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BW160086

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

Braidwood Station, Unit 1  
Renewed Facility Operating License No. NPF-72  
NRC Docket No. STN 50-456

Subject: Core Operating Limits Report, Braidwood Unit 1 Cycle 20

The purpose of this letter is to transmit the Core Operating Limits Report (COLR) for Braidwood Unit 1 Cycle 20 in accordance with Technical Specification 5.6.5, "Core Operating Limits Report (COLR)." Braidwood Unit 1 Cycle 20 COLR, Revision 13 was implemented during Braidwood Unit 1 Refueling Outage 19 in support of Cycle 20 operation. Note that the revision number is based on a numbering convention that continues from the previous revision of the Unit 1 COLR, i.e., Braidwood Unit 1 Cycle 19, Revision 12.

If you have any questions regarding this matter, please contact Mr. Steven Reynolds, Regulatory Assurance Manager, at (815) 417-2800.

Sincerely,

A handwritten signature in black ink, appearing to read "Marri Marchionda-Palmer".

Marri Marchionda-Palmer  
Site Vice President  
Braidwood Station

Attachment: Core Operating Limits Report (COLR) for Braidwood Unit 1 Cycle 20, Revision 13

cc: NRC Regional Administrator, Region III  
NRC Senior Resident Inspector – Braidwood Station  
NRC Project Manager, NRR – Braidwood and Byron Stations

CORE OPERATING LIMITS REPORT (COLR)

FOR

BRAIDWOOD UNIT 1 CYCLE 20

EXELON TRACKING ID:

COLR BRAIDWOOD 1 REVISION 13

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 20

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Braidwood Station Unit 1 Cycle 20 has been prepared in accordance with the requirements of Technical Specification 5.6.5 (ITS).

The Technical Specification Safety Limits and Limiting Conditions for Operation (LCOs) 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 (MTC)
- 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 3.2.5 Departure from Nucleate Boiling Ratio (DNBR)
- 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) Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits
- LCO 3.9.1 Boron Concentration

The portions of the Technical Requirements Manual (TRM) 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 1 CYCLE 20

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 Safety Limits (SLs) (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.

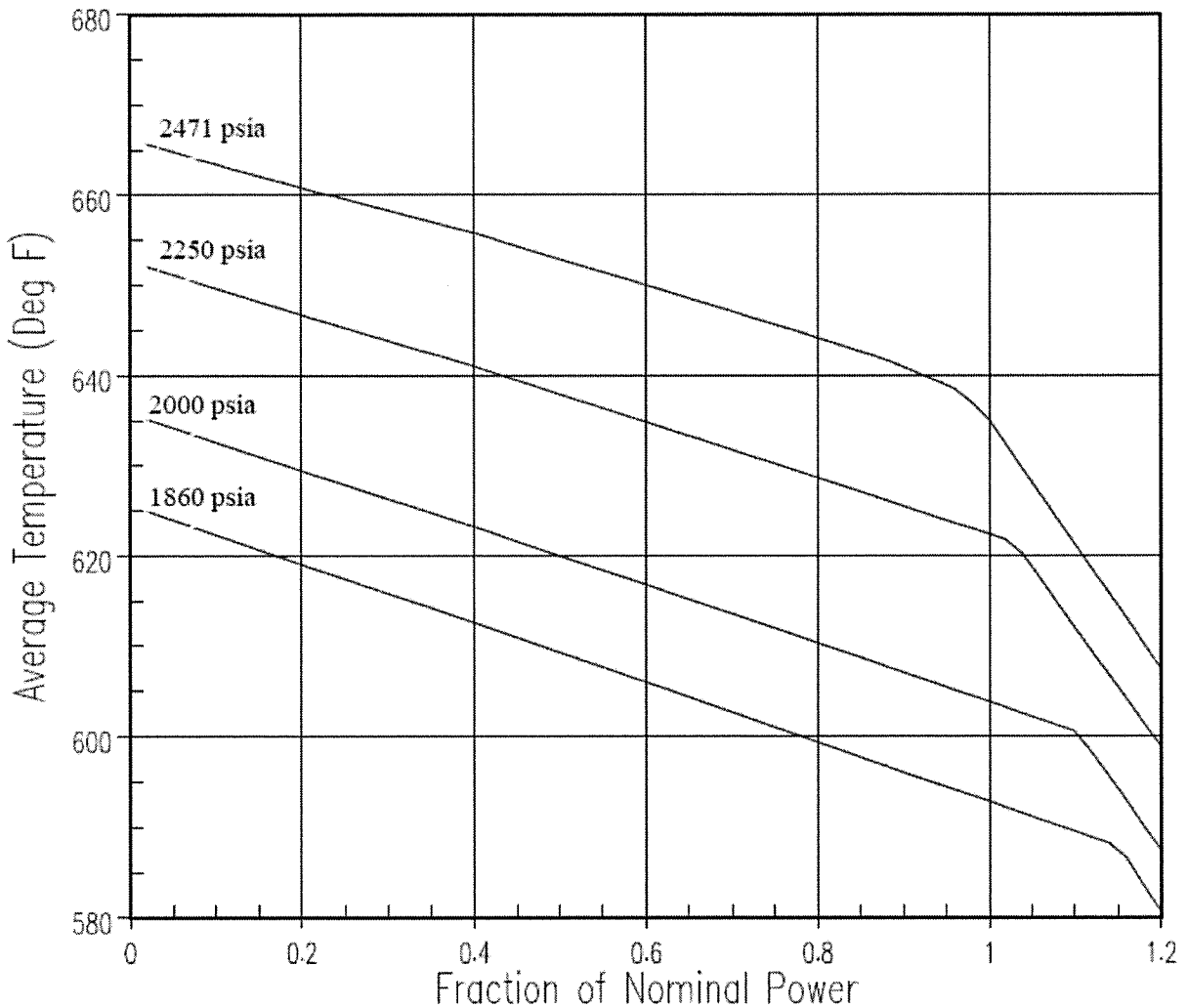


Figure 2.1.1: Reactor Core Limits

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 20

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 limit for MODE 5 is:

2.2.2 SDM shall be greater than or equal to 1.3%  $\Delta k/k$  (LCO 3.1.1, LCO 3.3.9; TRM TLCOs 3.1.i and 3.1.j).

2.3 Moderator Temperature Coefficient (MTC) (LCO 3.1.3)

The Moderator Temperature Coefficient (MTC) limits are:

2.3.1 The BOL/ARO/HZP-MTC upper limit shall be  $+2.104 \times 10^{-5} \Delta k/k/^{\circ}F$ .

2.3.2 The EOL/ARO/HFP-MTC lower limit shall be  $-4.6 \times 10^{-4} \Delta k/k/^{\circ}F$ .

2.3.3 The EOL/ARO/HFP-MTC Surveillance limit at 300 ppm shall be  $-3.7 \times 10^{-4} \Delta k/k/^{\circ}F$ .

2.3.4 The EOL/ARO/HFP-MTC Surveillance limit at 60 ppm shall be  $-4.3 \times 10^{-4} \Delta k/k/^{\circ}F$ .

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 Limits (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, with Bank A greater than or equal to 224 steps, 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.

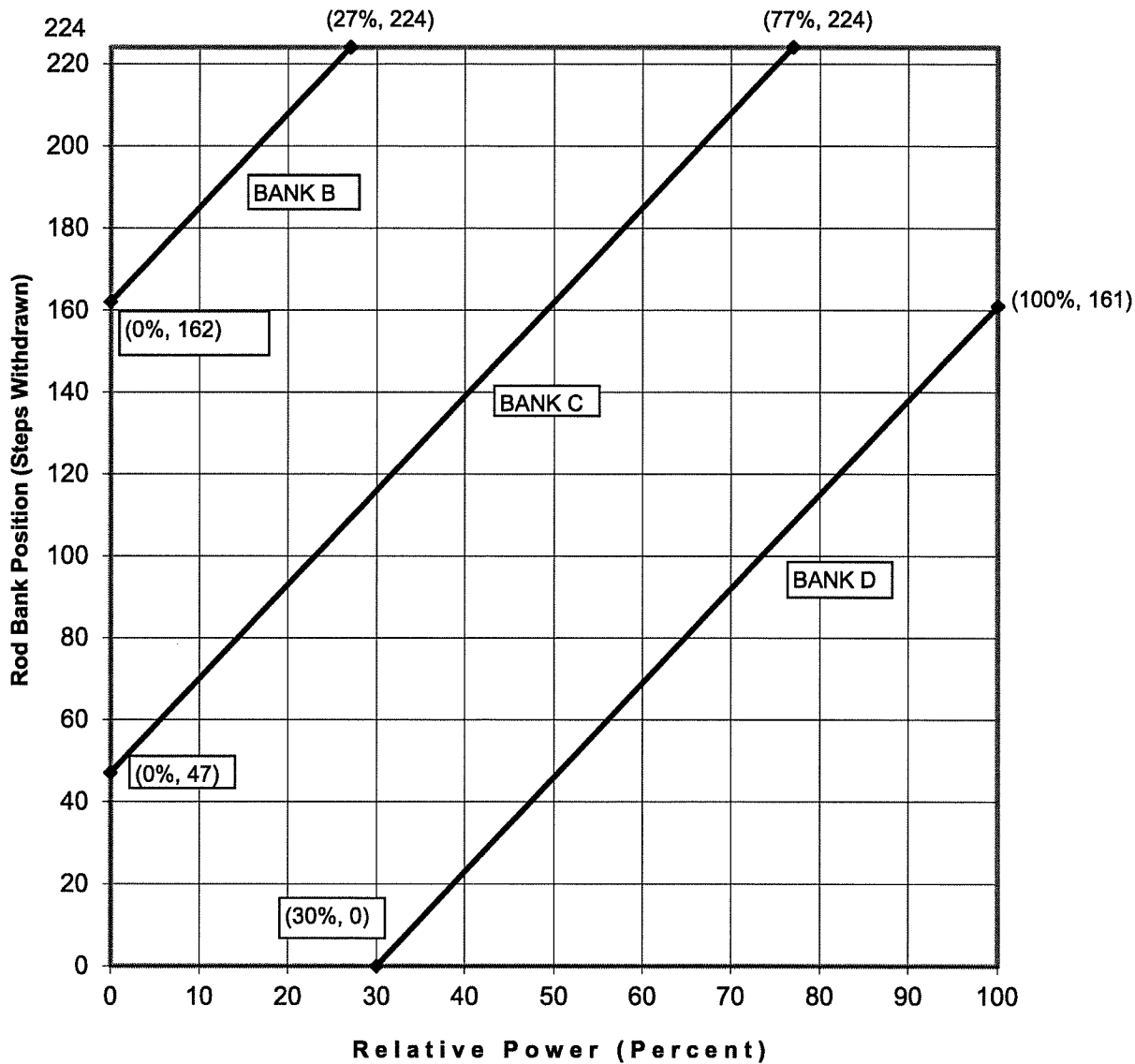
2.5.3 The control banks shall be operated in sequence by withdrawal of Bank A, Bank B, Bank C and Bank D. The control banks shall be sequenced in reverse order upon insertion.

2.5.4 Each control bank not fully withdrawn from the core shall be operated with the following overlap limits as a function of park position:

Park Position (step)	Overlap Limit (step)
226	111
227	112
228	113
229	114

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 20

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



CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 20

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

2.6.1 Total Peaking Factor:

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

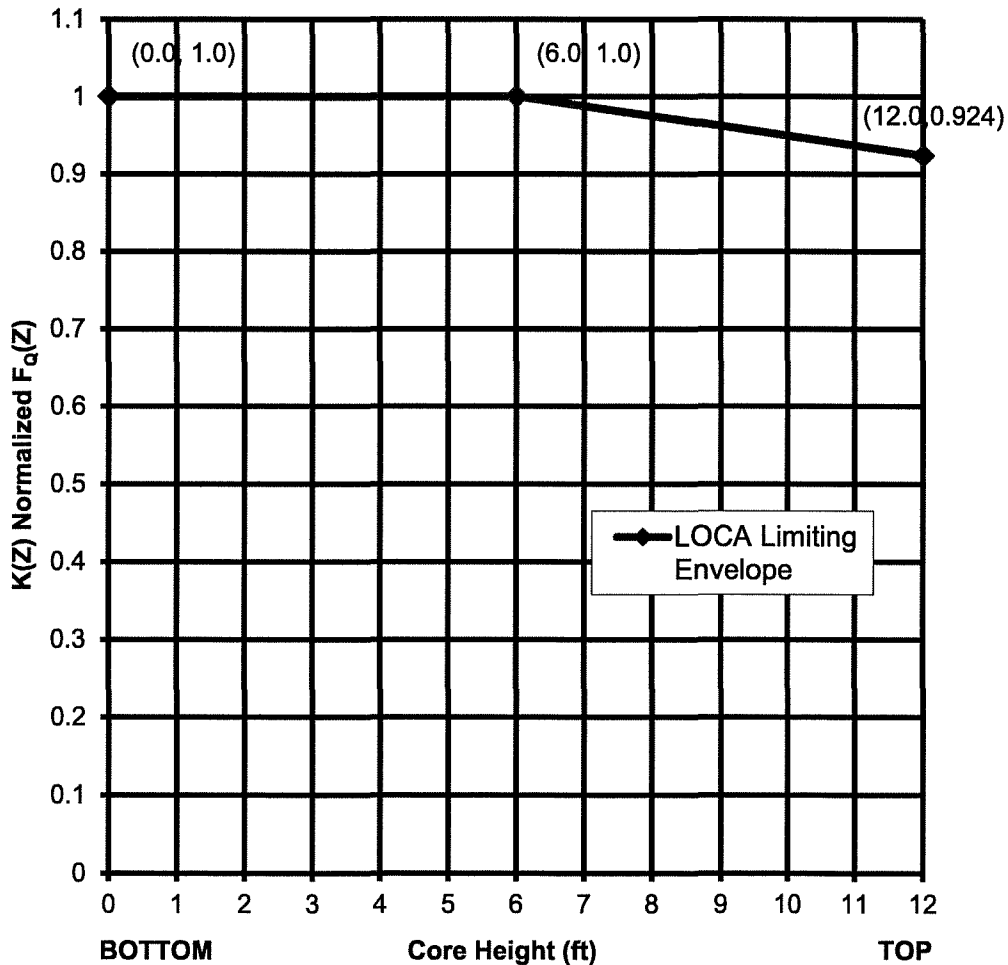
$$F_Q(Z) \leq \frac{F_Q^{RTP}}{P} \times K(Z) \text{ for } P > 0.5$$

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

$$F_Q^{RTP} = 2.60$$

K(Z) is provided in Figure 2.6.1.

**Figure 2.6.1**  
**K(Z) - Normalized  $F_Q(Z)$  as a Function of Core Height**



CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 20

2.6.2 W(Z) Values:

- a) When the Power Distribution Monitoring System (PDMS) is OPERABLE,  $W(Z) = 1.00000$  for all axial points.
- b) When PDMS is inoperable, W(Z) is provided as:
  - 1) Table 2.6.2.a are the normal operation W(Z) values that correspond to the NORMAL AXIAL FLUX DIFFERENCE (AFD) Acceptable Operation Limits provided in Figure 2.8.1.a. The normal operation W(Z) values have been determined at burnups of 150, 6000, 14000, and 20000 MWD/MTU. The Normal AFD Acceptable Operation Limits may be invoked at any time and must be used with the corresponding W(Z) values.
  - 2) Table 2.6.2.b are the Expanded normal operation W(Z) values that correspond to the EXPANDED AXIAL FLUX DIFFERENCE (AFD) Acceptable Operation Limits provided in Figure 2.8.1.b. The Expanded normal operation W(Z) values have been determined at burnups of 150, 6000, 14000, and 20000 MWD/MTU. The Expanded AFD Acceptable Operation Limits may be invoked at any time and must be used with the corresponding W(Z) values.

Table 2.6.2.c shows the  $F^C_{\alpha}(z)$  penalty factors that are greater than 2% per 31 Effective Full Power Days (EFPD). These values shall be used to increase the  $F^W_{\alpha}(z)$  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.c.

2.6.3 Uncertainty:

The uncertainty,  $U_{FQ}$ , to be applied to the Heat Flux Hot Channel Factor  $F_{\alpha}(Z)$  shall be calculated by the following formula

$$U_{FQ} = U_{qu} \bullet U_e$$

where:

- $U_{qu}$  = Base  $F_{\alpha}$  measurement uncertainty = 1.05 when PDMS is inoperable  
( $U_{qu}$  is defined by PDMS when OPERABLE.)
- $U_e$  = Engineering uncertainty factor = 1.03

2.6.4 PDMS Alarms:

$F_{\alpha}(Z)$  Warning Setpoint = 2%  $F_{\alpha}(Z)$  Margin  
 $F_{\alpha}(Z)$  Alarm Setpoint = 0%  $F_{\alpha}(Z)$  Margin



## CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 20

Height (feet)	150 MWD/MTU	6000 MWD/MTU	14000 MWD/MTU	20000 MWD/MTU
0.00 (core bottom)	1.1846	1.3192	1.2784	1.2178
0.20	1.1761	1.2860	1.2570	1.2116
0.40	1.1735	1.2680	1.2477	1.2118
0.60	1.1674	1.2574	1.2379	1.2100
0.80	1.1549	1.2388	1.2217	1.2029
1.00	1.1433	1.2202	1.2102	1.2015
1.20	1.1372	1.2102	1.1954	1.1921
1.40	1.1307	1.2051	1.1839	1.1861
1.60	1.1301	1.1876	1.1754	1.1767
1.80	1.1396	1.1715	1.1725	1.1676
2.00	1.1335	1.1564	1.1695	1.1569
2.20	1.1254	1.1383	1.1626	1.1437
2.40	1.1179	1.1232	1.1577	1.1313
2.60	1.1098	1.1072	1.1498	1.1164
2.80	1.1022	1.1070	1.1428	1.1073
3.00	1.0956	1.1067	1.1359	1.1043
3.20	1.0934	1.1043	1.1270	1.1042
3.40	1.0913	1.1040	1.1194	1.1117
3.60	1.0927	1.1023	1.1121	1.1202
3.80	1.0974	1.1018	1.1064	1.1289
4.00	1.1013	1.1011	1.1061	1.1427
4.20	1.1052	1.1001	1.1115	1.1554
4.40	1.1081	1.0990	1.1167	1.1668
4.60	1.1102	1.0959	1.1208	1.1764
4.80	1.1115	1.0937	1.1229	1.1864
5.00	1.1116	1.0918	1.1241	1.1935
5.20	1.1110	1.0879	1.1260	1.1991
5.40	1.1195	1.0848	1.1288	1.2028
5.60	1.1269	1.0848	1.1322	1.2043
5.80	1.1339	1.0917	1.1496	1.2082
6.00	1.1406	1.1002	1.1661	1.2247
6.20	1.1453	1.1069	1.1807	1.2383
6.40	1.1490	1.1136	1.1932	1.2499
6.60	1.1508	1.1194	1.2019	1.2565
6.80	1.1526	1.1233	1.2105	1.2622
7.00	1.1524	1.1283	1.2153	1.2639
7.20	1.1511	1.1362	1.2181	1.2617
7.40	1.1579	1.1451	1.2189	1.2556
7.60	1.1665	1.1532	1.2158	1.2456
7.80	1.1742	1.1614	1.2127	1.2346
8.00	1.1776	1.1678	1.2068	1.2226
8.20	1.1773	1.1735	1.1989	1.2058
8.40	1.1757	1.1794	1.1901	1.1910
8.60	1.1744	1.1895	1.1793	1.1752
8.80	1.1743	1.2061	1.1748	1.1629
9.00	1.1795	1.2205	1.1740	1.1651
9.20	1.1861	1.2374	1.1786	1.1653
9.40	1.1912	1.2495	1.1845	1.2010
9.60	1.1955	1.2624	1.1895	1.2470
9.80	1.1999	1.2716	1.2220	1.2860
10.00	1.2036	1.2791	1.2470	1.3200
10.20	1.2081	1.2795	1.2710	1.3566
10.40	1.2152	1.2848	1.2905	1.3884
10.60	1.2197	1.2830	1.3093	1.4162
10.80	1.2261	1.2916	1.3241	1.4320
11.00	1.2347	1.3023	1.3349	1.4418
11.20	1.2426	1.2988	1.3308	1.4347
11.40	1.2449	1.3089	1.3286	1.4176
11.60	1.2471	1.3118	1.3086	1.4116
11.80	1.2495	1.3147	1.2916	1.3956
12.00 (core top)	1.2557	1.3252	1.2794	1.3834

Note: W(Z) values at 20000 MWD/MTU may be applied to cycle burnups greater than 20000 MWD/MTU to prevent W(Z) function extrapolation

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 20

**Table 2.6.2.b**

**W(Z) versus Core Height for Expanded AFD Acceptable Operation Limits in Figure 2.8.1.b**  
(Top and Bottom 8% Excluded per WCAP-10216)

Height (feet)	150 MWD/MTU	6000 MWD/MTU	14000 MWD/MTU	20000 MWD/MTU
0.00 (core bottom)	1.3461	1.4594	1.4170	1.3451
0.20	1.3317	1.4199	1.3910	1.3358
0.40	1.3275	1.4011	1.3800	1.3350
0.60	1.3192	1.3900	1.3680	1.3362
0.80	1.2964	1.3686	1.3480	1.3268
1.00	1.2776	1.3461	1.3340	1.3233
1.20	1.2661	1.3332	1.3160	1.3110
1.40	1.2554	1.3260	1.3020	1.3025
1.60	1.2533	1.3026	1.2840	1.2902
1.80	1.2578	1.2819	1.2700	1.2788
2.00	1.2449	1.2612	1.2550	1.2654
2.20	1.2275	1.2368	1.2370	1.2483
2.40	1.2118	1.2153	1.2240	1.2330
2.60	1.1943	1.1924	1.2112	1.2140
2.80	1.1785	1.1835	1.2014	1.1958
3.00	1.1638	1.1785	1.1906	1.1796
3.20	1.1567	1.1718	1.1799	1.1625
3.40	1.1527	1.1674	1.1720	1.1565
3.60	1.1477	1.1605	1.1619	1.1552
3.80	1.1427	1.1547	1.1532	1.1543
4.00	1.1367	1.1473	1.1436	1.1534
4.20	1.1366	1.1385	1.1364	1.1554
4.40	1.1373	1.1301	1.1317	1.1668
4.60	1.1367	1.1203	1.1255	1.1764
4.80	1.1355	1.1104	1.1229	1.1864
5.00	1.1331	1.1006	1.1241	1.1935
5.20	1.1295	1.0888	1.1260	1.1991
5.40	1.1259	1.0848	1.1288	1.2028
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11.40	1.2449	1.3089	1.3286	1.4176
11.60	1.2471	1.3118	1.3086	1.4116
11.80	1.2495	1.3147	1.2916	1.3956
12.00 (core top)	1.2557	1.3252	1.2794	1.3834

Note: W(Z) values at 20000 MWD/MTU may be applied to cycle burnups greater than 20000 MWD/MTU to prevent W(Z) function extrapolation

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 20

<b>Table 2.6.2.c</b> <b>Penalty Factors in Excess of 2% per 31 EFPD</b>	
<b>Cycle Burnup</b> <b>(MWD/MTU)</b>	<b>Penalty Factor</b> $F^C_{q(z)}$
0	1.0200
501	1.0200
676	1.0304
852	1.0392
1027	1.0450
1202	1.0487
1378	1.0501
2781	1.0200
13830	1.0200
14006	1.0207
14882	1.0203
15058	1.0200
16461	1.0200
17162	1.0225
17864	1.0255
18215	1.0258
18566	1.0255
18916	1.0230
19267	1.0200
24768	1.0200

**Notes:**

Linear interpolation is adequate for intermediate cycle burnups.

All cycle burnups outside the range of Table 2.6.2.c shall use a 2% penalty factor for compliance with the 3.2.1.2 Surveillance Requirements.

CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 20

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

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

where: P = the ratio of THERMAL POWER to RATED THERMAL POWER (RTP)

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

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

2.7.2 Uncertainty:

The uncertainty,  $U_{FAH}$ , to be applied to the Nuclear Enthalpy Rise Hot Channel Factor  $F_{\Delta H}^N$  shall be calculated by the following formula:

$$U_{FAH} = U_{FAHm}$$

where:

$$U_{FAHm} = \text{Base } F_{\Delta H}^N \text{ measurement uncertainty} = 1.04 \text{ when PDMS is inoperable} \\ (U_{FAHm} \text{ is defined by PDMS when OPERABLE.)}$$

2.7.3 PDMS Alarms:

$$F_{\Delta H}^N \text{ Warning Setpoint} = 2\% F_{\Delta H}^N \text{ Margin}$$

$$F_{\Delta H}^N \text{ Alarm Setpoint} = 0\% F_{\Delta H}^N \text{ Margin}$$

2.8 AXIAL FLUX DIFFERENCE (AFD) (LCO 3.2.3)

2.8.1 When PDMS is inoperable, the AXIAL FLUX DIFFERENCE (AFD) Acceptable Operation Limits are provided in the Figures described below or the latest valid PDMS Surveillance Report, whichever is more conservative.

a) Figure 2.8.1.a is the Normal AFD Acceptable Operation Limits associated with the W(Z) values in Table 2.6.2.a. Prior to changing to Figure 2.8.1.a, confirm that the plant is within the specified AFD envelope.

b) Figure 2.8.1.b is the Expanded AFD Acceptable Operation Limits associated with the W(Z) values in Table 2.6.2.b.

2.8.2 When PDMS is OPERABLE, no AFD Acceptable Operation Limits are applicable.

2.9 Departure from Nucleate Boiling Ratio (DNBR) (LCO 3.2.5)

2.9.1  $DNBR_{APSL} \geq 1.563$

The Axial Power Shape Limiting DNBR ( $DNBR_{APSL}$ ) is applicable with THERMAL POWER  $\geq 50\%$  RTP when PDMS is OPERABLE.

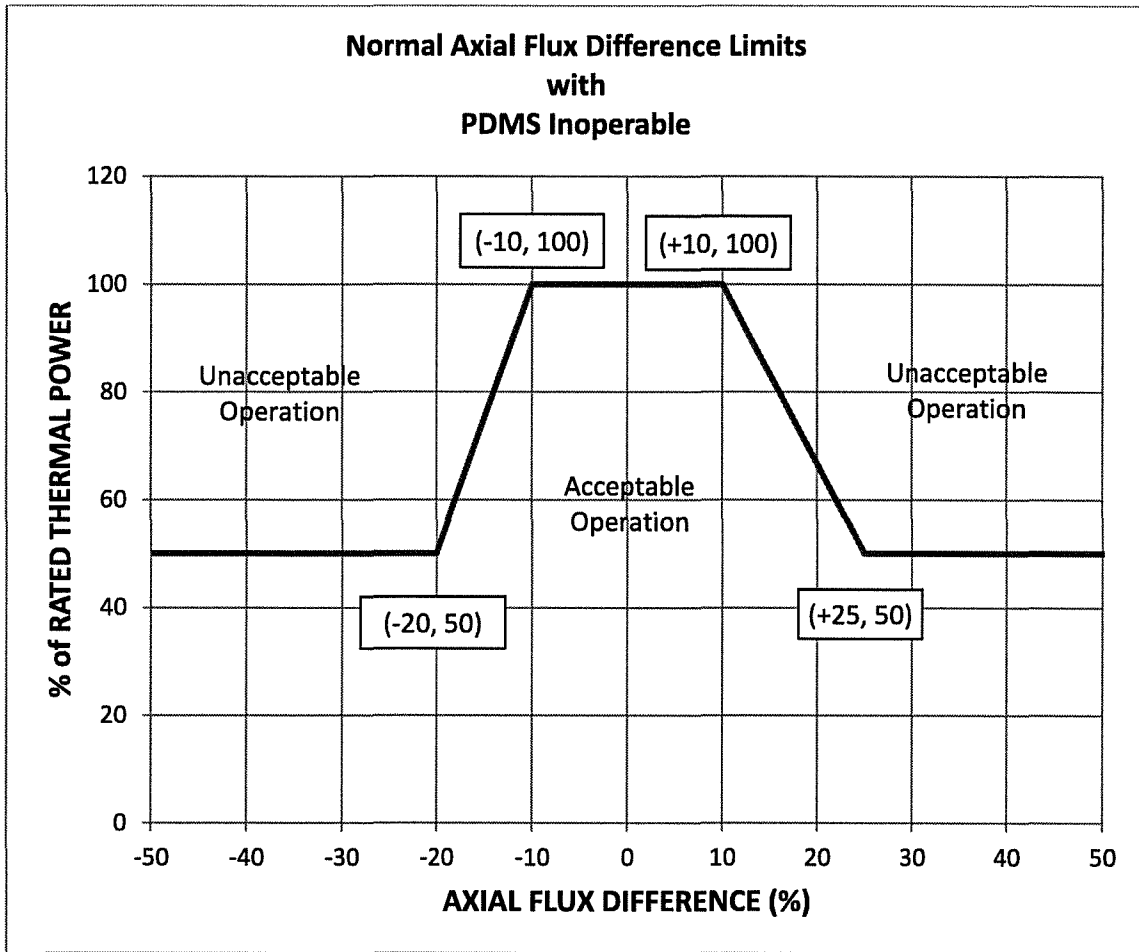
2.9.2 PDMS Alarms:

$$DNBR \text{ Warning Setpoint} = 2\% DNBR \text{ Margin}$$

$$DNBR \text{ Alarm Setpoint} = 0\% DNBR \text{ Margin}$$

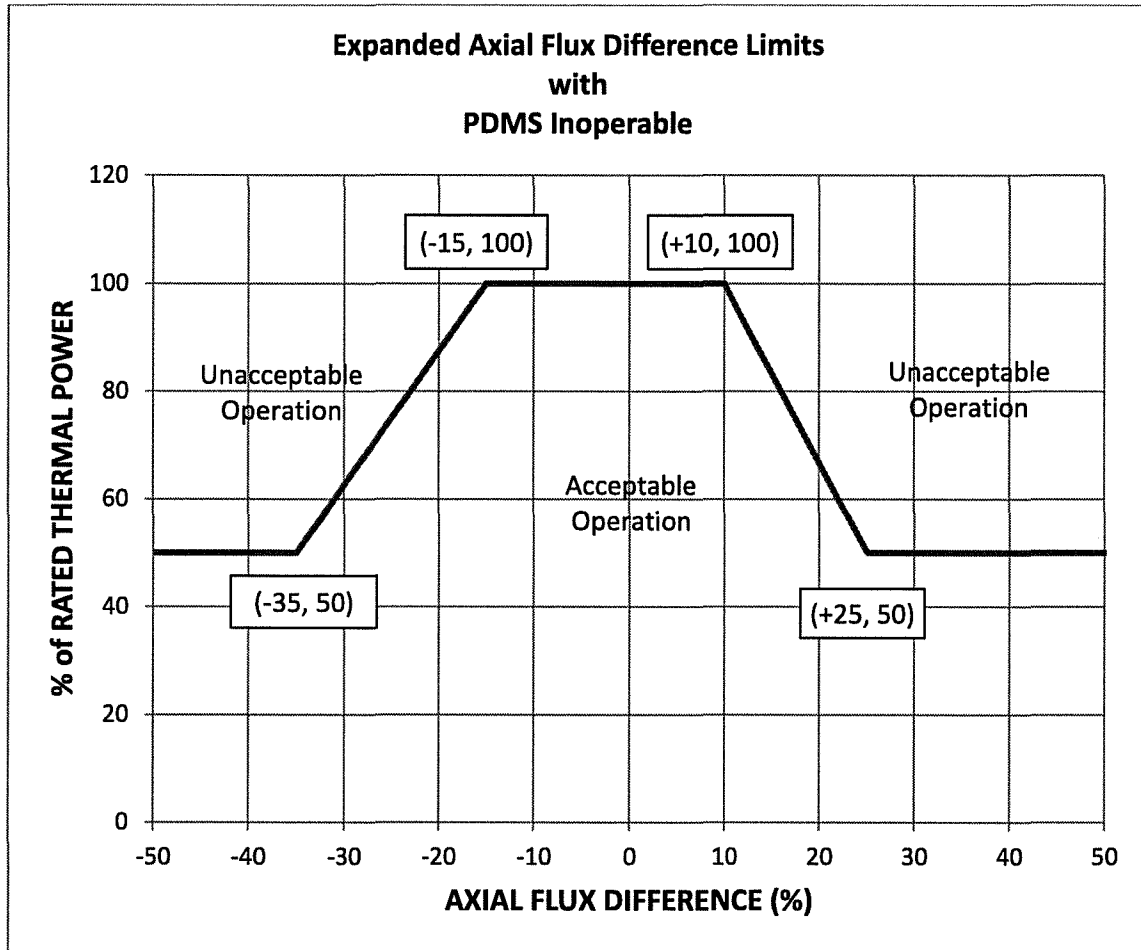
CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 20

**Figure 2.8.1.a:**  
**Normal Axial Flux Difference Limits**  
**as a Function of Rated Thermal Power**



CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 20

**Figure 2.8.1.b:**  
**Expanded Axial Flux Difference Limits**  
**as a Function of Rated Thermal Power**



CORE OPERATING LIMITS REPORT (COLR) for BRAIDWOOD UNIT 1 CYCLE 20

2.10 Reactor Trip System (RTS) Instrumentation (LCO 3.3.1) - Overtemperature  $\Delta T$  Setpoint Parameter Values

- 2.10.1 The Overtemperature  $\Delta T$  reactor trip setpoint  $K_1$  shall be equal to 1.325.
- 2.10.2 The Overtemperature  $\Delta T$  reactor trip setpoint  $T_{avg}$  coefficient  $K_2$  shall be equal to 0.0297 / °F.
- 2.10.3 The Overtemperature  $\Delta T$  reactor trip setpoint pressure coefficient  $K_3$  shall be equal to 0.00135 / psi.
- 2.10.4 The nominal  $T_{avg}$  at RTP (indicated)  $T'$  shall be less than or equal to 588.0 °F.
- 2.10.5 The nominal RCS operating pressure (indicated)  $P'$  shall be equal to 2235 psig.
- 2.10.6 The measured reactor vessel  $\Delta T$  lead/lag time constant  $\tau_1$  shall be equal to 8 sec.
- 2.10.7 The measured reactor vessel  $\Delta T$  lead/lag time constant  $\tau_2$  shall be equal to 3 sec.
- 2.10.8 The measured reactor vessel  $\Delta T$  lag time constant  $\tau_3$  shall be less than or equal to 2 sec.
- 2.10.9 The measured reactor vessel average temperature lead/lag time constant  $\tau_4$  shall be equal to 33 sec.
- 2.10.10 The measured reactor vessel average temperature lead/lag time constant  $\tau_5$  shall be equal to 4 sec.
- 2.10.11 The measured reactor vessel average temperature lag time constant  $\tau_6$  shall be less than or equal to 2 sec.
- 2.10.12 The  $f_1$  ( $\Delta I$ ) "positive" breakpoint shall be +10%  $\Delta I$ .
- 2.10.13 The  $f_1$  ( $\Delta I$ ) "negative" breakpoint shall be -18%  $\Delta I$ .
- 2.10.14 The  $f_1$  ( $\Delta I$ ) "positive" slope shall be +3.47% / %  $\Delta I$ .
- 2.10.15 The  $f_1$  ( $\Delta I$ ) "negative" slope shall be -2.61% / %  $\Delta I$ .

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2.11 Reactor Trip System (RTS) Instrumentation (LCO 3.3.1) - Overpower  $\Delta T$  Setpoint Parameter Values

- 2.11.1 The Overpower  $\Delta T$  reactor trip setpoint  $K_4$  shall be equal to 1.072.
- 2.11.2 The Overpower  $\Delta T$  reactor trip setpoint  $T_{avg}$  rate/lag coefficient  $K_5$  shall be equal to 0.02 / °F for increasing  $T_{avg}$ .
- 2.11.3 The Overpower  $\Delta T$  reactor trip setpoint  $T_{avg}$  rate/lag coefficient  $K_5$  shall be equal to 0 / °F for decreasing  $T_{avg}$ .
- 2.11.4 The Overpower  $\Delta T$  reactor trip setpoint  $T_{avg}$  heatup coefficient  $K_6$  shall be equal to 0.00245 / °F when  $T > T''$ .
- 2.11.5 The Overpower  $\Delta T$  reactor trip setpoint  $T_{avg}$  heatup coefficient  $K_6$  shall be equal to 0 / °F when  $T \leq T''$ .
- 2.11.6 The nominal  $T_{avg}$  at RTP (indicated)  $T''$  shall be less than or equal to 588.0 °F.
- 2.11.7 The measured reactor vessel  $\Delta T$  lead/lag time constant  $\tau_1$  shall be equal to 8 sec.
- 2.11.8 The measured reactor vessel  $\Delta T$  lead/lag time constant  $\tau_2$  shall be equal to 3 sec.
- 2.11.9 The measured reactor vessel  $\Delta T$  lag time constant  $\tau_3$  shall be less than or equal to 2 sec.
- 2.11.10 The measured reactor vessel average temperature lag time constant  $\tau_6$  shall be less than or equal to 2 sec.
- 2.11.11 The measured reactor vessel average temperature rate/lag time constant  $\tau_7$  shall be equal to 10 sec.
- 2.11.12 The  $f_2(\Delta I)$  "positive" breakpoint shall be 0 for all  $\Delta I$ .
- 2.11.13 The  $f_2(\Delta I)$  "negative" breakpoint shall be 0 for all  $\Delta I$ .
- 2.11.14 The  $f_2(\Delta I)$  "positive" slope shall be 0 for all  $\Delta I$ .
- 2.11.15 The  $f_2(\Delta I)$  "negative" slope shall be 0 for all  $\Delta I$ .



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2.12 Reactor Coolant System (RCS) Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits (LCO 3.4.1)

- 2.12.1 The pressurizer pressure shall be greater than or equal to 2209 psig.
- 2.12.2 The RCS average temperature ( $T_{avg}$ ) shall be less than or equal to 593.1 °F.
- 2.12.3 The RCS total flow rate shall be greater than or equal to 386,000 gpm.

2.13 Boron Concentration

- 2.13.1 The refueling boron concentration shall be greater than or equal to the applicable value given in the Table below (LCO 3.9.1). The reported "prior to initial criticality" value also bounds the end-of-cycle requirements for the previous cycle.
- 2.13.2 To maintain  $k_{eff} \leq 0.987$  with all shutdown and control rods fully withdrawn in MODES 3, 4, or 5 (TRM TLCO 3.1.g Required Action B.2 and TRM TLCO 3.1.k.2), the Reactor Coolant System boron concentration shall be greater than or equal to the applicable value given in the Table below.

COLR Section	Conditions	Boron Concentration (ppm)
2.13.1	a) prior to initial criticality	1723
	b) for cycle burnups $\geq 0$ MWD/MTU and $< 16000$ MWD/MTU	1823
	c) for cycle burnups $\geq 16000$ MWD/MTU	1486
2.13.2	a) prior to initial criticality	1780
	b) for cycle burnups $\geq 0$ MWD/MTU and $< 16000$ MWD/MTU	2014
	c) for cycle burnups $\geq 16000$ MWD/MTU	1610