CALVERT CLIFFS NUCLEAR POWER PLANT

CORE OPERATING LIMITS REPORT

for

UNIT 1, CYCLE 13

REVISION 0

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CORE OPERATING LIMITS REPORT

CALVERT CLIFFS UNIT 1, CYCLE 13

The following limits are included in this Core Operating Limits Report:

The following figures are included in this Core Operating Limits Report:

LIST OF EFFECTIVE PAGES

Page No.	Rev. No.	Page No.	Rev. No.
1	0	15	0
2	0	16	0
3	0	17	0
4	0	18	0
5	0	19	0
6	0	20	0
7	0	21	0
8	0	22	0
9	0		
10	0		
11	0		
12	0		
13	0		
14	0		

INTRODUCTION

This report provides the cycle-specific limits for operation of Calvert Cliffs Unit 1, Cycle 13. It contains the limits for:

Reactor Trip Setpoints
Shutdown Margin
Moderator Temperature Coefficient
CEA Position
Regulating CEA Insertion Limits
Linear Heat Rate
Total Planar Radial Peaking Factor
Total Integrated Radial Peaking Factor
DNB Parameters
Refueling Boron Concentration

In addition, this report contains a number of figures which give limits on the parameters listed above. If any of the limits contained in this report are exceeded, corrective action will be taken as defined in the Technical Specifications.

This report has been prepared in accordance with the requirements of Technical Specification 6.9.1.9. The cycle specific limits have been developed using the NRC-approved methodologies given in the "List of Approved Methodologies" section of this report and in Section 6.9.1.9 of the Technical Specifications.

CYCLE SPECIFIC LIMITS FOR UNIT 1, CYCLE 13

2.2.1 Reactor Trip Setpoints

The Axial Flux Offset trip setpoint and allowable values are given in COLR Figure 2.2-1.

The Thermal Margin/Low Pressure trip setpoint is given in COLR Figures 2.2-2 and 2.2-3. The allowable values are to be not less than the larger of (1) 1875 psia or (2) the value calculated from COLR Figures 2.2-2 and 2.2-3.

3.1.1.1 Shutdown Margin - Tavg > 200 °F

The shutdown margin shall be equal to or greater than the limit line of COLR Figure 3.1.1-1.

3.1.1.2 Shutdown Margin - Tavg ≤ 200 °F

The shutdown margin shall be ≥ 3.0% $\Delta\rho$.

3.1.1.4 Moderator Temperature Coefficient

The moderator temperature coefficient (MTC) shall be less negative than -3.0×10^{-4} $\Delta\rho/^{o}F$ at rated thermal power.

3.1.3.1 CEA Position

The allowable time to realign a CEA versus the initial total integrated radial peaking factor is given in COLR Figure 3.1.3-1.

3.1.3.6 Regulating CEA Insertion Limits

The regulating CEA groups insertion limits are shown on COLR Figure 3.1.3-2.

3.2.1 Linear Heat Rate

The linear heat rate shall not exceed the limits shown on COLR Figure 3.2.1-1.

The axial shape index power dependent control limits are given in COLR Figure 3.2.1-2.

<u>When using the excore detector monitoring system (SR 4.2.1.3):</u>

The axial shape index alarm setpoints are shown on COLR Figure 3.2.1-2.

The maximum allowable fraction of rated thermal power vs. Fxy^{T} is shown in COLR Figure 3.2.1-3.

<u>When using the incore detector monitoring system (SR 4.2.1.4):</u>

The alarm setpoints are set to protect the Linear Heat Rate limits shown on COLR Figure 3.2.1-1.

The uncertainty factors for the incore detector monitoring system are:

1. A measurement-calculational uncertainty factor of 1.062,

2. An engineering uncertainty factor of 1.03,

3. A linear heat rate uncertainty factor of 1.002 due to axial fuel densification and thermal expansion, and

4.a For measured thermal power less than or equal to 50 percent but greater than 20 percent of rated full core power a thermal power measurement uncertainty factor of 1.035.

4.b For measured thermal power greater than 50 percent of rated full core power a thermal power measurement uncertainty factor of 1.020.

3.2.2.1 Total Planar Radial Peaking Factor

The calculated value of Fxy^T shall be limited to ≤ 1.70.

The allowable combination of thermal power and Fxy^T are shown on COLR Figure 3.2.2-1.

3.2.3 Total Integrated Radial Peaking Factor

The calculated value of Fr^T shall be limited to ≤ 1.70.

The allowable combinations of thermal power and Fr^T are shown on COLR Figure 3.2.3-1.

The DNB axial flux control limits are shown on COLR Figure 3.2.3-2.

3.2.5 DNB Parameters

The axial shape index, thermal power shall be maintained within t' e limits established by the Better Axial Shape Selection System (BASSS) for CEA insertions of the lead bank of < 55% when BASSS is operable, or within the limits of COLR Figure 3.2.3-2 for CEA insertions specified by COLR Figure 3.1.3-2.

3.9.1 Boron Concentration

The refueling boron concentration shall be maintained uniform and sufficient to ensure that the boron concentration is $\geq$ 2386 ppm.

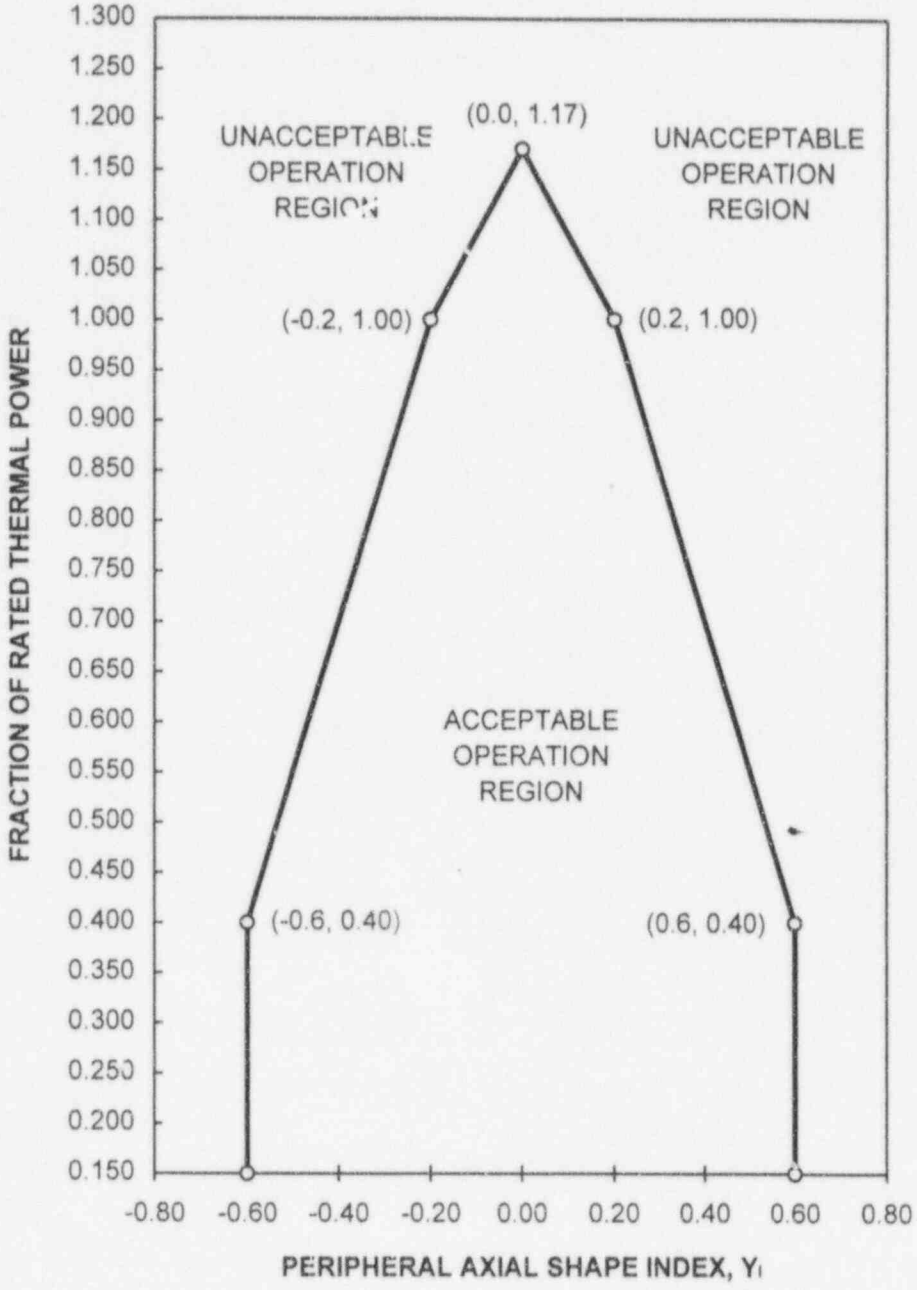

Figure 2.2-1

Peripheral Axial Shape Index vs. Fraction of Rated Thermal Power

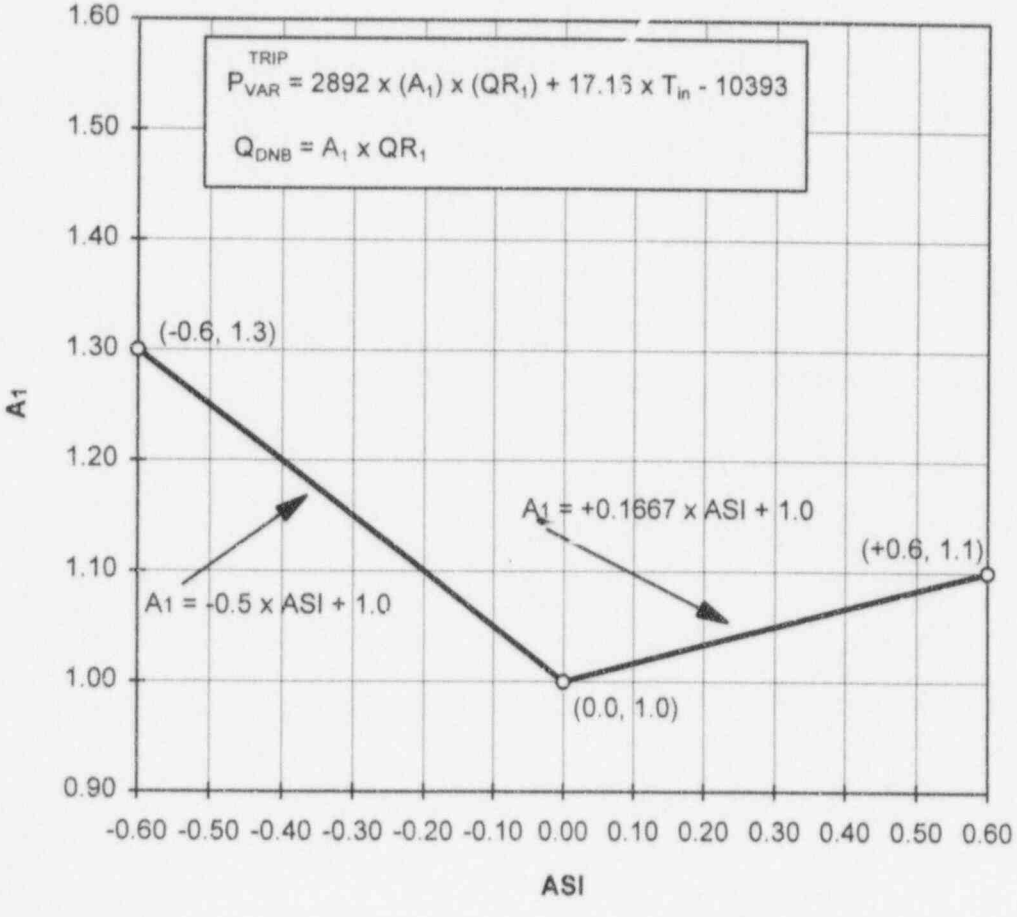

Figure 2.2-2

Thermal Margin/Low Pressure Trip Setpoint - Part 1
(ASI vs. A_1)

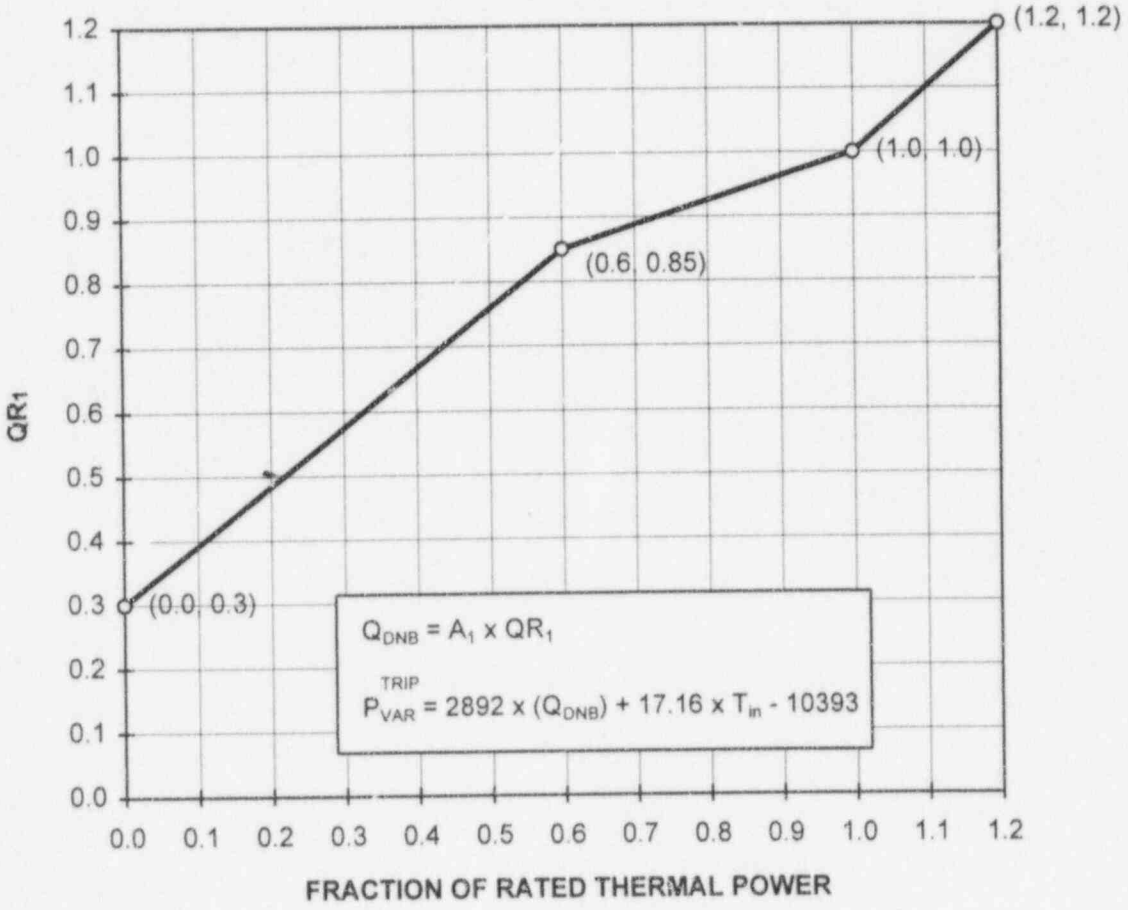

Figure 2.2-3

Thermal Margin/Low Pressure Trip Setpoint - Part 2
(Fraction of Rated Thermal Power vs. QR_1)

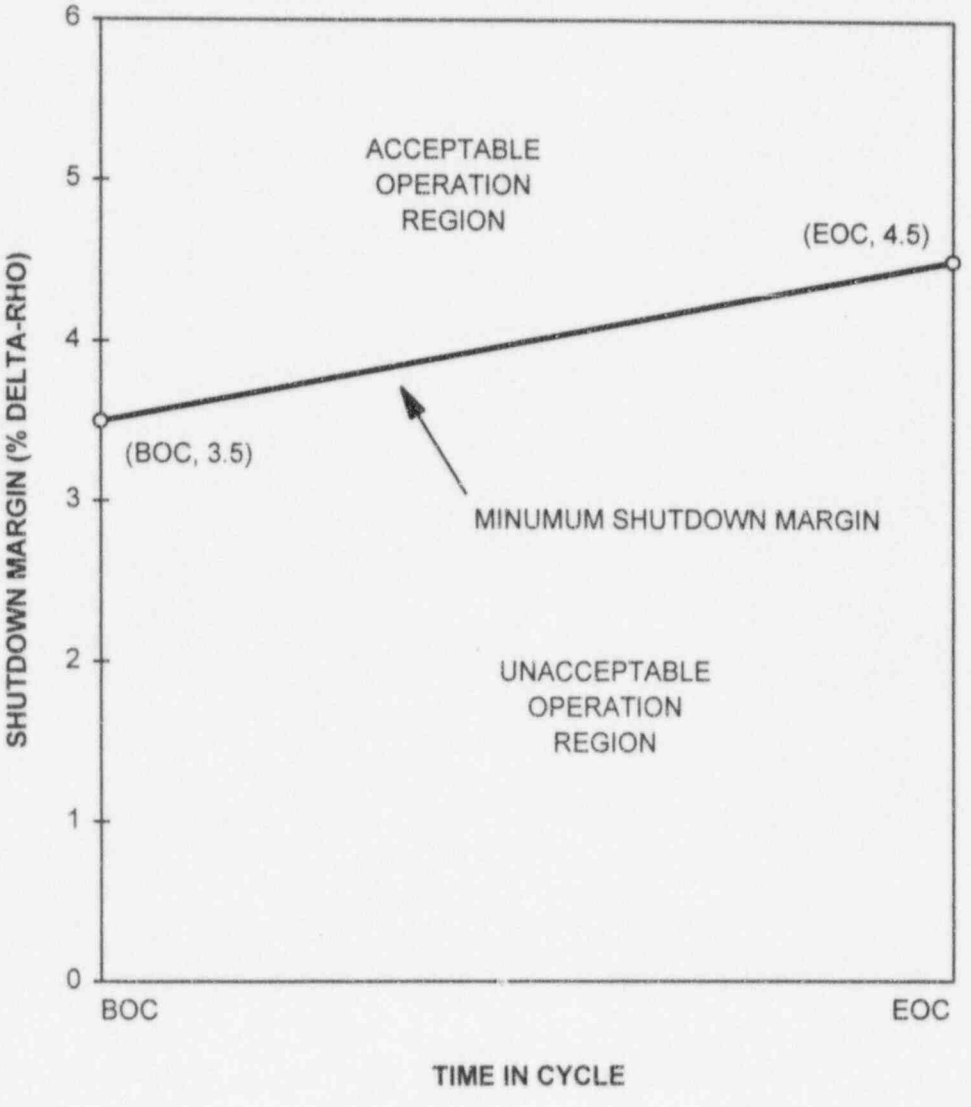

Figure 3.1.1-1

Shutdown Margin vs. Time in Cycle

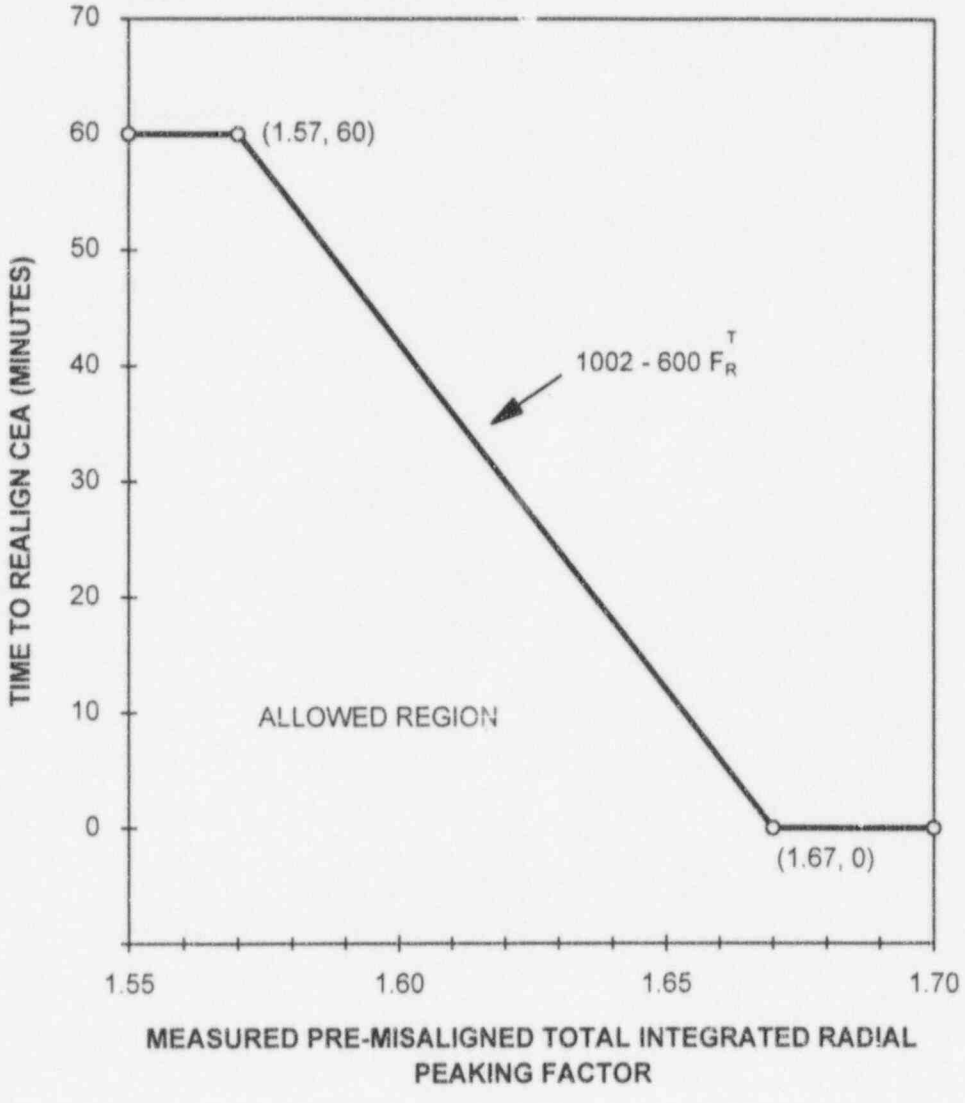

Figure 3.1.3-1

Allowable Time to Realign CEA Versus Initial Total Integrated Radial Peaking Factor

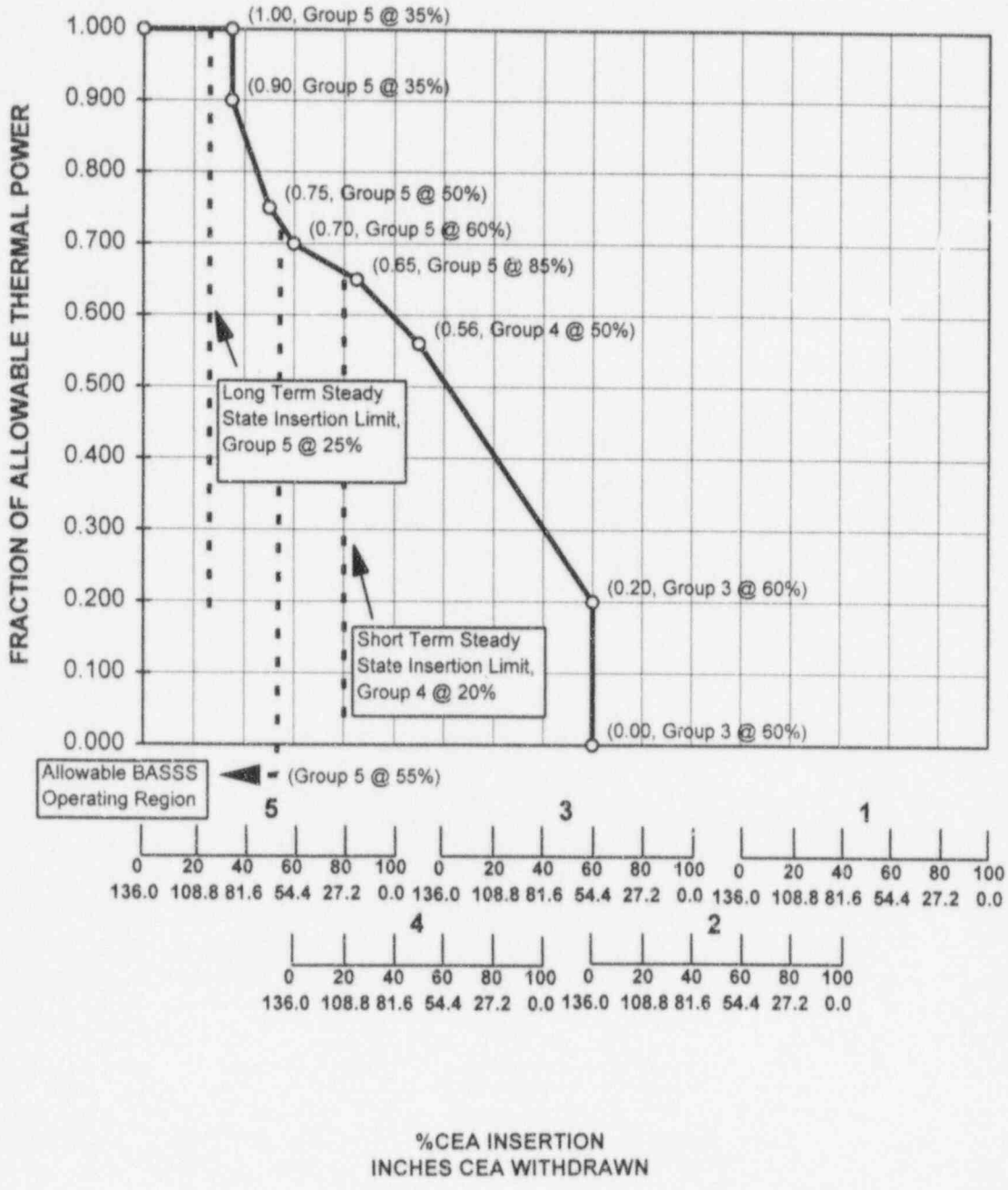

Figure 3.1.3-2

CEA Group Insertion Limits vs. Fraction of Rated Thermal Power

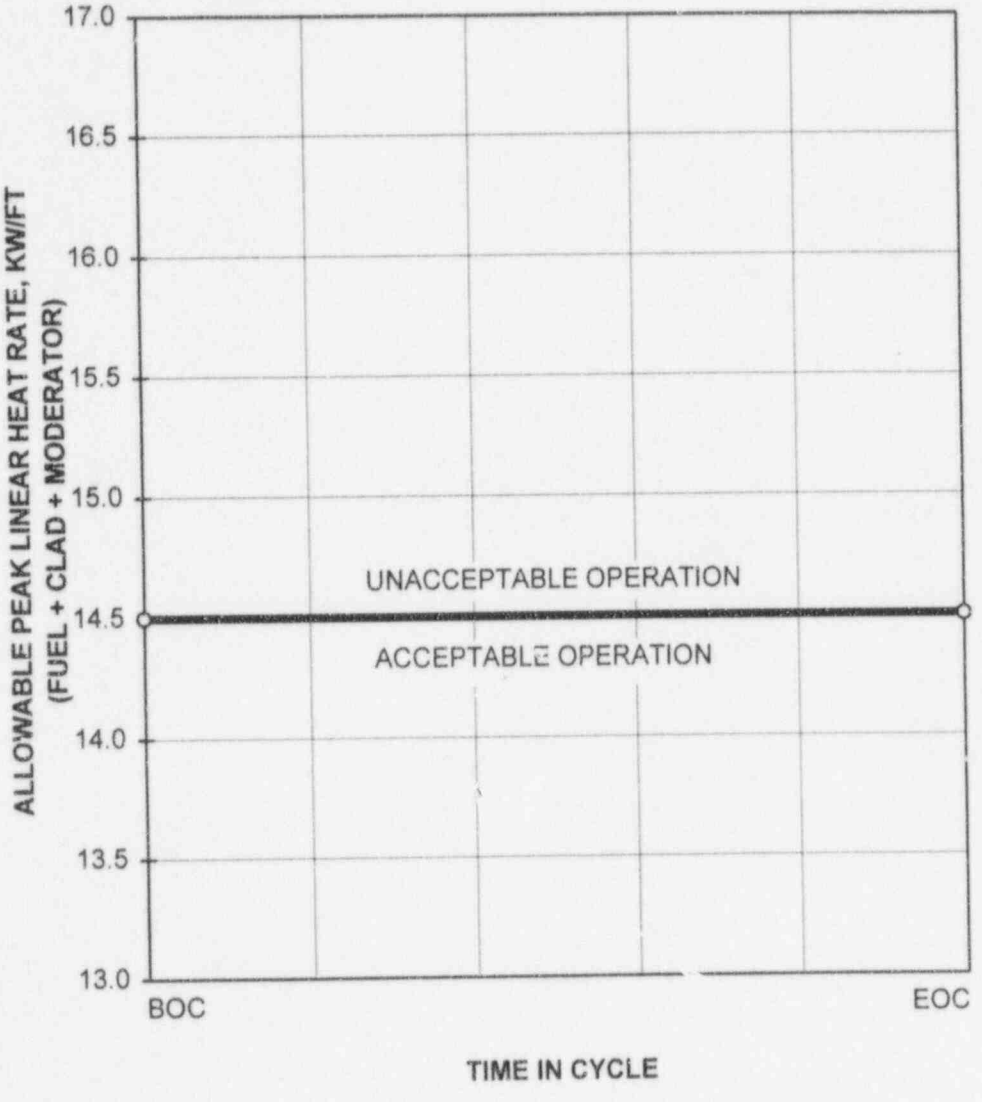

Figure 3.2.1-1

Allowable Peak Linear Heat Rate vs. Time in Cycle

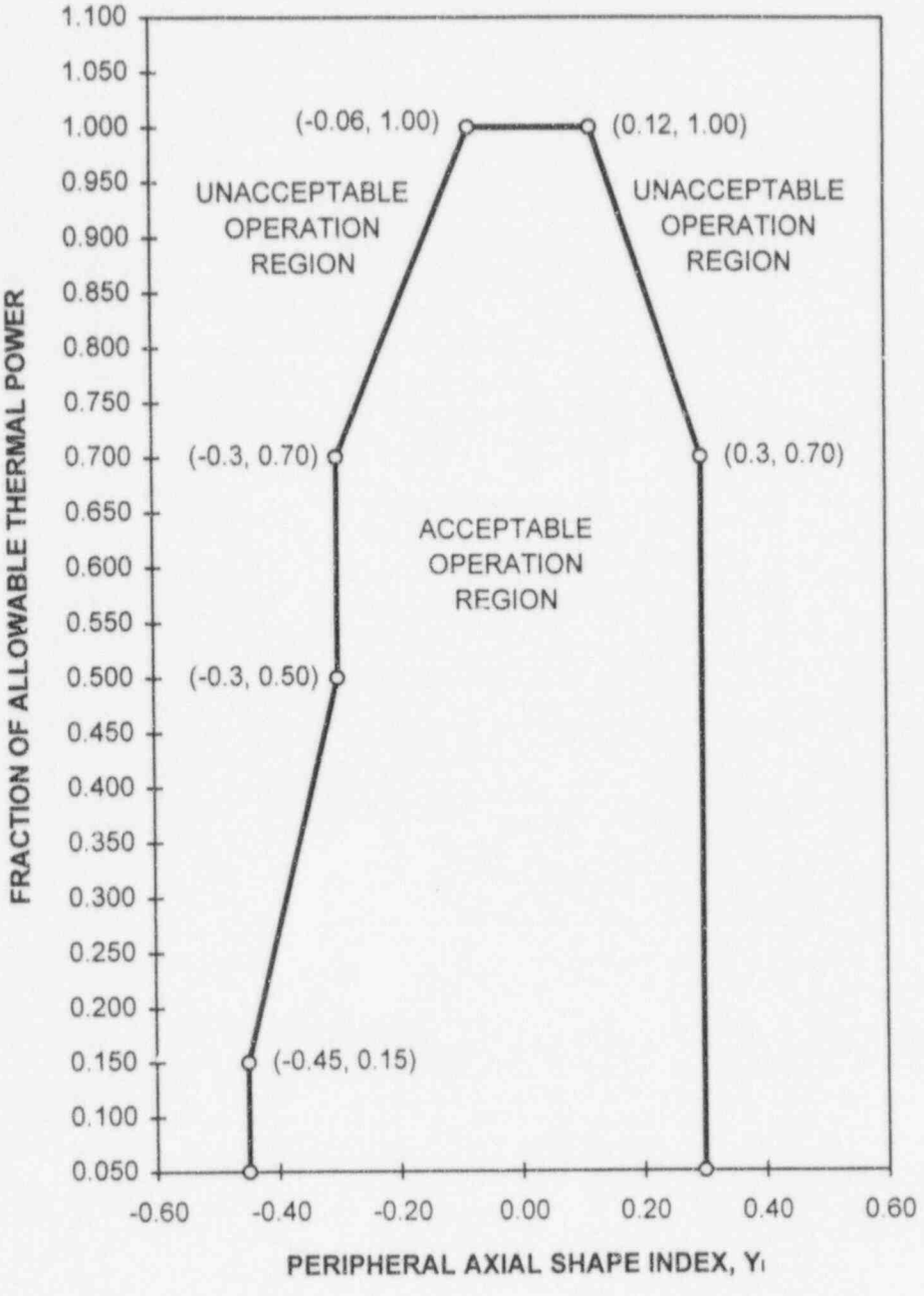

Figure 3.2.1-2

Linear Heat Rate Axial Flux Offset Control Limits

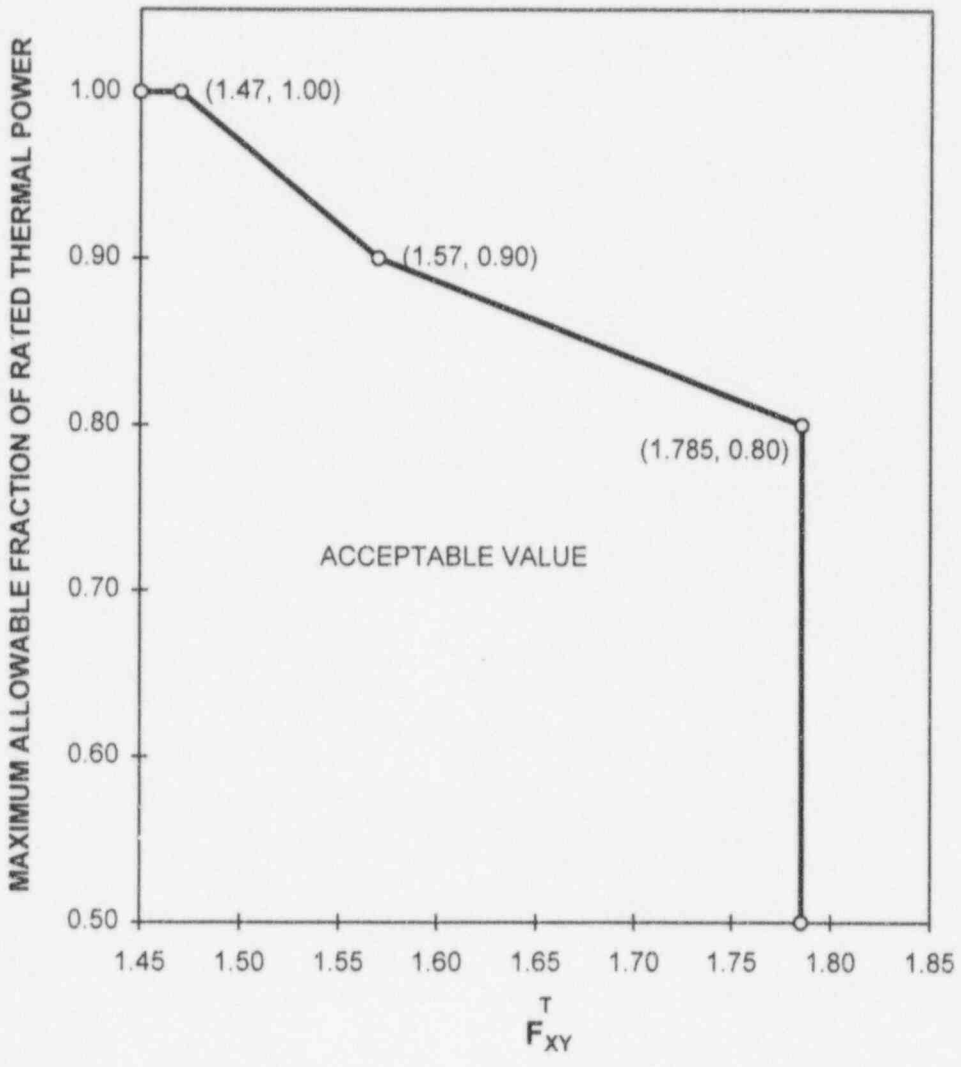

Figure 3.2.1-3

**Total Planar Radial Peaking Factor/Fxy^T vs.
Maximum Allowable Fraction of Rated Thermal Power
(Surveillance 4.2.1.3)**

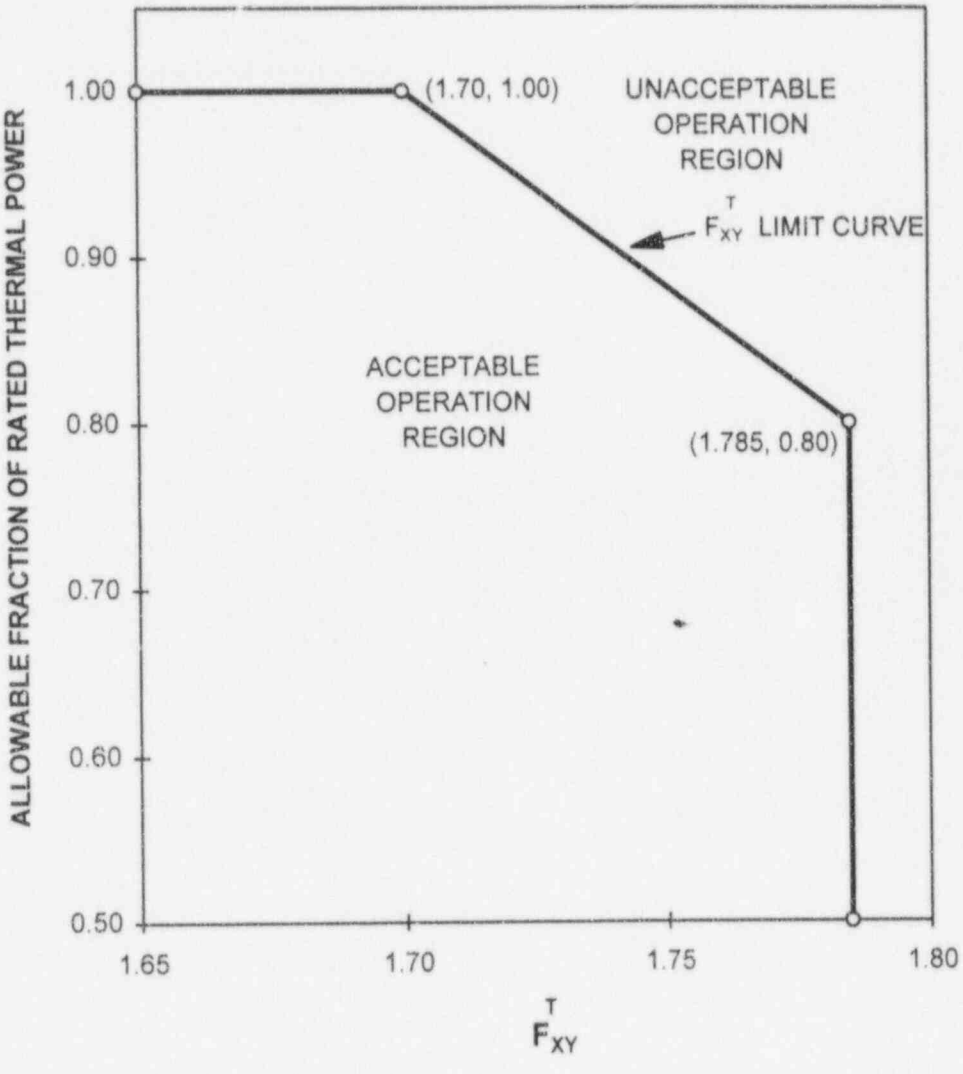

Figure 3.2.2-1

**Total Planar Radial Peaking Factor vs.
Allowable Fraction of Rated Thermal Power
(ACTION 3.2.2.1.a.1)**

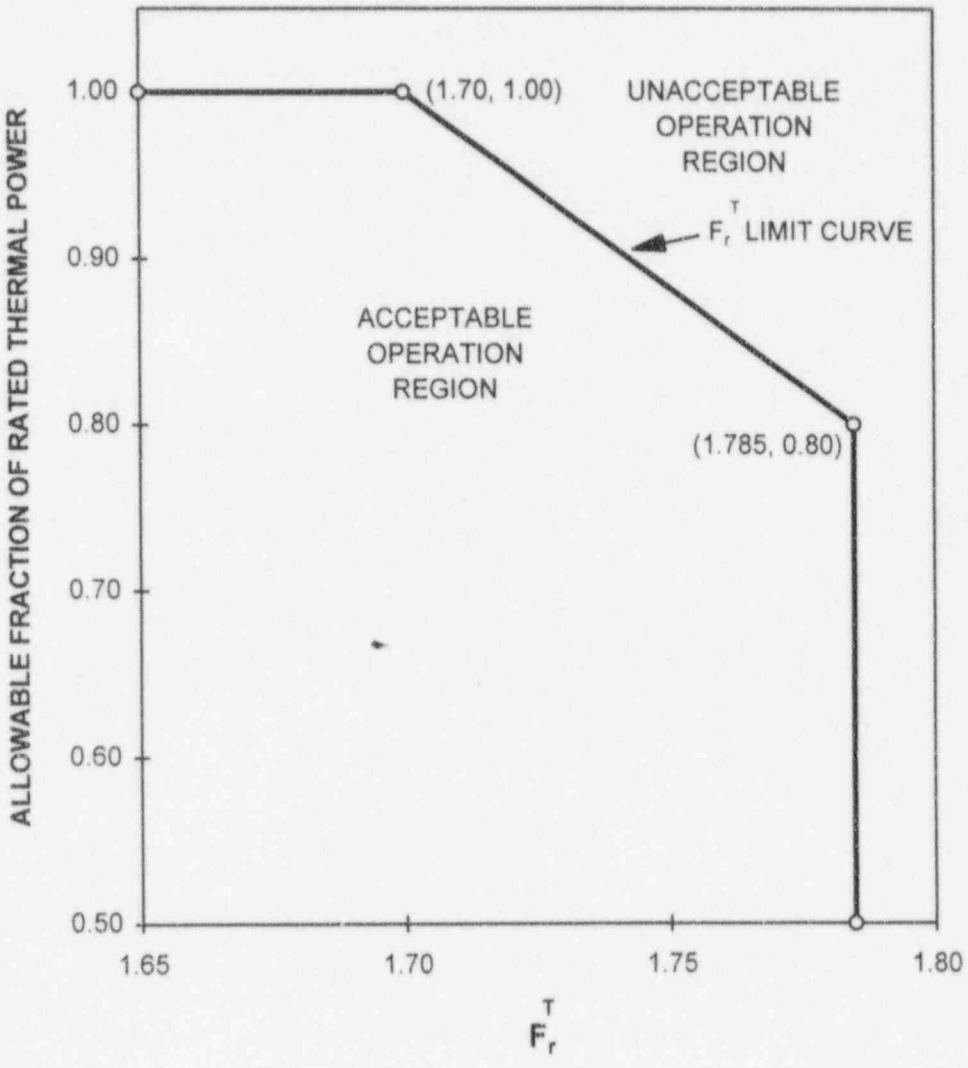

Figure 3.2.3-1

**Total Integrated Radial Peaking Factor vs.
Allowable Fraction of Rated Thermal Power**

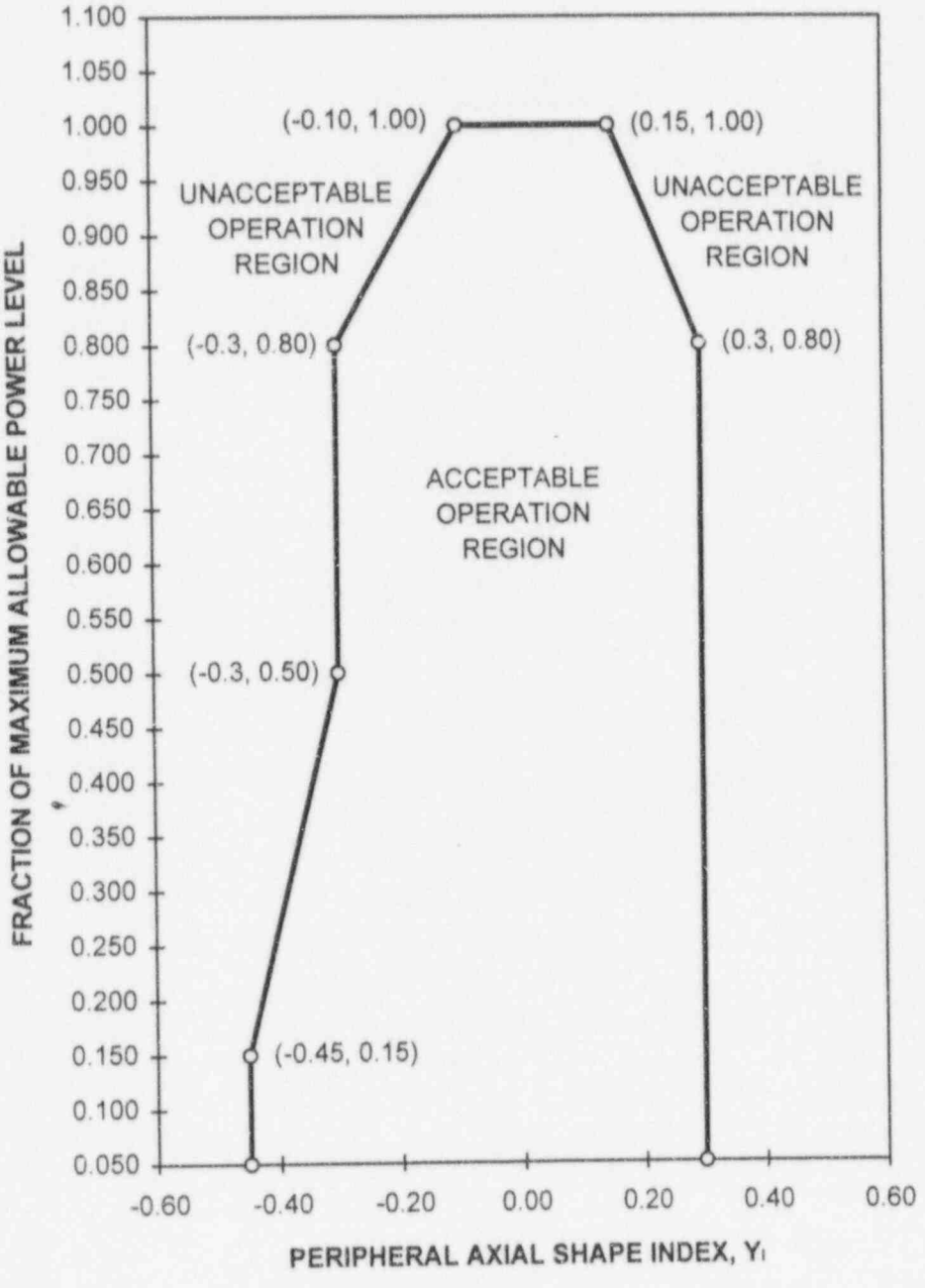

Figure 3.2.3-2

DNB Axial Flux Offset Control Limits

LIST OF APPROVED METHODOLOGIES

(1) CENPD-199-P, Rev 1-P-A, "C-E Setpoint Methodology: C-E Local Power Density and DNB LSSS and LCO Setpoint Methodology for Analog Protection Systems," January 1986 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.1, 3.2.2.1, 3.2.3, 3.2.5)

(2) CEN-124(B)-P, "Statistical Combination of Uncertainties Methodology Part 1: C-E Calculated Local Power Density and Thermal Margin/Low Pressure LSSS for Calvert Cliffs Units I and II," December 1979 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.2.1, 3.2.3)

(3) CEN-124(B)-P, "Statistical Combination of Uncertainties Methodology Part 2: Combination of System Parameter Uncertainties in Thermal Margin Analyses for Calvert Cliffs Units 1 and 2," January 1980 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.3, 3.2.5)

(4) CEN-124(B)-P, "Statistical Combination of Uncertainties Methodology Part 3: C-E Calculated Departure from Nucleate Boiling and Linear Heat Rate Limiting Conditions for Operation for Calvert Cliffs Units 1 and 2," March 1980 (Methodology for Specifications 3.1.3.6, 3.2.1, 3.2.2.1, 3.2.3, 3.2.5)

(5) CEN-191(B)-P, "CETOP-D Code Structure and Modeling Methods for Calvert Cliffs Units 1 and 2," December 1981 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.3, 3.2.5)

(6) Letter from Mr. D. H. Jaffe (NRC) to Mr. A. E. Lundvall, Jr. (BG&E), dated June 24, 1982, Unit 1 Cycle 6 License Approval (Amendment No. 71 to DPR-53 and SER) [Approval to CEN-124(B)-P (three parts) and CEN-191(B)-P)]

(7) CEN-348(B)-P, "Extended Statistical Combination of Uncertainties," January 1987 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.3, 3.2.5)

(8) Letter from Mr. S. A. McNeil, Jr. (NRC) to Mr. J. A. Tiernan (BG&E), dated October 21, 1987, Docket Nos. 50-317 and 50-318, "Safety Evaluation of Topical Report CEN-348(B)-P, Extended Statistical Combination of Uncertainties"

(9) CENPD-161-P-A, "TORC Code, A Computer Code for Determining the Thermal Margin of a Reactor Core," April 1986 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.3, 3.2.5)

(10) CENPD-162-P-A, "Critical Heat Flux Correlation of C-E Fuel Assemblies with Standard Spacer Grids Part 1, Uniform Axial Power Distribution," April 1975 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.3, 3.2.5)

(11) CENPD-207-P-A, "Critical Heat Flux Correlation for C-E Fuel Assemblies with Standard Spacer Grids Part 2, Non-uniform Axial Power Distribution," December 1984 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.3, 3.2.5)

(12) CENPD-206-P-A, "TORC Code, Verification and Simplified Modeling Methods," June 1981 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.3, 3.2.5)

(13) CENPD-225-P-A, "Fuel and Poison Rod Bowing," June 1983 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.3, 3.2.5)

(14) CENPD-266-P-A, "The ROCS and DIT Computer Code for Nuclear Design," April 1983 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.1, 3.2.2.1, 3.2.3, 3.2.5)

(15) CENPD-275-P-A, "C-E Methodology for Core Designs Containing Gadolinia - Urania Burnable Absorbers," May 1988 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.1, 3.2.2.1, 3.2.3, 3.2.5)

(16) CENPD-382-P-A, "Methodology for Core Designs Containing Erbium Burnable Absorbers," August 1993 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.1, 3.2.2.1, 3.2.3, 3.2.5)

(17) CENPD-139-P-A, "C-E Fuel Evaluation Model Topical Report," July 1974 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.1, 3.2.2.1)

(18) CEN-161-(B)-P-A, "Improvements to Fuel Evaluation Model," August 1989 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.1, 3.2.2.1)

(19) CEN-161-(B)-P, Supplement 1-P, "Improvements to Fuel Evaluation Model," April 1986 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.1, 3.2.2.1)

(20) Letter from Mr. S. A. McNeil, Jr. (NRC) to Mr. J. A. Tiernan (BG&E), dated February 4, 1987, Docket Nos. 50-317 and 50-318, "Safety Evaluation of Topical Report CEN-161-(B)-P, Supplement 1-P, Improvements to Fuel Evaluation Model" (Approval of CEN-161(B), Supplement 1-P)

(21) CEN-372-P-A, "Fuel Rod Maximum Allowable Gas Pressure," May 1990 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.1, 3.2.2.1)

(22) Letter from Mr. A. E. Scherer (CE) to Mr. J. R. Miller (NRC) dated December 15, 1981, LD-81-095, Enclosure 1-P, "C-E ECCS Evaluation Model Flow Blockage Analysis" (Methodology for Specifications 3.2.1, 3.2.2.1)

(23) CENPD-132, Supplement 3-P-A, "Calculative Methods for the C-E Large Break LOCA Evaluation Model for the Analysis of C-E and W Designed NSSS," June 1985 (Methodology for Specifications 3.2.1, 3.2.2.1 and approval of Letter LD-81-095, dated December 15, 1981)

(24) CENPD-133, Supplement 5, "CEFLASH-4A, a FORTRAN77 Digital Computer Program for Reactor Blowdown Analysis," June 1985 (Methodology for Specifications 3.2.1, 3.2.2.1)

(25) CENPD-134, Supplement 2, "COMPERC-II, A Program for Emergency Refill-Reflood of the Core," June 1985 (Methodology for Specifications 3.2.1, 3.2.2.1)

(26) Letter from Mr. D. M. Crutchfield (NRC) to Mr. A. E. Scherer (CE), dated July 31, 1986, "Safety Evaluation of Combustion Engineering ECCS Large Break Evaluation Model and Acceptance for Referencing of Related Licensing Topical Reports (Approval of CENPD-133, Supplement 5 and CENPD-134, Supplement 2)

(27) CENPD-135, Supplement 5-P, "STRIKIN-II, A Cylindrical Geometry Fuel Rod Heat Transfer Program," April 1977 (Methodology for Specifications 3.2.1, 3.2.2.1)

(28) Letter from Mr. R. L. Baer (NRC) to Mr. A. E. Scherer (CE) dated September 6, 1978, "Evaluation of Topical Report CENPD-135, Supplement 5"

(29) CENPD-137, Supplement 1-P, "Calculative Methods for the C-E Small Break LOCA Evaluation Model," January 1977 (Methodology for Specifications 3.2.1, 3.2.2.1)

(30) CENPD-133, Supplement 3-P, "CEFLASH-4AS, "A Computer Program for the Reactor Blowdown Analysis of the Small Break Loss of Coolant Accident," January 1977 (Methodology for Specifications 3.2.1, 3.2.2.1)

(31) Letter from Mr. K. Kniel (NRC) to Mr. A. E. Scherer (CE), dated September 27, 1977, "Evaluation of Topical Reports CENPD-133, Supplement 3-P and CENPD-137, Supplement 1-P"

(32) CENPD-138, Supplement 2-P, "PARCH, A FORTRAN-IV Digital Program to Evaluate Pool Boiling, Axial Rod and Coolant Heatup," January 1977 (Methodology for Specifications 3.2.1, 3.2.2.1)

(33) Letter from Mr. C. Aniel (NRC) to Mr. A. E. Scherer (CE), April 10, 1978. "Evaluation of Topical Report CENPD-138, Supplement 2-P"

(34) Letter from Mr. A. E. Lundvall, Jr. (BG&E) to Mr. J. R. Miller (NRC), dated February 22, 1985, "Calvert Cliffs Nuclear Power Plant Unit 1, Docket No. 50-317, Amendment to Operating License DPR-53, Eighth Cycle License Application" (Section 7.3.2 contains Methodology for Specifications 3.1.1.1 and 3.1.1.4 and 3.1.3.6)

(35) Letter from Mr. D. H. Jaffe (NRC) to Mr. A. E. Lundvall, Jr. (BG&E), dated May 20, 1985, Safety Evaluation Report Approving Unit 1 Cycle 8 License Application

(36) Letter from Mr. A. E. Lundvall, Jr. (BG&E) to Mr. R. A. Clark (NRC), dated September 22, 1980, "Amendment to Operating License No. 50-317, Fifth Cycle License Application (Section 7.1.2 contains Methodology for Specifications 3.1.1.2, 3.9.1)

(37) Letter from Mr. R. A. Clark (NRC) to Mr. A. E. Lundvall, Jr. (BG&E), dated December 12, 1980, "Safety Evaluation Report Approving Unit 1, Cycle 5 License Application"

(38) Letter from Mr. J. A. Tiernan (BG&E) to Mr. A. C. Thadani (NRC), dated October 1, 1986, "Calvert Cliffs Nuclear Power Plant Unit Nos. 1 & 2, Docket Nos. 50-317 and 50-318, Request for Amendment" (Methodology for Specifications 3.1.3.1)

(39) Letter from S. A. McNeil, Jr. (NRC) to Mr. J. A. Tiernan (BG&E), dated July 7, 1987, Docket Nos. 50-317 and 50-318, Approval of Amendments 127 (Unit 1) and 109 (Unit 2) (Support for Specification 3.1.3.1)

(40) CENPD-188-A, "HERMITE: A Multi-Dimensional Space - Time Kinetics Code for PWR Transients," July 1976 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.1, 3.2.2.1, 3.2.3, 3.2.5)

(41) The Full Core Power Distribution Monitoring System referenced in Specifications 3.1.3.1, 3.2.2.1, 3.2.3, and the BASES is described in the following documents:

(a) CENPD-153-P, Revision 1-P-A, "Evaluation of Uncertainty in the Nuclear Power Peaking Measured by the Self-Powered, Fixed Incore Detector System," May 1980 (Methodology for Specifications 2.2.1, 3.1.3.6, 3.2.1, 3.2.2.1, 3.2.3, 3.2.5)

(b) CEN-119(B)-P, "BASSS, Use of the Incore Detector System to Monitor the DNB-LCO on Calvert Cliffs Unit 1 and Unit 2," November 1979 (Referenced in Appendix B of Unit 2 Cycle 9 License Application)

(c) Letter from Mr. G. C. Creel (BG&E) to NRC Document Control Desk, dated February 7, 1989, "Calvert Cliffs Nuclear Power Plant Unit No. 2; Docket No. 50-318. Request for Amendment, Unit 2 Ninth Cycle License Application" (Appendix B contains Methodologies for Specifications 3.1.3.1, 3.2.2.1, 3.2.3, 3.2.5)

(d) Letter from Mr. S. A. McNeil, Jr. (NRC) to Mr. G. C. Creel (BG&E), dated January 10, 1990, "Safety Evaluation Report Approving Unit 2 Cycle 9 License Application"

(42) Letter from Mr. D. G. McDonald, Jr. (NRC) to Mr. R. E. Denton (BGE), dated May 11, 1995, "Approval to Use Convolution Technique in Main Steam Line Break Analysis - Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 (TAC Nos. M90897 and M90898)