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Serial: RNP-RA/01-0089

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United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23

TRANSMITTAL OF CORE OPERATING LIMITS REPORT

Ladies and Gentlemen:

This letter transmits to the NRC the latest revision to the Core Operating Limits Report (COLR) for the H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2. This revision to the COLR reflects a change in approved methodology for the Large Break Loss-of-Coolant Accident (LBLOCA) Evaluation Model (EM). This change was made effective when Amendment No. 188 to Technical Specifications was implemented. The EM has been changed to Siemens Power Corporation (SPC)'s approved SEM/PWR-98 LBLOCA EM[1] for operating cycle 21, replacing SPC's EXEM PWR LBLOCA EM[2]. The new analysis results in a Peak Cladding Temperature (PCT) of 1977°F.

The current PCTs associated with Loss-of-Coolant Accidents (LOCAs) are listed below.

Event	PCT (°F)
LBLOCA ECCS Injection Mode	1977
LBLOCA Transfer to Recirculation Mode	260

Event	PCT (°F)
Small Break (SB) LOCA ECCS Injection Mode	2010
SBLOCA Transfer to Recirculation Mode	900

1 EMF-2087(A), "SEM/PWR-98: ECCS Evaluation Model for PWR LBLOCA Applications," Siemens Power Corporation, June 1999.

2 EXEM PWR LBLOCA Evaluation Model as accepted in NRC Letter, D. M. Crutchfield (NRC) to G. N. Ward, "Safety Evaluation of Exxon Nuclear Corporation's Large Break ECCS Evaluation Model EXEM/PWR and Acceptance for Referencing of Related Licensing Topical Reports," July 8, 1986.

Robinson Nuclear Plant
3581 West Entrance Road
Hartsville, SC 29550

A001

If you have any questions concerning this matter, please contact Mr. H. K. Chernoff.

Sincerely,

for B. L. Fletcher III
Manager - Regulatory Affairs

ALG/alg

Attachment

c: Mr. L. A. Reyes, USNRC, Region II
Mr. R. Subbaratnam, NRC, NRR
NRC Resident Inspector, HBRSEP

U. S. Nuclear Regulatory Commission
Attachment to Serial: RNP-RA/01-0089
22 Pages

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

CORE OPERATING LIMITS REPORT, REVISION 14

CP&L

I
Information Use

CAROLINA POWER & LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

PLANT OPERATING MANUAL

VOLUME 6
PART 5

FUEL MANAGEMENT PROCEDURE

FMP-001

CORE OPERATING LIMITS REPORT (COLR)

REVISION 14

SUMMARY OF CHANGES

REVISION #	REVISION COMMENTS
14	1) Reference 2.5, 2.11 and Attachment 7.1 revised to reflect Cycle 21 specific Core Operating Limits and implementation of Technical Specification Amendment 188. 2) Reference 2.6 revised to reflect new title of AP-022 3) Reference 2.8 and Steps 5.1.3 and 5.3.1 revised to reflect new 10 CFR 50.59 process. 4) Attachment 7.2 revised to reflect deletion of PLP-067.

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1.0 PURPOSE

1.1 To present the cycle-specific Core Operating Limits Report (COLR) for HBRSEP Unit No. 2

1.2 To provide a means of incorporating the COLR into the Plant Operating Manual (POM). The COLR is placed in the POM to ensure that it resides in a controlled location, and that references are provided that ensure that the requirements specified in NRC Generic Letter 88-16 and Improved Technical Specification 5.6.5 are met.

2.0 REFERENCES

2.1 Improved Technical Specifications 1.1, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.4.5, 3.4.6, 3.9.1, and 5.6.5

2.2 PLP-100, Technical Requirements Manual (TRM)

2.3 NRC Generic Letter 88-16, "Removal of Cycle-Specific Parameter Limits from Technical Specifications," October 4, 1988.

2.4 License Amendment No. 141 - Regarding Removal of Cycle-Specific Parameter Limits to Core Operating Limits Report

2.5 ESR 00-00026, Cycle 21 Core Reload Design

2.6 AP-022, Procedure Review and Approval Process

2.7 PLP-001, Plant Nuclear Safety Committee (PNSC)

2.8 REG-NGGC-0010, 10 CFR 50.59 Reviews

2.9 not used

2.10 UFSAR Section 17.3, RNP Quality Assurance Program Description

2.11 Calculation RNP-F/NFSA-0056, "RNP Cycle 21 COLR Update"

3.0 RESPONSIBILITIES

3.1 RESS Reactor Systems and/or the Nuclear Fuels Management and Safety Analysis Section (NFM&SA) is responsible for revising this procedure as changes to the COLR are required. At a minimum, revisions are required once per cycle, at Beginning of Cycle, to make the COLR cycle-specific.

3.2 The Plant Nuclear Safety Committee (PNSC) is responsible for reviewing revisions to the COLR and providing concurrence prior to implementation of COLR revisions (UFSAR Section 17.3, RNP Quality Assurance Program Description, Appendix A Item A.1.6.6.j).

3.3 RESS Reactor Systems and Operations are responsible for monitoring plant conditions to ensure the Core Operating Limits specified in this procedure are met.

3.4 Licensing/Regulatory Programs is responsible for providing prompt notification of COLR revisions to the NRC in accordance with ITS 5.6.5.d.

4.0 DEFINITIONS/ABBREVIATIONS

4.1 Definitions

4.1.1 $F_Q^V(Z)$ - the Heat Flux Hot Channel Factor is the maximum local heat flux on the surface of a fuel rod divided by the average fuel rod heat flux and including the V (z) penalty and measurement uncertainties.

4.1.2 CFQ = F_Q^{RTP} - the cycle-specific F_Q limit at Rated Thermal Power (RTP).

4.1.3 K(Z) - the normalized axial dependence factor for F_Q versus core elevation.

4.1.4 $F_{\Delta H}^N$ - the Nuclear Enthalpy Rise Hot Channel Factor is the integral of linear power along the rod with the highest integrated power divided by the average rod power

4.1.5 $F_{\Delta H}^{RTP}$ - the cycle-specific $F_{\Delta H}$ limit at Rated Thermal Power (RTP).

4.1.6 $PF_{\Delta H}$ - the Power Factor Multiplier for $F_{\Delta H}$

4.1.7 AFD - the Axial Flux Difference is the difference in signals between the top and bottom halves of a two-section excore detector which is proportional to the difference in power between the top and bottom halves of the core.

4.1.8 V(Z) - the ratio of the maximum $F_Q(Z)$ produced during and following transient maneuvers to the equilibrium $F_Q(Z)$ value at target axial offset conditions.

4.1.9 P - the fraction of rated power (2300 Mwt) at which the core is operating

4.1.10 RTP - Rated Thermal Power, 2300 Mwt

4.2 Abbreviations

4.2.1 POM - Plant Operating Manual

4.2.2 PNSC - Plant Nuclear Safety Committee

4.2.3 COLR - Core Operating Limits Report

4.2.4 MTC - Moderator Temperature Coefficient

4.2.5 ITS - Improved Technical Specifications

4.2.6 RIL - Rod Insertion Limits

4.2.7 EFPD - Effective Full Power Day

5.0 **GENERAL**

5.1 Background Information

5.1.1 HBRSEP Unit No. 2, like all other commercial nuclear power plants, is required to operate within the specific core operating limits and restrictions as specified in the Technical Specifications. Examples of these limits/restrictions include power dependent rod insertion limits, and limits of $F_Q(Z)$ and $F_{\Delta H,}$ among others. Technical Specification changes and NRC approval were required as specific numerical values for these limits/restrictions were revised. If these changes were frequent, e.g. on a cycle-specific basis, or if they were needed on accelerated schedules, considerable administrative burdens were placed on both the NRC and on utility personnel.

5.1.2 To reduce this burden, the COLR concept was developed in which specific numerical values for certain core operating limits and/or restrictions would be removed from the Technical Specifications and relocated to a COLR document. Using NRC approved methodologies, numerical values for these operating limits and/or restrictions can be updated on an as-needed basis (e.g. each cycle) by simply revising the COLR with appropriate review and notification to the NRC, hence, revisions to the Technical Specifications are not required.

5.1.3 The NRC endorsed the COLR concept by encouraging licensees to develop such a document in Generic Letter 88-16 which provided guidance for relocation of specific numerical values for various core operating limits and/or restrictions to a COLR and indicated that these values could be changed without prior NRC approval so long as an NRC-approved methodology is followed. Future changes and updates would be allowable provided an Evaluation is performed in accordance with the provisions of 10CFR 50.59, the COLR is suitably revised, and the NRC is promptly informed of the revision.

5.1.4 The use of a COLR at H. B. Robinson was accepted by the NRC per License Amendment 141. The amendment established requirements for a cycle-specific COLR and for notification of the NRC (ITS 5.6.5.d) when revisions are made. Since the COLR is cycle-specific, the COLR will be revised at least once per cycle, that is, at the beginning of the cycle.

5.2 Contents of the H.B. Robinson Unit 2 COLR

5.2.1 Technical Specification ITS 5.6.5.a requires the following cycle-specific core operating limits be established and documented in the Core Operating Limits Reports

1. Moderator Temperature Coefficient (MTC) Limits
2. Shutdown Bank Insertion Limits
3. Control Bank Insertion Limits
4. Heat Flux Hot Channel Factor ($F_Q(Z)$) Limit, CFQ
5. K(Z) Curve
6. Nuclear Enthalpy Rise Hot Channel Factor ($F_{\Delta H}{}^{N}$) Limit, $F_{\Delta H}{}^{RTP}$
7. $F_{\Delta H}$ Power Factor Multiplier ($PF_{\Delta H}$)
8. Axial Flux Difference (AFD) Limits
9. V(Z) Curve
10. Shutdown Margin
11. Refueling Boron Concentration

5.2.2 The COLR will also contain a listing of the specific methodologies used to support the core operating limits.

5.3 Requirements for Revision of the COLR

5.3.1 Since the COLR is cycle-specific, this procedure will be revised at least once per cycle, that is, at the beginning of the cycle. The methods and requirements established by this procedure for revision of the COLR supplement those of AP-022. Changes will require a 10CFR 50.59 Evaluation as well as PNSC concurrence and notification of the NRC as part of the revision process.

5.4 Core Operating Limits Report (COLR)

5.4.1 The current cycle-specific Core Operating Limits Report is provided in ATTACHMENT 7.1.

6.0 PROCEDURE

6.1 Nuclear Fuels Management & Safety Analysis Section (NFM&SA) shall review and recommend for implementation any changes to the COLR. The review is normally documented in an ESR including any required Owner's Reviews, calculations and other reviews. The use of NRC approved methodologies is also confirmed in the ESR. Changes recommended by NFM&SA are normally transmitted to the plant via a memo recommending the revision of the COLR.

6.2 Once NFM&SA recommends a revision to the COLR, a Reactor Engineer shall prepare a revision to FMP-001 in accordance with the requirements of AP-022.

6.3 Other plant procedures shall be reviewed to determine if they require revision in order to implement the revised COLR. At a minimum, the procedures listed in ATTACHMENT 7.2 shall be reviewed.

6.4 Any required procedure revisions or new procedures necessary to incorporate the change to the COLR shall be completed by the effective date of the COLR change.

6.5 The proposed revision of the COLR shall be submitted to the PNSC for review.

6.6 The PNSC shall review the proposed revision to the COLR and concur with the changes prior to their implementation in accordance with UFSAR Section 17.3 Appendix A Item A.1.6.6.j.

6.7 Upon PNSC concurrence with the revision to the COLR, Licensing/Regulatory Programs shall notify the NRC per ITS 5.6.5.d.

7.0 ATTACHMENTS

7.1 HBRSEP Unit No. 2 Cycle 21 Core Operating Limits Report, Revision 0

7.2 Procedures Potentially Affected By COLR Revisions

HBRSEP UNIT NO. 2, CYCLE 21
CORE OPERATING LIMITS REPORT
REVISION 0

1.0 OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for HBRSEP Unit No. 2, Cycle 21 has been prepared per ESR 00-00026 in accordance with the requirements of ITS 5.6.5.

The Improved Technical Specifications affected by this report and the methodologies used for the various parameters are listed below.

Parameter	ITS Reference	Applicable Methodology (Section 3.0 Number)
MTC	3.1.3	1, 2, 4, 15, 18, 19, 22
Shutdown Bank RILs	3.1.5	1, 2, 4, 8, 15, 18, 19, 22
Control Bank RILs	3.1.6	1, 2, 4, 8, 15, 18, 19, 22
$F_Q^V(Z)$	3.2.1, 3.2.3	1, 2, 5, 6, 7, 8, 11, 12, 13, 14, 15, 17, 18, 19, 21, 22
$F_{\Delta H}$	3.2.2, 3.2.3	1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22
AFD	3.2.1, 3.2.3	1, 2, 6, 7, 12, 13, 14, 15, 16, 18, 19, 21, 22
Shutdown Margin Requirements	3.1.1, 3.4.5, 3.4.6	1, 2, 4, 8, 15, 18, 19, 22
Refueling Boron Requirements	3.9.1	1, 2, 4, 8, 18, 19, 22
COLR	5.6.5	None

HBRSEP UNIT NO. 2, CYCLE 21
CORE OPERATING LIMITS REPORT
REVISION 0

2.0 OPERATING LIMITS

The cycle-specific parameter limits for the specifications listed in Section 1.0 are presented in the following subsections. These limits have been developed using the NRC-approved methodologies specified in ITS 5.6.5 and the COLR Section 3.0.

2.1 Moderator Temperature Coefficient (ITS 3.1.3)

2.1.1 The Moderator Temperature Coefficient (MTC) limits are:

a) The Positive MTC (ARO) shall be less positive than +5.0 pcm/°F for power levels up to 50% RTP, and

b) The Positive MTC (ARO) shall be less than or equal to 0.0 pcm/°F at 50% RTP and above.

c) The Negative MTC (ARO/RTP) shall be less negative than -40.0 pcm/°F.

2.1.2 The 300 ppm Surveillance limit is:

At an equilibrium boron concentration of 300 ppm the MTC shall be less negative than or equal to -32.8 pcm/°F.

2.1.3 The 60 ppm Surveillance limit is:

At an equilibrium boron concentration of 60 ppm the MTC shall be less negative than or equal to -36.8 pcm/°F.

2.2 Shutdown Rod Insertion Limits (ITS 3.1.5)

2.2.1 The shutdown rods shall be withdrawn to at least 225 steps.

2.3 Control Rod Insertion Limits (ITS 3.1.6)

2.3.1 The control rods shall be limited in physical insertion as shown in Figure 1.0

2.4 Heat Flux Hot Channel Factor - F_Q^V (Z) (ITS 3.2.1, 3.2.3)

$F_Q^V(Z) \leq (CFQ/P) \times K(Z)$ for $P > 0.5$

$F_Q^V(Z) < (CFQ/0.5) \times K(Z)$ for $P \leq 0.5$

Where: P = (Thermal Power / Rated Thermal Power)

2.4.1 CFQ = 2.44 for ROB-13, ROB-14, ROB-16, ROB-17 and ROB-18 reload batches

2.4.2 K(Z) is specified in Figure 2.0

2.5 Nuclear Enthalpy Rise Hot Channel Factor - $F_{\Delta H}$ (ITS 3.2.2, 3.2.3)

$F_{\Delta H} < F_{\Delta H}^{RTP} (1 + PF_{\Delta H} (1-P))$

Where: P = (Thermal Power / Rated Thermal Power)

2.5.1 $F_{\Delta H}$ is the measured $F_{\Delta H}^N$ multiplied by the measurement uncertainty (1.04)

2.5.2 $F_{\Delta H}^{RTP} = 1.80$ for ROB-13, ROB-14, ROB-16, ROB-17 and ROB-18 reload batches

2.5.3 $PF_{\Delta H} = 0.2$

2.6 Axial Flux Difference (ITS 3.2.1, 3.2.3)

2.6.1 The axial flux difference target bands are ±3% and ±5% about the target AFD.

2.6.2 V(Z) values for the ±3% and ±5% target bands are specified in Figure 3.0

2.6.3 The AFD Acceptable Operation Limits are specified in Figure 4.0

2.7 Shutdown Margin Requirements (SDM) (ITS 3.1.1, 3.4.5, 3.4.6)

2.7.1 The Mode 1 and Mode 2 required SDM versus RCS boron concentration is presented in Figure 5.0.

2.7.2 The Mode 3 SDM requirements are as follows:

a) With at least 2 reactor coolant pumps in operation, the SDM shall be greater than or equal to that specified in Figure 5.0.

b) With less than 2 reactor coolant pumps in operation and the rod control system capable of rod withdrawal, the SDM shall be greater than or equal to 4% $\Delta k/k$.

c) With less than 2 reactor coolant pumps in operation and with the rod control system not capable of rod withdrawal, the SDM shall be greater than or equal to that specified in Figure 5.0.

2.7.3 The Mode 4 SDM requirements are as follows:

a) With at least 2 reactor coolant pumps in operation, the SDM shall be greater than or equal to that specified in Figure 5.0.

b) With less than 2 reactor coolant pumps in operation and the rod control system capable of rod withdrawal, the SDM shall be greater than or equal to 4% $\Delta k/k$.

c) With less than 2 reactor coolant pumps in operation and with the rod control system not capable of rod withdrawal, the SDM shall be greater than or equal to that specified in Figure 5.0.

2.7.4 The minimum required SDM for Mode 5 is 1% $\Delta k/k$.

2.7.5 The minimum required SDM for Mode 6 is 6% $\Delta k/k$.

2.8 Refueling Boron Concentration (ITS 3.9.1)

2.8.1 In Mode 6 the minimum boron concentration shall be 1950 ppm.

3.0 METHODOLOGY REFERENCES

1) Not Used For Cycle 21

2) XN-NF-84-73(A), Revision 5, "Exxon Nuclear Methodology For PWRs: Analysis of Chapter 15 Events," Siemens Power Corporation, October 1990.

3) XN-NF-82-21(A), Revision 1, "Application of Exxon Nuclear Company PWR Thermal Margin Methodology to Mixed Core Configurations," Exxon Nuclear Company, September 1983.

4) EMF-84-093(A), Revision 1, "Steamline Break Methodology for PWRs," Siemens Power Corporation, February 1999.

5) XN-75-32(A) Supplements 1, 2, 3, and 4, "Computational Procedure for Evaluating Fuel Rod Bow," Exxon Nuclear Company, October 1983.

6) XN-NF-82-49(A), Revision 1 (April 1989) and Supplement 1 (December 1994), "Exxon Nuclear Company Evaluation Model Revised EXEM PWR Small Break Model," Siemens Power Corporation.

7) EMF-2087(A), "SEM/PWR-98: ECCS Evaluation Model for PWR LBLOCA Applications," Siemens Power Corporation, June 1999.

8) XN-NF-78-44(A)," A Generic Analysis of the Control Rod Ejection Transient for Pressurized Water Reactors," Exxon Nuclear Company, October 1983

9) Not Used For Cycle 21

10) Not Used For Cycle 21

11) XN-NF-82-06(A), Revision 1 and Supplements 2, 4, and 5, "Qualification of Exxon Nuclear Fuel for Extended Burnup (PWR)," Exxon Nuclear Company, October 1986.

12) Not Used For Cycle 21

13) Not Used For Cycle 21

14) Not Used For Cycle 21

15) Not Used For Cycle 21

16) ANF-88-054(A), "PDC-3: Advanced Nuclear Fuels Corporation Power Distribution Control for Pressurized Water Reactors and Application of PDC-3 to H.B. Robinson Unit 2," Advanced Nuclear Fuels Corporation, October 1990.

17) ANF-88-133(A), and Supplement 1, "Qualification of Advanced Nuclear Fuels PWR Design Methodology for Rod Burnups of 62 GWd/MTU," Advanced Nuclear Fuels Corporation, December 1991.

18) ANF-89-151(A), and correspondence "ANF-RELAP Methodology for Pressurized Water Reactors: Analysis of Non-LOCA Chapter 15 Events," Advanced Nuclear Fuels Corporation, May 1992.

19) EMF-92-081(A), and Supplement 1, "Statistical Setpoint/Transient Methodology for Westinghouse Type Reactors," Siemens Power Corporation, February 1994.

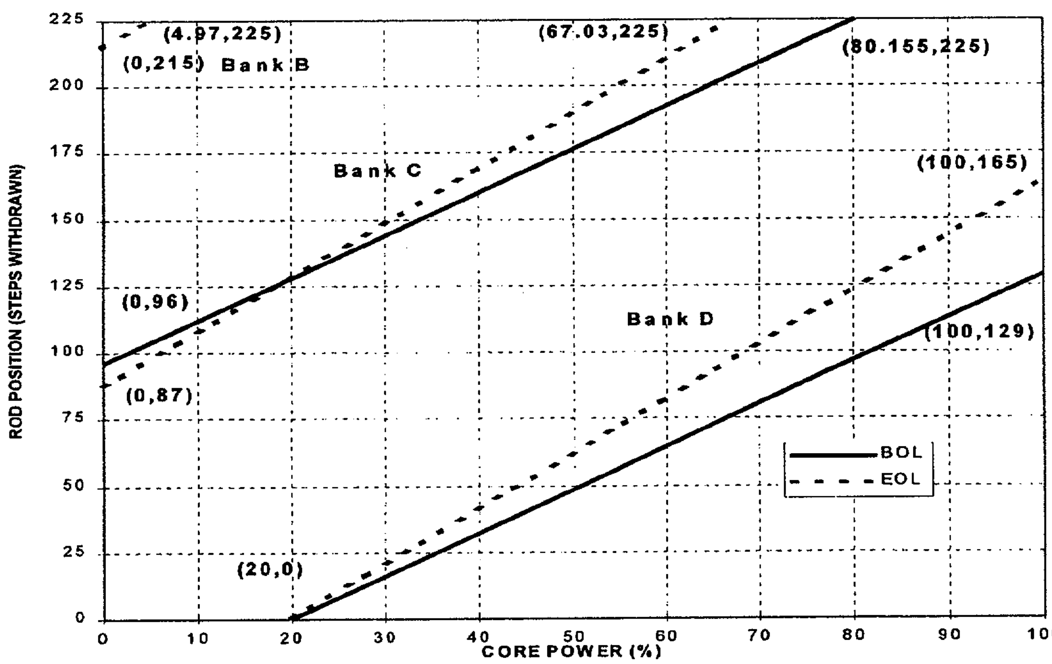
20) EMF-92-153(A), Revision 0 and Supplement 1, "HTP: Departure from Nucleate Boiling Correlation for High Thermal Performance Fuel," Siemens Power Corporation, March 1994.

21) XN-NF-85-92(A), "Exxon Nuclear Uranium Dioxide/Gadolinia Irradiation Examination and Thermal Conductivity Results," Exxon Nuclear Company, November 1986.

22) EMF-96-029(A), Volume 1, Volume 2 and Attachment, "Reactor Analysis System for PWRs," Siemens Power Corporation, January 1997.

23) EMF-92-116(A), "Generic Mechanical Design Criteria for PWR Fuel Designs," Siemens Power Corporation, February 1999.

Figure 1.0, Control Group Insertion Limits for Three Loop Operation



NOTE: The breakpoint between BOL and EOL RIL occurs at 50% of the cycle as defined by burnup. For Cycle 21, this burnup occurs at 255 EFPDs.

Control rod banks shall always be withdrawn and inserted in the prescribed sequence. For withdrawal, the sequence is Shutdown "A", Shutdown "B", Control "A", Control "B", Control "C", and Control "D". The insertion sequence is the reverse of the withdrawal sequence.

Overlap of consecutive Control Banks shall not exceed the prescribed setpoint for automatic overlap. The setpoint is 97 steps.

Control Bank A must be withdrawn from the core prior to power operation.

At BOL and 0% core power, Control Bank B will be at or above step 224.

Figure 2.0, Normalized Axial Dependence Factor K(z) for Fq Versus Elevation

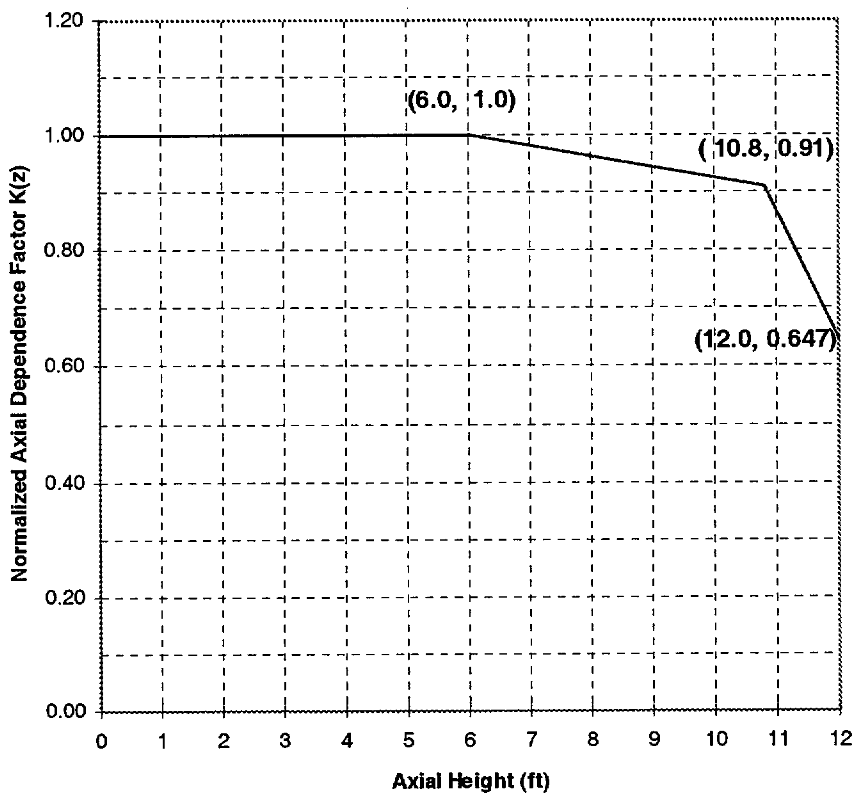
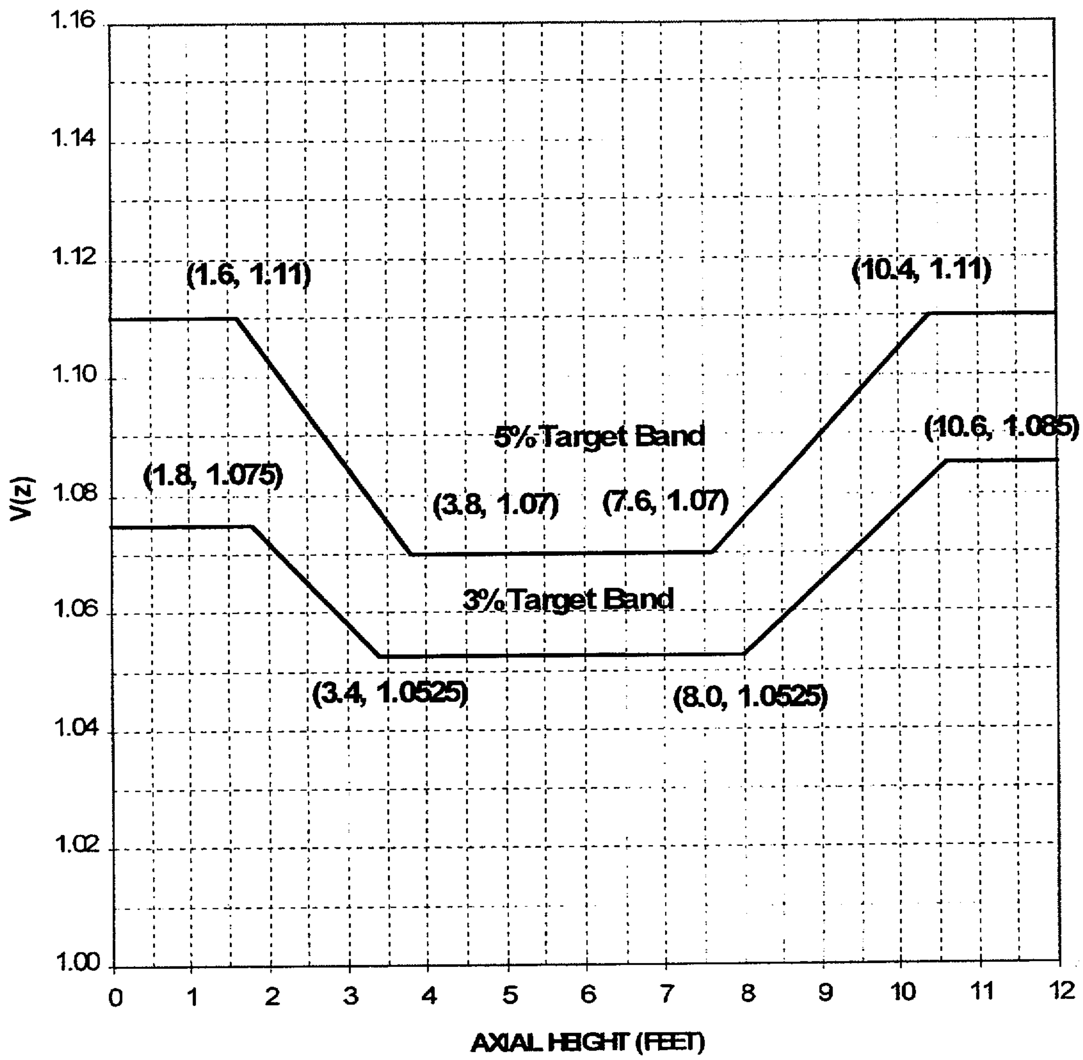


Figure 3.0, V(z) as a Function of Core Height



HBRSEP UNIT NO. 2, CYCLE 21
CORE OPERATING LIMITS REPORT
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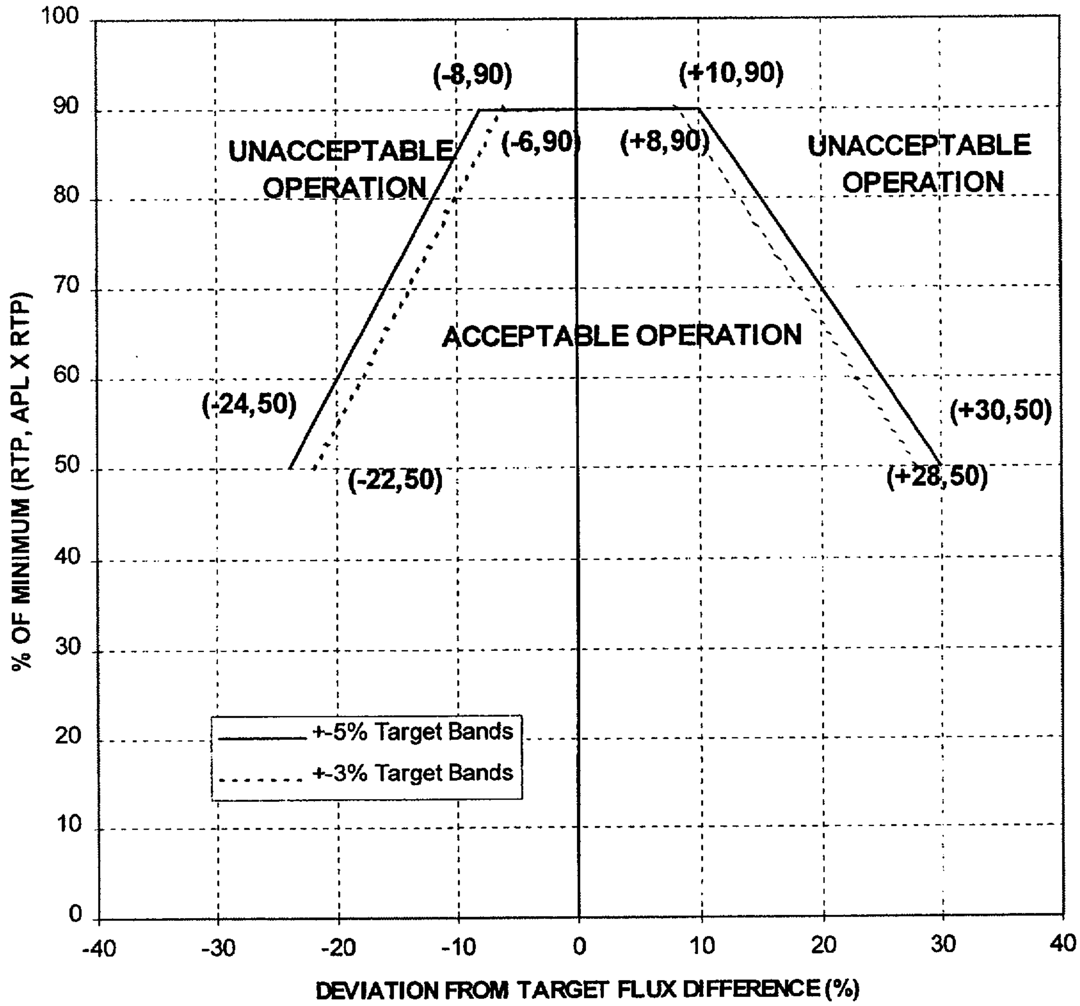
Figure 4.0, Allowable Deviation from Target Flux Difference



NOTE: For power levels above 90%, power operation is allowed within the target bands (±3% and ±5%).

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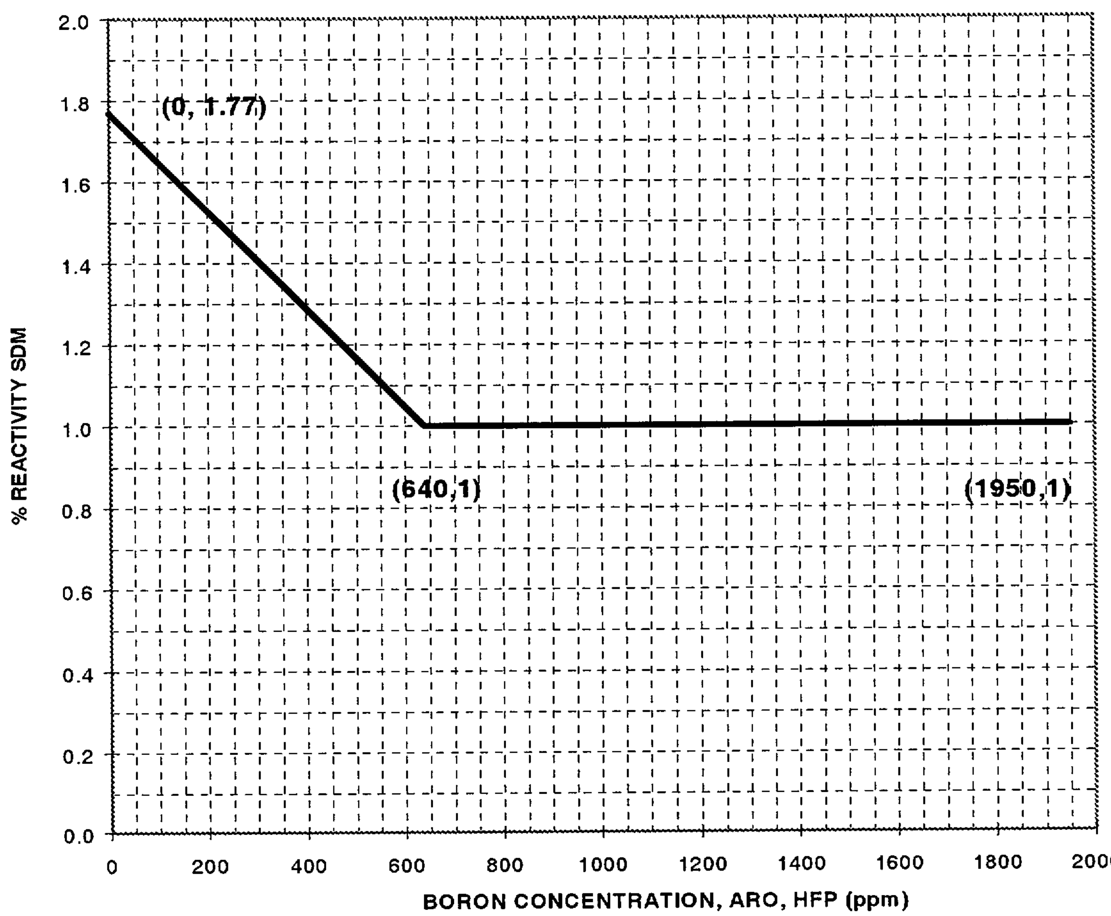
Figure 5.0, Shutdown Margin Versus Boron Concentration



PROCEDURES POTENTIALLY AFFECTED BY COLR REVISIONS

Revisions to the COLR may require that revisions be made to other plant procedures. At a minimum the following procedures should be reviewed to determine if they must be revised:

APP-005	FHP-003
CP-010	GP-002
EST-002	GP-003
EST-003	GP-006
EST-028	GP-009
EST-048	GP-010
EST-049	LP-551
EST-050	LP-552
EST-105	OP-003
EST-146	OP-910
FMP-009	OMP-003
FMP-012	PLP-100
FMP-014	
FMP-019	

Station Curve Book

ERFIS CAOC Software

NFP-NGGC-0003

The procedures listed above are those that are typically affected by COLR revisions; however, other procedures may also be affected.