

April 11, 2014

NRC 2014-0028  
TS 5.6.4

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

Point Beach Nuclear Plant Unit 2  
Docket No. 50-301  
Renewed License No. DPR-27

Core Operating Limits Report (COLR)  
Unit 2 Cycle 34 (U2C34)

In accordance with the requirements of Point Beach Nuclear Plant (PBNP)  
Technical Specification 5.6.4, enclosed is revised TRM 2.1, COLR, Unit 2 Cycle 34.

The enclosure to this letter contains the revised PBNP U2C34 COLR that was issued on  
March 26, 2014.

This letter contains no new regulatory commitments and no revisions to existing commitments.

Very truly yours,

NextEra Energy Point Beach, LLC

A handwritten signature in black ink, appearing to read "Michael Millen".

Michael Millen  
Licensing Manager

Enclosure

cc: Administrator, Region III, USNRC  
Project Manager, Point Beach Nuclear Plant, USNRC  
Resident Inspector, Point Beach Nuclear Plant, USNRC  
PSCW

**ENCLOSURE**

**NEXTERA ENERGY POINT BEACH, LLC  
POINT BEACH NUCLEAR PLANT, UNIT 2**

**CORE OPERATING LIMITS REPORT (COLR)  
UNIT 2 CYCLE 34 (U2C34)**

TRM 2.1

CORE OPERATING LIMITS REPORT  
(COLR)

UNIT 2 CYCLE 34

REVISION 17

CORE OPERATING LIMITS REPORT (COLR)  
UNIT 2 CYCLE 34

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## 1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Point Beach Nuclear Plant has been prepared in accordance with the requirements of Technical Specification (TS) 5.6.4.

A cross-reference between the COLR sections and the PBNP Technical Specifications affected by this report is given below:

<u>COLR Section</u>	<u>PBNP TS</u>	<u>Description</u>
2.1	2.1.1	Reactor Core Safety Limits
2.2	3.1.1	Shutdown Margin
	3.1.4	Rod Group Alignment Limits
	3.1.5	Shutdown Bank Insertion Limits
	3.1.6	Control Bank Insertion Limits
	3.1.8	Physics Test Exceptions
2.3	3.1.3	Moderator Temperature Coefficient
2.4	3.1.5	Shutdown Bank Insertion Limit
2.5	3.1.6	Control Bank Insertion Limits
2.6	3.2.1	Nuclear Heat Flux Hot Channel Factor ( $F_Q(Z)$ )
2.7	3.2.2	Nuclear Enthalpy Rise Hot Channel Factor ( $F_{\Delta H}^N$ )
2.8	3.2.3	Axial Flux Difference (AFD)
2.9	3.3.1	Overtemperature $\Delta T$ Setpoint
2.10	3.3.1	Overpower $\Delta T$ Setpoint
2.11	3.4.1	RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits
2.12	3.9.1	Refueling Boron Concentration
Figure 1	2.1.1	Reactor Core Safety Limits Curve
Figure 2	3.1.1	Required Shutdown Margin
Figure 3	3.1.6	Control Bank Insertion Limits
Figure 4	3.2.1	Hot Channel Factor Normalized Operating Envelope ( $K(Z)$ ) for 422V+ Fuel
Figure 5	3.2.1	Summary of $W(Z)$ as a Function of Core Height
Figure 5A	3.2.1	BOC Part-Power Summary of $W(Z)$ as a Function of Core Height
Figure 6	3.2.3	Flux Difference Operating Envelope
Table 1	5.6.4	NRC Approved Methodologies for COLR Parameters

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## 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 Technical Specification 5.6.4.

### 2.1 Reactor Core Safety Limits (TS 2.1.1)

The combination of THERMAL POWER, Reactor Coolant System (RCS) highest loop average temperature, and pressurizer pressure shall not exceed the limits specified in Figure 1.

Applicability: MODES 1 and 2

### 2.2 Shutdown Margin (TS 3.1.1 and referenced in TS 3.1.4, 3.1.5, 3.1.6, and 3.1.8)

2.2.1 SDM shall be  $\geq 2.0\% \Delta k/k$  (see Figure 2).

Applicability: MODES 1, 2, and 3

2.2.2 SDM shall be  $\geq 1\% \Delta k/k$ .

Applicability: MODES 4 and 5

### 2.3 Moderator Temperature Coefficient (TS 3.1.3)

2.3.1 The upper MTC limits shall be maintained within the limits.

2.3.2 The maximum upper MTC limits shall be:

$\leq 5 \text{ pcm}/^\circ\text{F}$  for power levels  $\leq 70\% \text{ RTP}$   
 $\leq 0 \text{ pcm}/^\circ\text{F}$  for power levels  $> 70\% \text{ RTP}$

Applicability: MODE 1 and MODE 2 with  $k_{\text{eff}} \geq 1.0$ .

### 2.4 Shutdown Bank Insertion Limit (TS 3.1.5)

**NOTE: This limit is not applicable while performing SR 3.1.4.2.**

2.4.1 Each shutdown bank shall be fully withdrawn.

2.4.2 Fully withdrawn is defined as  $\geq 225$  steps.

Applicability: MODES 1 and 2

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2.5 Control Bank Insertion Limits (TS 3.1.6)

**NOTE:** This limit is not applicable while performing SR 3.1.4.2.

The control banks shall be within the insertion, sequence and overlap limits specified in Figure 3.

Applicability: MODE 1 and MODE 2 with  $k_{eff} \geq 1.0$

2.6 Nuclear Heat Flux Hot Channel Factor ( $F_Q(Z)$ ) (TS 3.2.1)

The Heat Flux Hot Channel Factor shall be within the following limits:

$$F_Q(Z) \leq CF_Q * K(Z) / P \quad \text{for } P > 0.5$$

$$F_Q(Z) \leq CF_Q * K(Z) / 0.5 \quad \text{for } P \leq 0.5$$

Where P is the fraction of Rated Power at which the core is operating.

$F_Q(Z)$  is both:

- Steady State  $F_Q^C(Z) = F_Q(Z) * 1.08$
- Transient  $F_Q^W(Z) = F_Q^C(Z) * W(Z) / P$  for  $P > 0.5$   
 $F_Q^W(Z) = F_Q^C(Z) * W(Z) / 0.5$  for  $P \leq 0.5$

$$CF_Q = 2.60$$

$K(Z)$  is the function in Figure 4

$W(Z)$  is the function in Figures 5 and 5A

The following FQ penalty factors are applicable to Cycle 34.

Cycle Burnup (MWD/MTU)	$F_Q^W(Z)$ Penalty Factors
BOL to EOL	1.02

Applicability: MODE 1

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2.7 Nuclear Enthalpy Rise Hot Channel Factor ( $F_{\Delta H}^N$ ) (TS 3.2.2)

The Nuclear Enthalpy Rise Hot Channel Factor shall be within the following limit:

$$2.7.1 \quad F_{\Delta H}^N < 1.68 \times [1 + 0.3(1-P)]$$

where: P is the fraction of Rated Power at which the core is operating.

Applicability: MODE 1

2.8 Axial Flux Difference (AFD) (TS 3.2.3)

The AFD target band is  $\pm 5\%$ .

The AFD Acceptability Operation Limits are provided in Figure 6.

Applicability: MODE 1 with THERMAL POWER >15% RTP

2.9 Overtemperature  $\Delta T$  Setpoint (TS 3.3.1, Table 3.3.1-1 note 1)

Overtemperature  $\Delta T$  setpoint parameter values (for 1800 MWt core power):

$\Delta T_o$	=	indicated $\Delta T$ at RTP, °F
T	=	indicated RCS average temperature, °F
T'	≤	576.0°F
P	=	pressurizer pressure, psig
P'	≥	2235 psig
$K_1$	≤	1.175 (NTSP) <sup>1</sup>
$K_1$	≤	1.188 (AV) <sup>2</sup>
$K_2$	≥	0.016
$K_3$	≥	0.000811
$\tau_1$	=	40 sec
$\tau_2$	=	8 sec
$\tau_3$	=	4 sec
$\tau_4$	=	2 sec

$f(\Delta I)$  is an event function of the indicated difference between top and bottom detectors of the power-range nuclear ion chambers; with gains to be selected based on measured instrument response during plant startup tests, where  $q_t$  and  $q_b$  are the percent power in the top and bottom halves of the core respectively, and  $q_t + q_b$  is total core power in percent of RTP, such that:

<sup>1</sup> Nominal Setpoint Value

<sup>2</sup> Allowable Value

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- 2.9.1 For  $q_t - q_b$  within -12, +6 percent,  $f(\Delta I) = 0$ .
- 2.9.2 For each percent that the magnitude of  $q_t - q_b$  exceeds +6 percent, the  $\Delta T$  trip setpoint shall be automatically reduced by an equivalent of 2.00 percent of Rated Power.
- 2.9.3 For each percent that the magnitude of  $q_t - q_b$  exceeds -12 percent, the  $\Delta T$  trip setpoint shall be automatically reduced by an equivalent of 2.69 percent of Rated Power.

Applicability: MODES 1 and 2

2.10 Overpower  $\Delta T$  Setpoint (TS 3.3.1, Table 3.3.1-1 note 2)

Overpower  $\Delta T$  setpoint parameter values (for 1800 MWt core power):

$\Delta T_o$	=	indicated $\Delta T$ at RTP, °F
T	=	indicated RCS average temperature, °F
T'	≤	576.0°F
$K_4$	≤	1.098 (NTSP) <sup>1</sup>
$K_4$	≤	1.111 (AV) <sup>2</sup>
$K_5$	=	0.0 for increasing T
$K_5$	=	0.0 for decreasing T
$K_6$	≥	0.00123 for $T \geq T'$
$K_6$	=	0.0 for $T < T'$
$\tau_5$	=	0 sec
$\tau_3$	=	4 sec
$\tau_4$	=	2 sec

Applicability: MODES 1 and 2

<sup>1</sup> Nominal Setpoint Value

<sup>2</sup> Allowable Value



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2.11 RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits (TS 3.4.1)

2.11.1 T<sub>avg</sub> shall be ≤577°F.

2.11.2 Pressurizer pressure shall be maintained ≥2205 psig during operation.

**NOTE: Pressurizer pressure limit does not apply during:**

- 1) THERMAL POWER ramp >5% RTP per minute; or**
- 2) THERMAL POWER step >10% RTP.**

2.11.3 Reactor Coolant System raw measured Total Flow Rate shall be maintained ≥186,000 gpm.

| Applicability: MODE 1

2.12 Refueling Boron Concentration (TS 3.9.1)

Boron concentrations of the Reactor Coolant System, the refueling canal, and the refueling cavity shall be maintained ≥2300 ppm.

Applicability: MODE 6

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FIGURE 1  
REACTOR CORE SAFETY LIMITS CURVE

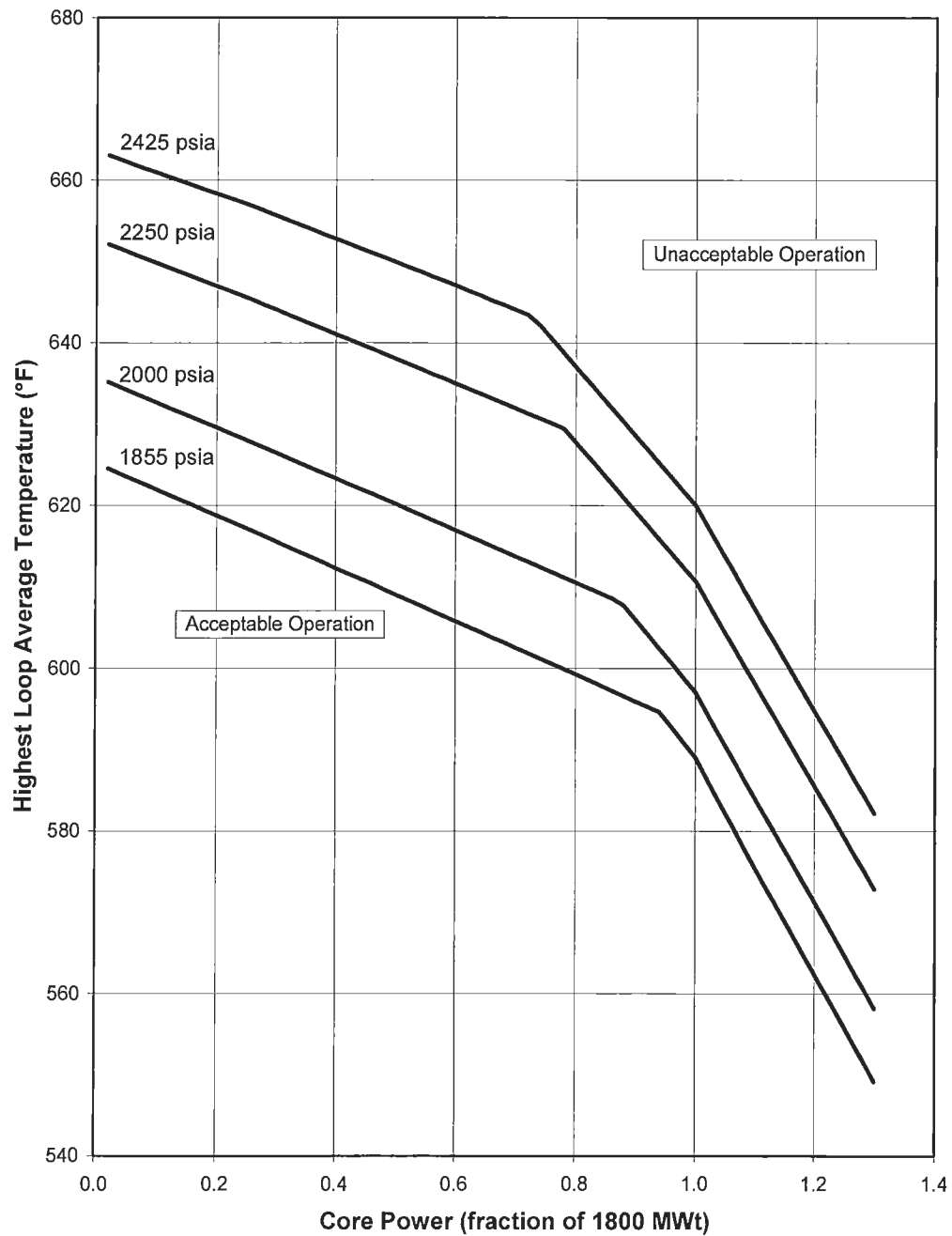
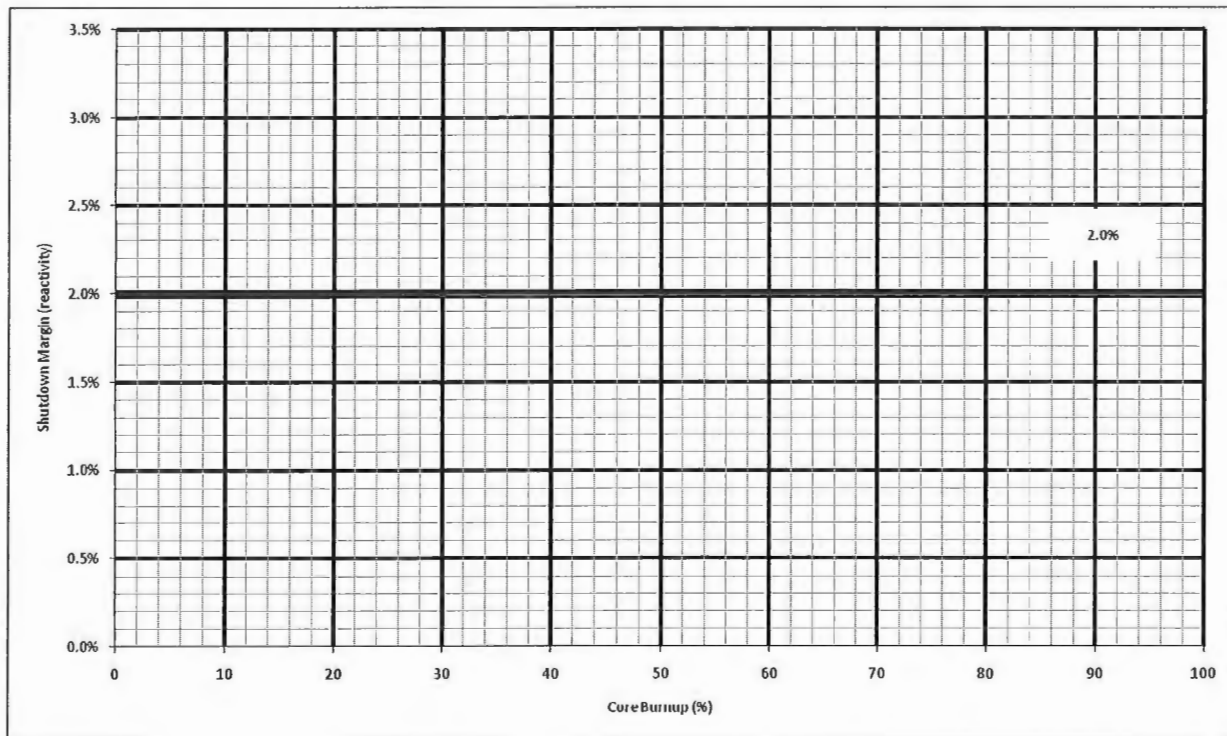
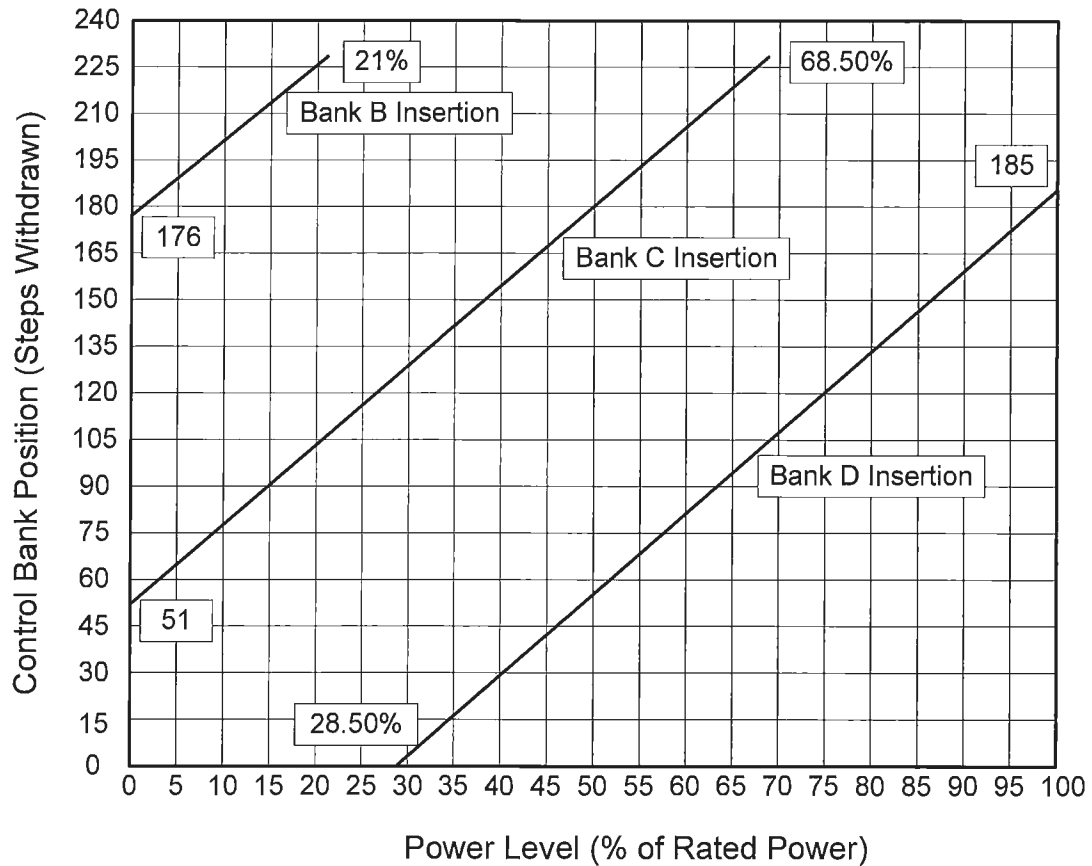


FIGURE 2  
REQUIRED SHUTDOWN MARGIN



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FIGURE 3  
CONTROL BANK INSERTION LIMITS

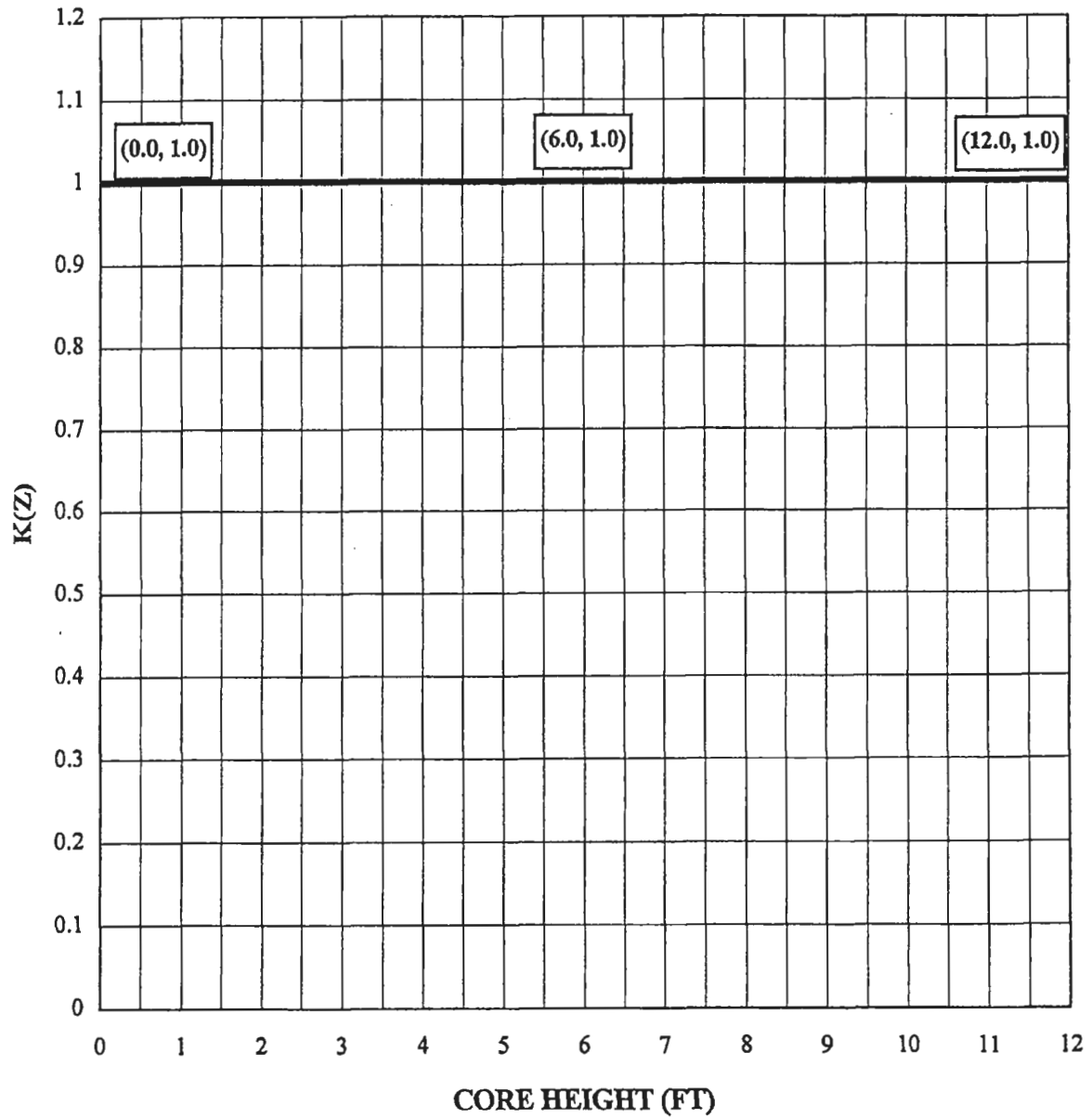


**NOTE:** The Figure is applicable for any fully withdrawn position of  $\geq 225$  steps (Limits are always considered met when withdrawn position is  $\geq 225$  steps).

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FIGURE 4  
HOT CHANNEL FACTOR NORMALIZED OPERATING ENVELOPE ( $K(Z)$ )



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FIGURE 5  
Summary of W(Z) as a Function of Core Height  
(Top 15% and Bottom 12% Excluded)

Height (feet)	W(Z)			
	150 MWD/MTU	2000 MWD/MTU	8000 MWD/MTU	18000 MWD/MTU
0.0	1.0000	1.0000	1.0000	1.0000
0.2	1.0000	1.0000	1.0000	1.0000
0.4	1.0000	1.0000	1.0000	1.0000
0.6	1.0000	1.0000	1.0000	1.0000
0.8	1.0000	1.0000	1.0000	1.0000
1.0	1.0000	1.0000	1.0000	1.0000
1.2	1.0000	1.0000	1.0000	1.0000
1.4	1.0000	1.0000	1.0000	1.0000
1.6	1.0971	1.0967	1.1065	1.1231
1.8	1.0972	1.0969	1.1057	1.1202
2.0	1.0971	1.0968	1.1045	1.1166
2.2	1.0966	1.0964	1.1029	1.1124
2.4	1.0959	1.0958	1.1009	1.1077
2.6	1.0950	1.0949	1.0986	1.1025
2.8	1.0939	1.0938	1.0959	1.0971
3.0	1.0925	1.0924	1.0929	1.0909
3.2	1.0909	1.0907	1.0899	1.0868
3.4	1.0895	1.0894	1.0871	1.0841
3.6	1.0887	1.0883	1.0853	1.0825
3.8	1.0883	1.0877	1.0836	1.0821
4.0	1.0876	1.0872	1.0822	1.0821
4.2	1.0868	1.0864	1.0811	1.0827
4.4	1.0859	1.0853	1.0803	1.0835
4.6	1.0848	1.0841	1.0797	1.0840
4.8	1.0836	1.0829	1.0790	1.0843
5.0	1.0821	1.0816	1.0785	1.0843
5.2	1.0804	1.0799	1.0778	1.0840
5.4	1.0785	1.0781	1.0769	1.0834
5.6	1.0764	1.0759	1.0757	1.0824
5.8	1.0739	1.0736	1.0742	1.0810
6.0	1.0715	1.0708	1.0723	1.0791

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FIGURE 5 (con't)  
Summary of W(Z) as a Function of Core Height  
(Top 15% and Bottom 12% Excluded)

Height (feet)	W(Z)			
	150 MWD/MTU	2000 MWD/MTU	8000 MWD/MTU	18000 MWD/MTU
6.2	1.0690	1.0678	1.0702	1.0767
6.4	1.0663	1.0644	1.0689	1.0740
6.6	1.0636	1.0620	1.0677	1.0737
6.8	1.0612	1.0602	1.0655	1.0773
7.0	1.0592	1.0590	1.0656	1.0803
7.2	1.0573	1.0577	1.0691	1.0831
7.4	1.0564	1.0572	1.0735	1.0854
7.6	1.0601	1.0624	1.0775	1.0874
7.8	1.0658	1.0685	1.0814	1.0891
8.0	1.0718	1.0742	1.0850	1.0903
8.2	1.0775	1.0798	1.0883	1.0913
8.4	1.0832	1.0853	1.0913	1.0919
8.6	1.0886	1.0905	1.0939	1.0923
8.8	1.0939	1.0955	1.0962	1.0923
9.0	1.0988	1.1002	1.0981	1.0923
9.2	1.1034	1.1045	1.0995	1.0923
9.4	1.1076	1.1084	1.1005	1.0926
9.6	1.1122	1.1127	1.1017	1.0927
9.8	1.1166	1.1168	1.1030	1.0932
10.0	1.1206	1.1206	1.1035	1.0943
10.2	1.1240	1.1238	1.1043	1.0956
10.4	1.0000	1.0000	1.0000	1.0000
10.6	1.0000	1.0000	1.0000	1.0000
10.8	1.0000	1.0000	1.0000	1.0000
11.0	1.0000	1.0000	1.0000	1.0000
11.2	1.0000	1.0000	1.0000	1.0000
11.4	1.0000	1.0000	1.0000	1.0000
11.6	1.0000	1.0000	1.0000	1.0000
11.8	1.0000	1.0000	1.0000	1.0000
12.0	1.0000	1.0000	1.0000	1.0000

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FIGURE 5A  
BOC Part-Power Summary of W(Z) as a Function of Core Height  
(Top 15% and Bottom 12% Excluded)

Height (feet)	Part -Power W(Z) with Correction Factor (excluding power ratio)			
	Hot Full Power	30% Power	50% Power	75% Power
0	1.0000	1.0000	1.0000	1.0000
0.2	1.0000	1.0000	1.0000	1.0000
0.4	1.0000	1.0000	1.0000	1.0000
0.6	1.0000	1.0000	1.0000	1.0000
0.8	1.0000	1.0000	1.0000	1.0000
1	1.0000	1.0000	1.0000	1.0000
1.2	1.0000	1.0000	1.0000	1.0000
1.4	1.0000	1.0000	1.0000	1.0000
1.6	1.0971	1.3805	1.2720	1.1734
1.8	1.0972	1.3658	1.2638	1.1699
2	1.0971	1.3477	1.2537	1.1655
2.2	1.0966	1.3276	1.2422	1.1602
2.4	1.0959	1.3088	1.2311	1.1552
2.6	1.0950	1.2913	1.2204	1.1502
2.8	1.0939	1.2741	1.2096	1.1449
3	1.0925	1.2564	1.1982	1.1390
3.2	1.0909	1.2383	1.1867	1.1331
3.4	1.0895	1.2205	1.1759	1.1276
3.6	1.0887	1.2041	1.1657	1.1226
3.8	1.0883	1.1886	1.1559	1.1178
4	1.0876	1.1731	1.1457	1.1126
4.2	1.0868	1.1576	1.1353	1.1073
4.4	1.0859	1.1422	1.1250	1.1019
4.6	1.0848	1.1268	1.1146	1.0963
4.8	1.0836	1.1116	1.1044	1.0906
5	1.0821	1.0966	1.0941	1.0846
5.2	1.0804	1.0817	1.0835	1.0786
5.4	1.0785	1.0668	1.0727	1.0725
5.6	1.0764	1.0530	1.0627	1.0665
5.8	1.0739	1.0390	1.0523	1.0601
6	1.0715	1.0251	1.0417	1.0536



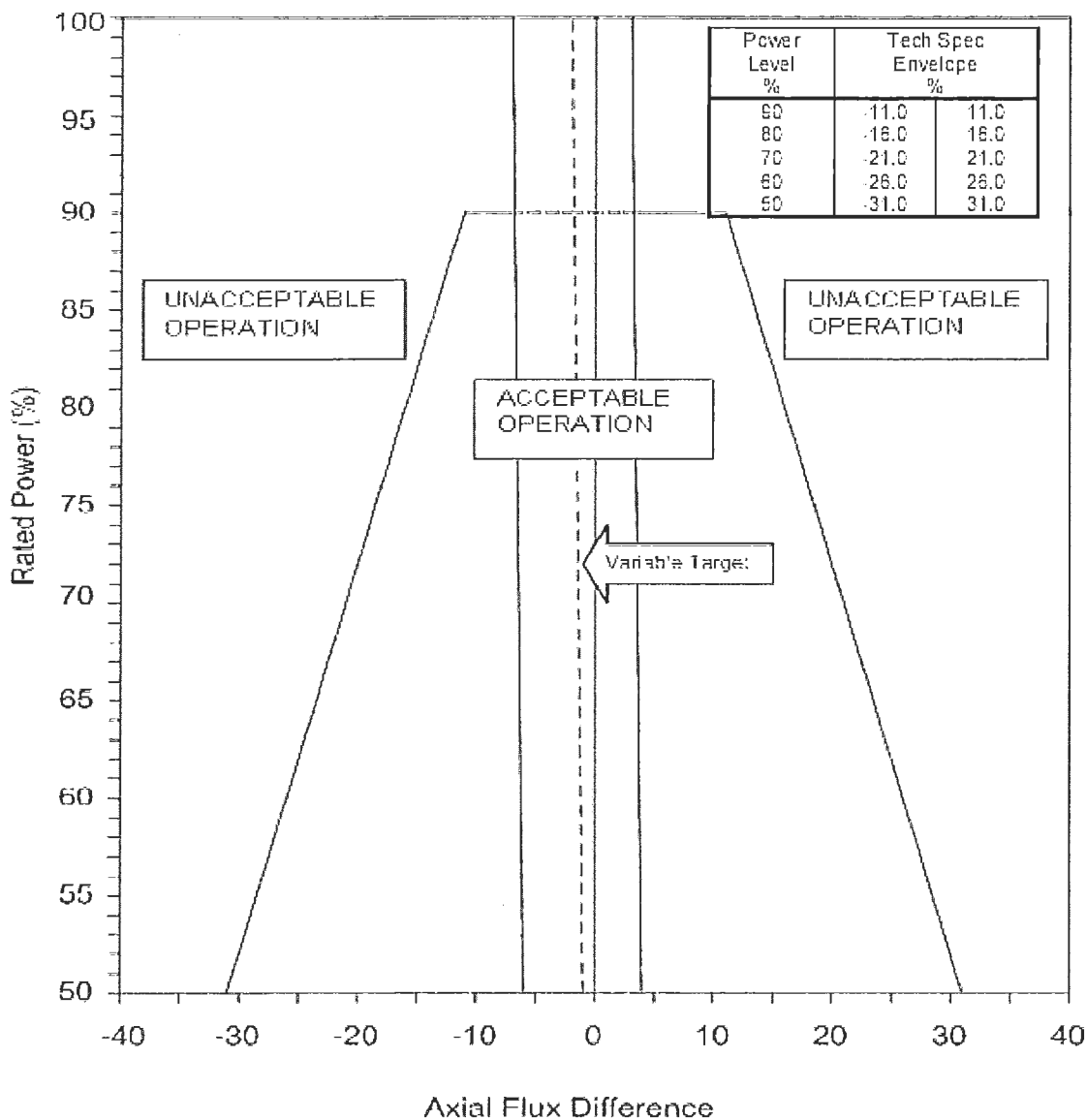
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FIGURE 5A (con't)  
BOC Part-Power Summary of W(Z) as a Function of Core Height  
(Top 15% and Bottom 12% Excluded)

Height (feet)	Part -Power W(Z) with Correction Factor (excluding power ratio)			
	Hot Full Power	30% Power	50% Power	75% Power
6.2	1.0690	1.0114	1.0310	1.0468
6.4	1.0663	1.0000	1.0204	1.0398
6.6	1.0636	1.0000	1.0097	1.0330
6.8	1.0612	1.0000	1.0000	1.0267
7	1.0592	1.0000	1.0000	1.0206
7.2	1.0573	1.0000	1.0000	1.0147
7.4	1.0564	1.0000	1.0000	1.0099
7.6	1.0601	1.0000	1.0000	1.0098
7.8	1.0658	1.0000	1.0000	1.0119
8	1.0718	1.0000	1.0000	1.0146
8.2	1.0775	1.0000	1.0000	1.0171
8.4	1.0832	1.0000	1.0000	1.0196
8.6	1.0886	1.0000	1.0000	1.0220
8.8	1.0939	1.0000	1.0000	1.0245
9	1.0988	1.0000	1.0000	1.0273
9.2	1.1034	1.0000	1.0000	1.0306
9.4	1.1076	1.0000	1.0000	1.0347
9.6	1.1122	1.0000	1.0000	1.0402
9.8	1.1166	1.0000	1.0000	1.0461
10	1.1206	1.0000	1.0000	1.0518
10.2	1.1240	1.0000	1.0000	1.0617
10.4	1.0000	1.0000	1.0000	1.0000
10.6	1.0000	1.0000	1.0000	1.0000
10.8	1.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000
11.2	1.0000	1.0000	1.0000	1.0000
11.4	1.0000	1.0000	1.0000	1.0000
11.6	1.0000	1.0000	1.0000	1.0000
11.8	1.0000	1.0000	1.0000	1.0000
12	1.0000	1.0000	1.0000	1.0000

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FIGURE 6  
FLUX DIFFERENCE OPERATING ENVELOPE



NOTE:

1. This figure represents the Constant Axial Offset Control (CAOC) band used in safety analyses, it may be administratively tightened depending on in-core flux map results. Refer to Figure 2 of Reactor Operating Data (ROD) 1.2 for the administrative limit.
2. The AFD may deviate outside the target band with THERMAL POWER < 50% RTP.
3. The AFD target band is +/-5% for THERMAL POWER ≥ 15% RTP.

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TABLE 1  
NRC APPROVED METHODOLOGIES FOR COLR PARAMETERS

COLR Section	Parameter	NRC Approved Methodology
All	Reactor Thermal Output	Caldon, Inc., Engineering Report-80P, "TOPICAL REPORT: Improving Thermal Power Accuracy and Plant Safety While Increasing Operating Power Level Using the LEFM <sup>√</sup> ™ System," Revision 0, Mar 1997.  Caldon, Inc., Engineering Report-160P, "Supplement to Topical Report ER-80P: Basis for a Power Upate With the LEFM <sup>√</sup> ™ System," Revision 0, May 2000.
2.1	Reactor Core Safety Limits	WCAP-9272-P-A, "Westinghouse Reload Safety Evaluation Methodology," July 1985.
2.2	Shutdown Margin	WCAP-9272-P-A, "Westinghouse Reload Safety Evaluation Methodology," July 1985.
2.3	Moderator Temperature Coefficient	WCAP-9272-P-A, "Westinghouse Reload Safety Evaluation Methodology," July 1985.
2.4	Shutdown Bank Insertion Limit	WCAP-9272-P-A, "Westinghouse Reload Safety Evaluation Methodology," July 1985.
2.5	Control Bank Insertion Limits	WCAP-9272-P-A, "Westinghouse Reload Safety Evaluation Methodology," July 1985.
2.6	Nuclear Heat Flux Hot Channel Factor ( $F_Q(Z)$ )	WCAP-8403 (non-proprietary), "Power Distribution Control and Load Following Procedures," Westinghouse Electric Corporation, September 1974.  WCAP-14449-P-A, "Application of Best Estimate Large Break LOCA Methodology to Westinghouse PWRs with Upper Plenum Injection," Revision 1, October 1999 (cores containing 422V + fuel).  WCAP-16009-P-A, "Realistic Large-Break LOCA Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty Method (ASTRUM)," January 2005.  WCAP-10054-P-A, "Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code," August 1985.  WCAP-10054-P-A, "Addendum to the Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code: Safety Injection into the Broken Loop and COSI Condensation Model," Addendum 2, Revision 1, July 1997.

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TABLE 1  
NRC APPROVED METHODOLOGIES FOR COLR PARAMETERS

COLR Section	Parameter	NRC Approved Methodology
2.7	Nuclear Enthalpy Rise Hot Channel Factor ( $F_{\Delta H}^N$ )	WCAP-9272-P-A, "Westinghouse Reload Safety Evaluation Methodology," July 1985.  WCAP-16259-P-A, "Westinghouse Methodology for Applications of 3-D Transient Neutronics to Non-LOCA Accident Analysis," August 2006.
2.8	Axial Flux Difference (AFD)	WCAP-8403 (nonproprietary), "Power Distribution Control and Load Following Procedures," Westinghouse Electric Corporation, September 1974.  NS-TMA-2198, Westinghouse to NRC Letter Attachment: "Operation and Safety Analysis Aspects of an Improved Load Follow Package," January 31, 1980.  NS-CE-687, Westinghouse to NRC Letter, "Power Distribution Control Analysis," July 16, 1975.
2.9	Overtemperature $\Delta T$ Setpoint	WCAP-8745-P-A, "Design Bases for the Thermal Overpower $\Delta T$ and Thermal Overtemperature $\Delta T$ Trip Functions," September 1986
2.10	Overpower $\Delta T$ Setpoint	WCAP-8745-P-A, "Design Bases for the Thermal Overpower $\Delta T$ and Thermal Overtemperature $\Delta T$ Trip Functions," September 1986
2.11	RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits	WCAP-11397-P-A, "Revised Thermal Design Procedure," April 1989, for those events analyzed using RTDP  WCAP-14787-P, Rev. 3, "Westinghouse Revised Thermal Design Procedure Instrument Uncertainty Methodology for Point Beach Units 1 & 2 Power Uprate (1775 MWt Core Power with Feedwater Venturis, or 1800 MWt Core Power with LEFM on Feedwater Header)", February 2009.  WCAP-9272-P-A, "Westinghouse Reload Safety Evaluation Methodology," July 1985 for those events not utilizing RTDP
2.12	Refueling Boron Concentration	WCAP-9272-P-A, "Westinghouse Reload Safety Evaluation Methodology," July 1985