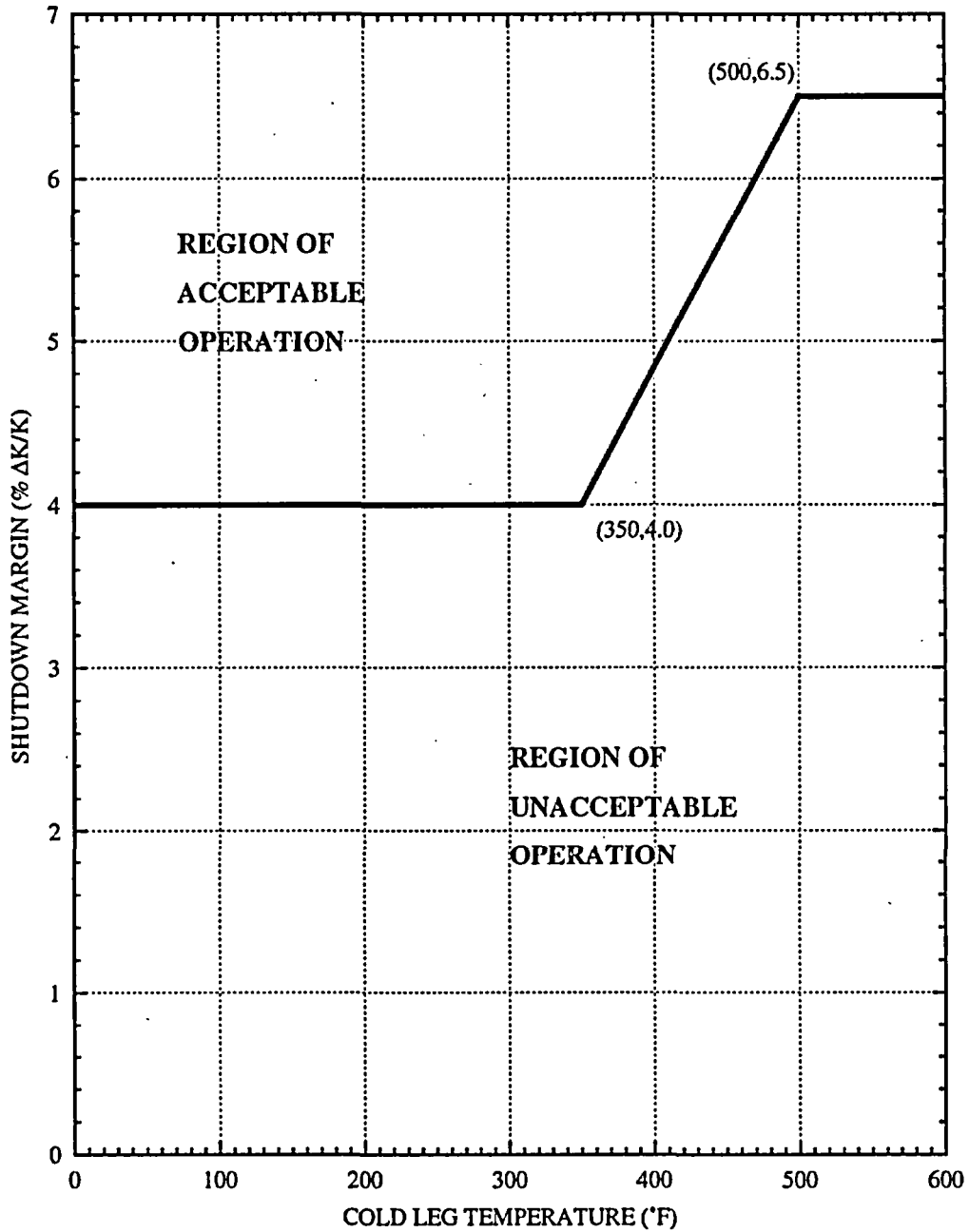


FIGURE 3.1.4-1
MTC ACCEPTABLE OPERATION, MODES 1 AND 2

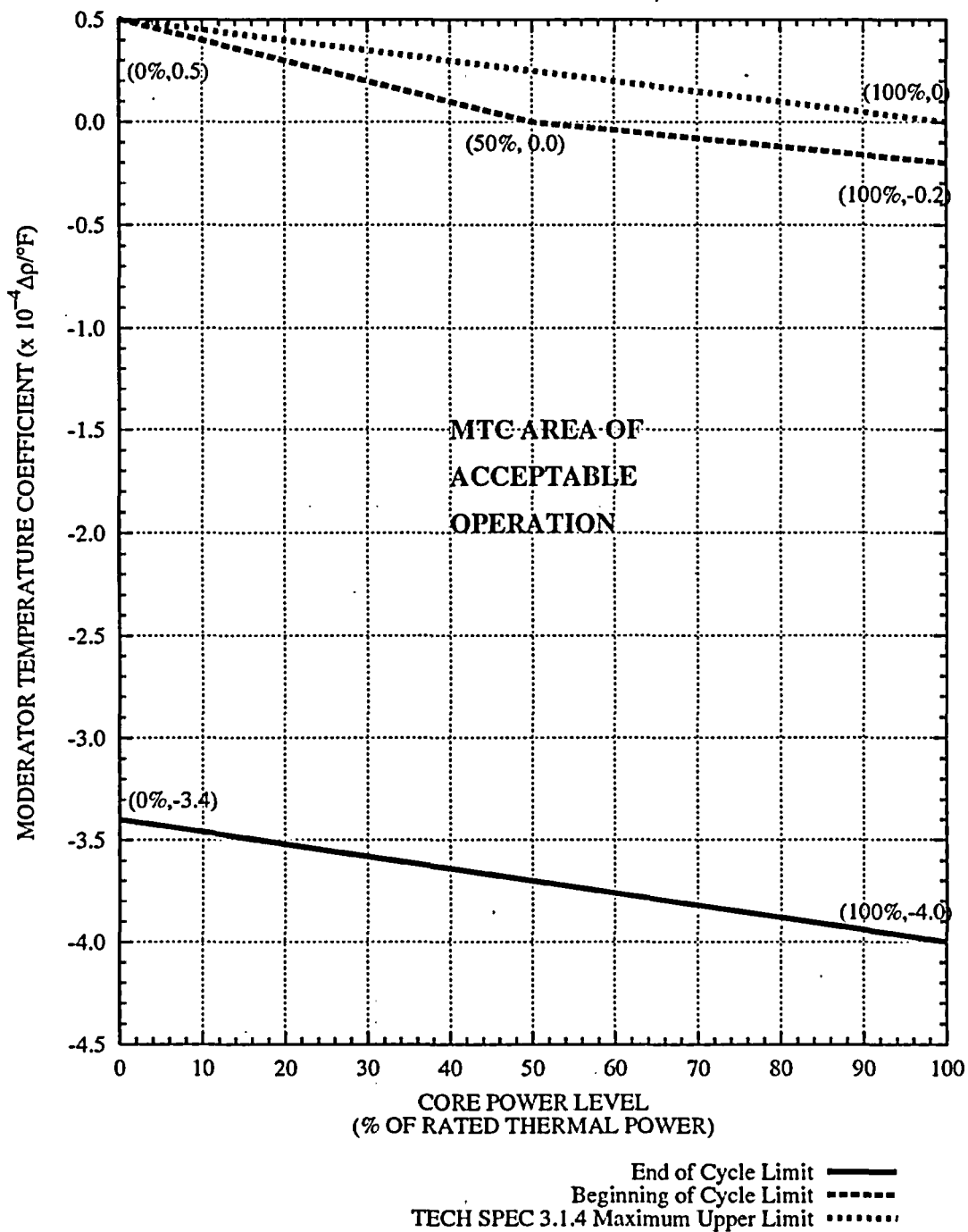
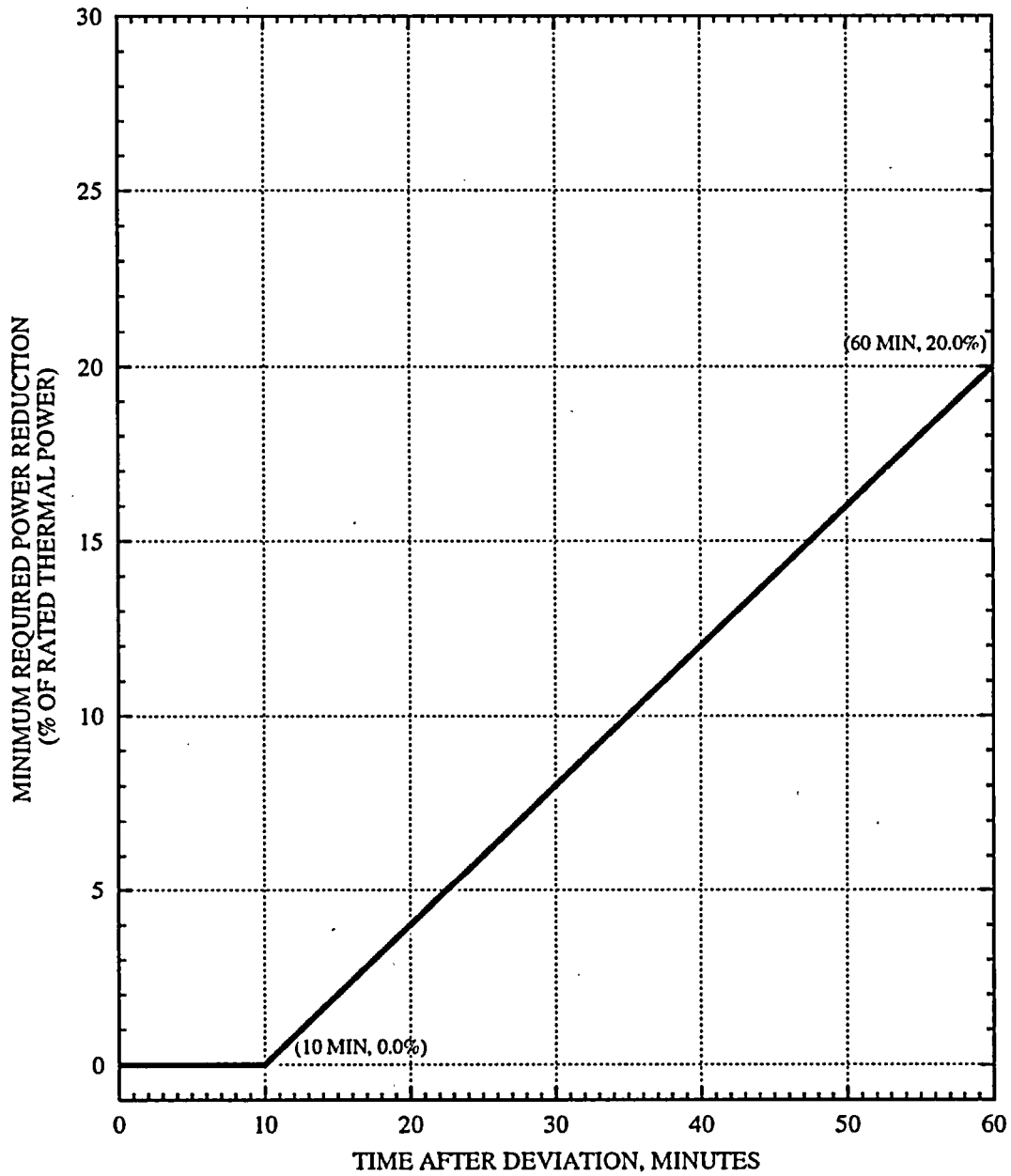


FIGURE 3.1.5-1
CORE POWER LIMIT AFTER CEA DEVIATION*



* 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)

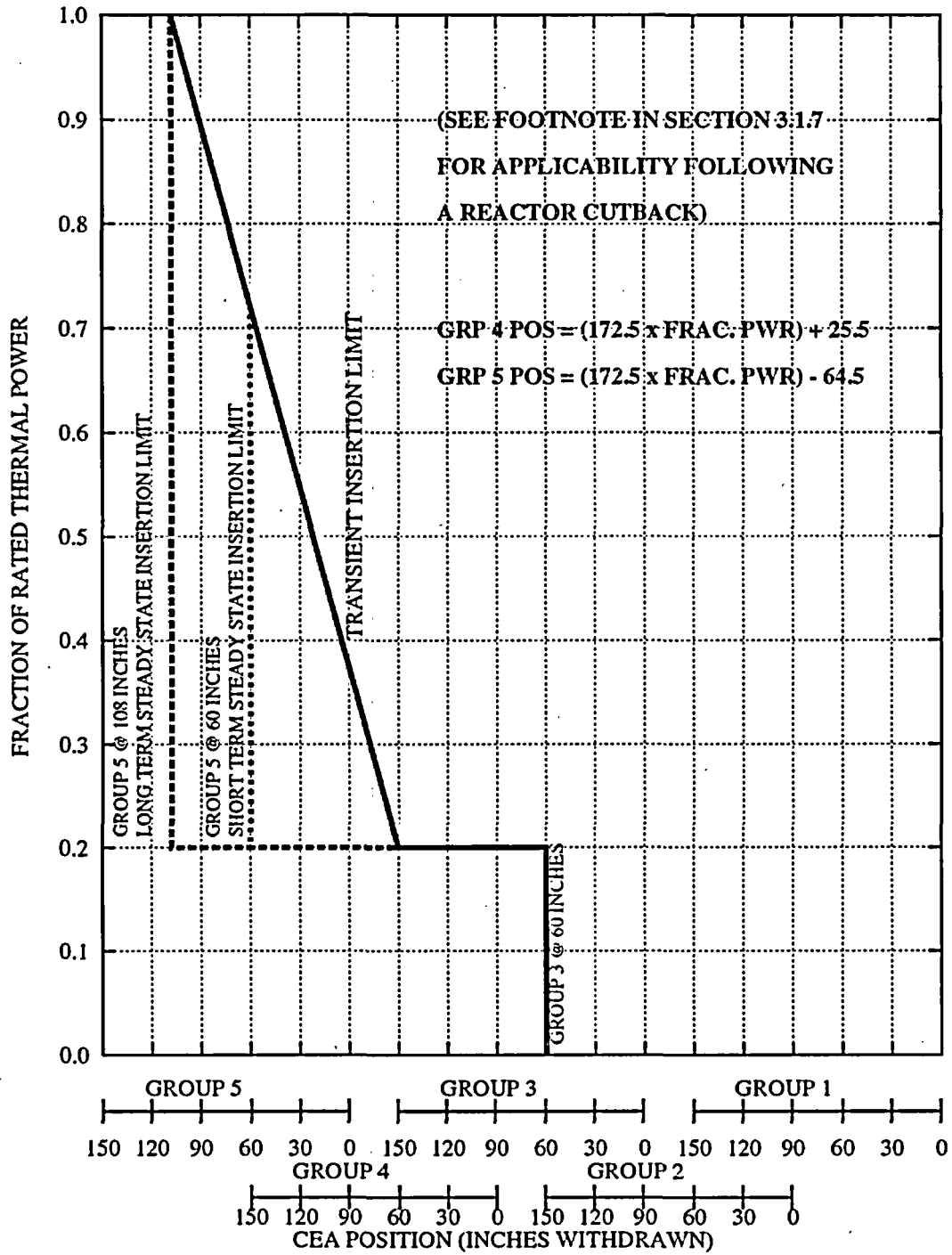
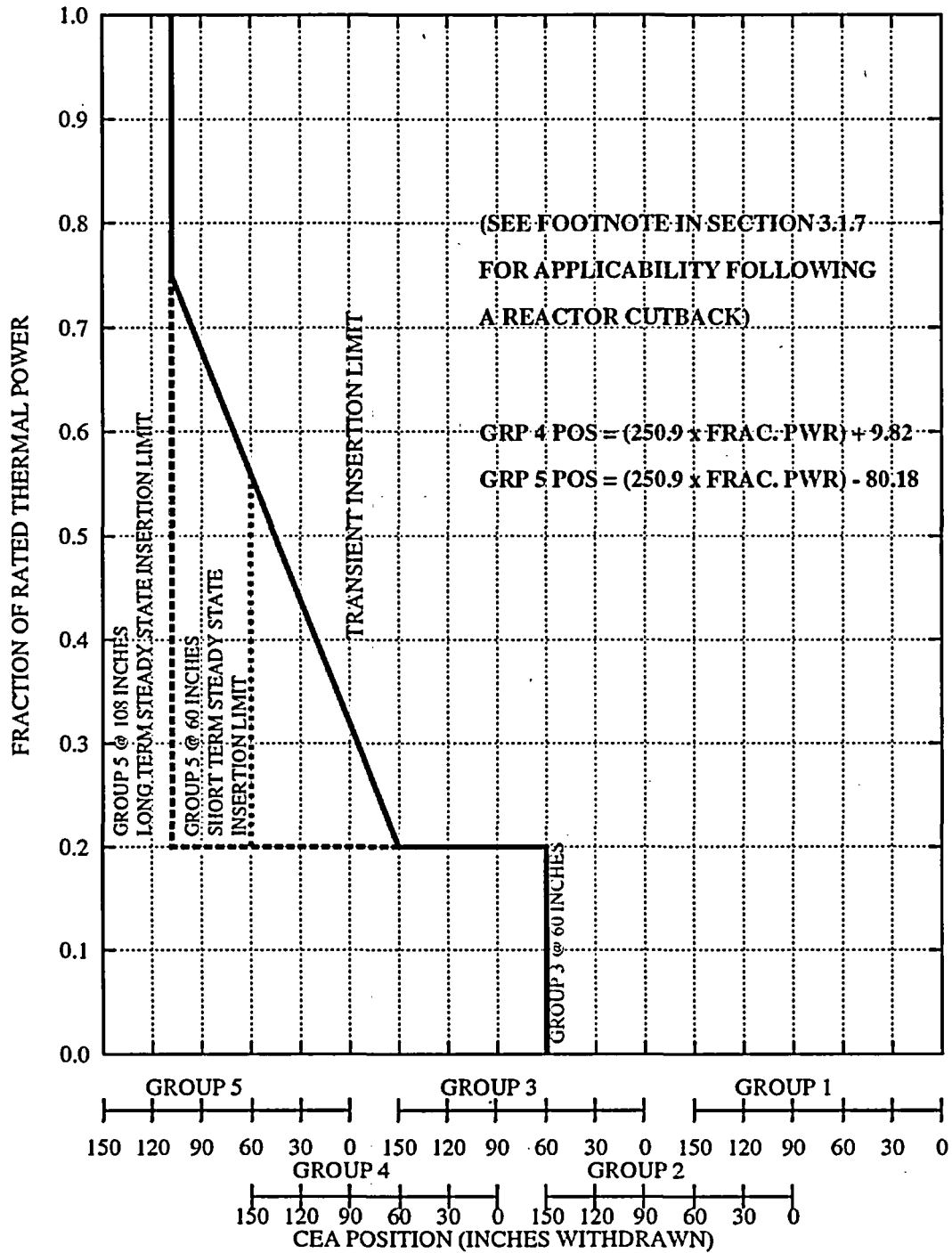


FIGURE 3.1.7-2

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



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

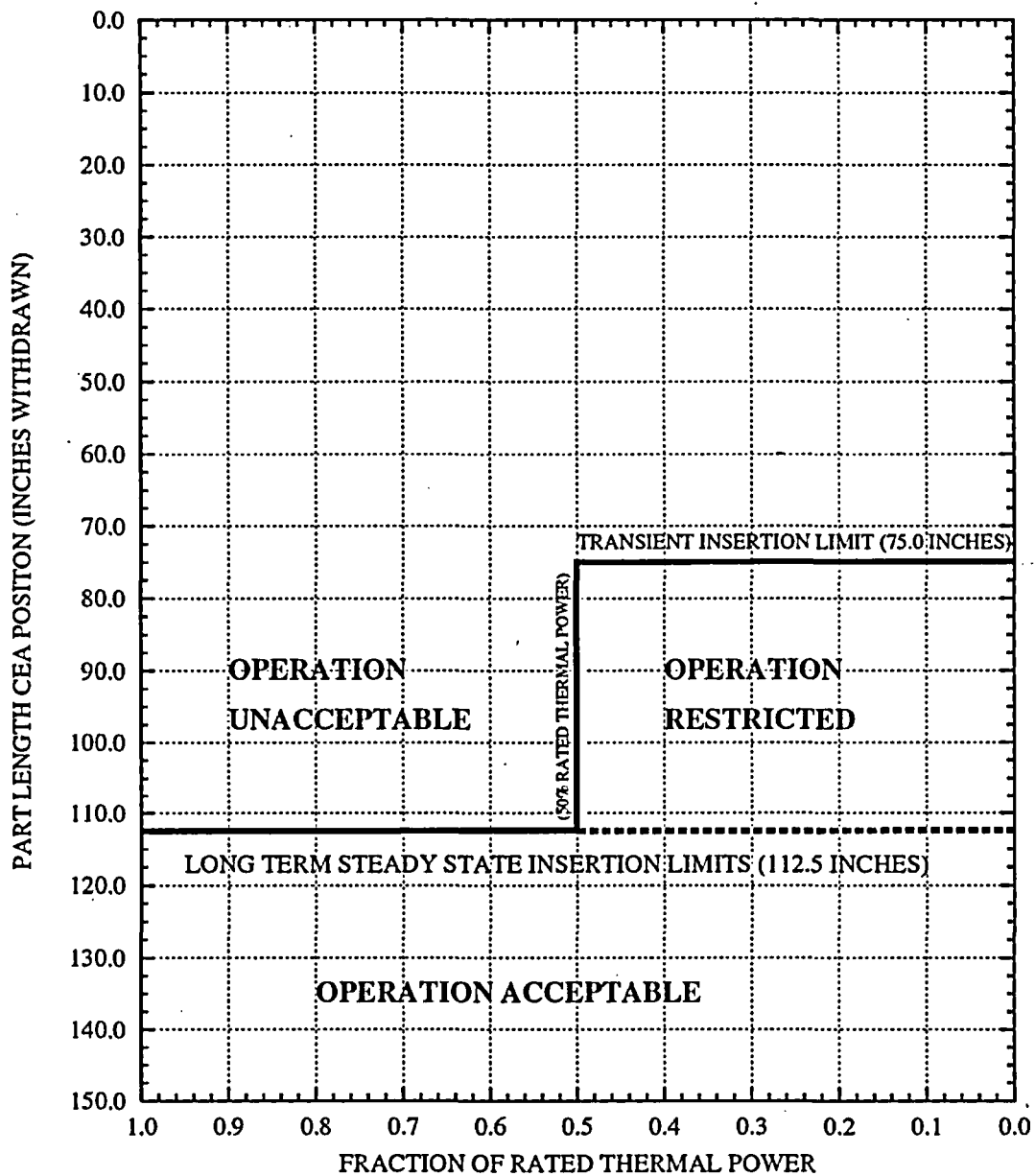


FIGURE 3.2.4-1
COLSS DNBR OPERATING LIMIT
ALLOWANCE FOR BOTH CEACs INOPERABLE
IN ANY OPERABLE CPC CHANNEL

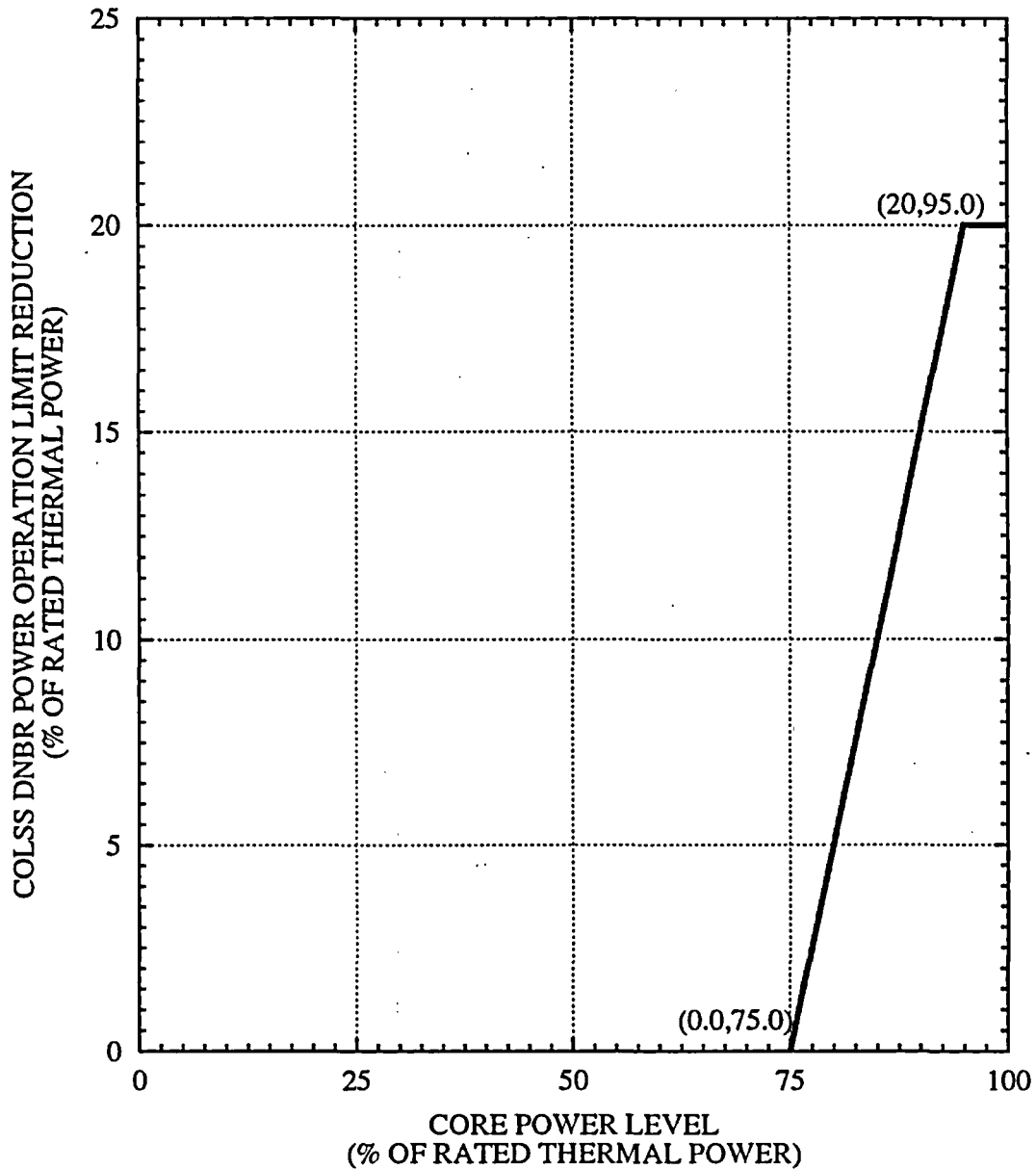


FIGURE 3.2.4-2
 DNBR MARGIN OPERATING LIMIT BASED ON
 THE CORE PROTECTION CALCULATORS
 (COLSS OUT OF SERVICE, CEAC(s) OPERABLE)

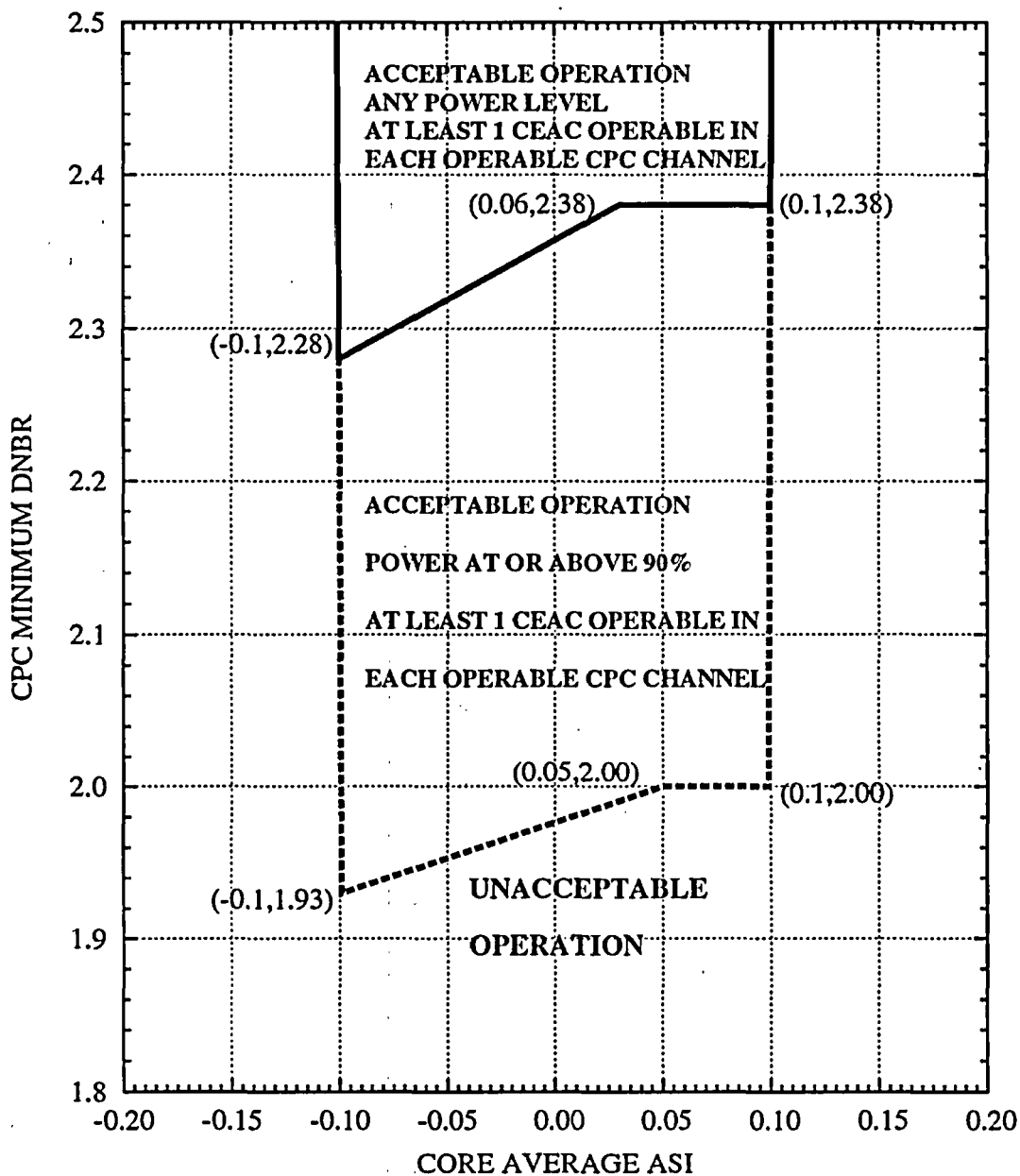
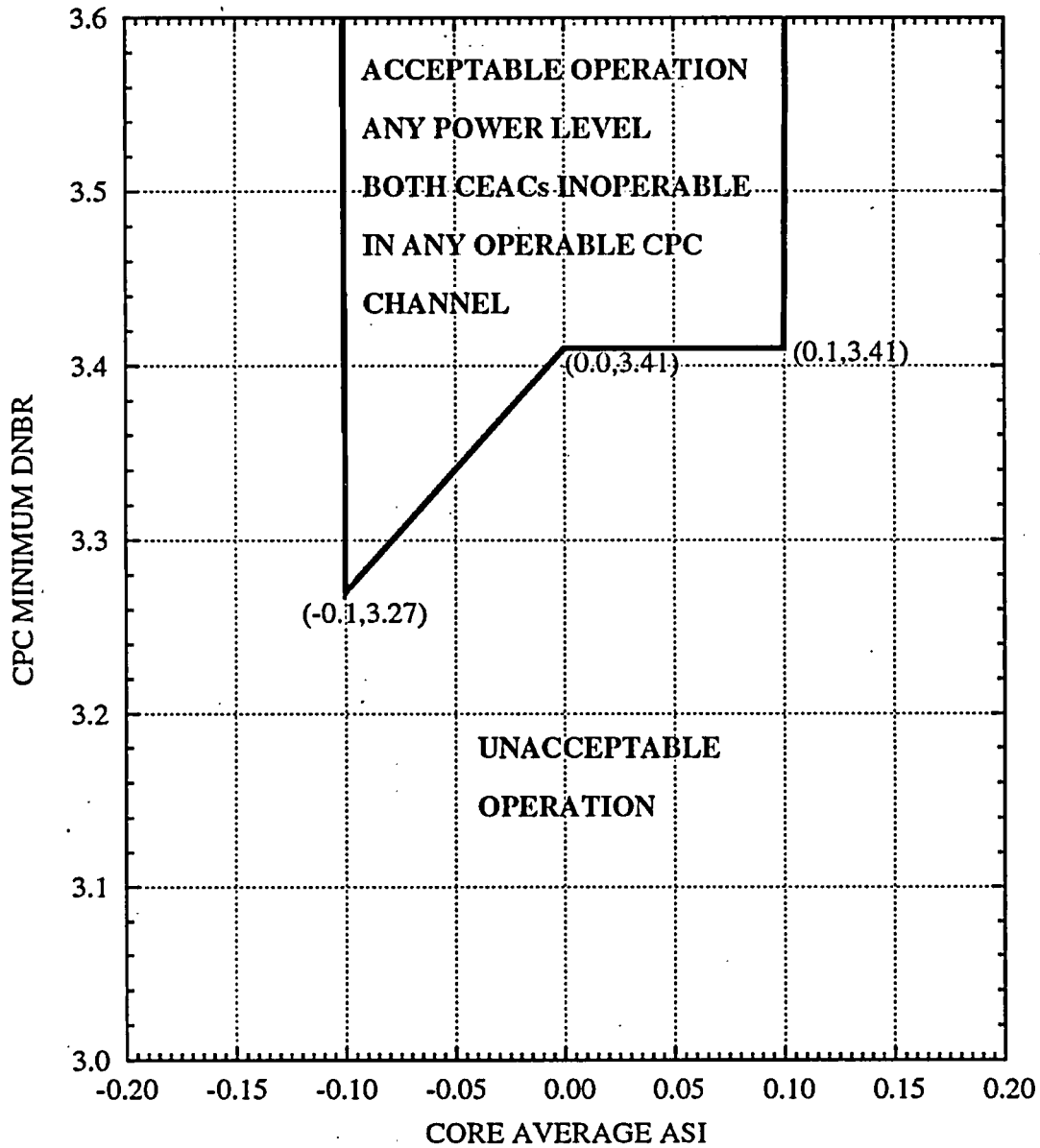


FIGURE 3.2.4-3

DNBR MARGIN OPERATING LIMIT BASED ON
 THE CORE PROTECTION CALCULATORS
 (COLSS OUT OF SERVICE, BOTH CEACs INOPERABLE
 IN ANY OPERABLE CPC CHANNEL)



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

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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 $0.96 \geq K_{eff} > 0.95$**

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