Technical Specification 5.6.5.d

Palo Verde Nuclear Generating Station

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102-05514-SAB/TNW/CJJ
June 09, 2006

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
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 (COLR), Unit 1 - Revision 17,
Unit 2 - Revision 14, and Unit 3 - Revision 16

Pursuant to PVNGS Technical Specifications, Section 5.6.5.d, enclosed is Unit 1 - Revision 17, Unit 2 - Revision 14, and Unit 3 - Revision 16 COLRs, which were made effective on June 9, 2006. The COLR revisions update the SIMULATE reference under "Analytical Methods," update the CENTS reference under "Analytical Methods," and make editorial changes to establish conformity in wording between the three unit COLR's.

By copy of this letter and the enclosure, these COLR revisions are 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 Thomas N. Weber at (623) 393-5764 if you have any questions or require additional information.

Sincerely,

TNW Weber... for
SA Bauer

SAB/TNW/CJJ/gt

Enclosure: PVNGS Unit 1 Core Operating Limits Report (COLR), Revision 17
PVNGS Unit 2 Core Operating Limits Report (COLR), Revision 14
PVNGS Unit 3 Core Operating Limits Report (COLR), Revision 16

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

A001

Enclosure

PVNGS Unit 1 Core Operating Limits Report (COLR)
Revision 17

PALO VERDE NUCLEAR GENERATING STATION (PVNGS)

UNIT 1

CORE OPERATING LIMITS REPORT

Revision 17

Responsible Engineer Date	Delorenzi, Mark J (Z01931) Digitally signed by Delorenzi, Mark J(Z01931) DN: CN = Delorenzi, Mark J (Z01931) Reason: I am the author of this document. Date: 2006.06.02 08:00:38 -07'00'
Independent Reviewer Date	Webb, James R (V97187) Digitally signed by Webb, James R(V97187) DN: CN = Webb, James R (V97187) Reason: I have reviewed this document. Date: 2006.06.02 08:17:49 -07'00'
Responsible Section Leader Date	Cannon, Thomas C (Z20485) Digitally signed by Cannon, Thomas C(Z20485) DN: CN = Cannon, Thomas C(Z20485) Reason: I am approving this document. Date: 2006.06.07 08:15:34 -07'00'

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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 Strength 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

ANALYTICAL METHODS

The COLR contains the complete identification for each of the Technical Specification referenced topical reports (i.e., report number, title, revision, date, and any supplements) that provide the NRC-approved analytical methods used to determine the core operating limits, described in the following documents:

Title	Report No.	Rev	Date	Supplement
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 (AR1)	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-N001-1900-01192-3)	CENPD-132	N.A.	March 2001	4-P-A
6) Calculative Methods for the CE Small Break LOCA Evaluation Model (13-N001-1900-01185-3)	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-005)	NFM-005	N.A.	January 2006	N.A.

Title	Report No.	Rev	Date	Supplement
9) Technical Description Manual for the CENTS CodeVolume 1 (CENTS-TD MANUAL-VOL 1)	CE-NPD 282-P-A Vols. 1	2	March 2005	N.A.
10) Technical Description Manual for the CENTS Code Volume 2 (CENTS-TD MANUAL-VOL 2)	CE-NPD 282-P-A Vols. 2	2	March 2005	N.A.
11) Technical Description Manual for the CENTS CodeVolume 3 (CENTS-TD MANUAL-VOL 3)	CE-NPD 282-P-A Vols. 3	2	March 2005	N.A.
12) 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.

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-strength or part-strength 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 limits[1] shown in Figure 3.1.7-1[2]; with COLSS OUT OF SERVICE, regulating CEA groups shall be limited to the withdrawal sequence and to the insertion limits[1] shown in Figure 3.1.7-2.[2] Regulating Groups 1 and 2 CEAs shall be maintained fully withdrawn[3] while in Modes 1 and 2 (except while performing SR 3.1.5.3).

[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] Fully withdrawn - ≥147.75" (Pulse Counter indication) and ≥145.25" (RSPT indication)

3.1.8 - Part Strength CEA Insertion Limits

The part strength 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 10% with COLSS IN SERVICE when power is greater than 20% and less than or equal to 50%. Additionally, the AZIMUTHAL POWER TILT (T_q) shall be less than or equal to 5% with COLSS IN SERVICE when power is greater than 50%. See Figure 3.2.3-1.

3.2.4 - Departure From Nucleate Boiling Ratio (DNBR)

COLSS IN SERVICE and Both CEACs INOPERABLE in Any OPERABLE CPC Channel - Maintain 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 CEAC(s) OPERABLE - Operate 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 - Operate within the region of acceptable operation of Figure 3.2.4-3 using any operable CPC channel with both CEACs INOPERABLE.

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 >20% and < 50%

COLSS OUT OF SERVICE (CPC)
$-0.10 \leq ASI \leq 0.10$ for power >20%

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

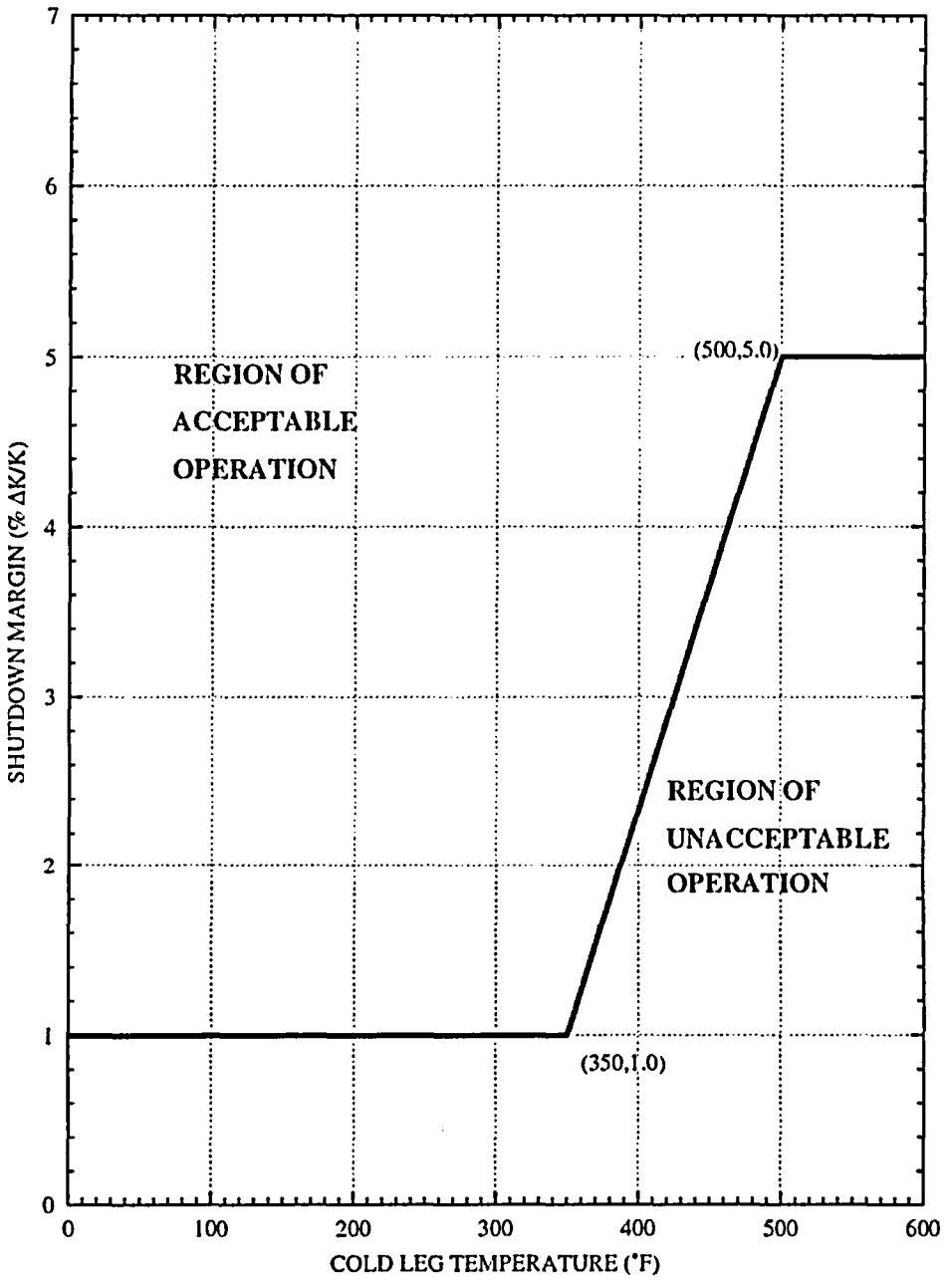


FIGURE 3.1.2-1
SHUTDOWN MARGIN VERSUS COLD LEG TEMPERATURE
REACTOR TRIP BREAKERS CLOSED

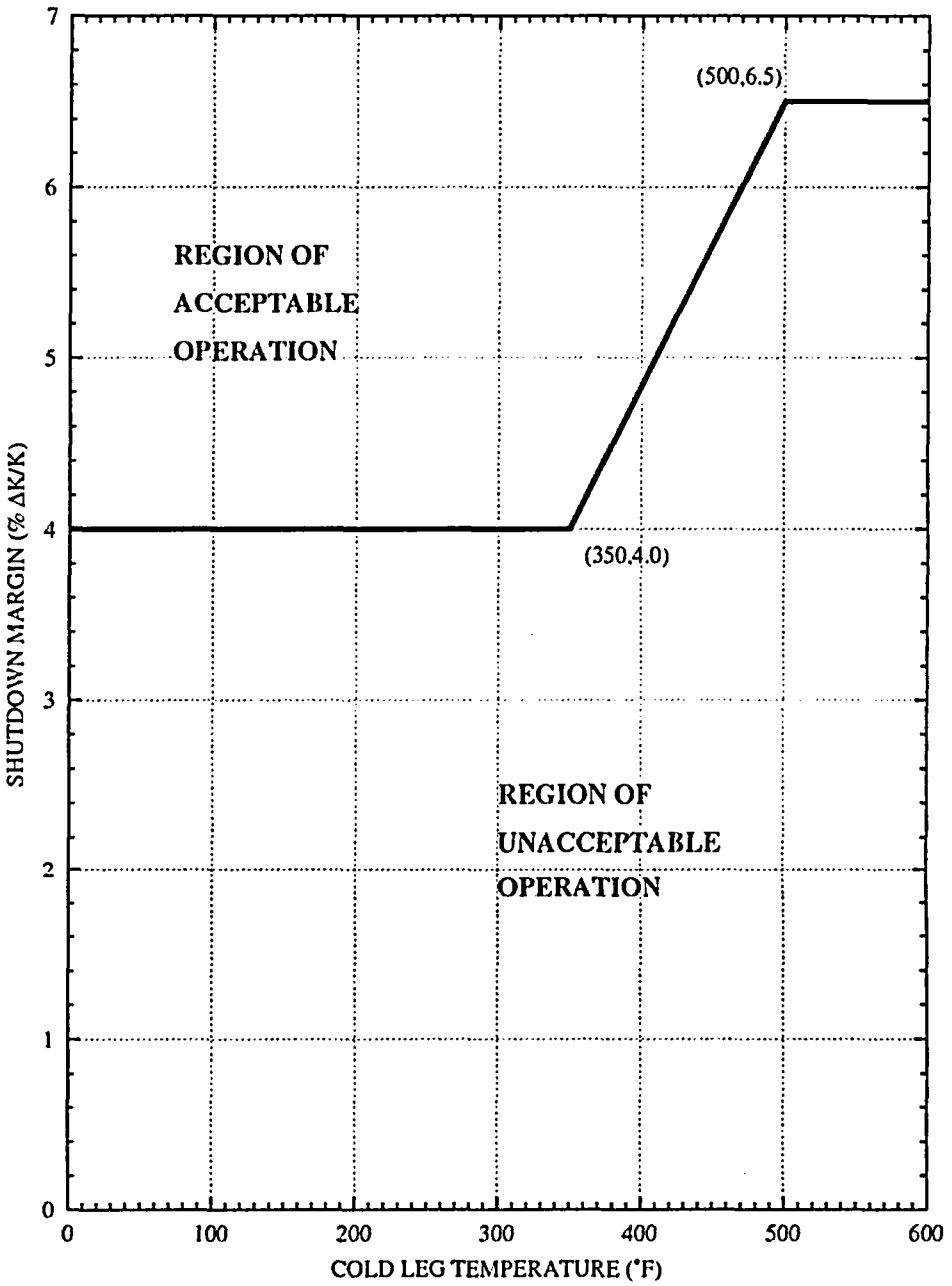


FIGURE 3.1.4-1
MTC ACCEPTABLE OPERATION, MODES 1 AND 2

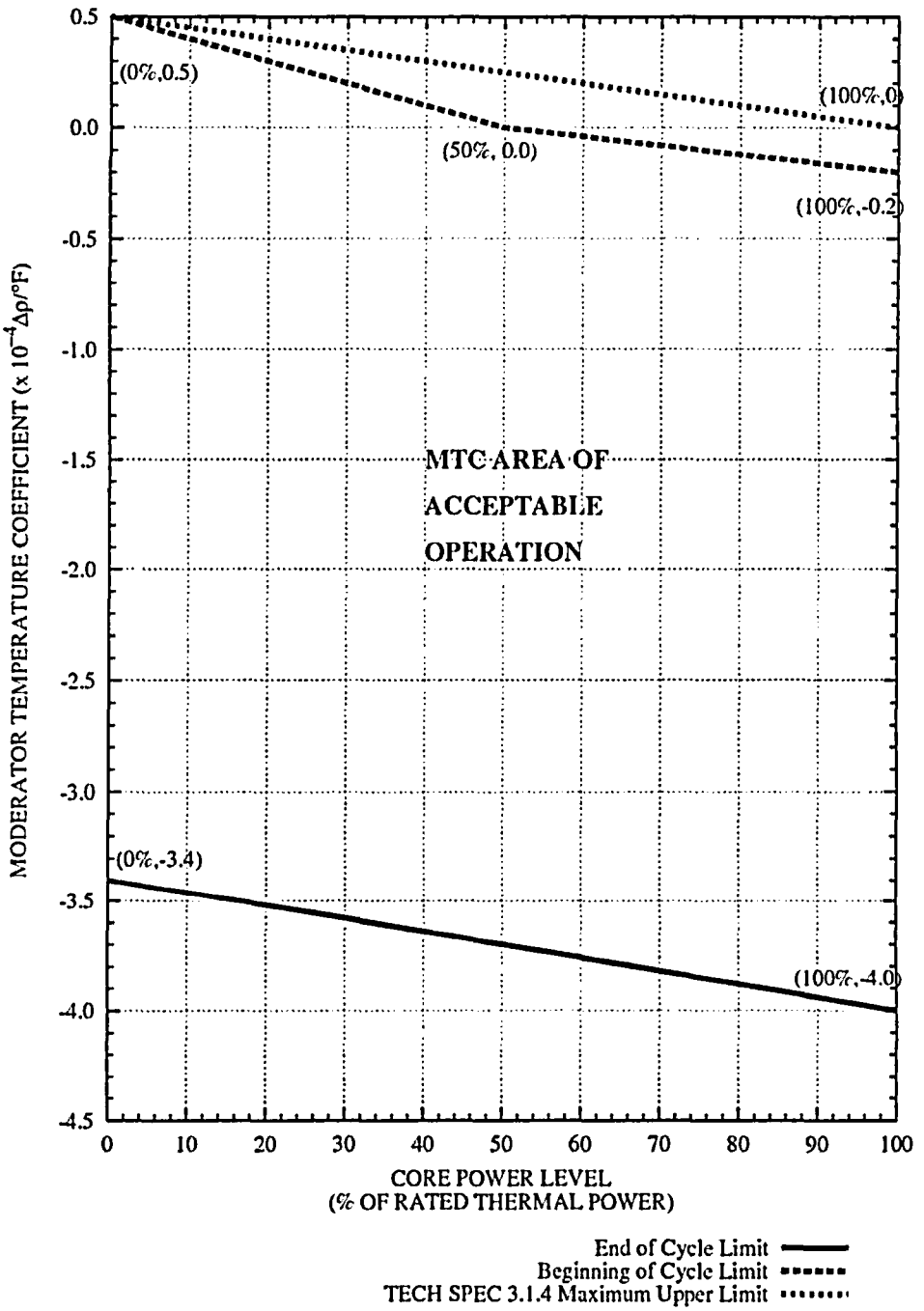
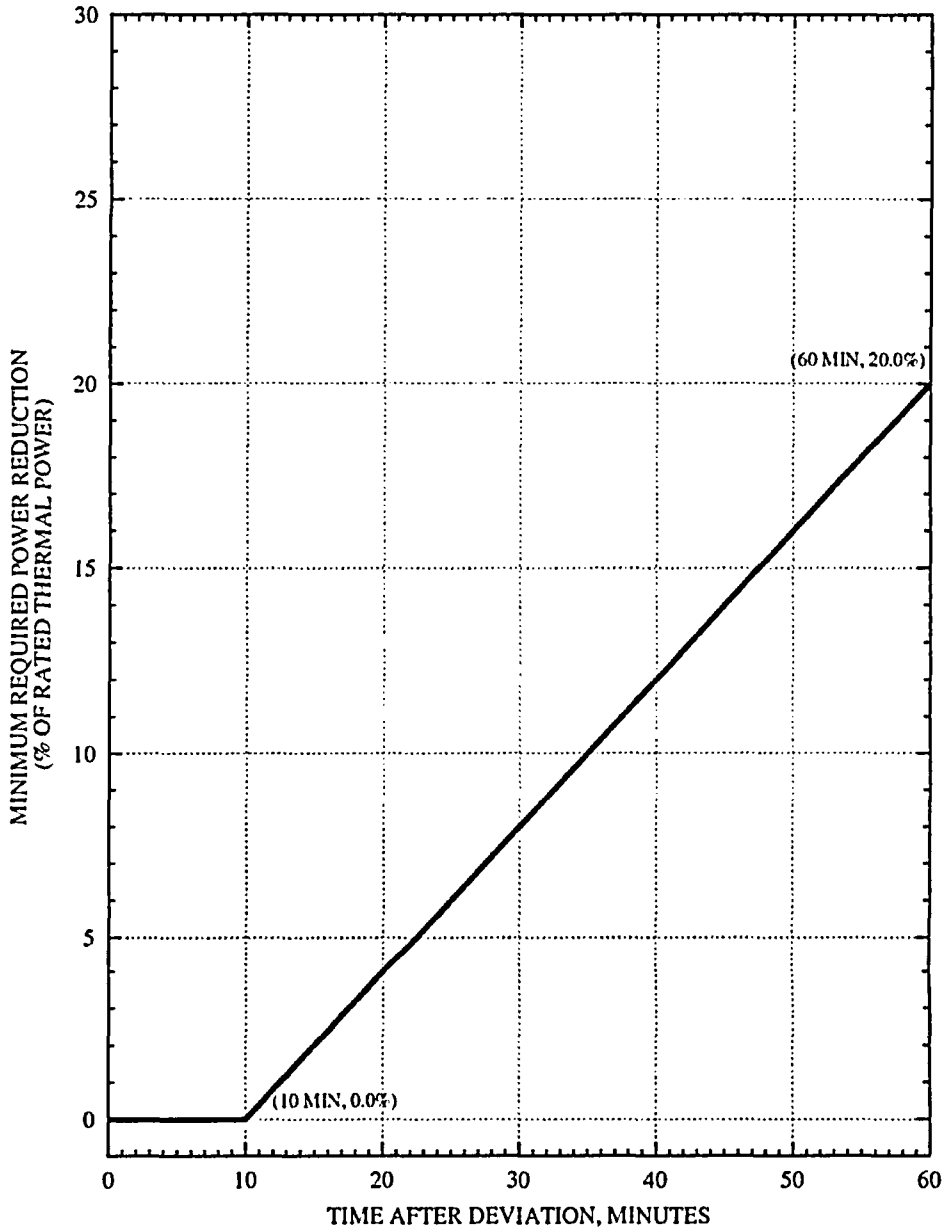
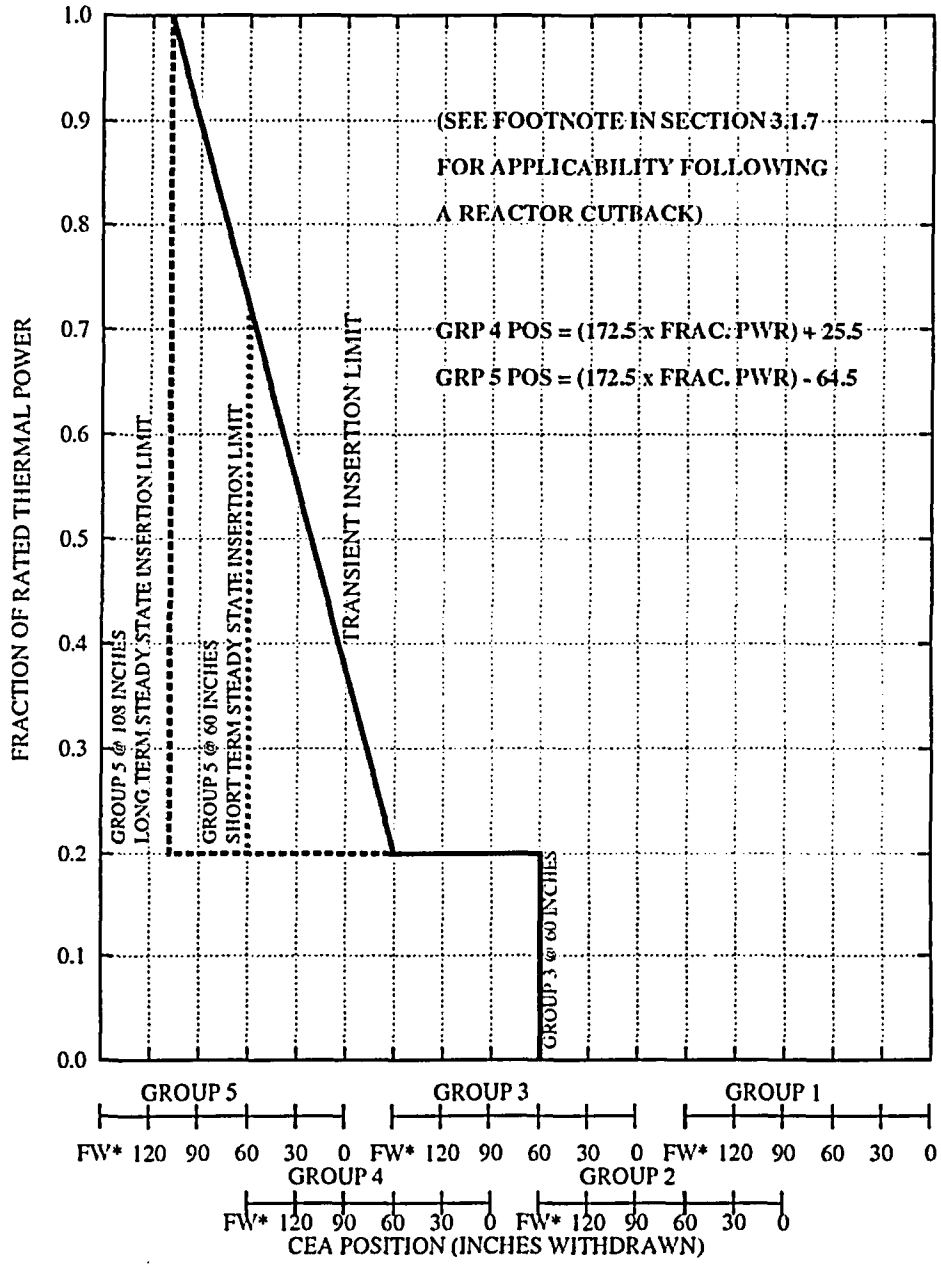


FIGURE 3.1.5-1
CORE POWER LIMIT AFTER CEA DEVIATION*



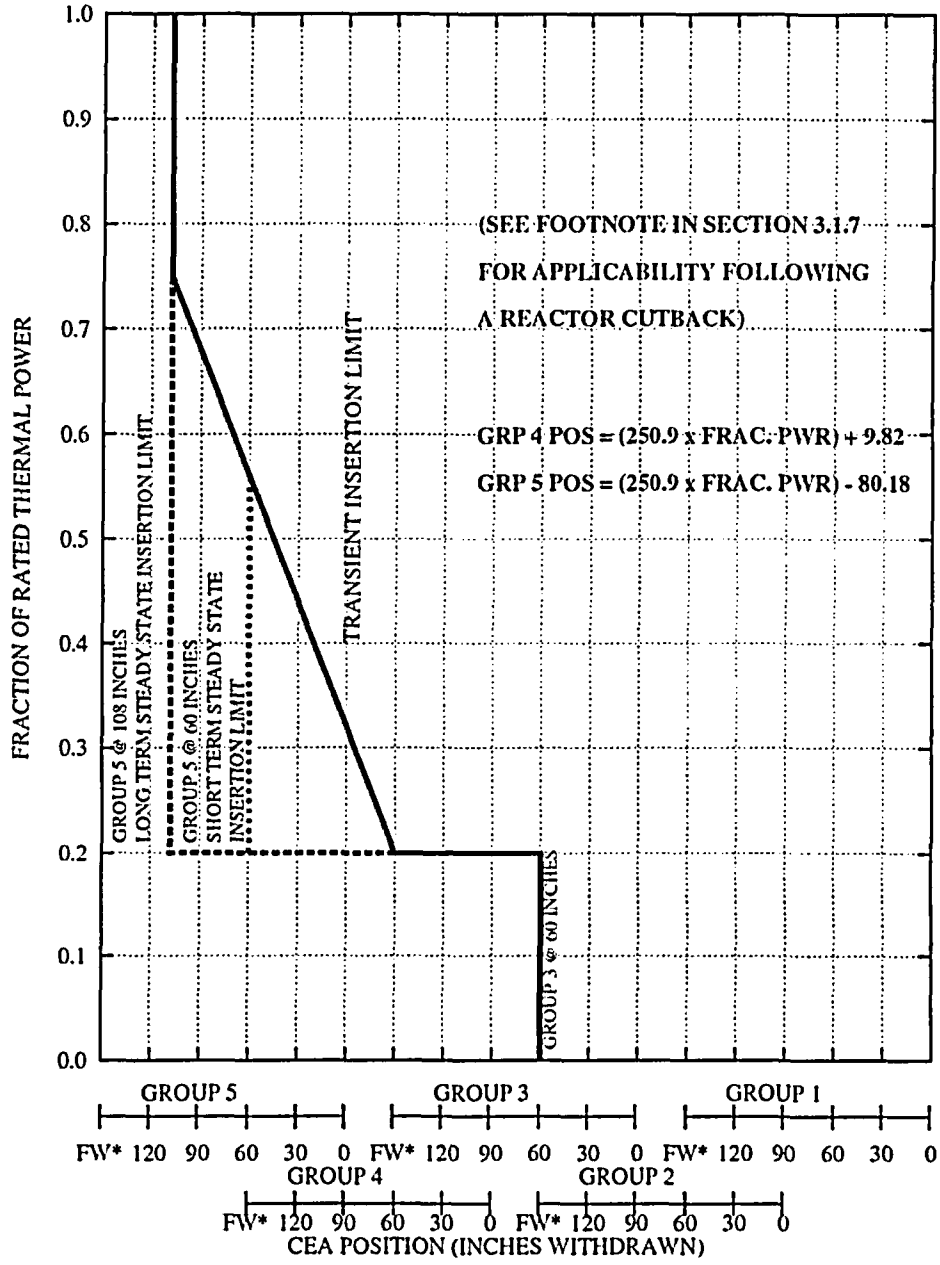
* WHEN CORE POWER IS REDUCED TO 55% OF RATED THERMAL POWER PER THIS LIMIT CURVE, FURTHER REDUCTION IS NOT REQUIRED.

FIGURE 3.1.7-1
CEA INSERTION LIMITS VERSUS THERMAL POWER
(COLSS IN SERVICE)



*Fully Withdrawn (FW) is defined as ≥ 147.75" (Pulse Counter) and ≥ 145.25" (RSPT).

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



*Fully Withdrawn (FW) is defined as ≥ 147.75" (Pulse Counter) and ≥ 145.25" (RSPT).

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

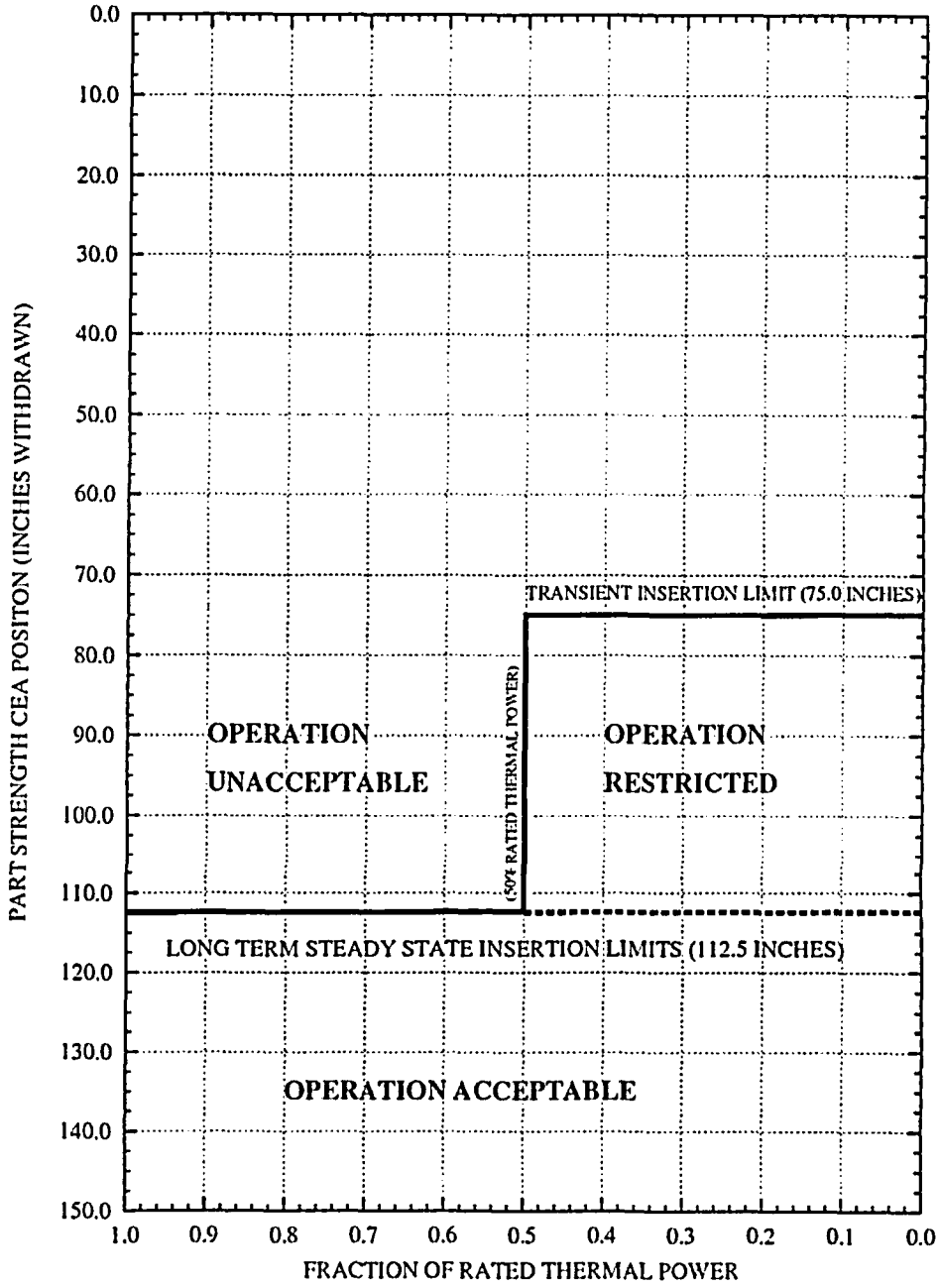


FIGURE 3.2.3-1
AZIMUTHAL POWER TILT VERSUS THERMAL POWER
(COLSS IN SERVICE)

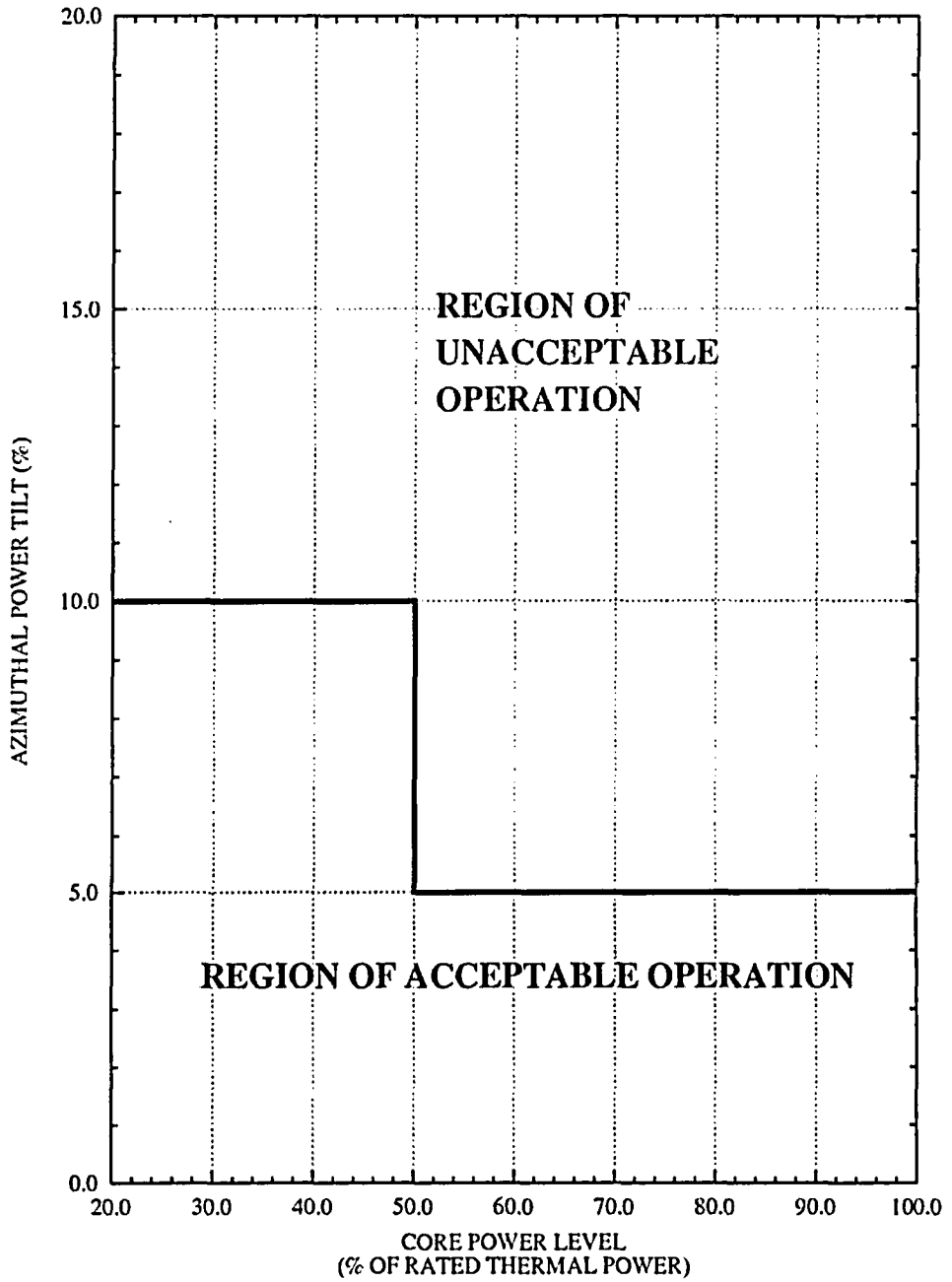


FIGURE 3.2.4-1
COLSS DNBR OPERATING LIMIT
ALLOWANCE FOR BOTH CEACs INOPERABLE
IN ANY OPERABLE CPC CHANNEL

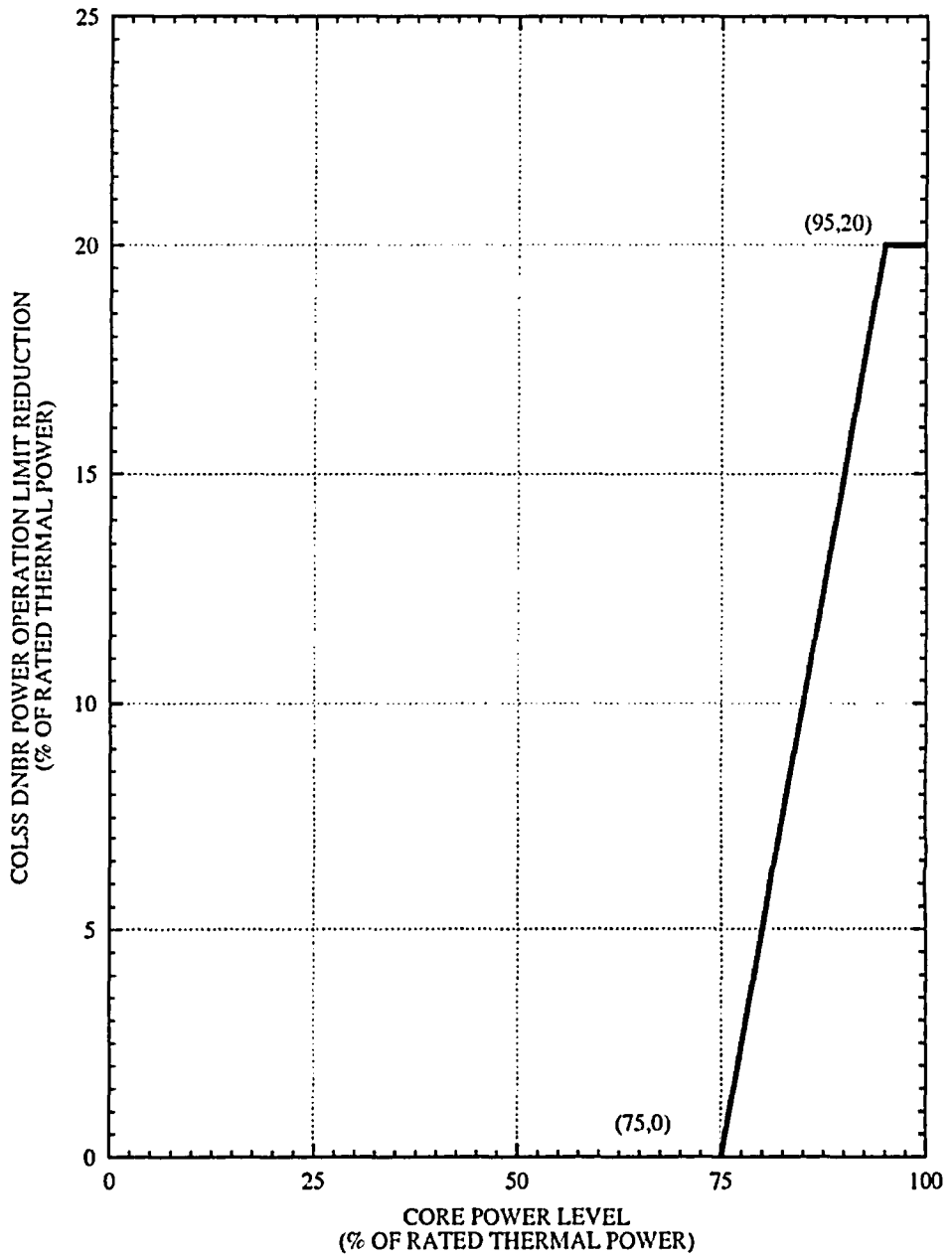


FIGURE 3.2.4-2
DNBR MARGIN OPERATING LIMIT BASED ON
THE CORE PROTECTION CALCULATORS
(COLSS OUT OF SERVICE, CEAC(s) OPERABLE)

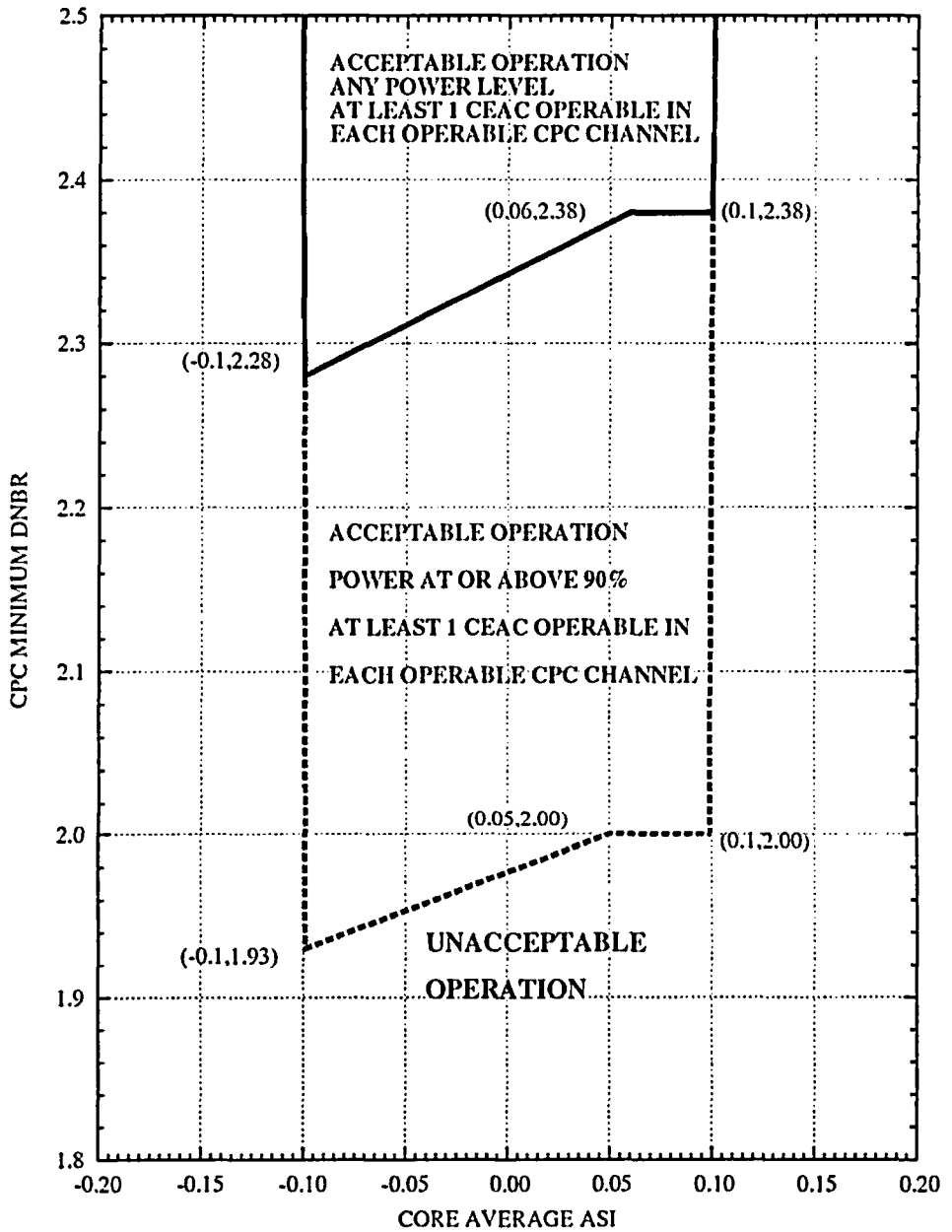


FIGURE 3.2.4-3
DNBR MARGIN OPERATING LIMIT BASED ON
THE CORE PROTECTION CALCULATORS
(COLSS OUT OF SERVICE, BOTH CEACs INOPERABLE
IN ANY OPERABLE CPC CHANNEL)

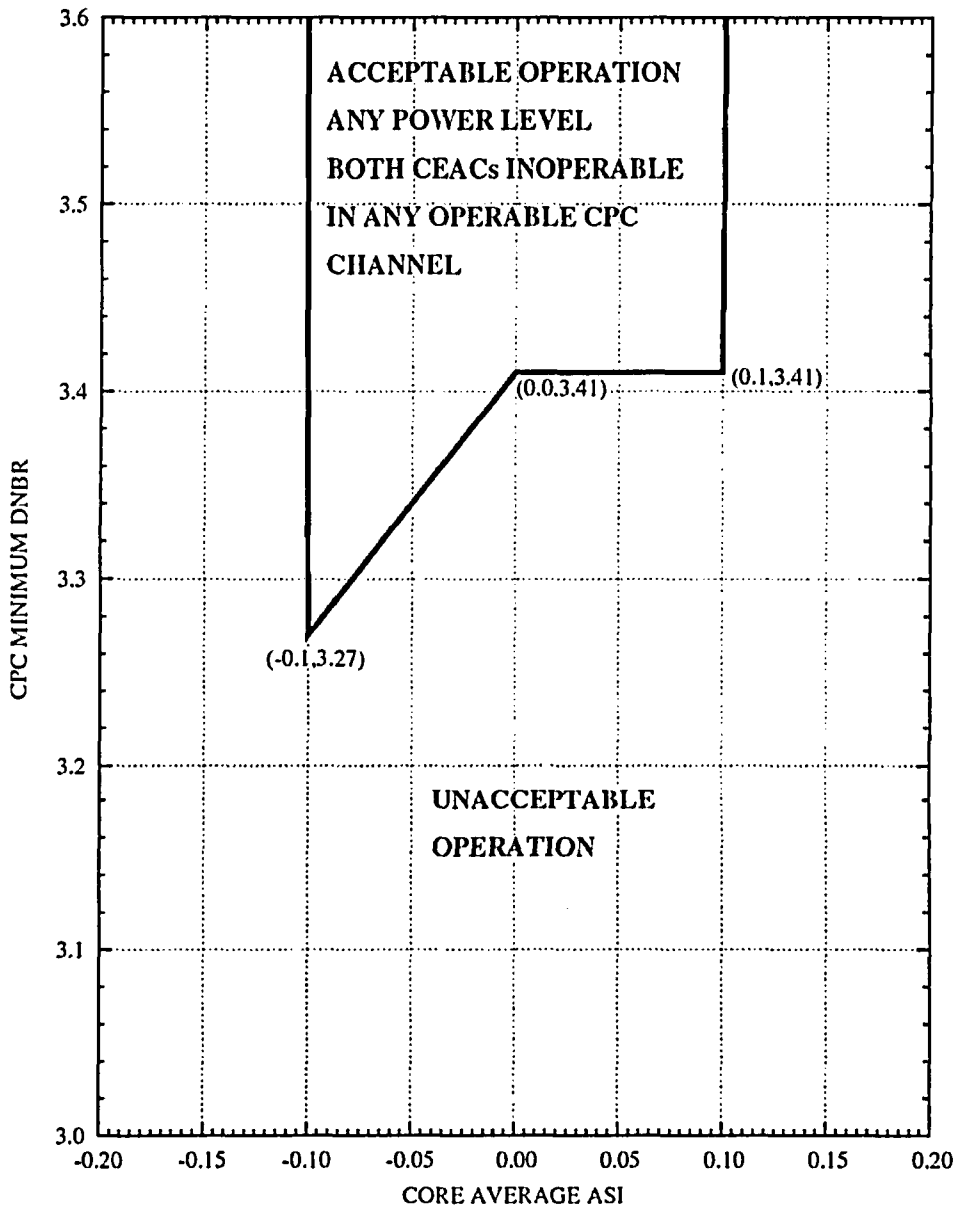


Table 3.3.12-1

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

Enclosure

PVNGS Unit 2 Core Operating Limits Report (COLR)
Revision 14

CORE OPERATING LIMITS REPORT

PALO VERDE NUCLEAR GENERATING STATION (PVNGS)

UNIT 2

Revision 14

Responsible Engineer Date	Delorenzi, Mark J (Z01931)	Digitally signed by Delorenzi, Mark J(Z01931) DN: CN = Delorenzi, Mark J (Z01931) Reason: I am the author of this document. Date: 2006.06.01 14:38:37 -07'00'
Independent Reviewer Date	Webb, James R (V97187)	Digitally signed by Webb, James R(V97187) DN: CN = Webb, James R (V97187) Reason: I have reviewed this document. Date: 2006.06.02 08:19:05 -07'00'
Responsible Section Leader Date	Cannon, Thomas C (Z20485)	Digitally signed by Cannon, Thomas C(Z20485) DN: CN = Cannon, Thomas C(Z20485) Reason: I am approving this document. Date: 2006.06.07 08:18:54 -07'00'

PVNGS UNIT 2 CORE OPERATING LIMITS REPORT

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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 Strength 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 COLR contains the complete identification for each of the Technical Specification referenced topical reports (i.e., report number, title, revision, date, and any supplements) that provide the NRC-approved analytical methods used to determine the core operating limits, described in the following documents:

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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 (AR1)	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-N001-1900-01192-3)	CENPD-132	N.A.	March 2001	4-P-A
6) Calculative Methods for the CE Small Break LOCA Evaluation Model (13-N001-1900-01185-3)	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-005)	NFM-005	N.A.	January 2006	N.A.

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9) Technical Description Manual for the CENTS CodeVolume 1 (CENTS-TD MANUAL-VOL 1)	CE-NPD 282-P-A Vols. 1	2	March 2005	N.A.
10) Technical Description Manual for the CENTS Code Volume 2 (CENTS-TD MANUAL-VOL 2)	CE-NPD 282-P-A Vols. 2	2	March 2005	N.A.
11) Technical Description Manual for the CENTS CodeVolume 3 (CENTS-TD MANUAL-VOL 3)	CE-NPD 282-P-A Vols. 3	2	March 2005	N.A.
12) 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.

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-strength or part-strength 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 limits[1] shown in Figure 3.1.7-1[2]; with COLSS OUT OF SERVICE, regulating CEA groups shall be limited to the withdrawal sequence and to the insertion limits[1] shown in Figure 3.1.7-2.[2] Regulating Groups 1 and 2 CEAs shall be maintained fully withdrawn[3] while in Modes 1 and 2 (except while performing SR 3.1.5.3).

[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] Fully withdrawn - ≥147.75" (Pulse Counter indication) and ≥145.25" (RSPT indication)

3.1.8 - Part Strength CEA Insertion Limits

The part strength 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 10% with COLSS IN SERVICE when power is greater than 20% and less than or equal to 50%. AZIMUTHAL POWER TILT (T_q) shall be less than or equal to 5% with COLSS IN SERVICE when power is greater than 50%. See Figure 3.2.3-1.

3.2.4 - Departure From Nucleate Boiling Ratio (DNBR)

COLSS IN SERVICE and Both CEACs INOPERABLE in Any OPERABLE CPC Channel - Maintain 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 CEAC(s) OPERABLE - Operate 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 - Operate within the region of acceptable operation of Figure 3.2.4-3 using any operable CPC channel with both CEACs INOPERABLE..

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 >20% and < 50%

COLSS OUT OF SERVICE (CPC)
$-0.10 \leq ASI \leq 0.10$ for power >20%

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

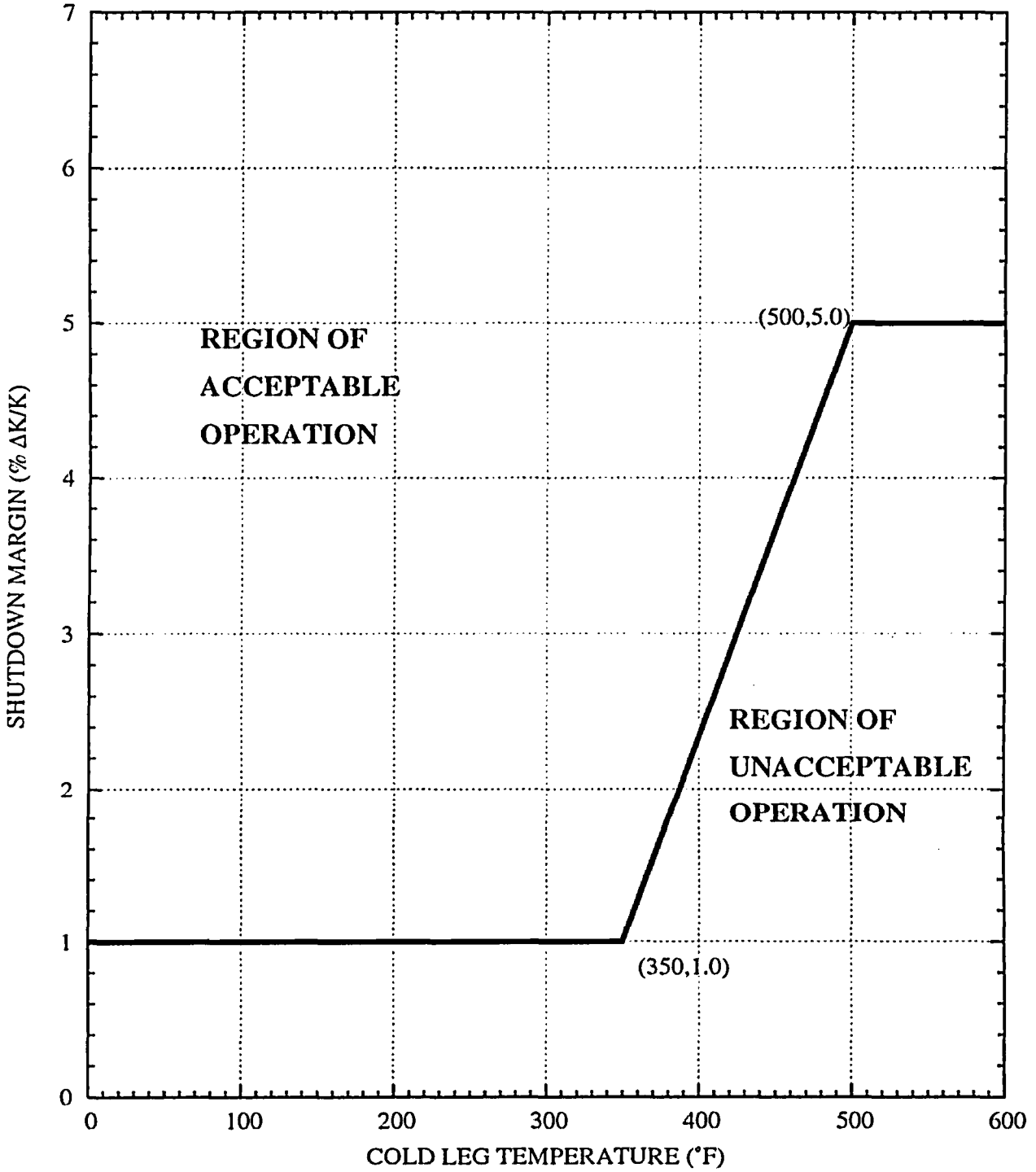


FIGURE 3.1.2-1
SHUTDOWN MARGIN VERSUS COLD LEG TEMPERATURE
REACTOR TRIP BREAKERS CLOSED

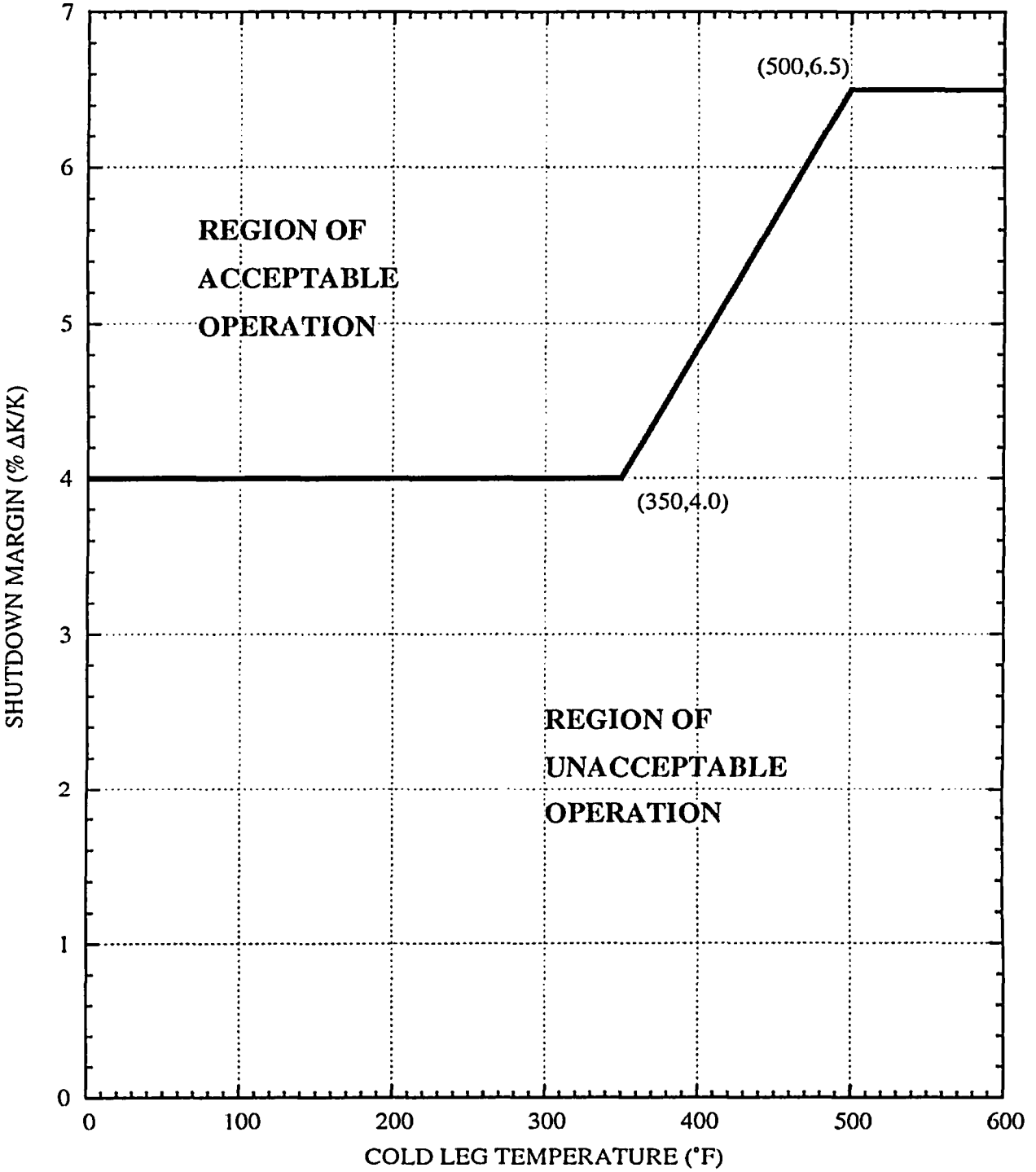


FIGURE 3.1.4-1
MTC ACCEPTABLE OPERATION, MODES 1 AND 2

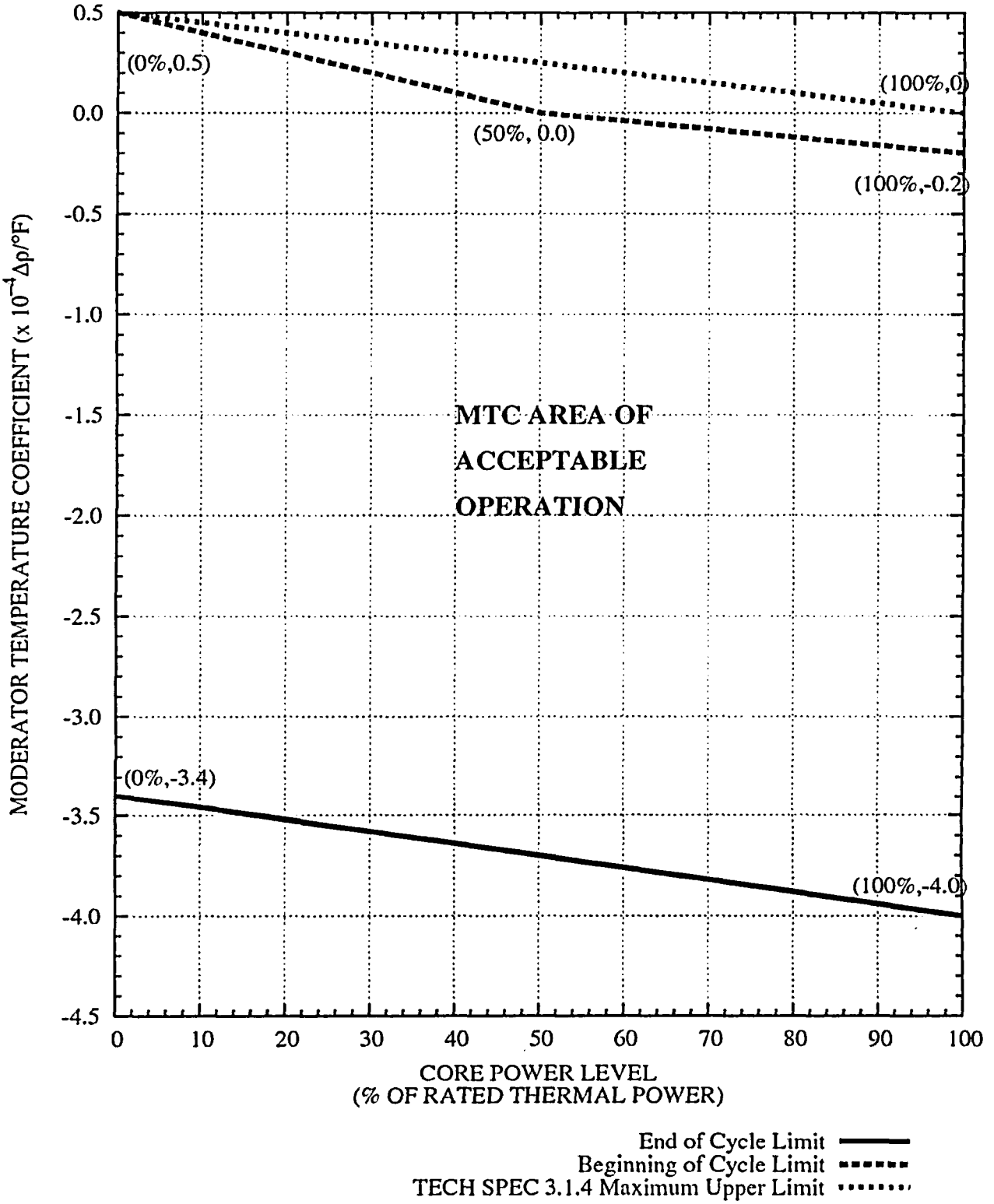
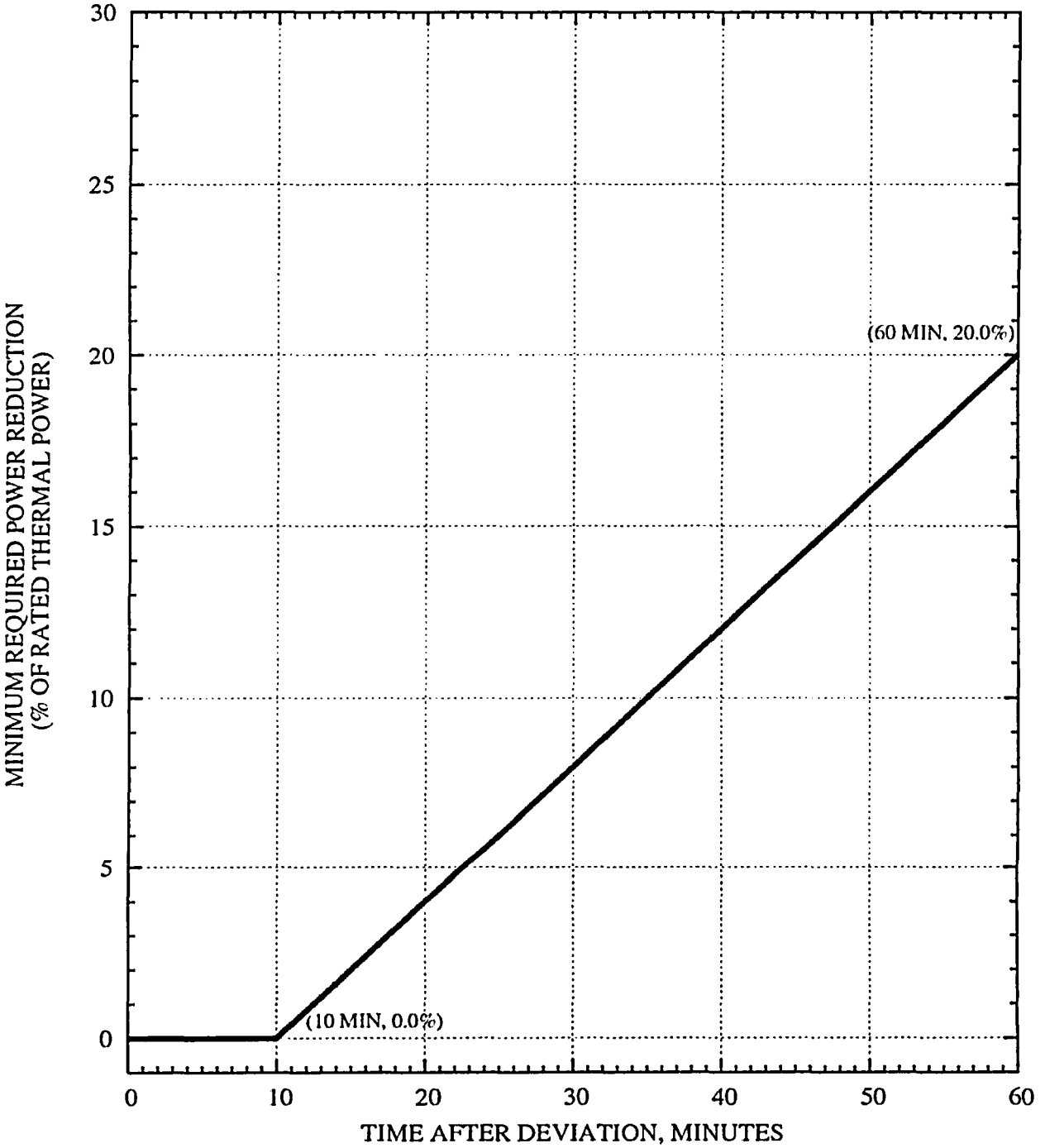
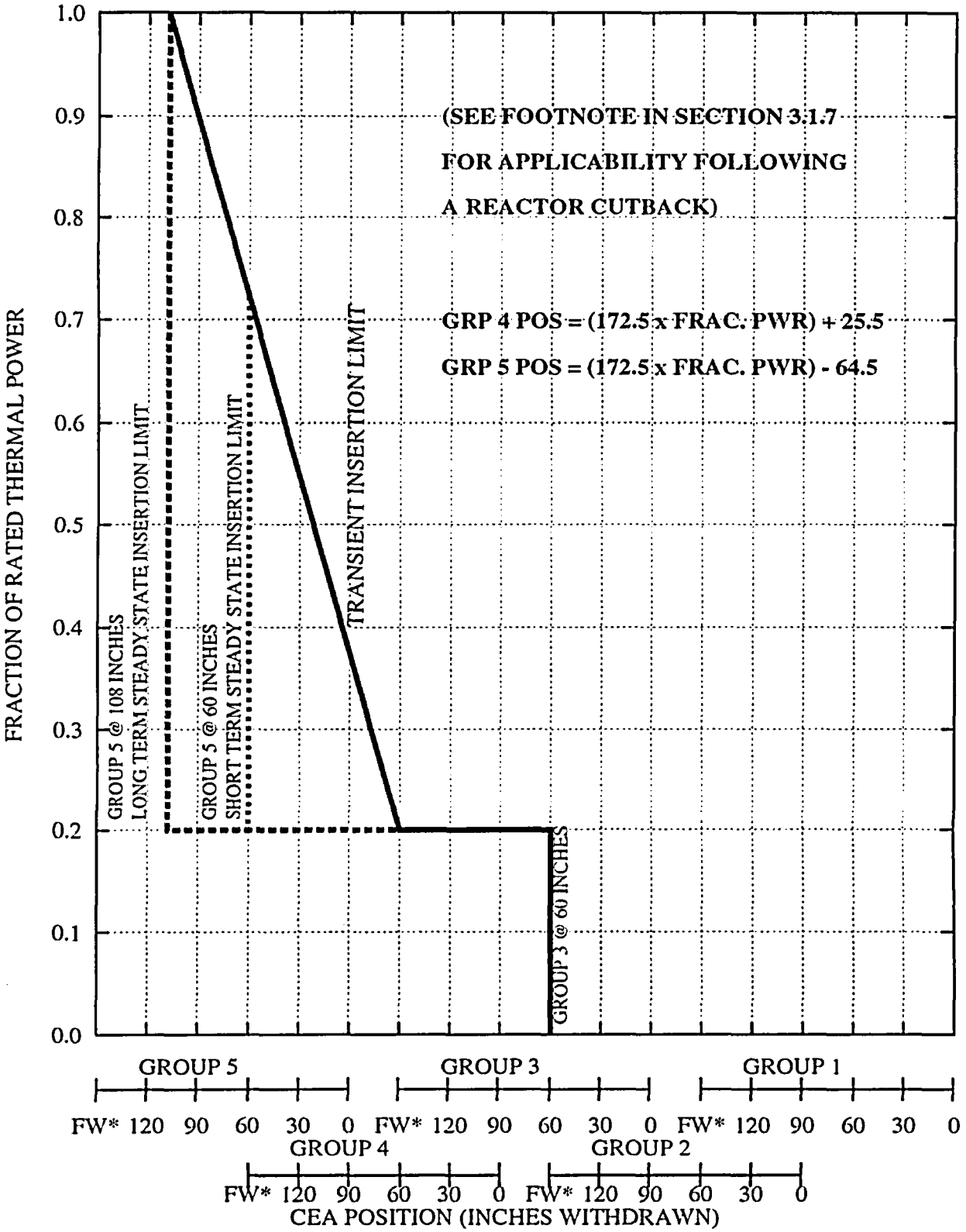


FIGURE 3.1.5-1
CORE POWER LIMIT AFTER CEA DEVIATION*



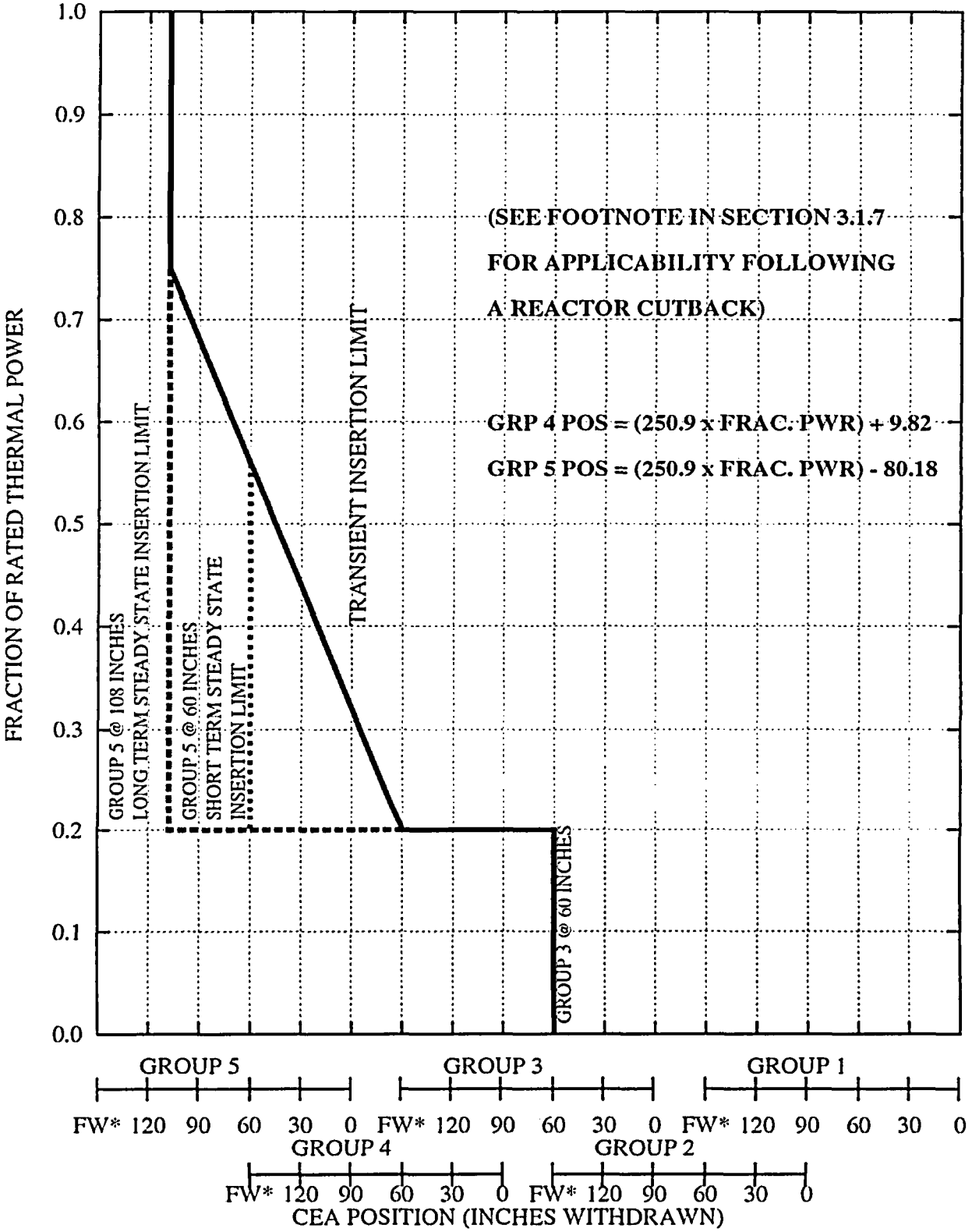
* WHEN CORE POWER IS REDUCED TO 55% OF RATED THERMAL POWER PER THIS LIMIT CURVE, FURTHER REDUCTION IS NOT REQUIRED.

FIGURE 3.1.7-1
CEA INSERTION LIMITS VERSUS THERMAL POWER
(COLSS IN SERVICE)



*Fully Withdrawn is defined as ≥147.75" (Pulse Counter) and ≥145.25" (RSPT)

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



*Fully Withdrawn is defined as ≥147.75" (Pulse Counter) and ≥145.25" (RSPT)

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

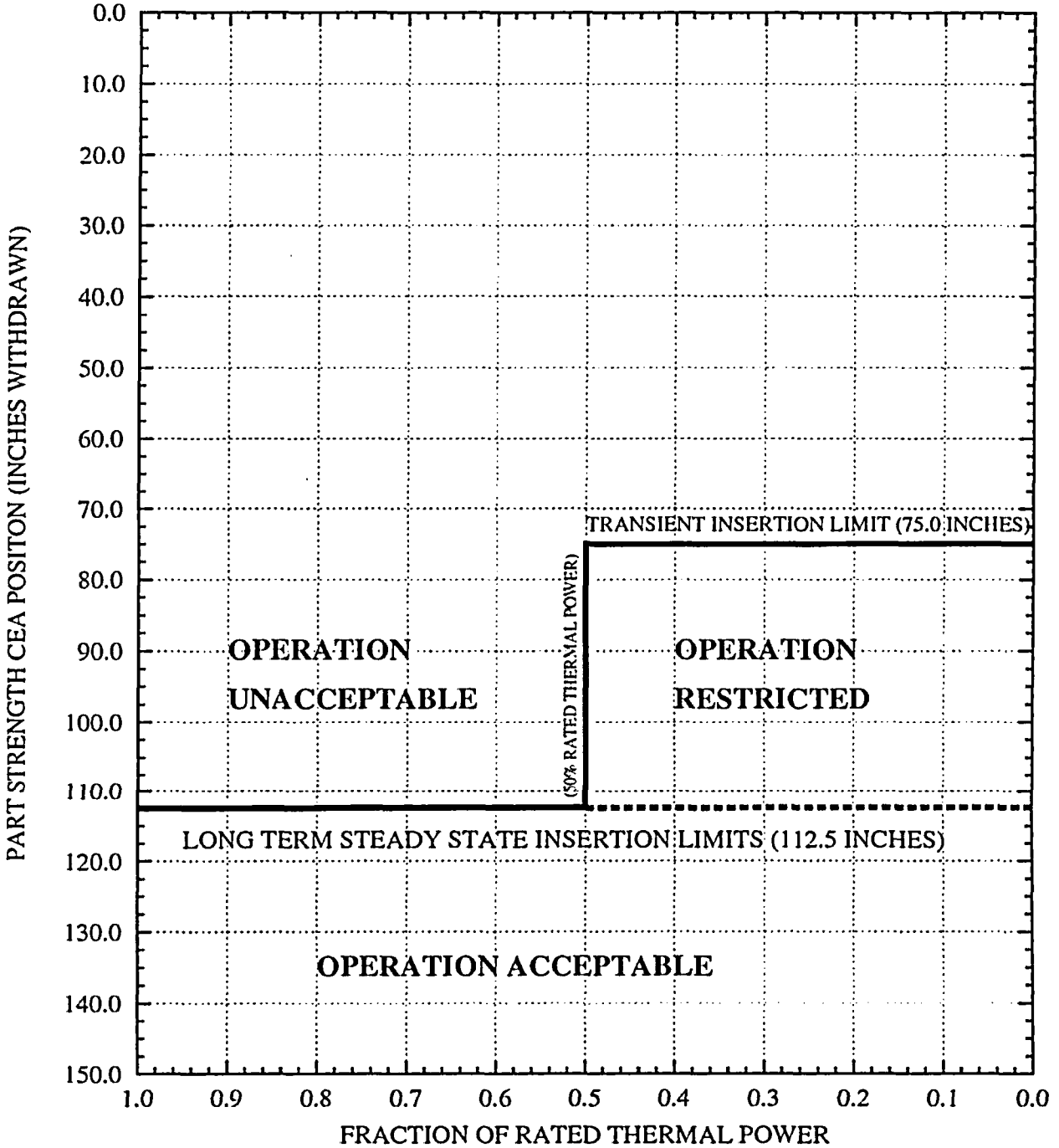


FIGURE 3.2.3-1

AZIMUTHAL POWER TILT VERSUS THERMAL POWER

(COLSS IN SERVICE)

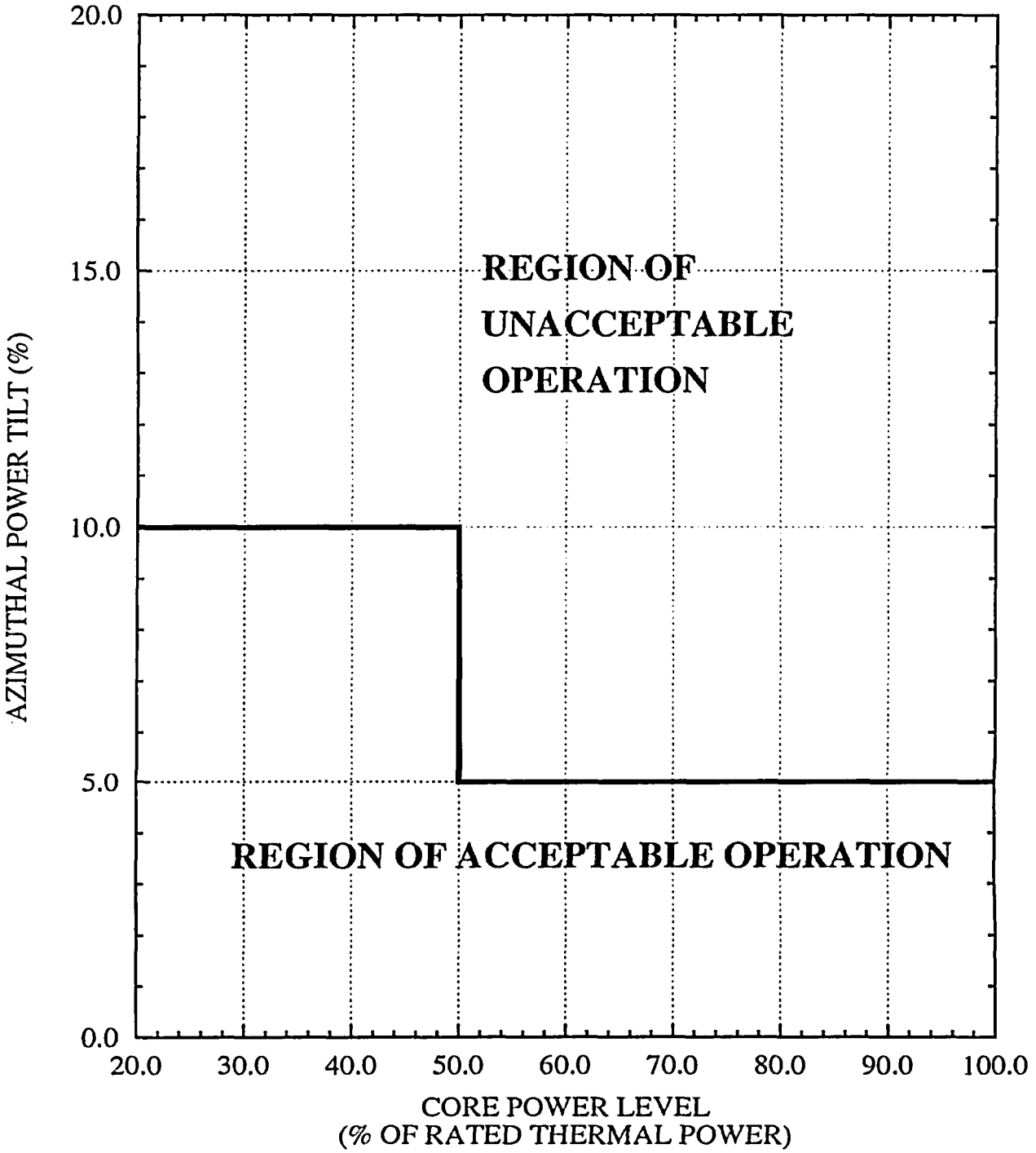


FIGURE 3.2.4-1
COLSS DNBR OPERATING LIMIT
ALLOWANCE FOR BOTH CEAC's INOPERABLE

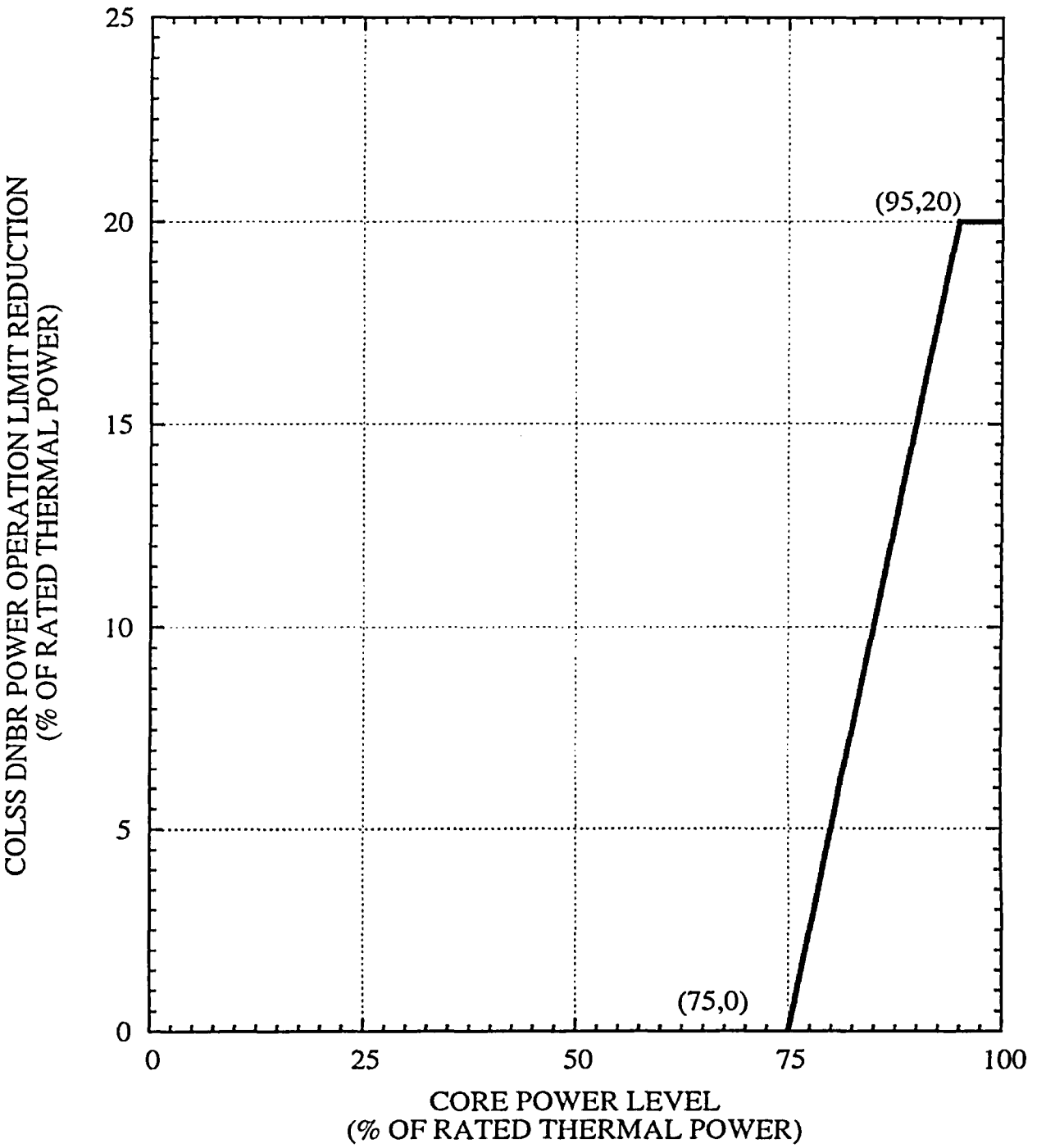


FIGURE 3.2.4-2

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

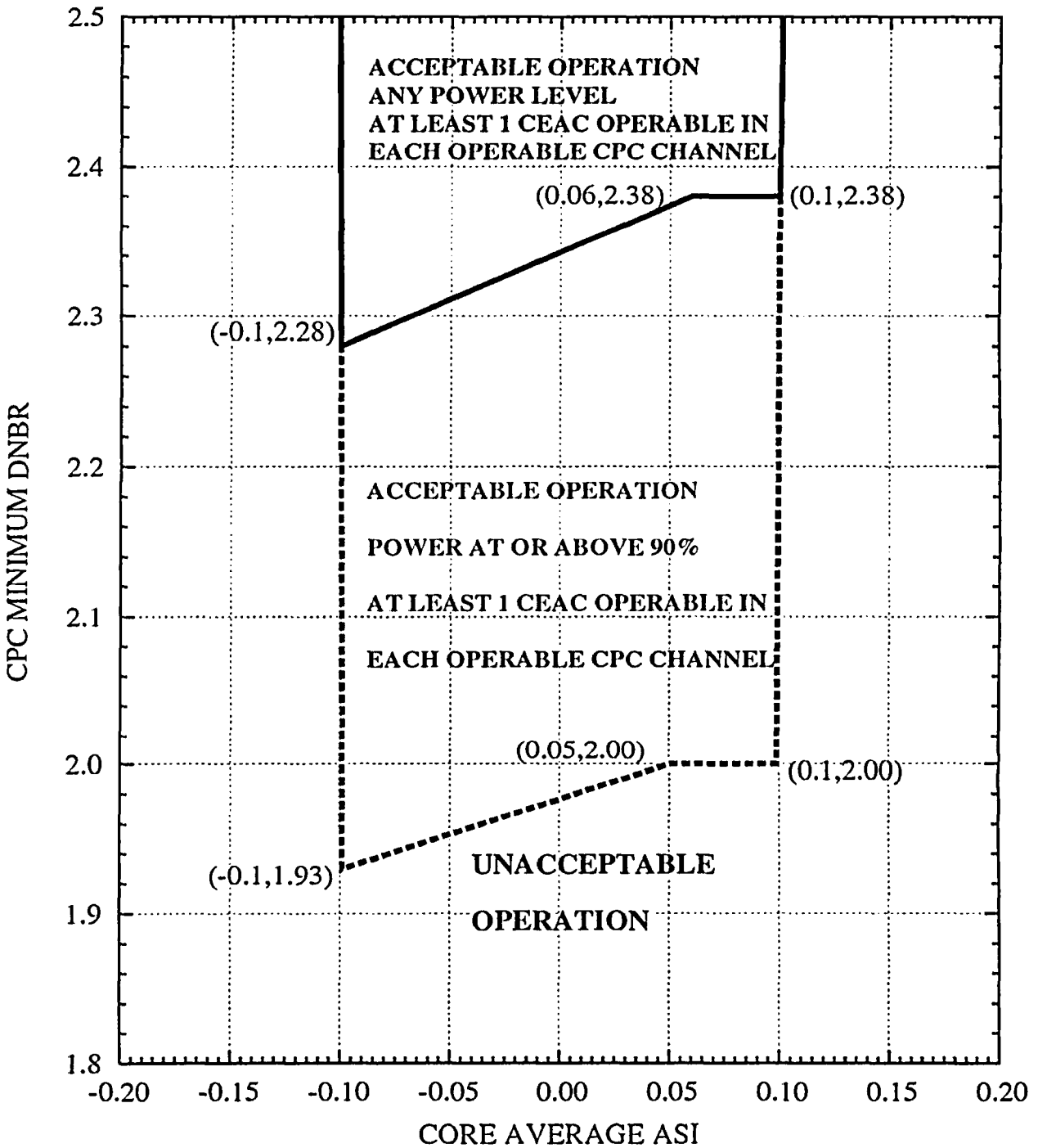


FIGURE 3.2.4-3

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

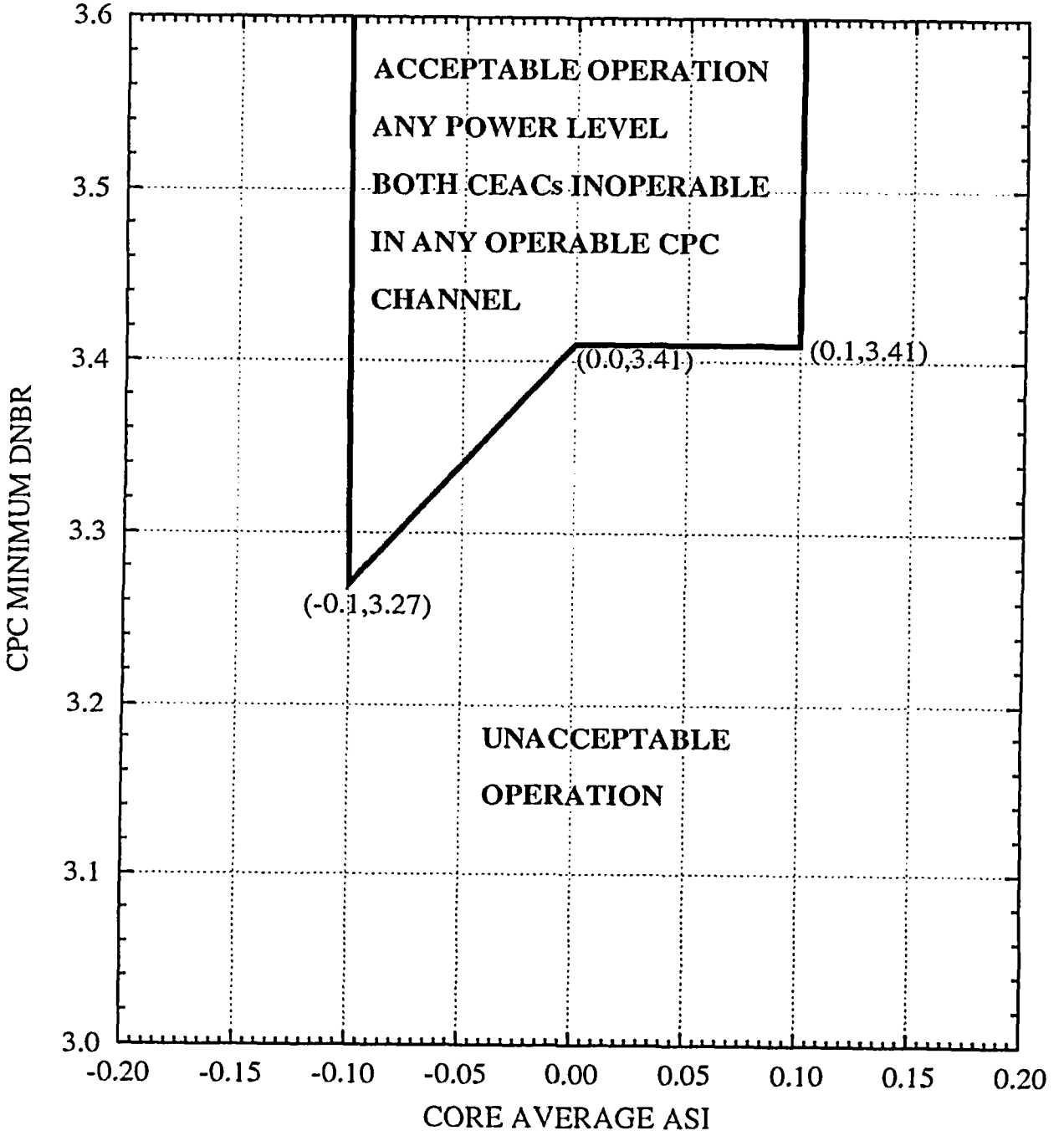


Table 3.3.12-1

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

Enclosure

PVNGS Unit 3 Core Operating Limits Report (COLR)
Revision 16

CORE OPERATING LIMITS REPORT

PALO VERDE NUCLEAR GENERATING STATION (PVNGS)

UNIT 3

Revision 16

Responsible Engineer Date	Delorenzi, Mark J (Z01931)	Digitally signed by Delorenzi, Mark J(Z01931) DN: CN = Delorenzi, Mark J (Z01931) Reason: I am the author of this document. Date: 2006.06.01 14:40:39 -07'00'
Independent Reviewer Date	Webb, James R (V97187)	Digitally signed by Webb, James R(V97187) DN: CN = Webb, James R (V97187) Reason: I have reviewed this document. Date: 2006.06.02 08:19:59 -07'00'
Responsible Section Leader Date	Cannon, Thomas C (Z20485)	Digitally signed by Cannon, Thomas C (Z20485) DN: CN = Cannon, Thomas C(Z20485) Date: 2006.06.07 08:20:06 -07'00'

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 Strength 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 COLR contains the complete identification for each of the Technical Specification referenced topical reports (i.e., report number, title, revision, date, and any supplements) that provide the NRC-approved analytical methods used to determine the core operating limits, described in the following documents:

Title	Report No.	Rev	Date	Supplement
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 (AR1)	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-N001-1900-01192-3)	CENPD-132	N.A.	March 2001	4-P-A
6) Calculative Methods for the CE Small Break LOCA Evaluation Model (13-N001-1900-01185-3)	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-005)	NFM-005	N.A.	January 2006	N.A.

Title	Report No.	Rev	Date	Supplement
9) Technical Description Manual for the CENTS CodeVolume 1 (CENTS-TD MANUAL-VOL 1)	CE-NPD 282-P-A Vols. 1	2	March 2005	N.A.
10) Technical Description Manual for the CENTS Code Volume 2 (CENTS-TD MANUAL-VOL 2)	CE-NPD 282-P-A Vols. 2	2	March 2005	N.A.
11) Technical Description Manual for the CENTS CodeVolume 3 (CENTS-TD MANUAL-VOL 3)	CE-NPD 282-P-A Vols. 3	2	March 2005	N.A.
12) 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.

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-strength or part-strength 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, regulating CEA groups shall be limited to the withdrawal sequence and to the insertion limits[1] shown in Figure 3.1.7-2.[2] Regulating Groups 1 and 2 CEAs shall be maintained fully withdrawn[3] while in Modes 1 and 2 (except while performing SR 3.1.5.3).

[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] Fully withdrawn - ≥147.75" (Pulse Counter indication) and ≥145.25" (RSPT indication)

3.1.8 - Part Strength CEA Insertion Limits

One or more CEACs OPERABLE: The part strength 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 10% with COLSS IN SERVICE when power is greater than 20% and less than or equal to 50%. AZIMUTHAL POWER TILT (T_q) shall be less than or equal to 5% with COLSS IN SERVICE when power is greater than 50%. See Figure 3.2.3-1.

3.2.4 - Departure From Nucleate Boiling Ratio (DNBR)

COLSS IN SERVICE and Both CEACs INOPERABLE - Maintain 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 - Operate within the region of acceptable operation of Figure 3.2.4-2 using any operable CPC channel.

COLSS OUT OF SERVICE and CEACs INOPERABLE - Operate 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 $>20\%$ and $< 50\%$

COLSS OUT OF SERVICE (CPC)
$-0.10 \leq ASI \leq 0.10$ for power $>20\%$

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

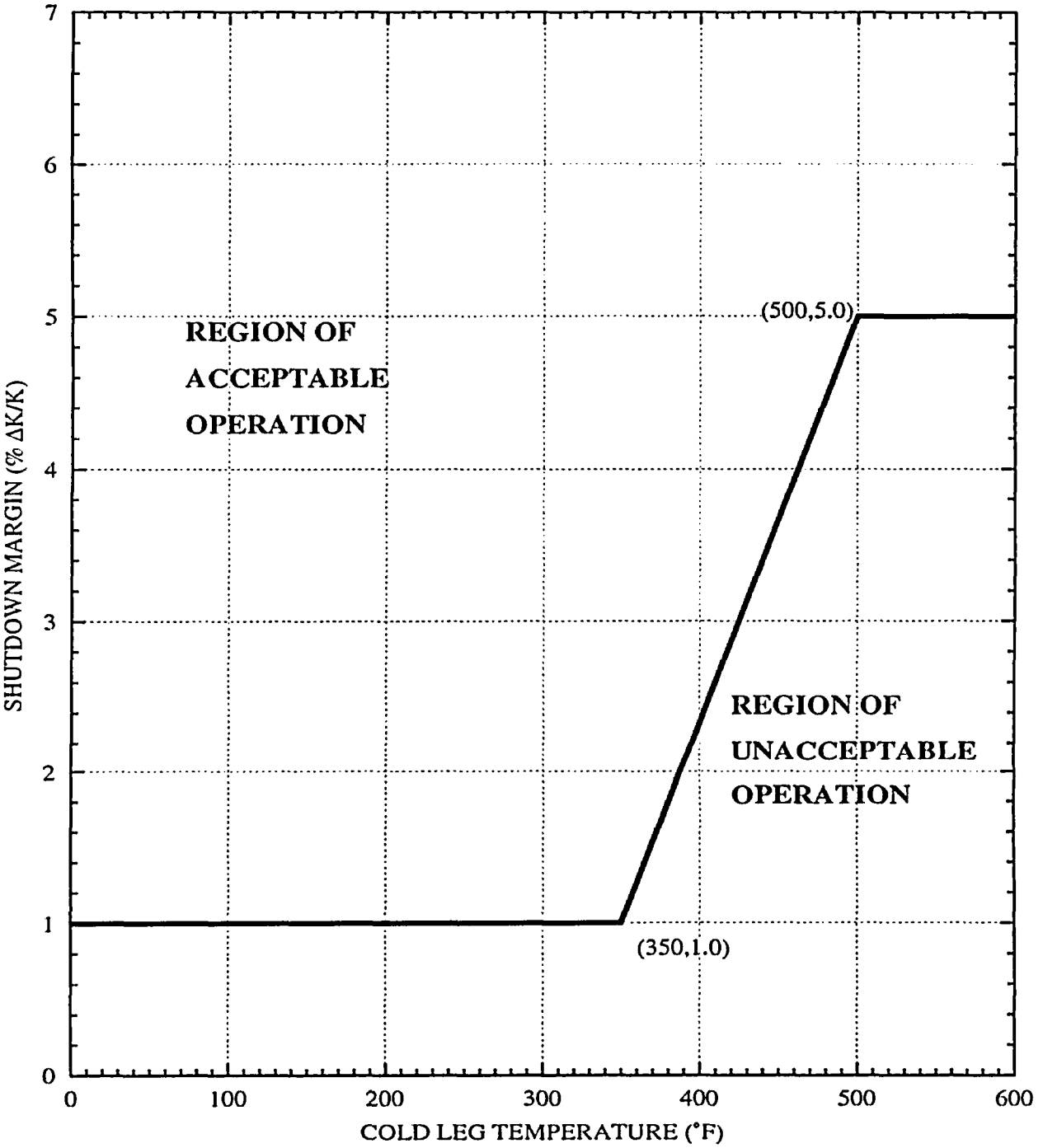


FIGURE 3.1.2-1
SHUTDOWN MARGIN VERSUS COLD LEG TEMPERATURE
REACTOR TRIP BREAKERS CLOSED

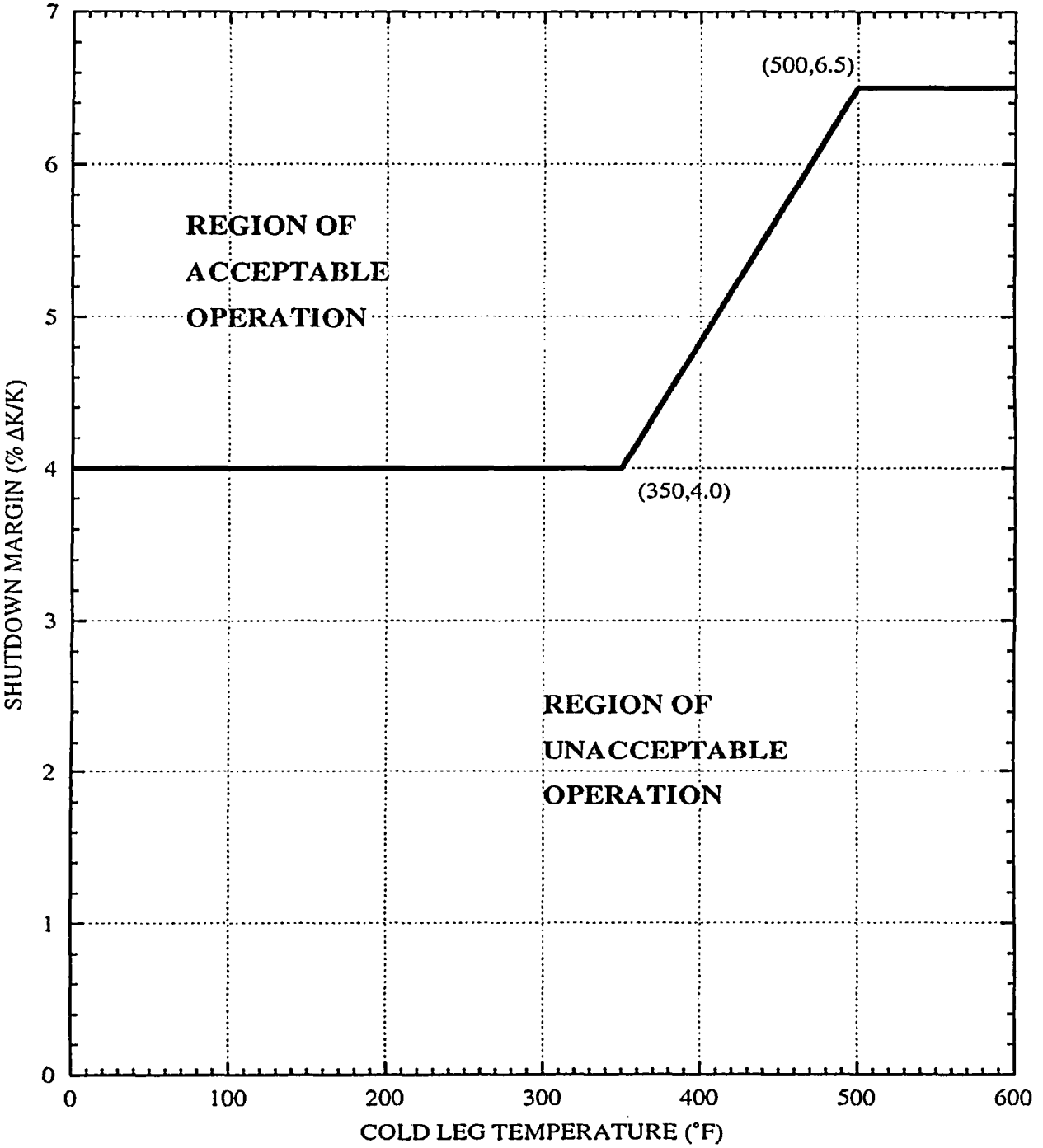


FIGURE 3.1.4-1
MTC ACCEPTABLE OPERATION, MODES 1 AND 2

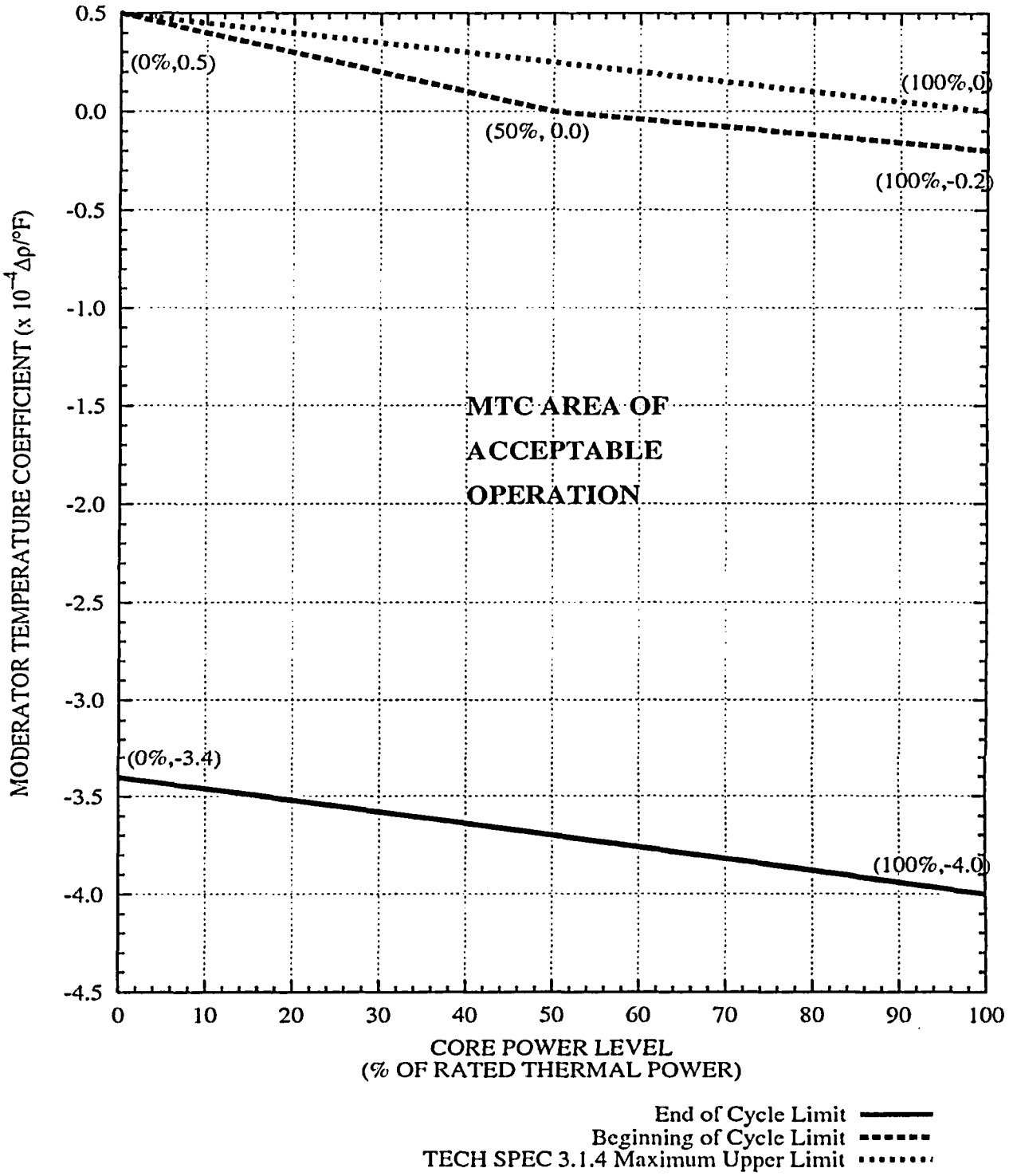
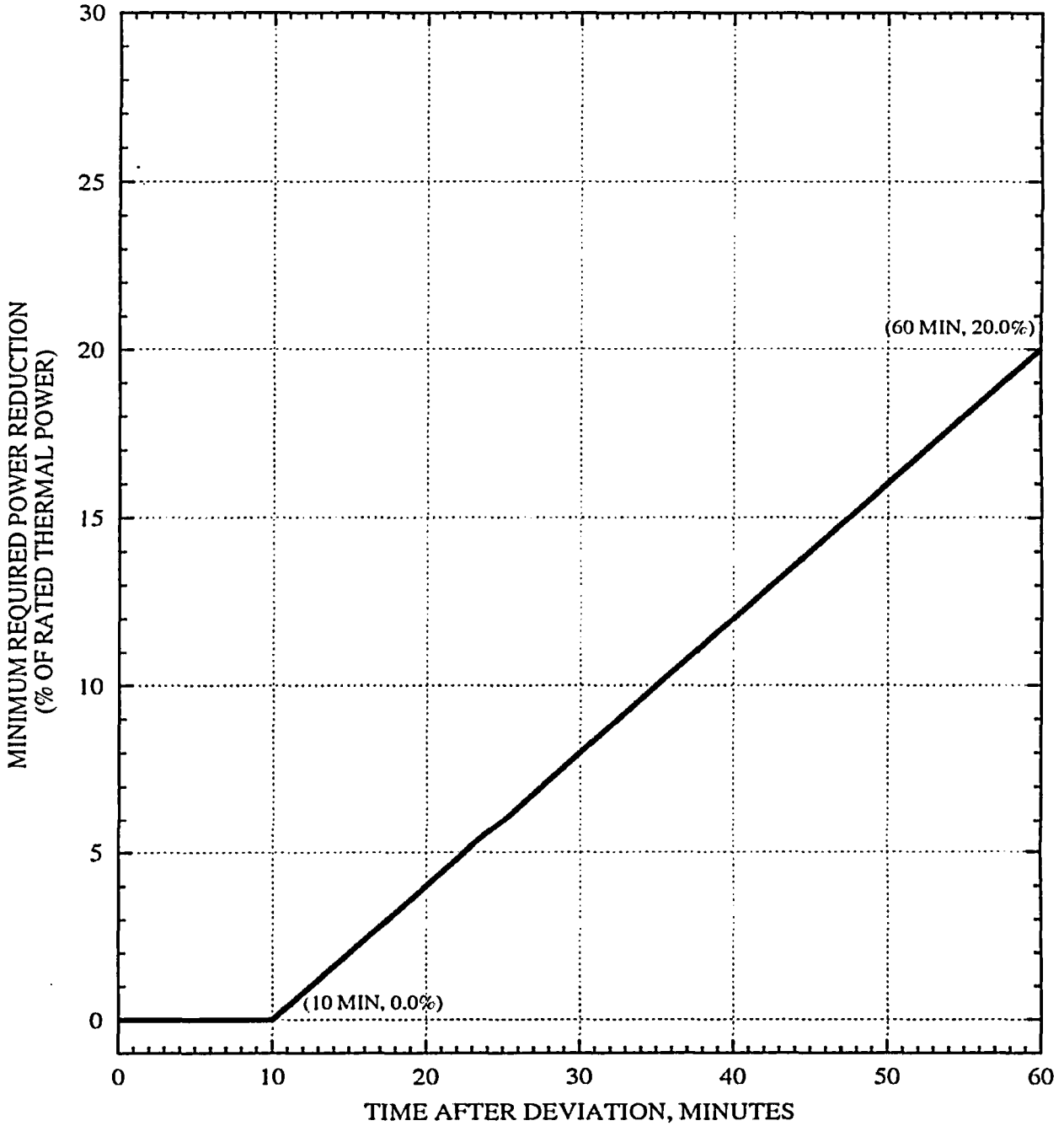


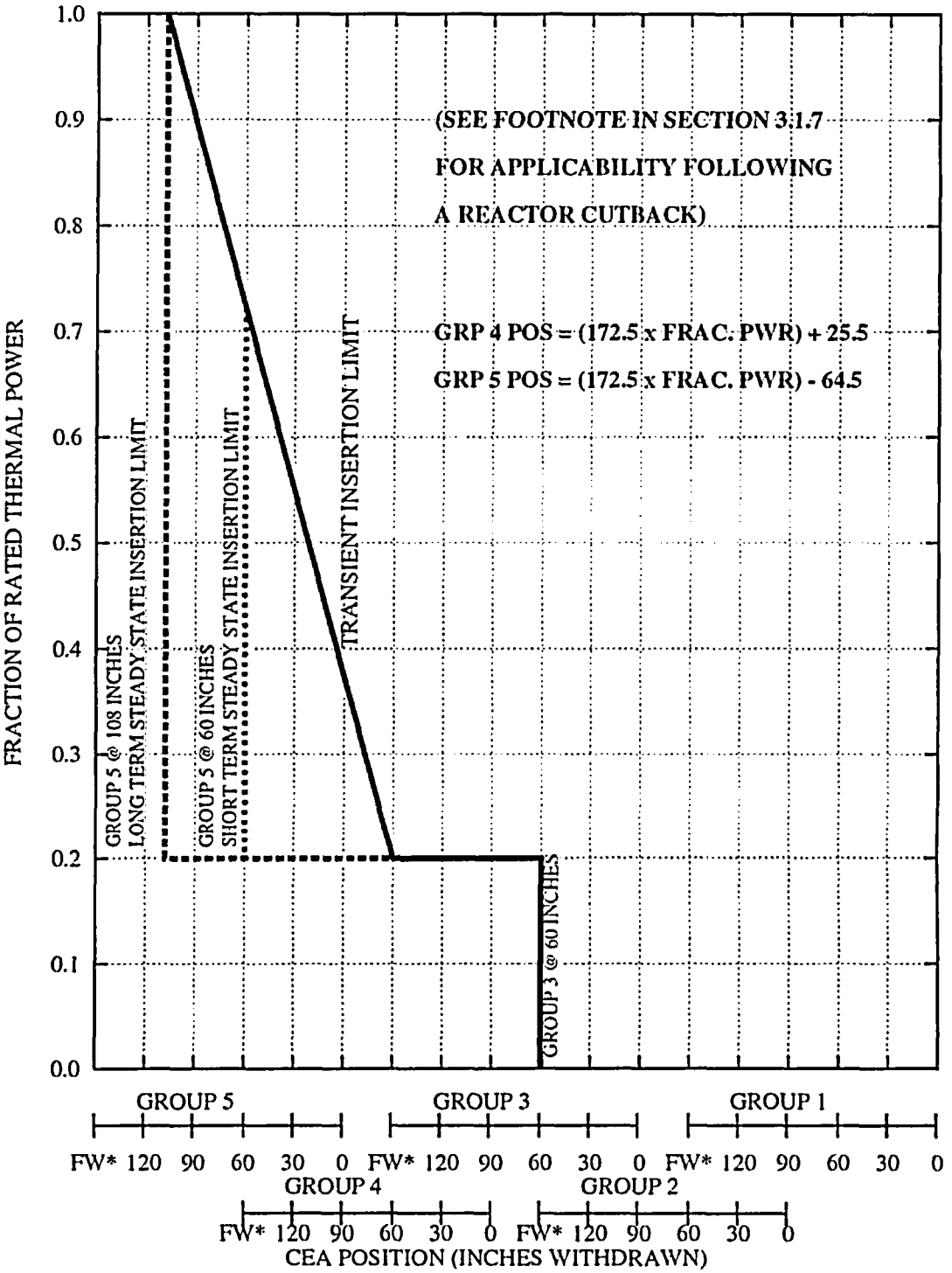
FIGURE 3.1.5-1
CORE POWER LIMIT AFTER CEA DEVIATION*



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

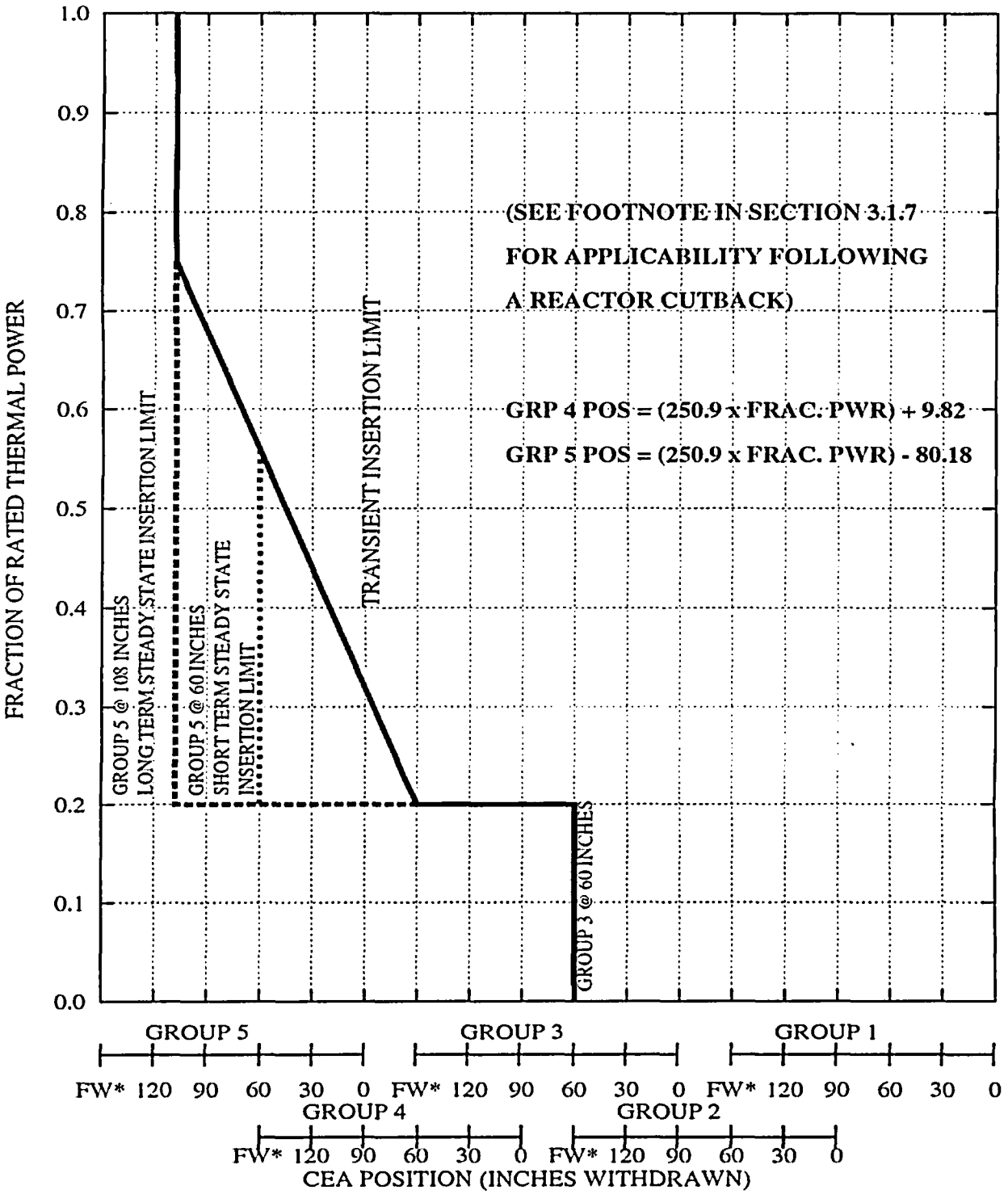
FIGURE 3.1.7-1

CEA INSERTION LIMITS VERSUS THERMAL POWER (COLSS IN SERVICE)



*Fully Withdrawn is defined as ≥147.75" (Pulse Counter) and ≥145.25" (RSPT)

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



*Fully Withdrawn is defined as ≥147.75" (Pulse Counter) and ≥145.25" (RSPT)

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

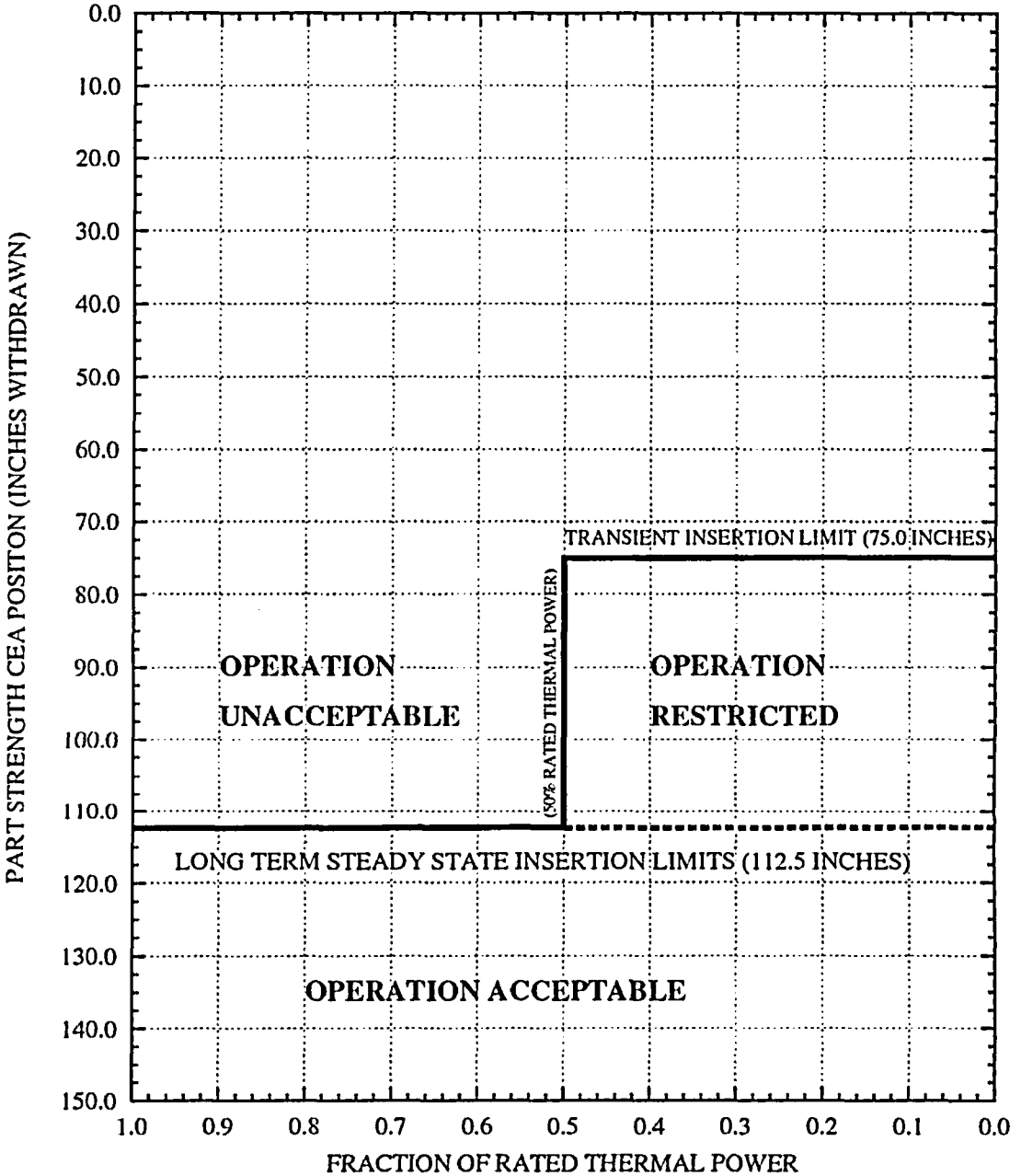


FIGURE 3.2.3-1

AZIMUTHAL POWER TILT VERSUS THERMAL POWER

(COLSS IN SERVICE)

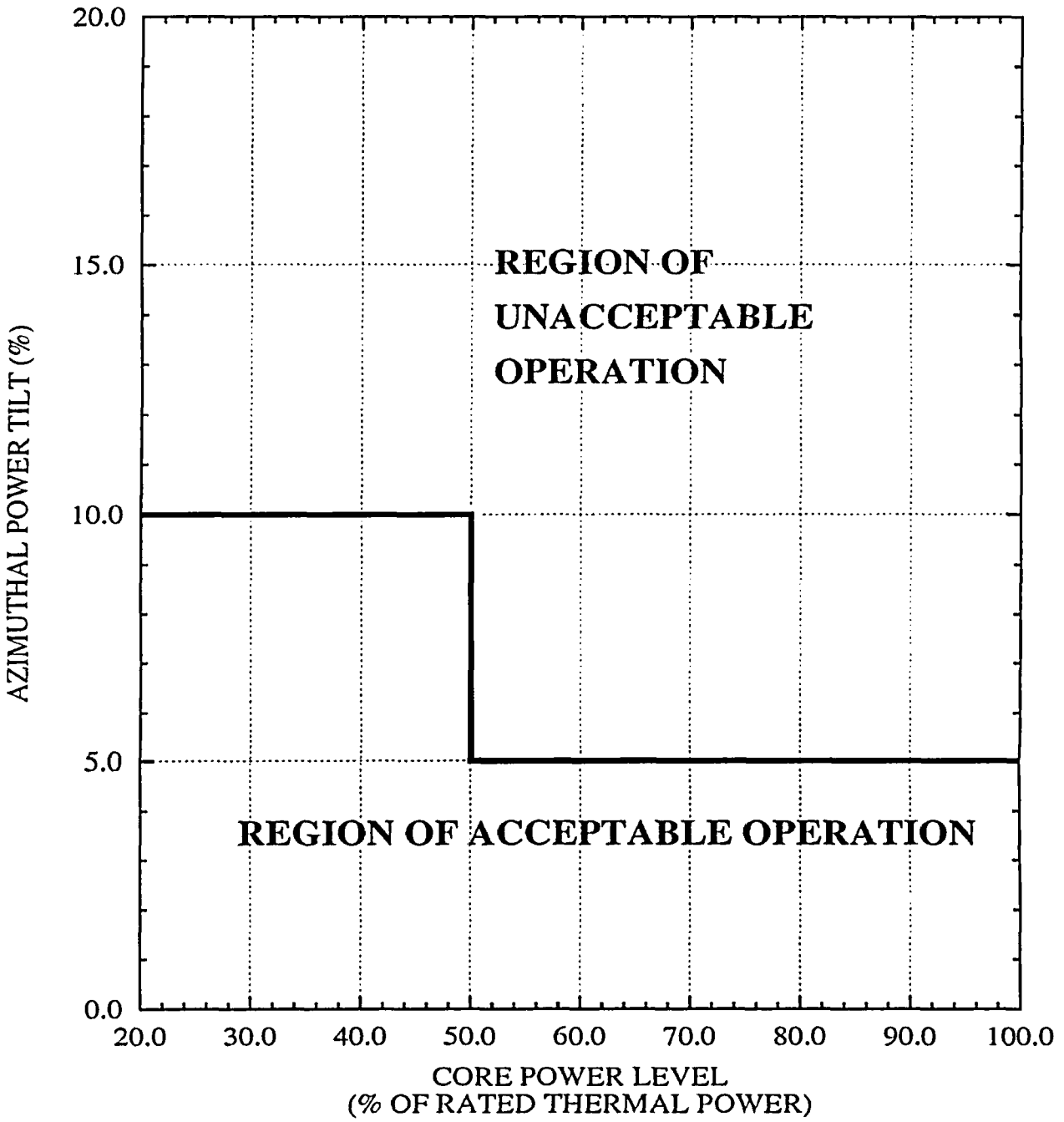


FIGURE 3.2.4-1
COLSS DNBR OPERATING LIMIT
ALLOWANCE FOR BOTH CEAC's INOPERABLE

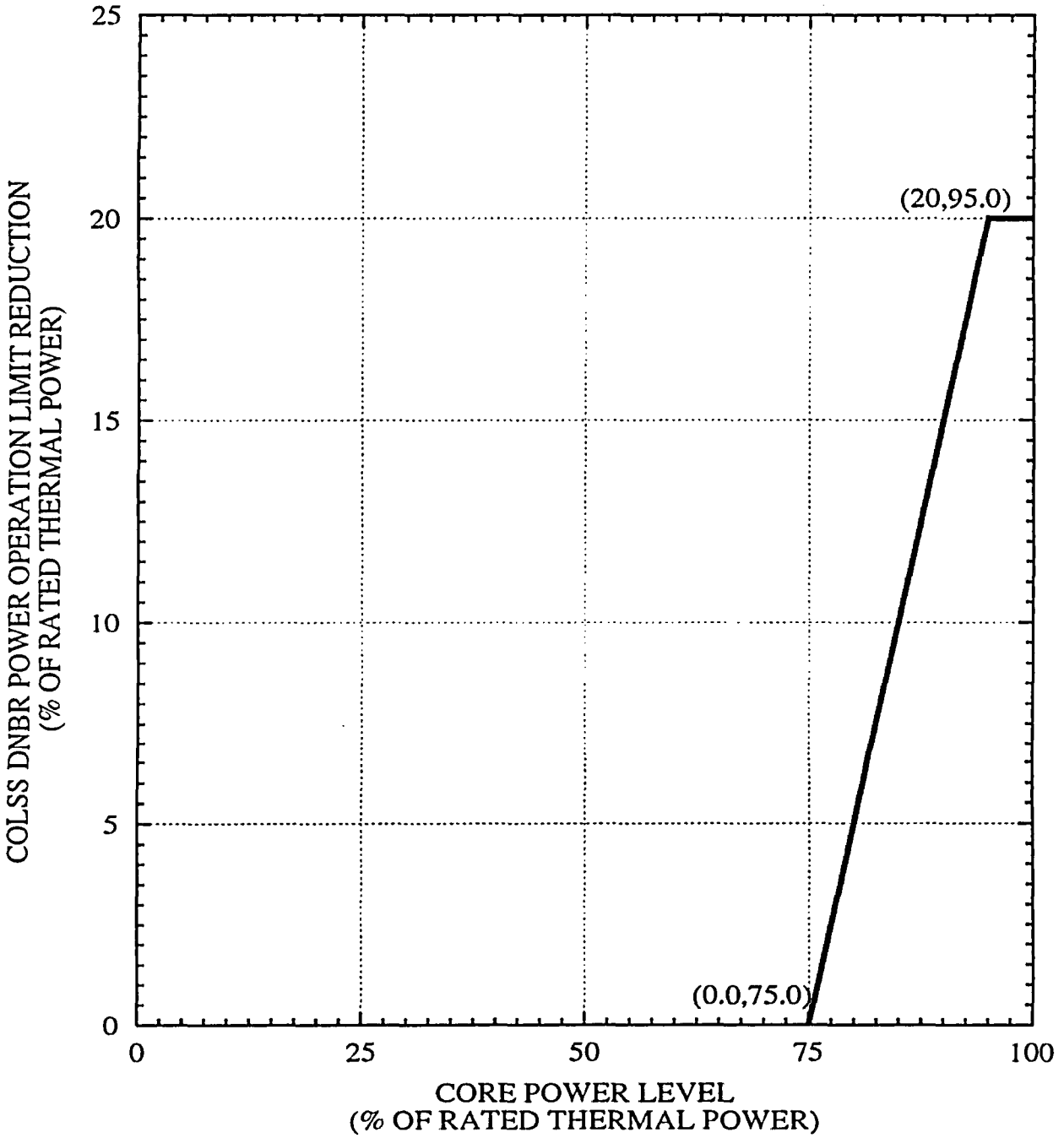


FIGURE 3.2.4-2
DNBR MARGIN OPERATING LIMIT BASED ON THE CORE PROTECTION CALCULATORS (COLSS OUT OF SERVICE, CEAC's OPERABLE)

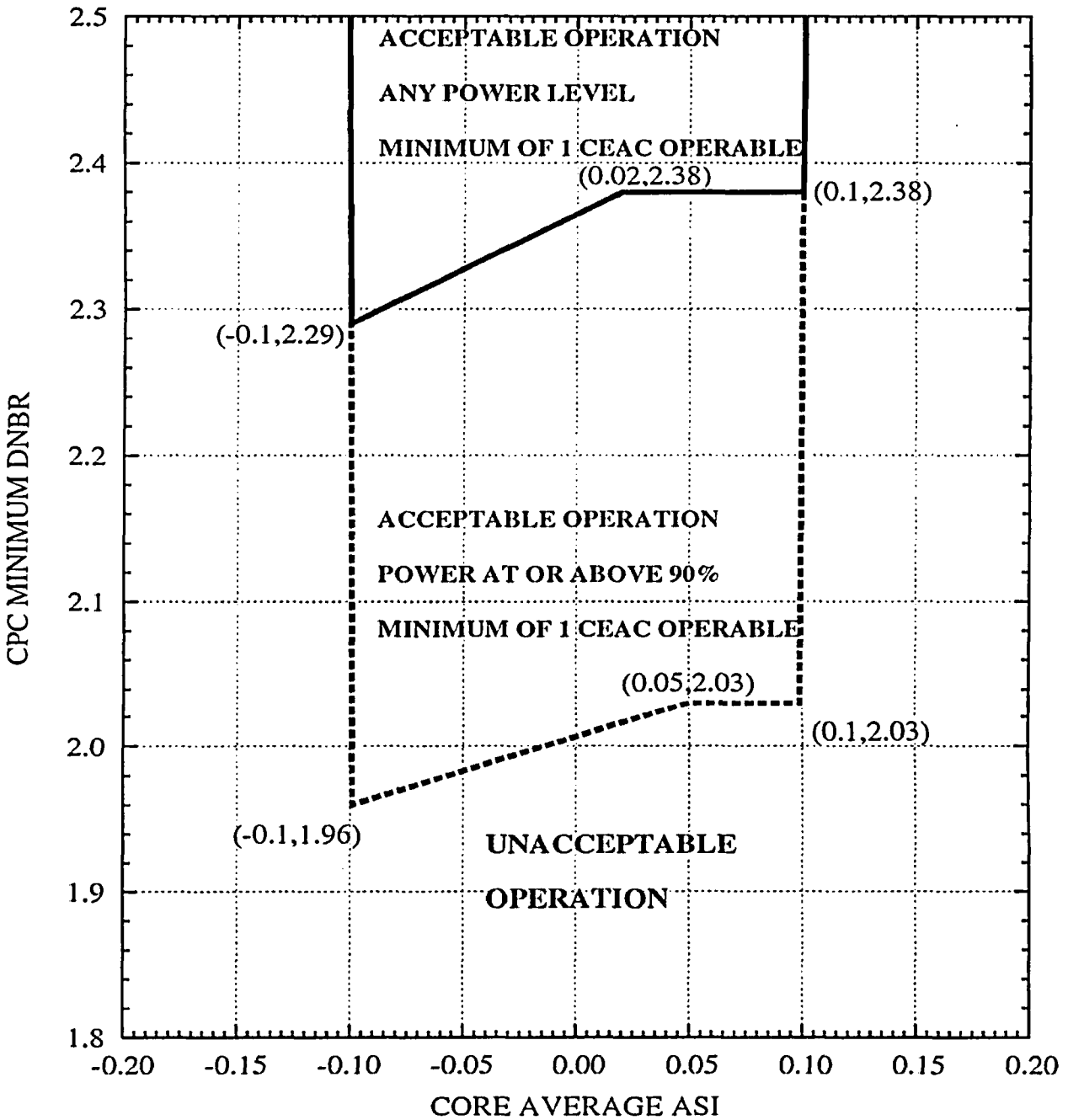


FIGURE 3.2.4-3

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

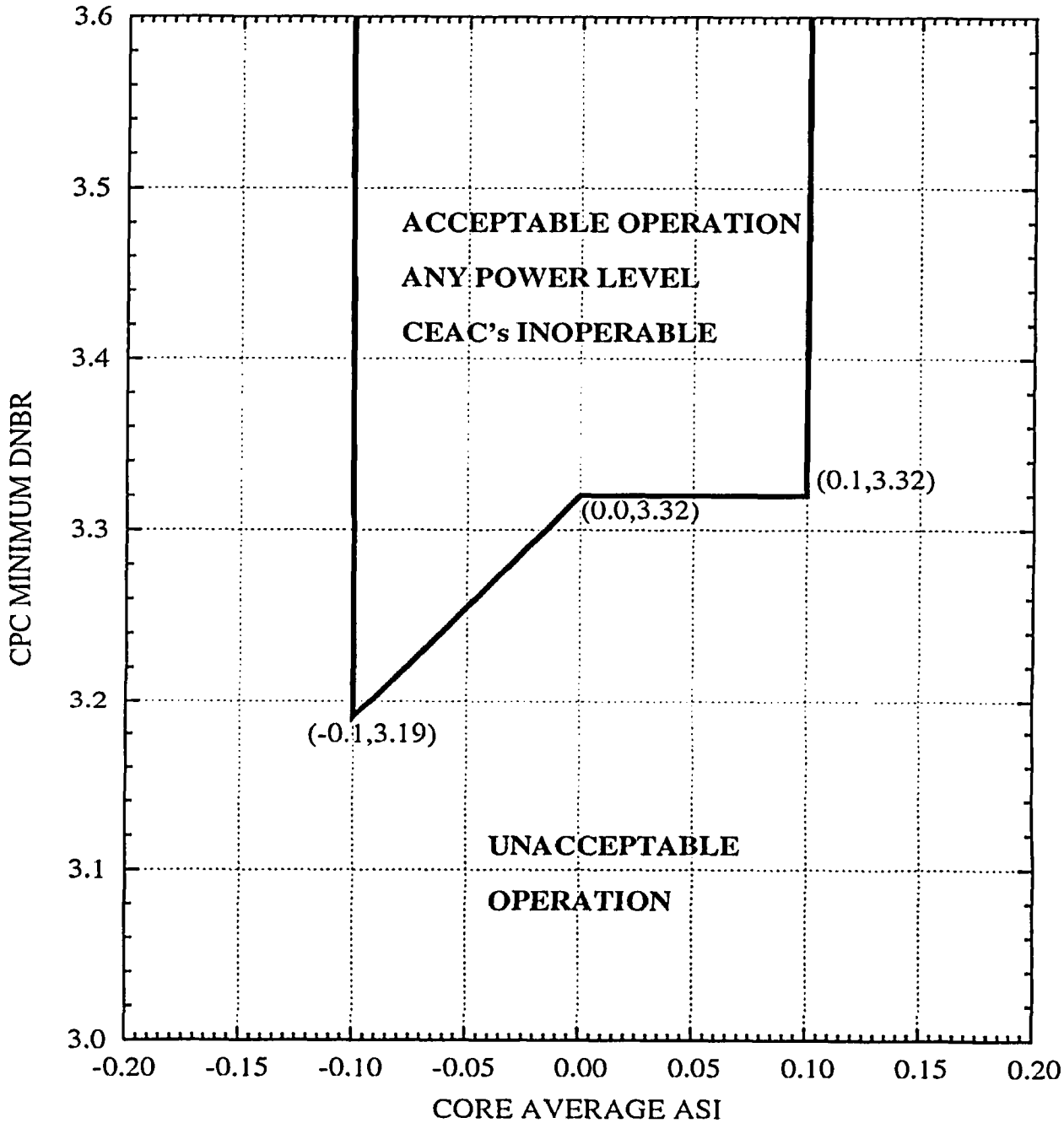


Table 3.3.12-1

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