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Technical Specification 5.6.5.d

102-04855 SAB/TNW/GAM
October 18, 2002

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-37
Washington, DC 20555-0001

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
Core Operating Limits Reports: Unit 1 - Revision 8;
Unit 2 - Revision 7; and Unit 3 - Revision 10

Pursuant to PVNGS Technical Specification 5.6.5.d, enclosed are the following revised Core Operating Limits Reports (COLRs) for PVNGS:

Unit 1 - Revision 8, issued October 11, 2002;
Unit 2 - Revision 7, issued October 15, 2002; and
Unit 3 - Revision 10, issued October 15, 2002.

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,

Scott A. Bauer

SAB/TNW/GAM/kg

Enclosure

cc: E. W. Merschoff
J. N. Donohew
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A001

Enclosure

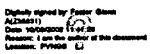
Core Operating Limits Reports for Palo Verde Nuclear Generating Station Unit 1 - Revision 8; Unit 2 - Revision 7; and Unit 3 - Revision 10

CORE OPERATING LIMITS REPORT

PALO VERDE NUCLEAR GENERATING STATION (PVNGS)

UNIT 1

Revision 8



PVNGS UNIT 1 CORE OPERATING LIMITS REPORT

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PVNGS UNIT 1 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 1 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 1 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:

Title	Report No.	Rev	Date	Supplement
1) CE Method for Control Element Assembly Ejection Analysis	CENPD-0190-A	N.A.	January 1976	N.A.
2) The ROCS and DIT Computer Codes for Nuclear Design	CENPD-266-P-A	N.A.	April 1983	N.A.
3) Modified Statistical Combination of Uncertainties	CEN-356(V)-P-A	01-P-A	May 1988	N.A.
4) System 80^{TM} Inlet Flow Distribution	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	CENPD-132	N.A.	March 2001	4-P-A
6) Calculative Methods for the CE Small Break LOCA Evaluation Model	CENPD-137-P	N.A.	April 1998	2-P-A
7) Fuel Rod Maximum Allowable Pressure	CEN-372-P-A	N.A.	May 1990	N.A.
8) Arizona Public Service Company PWR Reactor Physics Methodology Using CASMO-4/ SIMULATE-3	NFM002	0	September 1999	N.A.

Title	Report No.	Rev	Date	Supplement
9) Technical Manual for the CENTS Code	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	CENPD-404-P-A	0	November 2001	N.A.

PVNGS UNIT 1 CORE OPERATING LIMITS REPORT

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

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

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

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

3.2.4 - 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
$-0.18 \leq ASI \leq 0.18$ for power $\geq 50\%$
$-0.28 \leq ASI \leq 0.18$ for power $< 50\%$

COLSS OUT OF SERVICE (CPC)
$-0.10 \leq ASI \leq 0.10$

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

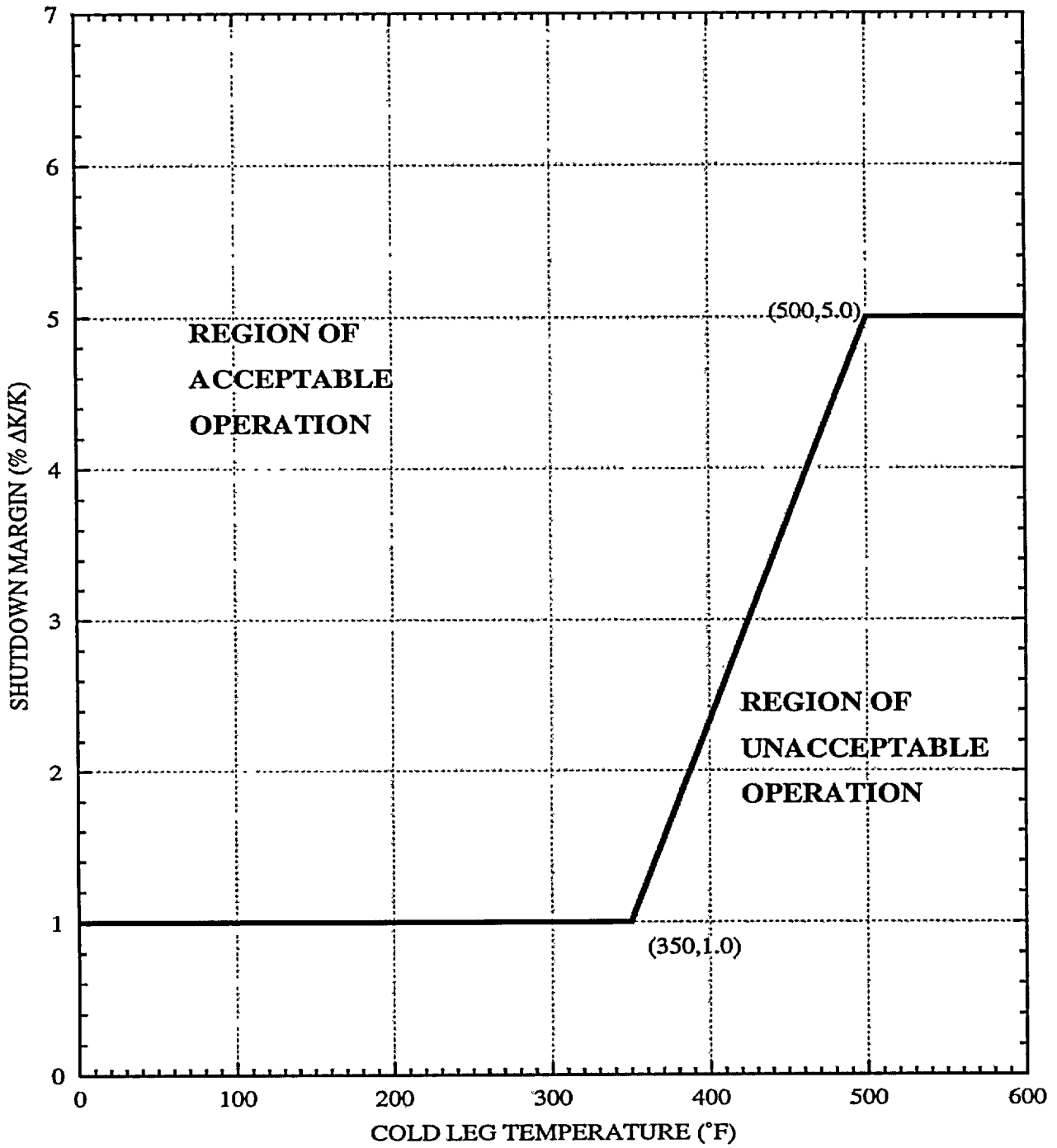


FIGURE 3.1.2-1
SHUTDOWN MARGIN VERSUS COLD LEG TEMPERATURE
REACTOR TRIP BREAKERS CLOSED

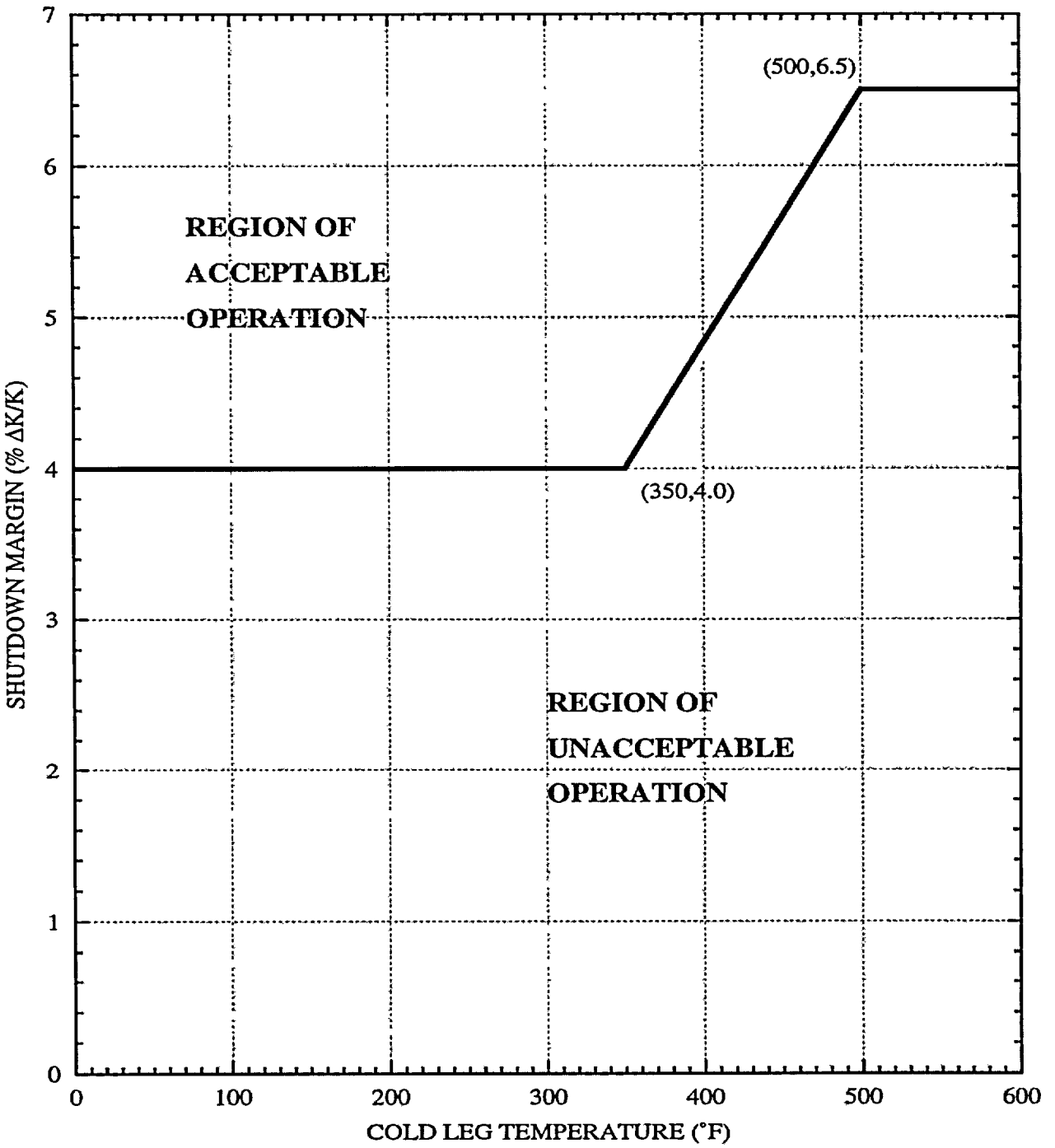


FIGURE 3.1.4-1
MTC ACCEPTABLE OPERATION, MODES 1 AND 2

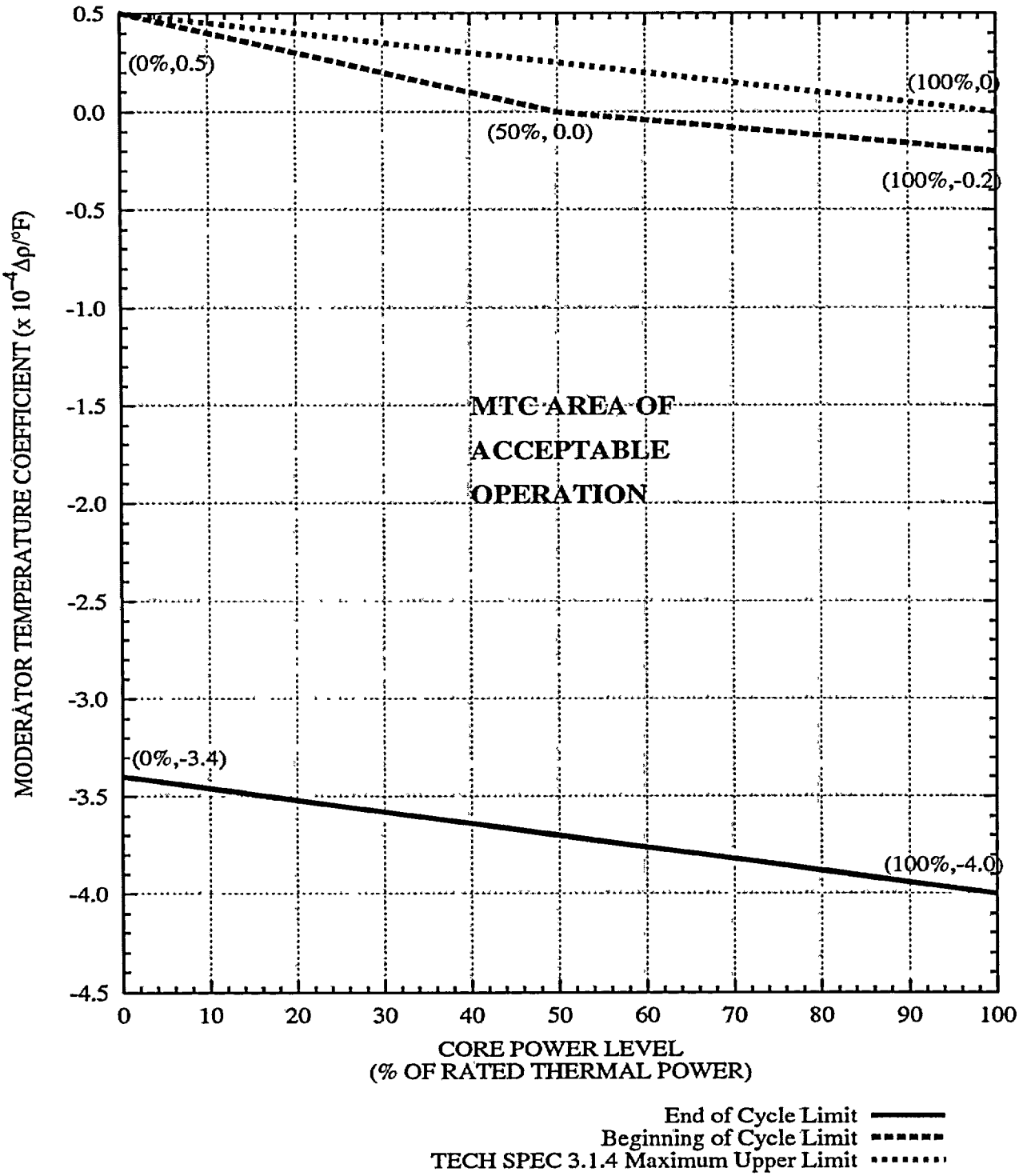
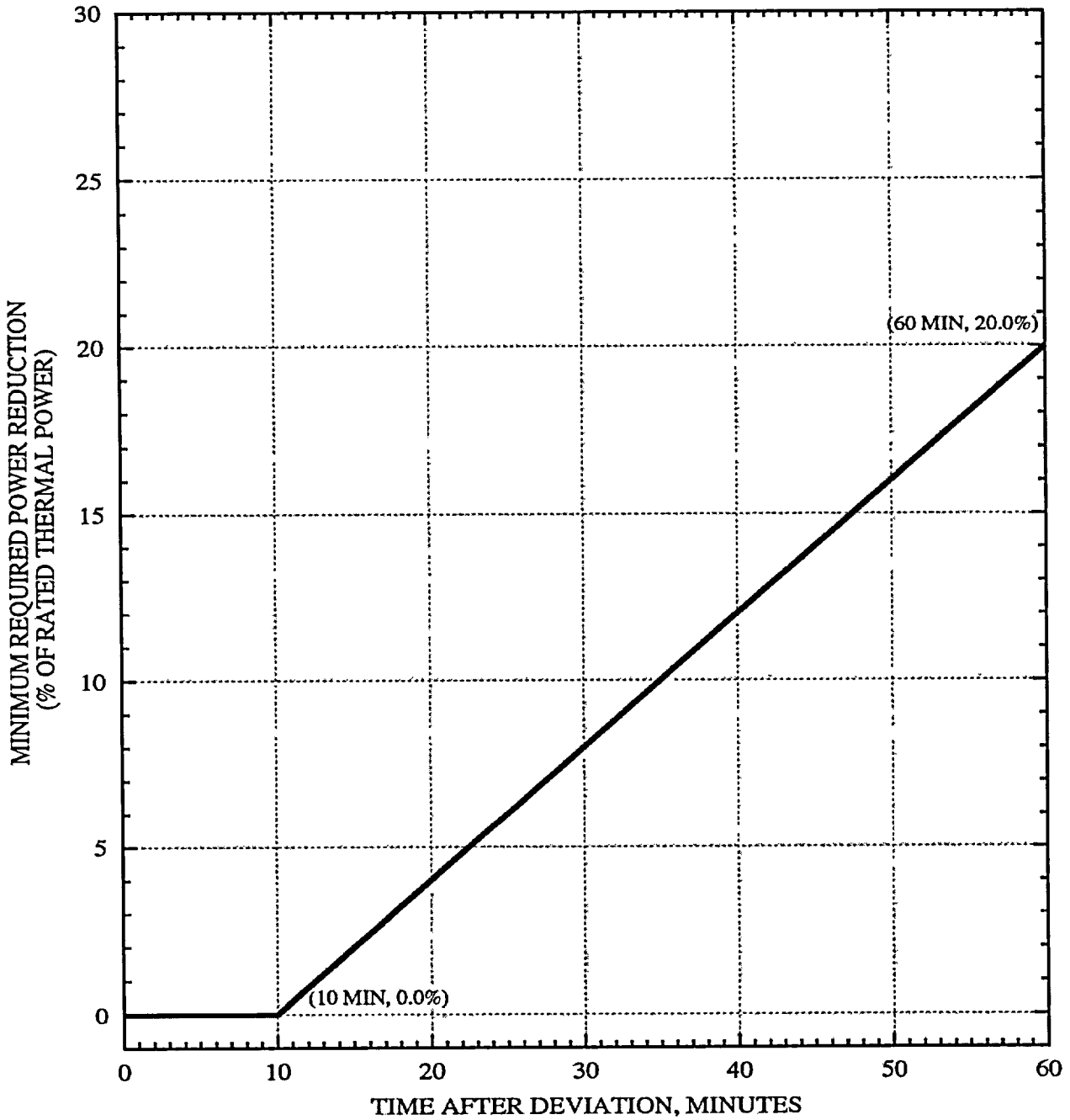


FIGURE 3.1.5-1
CORE POWER LIMIT AFTER CEA DEVIATION*



* 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)

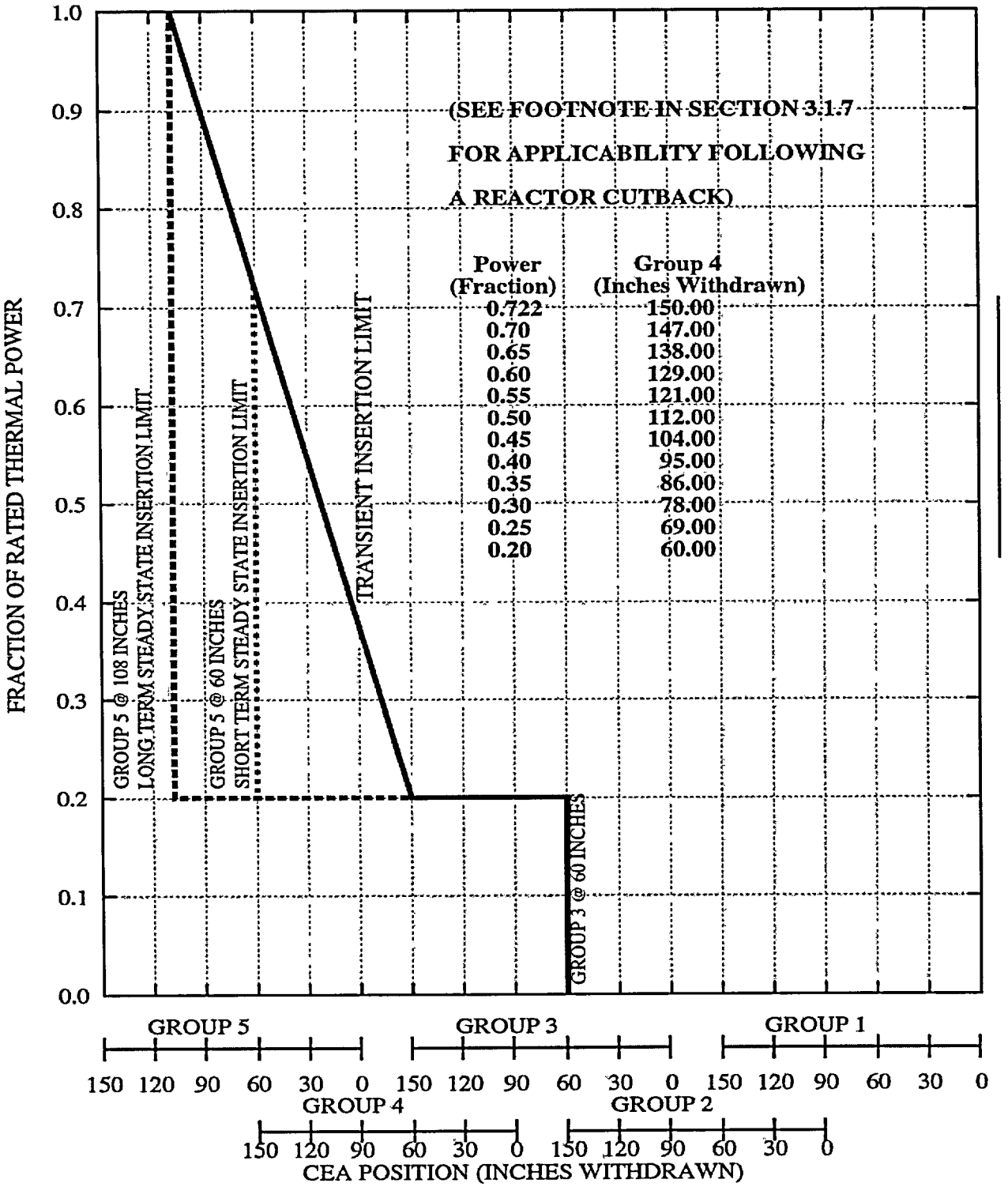


FIGURE 3.1.7-2
CEA INSERTION LIMITS VERSUS THERMAL POWER
(COLSS OUT OF SERVICE)

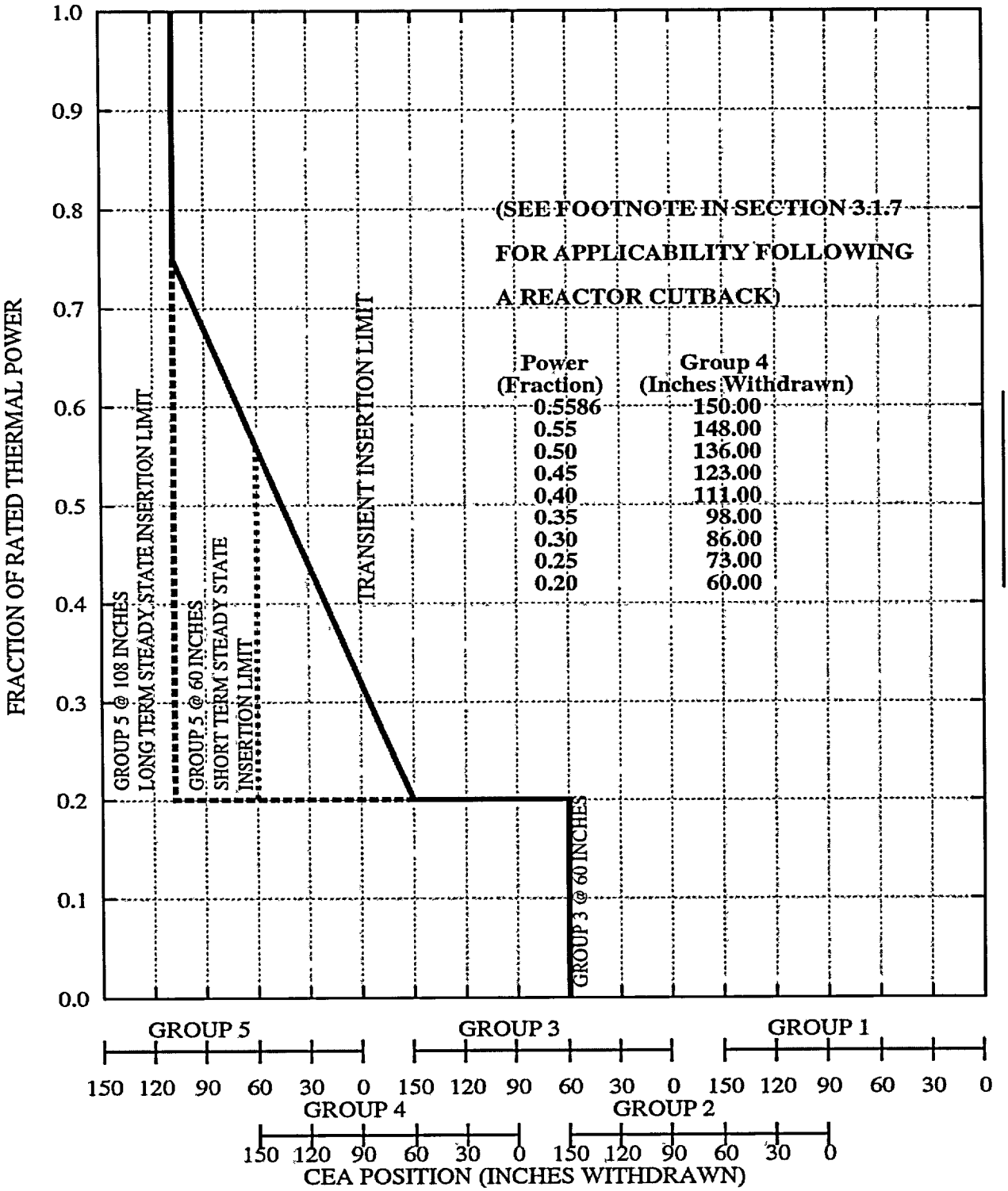


FIGURE 3.1.8-1
PART LENGTH CEA INSERTION LIMITS VERSUS THERMAL POWER

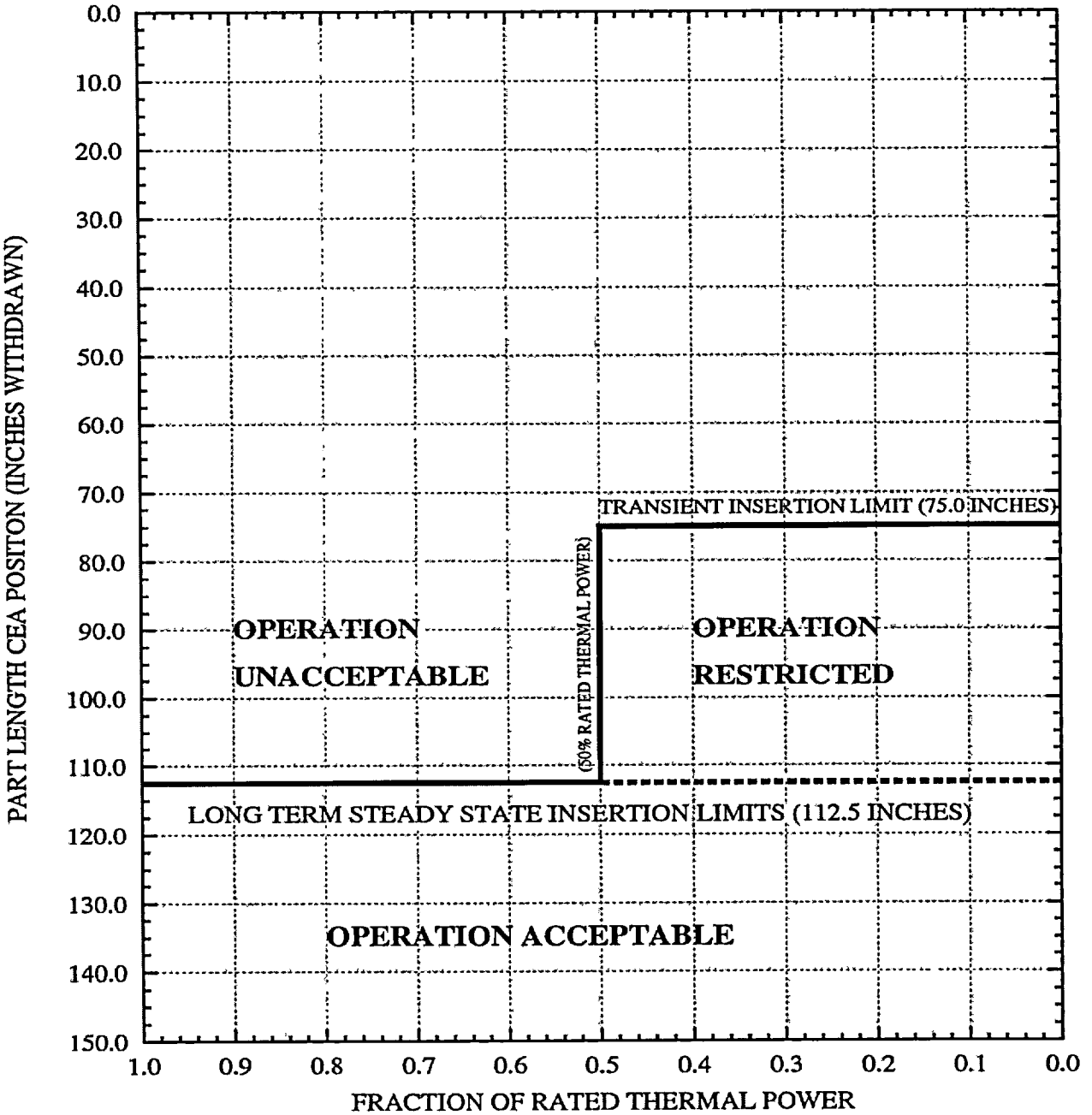


FIGURE 3.2.4-1
COLSS DNBR OPERATING LIMIT
ALLOWANCE FOR BOTH CEAC's INOPERABLE

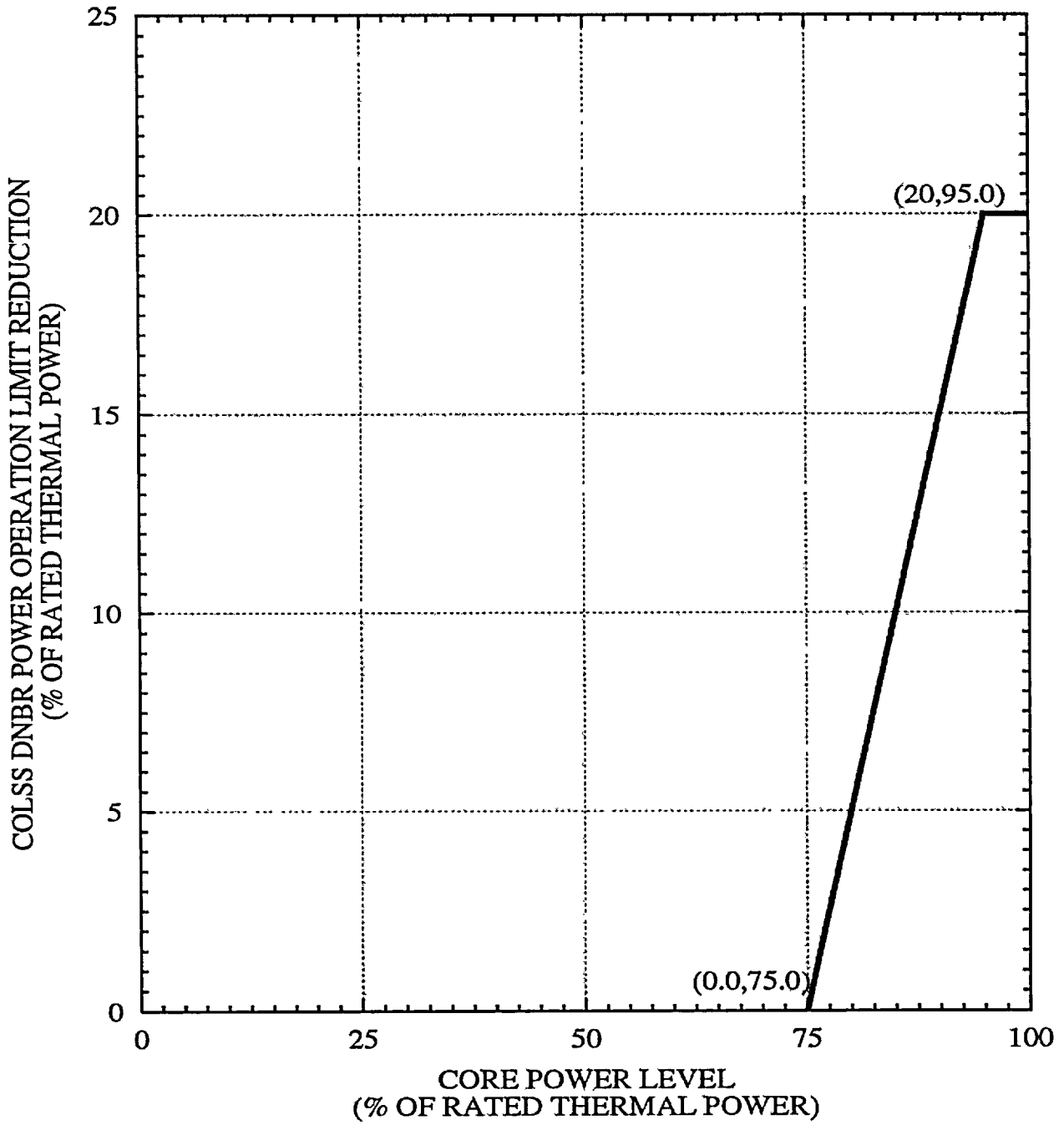


FIGURE 3.2.4-2
DNBR MARGIN OPERATING LIMIT BASED ON THE CORE PROTECTION CALCULATORS (COLSS OUT OF SERVICE, CEAC's OPERABLE)

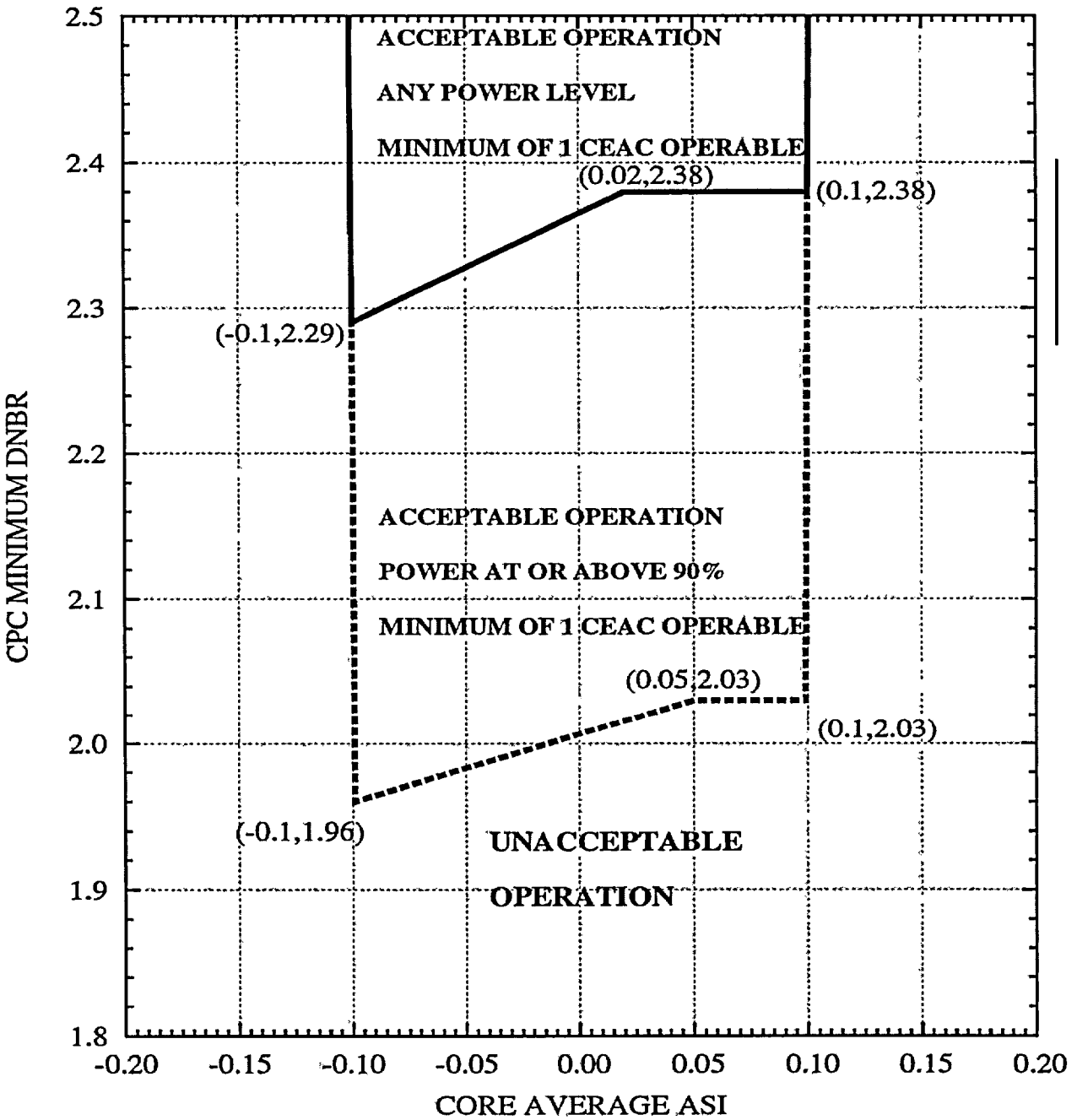


FIGURE 3.2.4-3

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

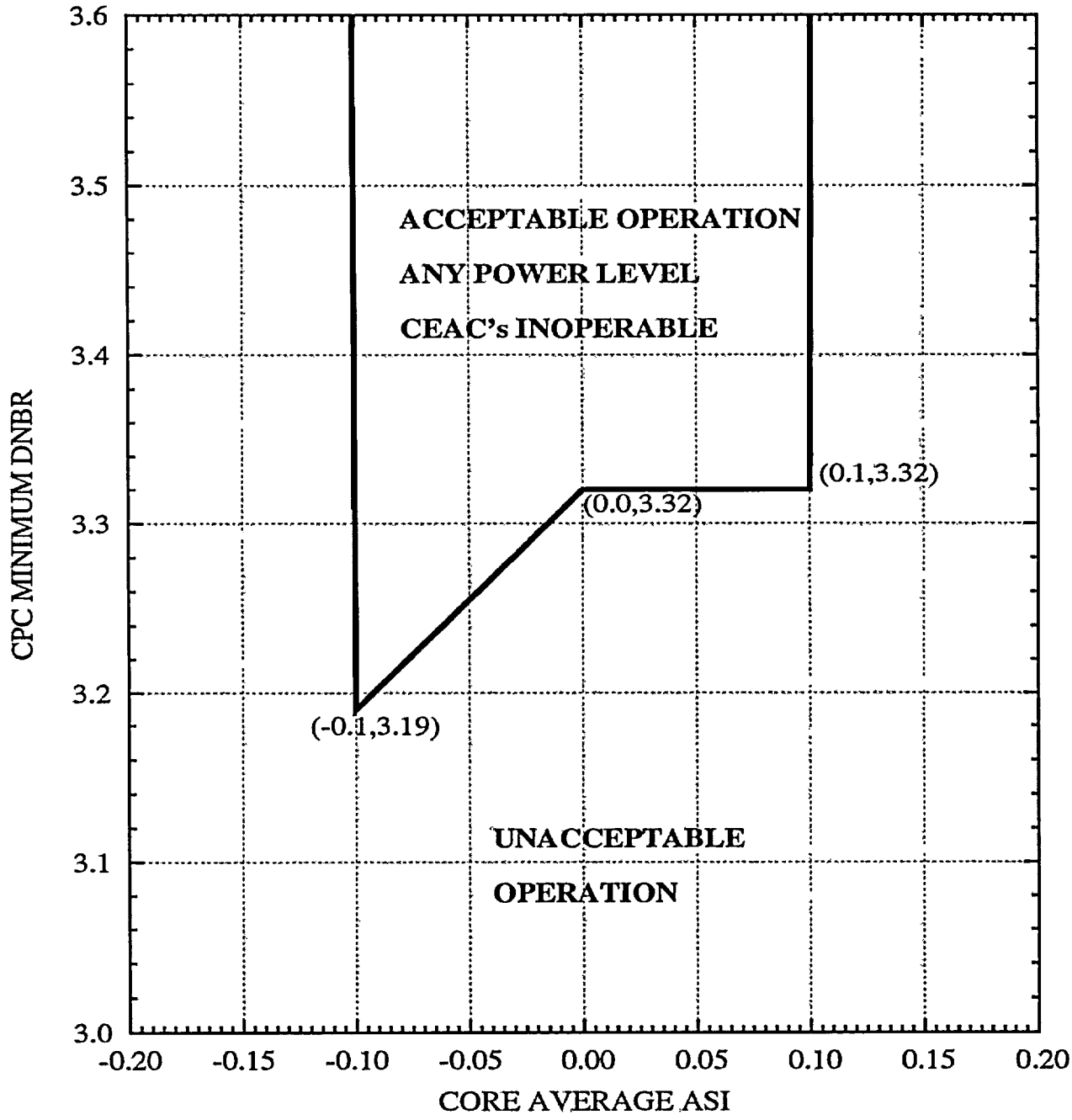


Table 3.3.12-1

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

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 $0.98 \geq K_{eff} > 0.97$

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

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 $0.97 \geq K_{eff} > 0.96$

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

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

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

CORE OPERATING LIMITS REPORT

PALO VERDE NUCLEAR GENERATING STATION (PVNGS)

UNIT 2

Revision 7

Digitally signed by
Foster Glenn A(Z35831)
Date 10/11/2002 14:59:44
Reason I am the author
of 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

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3.1.2	Shutdown Margin (SDM) - Reactor Trip Breakers Closed
3.1.4	Moderator Temperature Coefficient (MTC)
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3.9.1	Boron Concentration

PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

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5) Calculative Methods for the CE Large Break LOCA Evaluation Model for the Analysis of CE and W Designed NSSS	CENPD-132	N.A.	March 2001	4-P-A
6) Calculative Methods for the CE Small Break LOCA Evaluation Model	CENPD-137-P	N.A.	April 1998	2-P-A
7) Fuel Rod Maximum Allowable Pressure	CEN-372-P-A	N.A.	May 1990	N.A.
8) Arizona Public Service Company PWR Reactor Physics Methodology Using CASMO-4/ SIMULATE-3	NFM002	0	September 1999	N.A.

Title	Report No.	Rev	Date	Supplement
9) Technical Manual for the CENTS Code	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	CENPD-404-P-A	0	November 2001	N.A.

PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

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

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

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

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.

3.2.4 - 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
$-0.18 \leq ASI \leq 0.16$ for power $\geq 50\%$
$-0.28 \leq ASI \leq 0.16$ for power $< 50\%$

COLSS OUT OF SERVICE (CPC)
$-0.10 \leq ASI \leq 0.10$

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

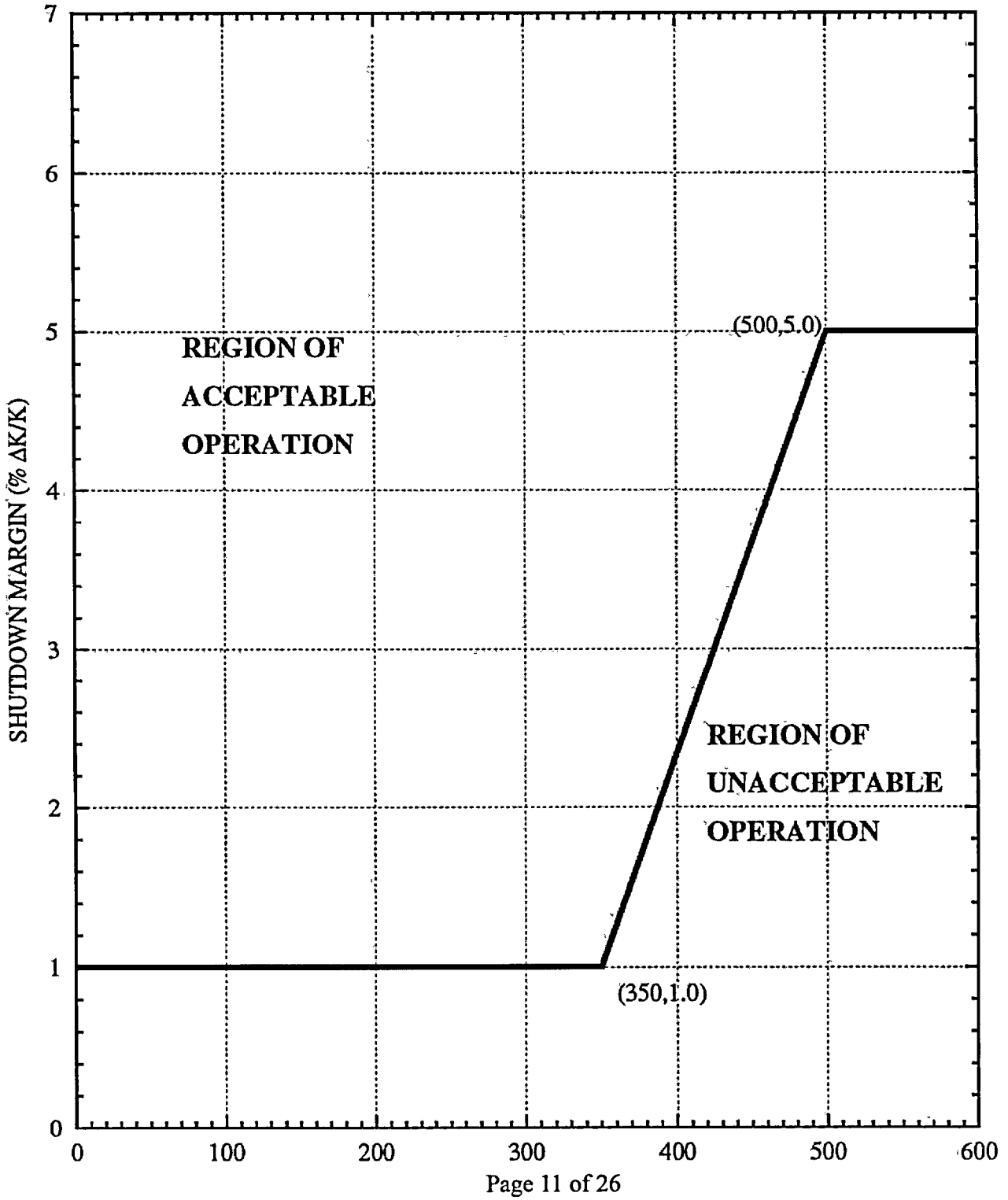


FIGURE 3.1.2-1
SHUTDOWN MARGIN VERSUS COLD LEG TEMPERATURE
REACTOR TRIP BREAKERS CLOSED

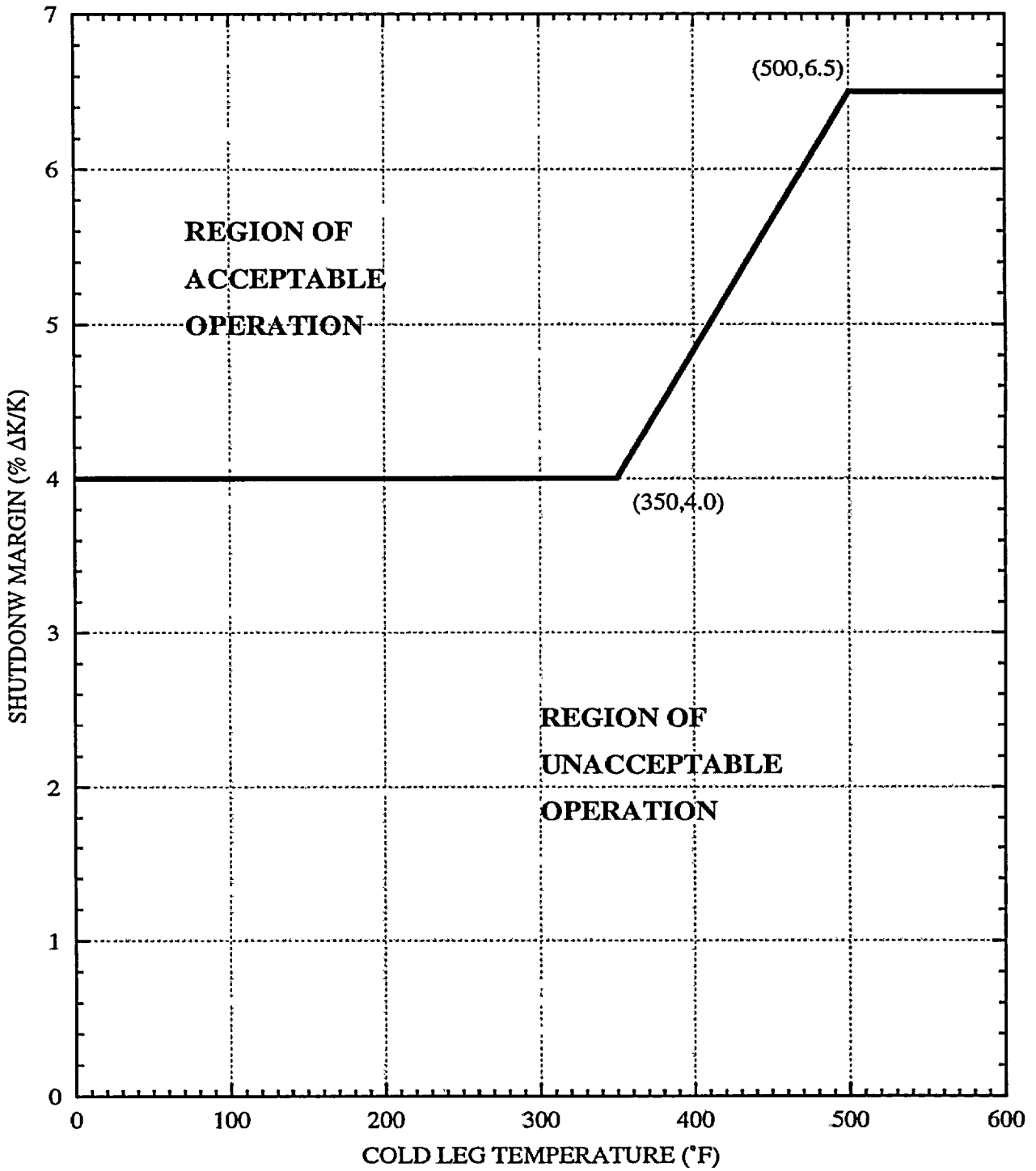


FIGURE 3.1.4-1
MTC ACCEPTABLE OPERATION, MODES 1 AND 2

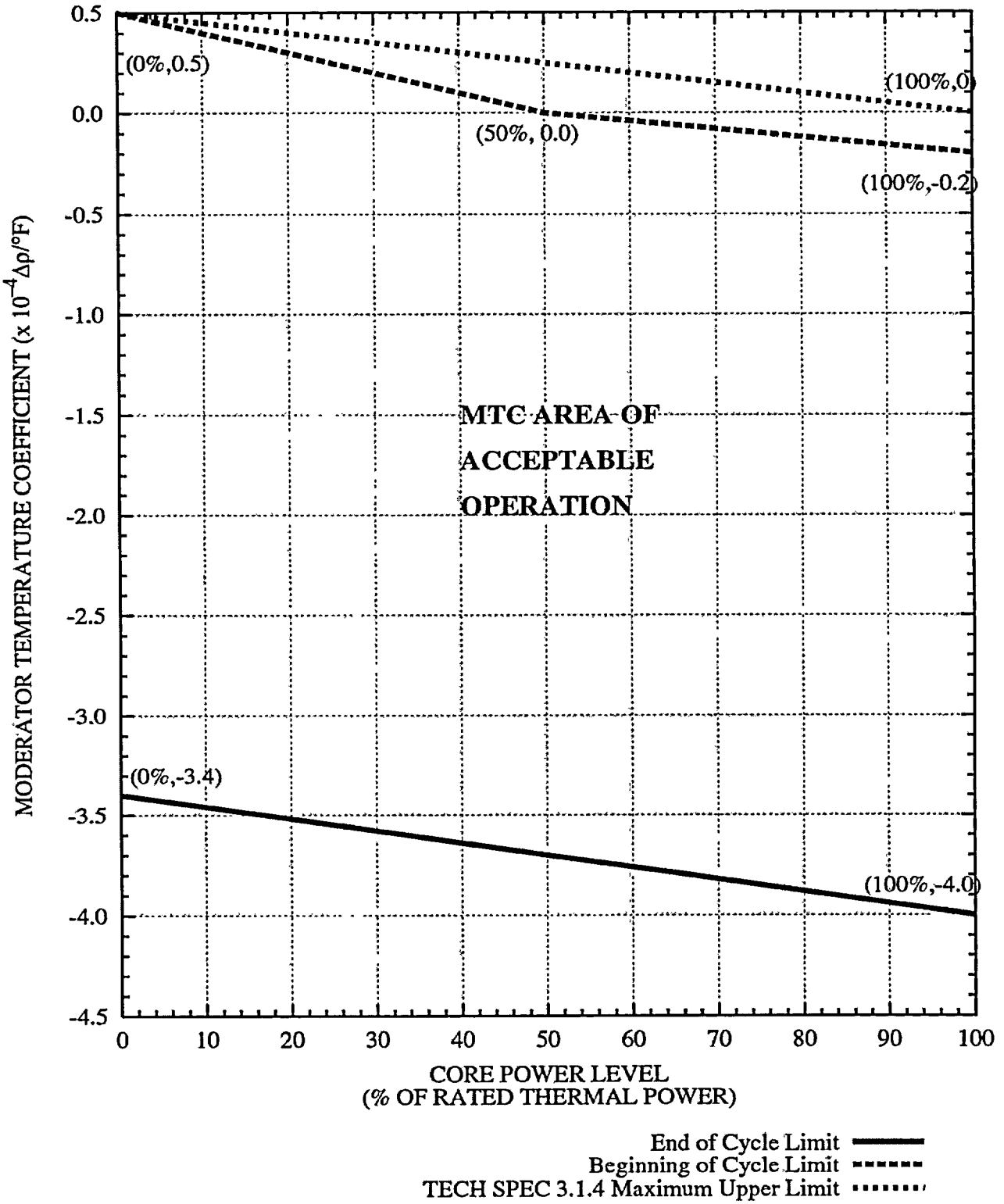
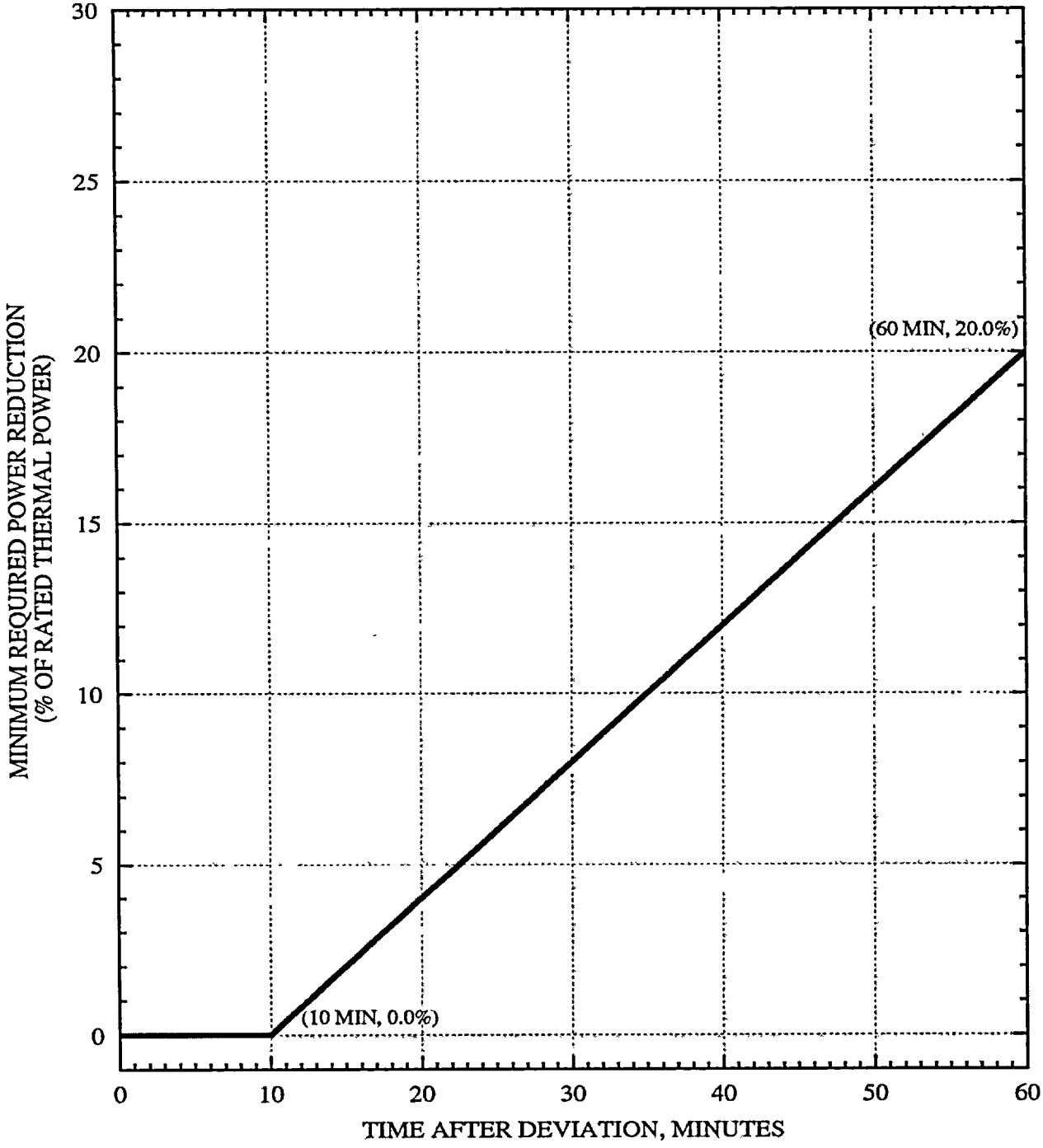


FIGURE 3.1.5-1
CORE POWER LIMIT AFTER CEA DEVIATION*



* 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)

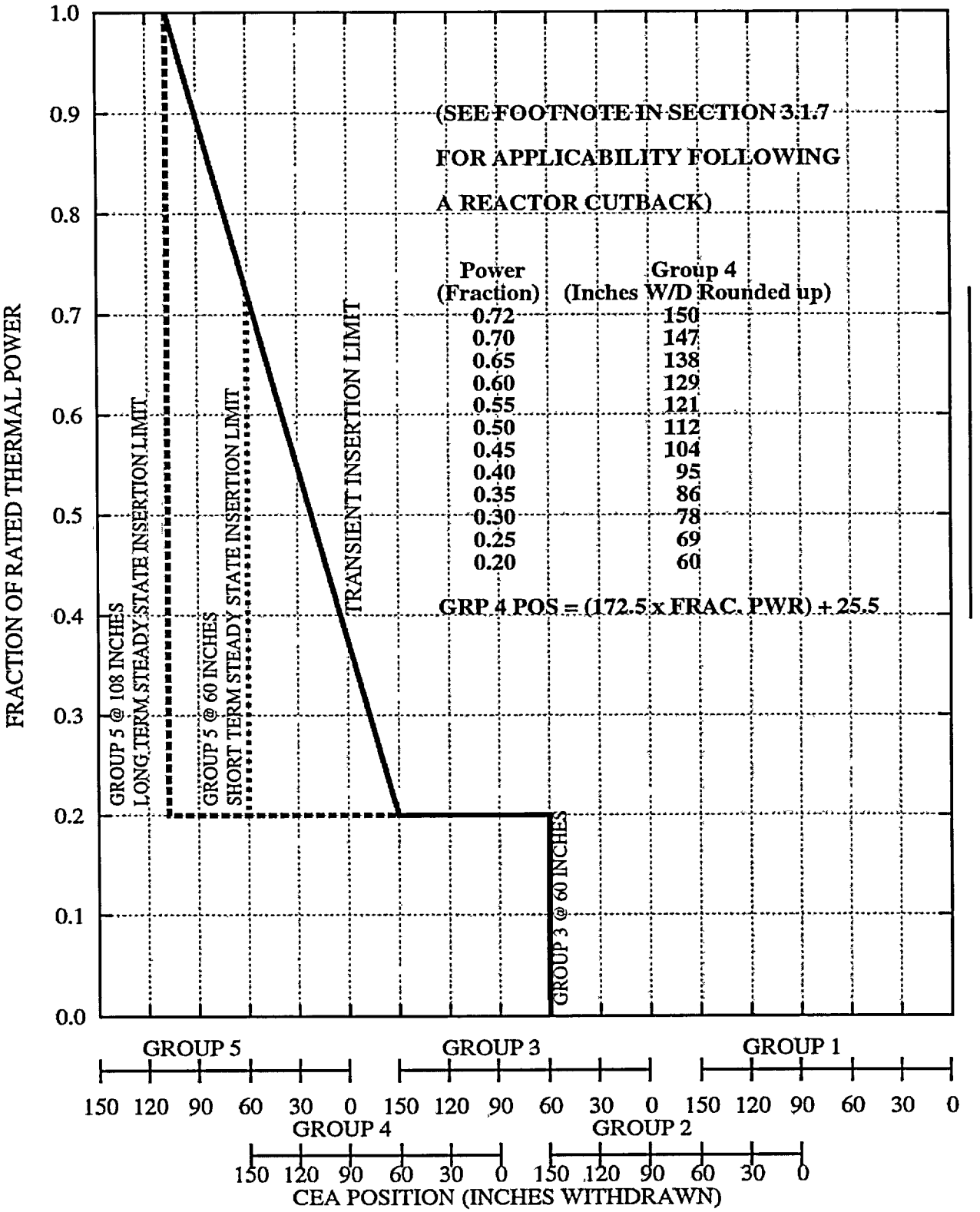


FIGURE 3.1.7-2
CEA INSERTION LIMITS VERSUS THERMAL POWER
(COLSS OUT OF SERVICE)

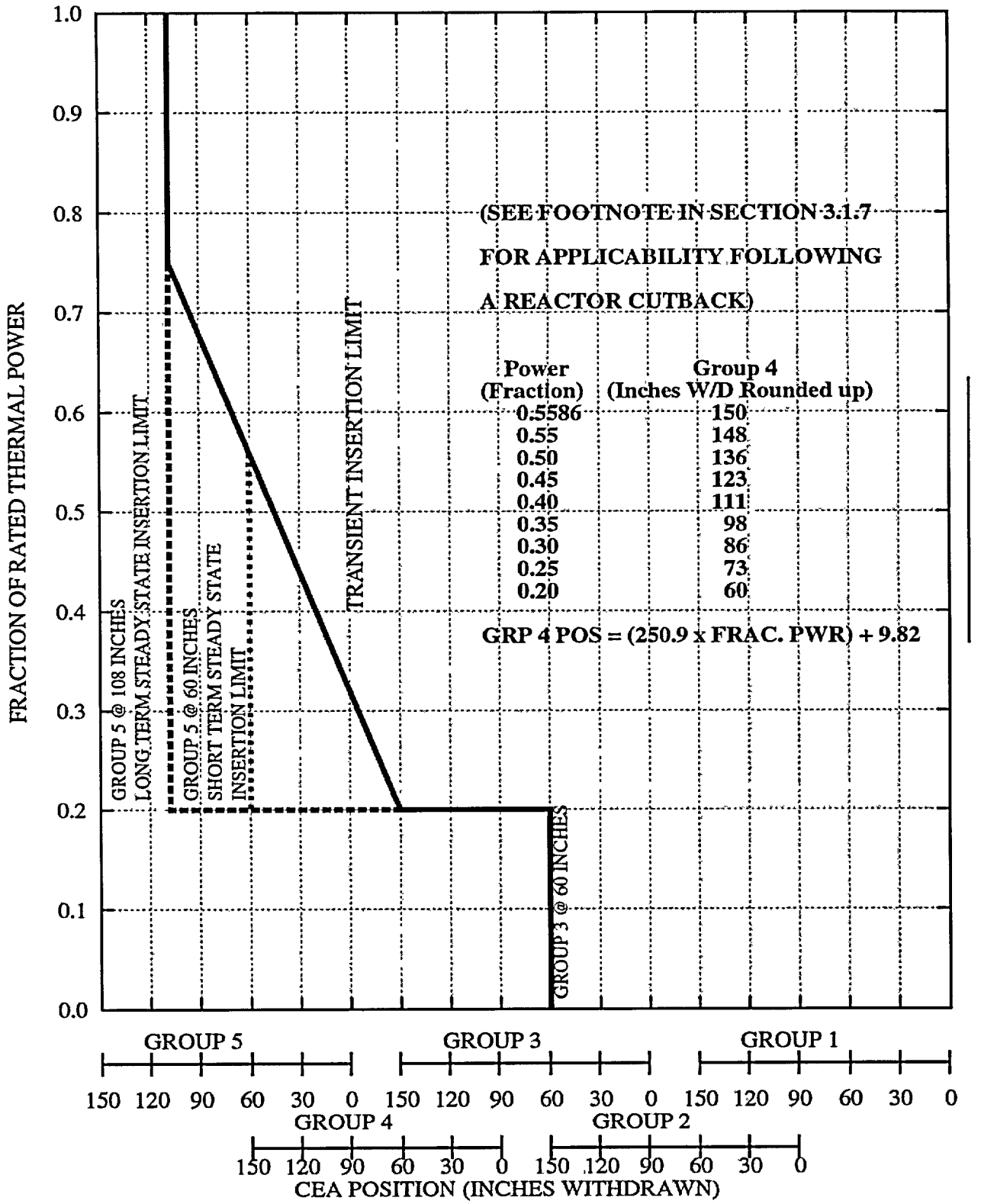


FIGURE 3.1.8-1
PART LENGTH CEA INSERTION LIMITS VERSUS THERMAL POWER

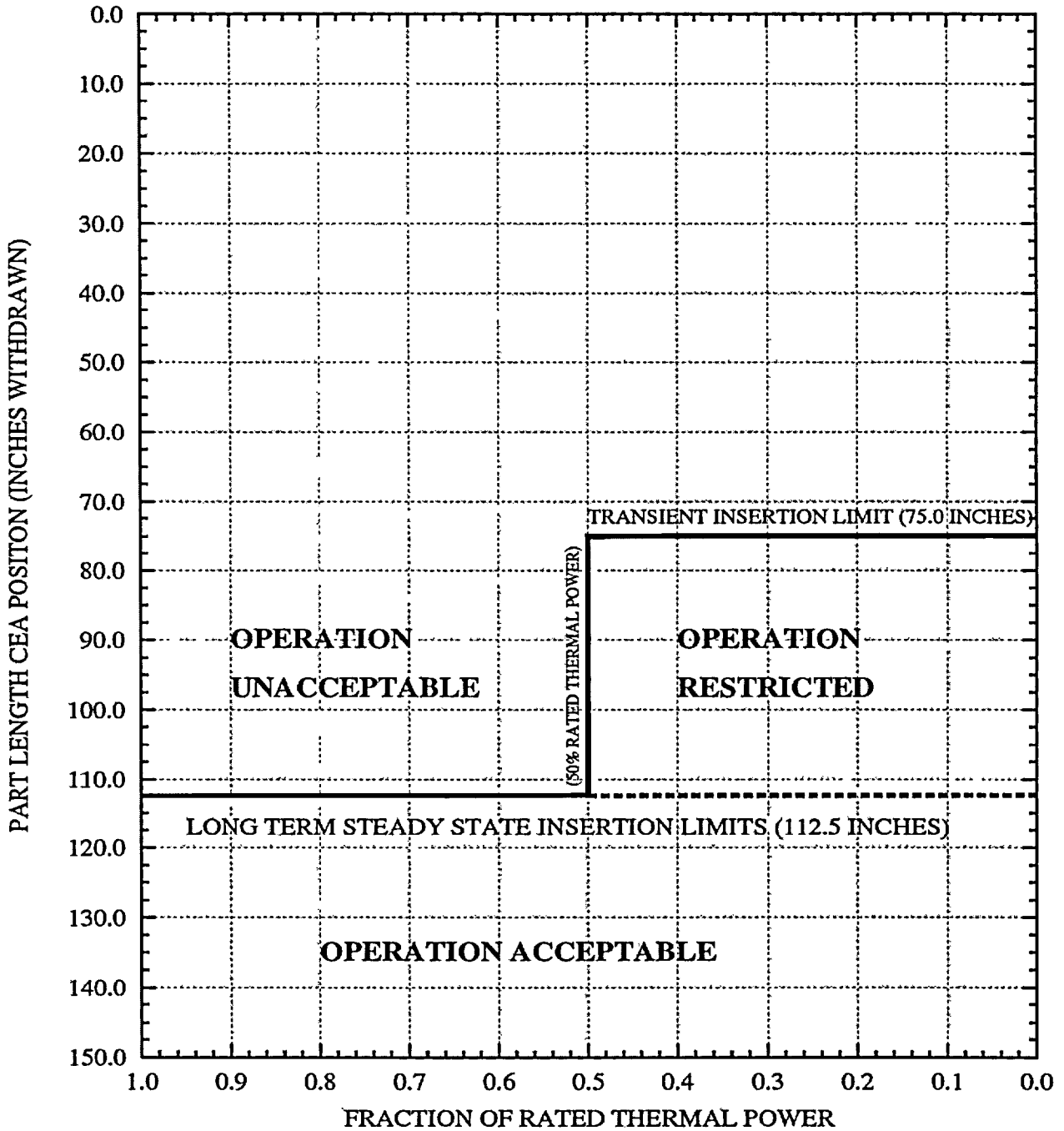


FIGURE 3.2.3-1
AZIMUTHAL POWER TILT VERSUS THERMAL POWER
(COLSS IN SERVICE)

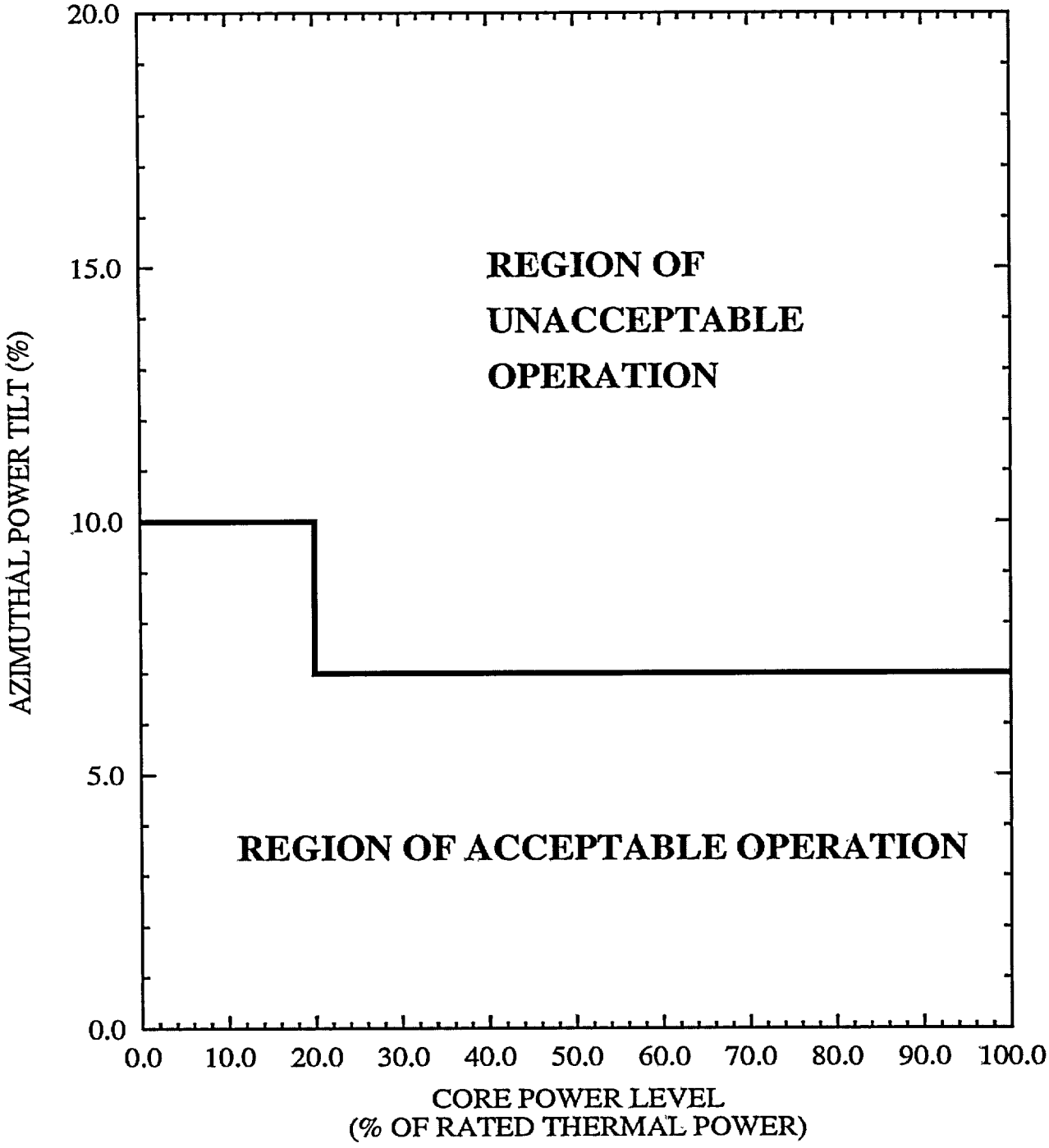


FIGURE 3.2.4-1
COLSS DNBR OPERATING LIMIT
ALLOWANCE FOR BOTH CEAC's INOPERABLE

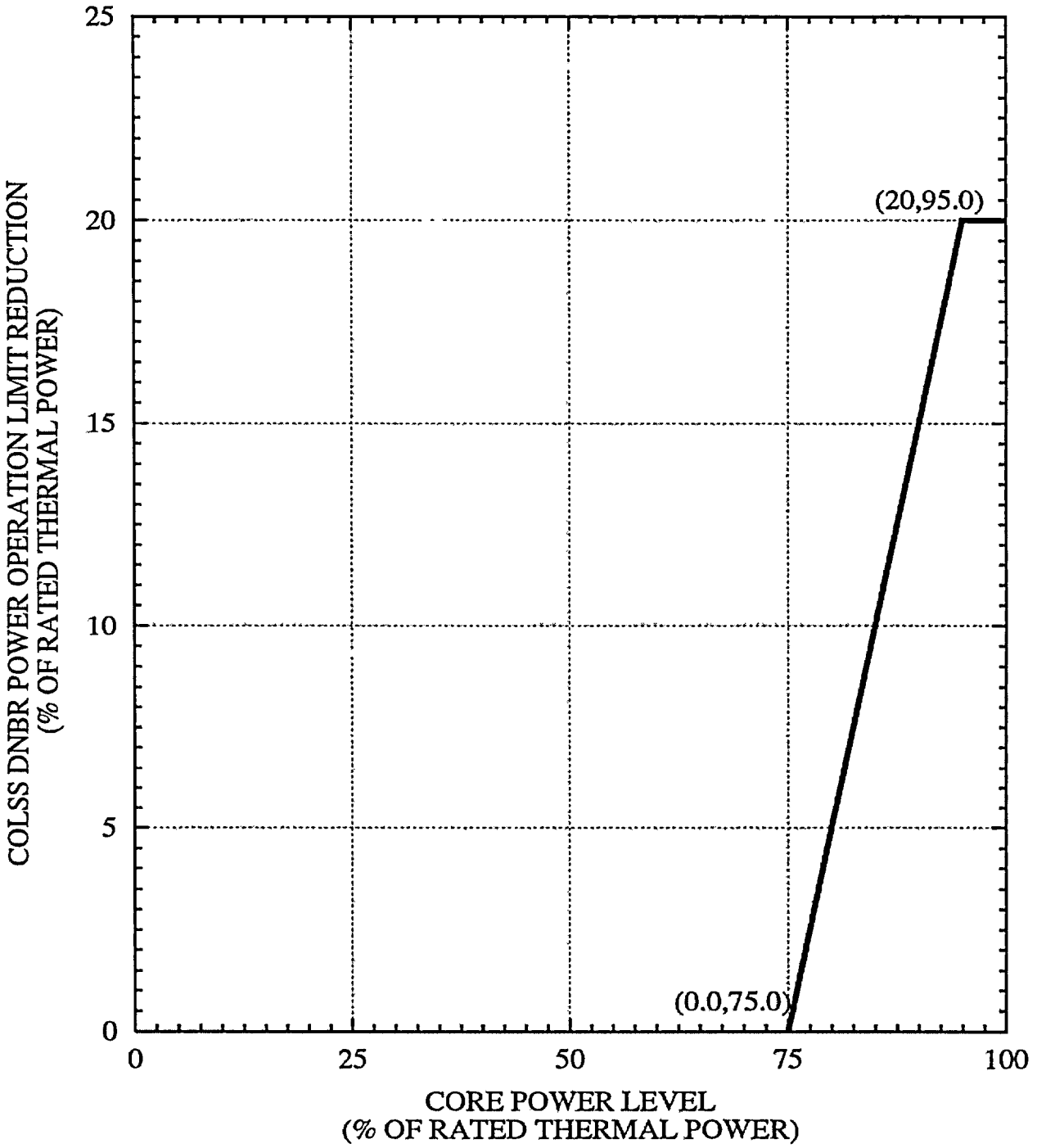


FIGURE 3.2.4-2

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

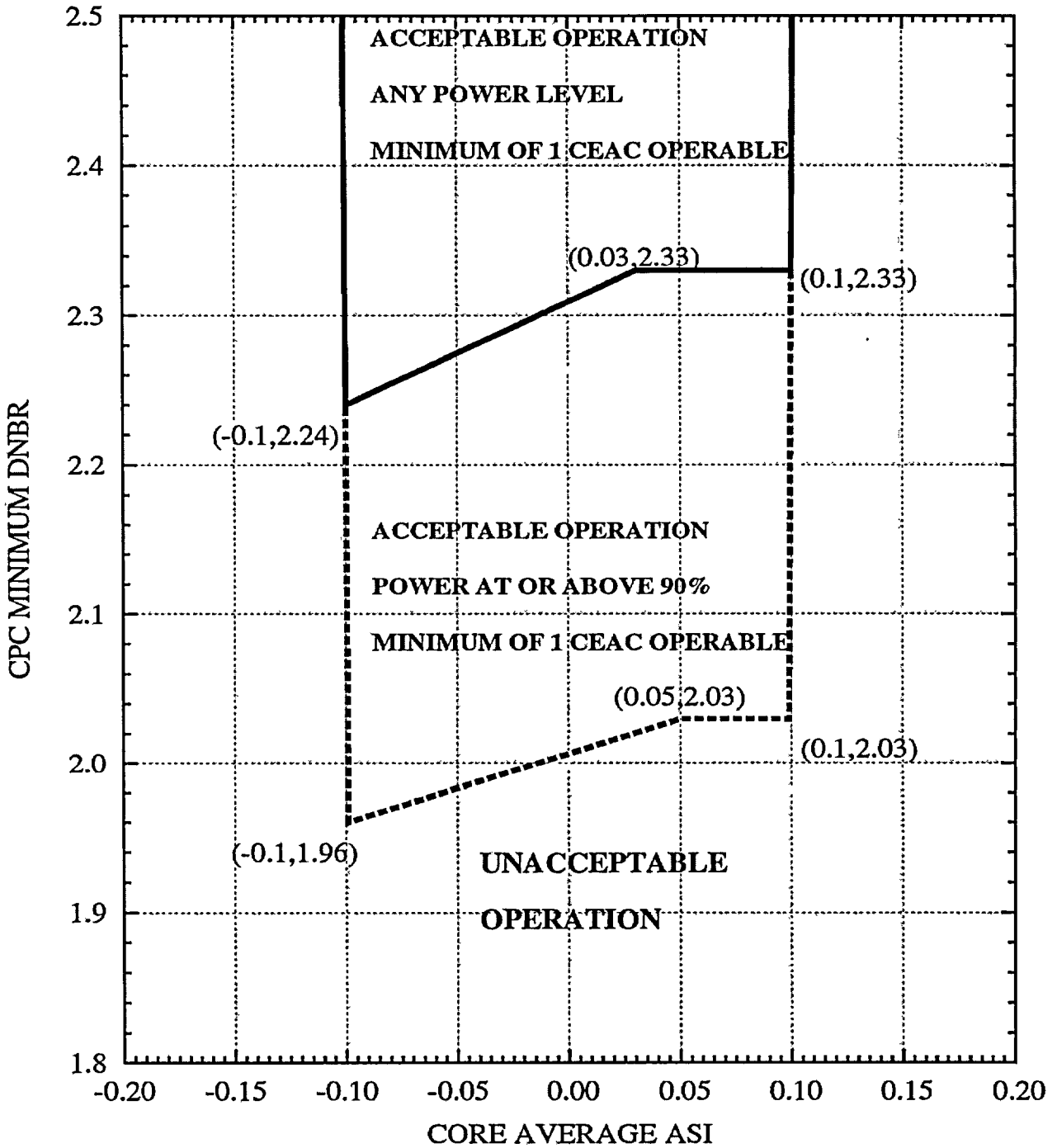


FIGURE 3.2.4-3

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

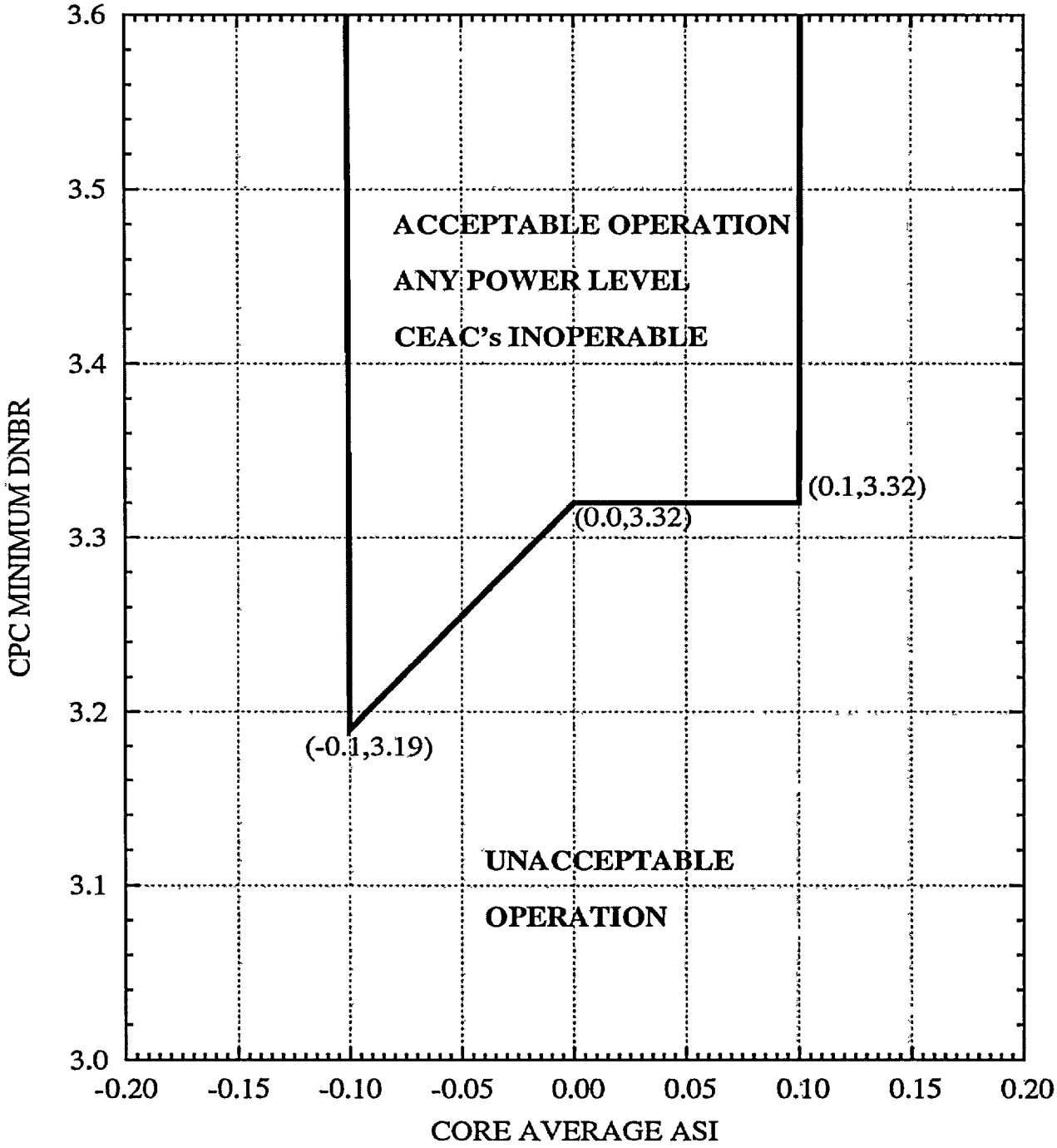


Table 3.3.12-1

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

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 $0.98 \geq K_{eff} > 0.97$

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

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 $0.97 \geq K_{eff} > 0.96$

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

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

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

CORE OPERATING LIMITS REPORT

PALO VERDE NUCLEAR GENERATING STATION (PVNGS)

UNIT 3

Revision 10

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Foster, Glenn A(Z35831)
Date: 10/11/2002 15:02:17
Reason: I am the author of this document
Location: PVNGS

PVNGS UNIT 3 CORE OPERATING LIMITS REPORT

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PVNGS UNIT 3 CORE OPERATING LIMITS REPORT

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PVNGS UNIT 3 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 3 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 3 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:

Title	Report No.	Rev	Date	Supplement
1) CE Method for Control Element Assembly Ejection Analysis	CENPD-0190-A	N.A.	January 1976	N.A.
2) The ROCS and DIT Computer Codes for Nuclear Design	CENPD-266-P-A	N.A.	April 1983	N.A.
3) Modified Statistical Combination of Uncertainties	CEN-356(V)-P-A	01-P-A	May 1988	N.A.
4) System 80^{TM} Inlet Flow Distribution	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	CENPD-132	N.A.	March 2001	4-P-A
6) Calculative Methods for the CE Small Break LOCA Evaluation Model	CENPD-137-P	N.A.	April 1998	2-P-A
7) Fuel Rod Maximum Allowable Pressure	CEN-372-P-A	N.A.	May 1990	N.A.
8) Arizona Public Service Company PWR Reactor Physics Methodology Using CASMO-4/ SIMULATE-3	NFM002	0	September 1999	N.A.

Title	Report No.	Rev	Date	Supplement
9) Technical Manual for the CENTS Code	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	CENPD-404-P-A	0	November 2001	N.A.

PVNGS UNIT 3 CORE OPERATING LIMITS REPORT

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

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

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

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.

3.2.4 - 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
$-0.18 \leq ASI \leq 0.16$ for power $\geq 50\%$
$-0.28 \leq ASI \leq 0.16$ for power $< 50\%$

COLSS OUT OF SERVICE (CPC)
$-0.10 \leq ASI \leq 0.10$

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

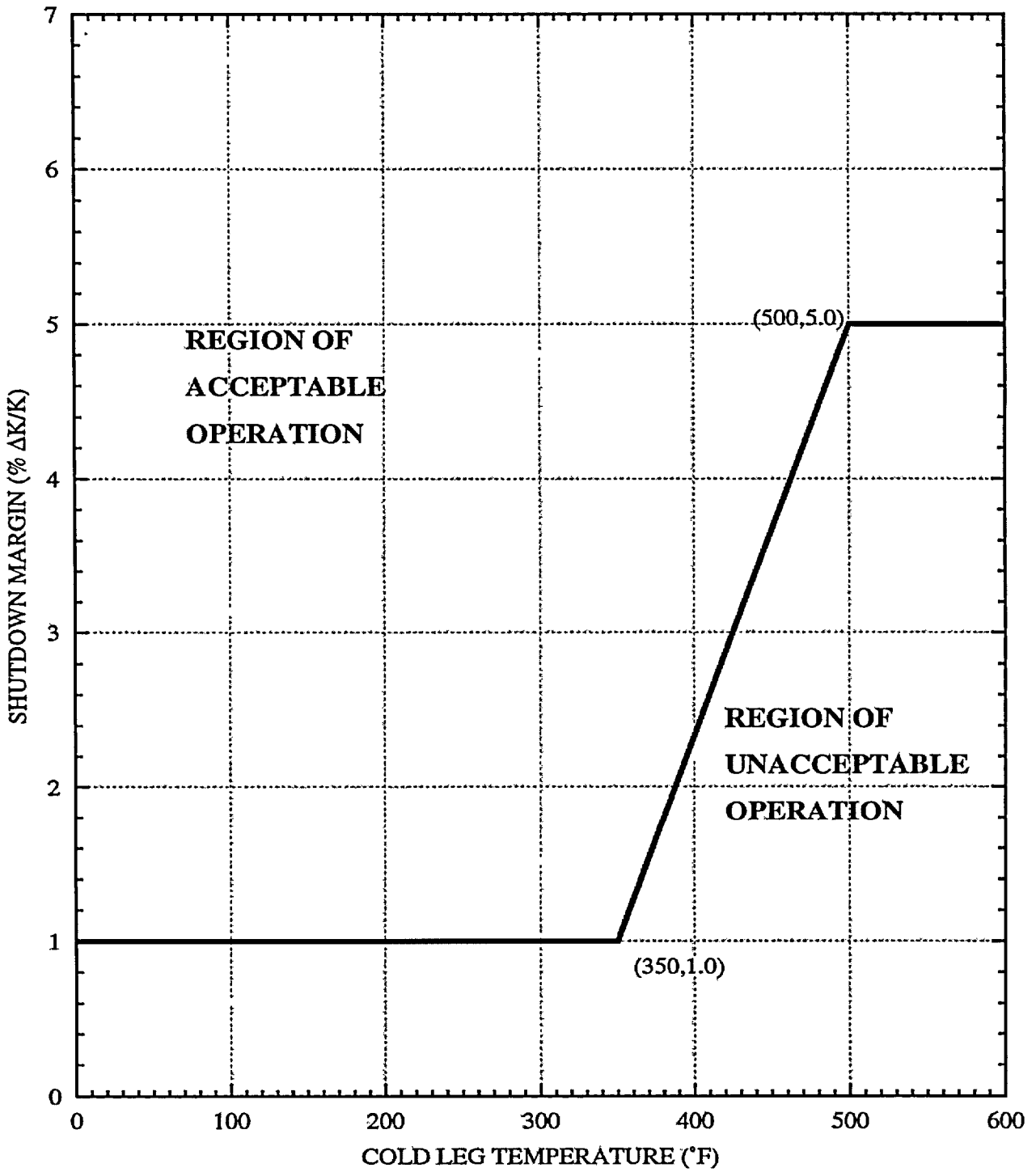


FIGURE 3.1.2-1
SHUTDOWN MARGIN VERSUS COLD LEG TEMPERATURE
REACTOR TRIP BREAKERS CLOSED

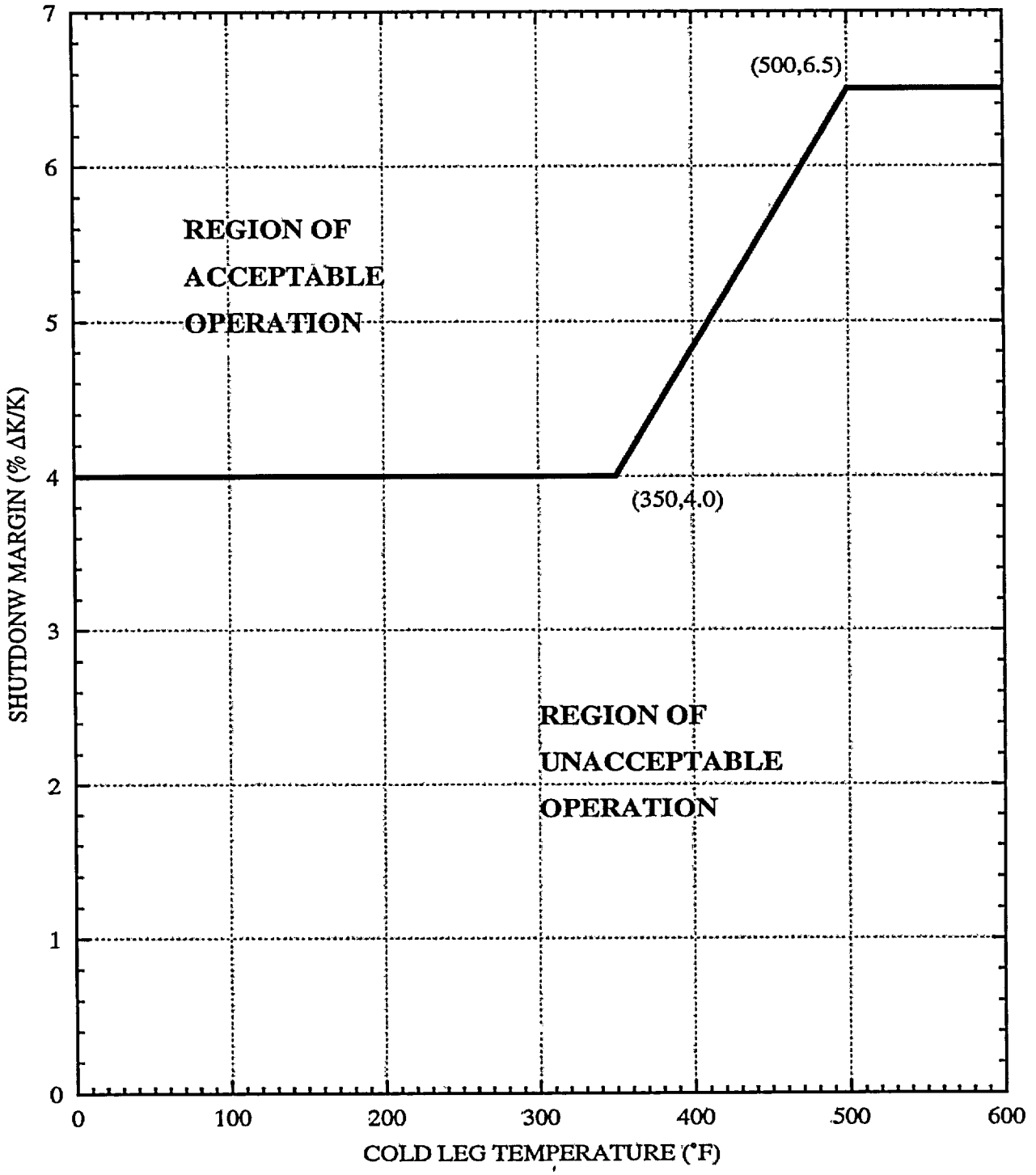


FIGURE 3.1.4-1
MTC ACCEPTABLE OPERATION, MODES 1 AND 2

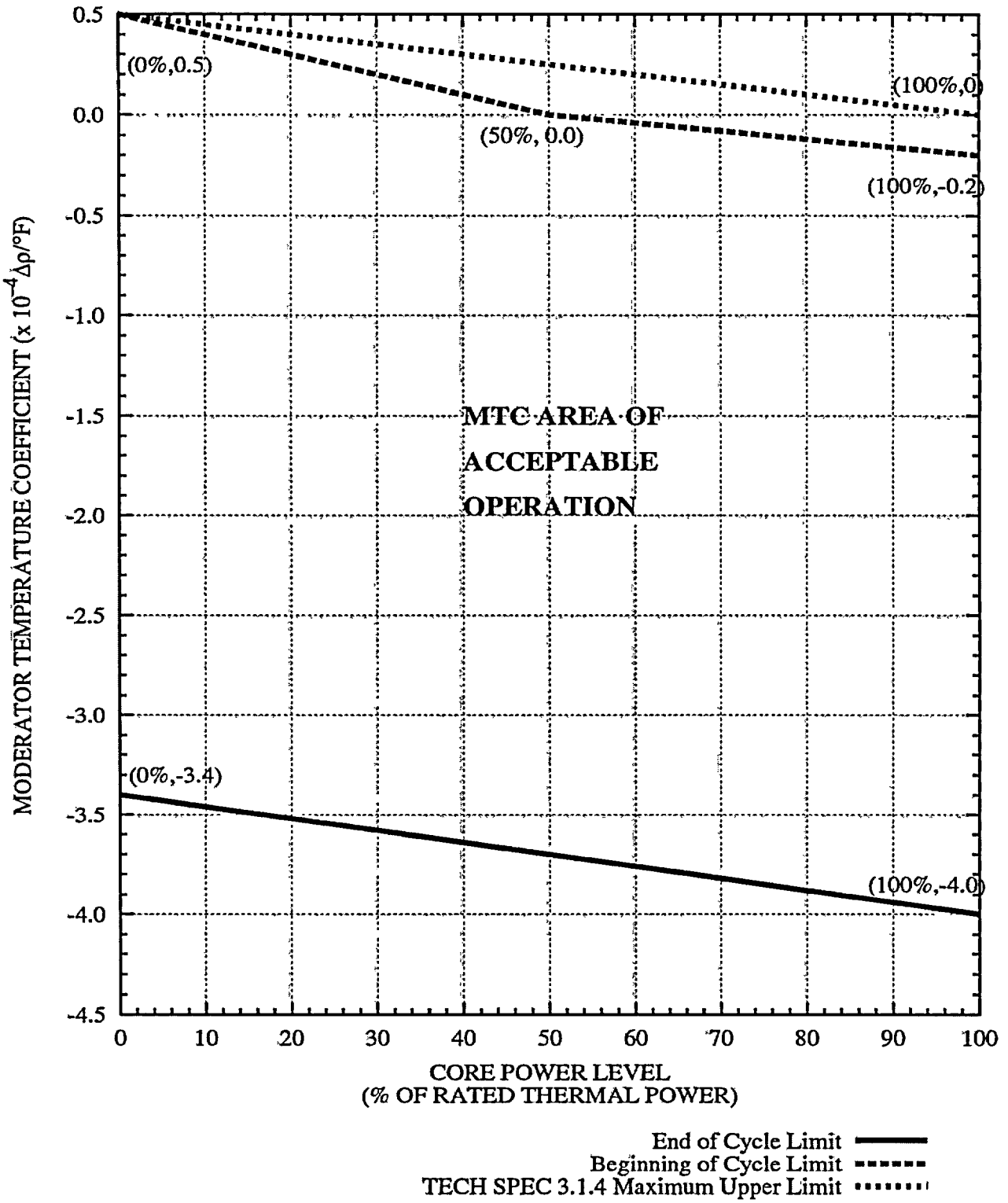
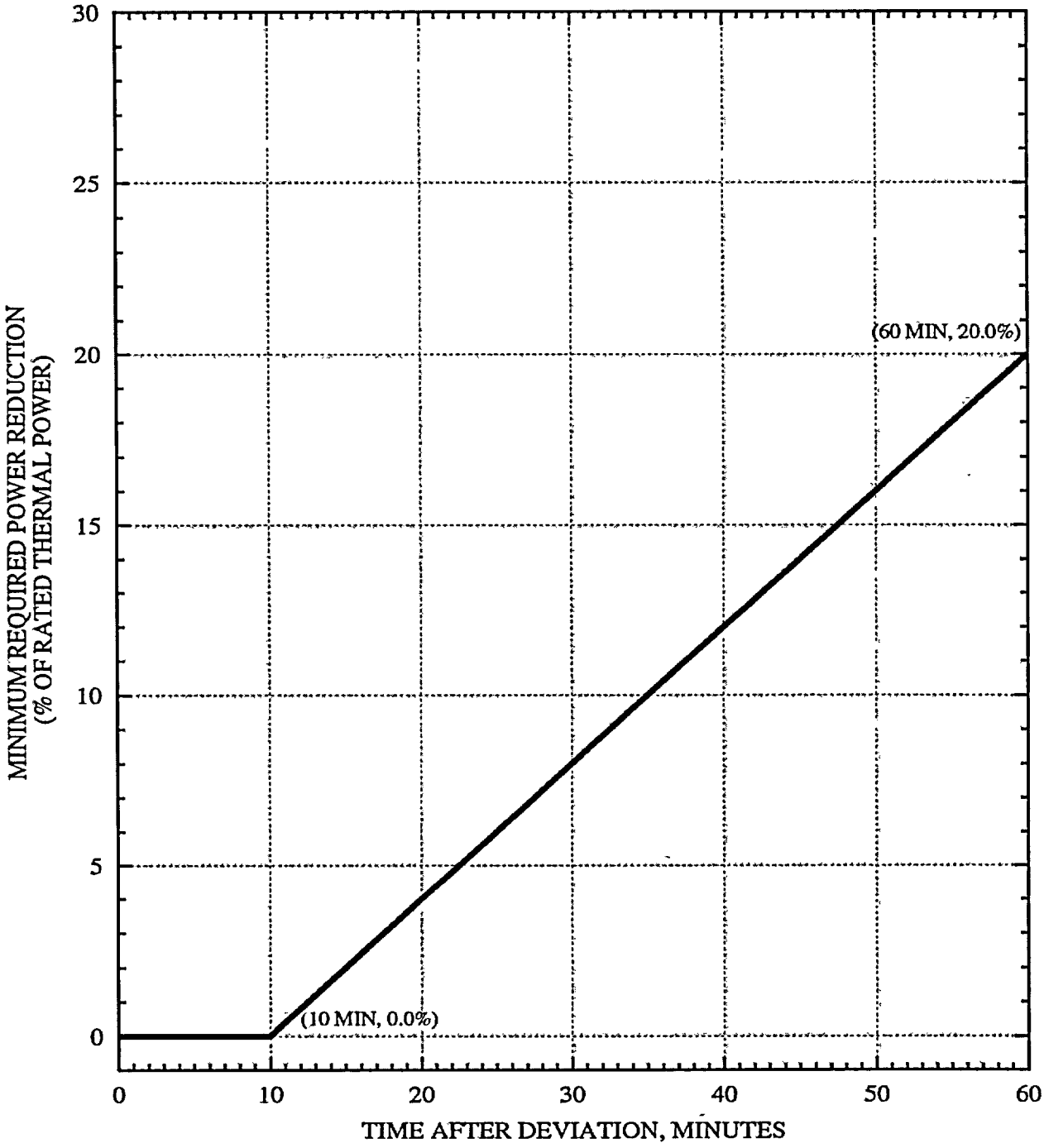


FIGURE 3.1.5-1
CORE POWER LIMIT AFTER CEA DEVIATION*



* 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)

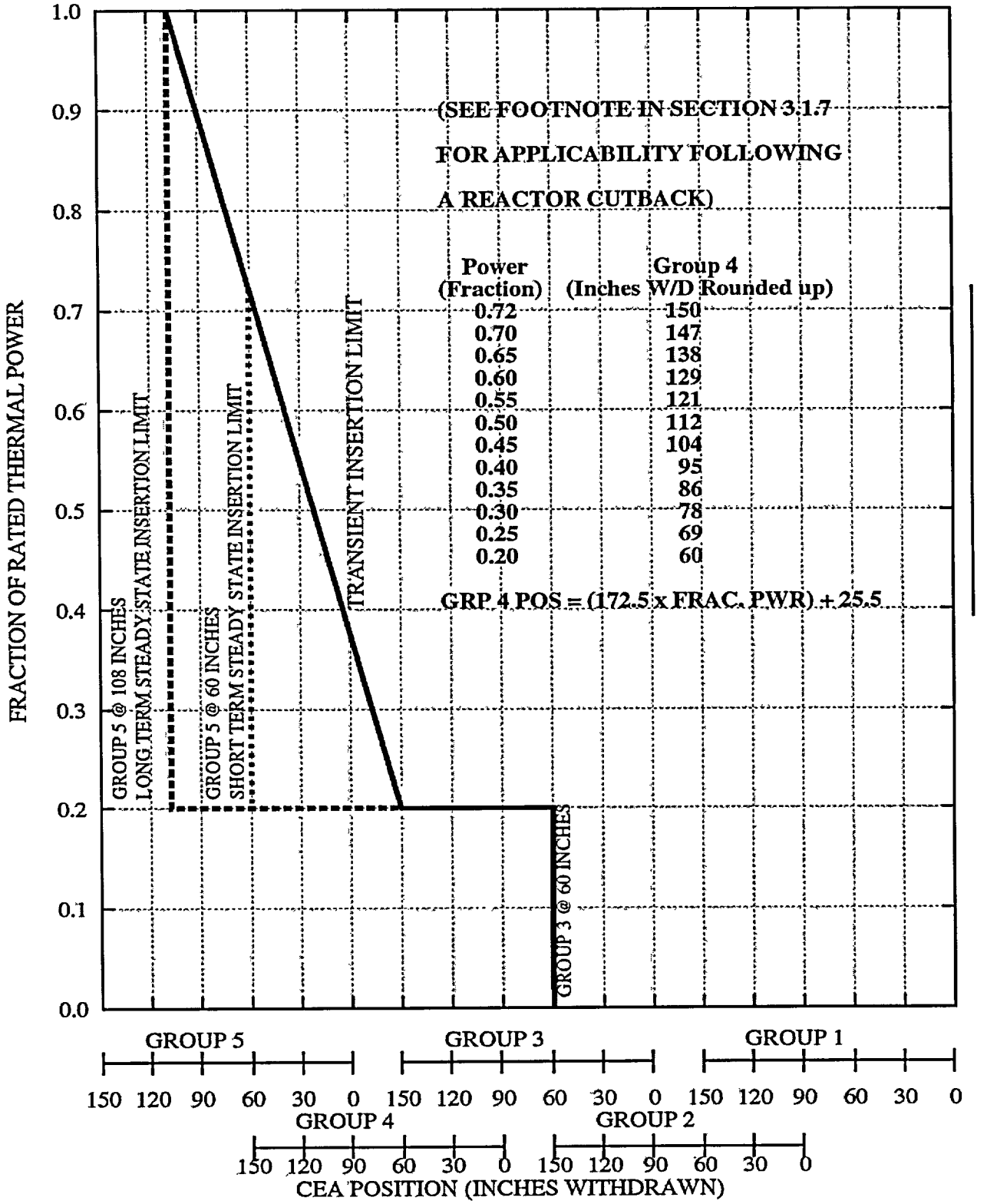


FIGURE 3.1.7-2
CEA INSERTION LIMITS VERSUS THERMAL POWER
(COLSS OUT OF SERVICE)

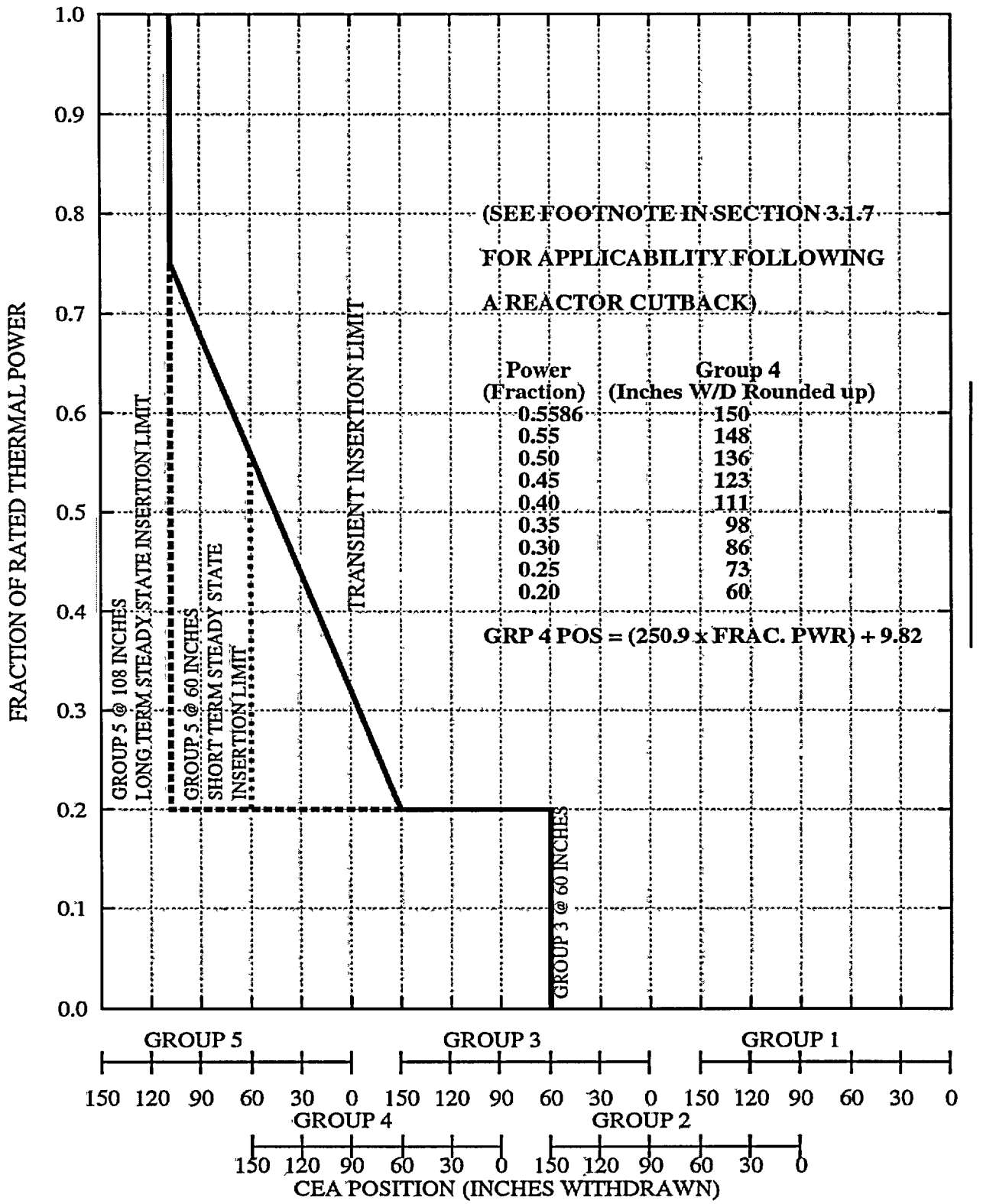


FIGURE 3.1.8-1
PART LENGTH CEA INSERTION LIMITS VERSUS THERMAL POWER

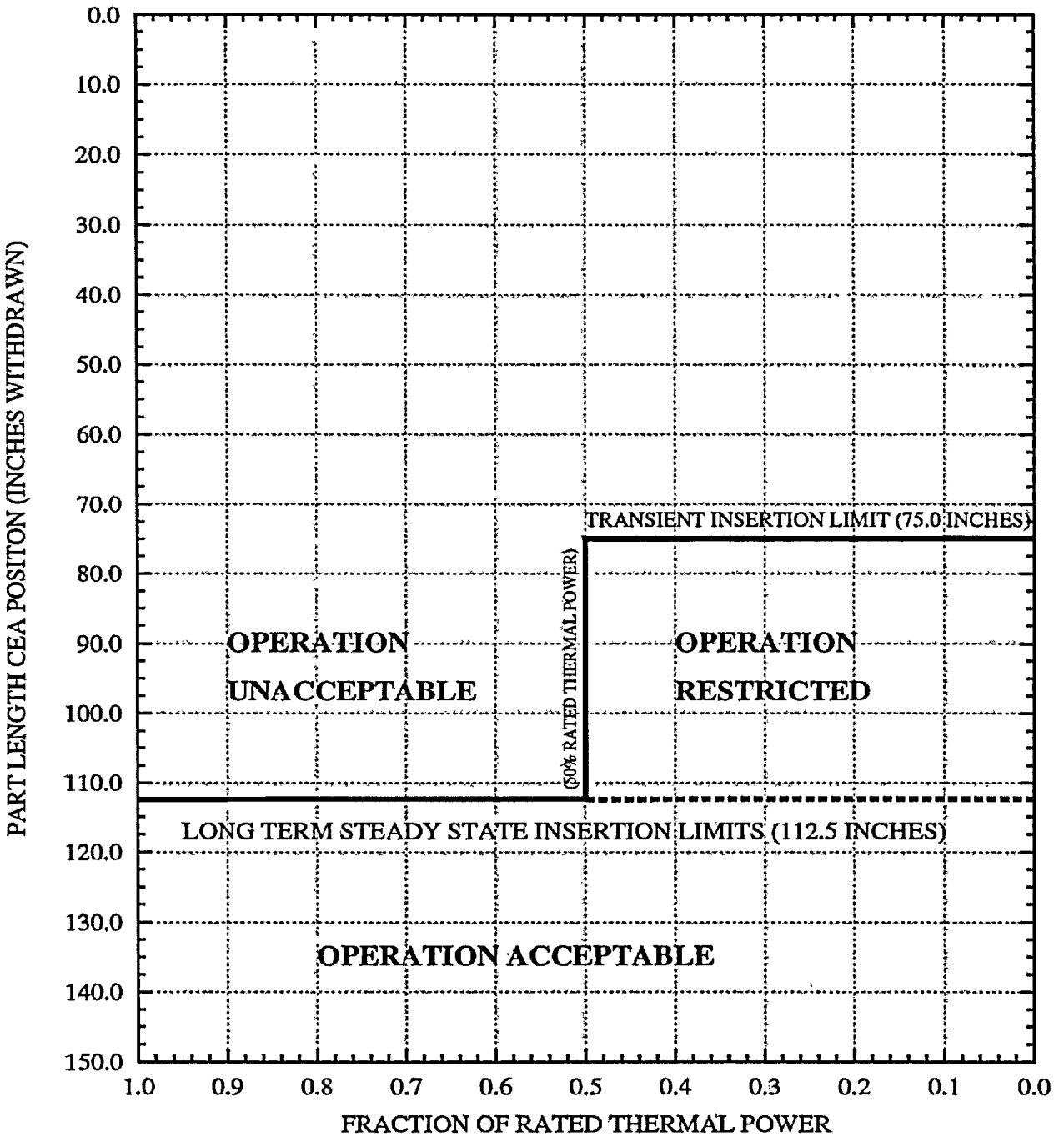


FIGURE 3.2.3-1
AZIMUTHAL POWER TILT VERSUS THERMAL POWER
(COLSS IN SERVICE)

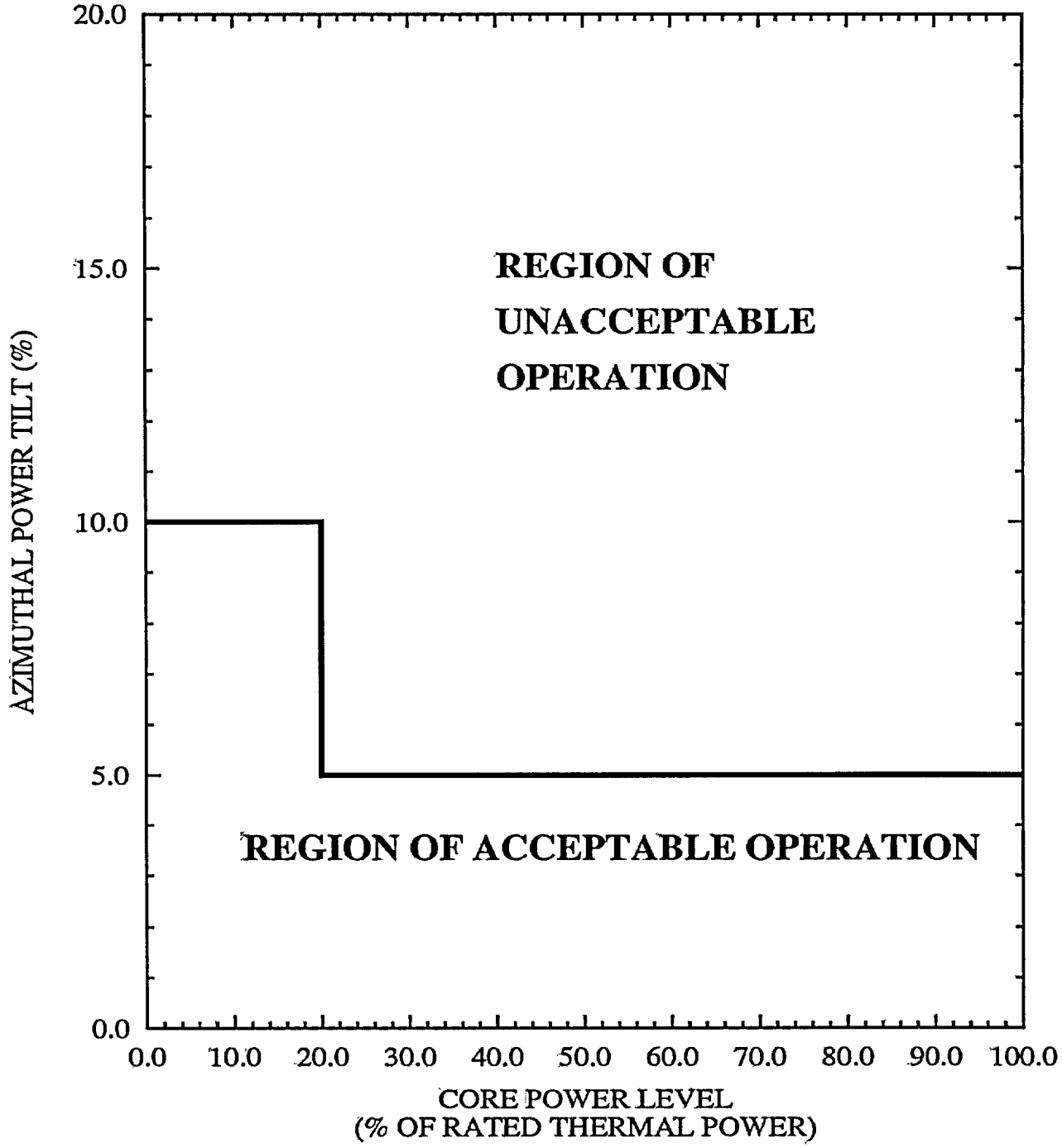


FIGURE 3.2.4-1
COLSS DNBR OPERATING LIMIT
ALLOWANCE FOR BOTH CEAC's INOPERABLE

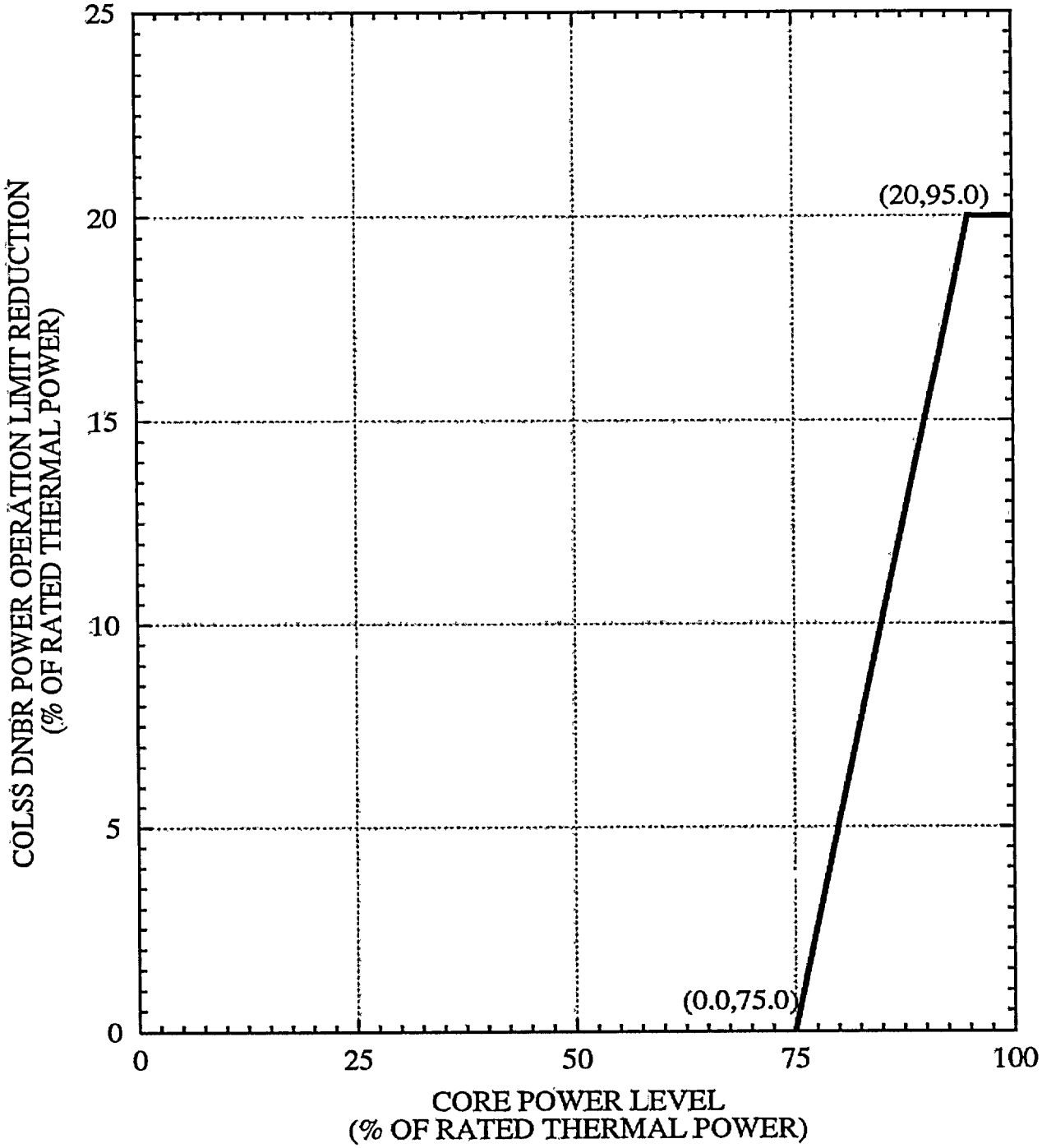


FIGURE 3.2.4-2

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

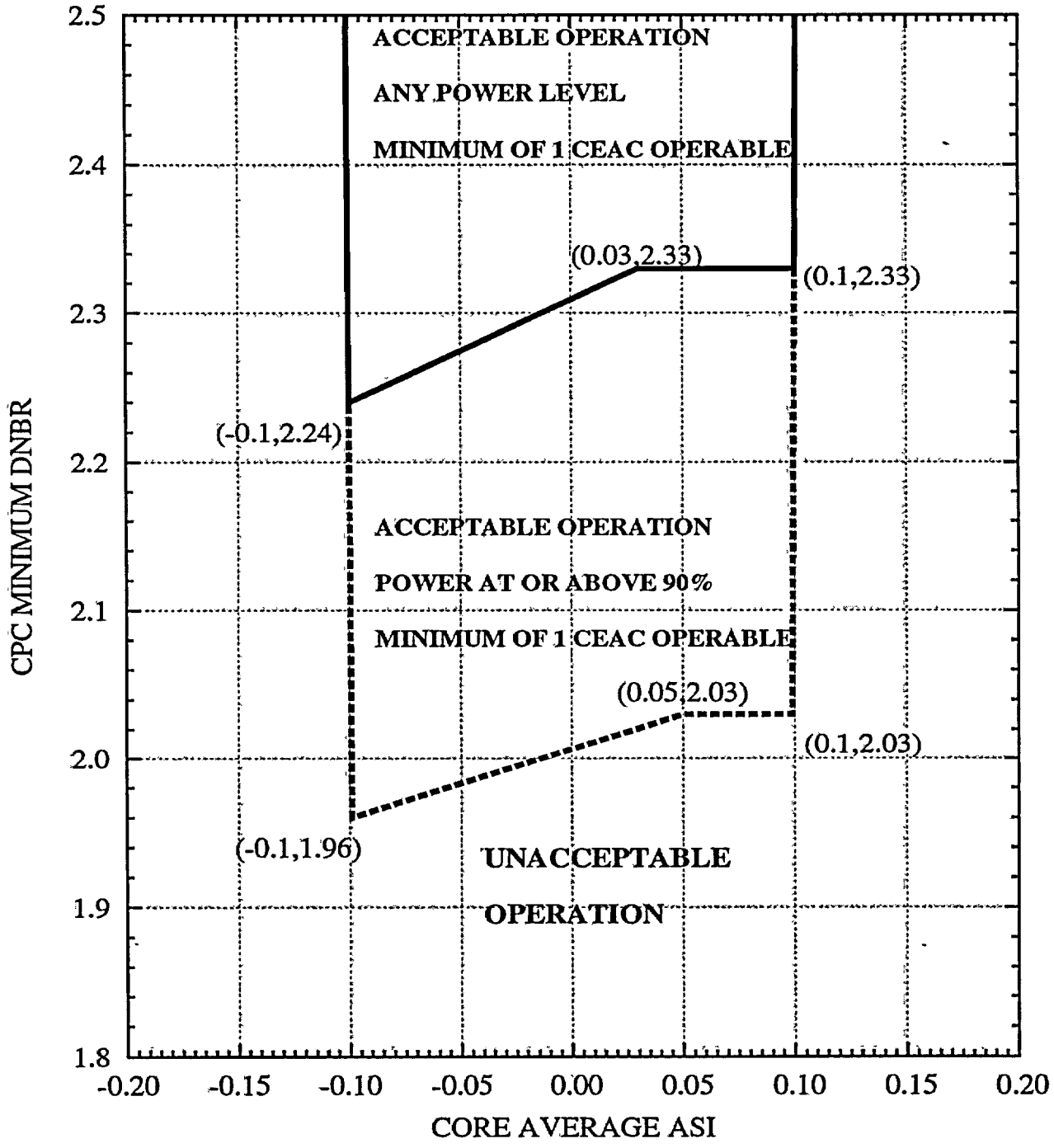


FIGURE 3.2.4-3

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

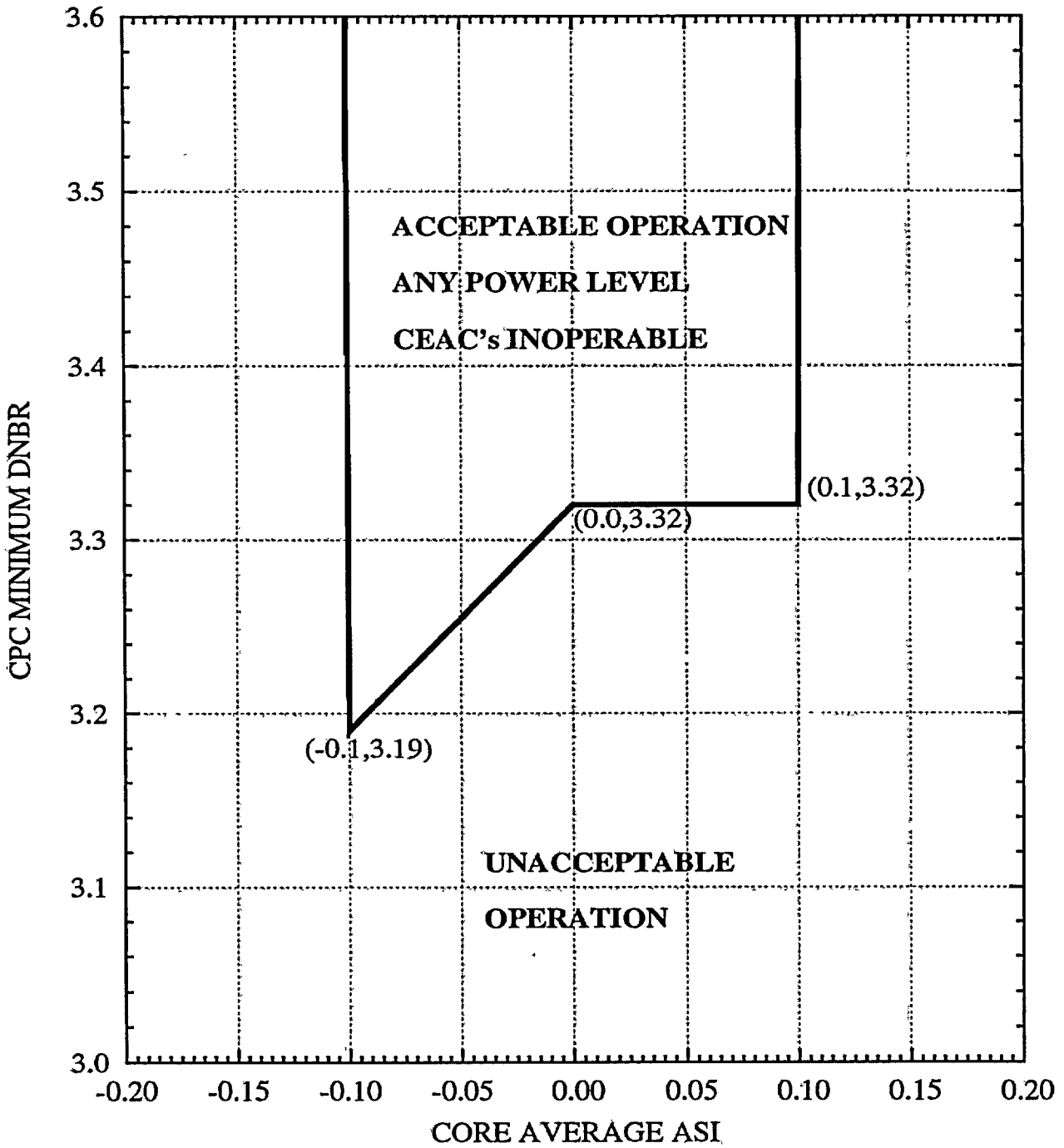


Table 3.3.12-1

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

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 $0.98 \geq K_{eff} > 0.97$

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

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 $0.97 \geq K_{eff} > 0.96$

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

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

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