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Braidwood Generating Station
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February 20, 2001
BW010013

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

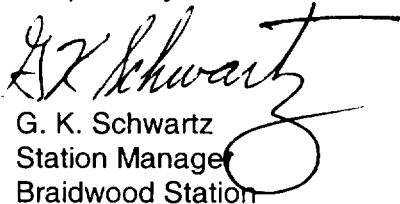
Braidwood Station, Units 1 and 2
Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Subject: Core Operating Limits Report, Braidwood Unit 1 Cycle 9 Sequence Number 4
and Braidwood Unit 2 Cycle 9 Revision Number 2

The purpose of this letter is to transmit the Core Operating Limits Reports (COLRs) for Braidwood Unit 1 Cycle 9 Sequence Number 4 and Braidwood Unit 2 Revision Number 2, in accordance with Technical Specification 5.6.5, "Core Operating Limits Report (COLR)." Sequence Number 4 for Unit 1 and Revision Number 2 for Unit 2 revise the pressurizer pressure Departure from Nucleate Boiling (DNB) limit specified in Section 2.11.1 of the respective COLRs. The revised pressurizer pressure DNB limit is based on a revised calculation of indication uncertainty. For Unit 1, Sequence Number 4 supercedes Sequence Number 3, and for Unit 2, Revision 2 supercedes Revision 1.

If you have any questions regarding this matter, please contact T. W. Simpkin, Regulatory Assurance Manager at (815) 458-2801, extension 2980.

Respectfully,


G. K. Schwartz
Station Manager
Braidwood Station

Attachments: 1. Core Operating Limits Report, Braidwood Unit 1 Cycle 9 Sequence Number 4
2. Core Operating Limits Report, Braidwood Unit 2 Cycle 9 Revision Number 2

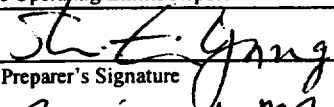
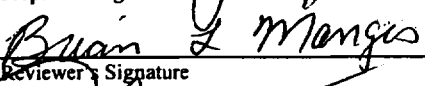

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Braidwood Station

A 001

ATTACHMENT 1

Core Operating Limits Report

Braidwood Unit 1, Cycle 9, Sequence Number 4

NUCLEAR FUEL MANAGEMENT DEPARTMENT NUCLEAR DESIGN INFORMATION TRANSMITTAL			
<input checked="" type="checkbox"/> SAFETY RELATED <input type="checkbox"/> NON-SAFETY RELATED <input type="checkbox"/> REGULATORY RELATED	Originating Organization <input checked="" type="checkbox"/> Nuclear Fuel Management <input type="checkbox"/> Other (specify) _____	NDIT No. <u>NFM0000014</u> Seq. No. <u>4</u> Page 1 of 21	
Station <u>Braidwood</u> Unit <u>1</u> Cycle <u>9</u> Generic _____ To: <u>Lonnie Kepley</u>			
Subject <u>Braidwood Unit 1 Cycle 9 Core Operating Limits Report</u>			
Shitien Yang Preparer	 Preparer's Signature	<u>12/21/00</u> Date	
Brian L. Manges Reviewer	 Reviewer's Signature	<u>12/21/2000</u> Date	
D. Redden NFM Supervisor	 NFM Supervisor's Signature	<u>12/22/00</u> Date	
Status of Information: <div style="display: inline-block; vertical-align: top; margin-left: 20px;"> <input checked="" type="checkbox"/> Verified <input type="checkbox"/> Unverified <input type="checkbox"/> Engineering Judgement </div>			
Method and Schedule of Verification for Unverified NDITs: _____			
Description of Information: Attached is the Braidwood Unit 1 Cycle 9 Core Operating Limits Report (COLR) in the ITS format and W(z) function.			
Purpose of Information: The Sequence 4 of this NDIT supersedes Sequence 3. This sequence changes Section 2.11.1 of the COLR to reflect the correct pressurizer pressure DNB Limit. Sequence 3 modifies Section 2.12.2 of the COLR to support the requirement for the new TRM TLCO 3.1.g. Sequence 2 incorporated a set of W(z) generated with AFD band of +5/-8. Sequence 1 incorporated the Expanded COLR format and other administrative changes. Braidwood Station is requested to perform a plant review of this document. Upon completion of the plant review, Braidwood Station is to transmit the COLR portion to the Nuclear Regulatory Commission pursuant to Technical Specification 5.6.5. Please provide NFM (Raymond Ng) with a copy of Braidwood Station's completed plant review and COLR submittal to the NRC.			
Source of Information: 1) PND Calculation Number SP-03, "BRIC9 SPIL - CAOC Analysis," Project BRIC9, File NDN 10.6, dated 9/22/99. 2) PND Calculation Number SP-15, "BRIC9 SPIL - UET," Project BRIC9, File NDN 10.6, dated 11/8/99. 3) PND Calculation Number SP-27, "BRIC9 SPIL - Minimum Required Boron Concentration for Rod Drop Testing," Project BRIC9, File NDN 10.6, dated 12/13/99. 4) PND Calculation Number NR-22, "BRIC9 NDR - Revised W(z) with New Delta-I Band," Project BRIC9, File NDN 10.6, dated 07/27/00. 5) Letter from M. Lesniak to U. S. Nuclear Regulatory Commission, "Application for Amendment to Facility Operating Licenses-Reactivity Control Systems; Byron Station Units 1 and 2, NPF -37/66: Docket Nos. 50-454/455; Braidwood Units 1 and 2 NPF-72/77 Docket Nos. 50-456/457," dated December 21, 1995. 6) TODI NFM0000188, Seq. 0, "Pressurizer Pressure DNB Limit," A. W. Wong to D. Wozniak and T. Luke, December 15, 2000.			
Supplemental Distribution: T. Simpkin / L. S. Dworakowski (BW)			

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Braidwood Station Unit 1 Cycle 9 has been prepared in accordance with the requirements of Technical Specification 5.6.5 (ITS).

The Technical Specifications affected by this report are listed below:

SL	2.1.1	Reactor Core Safety Limits (SLs)
LCO	3.1.1	Shutdown Margin (SDM)
LCO	3.1.3	Moderator Temperature Coefficient
LCO	3.1.4	Rod Group Alignment Limits
LCO	3.1.5	Shutdown Bank Insertion Limits
LCO	3.1.6	Control Bank Insertion Limits
LCO	3.1.8	Physics Tests Exceptions – Mode 2
LCO	3.2.1	Heat Flux Hot Channel Factor ($F_q(Z)$)
LCO	3.2.2	Nuclear Enthalpy Rise Hot Channel Factor ($F_{\Delta H}^N$)
LCO	3.2.3	Axial Flux Difference (AFD)
LCO	3.3.1	Reactor Trip System (RTS) Instrumentation
LCO	3.3.9	Boron Dilution Protection System (BDPS)
LCO	3.4.1	Reactor Coolant System (RCS) DNB Parameters
LCO	3.9.1	Boron Concentration

The portions of the Technical Requirements Manual affected by this report are listed below:

TRM TLCO 3.1.b	Boration Flow Paths - Operating
TRM TLCO 3.1.d	Charging Pumps - Operating
TRM TLCO 3.1.f	Borated Water Sources – Operating
TRM TLCO 3.1.g	Position Indication System – Shutdown
TRM TLCO 3.1.h	Shutdown Margin (SDM) – MODE 1 and MODE 2 with $keff \geq 1.0$
TRM TLCO 3.1.i	Shutdown Margin (SDM) – MODE 5
TRM TLCO 3.1.j	Shutdown and Control Rods
TRM TLCO 3.1.k	Position Indication System – Shutdown (Special Test Exception)

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

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 are applicable for the entire cycle unless otherwise identified. These limits have been developed using the NRC-approved methodologies specified in Technical Specification 5.6.5.

2.1 Reactor Core Limits (SL 2.1.1)

- 2.1.1 In Modes 1 and 2, the combination of Thermal Power, Reactor Coolant System (RCS) highest loop average temperature, and pressurizer pressure shall not exceed the limits specified in Figure 2.1.1.

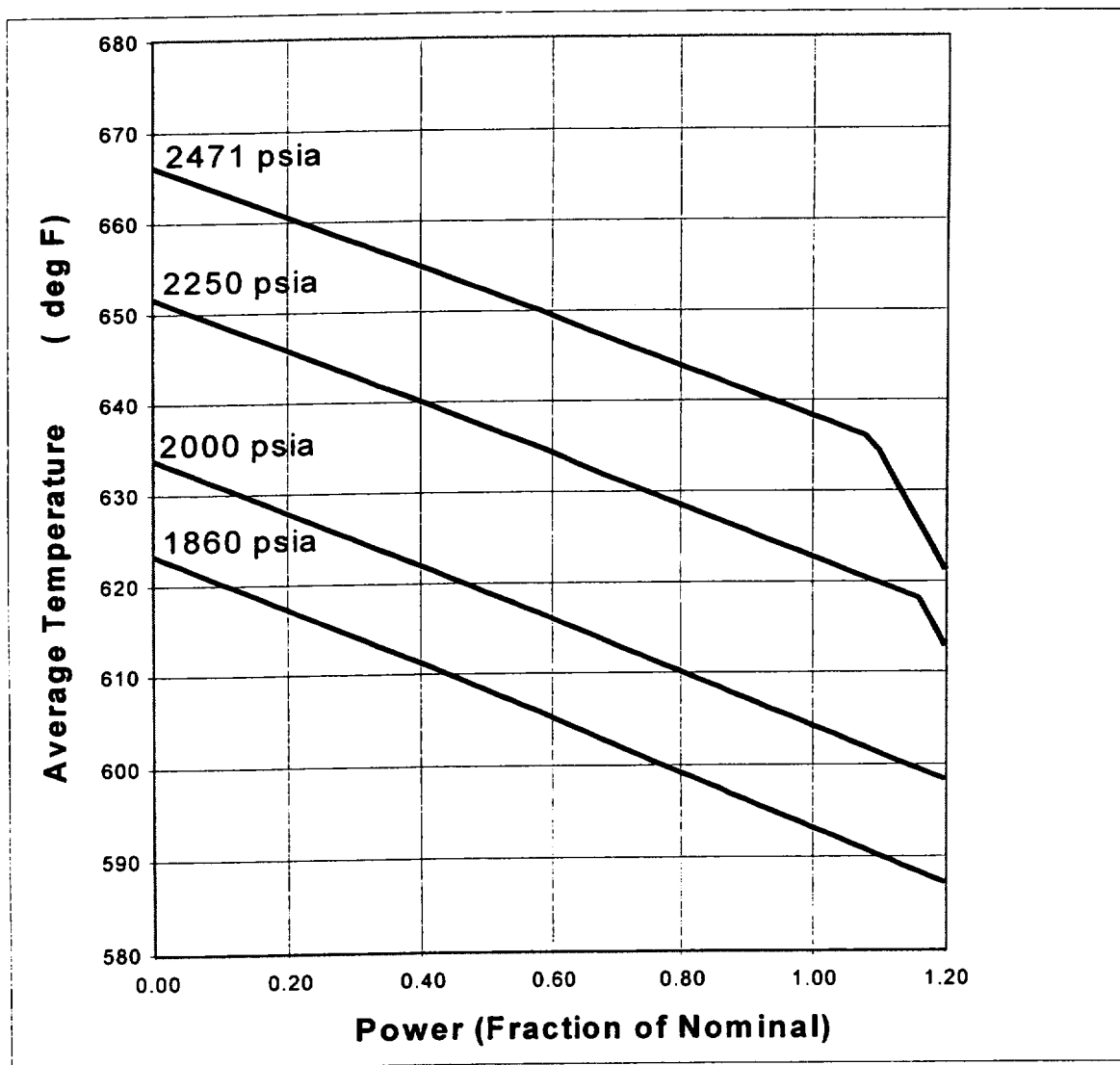


Figure 2.1.1: Reactor Core Limits

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

2.2 Shutdown Margin (SDM)

The SDM limit for MODES 1, 2, 3, and 4 is:

- 2.2.1 The SDM shall be greater than or equal to 1.3% $\Delta k/k$ (LCOs 3.1.1, 3.1.4, 3.1.5, 3.1.6, 3.1.8, 3.3.9; TRM TLCOs 3.1.b, 3.1.d, 3.1.f, 3.1.h, and 3.1.j).

The SDM limits for MODE 5 are:

- 2.2.2.1 SDM shall be greater than or equal to 1.0% $\Delta k/k$ (LCO 3.1.1).

- 2.2.2.2 SDM shall be greater than or equal to 1.3% $\Delta k/k$ (LCO 3.3.9; TRM TLCO 3.1.i and 3.1.j).

2.3 Moderator Temperature Coefficient (LCO 3.1.3)

The Moderator Temperature Coefficient (MTC) limits are:

- 2.3.1 The BOL/ARO/HZP-MTC upper limit shall be $+3.4 \times 10^{-5} \Delta k/k/^{\circ}F$.

- 2.3.2 The EOL/ARO/HFP-MTC lower limit shall be $-4.1 \times 10^{-4} \Delta k/k/^{\circ}F$.

- 2.3.3 The EOL/ARO/HFP-MTC Surveillance limit at 300 ppm shall be less negative than or equal to $-3.2 \times 10^{-4} \Delta k/k/^{\circ}F$.

where: BOL stands for Beginning of Cycle Life
ARO stands for All Rods Out
HZP stands for Hot Zero Thermal Power
EOL stands for End of Cycle Life
HFP stands for Hot Full Thermal Power

2.4 Shutdown Bank Insertion Limit (LCO 3.1.5)

- 2.4.1 All shutdown banks shall be fully withdrawn to at least 224 steps.

2.5 Control Bank Insertion Limits (LCO 3.1.6)

- 2.5.1 The control banks shall be limited in physical insertion as shown in Figure 2.5.1.

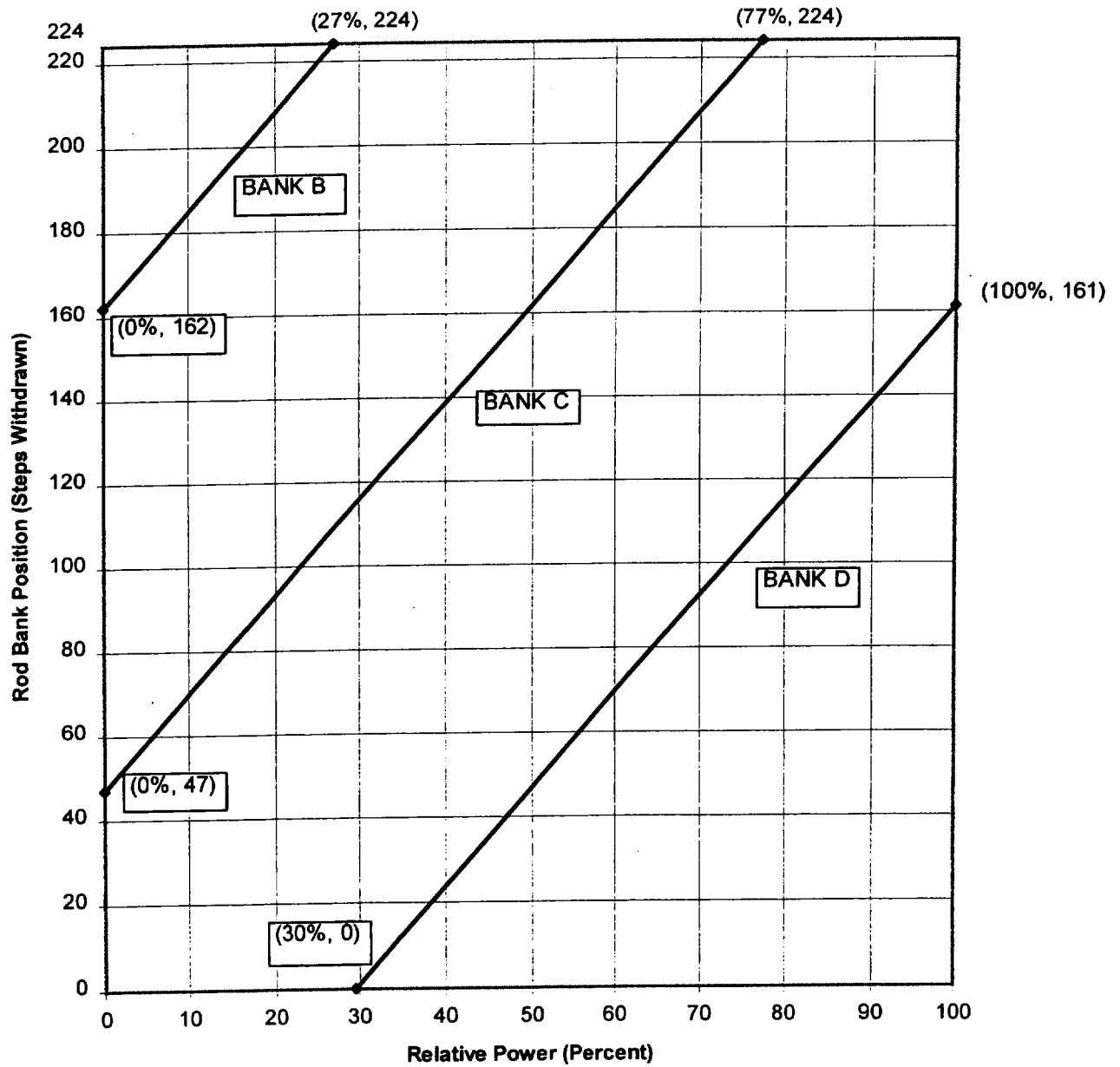
- 2.5.2 Each control bank shall be considered fully withdrawn from the core at greater than or equal to 224 steps.

- 2.5.3 The control banks shall be operated in sequence by withdrawal of Bank A, Bank B, Bank C and Bank D. The control banks shall be sequenced in reverse order upon insertion.

- 2.5.4 Each control bank not fully withdrawn from the core shall be operated with a 113 step overlap limit.

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

Figure 2.5.1:
Control Bank Insertion Limits Versus Percent Rated Thermal Power



CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

2.6 Heat Flux Hot Channel Factor ($F_q(Z)$) (LCO 3.2.1)

2.6.1

$$F_q(Z) \text{ Limit} \leq \frac{F_q^{RTP}}{0.5} \times K(Z) \text{ for } P \leq 0.5$$

$$F_q(Z) \text{ Limit} \leq \frac{F_q^{RTP}}{P} \times K(Z) \text{ for } P > 0.5$$

where: P = the ratio of THERMAL POWER to RATED THERMAL POWER

$$F_q^{RTP} = 2.60$$

$K(Z)$ for assembly average burnup > 4000 MWD/MTU is provided in Figure 2.6.1.
 $K(Z)$ for assembly average burnup \leq 4000 MWD/MTU is provided in Figure 2.6.1.a.

2.6.2 $W(Z)$ is provided in Figures 2.6.2.a through 2.6.2.d for AFD band of +5/-10, and Figures 2.6.2.e through 2.6.2.g for AFD band of +5/-8.

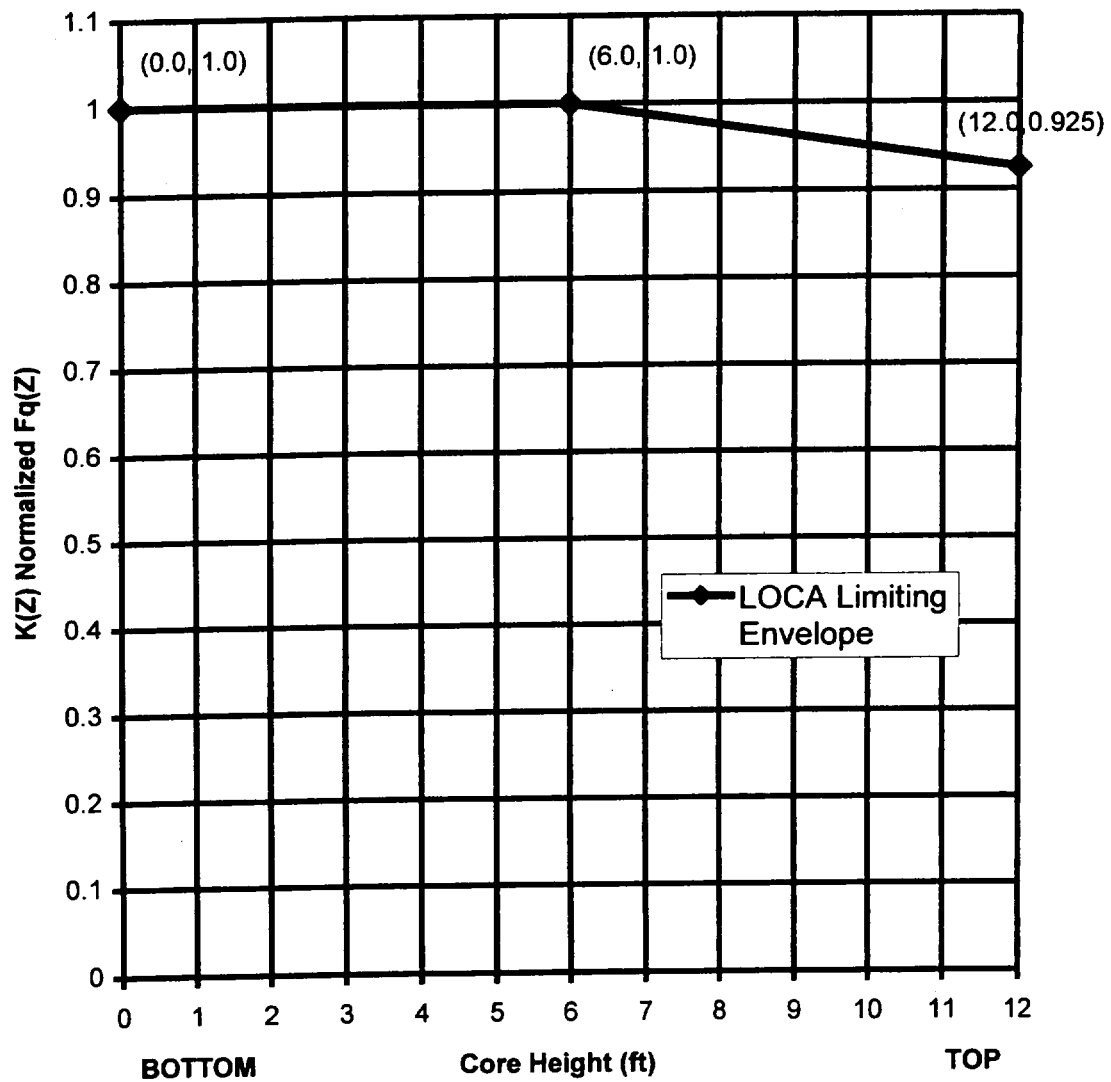
The normal operation $W(Z)$ values have been determined at burnups of 150, 4000, 10000 and 20000 MWD/MTU for AFD band of +5/-10, and at burnups of 4000, 10000, and 20000 MWD/MTU for AFD band of +5/-8.

Table 2.6.2 shows the $F_q^C(z)$ penalty factors that are greater than 2% per 31 Effective Full Power Days. These values shall be used to increase the $F_q^W(z)$ as per Surveillance Requirement 3.2.1.2. A 2% penalty factor shall be used at all cycle burnups that are outside the range of Table 2.6.2.

$$\text{Multiplication Factor} = 1.02$$

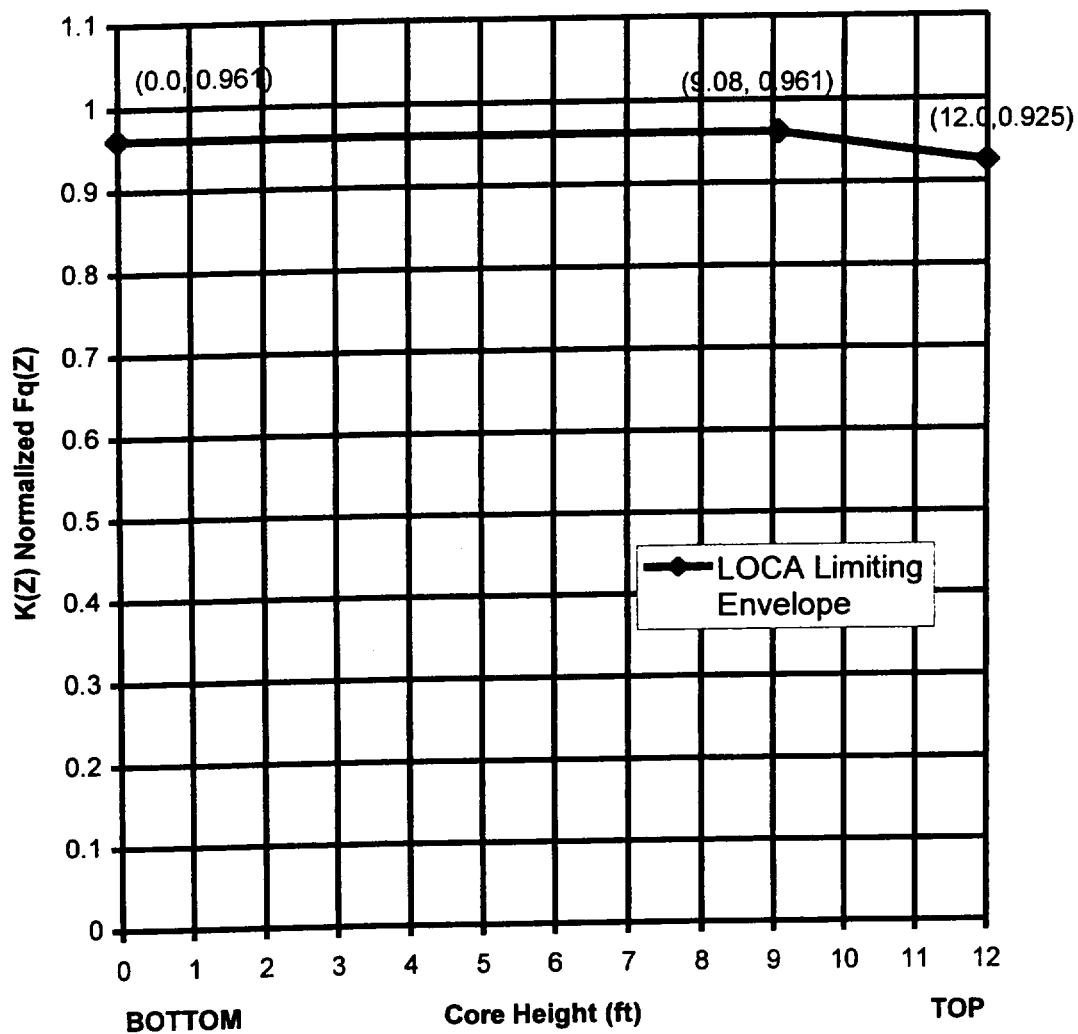
CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

Figure 2.6.1: $K(Z)$ - Normalized $F_q(Z)$ as a Function of Core Height (Assembly BU > 4000 MWD/MTU)



CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

Figure 2.6.1.a: $K(Z)$ - Normalized $F_q(Z)$ as a Function of Core Height (Assembly BU ≤ 4000 MWD/MTU)



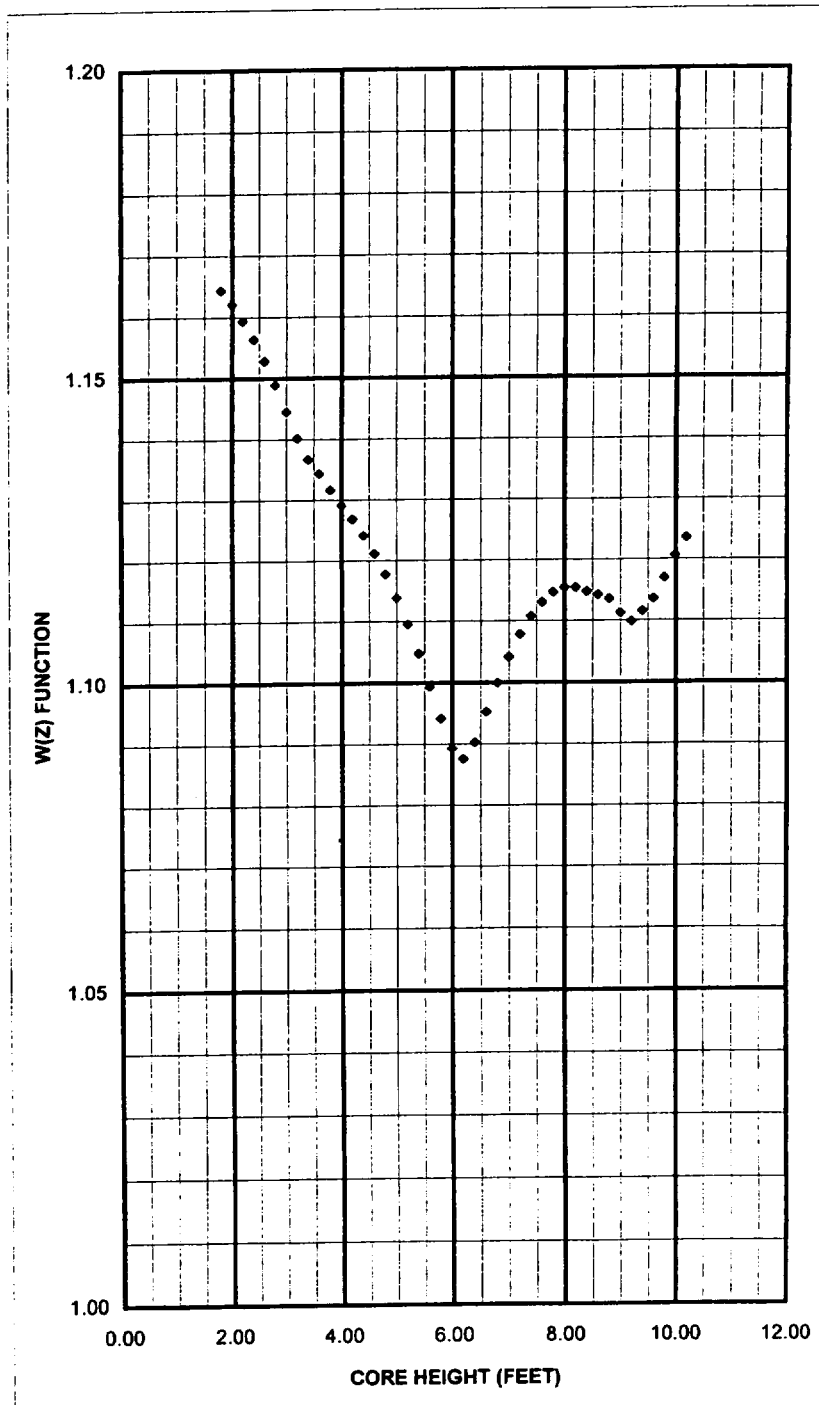
CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

Height Feet	MAX W(Z)
0.00	1.0000
0.20	1.0000
0.40	1.0000
0.60	1.0000
0.80	1.0000
1.00	1.0000
1.20	1.0000
1.40	1.0000
1.60	1.0000
1.80	1.1643
2.00	1.1620
2.20	1.1593
2.40	1.1563
2.60	1.1528
2.80	1.1489
3.00	1.1445
3.20	1.1402
3.40	1.1367
3.60	1.1343
3.80	1.1316
4.00	1.1291
4.20	1.1268
4.40	1.1241
4.60	1.1211
4.80	1.1177
5.00	1.1138
5.20	1.1095
5.40	1.1047
5.60	1.0993
5.80	1.0941
6.00	1.0892
6.20	1.0875
6.40	1.0902
6.60	1.0952
6.80	1.0999
7.00	1.1041
7.20	1.1078
7.40	1.1107
7.60	1.1130
7.80	1.1146
8.00	1.1154
8.20	1.1154
8.40	1.1147
8.60	1.1142
8.80	1.1135
9.00	1.1112
9.20	1.1098
9.40	1.1115
9.60	1.1135
9.80	1.1169
10.00	1.1206
10.20	1.1235
10.40	1.0000
10.60	1.0000
10.80	1.0000
11.00	1.0000
11.20	1.0000
11.40	1.0000
11.60	1.0000
11.80	1.0000
12.00	1.0000

Braidwood Unit 1 Cycle 9

Figure 2.6.2.a

Summary of W(Z) Function at 150 MWD/MTU (AFD band of +5, -10%)
(Top and Bottom 15% Excluded per WCAP-10216)



CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

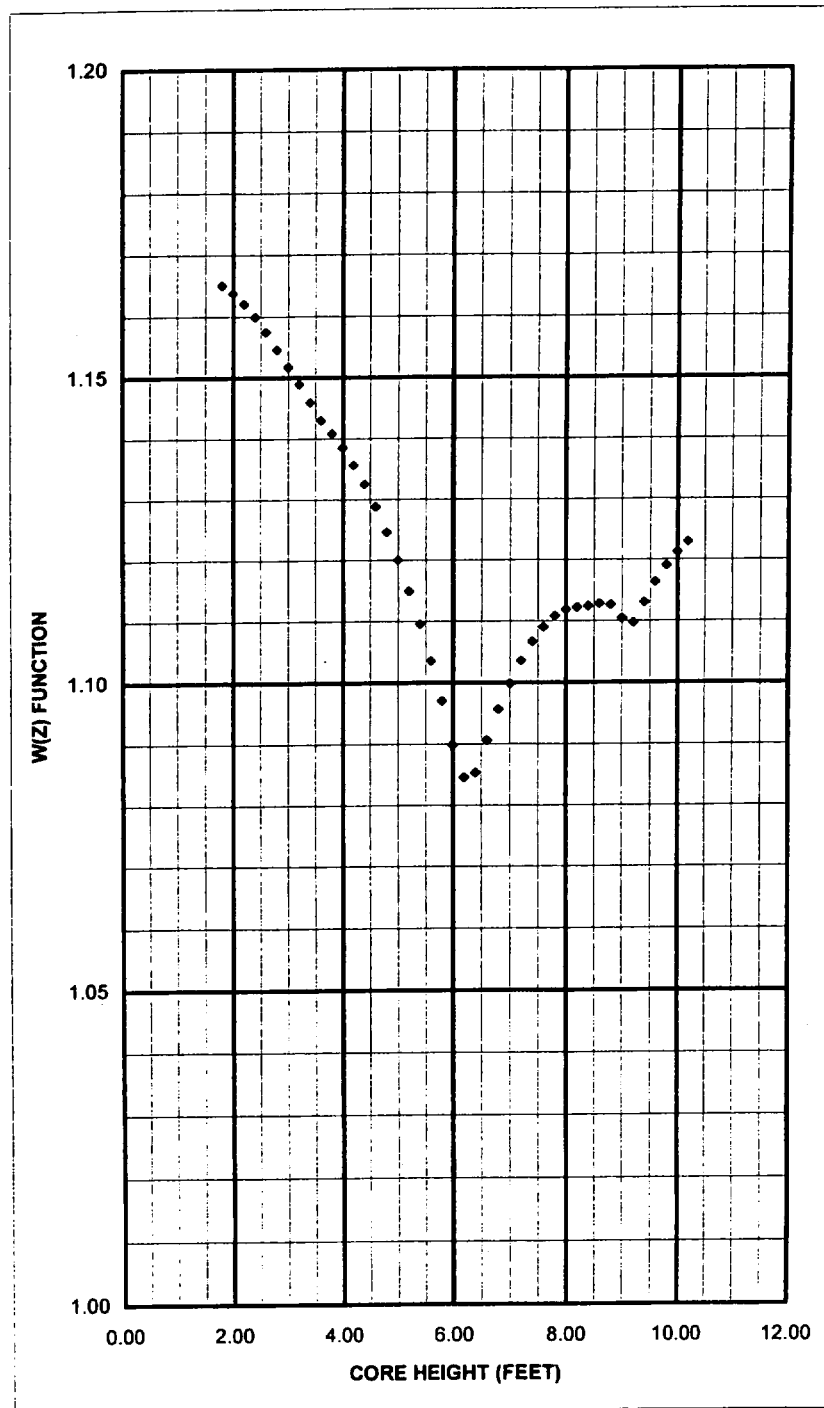
Height MAX W(Z)

Feet	
0.00	1.0000
0.20	1.0000
0.40	1.0000
0.60	1.0000
0.80	1.0000
1.00	1.0000
1.20	1.0000
1.40	1.0000
1.60	1.0000
1.80	1.1650
2.00	1.1637
2.20	1.1620
2.40	1.1599
2.60	1.1574
2.80	1.1545
3.00	1.1517
3.20	1.1489
3.40	1.1459
3.60	1.1430
3.80	1.1408
4.00	1.1385
4.20	1.1356
4.40	1.1325
4.60	1.1288
4.80	1.1246
5.00	1.1200
5.20	1.1149
5.40	1.1095
5.60	1.1035
5.80	1.0970
6.00	1.0898
6.20	1.0845
6.40	1.0853
6.60	1.0906
6.80	1.0956
7.00	1.0998
7.20	1.1035
7.40	1.1066
7.60	1.1090
7.80	1.1108
8.00	1.1118
8.20	1.1122
8.40	1.1124
8.60	1.1128
8.80	1.1126
9.00	1.1104
9.20	1.1097
9.40	1.1130
9.60	1.1163
9.80	1.1190
10.00	1.1212
10.20	1.1229
10.40	1.0000
10.60	1.0000
10.80	1.0000
11.00	1.0000
11.20	1.0000
11.40	1.0000
11.60	1.0000
11.80	1.0000
12.00	1.0000

Braidwood Unit 1 Cycle 9

Figure 2.6.2.b

Summary of W(Z) Function at 4000 MWD/MTU (AFD band of +5, -10%)
(Top and Bottom 15% Excluded per WCAP-10216)



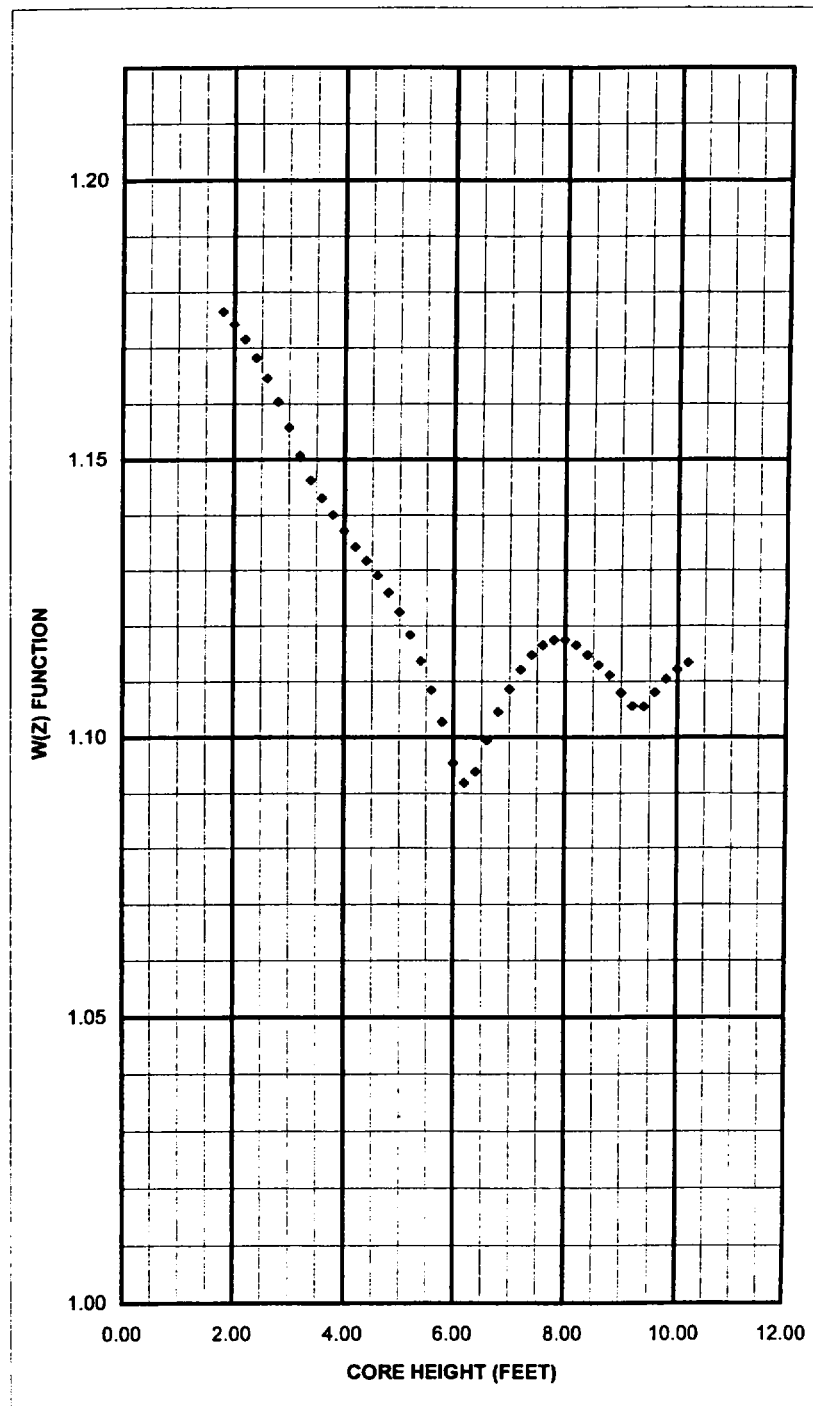
CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

Height Feet	MAX W(Z)
0.00	1.0000
0.20	1.0000
0.40	1.0000
0.60	1.0000
0.80	1.0000
1.00	1.0000
1.20	1.0000
1.40	1.0000
1.60	1.0000
1.80	1.1765
2.00	1.1742
2.20	1.1715
2.40	1.1682
2.60	1.1645
2.80	1.1603
3.00	1.1557
3.20	1.1507
3.40	1.1462
3.60	1.1430
3.80	1.1400
4.00	1.1371
4.20	1.1342
4.40	1.1317
4.60	1.1290
4.80	1.1259
5.00	1.1224
5.20	1.1183
5.40	1.1136
5.60	1.1084
5.80	1.1027
6.00	1.0953
6.20	1.0918
6.40	1.0938
6.60	1.0994
6.80	1.1045
7.00	1.1086
7.20	1.1121
7.40	1.1147
7.60	1.1165
7.80	1.1174
8.00	1.1174
8.20	1.1165
8.40	1.1147
8.60	1.1129
8.80	1.1111
9.00	1.1079
9.20	1.1055
9.40	1.1054
9.60	1.1080
9.80	1.1104
10.00	1.1121
10.20	1.1133
10.40	1.0000
10.60	1.0000
10.80	1.0000
11.00	1.0000
11.20	1.0000
11.40	1.0000
11.60	1.0000
11.80	1.0000
12.00	1.0000

Braidwood Unit 1 Cycle 9

Figure 2.6.2.c

Summary of W(Z) Function at 10000 MWD/MTU (AFD band of +5, -10%)
(Top and Bottom 15% Excluded per WCAP-10216)



CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

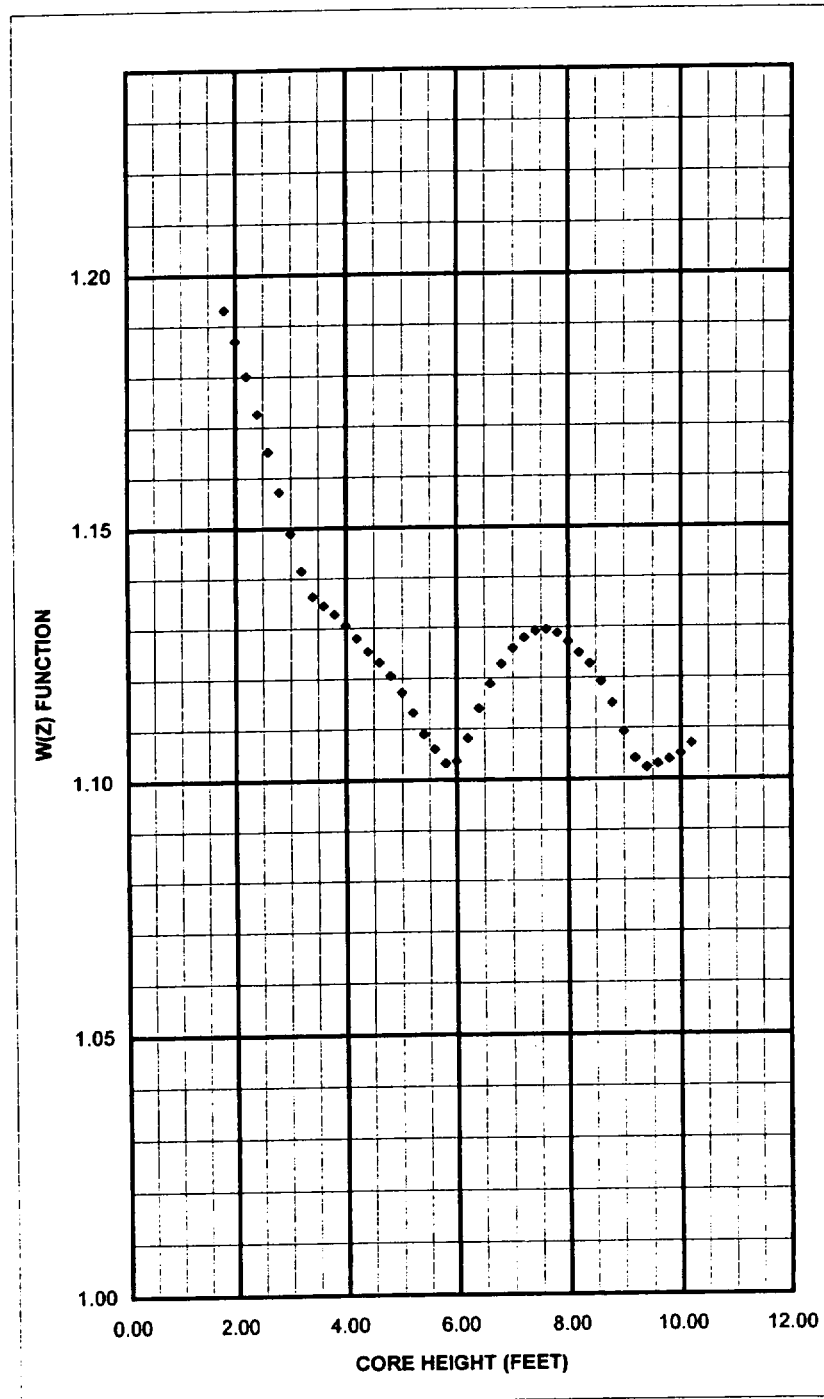
Height
Feet

MAX W(Z)
0.00 1.0000
0.20 1.0000
0.40 1.0000
0.60 1.0000
0.80 1.0000
1.00 1.0000
1.20 1.0000
1.40 1.0000
1.60 1.0000
1.80 1.1931
2.00 1.1870
2.20 1.1801
2.40 1.1726
2.60 1.1651
2.80 1.1571
3.00 1.1489
3.20 1.1415
3.40 1.1363
3.60 1.1345
3.80 1.1328
4.00 1.1305
4.20 1.1280
4.40 1.1253
4.60 1.1232
4.80 1.1205
5.00 1.1172
5.20 1.1132
5.40 1.1089
5.60 1.1060
5.80 1.1032
6.00 1.1036
6.20 1.1081
6.40 1.1140
6.60 1.1188
6.80 1.1227
7.00 1.1258
7.20 1.1279
7.40 1.1292
7.60 1.1295
7.80 1.1288
8.00 1.1271
8.20 1.1249
8.40 1.1227
8.60 1.1192
8.80 1.1149
9.00 1.1092
9.20 1.1040
9.40 1.1022
9.60 1.1029
9.80 1.1038
10.00 1.1049
10.20 1.1069
10.40 1.0000
10.60 1.0000
10.80 1.0000
11.00 1.0000
11.20 1.0000
11.40 1.0000
11.60 1.0000
11.80 1.0000
12.00 1.0000

Braidwood Unit 1 Cycle 9

Figure 2.6.2.d

Summary of W(Z) Function at 20000 MWD/MTU (AFD band of +5, -10%)
(Top and Bottom 15% Excluded per WCAP-10216)



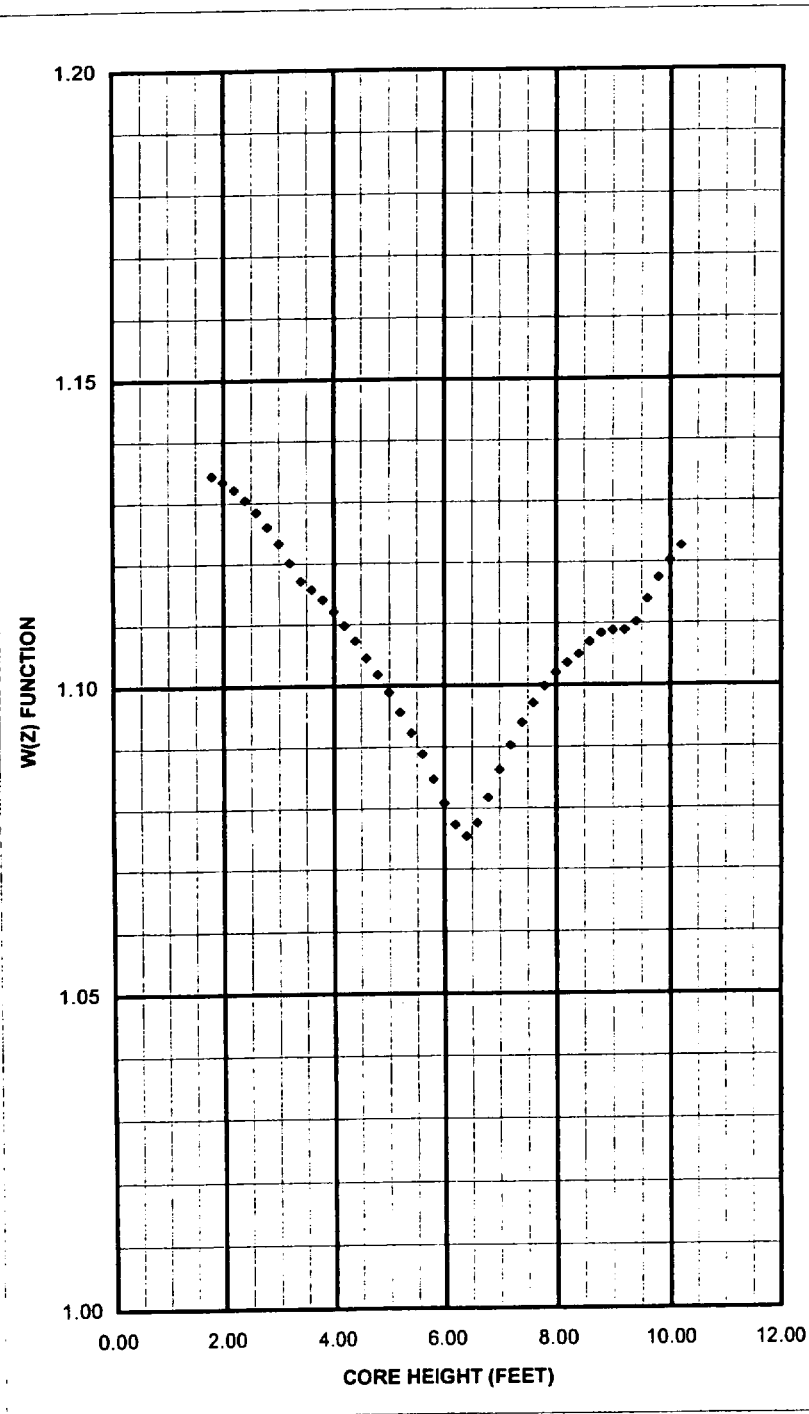
CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

Height MAX W(Z)

Braidwood Unit 1 Cycle 9

Figure 2.6.2.e

Summary of W(Z) Function at 4000 MWD/MTU (AFD band of +5, -8%)
(Top and Bottom 15% Excluded per WCAP-10216)



CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

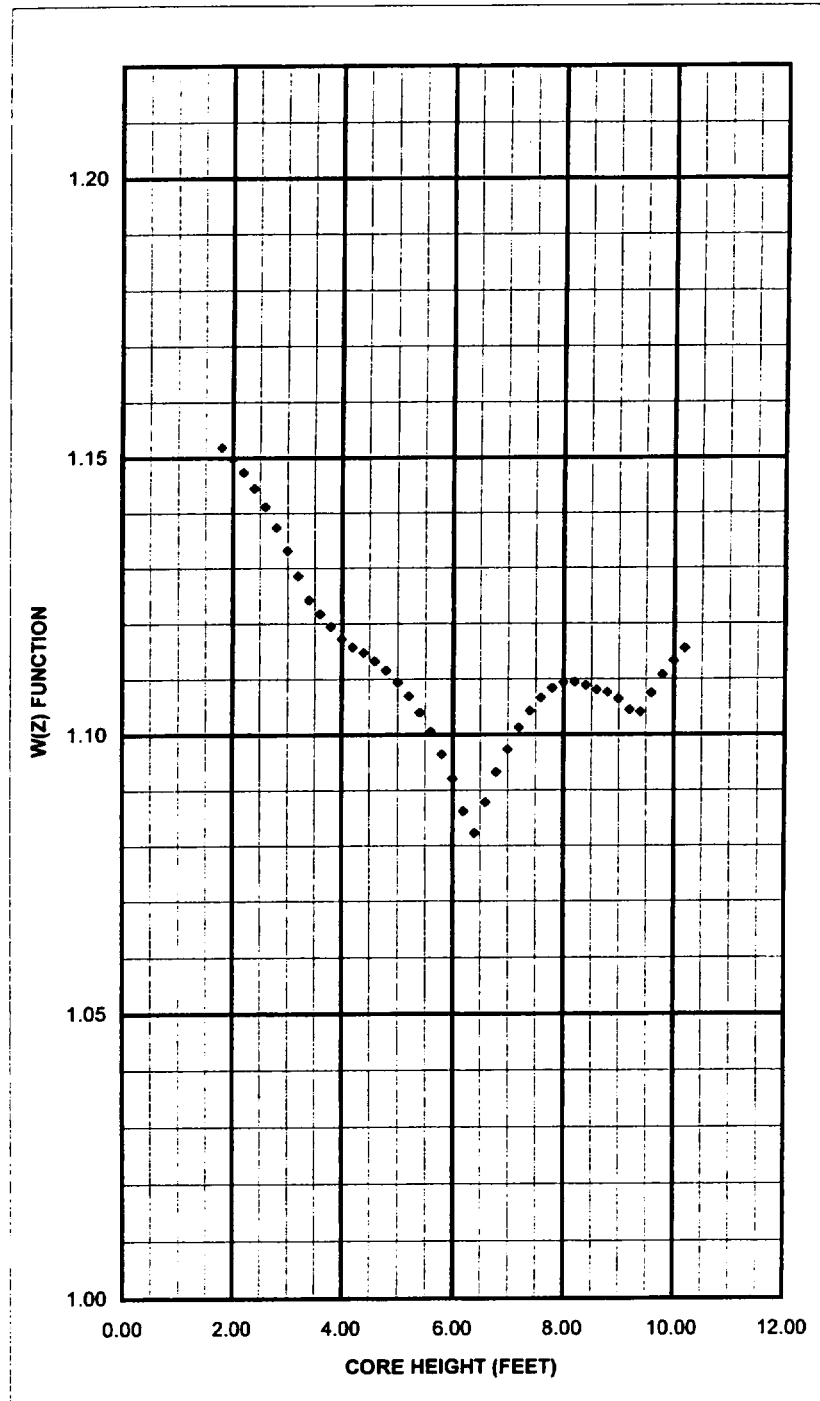
Height
Feet

MAX W(Z)

Braidwood Unit 1 Cycle 9

Figure 2.6.2.f

Summary of W(Z) Function at 10000 MWD/MTU (AFD band of +5, -8%)
(Top and Bottom 15% Excluded per WCAP-10216)



CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

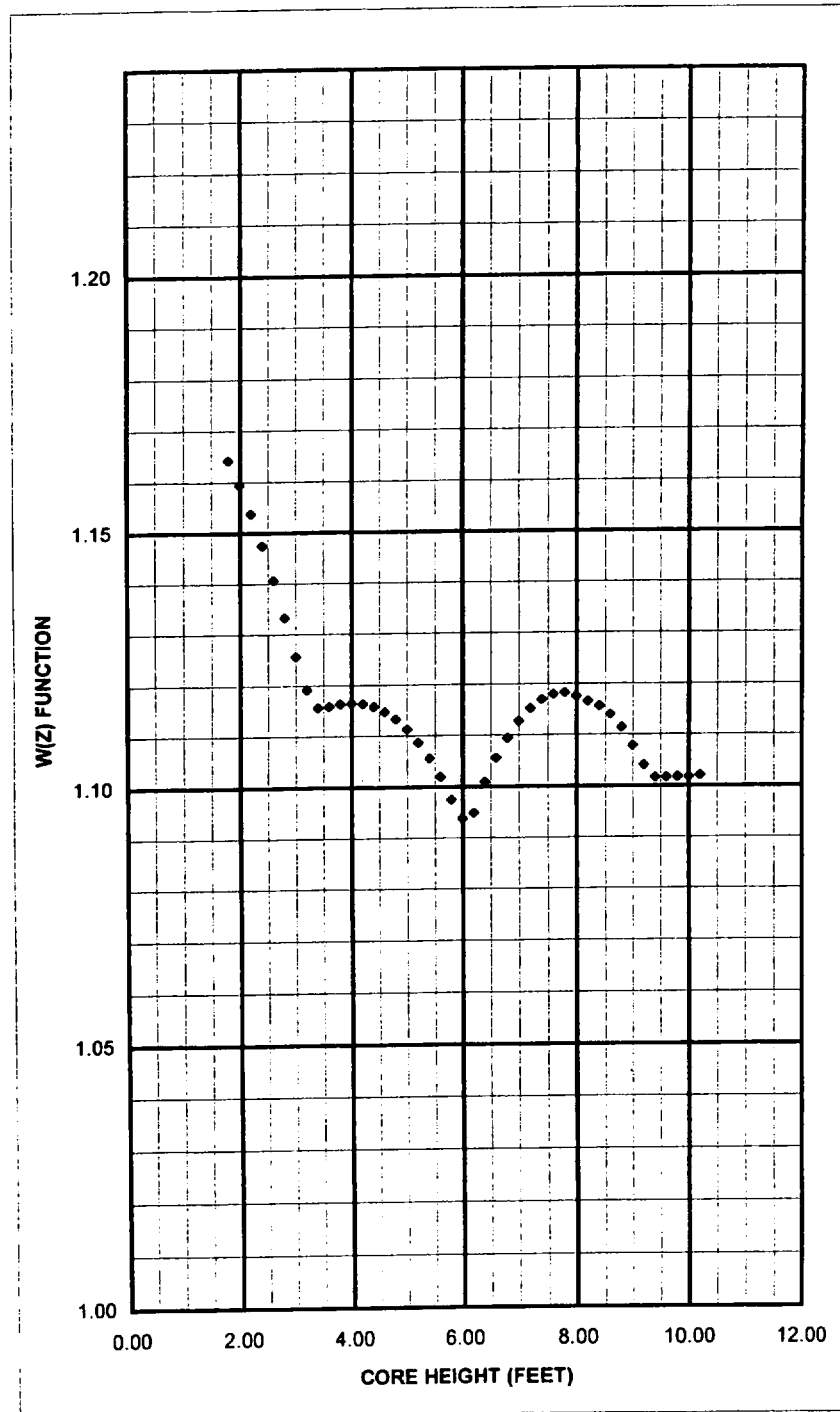
Height MAX W(Z)

Feet	
0.00	1.0000
0.20	1.0000
0.40	1.0000
0.60	1.0000
0.80	1.0000
1.00	1.0000
1.20	1.0000
1.40	1.0000
1.60	1.0000
1.80	1.1642
2.00	1.1593
2.20	1.1537
2.40	1.1474
2.60	1.1406
2.80	1.1332
3.00	1.1256
3.20	1.1191
3.40	1.1156
3.60	1.1158
3.80	1.1163
4.00	1.1164
4.20	1.1163
4.40	1.1157
4.60	1.1147
4.80	1.1132
5.00	1.1112
5.20	1.1086
5.40	1.1055
5.60	1.1019
5.80	1.0974
6.00	1.0937
6.20	1.0948
6.40	1.1009
6.60	1.1055
6.80	1.1094
7.00	1.1127
7.20	1.1152
7.40	1.1169
7.60	1.1179
7.80	1.1182
8.00	1.1175
8.20	1.1165
8.40	1.1156
8.60	1.1139
8.80	1.1114
9.00	1.1078
9.20	1.1040
9.40	1.1016
9.60	1.1016
9.80	1.1017
10.00	1.1017
10.20	1.1020
10.40	1.0000
10.60	1.0000
10.80	1.0000
11.00	1.0000
11.20	1.0000
11.40	1.0000
11.60	1.0000
11.80	1.0000
12.00	1.0000

Braidwood Unit 1 Cycle 9

Figure 2.6.2.g

Summary of W(Z) Function at 20000 MWD/MTU (AFD band of +5, -8%)
(Top and Bottom 15% Excluded per WCAP-10216)



CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

Table 2.6.2	
Fq Margin Decreases in Excess of 2% per 31 EFPD	
Cycle Burnup (MWD/MTU)	Max % Decrease in Fq Margin
150	3.79
313	5.42
477	6.83
640	7.95
804	8.65
967	8.89
1131	8.64
1294	8.03
1458	7.17
1621	6.21
1784	5.51
1948	4.82
2111	4.18
2275	3.59
2438	3.07
2602	2.61
2765	2.21

Note: All cycle burnups outside the range of the table shall use a 2% decrease in Fq margin for compliance with the 3.2.1.2 Surveillance Requirements. Linear interpolation is adequate for intermediate cycle burnups.

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

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

$$2.7.1 \quad F_{\Delta H}^N \leq F_{\Delta H}^{RTP} [1.0 + PF_{\Delta H} (1.0 - P)]$$

where: P = the ratio of THERMAL POWER to RATED THERMAL POWER

$$F_{\Delta H}^{RTP} = 1.70$$

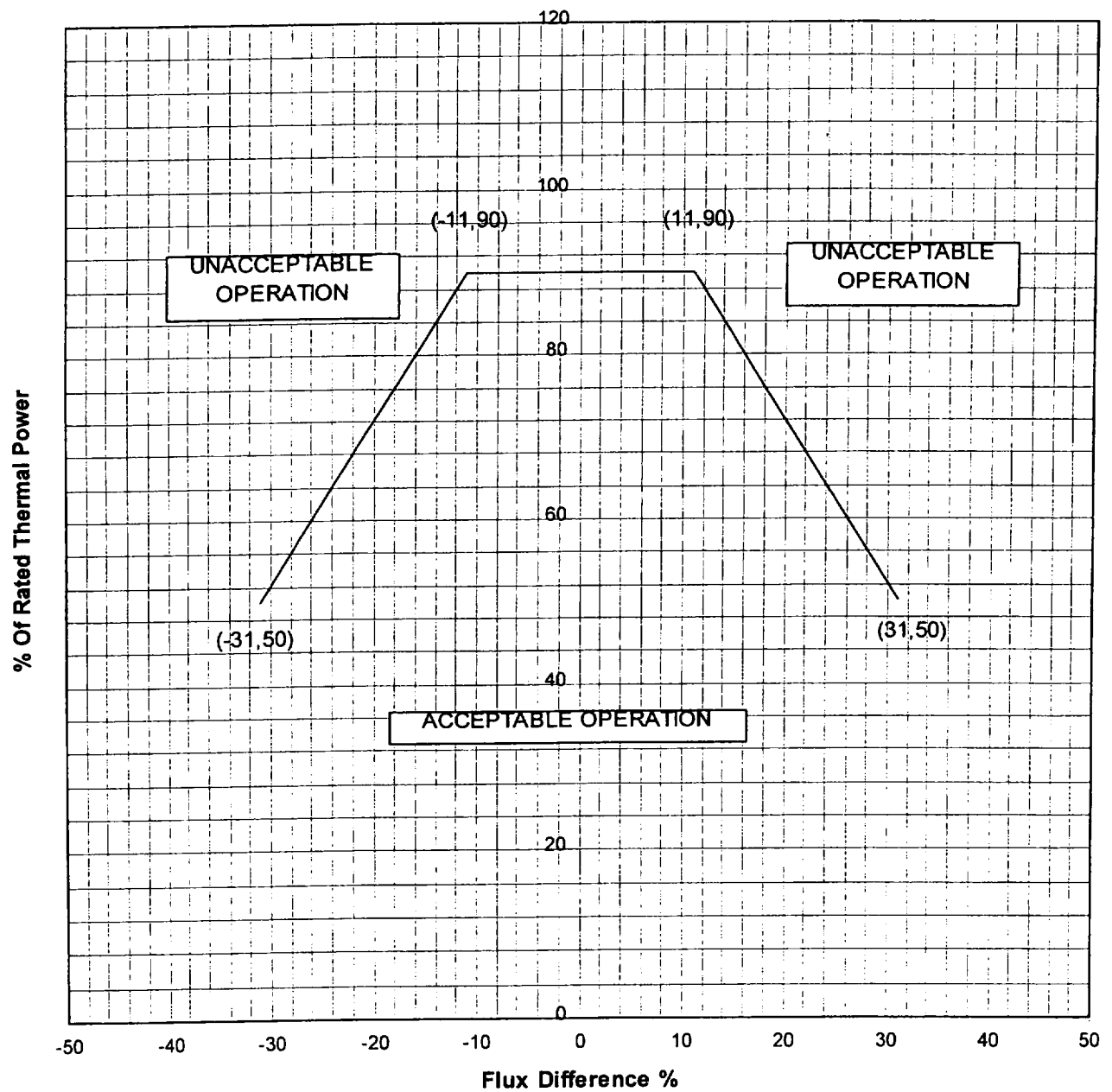
$$PF_{\Delta H} = 0.3$$

2.8 Axial Flux Difference (AFD) (LCO 3.2.3)

2.8.1 The AXIAL FLUX DIFFERENCE (AFD) target band is typically [+5, -10%]. AFD band can be [+5, -8%] when modified W(z) curves are used (COLR Figures 2.6.2.e, f and g).
(refer to procedure BwCB-1 Figures 19A-D for the current AFD band in use)

2.8.2 The AFD Acceptable Operation Limits are provided in Figure 2.8.1.

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

FIGURE 2.8.1: Axial Flux Difference Limits As A Function of Rated Thermal Power

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

2.9 Reactor Trip System Overtemperature ΔT Setpoint Parameter Values (LCO 3.3.1)

- 2.9.1 The Overtemperature ΔT reactor trip setpoint K_1 shall be equal to 1.325.
- 2.9.2 The Overtemperature ΔT reactor trip setpoint T_{avg} coefficient K_2 shall be equal to 0.0297 / °F.
- 2.9.3 The Overtemperature ΔT reactor trip setpoint pressure coefficient K_3 shall be equal to 0.00181 / psig.
- 2.9.4 The nominal T_{avg} at RTP (indicated) T' shall be less than or equal to 588.4 °F.
- 2.9.5 The nominal RCS operating pressure (indicated) P' shall be equal to 2235 psig.
- 2.9.6 The measured reactor vessel ΔT lead/lag time constant τ_1 shall be equal to 8 sec.
- 2.9.7 The measured reactor vessel ΔT lead/lag time constant τ_2 shall be equal to 3 sec.
- 2.9.8 The measured reactor vessel ΔT lag time constant τ_3 shall be less than or equal to 2 sec.
- 2.9.9 The measured reactor vessel average temperature lead/lag time constant τ_4 shall be equal to 33 sec.
- 2.9.10 The measured reactor vessel average temperature lead/lag time constant τ_5 shall be equal to 4 sec.
- 2.9.11 The measured reactor vessel average temperature lag time constant τ_6 shall be less than or equal to 2 sec.
- 2.9.12 The $f_1(\Delta I)$ "positive" breakpoint shall be +10% ΔI .
- 2.9.13 The $f_1(\Delta I)$ "negative" breakpoint shall be -24% ΔI .
- 2.9.14 The $f_1(\Delta I)$ "positive" slope shall be +4.11% / % ΔI .
- 2.9.15 The $f_1(\Delta I)$ "negative" slope shall be -3.35% / % ΔI .

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

2.10 Reactor Trip System Overpower ΔT Setpoint Parameter Values (LCO 3.3.1)

- 2.10.1 The Overpower ΔT reactor trip setpoint K_4 shall be equal to 1.072.
- 2.10.2 The Overpower ΔT reactor trip setpoint T_{avg} rate/lag coefficient K_5 shall be equal to 0.02 / °F for increasing T_{avg} .
- 2.10.3 The Overpower ΔT reactor trip setpoint T_{avg} rate/lag coefficient K_5 shall be equal to 0 / °F for decreasing T_{avg} .
- 2.10.4 The Overpower ΔT reactor trip setpoint T_{avg} heatup coefficient K_6 shall be equal to 0.00245 / °F when $T > T''$.
- 2.10.5 The Overpower ΔT reactor trip setpoint T_{avg} heatup coefficient K_6 shall be equal to 0 / °F when $T \leq T''$.
- 2.10.6 The nominal T_{avg} at RTP (indicated) T'' shall be less than or equal to 588.4 °F.
- 2.10.7 The measured reactor vessel ΔT lead/lag time constant τ_1 shall be equal to 8 sec.
- 2.10.8 The measured reactor vessel ΔT lead/lag time constant τ_2 shall be equal to 3 sec.
- 2.10.9 The measured reactor vessel ΔT lag time constant τ_3 shall be less than or equal to 2 sec.
- 2.10.10 The measured reactor vessel average temperature lag time constant τ_6 shall be less than or equal to 2 sec.
- 2.10.11 The measured reactor vessel average temperature rate/lag time constant τ_7 shall be equal to 10 sec.
- 2.10.12 The $f_2(\Delta I)$ "positive" breakpoint shall be 0 for all ΔI .
- 2.10.13 The $f_2(\Delta I)$ "negative" breakpoint shall be 0 for all ΔI .
- 2.10.14 The $f_2(\Delta I)$ "positive" slope shall be 0 for all ΔI .
- 2.10.15 The $f_2(\Delta I)$ "negative" slope shall be 0 for all ΔI .

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 9

2.11 Reactor Coolant System (RCS) DNB Parameter Limits (LCO 3.4.1)

- 2.11.1 The pressurizer pressure shall be greater than or equal to 2209 psig.
- 2.11.2 The RCS average temperature (T_{avg}) shall be less than or equal to 591.2 °F.
- 2.11.3 The RCS total flow rate shall be greater than or equal to 371,400 gpm.


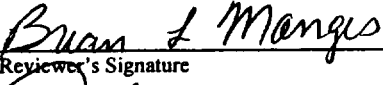

2.12 Boron Concentration

- 2.12.1 The refueling boron concentration shall be greater than or equal to 2000 ppm (LCO 3.9.1).
- 2.12.2 The Reactor Coolant System boron concentration shall be greater than or equal to 1969 ppm to maintain adequate shutdown margin for MODES 3, 4, and 5 during performance of rod drop time measurements and during the surveillance of Digital Rod Position Indication (DRPI) for OPERABILITY (TLCO 3.1.g and TLCO 3.1.k).

ATTACHMENT 2

Core Operating Limits Report

Braidwood Unit 2, Cycle 9, Revision Number 2

NUCLEAR FUEL MANAGEMENT DEPARTMENT TRANSMITTAL OF DESIGN INFORMATION		
<input checked="" type="checkbox"/> SAFETY RELATED <input type="checkbox"/> NON-SAFETY RELATED <input type="checkbox"/> REGULATORY RELATED	Originating Organization <input checked="" type="checkbox"/> Nuclear Fuel Management <input type="checkbox"/> Other (specify) _____	Doc No. <u>NFM0000143</u> Rev. No. <u>2</u> Page 1 of 18
Station <u>Braidwood</u> Unit <u>2</u> Cycle <u>9</u> Generic _____ To: <u>Lonnie K. Kepley</u> <small>Director, Nuclear Fuel Management Department</small>		
Subject <u>Braidwood Unit 2 Cycle 9 Core Operating Limits Report</u>		
<u>Shitien Yang</u> Preparer	 Preparer's Signature	<u>12/21/00</u> Date
<u>Brian L. Manges</u> Reviewer	 Reviewer's Signature	<u>12/21/2000</u> Date
<u>D. Redden</u> NFM Supervisor	 Supervisor's Signature	<u>12/22/2000</u> Date
Status of Information: <div style="display: inline-block; vertical-align: top; margin-left: 20px;"> <input checked="" type="checkbox"/> Verified <input type="checkbox"/> Unverified <input type="checkbox"/> Engineering Judgement </div>		
Method and Schedule of Verification for Unverified NDITs: _____		
Description of Information: Attached is the Braidwood Unit 2 Cycle 9 Core Operating Limits Report (COLR) in the ITS format and W(z) function.		
Purpose of Information: Revision 2 of this TODI supersedes Revision 1. This revision changes Section 2.11.1 of the COLR to reflect the correct pressurizer pressure DNB Limit. Revision 1 modifies Section 2.12.2 of the COLR to support the requirement for the new TRM TLCO 3.1.g. Braidwood Station is requested to perform a Plant Review of this document. Upon completion of the Plant Review, Braidwood Station is to transmit the COLR portion to the Nuclear Regulatory Commission. Please provide NFM (Raymond Ng) with a copy of Braidwood Station's completed ITR and COLR submittal to the NRC.		
Source of Information: <div style="display: flex; margin-left: 20px;"> <div style="width: 20px;">1)</div> <div>Westinghouse letter 00CB-G-0130/CAC-00-289, "Braidwood 2 Cycle 9 Input for COLR," dated 9/26/00.</div> </div> <div style="display: flex; margin-left: 20px;"> <div style="width: 20px;">2)</div> <div>TODI NFM0000126 Rev. 0, "Braidwood Unit 2 Cycle 9 Reload Design Key Parameter Checklist (RDKPC)," dated 9/25/00.</div> </div> <div style="display: flex; margin-left: 20px;"> <div style="width: 20px;">3)</div> <div>TODI NFM0000188, Seq. 0, "Pressurizer Pressure DNB Limit," A. W. Wong to D. Wozniak and T. Luke, December 15, 2000.</div> </div>		
Supplemental Distribution: T. Simpkin / L. S. Dworakowski (BW)		

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Braidwood Station Unit 2 Cycle 9 has been prepared in accordance with the requirements of Technical Specification 5.6.5 (ITS).

The Technical Specifications affected by this report are listed below:

SL	2.1.1	Reactor Core Safety Limits (SLs)
LCO	3.1.1	Shutdown Margin (SDM)
LCO	3.1.3	Moderator Temperature Coefficient
LCO	3.1.4	Rod Group Alignment Limits
LCO	3.1.5	Shutdown Bank Insertion Limits
LCO	3.1.6	Control Bank Insertion Limits
LCO	3.1.8	Physics Tests Exceptions – Mode 2
LCO	3.2.1	Heat Flux Hot Channel Factor ($F_o(Z)$)
LCO	3.2.2	Nuclear Enthalpy Rise Hot Channel Factor ($F_{\Delta H}^N$)
LCO	3.2.3	Axial Flux Difference (AFD)
LCO	3.3.1	Reactor Trip System (RTS) Instrumentation
LCO	3.3.9	Boron Dilution Protection System (BDPS)
LCO	3.4.1	Reactor Coolant System (RCS) DNB Parameters
LCO	3.9.1	Boron Concentration

The portions of the Technical Requirements Manual affected by this report are listed below:

TRM TLCO 3.1.b	Boration Flow Paths - Operating
TRM TLCO 3.1.d	Charging Pumps - Operating
TRM TLCO 3.1.f	Borated Water Sources – Operating
TRM TLCO 3.1.g	Position Indication System – Shutdown
TRM TLCO 3.1.h	Shutdown Margin (SDM) – MODE 1 and MODE 2 with $k_{eff} \geq 1.0$
TRM TLCO 3.1.i	Shutdown Margin (SDM) – MODE 5
TRM TLCO 3.1.j	Shutdown and Control Rods
TRM TLCO 3.1.k	Position Indication System – Shutdown (Special Test Exception)

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

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 are applicable for the entire cycle unless otherwise identified. These limits have been developed using the NRC-approved methodologies specified in Technical Specification 5.6.5.

2.1 Reactor Core Limits (SL 2.1.1)

- 2.1.1 In Modes 1 and 2, the combination of Thermal Power, Reactor Coolant System (RCS) highest loop average temperature, and pressurizer pressure shall not exceed the limits specified in Figure 2.1.1.

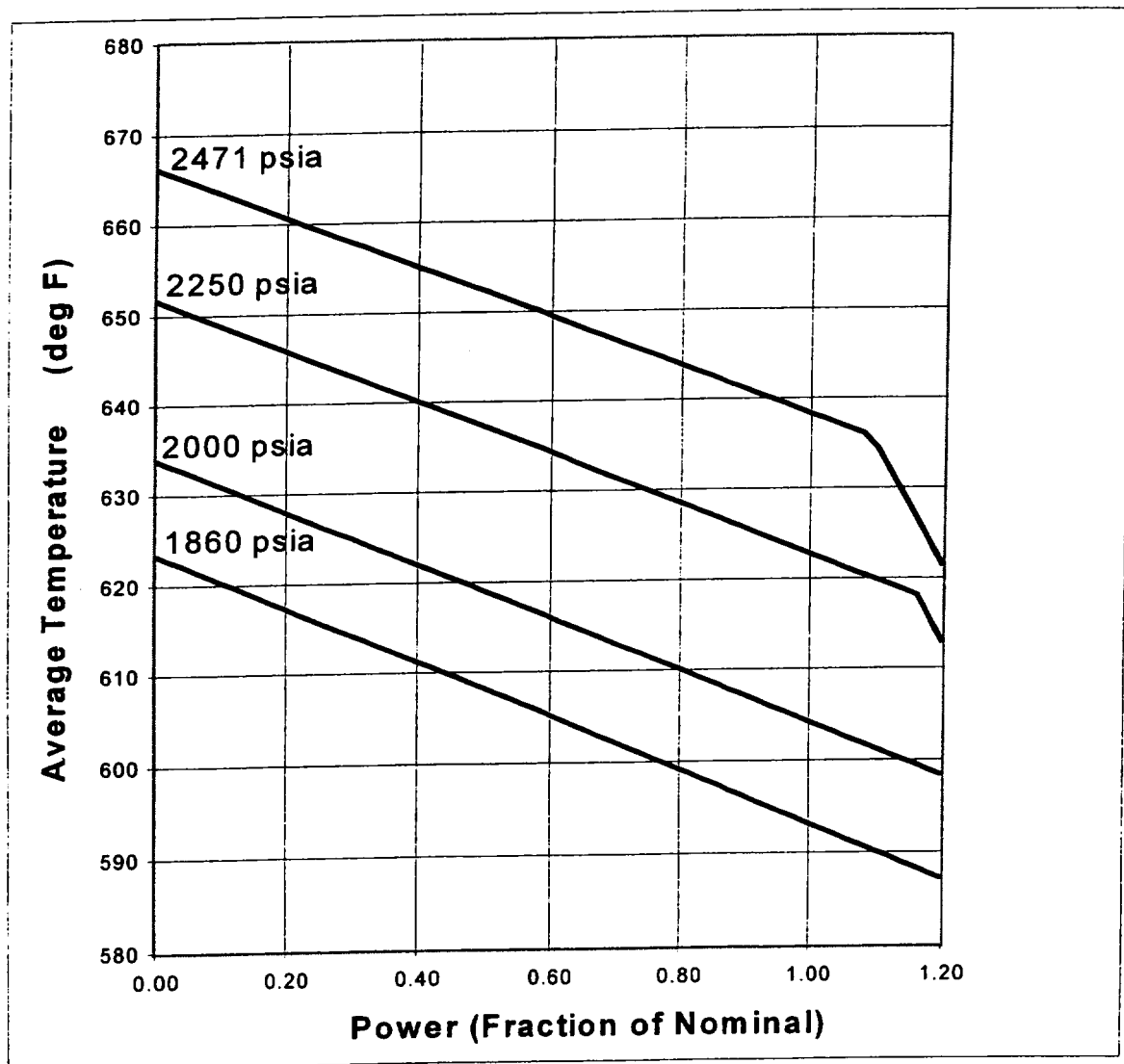


Figure 2.1.1: Reactor Core Limits

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

2.2 Shutdown Margin (SDM)

The SDM limit for MODES 1, 2, 3, and 4 is:

- 2.2.1 The SDM shall be greater than or equal to 1.3% $\Delta k/k$ (LCOs 3.1.1, 3.1.4, 3.1.5, 3.1.6, 3.1.8, 3.3.9, and 3.9.1; TRM TLCOs 3.1.b, 3.1.d, 3.1.f, 3.1.h, and 3.1.j)

The SDM limits for MODE 5 are:

- 2.2.2.1 SDM shall be greater than or equal to 1.0% $\Delta k/k$ (LCO 3.1.1).
- 2.2.2.2 SDM shall be greater than or equal to 1.3% $\Delta k/k$ (LCO 3.3.9; TRM TLCO 3.1.i and 3.1.j).

2.3 Moderator Temperature Coefficient (LCO 3.1.3)

The Moderator Temperature Coefficient (MTC) limits are:

- 2.3.1 The BOL/ARO/HZP-MTC upper limit shall be $+4.1 \times 10^{-5} \Delta k/k/^{\circ}F$.
- 2.3.2 The EOL/ARO/HFP-MTC lower limit shall be $-4.1 \times 10^{-4} \Delta k/k/^{\circ}F$.
- 2.3.3 The EOL/ARO/HFP-MTC Surveillance limit at 300 ppm shall be less negative than or equal to $-3.2 \times 10^{-4} \Delta k/k/^{\circ}F$.

where: BOL stands for Beginning of Cycle Life
ARO stands for All Rods Out
HZP stands for Hot Zero Thermal Power
EOL stands for End of Cycle Life
HFP stands for Hot Full Thermal Power

2.4 Shutdown Bank Insertion Limit (LCO 3.1.5)

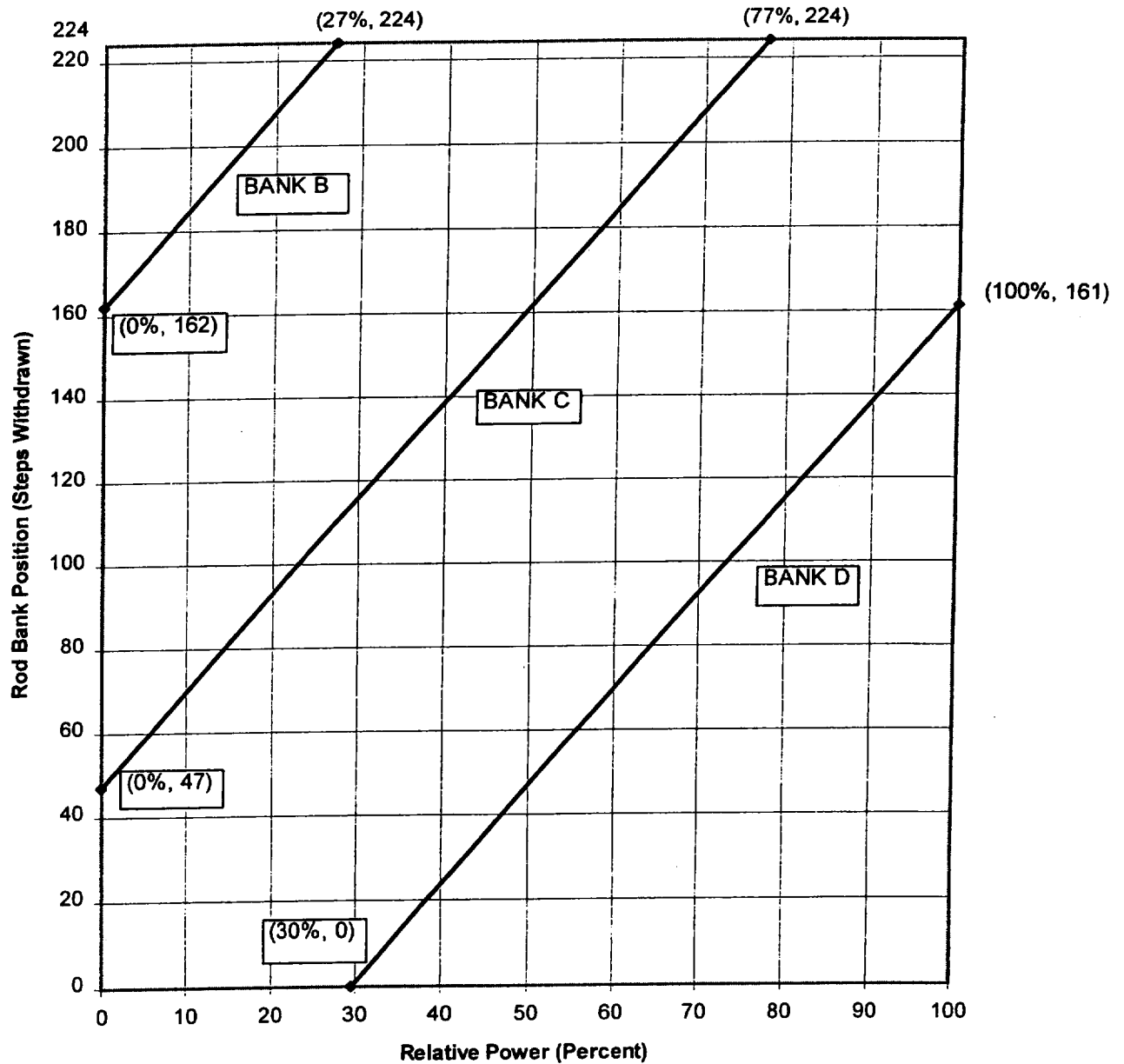
- 2.4.1 All shutdown banks shall be fully withdrawn to at least 224 steps.

2.5 Control Bank Insertion Limits (LCO 3.1.6)

- 2.5.1 The control banks shall be limited in physical insertion as shown in Figure 2.5.1.
- 2.5.2 Each control bank shall be considered fully withdrawn from the core at greater than or equal to 224 steps.
- 2.5.3 The control banks shall be operated in sequence by withdrawal of Bank A, Bank B, Bank C and Bank D. The control banks shall be sequenced in reverse order upon insertion.
- 2.5.4 Each control bank not fully withdrawn from the core shall be operated with a 113 step overlap limit.

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

Figure 2.5.1:
Control Bank Insertion Limits Versus Percent Rated Thermal Power



CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

2.6 Heat Flux Hot Channel Factor ($F_q(Z)$) (LCO 3.2.1)

2.6.1

$$F_q(Z) \leq \frac{F_q^{RTP}}{0.5} \times K(Z) \text{ for } P \leq 0.5$$

$$F_q(Z) \leq \frac{F_q^{RTP}}{P} \times K(Z) \text{ for } P > 0.5$$

where: P = the ratio of THERMAL POWER to RATED THERMAL POWER

$$F_q^{RTP} = 2.60$$

$K(Z)$ for assembly average burnup > 4000 MWD/MTU is provided in Figure 2.6.1. $K(Z)$ for assembly average burnup \leq 4000 MWD/MTU is provided in Figure 2.6.1.a.

2.6.2 $W(Z)$ is provided in Figures 2.6.2.a through 2.6.2.d.

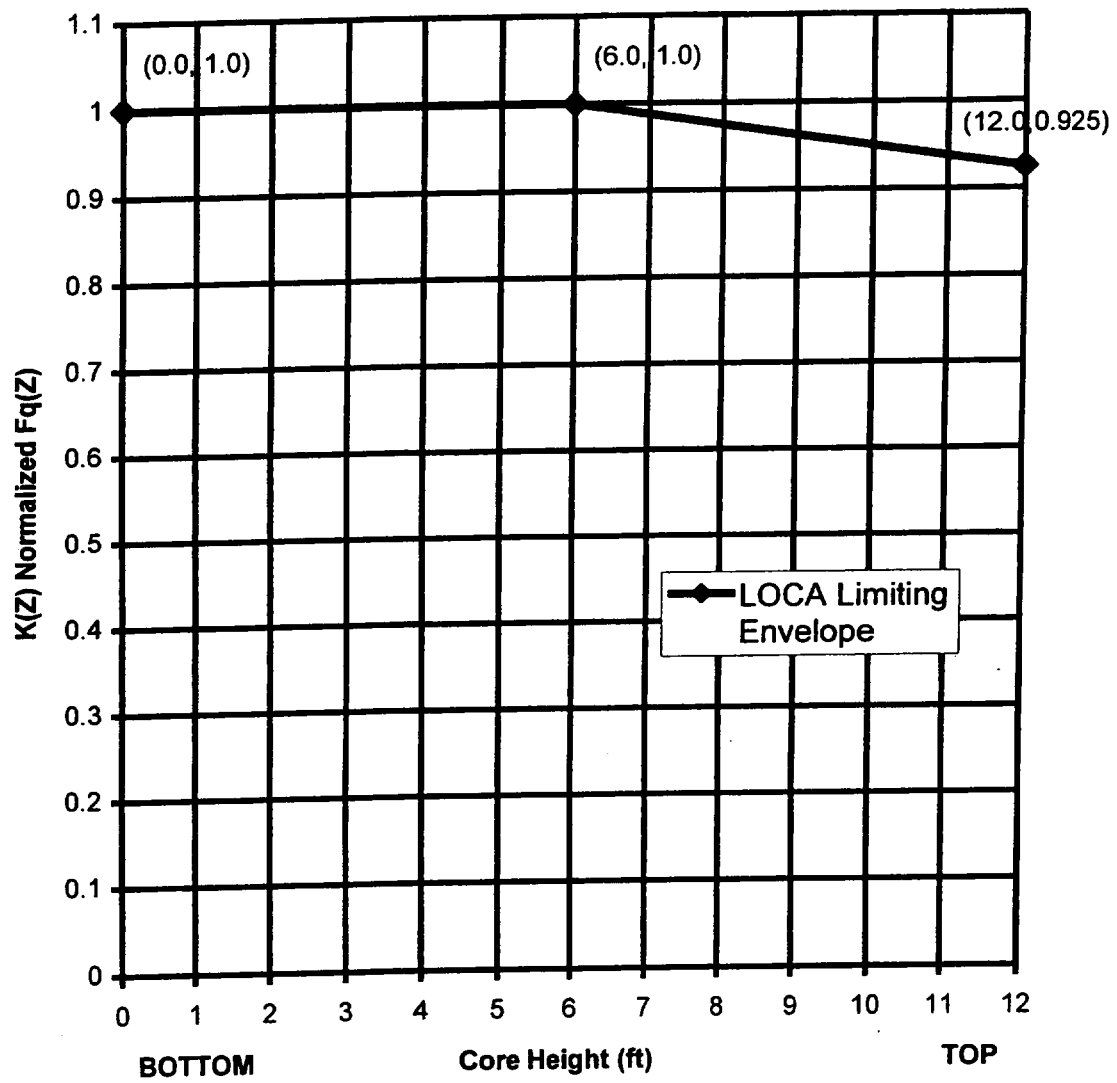
The normal operation $W(Z)$ values have been determined at burnups of 150, 3000, 10000, and 18000 MWD/MTU.

Table 2.6.2 shows the $F_q^c(z)$ penalty factors that are greater than 2% per 31 Effective Full Power Days. These values shall be used to increase the $F_q^w(z)$ as per Surveillance Requirement 3.2.1.2. A 2% penalty factor shall be used at all cycle burnups that are outside the range of Table 2.6.2.

$$\text{Multiplication Factor} = 1.02$$

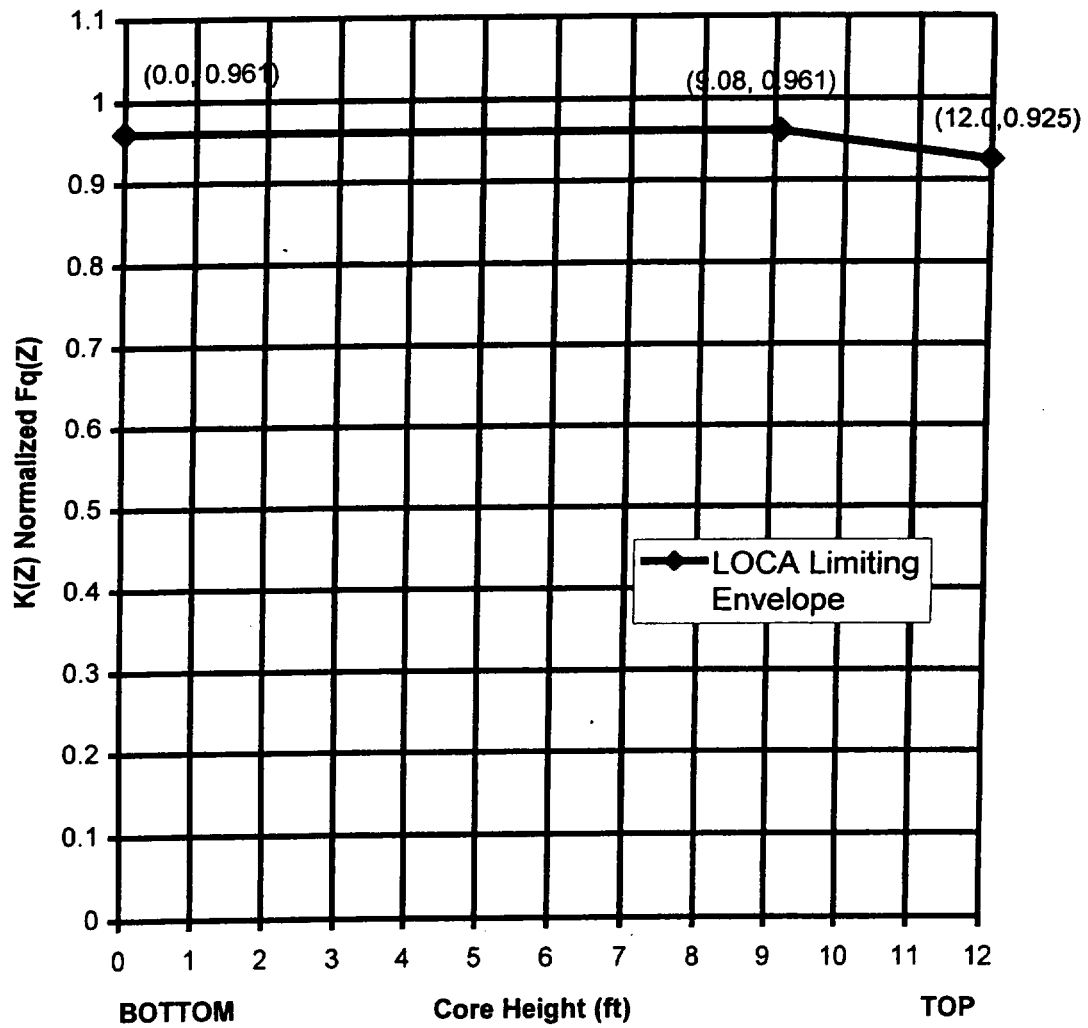
CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

Figure 2.6.1: K(Z) - Normalized Fq(Z) as a Function of Core Height (Assembly BU > 4000 MWD/MTU)



CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

Figure 2.6.1.a: K(Z) - Normalized Fq(Z) as a Function of Core Height (Assembly BU \leq 4000 MWD/MTU)



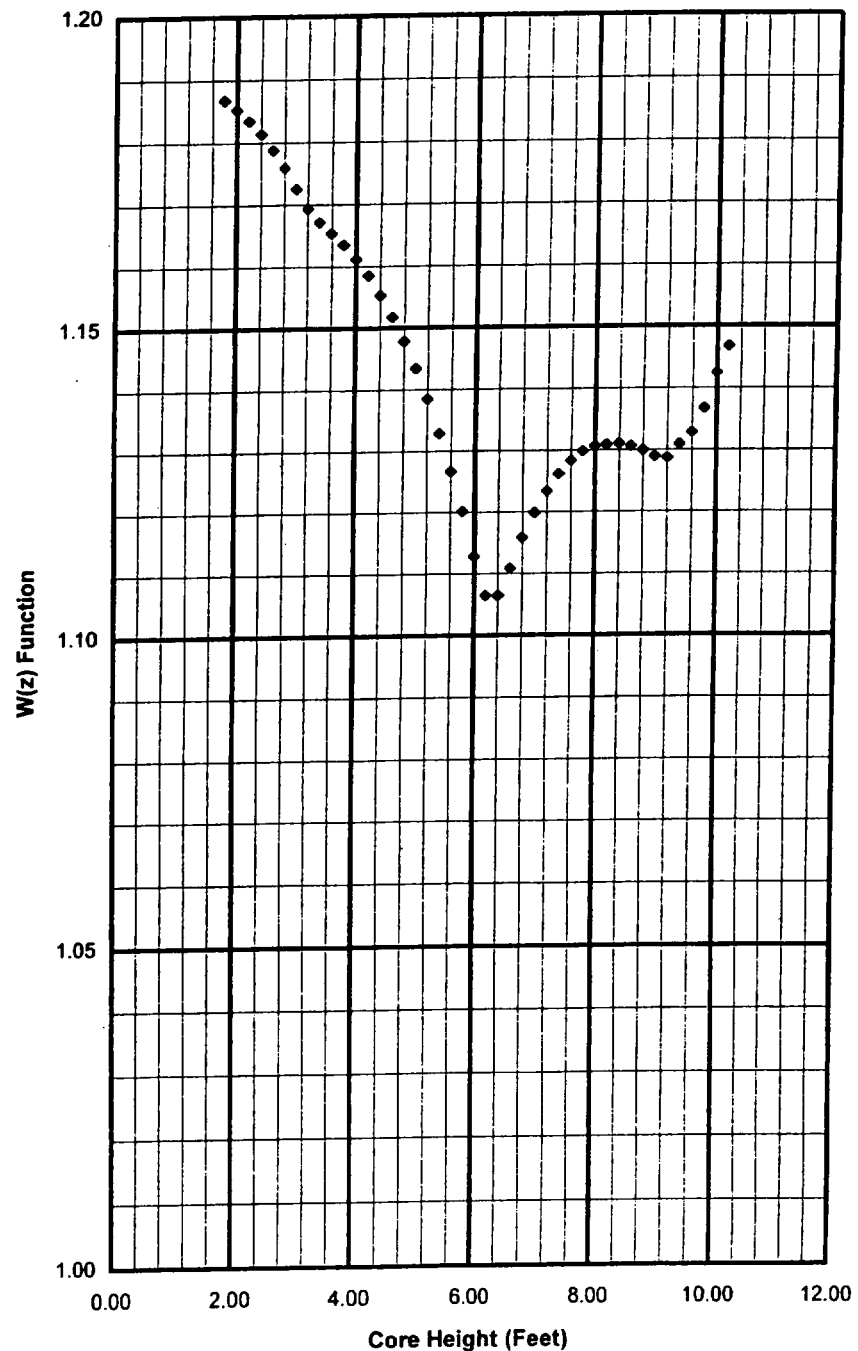
CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

Height (Feet)	W(z)
0.00	1.0000
0.20	1.0000
0.40	1.0000
0.60	1.0000
0.80	1.0000
1.00	1.0000
1.20	1.0000
1.40	1.0000
1.60	1.0000
1.80	1.1867
2.00	1.1852
2.20	1.1834
2.40	1.1813
2.60	1.1787
2.80	1.1759
3.00	1.1725
3.20	1.1693
3.40	1.1671
3.60	1.1653
3.80	1.1634
4.00	1.1611
4.20	1.1584
4.40	1.1552
4.60	1.1517
4.80	1.1478
5.00	1.1434
5.20	1.1384
5.40	1.1328
5.60	1.1266
5.80	1.1201
6.00	1.1127
6.20	1.1064
6.40	1.1064
6.60	1.1108
6.80	1.1158
7.00	1.1198
7.20	1.1233
7.40	1.1261
7.60	1.1283
7.80	1.1298
8.00	1.1306
8.20	1.1308
8.40	1.1310
8.60	1.1306
8.80	1.1299
9.00	1.1289
9.20	1.1287
9.40	1.1309
9.60	1.1328
9.80	1.1367
10.00	1.1424
10.20	1.1467
10.40	1.0000
10.60	1.0000
10.80	1.0000
11.00	1.0000
11.20	1.0000
11.40	1.0000
11.60	1.0000
11.80	1.0000
12.00	1.0000

Braidwood Unit 2 Cycle 9

Figure 2.6.2.a

Summary of W(z) Function at 150 MWD/MTU
(top and Bottom 15% Excluded per WCAP-10216)



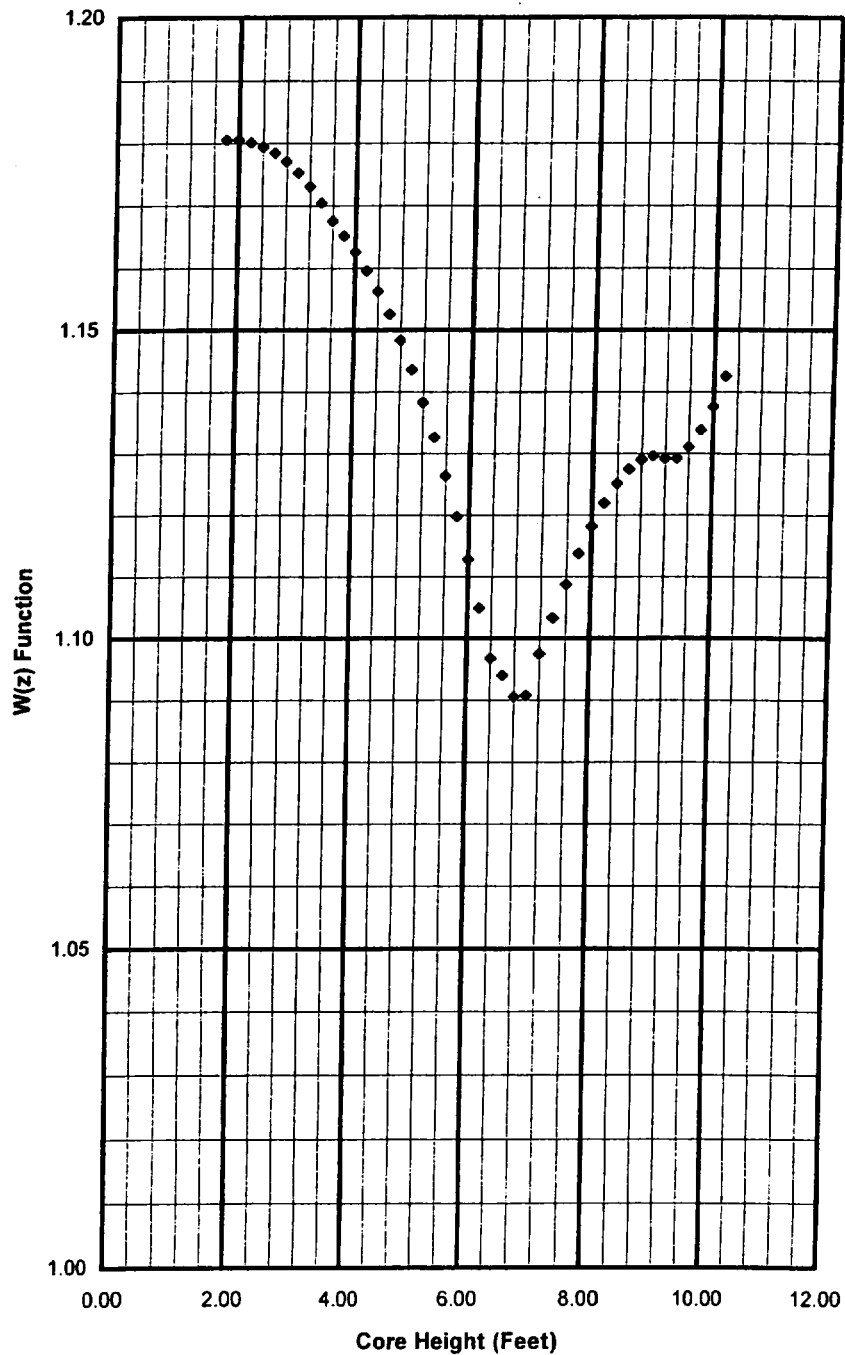
CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

Height (Feet)	W(z)
0.00	1.0000
0.20	1.0000
0.40	1.0000
0.60	1.0000
0.80	1.0000
1.00	1.0000
1.20	1.0000
1.40	1.0000
1.60	1.0000
1.80	1.1805
2.00	1.1805
2.20	1.1801
2.40	1.1794
2.60	1.1784
2.80	1.1770
3.00	1.1752
3.20	1.1730
3.40	1.1704
3.60	1.1675
3.80	1.1651
4.00	1.1625
4.20	1.1595
4.40	1.1562
4.60	1.1525
4.80	1.1483
5.00	1.1436
5.20	1.1383
5.40	1.1326
5.60	1.1263
5.80	1.1197
6.00	1.1128
6.20	1.1049
6.40	1.0968
6.60	1.0940
6.80	1.0905
7.00	1.0907
7.20	1.0975
7.40	1.1033
7.60	1.1087
7.80	1.1137
8.00	1.1181
8.20	1.1219
8.40	1.1251
8.60	1.1274
8.80	1.1290
9.00	1.1296
9.20	1.1292
9.40	1.1292
9.60	1.1310
9.80	1.1338
10.00	1.1376
10.20	1.1425
10.40	1.0000
10.60	1.0000
10.80	1.0000
11.00	1.0000
11.20	1.0000
11.40	1.0000
11.60	1.0000
11.80	1.0000
12.00	1.0000

Braidwood Unit 2 Cycle 9

Figure 2.6.2.b

Summary of W(z) Function at 3000 MWD/MTU
(top and Bottom 15% Excluded per WCAP-10216)



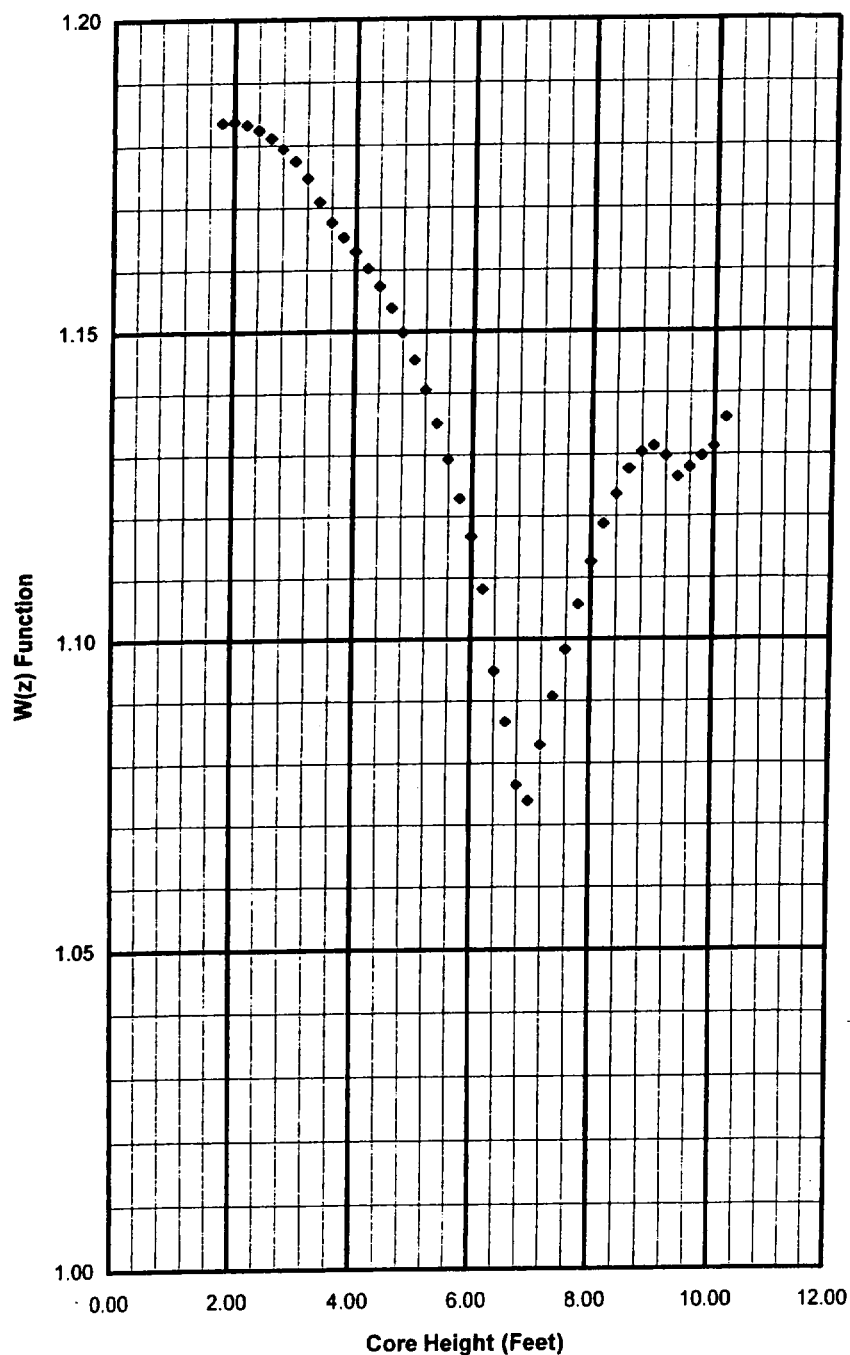
CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

Height (Feet)	W(z)
0.00	1.0000
0.20	1.0000
0.40	1.0000
0.60	1.0000
0.80	1.0000
1.00	1.0000
1.20	1.0000
1.40	1.0000
1.60	1.0000
1.80	1.1836
2.00	1.1837
2.20	1.1833
2.40	1.1824
2.60	1.1811
2.80	1.1794
3.00	1.1774
3.20	1.1747
3.40	1.1709
3.60	1.1676
3.80	1.1652
4.00	1.1629
4.20	1.1602
4.40	1.1573
4.60	1.1538
4.80	1.1498
5.00	1.1454
5.20	1.1405
5.40	1.1351
5.60	1.1292
5.80	1.1229
6.00	1.1167
6.20	1.1081
6.40	1.0948
6.60	1.0866
6.80	1.0765
7.00	1.0739
7.20	1.0829
7.40	1.0907
7.60	1.0983
7.80	1.1056
8.00	1.1125
8.20	1.1187
8.40	1.1235
8.60	1.1276
8.80	1.1303
9.00	1.1313
9.20	1.1297
9.40	1.1263
9.60	1.1279
9.80	1.1297
10.00	1.1312
10.20	1.1359
10.40	1.0000
10.60	1.0000
10.80	1.0000
11.00	1.0000
11.20	1.0000
11.40	1.0000
11.60	1.0000
11.80	1.0000
12.00	1.0000

Braidwood Unit 2 Cycle 9

Figure 2.6.2.c

Summary of W(z) Function at 10000 MWD/MTU
(top and Bottom 15% Excluded per WCAP-10216)



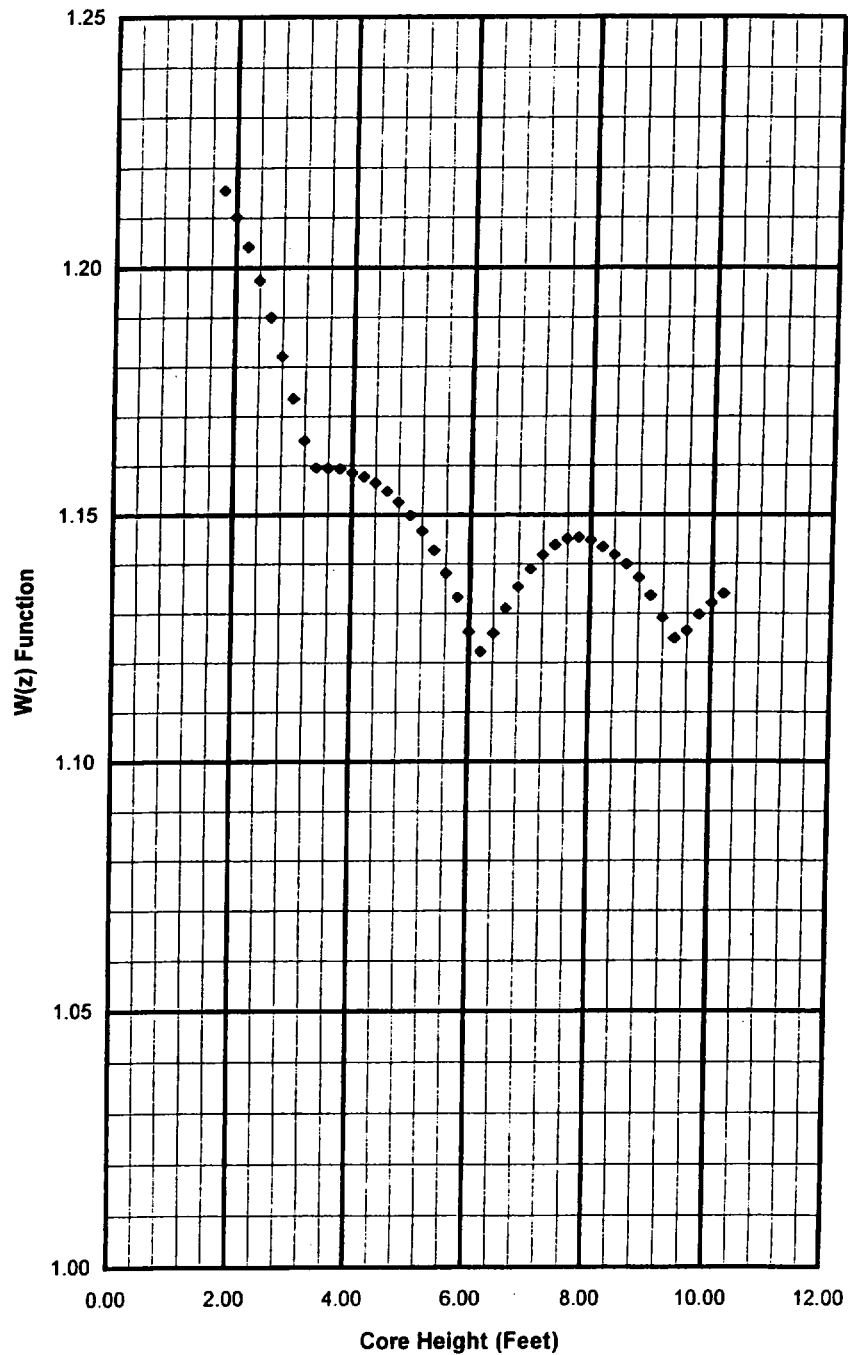
CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

Height (Feet)	18000 W(z)
0.00	1.0000
0.20	1.0000
0.40	1.0000
0.60	1.0000
0.80	1.0000
1.00	1.0000
1.20	1.0000
1.40	1.0000
1.60	1.0000
1.80	1.2154
2.00	1.2101
2.20	1.2041
2.40	1.1974
2.60	1.1900
2.80	1.1821
3.00	1.1735
3.20	1.1650
3.40	1.1595
3.60	1.1594
3.80	1.1593
4.00	1.1585
4.20	1.1577
4.40	1.1564
4.60	1.1547
4.80	1.1525
5.00	1.1498
5.20	1.1486
5.40	1.1427
5.60	1.1381
5.80	1.1332
6.00	1.1262
6.20	1.1222
6.40	1.1259
6.60	1.1310
6.80	1.1353
7.00	1.1389
7.20	1.1418
7.40	1.1438
7.60	1.1451
7.80	1.1454
8.00	1.1448
8.20	1.1434
8.40	1.1418
8.60	1.1399
8.80	1.1372
9.00	1.1335
9.20	1.1290
9.40	1.1249
9.60	1.1264
9.80	1.1297
10.00	1.1320
10.20	1.1339
10.40	1.0000
10.60	1.0000
10.80	1.0000
11.00	1.0000
11.20	1.0000
11.40	1.0000
11.60	1.0000
11.80	1.0000
12.00	1.0000

Braidwood Unit 2 Cycle 9

Figure 2.6.2.d

Summary of W(z) Function at 18000 MWD/MTU
(top and Bottom 15% Excluded per WCAP-10216)



CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

Table 2.6.2	
Fq Margin Decreases in Excess of 2% per 31 EFPD	
Cycle Burnup (MWD/MTU)	Max % Decrease in Fq Margin
150	2.00
275	2.42
400	2.97
525	3.45
650	3.84
775	4.12
900	4.30
1025	4.35
1150	4.28
1275	4.11
1400	3.86
1525	3.55
1650	3.21
1775	2.85
1900	2.48
2025	2.16
≥2150	2.00

Note: All cycle burnups outside the range of the table shall use a 2% decrease in Fq margin for compliance with the 3.2.1.2 Surveillance Requirements.

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

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

$$2.7.1 \quad F_{\Delta H}^N \leq F_{\Delta H}^{RTP} [1.0 + PF_{\Delta H}(1.0 - P)]$$

where: P = the ratio of THERMAL POWER to RATED THERMAL POWER

$$F_{\Delta H}^{RTP} = 1.70$$

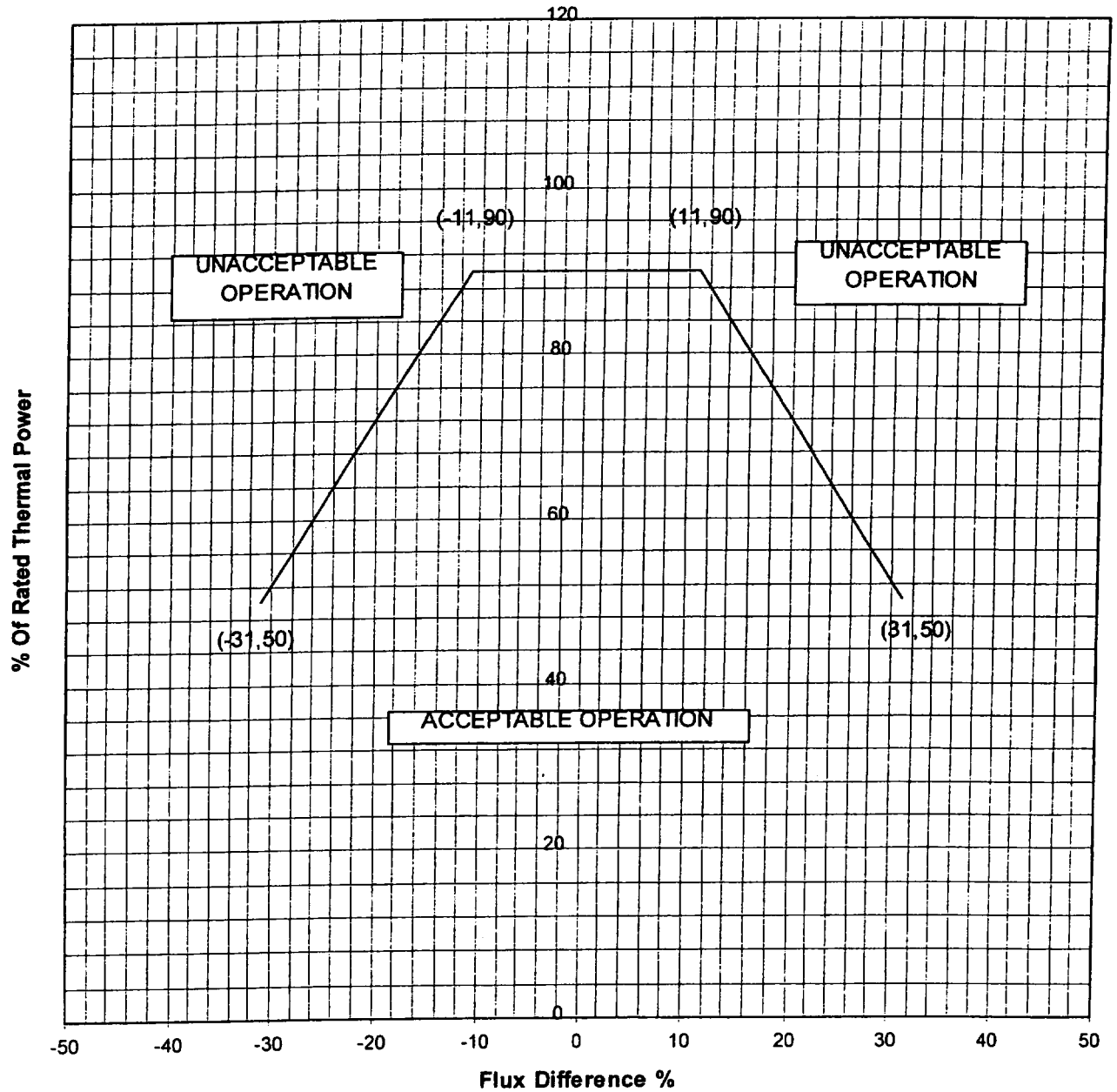
$$PF_{\Delta H} = 0.3$$

2.8 Axial Flux Difference (AFD) (LCO 3.2.3)

2.8.1 The AXIAL FLUX DIFFERENCE (AFD) target band is +5, -10% of the target flux difference.

2.8.2 The AFD Acceptable Operation Limits are provided in Figure 2.8.1.

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

FIGURE 2.8.1: Axial Flux Difference Limits As A Function of Rated Thermal Power

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

2.9 Reactor Trip System Overtemperature ΔT Setpoint Parameter Values (LCO 3.3.1)

- 2.9.1 The Overtemperature ΔT reactor trip setpoint K_1 shall be equal to 1.325.
- 2.9.2 The Overtemperature ΔT reactor trip setpoint T_{avg} coefficient K_2 shall be equal to 0.0297 / °F.
- 2.9.3 The Overtemperature ΔT reactor trip setpoint pressure coefficient K_3 shall be equal to 0.00181 / psig.
- 2.9.4 The nominal T_{avg} at RTP (indicated) T' shall be less than or equal to 588.4 °F.
- 2.9.5 The nominal RCS operating pressure (indicated) P' shall be equal to 2235 psig.
- 2.9.6 The measured reactor vessel ΔT lead/lag time constant τ_1 shall be equal to 8 sec.
- 2.9.7 The measured reactor vessel ΔT lead/lag time constant τ_2 shall be equal to 3 sec.
- 2.9.8 The measured reactor vessel ΔT lag time constant τ_3 shall be less than or equal to 2 sec.
- 2.9.9 The measured reactor vessel average temperature lead/lag time constant τ_4 shall be equal to 33 sec.
- 2.9.10 The measured reactor vessel average temperature lead/lag time constant τ_5 shall be equal to 4 sec.
- 2.9.11 The measured reactor vessel average temperature lag time constant τ_6 shall be less than or equal to 2 sec.
- 2.9.12 The $f_1(\Delta I)$ "positive" breakpoint shall be +10% ΔI .
- 2.9.13 The $f_1(\Delta I)$ "negative" breakpoint shall be -24% ΔI .
- 2.9.14 The $f_1(\Delta I)$ "positive" slope shall be +4.11% / % ΔI .
- 2.9.15 The $f_1(\Delta I)$ "negative" slope shall be -3.35% / % ΔI .

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

2.10 Reactor Trip System Overpower ΔT Setpoint Parameter Values (LCO 3.3.1)

- 2.10.1 The Overpower ΔT reactor trip setpoint K_4 shall be equal to 1.072.
- 2.10.2 The Overpower ΔT reactor trip setpoint T_{avg} rate/lag coefficient K_5 shall be equal to 0.02 / °F for increasing T_{avg} .
- 2.10.3 The Overpower ΔT reactor trip setpoint T_{avg} rate/lag coefficient K_5 shall be equal to 0 / °F for decreasing T_{avg} .
- 2.10.4 The Overpower ΔT reactor trip setpoint T_{avg} heatup coefficient K_6 shall be equal to 0.00245 / °F when $T > T''$.
- 2.10.5 The Overpower ΔT reactor trip setpoint T_{avg} heatup coefficient K_6 shall be equal to 0 / °F when $T \leq T''$.
- 2.10.6 The nominal T_{avg} at RTP (indicated) T'' shall be less than or equal to 588.4 °F.
- 2.10.7 The measured reactor vessel ΔT lead/lag time constant τ_1 shall be equal to 8 sec.
- 2.10.8 The measured reactor vessel ΔT lead/lag time constant τ_2 shall be equal to 3 sec.
- 2.10.9 The measured reactor vessel ΔT lag time constant τ_3 shall be less than or equal to 2 sec.
- 2.10.10 The measured reactor vessel average temperature lag time constant τ_6 shall be less than or equal to 2 sec.
- 2.10.11 The measured reactor vessel average temperature rate/lag time constant τ_7 shall be equal to 10 sec.
- 2.10.12 The $f_2(\Delta I)$ "positive" breakpoint shall be 0 for all ΔI .
- 2.10.13 The $f_2(\Delta I)$ "negative" breakpoint shall be 0 for all ΔI .
- 2.10.14 The $f_2(\Delta I)$ "positive" slope shall be 0 for all ΔI .
- 2.10.15 The $f_2(\Delta I)$ "negative" slope shall be 0 for all ΔI .

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 2 CYCLE 9

2.11 Reactor Coolant System (RCS) DNB Parameter Limits (LCO 3.4.1)

- 2.11.1 The pressurizer pressure shall be greater than or equal to 2209 psig.
- 2.11.2 The RCS average temperature (T_{avg}) shall be less than or equal to 591.2 °F.
- 2.11.3 The RCS total flow rate shall be greater than or equal to 371,400 gpm.

2.12 Boron Concentration

- 2.12.1 The refueling boron concentration shall be greater than or equal to 2000 ppm (LCO 3.9.1).
- 2.12.2 The Reactor Coolant System boron concentration shall be greater than or equal to 2041 ppm prior to initial criticality of Cycle 9, or greater than or equal to 2143 ppm at all other times in core life, to maintain adequate shutdown margin for MODES 3, 4, and 5 during performance of rod drop time measurements and during the surveillance of Digital Rod Position Indication (DRPI) for OPERABILITY (TLCO 3.1.g and TLCO 3.1.k).