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W3F1-2005-0033

May 17, 2005

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Core Operating Limits Report – Cycle 14 Revision 0
Waterford Steam Electric Station, Unit 3
Docket No. 50-382
License No. NPF-38

Dear Sir or Madam:

Waterford 3 Technical Specification 6.9.1.11.3 requires submittal of the Core Operating Limits Report for each reload cycle. Attached is the Waterford 3 submittal of the Core Operating Limits Report for Cycle 14.

If you have any questions concerning this submittal please contact E.G. Wiegert at (504) 739-6779.

There are no new commitments contained in this submittal.

Sincerely,

R.J. Murillo
Licensing Manager, Acting

RJM/RLW/cbh

A001

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Attachment 1

W3F1-2005-0033

Waterford 3 Core Operating Limits Report
Cycle 14, Revision 0

ENTERGY OPERATIONS

WATERFORD 3

CORE OPERATING LIMITS REPORT

FOR CYCLE 14

REVISION 0

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WATERFORD 3

CORE OPERATING LIMITS REPORT
CYCLE 14, REVISION 0

LIST OF EFFECTIVE PAGES	
Revision 0	Pages 1-6, COLR 3/4 1-1 through COLR 3/4 9-1 and Pages 34 through 35

LIST OF FIGURES

LIST OF EFFECTIVE FIGURE PAGES	
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LIST OF TABLES PAGE

LIST OF EFFECTIVE TABLE PAGES	
Revision 0	COLR 3/4 1-15A through COLR 3/4 1-15E

WATERFORD 3

CORE OPERATING LIMITS REPORT
CYCLE 14, REVISION 0

I. INTRODUCTION

This CORE OPERATING LIMITS REPORT (COLR) has been prepared in accordance with the requirements of Waterford 3 Technical Specification 6.9.1.11 for Waterford 3 Cycle 14. The core operating limits have been developed using the NRC approved methodologies specified in Section III. This is Revision 0 of the Cycle 14 COLR.

The major changes between the Cycle 14 Revision 0 COLR and the Cycle 13 COLR are listed below:

- The Table of Contents List of Effective Pages was updated.
- The List of Figures was revised to add COLR Figure 9A and to update the List of Effective Figure Pages
- This Introduction section was revised to reflect the changes for Cycle 14.
- Figure 2 was changed to limit the most-negative hot full power MTC to less negative than -3.9×10^{-4} $\Delta\rho$/ °F.
- Section 3.2.1 was revised to list the Linear Heat Rate with COLSS in service as 12.9 kw/ft and the Linear Heat Rate with COLSS out of service as 13.2 kw/ft.
- Figure 6 represents the Linear Heat Rate for Cycle 14 of 12.9 kw/ft and constant with temperature with COLSS in Service
- Figure 7 represents the Linear Heat Rate for Cycle 14 of 13.2 kw/ft and constant with temperature with COLSS Out of Service
- Section 3.2.4.c was revised to allow use of Figure 9A
- Notes below the text of Section 3.2.4 for use with Figures 8, 8A, 9 & 9A were updated and new notes were added.
- Figure 8, was revised to incorporate cycle-specific limits for Cycle 14.
- Figure 8A, was revised to provide better resolution for the four power ranges in the lower portion of Figure 8.
- Figure 9, was revised to incorporate cycle-specific limits for Cycle 14.
- Figure 9A, was added to provide better resolution for the four power ranges in the lower portion of Figure 9.
- Section 3.2.7 was revised to incorporate the new Axial Shape Index (ASI) limits required to support extended power uprate and the Cycle 14 COOS analysis.
- Section III.6 was revised to correct the document number.
- Sections III.9 and III.10 were added in accordance with License Amendment 199, Extended Power Uprate.
- Sections III.11, III.12 and III.13 were added in accordance with License Amendment to modify TS 6.9.1.11.1, Core Operating Limits Report. These methodologies were added to support eventual adoption of Zirconium Diboride as an integral fuel burnable absorber and ZIRLO™ fuel rod cladding.

II. AFFECTED TECHNICAL SPECIFICATIONS

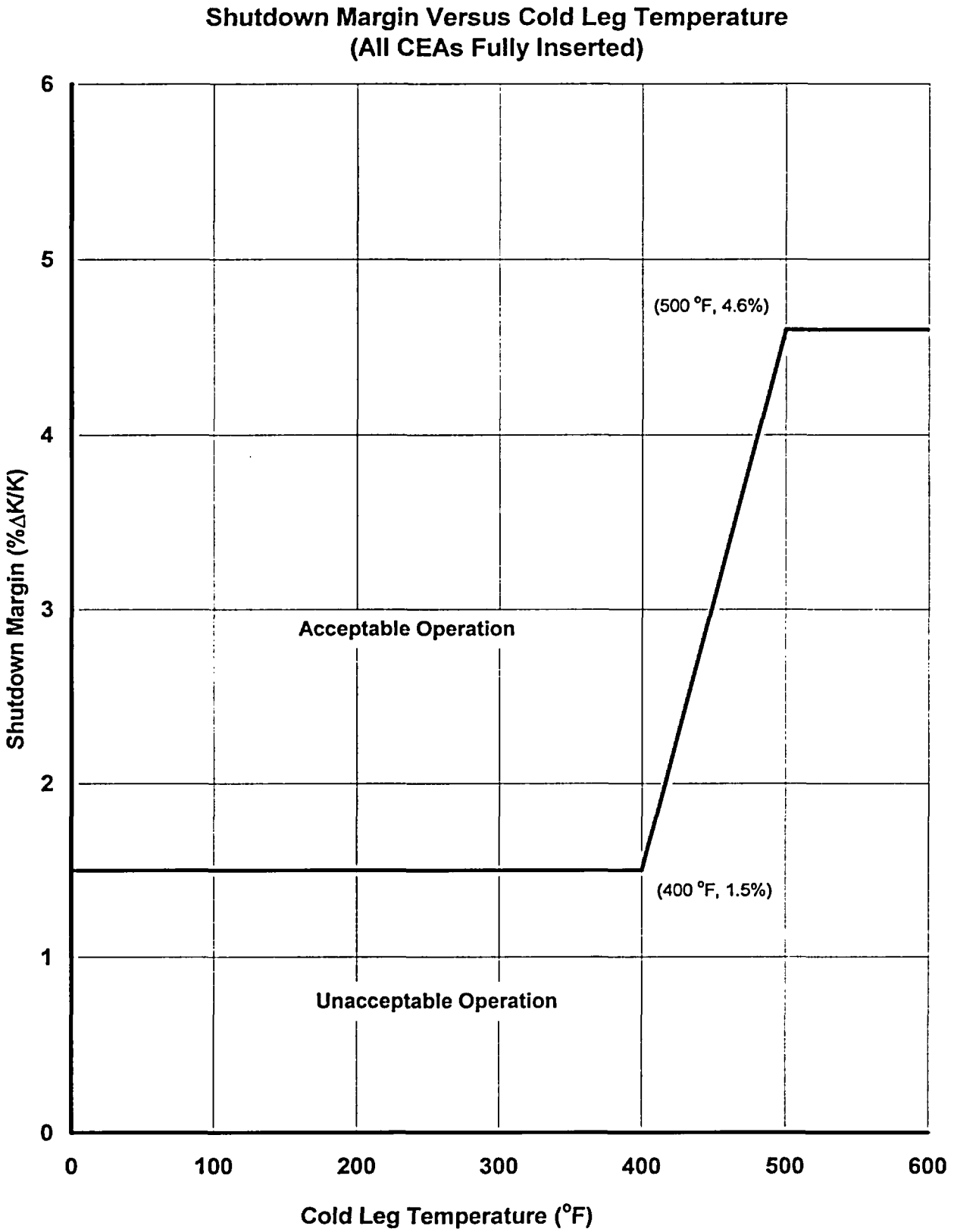
CORE OPERATING LIMITS REPORT

SHUTDOWN MARGIN - ANY CEA WITHDRAWN

3.1.1.1 The SHUTDOWN MARGIN shall be greater than or equal to 5.15% $\Delta k/k$ when T_{avg} is greater than 200 °F or 2.0% $\Delta k/k$ when T_{avg} is less than or equal to 200 °F.

SHUTDOWN MARGIN - ALL CEAs FULLY INSERTED

3.1.1.2 The SHUTDOWN MARGIN shall be maintained within the region of acceptable operation of COLR Figure 1.



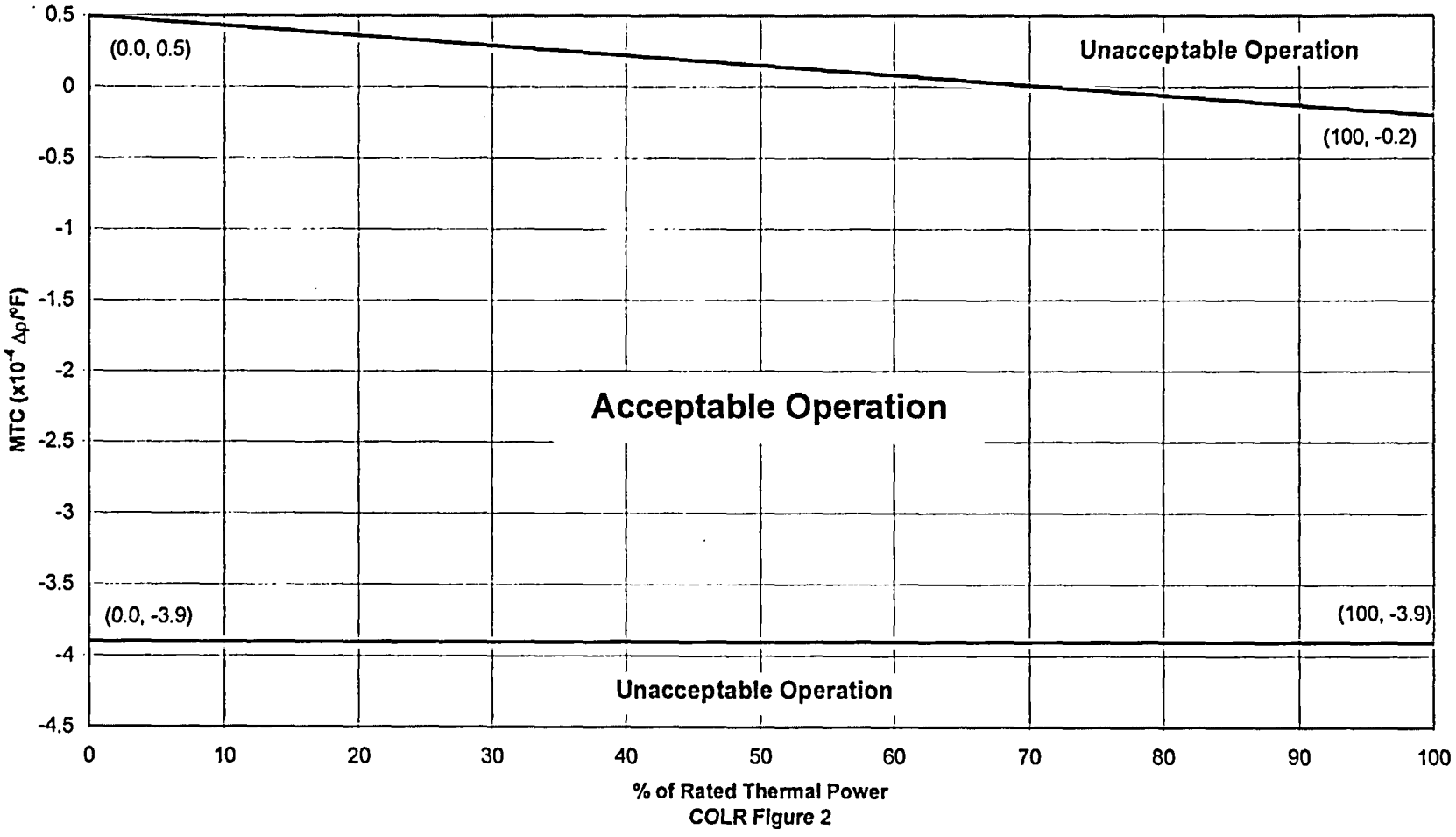
COLR Figure 1

CORE OPERATING LIMITS REPORT

MODERATOR TEMPERATURE COEFFICIENT

3.1.1.3 The Moderator Temperature Coefficient (MTC) shall be maintained within the region of acceptable operation of COLR Figure 2.

Moderator Temperature Coefficient Versus % of Rated Thermal Power



COLR Figure 2

CORE OPERATING LIMITS REPORT

BORON DILUTION

3.1.2.9 See COLR Tables 1 through 5 for required RCS boron concentration monitoring frequencies and Charging Pump operation limits.

SURVEILLANCE REQUIREMENTS

Each required boron dilution alarm shall be adjusted to less than or equal to 1.75 times (1.75x) the existing neutron flux (cps) at the following frequencies:

a. No sooner than one half hour after shutdown and no later than 1 hour after shutdown.

b. At least once per one-half (1/2) hour if the reactor has been shut down $\geq$ 0.5 hour but < 2 hours

c. At least once per hour if the reactor has been shutdown $\geq$ 2 hours but < 10 hours.

d. At least once per 5 hours if the reactor has been shut down $\geq$ 10 hours but < 25 hours.

e. At least once per 24 hours if the reactor has been shut down $\geq$ 25 hours but < 21 days.

f. At least once per 7 days if the reactor has been shut down $\geq$ 21 days.

COLR TABLE 1

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

$K_{eff} > 0.98$

OPERATIONAL MODE	Number of Operating Charging Pumps* 0	1	2	3
3	12 hours	0.75 hours	Operation not allowed **	
4	12 hours		Operation not allowed **	
5 RCS filled	8 hours		Operation not allowed **	
5 RCS partially drained	8 hours		Operation not allowed **	
6		Operation not allowed **		

* Charging pump OPERABILITY for any period of time shall constitute OPERABILITY for the entire monitoring frequency.

** The precluded number of charging pumps shall be verified to be inoperable by racking out their motor circuit breakers.

COLR TABLE 2

REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR K_{eff} GREATER THAN 0.97 AND LESS THAN OR EQUAL TO 0.98

$0.98 \geq K_{eff} > 0.97$

OPERATIONAL MODE	Number of Operating Charging Pumps* 0	1	2	3
3	12 hours	2.0 hours	0.5 hours	Operation not allowed**
4	12 hours	0.75 hours	Operation not allowed**	
5 RCS filled	8 hours	0.75 hours	Operation not allowed**	
5 RCS partially drained	8 hours	0.5 hours	Operation not allowed**	
6		Operation not allowed**		

* Charging pump OPERABILITY for any period of time shall constitute OPERABILITY for the entire monitoring frequency.

** The precluded number of charging pumps shall be verified to be inoperable by racking out their motor circuit breakers.

COLR TABLE 3

REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR K_{eff} GREATER THAN 0.96 AND LESS THAN OR EQUAL TO 0.97

$0.97 \geq K_{eff} > 0.96$

OPERATIONAL MODE	Number of Operating Charging Pumps* 0	1	2	3
3	12 hours	3.0 hours	1.25 hours	0.5 hours
4	12 hours	1.5 hours	Operation not allowed**	
5 RCS filled	8 hours	1.5 hours	Operation not allowed**	
5 RCS partially drained	8 hours	0.75 hours	Operation not allowed**	
6		Operation not allowed**		

* Charging pump OPERABILITY for any period of time shall constitute OPERABILITY for the entire monitoring frequency.

** The precluded number of charging pumps shall be verified to be inoperable by racking out their motor circuit breakers.

COLR TABLE 4

REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR K_{eff} GREATER THAN 0.95 AND LESS THAN OR EQUAL TO 0.96

$0.96 \geq K_{eff} > 0.95$

OPERATIONAL MODE	Number of Operating Charging Pumps* 0	1	2	3
3	12 hours	4.0 hours	2.0 hours	1.0 hours
4	12 hours	2.25 hours	0.75 hours	Operation not allowed**
5 RCS filled	8 hours	2.0 hours	0.75 hours	Operation not allowed**
5 RCS partially drained	8 hours	2.0 hours	0.5 hours	Operation not allowed**
6		Operation not allowed**		

* Charging pump OPERABILITY for any period of time shall constitute OPERABILITY for the entire monitoring frequency.

** The precluded number of charging pumps shall be verified to be inoperable by racking out their motor circuit breakers.

COLR TABLE 5

REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR K_{eff} LESS THAN OR EQUAL TO 0.95

$K_{eff} \leq 0.95$

OPERATIONAL MODE	Number of Operating Charging Pumps* 0	1	2	3
3	12 hours	5.0 hours	2.0 hours	1.0 hours
4	12 hours	2.75 hours	1.0 hours	Operation not allowed**
5 RCS filled	8 hours	3.0 hours	1.0 hours	0.5 hours
5 RCS partially drained	8 hours	2.5 hours	0.75 hours	Operation not allowed**
6	24 hours	2.25 hours	0.5 hours	Operation not allowed**

* Charging pump OPERABILITY for any period of time shall constitute OPERABILITY for the entire monitoring frequency.

** The precluded number of charging pumps shall be verified to be inoperable by racking out their motor circuit breakers.

CORE OPERATING LIMITS REPORT

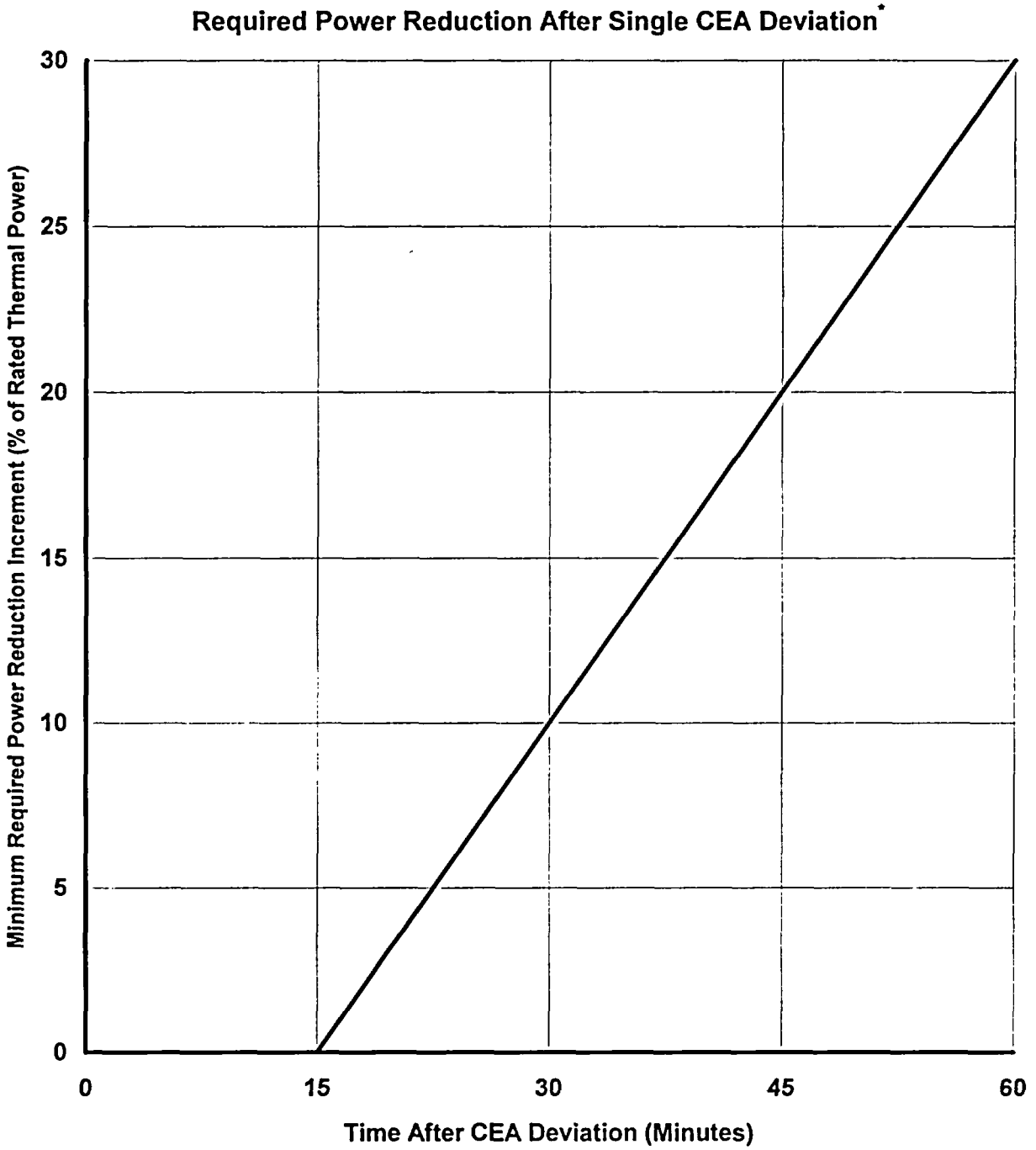
MOVABLE CONTROL ASSEMBLIES - CEA POSITION

3.1.3.1.a With one CEA trippable but misaligned from any other CEA in its group by more than 19 inches, operation in MODES 1 and 2 may continue, provided that core power is reduced in accordance with COLR Figure 3.

3.1.3.1.b With one or more CEAs trippable but misaligned from any other CEAs in its group by more than 7 inches but less than or equal to 19 inches, operation in MODES 1 and 2 may continue, provided that core power is reduced in accordance with COLR Figure 3.

NOTES

1. Item 3.1.3.1.a corresponds with ACTION "c" of Technical Specification 3.1.3.1.
2. Item 3.1.3.1.b corresponds with ACTION "d" of Technical Specification 3.1.3.1.



COLR Figure 3

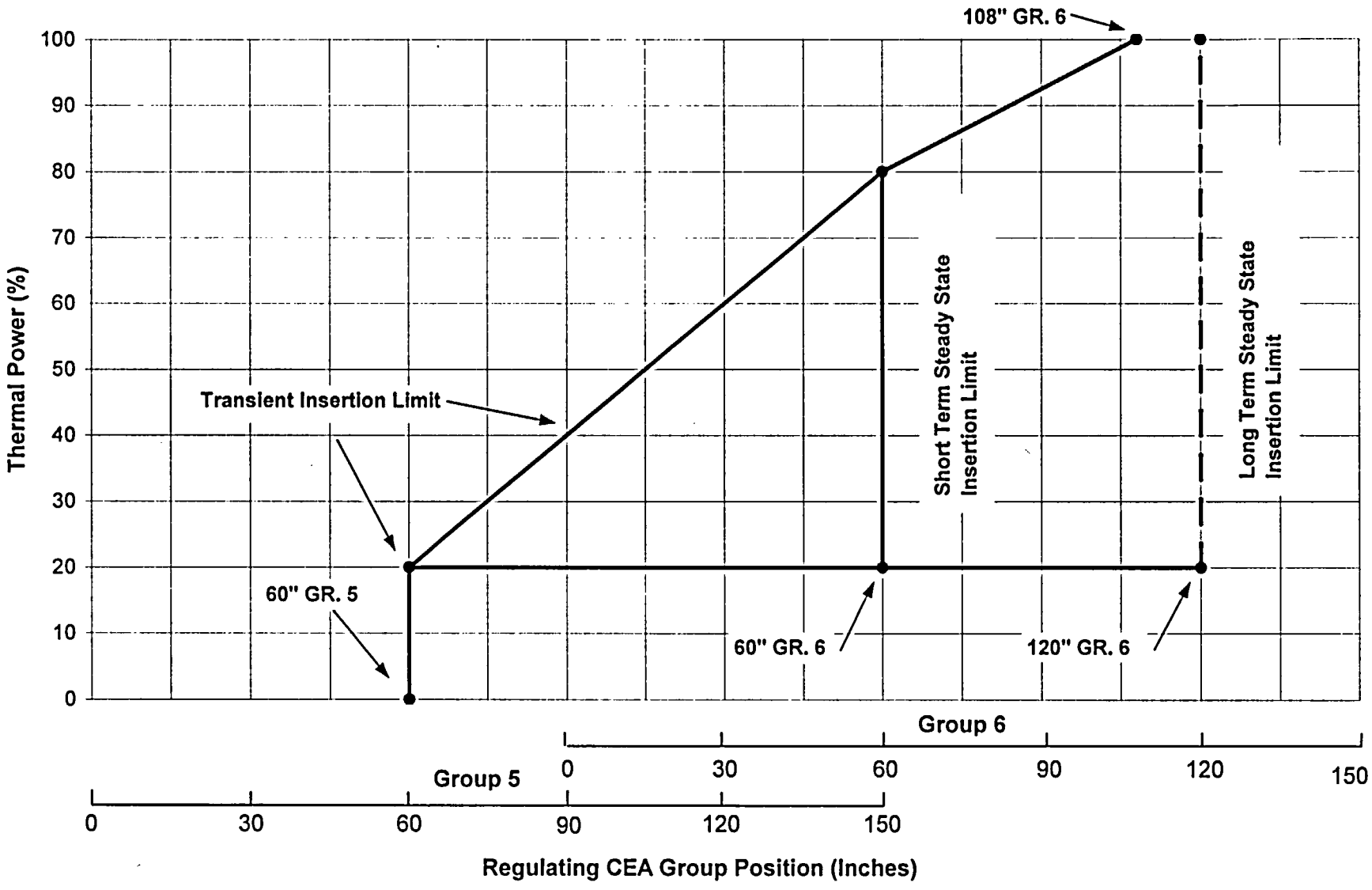
*** When thermal power is reduced to 60% of rated thermal power per this limit curve, further reduction is not required by this Technical Specification.**

CORE OPERATING LIMITS REPORT

REGULATING AND GROUP P CEA INSERTION LIMITS

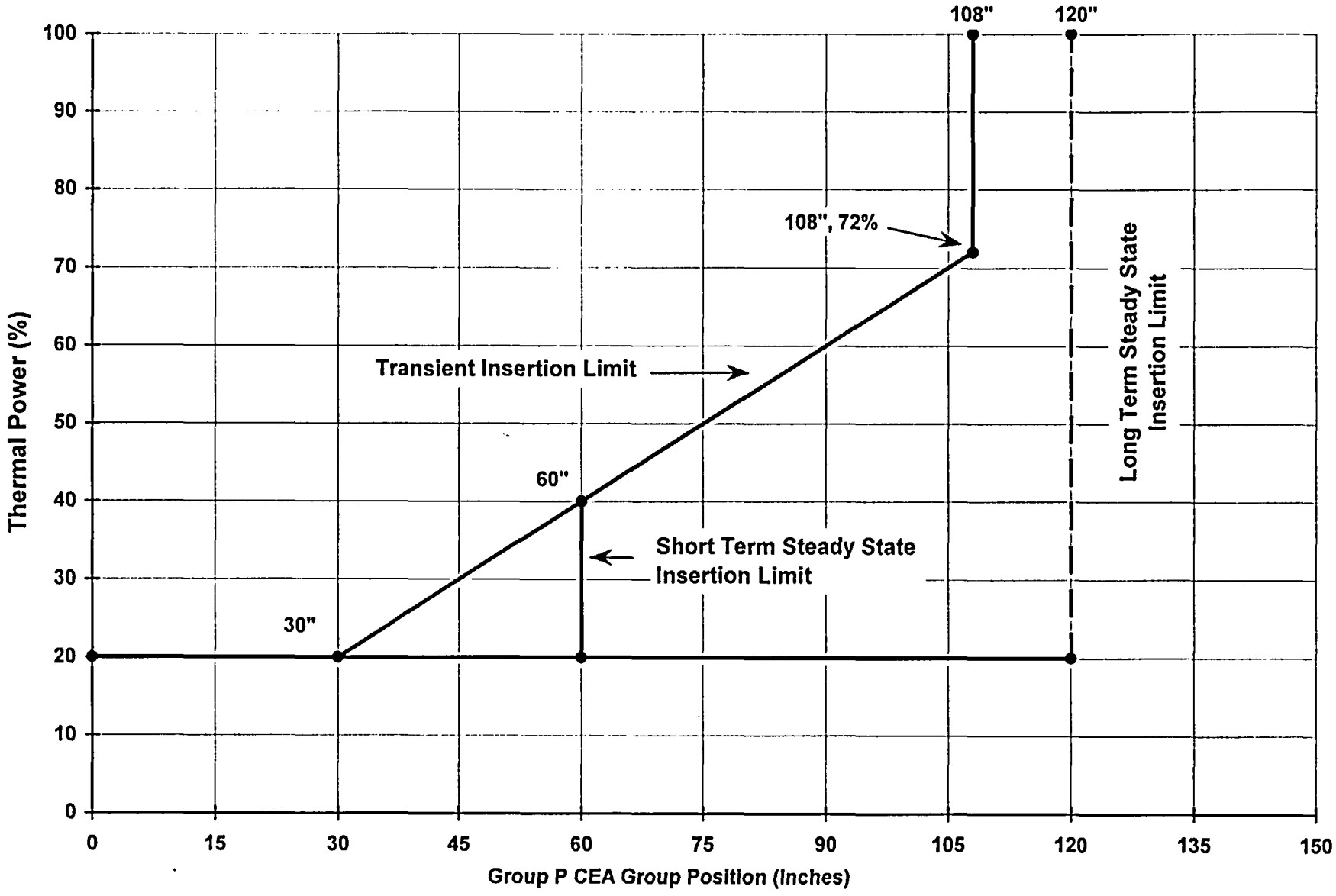
3.1.3.6 The regulating CEA groups and Group P CEAs shall be limited to the withdrawal sequence and to the insertion limits shown on COLR Figure 4 (regulating groups) and Figure 5 (Group P).

Regulating CEA Group Insertion Limits Versus Thermal Power



COLR Figure 4

Group P CEA Group Insertion Limits Versus Thermal Power



COLR Figure 5

CORE OPERATING LIMITS REPORT

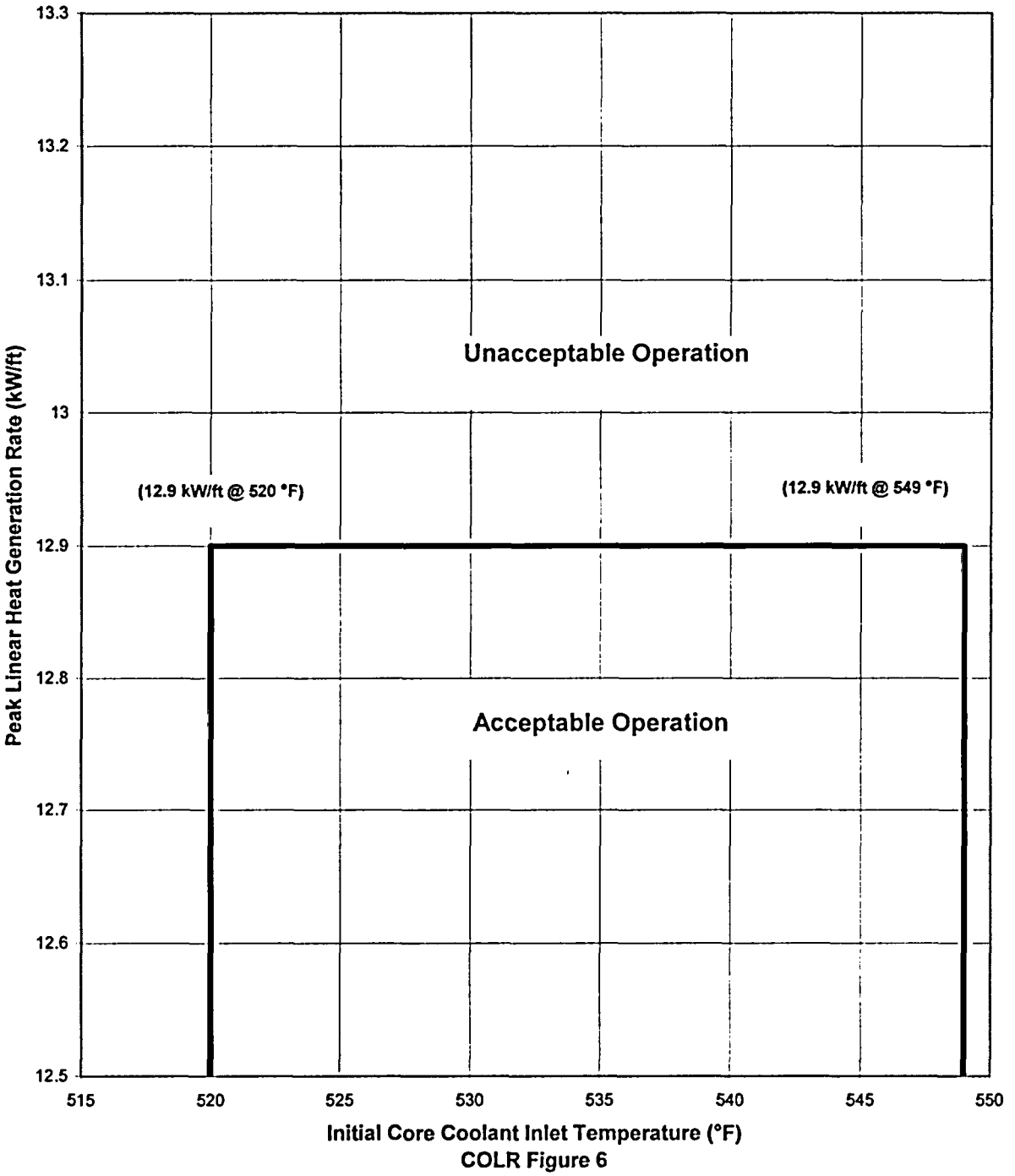
LINEAR HEAT RATE

3.2.1 The linear heat rate shall be maintained:

a. Within the region of acceptable operation of COLR Figure 6, when COLSS is in service.

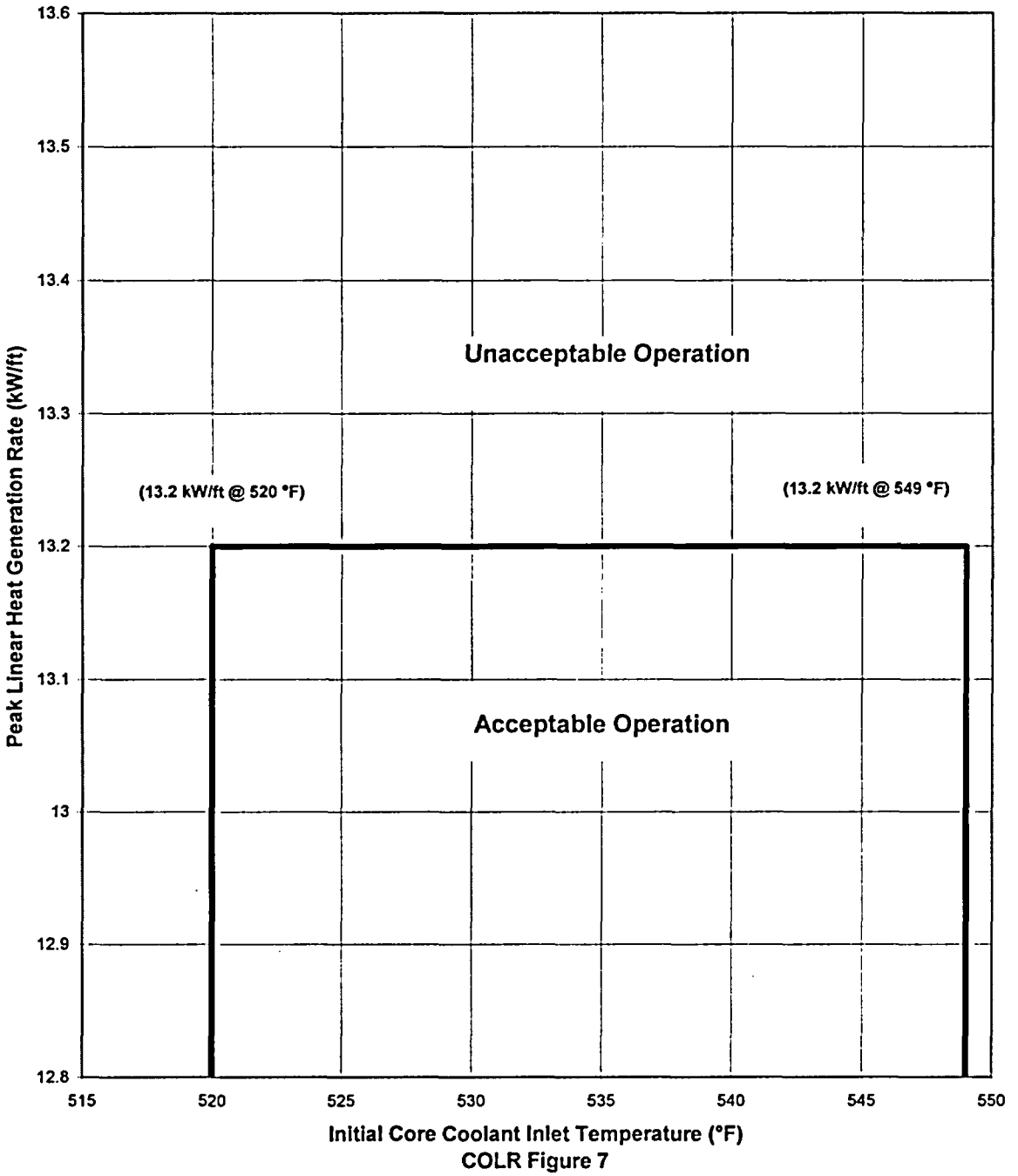
b. Within the region of acceptable operation of COLR Figure 7, when COLSS is out of service.

Allowable Peak Linear heat Rate Versus Tc (°F)
(COLSS in Service)



COLR Figure 6

Allowable Peak Linear heat Rate Versus Tc (°F)
(COLSS Out of Service)



COLR Figure 7

CORE OPERATING LIMITS REPORT

AZIMUTHAL POWER TILT- T_q

3.2.3 The measured AZIMUTHAL POWER TILT shall be maintained ≤ 0.03.

CORE OPERATING LIMITS REPORT

DNBR MARGIN

3.2.4 The DNBR margin shall be maintained by one of the following methods:

a) When COLSS is in service and neither CEAC is operable: maintain COLSS calculated core power less than or equal to COLSS calculated core power operating limit based on DNBR decreased by 13% RATED THERMAL POWER.

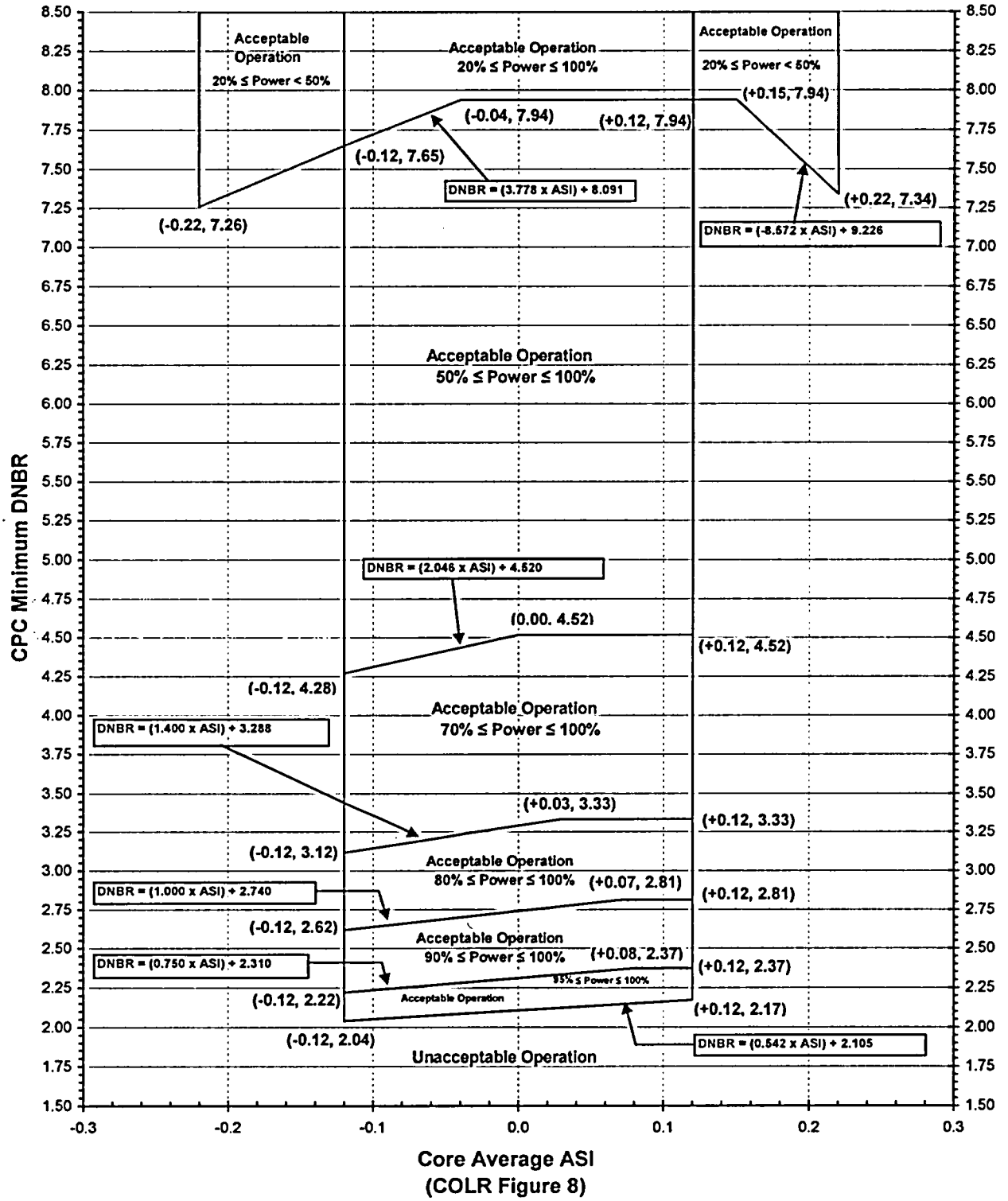
b) When COLSS is out of service and at least one CEAC is operable: operate within the region of acceptable operation shown on COLR Figure 8 (or 8A as appropriate), using any operable CPC channel.

c) When COLSS is out of service and neither CEAC is operable: operate within the region of acceptable operation shown on COLR Figure 9 (or 9A as appropriate), using any operable CPC channel.

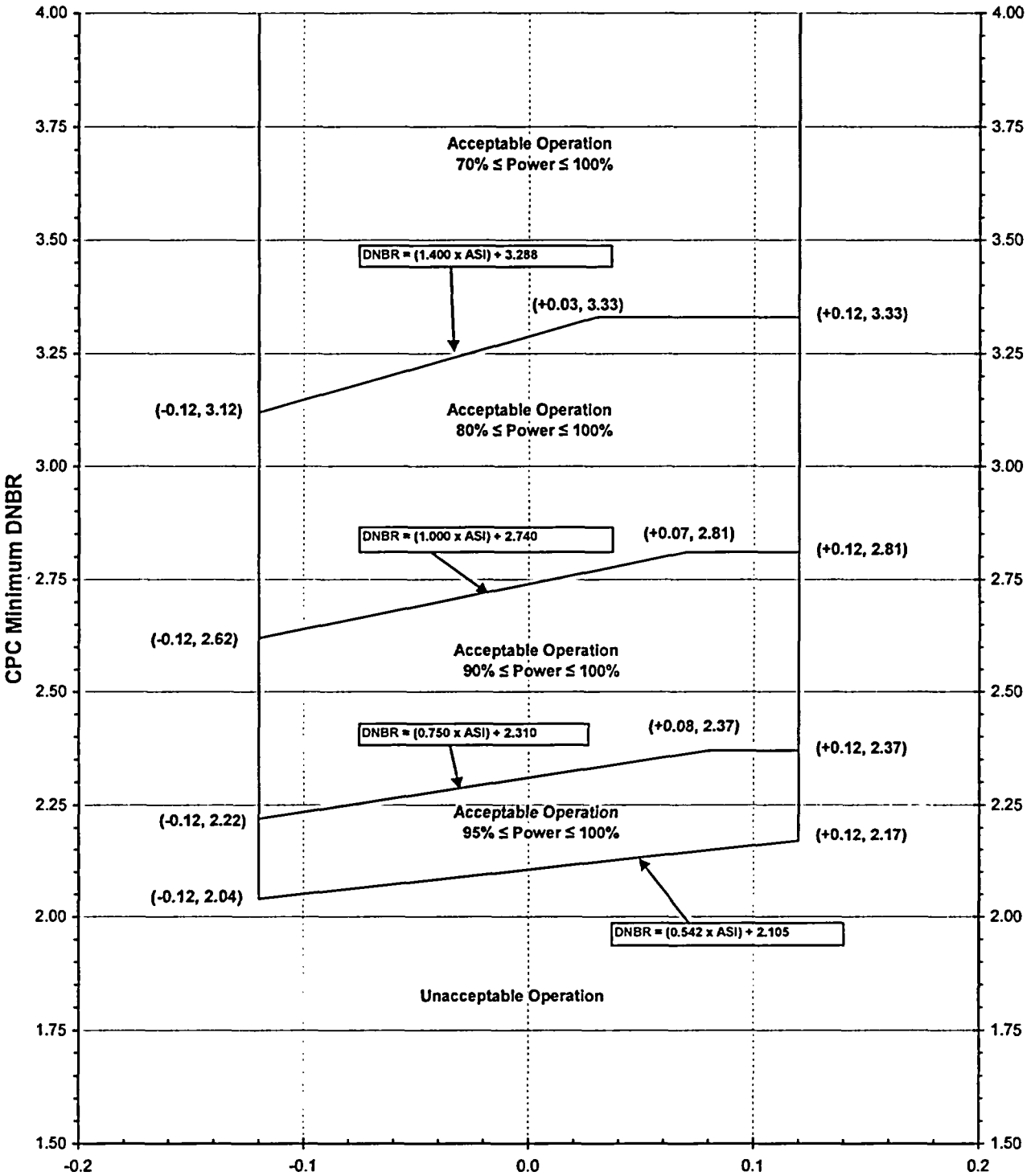
NOTES

1. The various DNBR limit lines shown between the vertical ASI limit lines drawn at ±0.12 and ±0.22 on Figures 8, 8A, 9, and 9A represent the minimum CPC-calculated DNBR value required for operation in the power range displayed in the area above each line. Operation at lower power levels requires that a larger DNBR value be maintained. For example, with ASI equal to -0.12 and a core power of 85%, CPC calculated DNBR must be a minimum of 2.62 with any CEAC Operable. At 79% power and the same ASI value with any CEAC Operable, the calculated DNBR must be at least 3.12. At 65% power and the same ASI value, DNBR must be a minimum of 4.28. At 90% power and an ASI value of +0.08, DNBR must be no less than 2.37.
2. The vertical ASI limit lines shown at ±0.12 and ±0.22 on Figures 8, 8A, 9, and 9A may be considered as extending beyond the maximum DNBR value on the Y-axis of the charts. Therefore, when monitoring DNBR with these figures, compliance is achieved at all power levels shown on a given figure when DNBR is greater than the largest DNBR value on the vertical scale.
3. Figure 8A is provided to offer better resolution for the four power ranges in the lower portion of Figure 8. Figure 9A is provided to offer better resolution for the four power ranges in the lower portion of Figure 9.
4. Equations are provided on Figures 8, 8A, 9, and 9A to assist in determining DNBR limits in the sloped portions of the plots.

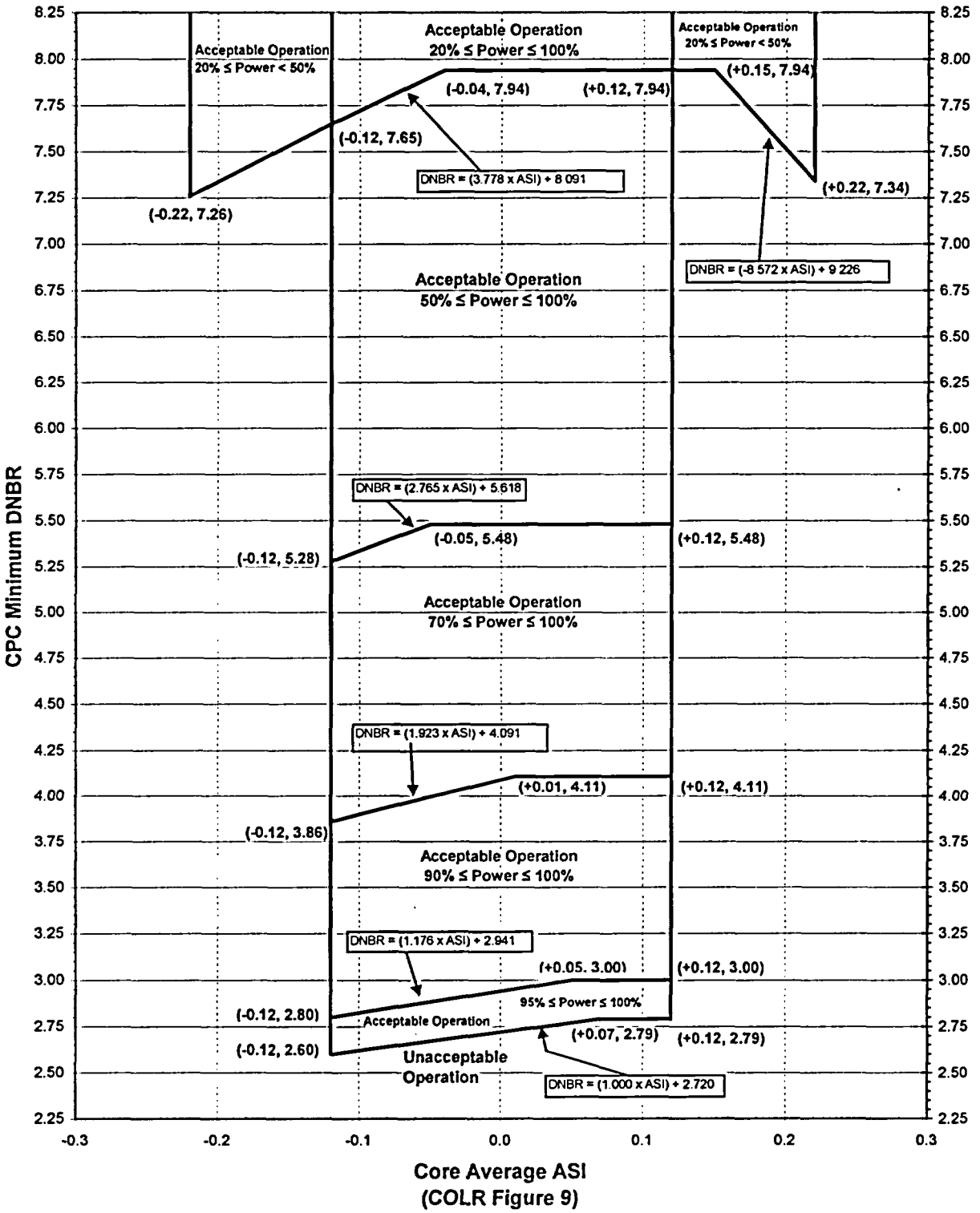
Allowable DNBR with Any CEAC Operable
(COLSS Out of Service)



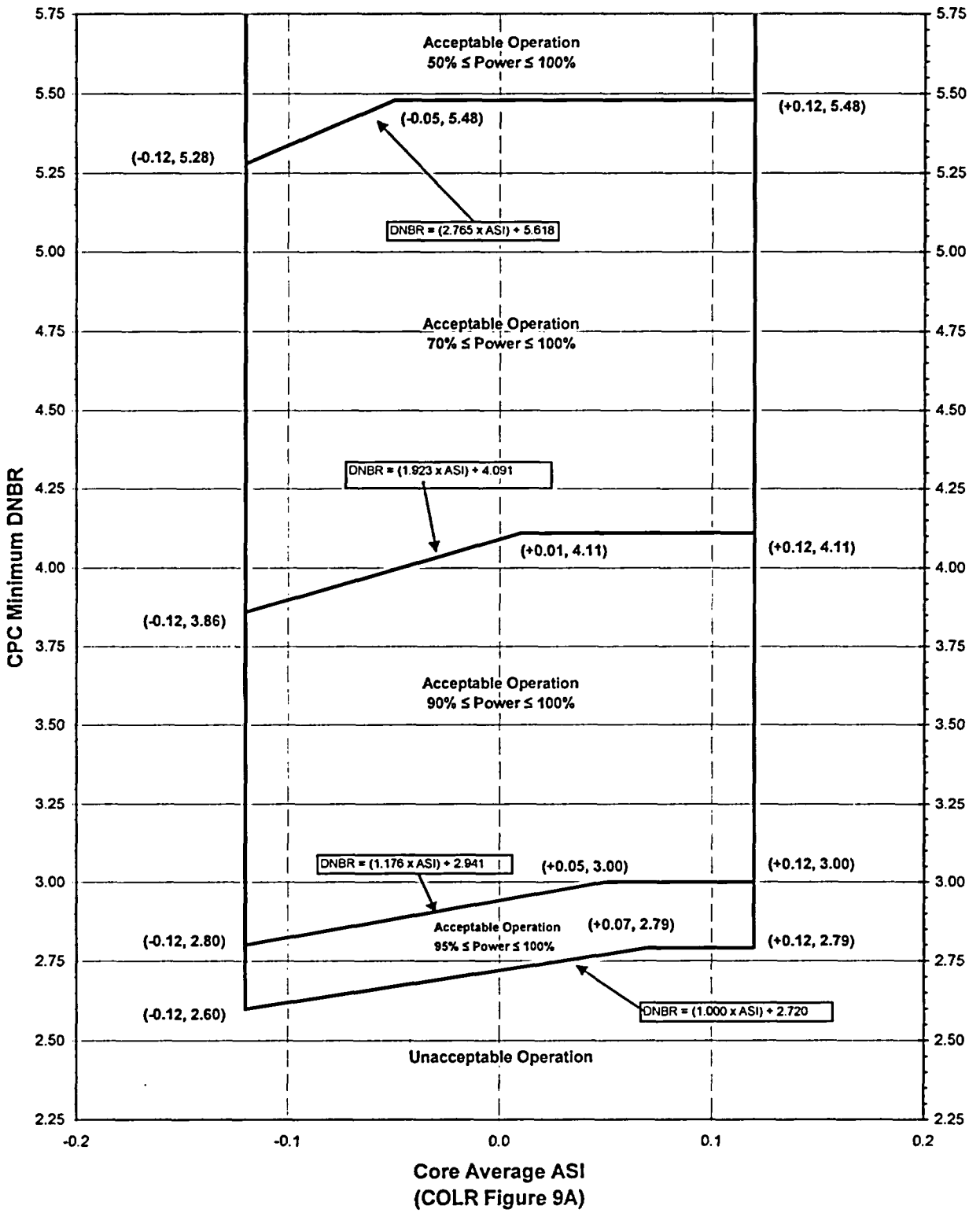
Subset of Allowable DNBR with Any CEAC Operable
(COLSS Out of Service)



Allowable DNBR with No CEAC(s) Operable
(COLSS Out of Service)



Subset of Allowable DNBR with No CEAC(s) Operable
(COLSS Out of Service)



CORE OPERATING LIMITS REPORT

AXIAL SHAPE INDEX

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

COLSS Operable

$-0.16 \leq ASI \leq +0.16$	for THERMAL POWERS $\geq$ 50% of RATED THERMAL POWER
$-0.26 \leq ASI \leq +0.26$	for THERMAL POWERS from 20% to <50% of RATED THERMAL POWER

COLSS Out of Service

$-0.12 \leq ASI \leq +0.12$	for THERMAL POWERS $\geq$ 50% of RATED THERMAL POWER
$-0.22 \leq ASI \leq +0.22$	for THERMAL POWERS from 20% to <50% of RATED THERMAL POWER

CORE OPERATING LIMITS REPORT

BORON CONCENTRATION

3.9.1 While in Mode 6, the RCS boron concentration shall be maintained sufficiently to ensure that the more restrictive of the following reactivity conditions is met:

a. Either K_{eff} of 0.95 or less, or

b. A boron concentration of greater than or equal to 2050 ppm.

III. METHODOLOGIES

The analytical methods used to determine the core operating limits listed above are those previously reviewed and approved by the NRC in:

1. "The ROCS and DIT Computer Codes for Nuclear Design," CENPD-266-P-A, April 1983; and "C-E Methodology for Core Designs Containing Gadolinia-Urania Burnable Absorber," CENPD-275-P-A, May 1988. (Methodology for Specifications 3.1.1.1 and 3.1.1.2 for Shutdown Margins, 3.1.1.3 for MTC, 3.1.3.6 for Regulating and Group P CEA Insertion Limits, 3.1.2.9 Boron Dilution (Calculation of CBC & IBW), and 3.9.1 Boron Concentration).

2. "C-E Method for Control Element Assembly Ejection Analysis," CENPD-0190-A, January 1976. (Methodology for Specification 3.1.3.6 for Regulating and Group P CEA Insertion Limits and 3.2.3 for Azimuthal Power Tilt).

3. "Modified Statistical Combination of Uncertainties" CEN-356(V)-P-A, May 1988. (Methodology for Specification 3.2.4 for DNBR Margin and 3.2.7 for ASI).

4. "Calculative Methods for the CE Large Break LOCA Evaluation Model For The Analysis of C-E and W Designed NSSS," CENPD-132, Supplement 3-P-A, June 1985. (Methodology for Specification 3.1.1.3 for MTC, 3.2.1 for Linear Heat Rate, 3.2.3 for Azimuthal Power Tilt and 3.2.7 for ASI).

5. "Calculative Methods for the ABB CE Small Break LOCA Evaluation Model," CENPD-137-P, August 1974: Supplement 2-P-A, April 1998. (Methodology for Specification 3.1.1.3 for MTC, 3.2.1 for Linear Heat Rate, 3.2.3 for Azimuthal Power Tilt and 3.2.7 for ASI).

6. "CESEC - Digital Simulation of a Combustion Engineering Nuclear Steam Supply System," (CE letter LD-82-001 and NRC SE to CE dated April 3, 1984). (Methodology for Specification 3.1.1.1 and 3.1.1.2 for Shutdown Margins, 3.1.1.3 for MTC, 3.1.3.1 for Movable Control Assemblies – CEA Position, 3.1.3.6 for Regulating and Group P CEA Insertion Limits, and 3.2.3 for Azimuthal Power Tilt).

7. "Qualification of Reactor Physics Methods for the Pressurized Water Reactors of the Entergy System," ENEAD-01-P, Revision 0, December 21, 1993. (Methodology for Specifications 3.1.1.1 and 3.1.1.2 for Shutdown Margins, 3.1.1.3 for MTC, 3.1.3.6 for Regulating and Group P CEA Insertion Limits, 3.1.2.9 Boron Dilution (calculation of CBC & IBW), and 3.9.1 Boron Concentration).

8. "Fuel Rod Maximum Allowable Gas Pressure," CEN-372-P-A, May 1990. (Methodology for Specification 3.2.1, Linear Heat Rate).

9. "Technical Description Manual for the CENTS Code," WCAP-15996-P-A, April 2004. (Methodology for Specification 3.1.1.1 and 3.1.1.2 for Shutdown Margins, 3.1.1.3 for MTC, 3.1.3.1 for Movable Control Assemblies – CEA Position, 3.1.3.6 for Regulating and group P CEA Insertion Limits, and 3.2.3 for Azimuthal Power Tilt).

10. "Calculative Methods for the CE Nuclear Power Large Break LOCA Evaluation Model," CENPD-132, Supplement 4-P-A, March 2001. (Methodology for Specification 3.1.1.3 for MTC, 3.2.1 for Linear Heat Rate, 3.2.3 for Azimuthal Power Tilt and 3.2.7 for ASI).

11. "Implementation of ZIRLO Material Cladding in CE Nuclear Power Fuel Assembly Designs," CENPD-404-P-A, November 2001 (Methodology for Specification 3.1.1.3 for MTC, 3.2.1 for Linear Heat Rate, 3.2.3 for Azimuthal Power Tilt, and 3.2.7 for ASI).

12. "Qualification of the PHOENIX-P/ANC Nuclear Design System For Pressurized Water Reactor Cores," WCAP-11596-P-A, June 1988; "ANC: A Westinghouse Advanced Nodal Computer Code," WCAP-10965-P-A, September 1986; and "ANC: A Westinghouse Advanced Nodal Computer Code: Enhancements to ANC Rod Power Recovery," WCAP-10965-P-A Addendum 1, April 1989. (Methodology for Specifications 3.1.1.1 and 3.1.1.2 for Shutdown Margins, 3.1.1.3 for MTC, 3.1.3.6 for Regulating and group P CEA Insertion Limits, 3.1.2.9 Boron Dilution (Calculation of CBC and IBW), and 3.9.1 Boron Concentration).

13. "Qualification of the Two-Dimensional Transport Code PARAGON," WCAP-16045-P-A, August 2004 (Methodology for Specifications 3.1.1.1 and 3.1.1.2 for Shutdown Margins, 3.1.1.3 for MTC, 3.1.3.6 for Regulating and group P CEA Insertion Limits, 3.1.2.9 Boron Dilution (Calculation of CBC & IBW), and 3.9.1 Boron Concentration).