Exelon Generation

Byron Generating Station

4450 North German Church Rd
Byron, IL 61010-9794

www.exeloncorp.com

April 26, 2016

LTR: BYRON 2016-0035
File: 2.01.0300 (5A.101)
1.10.0101 (1D.101)

United States Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Byron Station Unit 2
Renewed Facility Operating License No. NPF-66
NRC Docket No. STN 50-455

Subject: Byron Station Unit 2 Cycle 20 Core Operating Limits Report

In accordance with Technical Specification 5.6.5, "Core Operating Limits Report (COLR)," we are submitting the Unit 2 COLR, Revision 8, for Cycle 20.

Should you have any questions concerning this report, please contact Mr. Douglas Spitzer, Regulatory Assurance Manager, at (815) 406-2800.

Respectfully,

Mark E. Kanavos
Site Vice President
Byron Generating Station

Attachment: Byron Station Unit 2 Cycle 20, COLR, Revision 8

MEK/GC/sg

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

CORE OPERATING LIMITS REPORT (COLR)

FOR

BYRON UNIT 2 CYCLE 20

EXELON TRACKING ID:

COLR BYRON 2 REVISION 8

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 20

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Byron Station Unit 2 Cycle 20 has been prepared in accordance with the requirements of Technical Specification Safety Limits and Limiting Conditions for Operation (LCOs) 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 ($F^N_{\Delta H}$)
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 keff ≥ 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 BYRON UNIT 2 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.

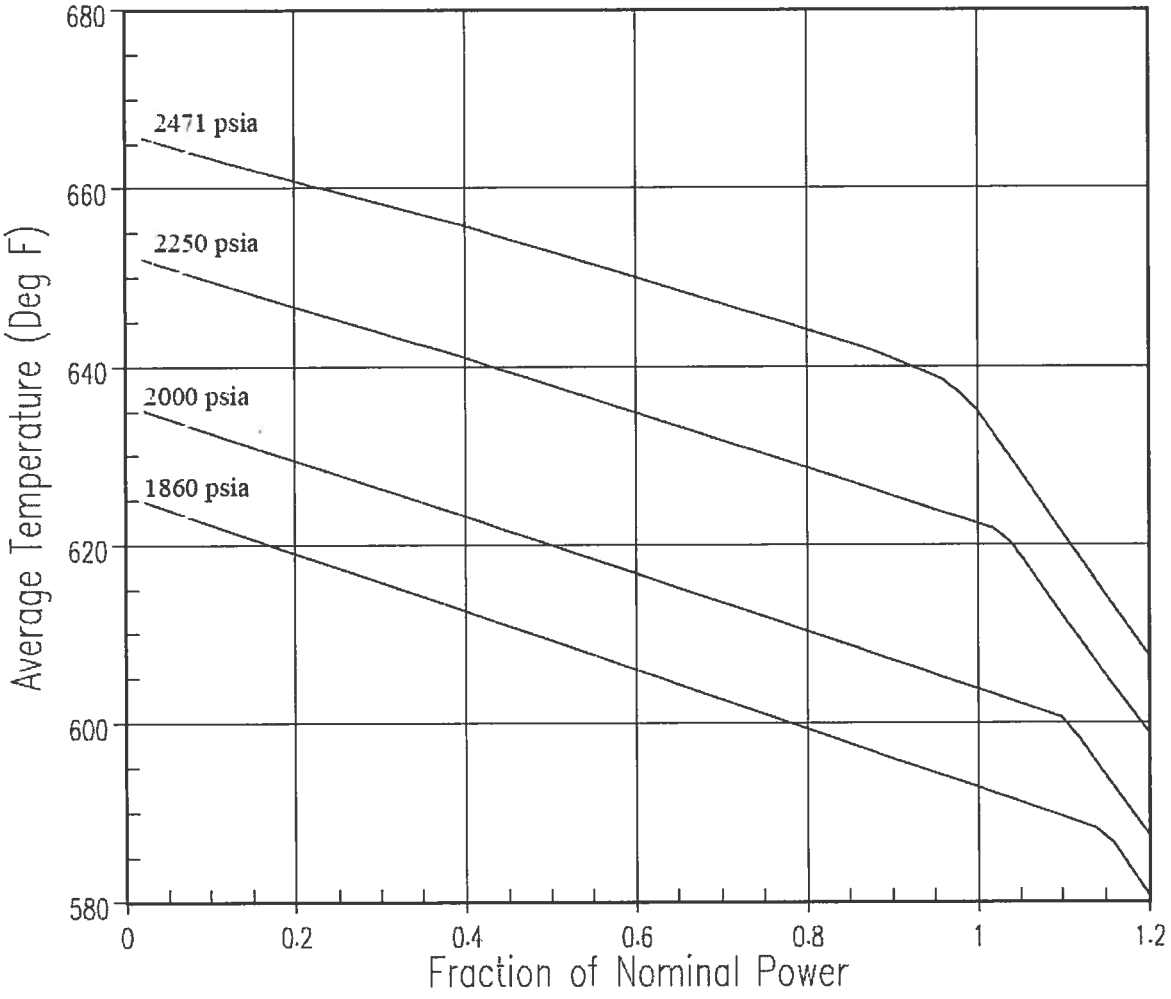


Figure 2.1.1: Reactor Core Limits

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 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% Δk/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% Δk/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 $+2.721 \times 10^{-5}$ Δk/k/°F.

2.3.2 The EOL/ARO/HFP-MTC lower limit shall be -4.6×10^{-4} Δk/k/°F.

2.3.3 The EOL/ARO/HFP-MTC Surveillance limit at 300 ppm shall be -3.7×10^{-4} Δk/k/°F.

2.3.4 The EOL/ARO/HFP-MTC Surveillance limit at 60 ppm shall be -4.3×10^{-4} Δk/k/°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.

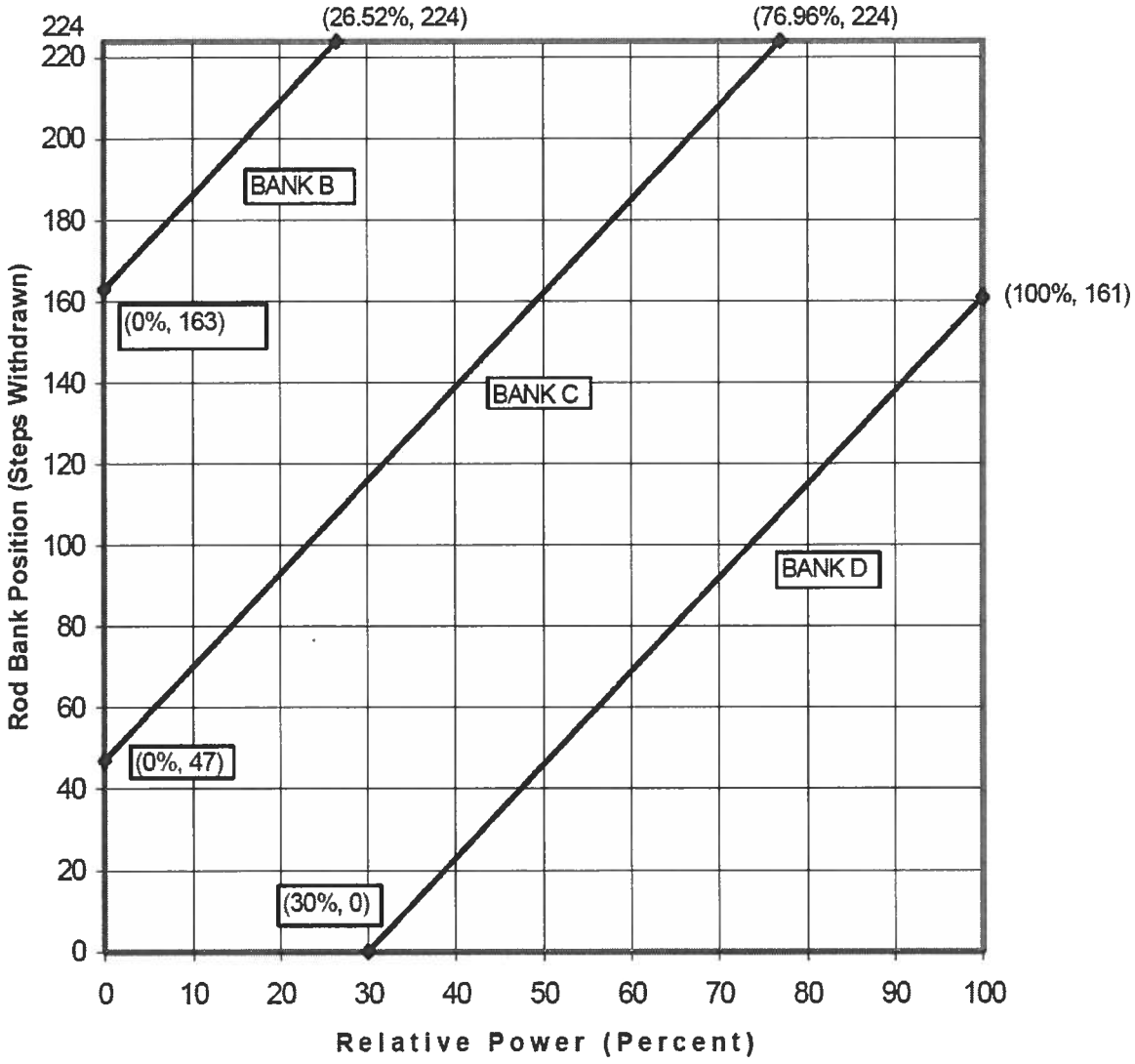
2.5.2 Each control bank shall be considered fully withdrawn from the core at greater than or equal to 224 steps.

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)
231	115

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



CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 20

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

2.6.1 Total Peaking Factor:

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

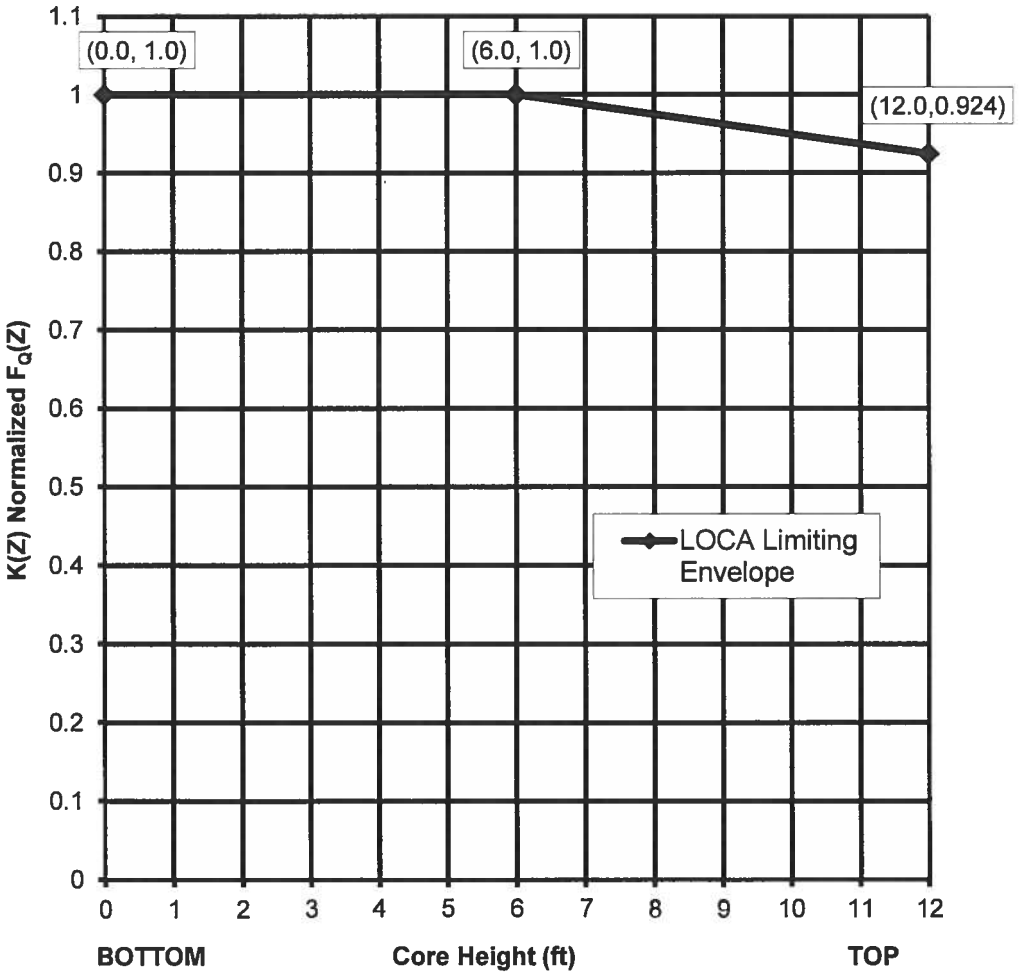
$$F_Q(Z) \leq \frac{F_Q^{RTP}}{P} xK(Z) \quad \text{for } P > 0.5$$

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 BYRON UNIT 2 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 for the full cycle and correspond to the 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, 5000, 14000, and 20000 MWD/MTU.

2) The EOL-only normal operation W(Z) values provided in Table 2.6.2.b may be used for cycle burnups ≥ 18000 MWD/MTU. The EOL-only W(Z) values correspond to the REDUCED AXIAL FLUX DIFFERENCE (AFD) Acceptable Operation Limits provided in Figure 2.8.1.b. The EOL-only normal operation W(Z) values have been determined at burnups of 18000 and 20000 MWD/MTU and the last column of W(Z) values is a duplicate of the 20000 MWD/MTU values. If invoked, the EOL-only W(Z) values are to be used for the remainder of the cycle unless superseded by a subsequent analysis.

Table 2.6.2.c shows the $F^C_Q(z)$ penalty factors that are greater than 2% per 31 Effective Full Power Days (EFPD). These values shall be used to increase the $F^W_Q(z)$ 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 $F_Q(Z)$ shall be calculated by the following formula

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

where:

U_{qu} = Base F_Q 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:

$F_Q(Z)$ Warning Setpoint = 2% $F_Q(Z)$ Margin
$F_Q(Z)$ Alarm Setpoint = 0% $F_Q(Z)$ Margin

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 20

Table 2.6.2.a

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

Height (feet)	150 MWD/MTU	5000 MWD/MTU	14000 MWD/MTU	20000 MWD/MTU
0.00 (core bottom)	1.3939	1.5083	1.3877	1.3456
0.20	1.3748	1.4558	1.3691	1.3355
0.40	1.3650	1.4434	1.3592	1.3329
0.60	1.3533	1.4285	1.3438	1.3302
0.80	1.3342	1.4182	1.3007	1.3254
1.00	1.3207	1.4008	1.2896	1.3188
1.20	1.3034	1.3591	1.2861	1.3097
1.40	1.2885	1.3440	1.2774	1.3007
1.60	1.2712	1.3283	1.2621	1.2873
1.80	1.2579	1.3124	1.2477	1.2753
2.00	1.2525	1.2962	1.2336	1.2613
2.20	1.2451	1.2813	1.2239	1.2428
2.40	1.2363	1.2621	1.2152	1.2263
2.60	1.2238	1.2411	1.2037	1.2066
2.80	1.2079	1.2199	1.1932	1.1888
3.00	1.1935	1.2077	1.1849	1.1755
3.20	1.1824	1.1982	1.1762	1.1715
3.40	1.1765	1.1929	1.1679	1.1734
3.60	1.1704	1.1852	1.1577	1.1786
3.80	1.1642	1.1786	1.1512	1.1822
4.00	1.1582	1.1716	1.1505	1.1852
4.20	1.1510	1.1623	1.1475	1.1878
4.40	1.1449	1.1529	1.1445	1.1998
4.60	1.1444	1.1426	1.1405	1.2099
4.80	1.1433	1.1320	1.1428	1.2177
5.00	1.1397	1.1218	1.1481	1.2240
5.20	1.1350	1.1151	1.1524	1.2274
5.40	1.1289	1.1138	1.1568	1.2303
5.60	1.1238	1.1179	1.1646	1.2473
5.80	1.1311	1.1240	1.1830	1.2651
6.00	1.1378	1.1281	1.2000	1.2787
6.20	1.1425	1.1308	1.2140	1.2874
6.40	1.1472	1.1360	1.2252	1.2954
6.60	1.1490	1.1411	1.2325	1.2965
6.80	1.1498	1.1434	1.2389	1.2967
7.00	1.1486	1.1461	1.2413	1.2929
7.20	1.1473	1.1511	1.2400	1.2843
7.40	1.1476	1.1550	1.2363	1.2734
7.60	1.1473	1.1605	1.2296	1.2584
7.80	1.1465	1.1664	1.2199	1.2416
8.00	1.1452	1.1660	1.2126	1.2231
8.20	1.1410	1.1658	1.2031	1.2026
8.40	1.1378	1.1653	1.1934	1.1879
8.60	1.1348	1.1646	1.1837	1.1743
8.80	1.1385	1.1660	1.1796	1.1673
9.00	1.1426	1.1661	1.1837	1.1666
9.20	1.1451	1.1790	1.1933	1.1858
9.40	1.1487	1.1996	1.2034	1.2362
9.60	1.1530	1.2183	1.2495	1.2856
9.80	1.1615	1.2370	1.2826	1.3280
10.00	1.1690	1.2536	1.3130	1.3638
10.20	1.1793	1.2690	1.3393	1.4005
10.40	1.1924	1.2849	1.3613	1.4279
10.60	1.2197	1.2948	1.3681	1.4505
10.80	1.2329	1.2962	1.3799	1.4671
11.00	1.2329	1.2890	1.3881	1.4805
11.20	1.2433	1.2698	1.3412	1.4699
11.40	1.2487	1.3068	1.4021	1.4788
11.60	1.2271	1.2748	1.3699	1.4428
11.80	1.2234	1.2788	1.3535	1.4267
12.00 (core top)	1.2244	1.2892	1.3399	1.4205

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 BYRON UNIT 2 CYCLE 20

Table 2.6.2.b
EOL-only W(Z) versus Core Height
for AFD Acceptable Operation Limits in Figure 2.8.1.b
(Top and Bottom 8% Excluded per WCAP-10216)

Height (feet)	18000 MWD/MTU	20000 MWD/MTU	23337 MWD/MTU
0.00 (core bottom)	1.2299	1.2430	1.2430
0.20	1.2130	1.2208	1.2208
0.40	1.2051	1.2127	1.2127
0.60	1.1962	1.2060	1.2060
0.80	1.1846	1.2040	1.2040
1.00	1.1749	1.1879	1.1879
1.20	1.1720	1.1819	1.1819
1.40	1.1677	1.1757	1.1757
1.60	1.1595	1.1660	1.1660
1.80	1.1529	1.1568	1.1568
2.00	1.1459	1.1458	1.1458
2.20	1.1342	1.1317	1.1317
2.40	1.1255	1.1187	1.1187
2.60	1.1179	1.1104	1.1104
2.80	1.1142	1.1065	1.1065
3.00	1.1137	1.1084	1.1084
3.20	1.1141	1.1131	1.1131
3.40	1.1205	1.1267	1.1267
3.60	1.1281	1.1441	1.1441
3.80	1.1356	1.1596	1.1596
4.00	1.1471	1.1745	1.1745
4.20	1.1592	1.1875	1.1875
4.40	1.1705	1.1995	1.1995
4.60	1.1795	1.2095	1.2095
4.80	1.1871	1.2174	1.2174
5.00	1.1936	1.2240	1.2240
5.20	1.1980	1.2274	1.2274
5.40	1.2019	1.2303	1.2303
5.60	1.2151	1.2473	1.2473
5.80	1.2340	1.2651	1.2651
6.00	1.2500	1.2787	1.2787
6.20	1.2617	1.2874	1.2874
6.40	1.2715	1.2954	1.2954
6.60	1.2754	1.2965	1.2965
6.80	1.2785	1.2967	1.2967
7.00	1.2773	1.2929	1.2929
7.20	1.2714	1.2843	1.2843
7.40	1.2630	1.2734	1.2734
7.60	1.2507	1.2584	1.2584
7.80	1.2358	1.2416	1.2416
8.00	1.2216	1.2231	1.2231
8.20	1.2051	1.2026	1.2026
8.40	1.1919	1.1879	1.1879
8.60	1.1794	1.1743	1.1743
8.80	1.1733	1.1673	1.1673
9.00	1.1749	1.1666	1.1666
9.20	1.1897	1.1858	1.1858
9.40	1.2219	1.2362	1.2362
9.60	1.2717	1.2856	1.2856
9.80	1.3110	1.3280	1.3280
10.00	1.3453	1.3638	1.3638
10.20	1.3783	1.4005	1.4005
10.40	1.4037	1.4279	1.4279
10.60	1.4195	1.4505	1.4505
10.80	1.4349	1.4671	1.4671
11.00	1.4472	1.4805	1.4805
11.20	1.4194	1.4699	1.4699
11.40	1.4519	1.4788	1.4788
11.60	1.4176	1.4428	1.4428
11.80	1.3999	1.4267	1.4267
12.00 (core top)	1.3888	1.4205	1.4205

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 BYRON UNIT 2 CYCLE 20

Table 2.6.2.c Penalty Factors in Excess of 2% per 31 EFPD	
Cycle Burnup (MWD/MTU)	**Penalty Factor $F^C_Q(z)$**
0	1.0200
853	1.0210
1029	1.0230
1205	1.0410
1381	1.0425
1556	1.0410
1908	1.0360
2436	1.0320
3139	1.0270
3666	1.0200
11929	1.0200
12105	1.0202
12281	1.0200
13336	1.0200
13512	1.0201
13688	1.0205
13863	1.0209
14039	1.0211
14215	1.0205
14391	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 BYRON UNIT 2 CYCLE 20

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

2.7.1 $F^N_{\Delta H} \leq F^{RTP}_{\Delta H}[1.0 + PF_{\Delta H}(1.0 - P)]$

where: P = the ratio of THERMAL POWER to RATED THERMAL POWER (RTP)
$F^{RTP}_{\Delta H} = 1.70$
$PF_{\Delta H} = 0.3$

2.7.2 Uncertainty:

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

$U_{F\Delta H} = U_{F\Delta Hm}$

where:

$U_{F\Delta Hm}$ = Base $F^N_{\Delta H}$ measurement uncertainty = 1.04 when PDMS is inoperable ($U_{F\Delta Hm}$ is defined by PDMS when OPERABLE.)

2.7.3 PDMS Alarms:

$F^N_{\Delta H}$ Warning Setpoint = 2% $F^N_{\Delta H}$ Margin
$F^N_{\Delta H}$ Alarm Setpoint = 0% $F^N_{\Delta H}$ 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 full cycle AFD Acceptable Operation Limits associated with the full cycle W(Z) values in Table 2.6.2.a.

b) Figure 2.8.1.b is the Reduced AFD Acceptable Operation Limits which may be applied after 18000 MWD/MTU. The Reduced AFD Acceptable Operation Limits are associated with the EOL-only W(Z) values in Table 2.6.2.b. Prior to changing to Figure 2.8.1.b, confirm that the plant is within the specified AFD envelope.

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 ≥ 50% RTP when PDMS is OPERABLE.

2.9.2 PDMS Alarms:

DNBR Warning Setpoint = 2% DNBR Margin
DNBR Alarm Setpoint = 0% DNBR Margin

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 20

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

(Full Cycle)

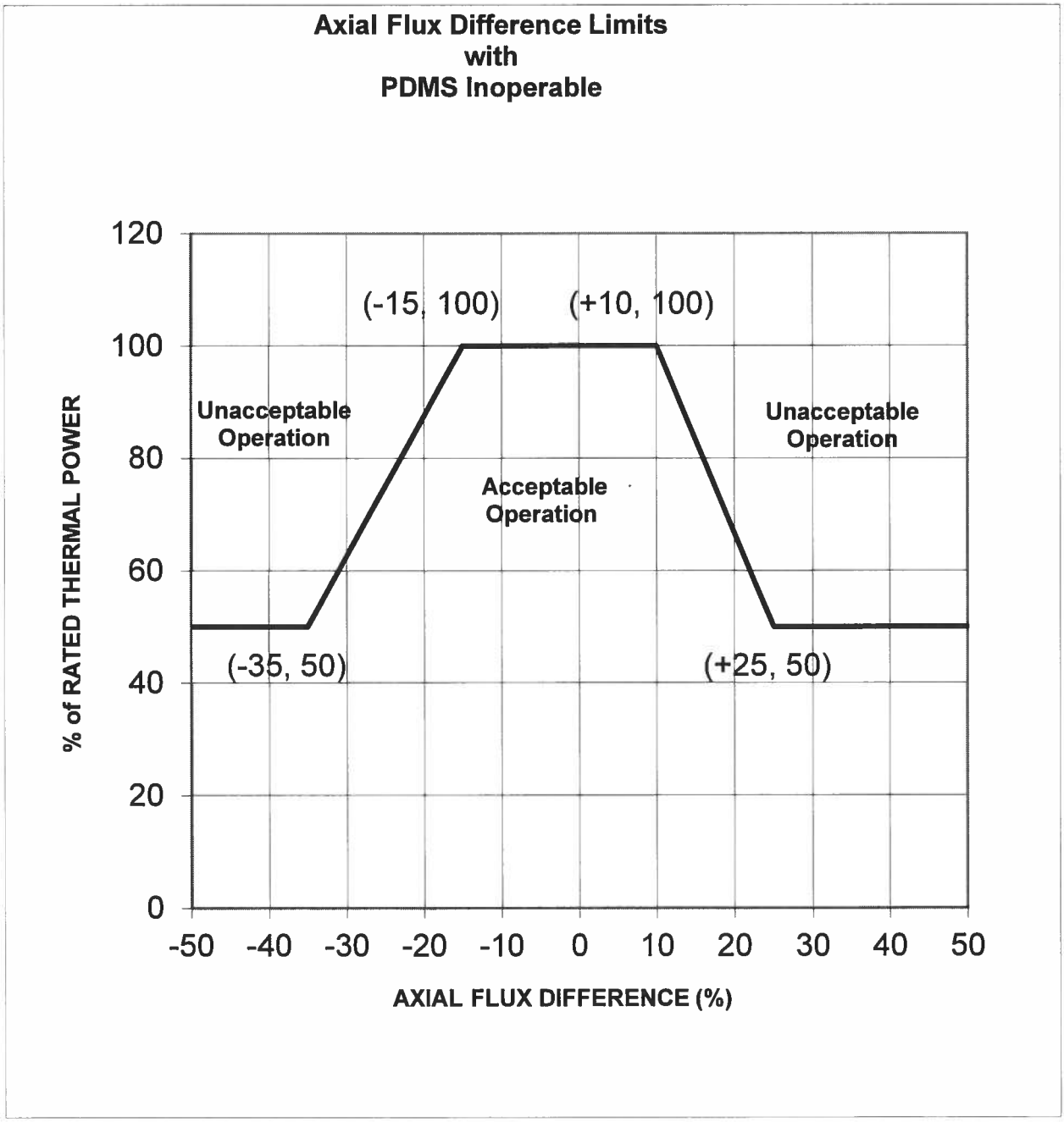
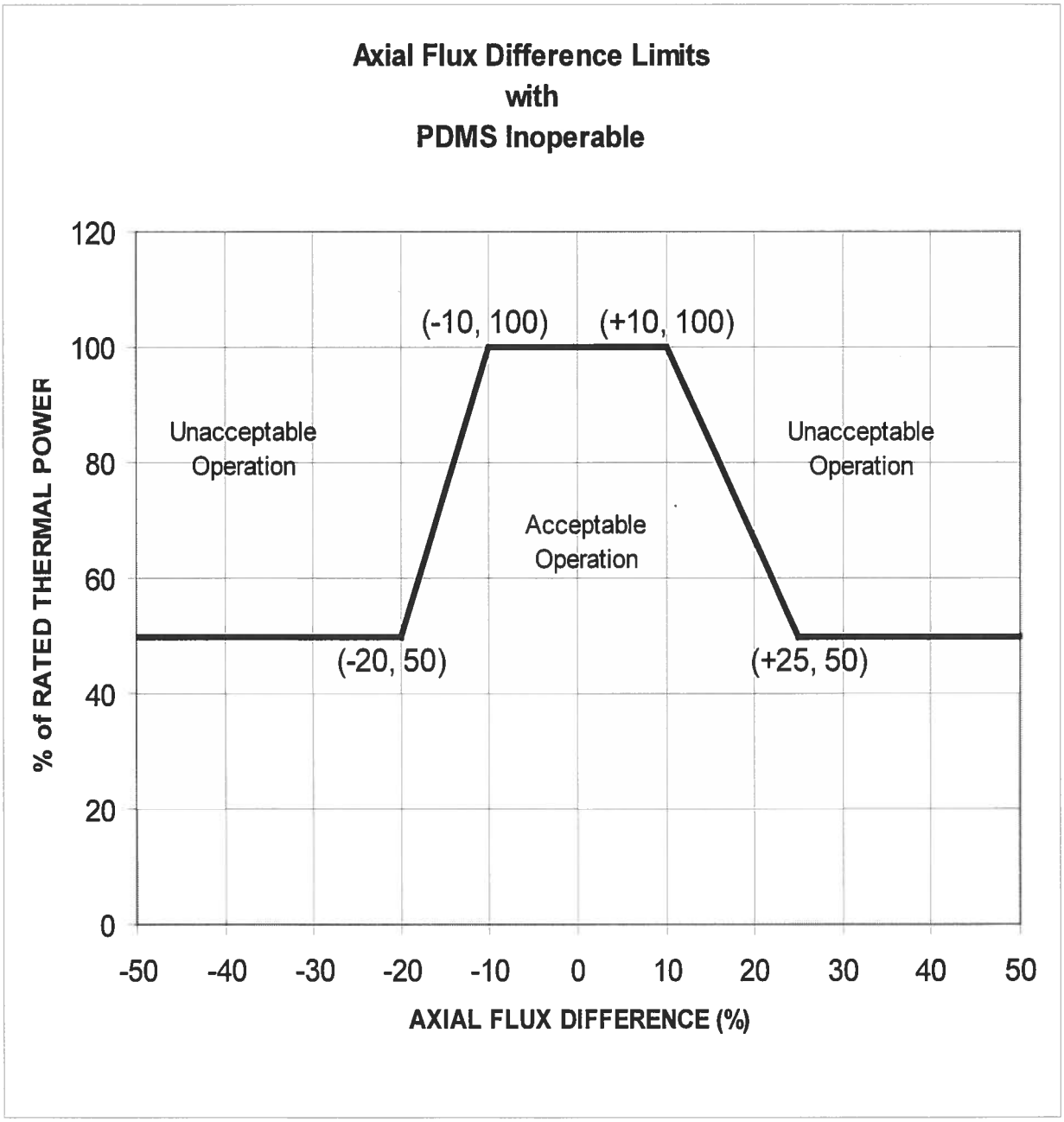


Figure 2.8.1.b:
Reduced Axial Flux Difference Limits
as a Function of Rated Thermal Power

(Cycle burnup ≥ 18000 MWD/MTU)



CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 20

2.10 Reactor Trip System (RTS) Instrumentation (LCO 3.3.1) - Overtemperature ΔT Setpoint Parameter Values

2.10.1 The Overtemperature ΔT reactor trip setpoint K_1 shall be equal to 1.325.

2.10.2 The Overtemperature ΔT reactor trip setpoint T_{avg} coefficient K_2 shall be equal to 0.0297 / °F.

2.10.3 The Overtemperature ΔT 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 ΔT lead/lag time constant τ_1 shall be equal to 8 sec.

2.10.7 The measured reactor vessel ΔT lead/lag time constant τ_2 shall be equal to 3 sec.

2.10.8 The measured reactor vessel ΔT lag time constant τ_3 shall be less than or equal to 2 sec.

2.10.9 The measured reactor vessel average temperature lead/lag time constant τ_4 shall be equal to 33 sec.

2.10.10 The measured reactor vessel average temperature lead/lag time constant τ_5 shall be equal to 4 sec.

2.10.11 The measured reactor vessel average temperature lag time constant τ_6 shall be less than or equal to 2 sec.

2.10.12 The f_1 (ΔI) "positive" breakpoint shall be +10% ΔI.

2.10.13 The f_1 (ΔI) "negative" breakpoint shall be -18% ΔI.

2.10.14 The f_1 (ΔI) "positive" slope shall be +3.47% / % ΔI.

2.10.15 The f_1 (ΔI) "negative" slope shall be -2.61% / % ΔI.

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 20

2.11 Reactor Trip System (RTS) Instrumentation (LCO 3.3.1) - Overpower ΔT Setpoint Parameter Values

2.11.1 The Overpower ΔT reactor trip setpoint K_4 shall be equal to 1.072.

2.11.2 The Overpower ΔT reactor trip setpoint T_{avg} rate/lag coefficient K_5 shall be equal to 0.02 / °F for increasing T_{avg}.

2.11.3 The Overpower ΔT reactor trip setpoint T_{avg} rate/lag coefficient K_5 shall be equal to 0 / °F for decreasing T_{avg}.

2.11.4 The Overpower ΔT reactor trip setpoint T_{avg} heatup coefficient K_6 shall be equal to 0.00245 / °F when $T > T''$.

2.11.5 The Overpower ΔT 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 ΔT lead/lag time constant τ_1 shall be equal to 8 sec.

2.11.8 The measured reactor vessel ΔT lead/lag time constant τ_2 shall be equal to 3 sec.

2.11.9 The measured reactor vessel ΔT lag time constant τ_3 shall be less than or equal to 2 sec.

2.11.10 The measured reactor vessel average temperature lag time constant τ_6 shall be less than or equal to 2 sec.

2.11.11 The measured reactor vessel average temperature rate/lag time constant τ_7 shall be equal to 10 sec.

2.11.12 The f_2 (ΔI) "positive" breakpoint shall be 0 for all ΔI.

2.11.13 The f_2 (ΔI) "negative" breakpoint shall be 0 for all ΔI.

2.11.14 The f_2 (ΔI) "positive" slope shall be 0 for all ΔI.

2.11.15 The f_2 (ΔI) "negative" slope shall be 0 for all ΔI.

CORE OPERATING LIMITS REPORT (COLR) for BYRON UNIT 2 CYCLE 20

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 keff ≤ 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	1733
	b) for cycle burnups ≥ 0 MWD/MTU and < 16000 MWD/MTU	1794
	c) for cycle burnups ≥ 16000 MWD/MTU	1387
2.13.2	a) prior to initial criticality	1759
	b) for cycle burnups ≥ 0 MWD/MTU and < 16000 MWD/MTU	1943
	c) for cycle burnups ≥ 16000 MWD/MTU	1480